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SITE ASSESSMENT, REMEDIATION & REVITALIZATION

Mr. G. Kendall Taylor, P.G., Director
Division of Site Assessment, Remediation, and Revitalization
Bureau of Land and Waste Management
South Carolina DHEC
2600 Bull Street
Columbia, SC 29201

RE: DHEC letter dated July 31, 2018
Removal Action Alternative
SCE&G Fleet Maintenance Site (Congaree River)
Columbia, South Carolina

Dear Mr. Taylor:

Per DHEC's request, enclosed with this letter are three copies of an updated work plan for the removal of the tar-like material within the Congaree River. The DRAFT REMOVAL ACTION PLAN submitted to DHEC in August 2014 was updated using data collected from April through July 2018 to provide current knowledge of tar-like material and river sediment within the Congaree River project area as well as an estimate of the volume to be removed. The three-dimensional models, maps and cross sections from the 2014 DRAFT REMOVAL ACTION PLAN have also been revised to incorporate the most recent data regarding the distribution of tar-like material, river sediment, and bedrock topography.

The removal method itself has not changed. Removal activities would have to be conducted in the dry using a cofferdam with a minimum elevation at 123.5 feet mean sea level (msl). The need for and design of the cofferdam continue to be based on the characteristics of the project area, the variable nature of river flow rates, the irregular river rock bottom contours, and the potential presence of unexploded ordnance (UXO) and historic artifacts within the work area. Therefore, pending DHEC's approval of the updated work plan and request to move forward, SCE&G will resubmit the necessary applications to the Army Corps of Engineers (USACE) and others in an effort to gain permits to allow this work to proceed in the Congaree River. SCE&G cannot predict if or when the USACE may issue a permit, nor the timing of such a review process, with any plan that includes removal. At a minimum, SCE&G anticipates that the submittals will have to be revised with new modeling information and other plan updates that reflect the river bottom contour changes and the revised flood considerations.

The work plan as submitted contemplates removal from the entire 8-acre project area, which has always been the desire of SCE&G. To that end, SCE&G noted in a March 19, 2018 letter to the USACE, "...if the USACE indicates that a removal of TLM from the Congaree River is potentially approvable if the "correct approach or technique" is selected, SCE&G fully intends to pursue this removal design as well as the USACE permit to authorize its use." However, the updated models, maps and cross sections that are fundamental for removal from the entire project area would also be necessary components for any modified removal action approach as referenced in DHEC's June 22, 2018 letter to SCE&G. SCE&G will consider and is willing to pursue any preferred final remedy proposed by DHEC that can be conducted in a safe and effective manner. The required permit activities and submittals will start immediately upon your approval of the updated work plan for removal and request to move forward. As before, SCE&G will continue to consult with DHEC and others as we progress through the permit process and will provide routine status updates. Once all necessary permits are issued, we will submit the final design for DHEC's final approval.

Thank you for your help to move a remedy forward for the Congaree River. If you have questions, please don't hesitate to give me a call at 803-217-9367.

Sincerely,

T. N. Effinger

Thomas N. Effinger, Director
Corporate Environmental Services
SCANA

cc: G. Cassidy, L. Berresford (SCDHEC) with hardcopies
Mark Plowden, Deputy Chief of Staff, Office of Governor Henry McMaster
Myra Reece, EA Director, SC DHEC
Veronica Barringer, Midlands EA Region
Bill Stangler, Congaree Riverkeeper
Tommy Lavender, Nexen Pruet

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SITE ASSESSMENT,
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REVITALIZATION

PRELIMINARY REMOVAL ACTION WORK PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

September 2018

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC

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(WITH PRELIMINARY INFORMATION FROM DRAFT REMOVAL ACTION PLAN DATED JUNE 2014)

1.0 INTRODUCTION

This Preliminary Removal Action Work Plan (PRAWP) presents the removal activities planned by South Carolina Electric and Gas Company (SCE&G) to address the tar-like material (TLM) that exists within a stretch of the Congaree River in Columbia, South Carolina. The general site location and planned removal area are shown on Figure 1-1. The project area includes the proposed removal area and landside areas necessary for access and operations to support the removal activities.

This PRAWP was developed in response to the July 31, 2018 request from the South Carolina Department of Health and Environmental Control (SCDHEC) to submit an updated work plan for the removal of TLM-impacted sediment. New bathymetric survey information collected in 2018 was utilized in conjunction with previously presented TLM and top of bedrock information to present the updated understanding of current conditions within the proposed removal area. An overview of this PRAWP and updating of the Draft Removal Action Plan (Apex, June 2014) is presented in Section 1.5.

There has been a considerable amount of work undertaken in support of this project, which is available in the Administrative Record and can be found on DHEC's website at the following location: http://www.scdhec.gov/HomeAndEnvironment/Pollution/CleanUpPrograms/OngoingProjectsUpdates/CongareeRiverSediment/AdministrativeRecord/. The Administrative Record is also available for review at the main branch of the Richland County Public Library located at 1431 Assembly Street, Columbia, SC 29201.

Removal of the TLM from the Congaree River will be a highly complex and complicated project involving multiple project stakeholders. This PRAWP was prepared to present the currently anticipated overall approach to safely and efficiently facilitate the removal of the TLM, while adhering to the appropriate federal, state and local requirements. This plan will serve as a guide for implementation. However, allowing SCE&G and their contractors maximum flexibility during implementation of this plan is critical in order to effectively address unforeseen difficulties and/or extreme weather conditions.

Due to the complexity of this multi-faceted project, this PRAWP has been written to briefly describe each project component and then refers the reviewer to an appendix that contains a specific plan, permit application or other work product that provides additional details for a particular issue (e.g., Riverbank and Shoreline Restoration Plan). This approach has the advantages of:

- Allows the overall plan to be presented in a concise format;
- Provides sufficient detailed information in the standalone documents; and
- Facilitates the review and approval process for the appropriate component plans.

1.1 Project Area Description

The Congaree River is formed at the confluence of the Saluda River and the Broad River. The portion of the Congaree River relevant to this project is the eastern shoreline of the river beginning slightly south of the Gervais Street Bridge and extending for approximately 2,000 feet downstream, towards the Blossom Street Bridge. Figure 1-1 provides the general project area location and Figure 1-2 provides bathymetric contours for the river bottom and topographic contours for the eastern shoreline based on updated survey information obtained in 2018.

The Congaree River in this area is a broad, shallow river with numerous bedrock outcroppings that create a riffle and pool complex. A United States Geologic Survey (USGS) river gage is located directly across the river from the project area. According to the USGS, the drainage area for the Congaree River at this gage location is 7,850 square miles and the gage height is 113.02 feet based on NGVD 29 (or 112.25 feet based on NAVD 88). Water depths vary from as little as a few inches to approximately 15 to 20 feet in a few locations within the project area. In addition, the flow and depth of the river tends to vary significantly due to bathymetric variances, storm water runoff events and is slightly affected by the operation of the Saluda River Hydroelectric Dam.

While conducting the Phase 1 MRA - Field Demonstration Project (FDP) [the FDP is described in Section 1.3.1], a significant storm event occurred in the Columbia area that resulted in extreme amounts of precipitation runoff to the Congaree River drainage basin. The City of Columbia received 12.5 inches of rain within a 5-day period. On October 4, 2015, the river crested at 31.81 feet (based on the river gage located directly across from the project area), which corresponds to an approximate elevation of 145 feet (NGVD 29). The last time river levels exceeded this elevation was in 1936 (33.34 feet) and the river has only exceeded this elevation a total of seven times since 1893. The highest historic crest was 39.80 feet in 1908.

Because of the significant flooding event that occurred in October 2015, the Columbia Canal located directly upstream of the project area was breached and released hundreds of thousands of tons of sediment downstream into the project area and beyond. This sediment was deposited as the flood waters subsided, including a significant amount in the proposed removal area. Due to the breach in the Columbia Canal, the hydroelectric dam is no longer functional and the absence of water flow from the dam has altered the normal river flow paths. Over time, since the original sediment deposition in the fall of 2015, much of the newly deposited sediment has migrated further downstream. Figure 1-3 presents the change in top of sediment elevation from 2010 to 2018 within the proposed removal area.

1.2 Site Regulatory Background

In June 2010, the occurrence of TLM within the Congaree River was reported to SCDHEC. Preliminary testing conducted on the material by SCDHEC and SCE&G indicated that the material may be attributable to the Huger Street former manufactured gas plant (MGP) that was built and operated by the Broad River Power Company beginning in the early 1900s and ending in the 1950s under SCE&G. The location of the former MGP and the general site location are shown on Figure 1-1.

SCDHEC and SCE&G agreed to investigate and delineate the extent of TLM within the Congaree River under an existing Voluntary Cleanup Contract (VCC #02-4295-RP) for the former MGP site located at 1409 Huger Street. The Administrative Record provides additional information on the VCC. The primary objective of the investigative work was to determine the vertical and horizontal extent of the TLM within the river. In support of that objective, SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012. SCDHEC approved the PDR on April 23, 2012. The PDR presented the results of the delineation work that required five separate phases of investigation that were completed over approximately 18 months. Based on the delineation work, the approximate spatial extent of continuous TLM is identified on Figure 1-4. The delineation activities also identified some additional, minor and sporadic impacts that are located downriver from the project area. These impacts will be evaluated and addressed separately from the scope of this PRAWP.

Numerous regulatory agencies, as well as other various stakeholder groups, have had input into this project. Section 4.0 provides information regarding the permits and approvals that will be necessary for implementation of the planned removal activities. Many of the details presented within this PRAWP to address removal of the TLM, including the plans provided as appendices, were developed based on various agency submittals, applications and/or in response to comments received from previous public notification processes.

This project will also involve potential historic and cultural resource management activities. Therefore, SCE&G has coordinated with the South Carolina Institute of Archeology and Anthropology (SCIAA) and the State Historical Preservation Office (SHPO) to develop an appropriate approach to recover and preserve any potential historical properties that may be located within the project area and from the submerged lands of the State of South Carolina. Because these historical artifacts include potentially unexploded ordnance (UXO), SCE&G has also coordinated with the United State Army Corps of Engineers (USACE) Huntsville Center.

1.3 Additional Recent Studies Completed Within the Project Area

As described in the overview of this PRAWP (Section 1.5), much of the content is based on the previously submitted Draft Removal Action Plan (Apex, June 2014). The understanding of conditions within the proposed removal area from 2014 has been updated based on the most recent information obtained through the following activities:

- Field Demonstration Project;
- Topographic and bathymetric survey data collection;
- SCDHEC macroinvertebrate bioassessment; and
- SCDHEC and SCE&G surface water monitoring.

The Field Demonstration Project and new topographic and bathymetric survey data provide valuable information to support the removal action planning efforts. Completion of the recent macroinvertebrate bioassessment by SCDHEC and surface water monitoring by SCDHEC and SCE&G provides important additional information and independent verification that the TLM is not adversely contributing to impacts in either the surface water or to the macroinvertebrate community that inhabits the sediment in the vicinity of the proposed removal area. More information regarding each of these activities is provided in this section.

1.3.1 Field Demonstration Project

Since the beginning of this project, there has existed an additional, complicating issue that has had a profound effect on the planning, logistics, permits, approvals and most importantly, the mutually shared, primary objective of completing the work in a safe manner. This complicating factor is the known presence of the historical Civil War Dump Site (38RD286) located in the Congaree River, in the same area and perhaps comingled with the TLM as shown on Figure 2-2.

There are numerous ramifications associated with this historical area and the most critical issue associated with the proposed removal action is the very real potential to encounter live cannon balls while completing the work. From the original delineation phase beginning in 2010 through the development of this PRAWP, the potential presence of cannon balls, [also referred to as potential Unexploded Ordnance (UXO)], has been a major issue to contend with and much work has been completed to address this important issue. The following paragraphs summarize existing reports, background information and first-hand experience gained from the previously completed work, which includes:

- *Project Delineation Report* submitted in March of 2012 and provides the approximate extent and location of TLM within the Congaree River and the surveyed location of metallic anomalies [which are considered "potentially hazardous" as explained in the document];
- *USACE JA-PCN Phase 1 - Field Demonstration Project (FDP), dated June 12, 2015 and Approvals* (provided herein as Appendix Q, with the following attachments called out)
    - Attachment B - Includes four (4) separate work plans that address the UXOs [Developed by EOTI, recognized experts in the UXO field and reviewed and approved by the USACE – Huntsville, Alabama];
    - Attachment C - Draft Phase 1 FDP Work Plan [provides various details as to how the FDP would be implemented in the alluvial fan area, on dry land];
    - Attachment D (consists of the following items)
        - Cultural Resource Identification Survey (CRIS) [identifies all historically significant areas located within the vicinity of the project area];
            - Includes "Attachment 1 - Anomaly Summary" [text, tables and figures that provide a summary of the methods and findings of the survey work to identify the magnetic anomalies, dated February 2014, for convenience this summary is also provided as Appendix R],
        - Archaeological Data Recovery Plan (Recovery Plan) [identifies and describes the methods and procedures to recover and preserve any historical artifact that may be encountered/recovered]; and
        - Memorandum of Agreement (MOA) [an agreement between the USACE, SHPO and SCANA that facilitates the disturbance/preservation of the historical sites];
- *FDP Documentation Report,* [submitted in July 2016 and documented the FDP activities and the effects of the "superstorm" that occurred in the fall of 2015].

Much of this background information is available at the SCDHEC website or is included herein. It is anticipated that after this PRAWP been reviewed and subsequently approved by SCDHEC, the documents contained in the previously submitted USACE Joint Application and Pre-Construction Notification (JA-PCN) for the FDP (Appendix Q), will be reviewed, revised and updated to address the currently planned removal action and submitted to the USACE, as part of the request for an Individual Permit to complete the project. The remainder of this section briefly presents a summary of the FDP work and includes:

- The magnetic anomalies (potential UXOs) identified while completing the delineation work;
- Findings from the FDP as they relate to the UXO issues; and
- Conclusions and recommendations for the future removal activities.

Magnetic Anomalies

In conjunction with the original TLM delineation investigations and based on the documented historical nature of the site, it was deemed necessary to conduct a magnetometer survey in the project area to try and ascertain the number and location of any magnetic anomalies that may be present within the sediment. From a safety perspective, it was imperative that each proposed sediment sampling location be free and clear of any magnetic anomaly that could potentially be a UXO. To that end, Tidewater Atlantic Research Inc. (Tidewater) conducted the initial magnetometer and side-scan sonar survey work in 2010 and 2012. Appendix R contains a summary of the magnetometer surveying activities completed in support of this project. This work resulted in identifying approximately 570 magnetic anomalies within the entire investigation area, with 101 being located within the general FDP area. Tidewater conducted additional analysis to identify the source of the magnetic signatures encountered and specifically if the signatures were UXO related. ***"Analysis of each target signature included consideration of magnetic and sonar signature characteristics previously demonstrated to be reliable indicators of historical ordnance."*** Tidewater cautioned… ***"those anomalies should be considered potentially hazardous until material generating the signatures can be identified."*** [This quote was found verbatim or in equivalent words in all reports provided by Tidewater] (A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Columbia, South Carolina, Preliminary-Phase IV Reports, Tidewater October 2010 – February 2012). Based on the precision of Tidewater's methods and the equipment utilized, the target object or source of each identified magnetic anomaly could be located anywhere within a 10-foot diameter circle surrounding the center point.

Field Demonstration Project

The Field Demonstration Project (FDP) was developed and implemented in the fall of 2015, following review, approval and receipt of the appropriate permits. For implementation of the FDP, many of the previously identified magnetic anomaly locations were re-established and flagged by a licensed surveyor. A total of 86 magnetic anomaly locations were re-established, with 12 being characterized as "pipeline" associated. [There is an 18-inch diameter metal pipe that exists on the southern side of the alluvial fan.] Thirteen (13) of the initial 99 magnetic anomalies in the FDP-project area were unable to be re-established due to either the high-water level and/or dense brush on the river bank which prevented an accurate GPS relocation of the point.

FDP – Field Activities

The FDP field screening activities to re-establish and positively identify the previously defined magnetic anomalies (74 total) were conducted during the fall of 2015. Consistent with the USACE permit, the field work was to be completed in the alluvial fan area, on dry land. Due to the storms and numerous high-water events that occurred in the fall of 2015, there were multiple attempts to complete the work. As stated in the FDP Documentation Report, there were two Phases of work reported (Phase 1A and Phase 1B). The information provided below is a summary of the detailed information provided in the FDP Documentation Report. The project team consisted of:

- EOTI, the UXO contractor;
- TRC, the archaeology contractor;
- A USACE - UXO representative, on-site, independent oversight and assurance that the safety protocols set forth in the approved Explosive Safety Submission (ESS) plans were followed;
- Apex, the environmental consultant;

- A&D Environmental, construction support; and
- SCANA/SCE&G representatives, overall project management.

EOTI began their investigation by evaluating the 74 re-surveyed, original magnetic anomaly locations previously identified by Tidewater. The objective was simple; to positively identify/recover the potential source of the magnetic signal previously documented. Ideally, this approach would develop and confirm a correlation between the previous investigation information and the actual conditions encountered within the FDP area, as each anomaly and/or area was “cleared”. The term “cleared” can be described as field locating the subsurface object believed to be generating the original magnetic anomaly and positively identifying and/or recovering the object and declaring the localized area to be safe. The process of “clearing” the previously flagged anomalies consisted of using numerous Schonstedt magnetic locators (a yellow cane-looking device) and other metal detection devices to screen the general area surrounding a flagged location. Generally, the crew would start screening within approximately 3 feet of the pin flag and then carefully begin hand digging and retrieving any metallic object(s) in the vicinity. Initially, the UXO team was targeting metallic objects larger than 3 inches in size. In some areas, where the anomaly signals were confirmed to be deeper or the area was found to contain a significant amount of metallic debris, a mini-excavator with a 12-inch bucket was used to increase the efficiency of the excavation operations.

Once the previously identified magnetic anomaly locations were checked and cleared, EOTI began to establish grids for the systematic investigation of the entire alluvial fan area. This process was referred to as “UXO lane clearing” and activities were prematurely discontinued on October 2, 2015 due to a large storm event and resulting high water, ending what was referred to as Phase 1A.

In order to fulfill the archaeological requirements of the FDP, TRC personnel were permitted to enter the project area and visually inspect cleared anomaly locations during the EOTI team breaks, at lunch time and after EOTI completed work for the day. The hand dug, or small excavations were left open with the excavated material staged beside each hole. TRC would carefully evaluate the spoils for any signs of significant cultural artifacts.

By November 2, 2015, the site was prepared for Phase 1B UXO and historical artifact screening activities. EOTI, TRC and the USACE over-sight personnel were on-site with the intentions of completing magnetic anomaly and lane clearing activities. The investigation work only lasted until approximately 2:00 PM on November 2, 2015 when site operations were again discontinued due to high river water levels.

<u>FDP – Findings</u>

The FDP activities were initially focused on clearing the 74 flagged, magnetic anomaly locations previously identified by Tidewater. The findings of the FDP consisted of:

- EOTI was able to re-establish and clear 51 anomaly locations during Phase 1A;
- 46 locations were determined to be “cultural debris” or “CD” as noted by EOTI - Cultural debris can be defined as non-hazardous modern-day items such as tin cans, fishing hooks, nails, wire, pipes, metal pans, metal banding “magnet pieces”, glass bottles, trash, etc.
- Five (5) previously identified locations were determined to be a “negative find”; meaning no metallic object was located within the within 10-foot diameter circle represented by the pin flag.

- 23 of the re-established points could not be investigated due to being below the water line or in an area too difficult to access at the time.

Figure 1-5 provides a photographic summary of the screening operations, some of the metallic "cultural debris" encountered and some of the open excavations. Table 1-1 provides the specific findings and other information for each location evaluated. Some of the larger items recovered/identified during Phase 1A included a brake rotor from a car, a man-hole cover, an old hot water heater, fence posts and tent stakes. Most notable is the fact that **no UXOs or other material of explosive concern (MEC) or historical artifacts** were observed or recovered.

FDP Lane Clearing

Since there was no apparent correlation between the Tidewater-defined, previously identified magnetic anomalies and the findings of "cultural debris" as described above, EOTI recommended a "lane clearing" approach whereas an area would be measured and divided up into grids, which were further defined as "lanes". The following presents some observations and extrapolations of this approach:

- For the FDP - 1,288 SF of "Lanes" were cleared by evaluating the surface/subsurface on virtually a centimeter basis. This was a meticulous, time consuming process (due in large part to the volume of cultural debris present) – the production rate observed was approximately 1 (7-man crew) hour/127 SF of area cleared. Extrapolating this information to the proposed removal action:
  - o If the area to be removed is 7.7 acres = 335,412 SF, then it will take approximately 2,641 crew hours or 264-10-hour days to screen the removal area [if it were dry].
  - o The screening/clearing process and the given site conditions (volume of subsurface cultural debris) resulted in a painstakingly slow process.
  - o Other variables that will affect the production rate for the UXO screening/clearing process include the sediment thickness of the area being evaluated, the presence or absence of cultural debris under water and if "live" cannon balls are actually encountered.
- Ten (10) additional cultural debris locations were identified during the lane clearing activities (see Table 1-1).

FDP – Conclusions and Recommendations

The FDP was originally anticipated to last one week but was delayed and lasted for over three months because of repeated bad weather conditions and the because the work area was in such close proximity to the river. Resulting conclusions and recommendations from the FDP that may apply to the removal action moving forward include:

- The project area is located in a fluctuating and dynamic river environment;
- The potential for encountering UXOs or Material of Explosive Concern (MEC) was greatly over stated, at least for the FDP - alluvial fan area;
- The team approach, comprised of the various contractors and oversight personnel listed above, worked well and should be continued for any future intrusive work at the site with similar roles and responsibilities;
- 5 'negative finds' – meaning nothing was found at the previously identified metal anomaly location (i.e., no object found at approximately 10% of the locations, for the FDP);
- The magnetic anomaly / UXO screening process is time consuming, but also very necessary to insure the safety of the removal action workers and the general public;

- The method for monitoring the weather (National Weather Service) and the river level forecast (NOAA National Weather Service Advanced Hydrologic Prediction Service, USGS river gage 02169500 Congaree River at Columbia, SC) was successful in alerting the project team to the significant incoming storm events, which provided enough time to discontinue activities and remove equipment and material from the FDP area and secure the site. However, there is no longer-term precision (greater than 24-48 hours ahead of time) for forecasting river elevations;
- Historical river level data is important but does not assure future river levels. The previously proposed construction season from May 1 through October 31 should be adhered to;
- Coordination with the operators of Saluda River Hydroelectric Dam and the Parr Shoals Dam was very successful in temporarily reducing the river flows (albeit a few hours) and lowering the water level in the project area in early December 2015. This coordination could be invaluable for future remediation activities;

FDP Conclusions and Recommendations Regarding UXO and Historical Artifacts

1. Based solely on the findings of the FDP, there is no correlation between the previous magnetic anomaly locations and the actual finding and recovery of an unexploded ordnance (UXO) or material of explosive concern (MEC). The same conclusion can be made for zero correlation of magnetic anomalies to historical artifacts, for at least the FDP areas evaluated.
2. One can only conclude that if the UXOs/artifact were deposited in the alluvial fan area in 1865, they must have been removed by previously documented and/or undocumented recovery/salvage operations.
3. It has been positively confirmed that there is a significant amount of metallic “cultural debris” (non-hazardous modern-day items such as tin cans, fishing hooks, nails, wire, pipes, metal pans, metal banding “magnet pieces”, glass bottles, trash, etc.) that exists within the alluvial fan and the southern dump site area. This metallic debris yielded a magnetic signal that Tidewater conservatively assumed or interpreted to be UXO-related (i.e., ***“signature characteristics that could be associated with ordnance”***), most likely based on the historical nature of the site.
4. Tidewater also cautioned within its magnetometer survey reports that ***“those anomalies should be considered potentially hazardous until material generating the signatures can be identified”.*** Based on the findings of the FDP, all of the metallic debris generating the magnetic signals was positively identified and none was found to be “hazardous”.
5. Out of an abundance of caution, SCE&G and its’ consultants worked with the USACE and developed numerous plans for safely managing the potential UXOs, using a similar, rigorous, protocol identical to how a federal project of this nature would be conducted. It is recommended that these plans be re-used for the removal action.
6. Since no items of historical interest were identified during implementation of the FDP, the need for SCANA and SHPO to consult to determine the format for a public education component resulting from the FDP, as outlined in the MOA between the USACE, SHPO and SCANA, is not currently required. However, for the planned removal action it is recommended (and will be required as part of the USACE permit process) to review and update the existing MOA and approved plans and procedures.

1.3.2 Topographic and Bathymetric Survey Data Collection

In April through July 2018, updated aerial imaging in conjunction with a LiDAR topographic survey and updated bathymetric survey data collection within the Congaree River were conducted. The survey area extended from the Jarvis Klapman Boulevard bridge crossing of the Congaree River down to the Blossom Street bridge crossing and included portions of both sides of the river.

The updated survey information was obtained to address several items and potential data needs including:

- Conditions within the area had changed since previous survey data were collected, partly due to the breaching of the Columbia Canal in 2015;
- More detail was needed to further evaluate options for access to the proposed removal area from the northern property currently owned by the City of Columbia;
- Contingent upon the results of updated backwater analyses that evaluate the effect of the cofferdam on existing conditions, information along the western river shoreline may be needed;
- Previous topographic information was based on two primary sources that led to discrepancies in contours; and
- An unacceptable level of uncertainty existed regarding the presence and migration of sediment within the proposed removal area that was deposited during the significant storm event and breaching of the canal in October 2015.

Figure 1-2 presents a portion of the aerial imaging and topographic and bathymetric data collected during the 2018 survey activities. To provide focus on the proposed removal area, Figure 1-2 extends from the Gervais Street to Blossom Street bridge crossings and displays surface contour lines on five-foot intervals for clarity.

Regarding top of sediment elevations within the proposed removal area, Figure 1-3 presents the change in elevation from 2010 to 2018 based on available data. As noted in the project area description in Section 1.1, a significant flooding and sediment migration event occurred in October 2015 when the Columbia Canal was breached. Since that time, the hydroelectric dam located directly upstream of the project area is no longer functional and the absence of water flow from the dam has altered the normal river flow paths. Over time, since the original sediment deposition within the proposed removal area in the fall of 2015, much of the newly deposited sediment has migrated further downstream. The current estimate of net change in sediment volume within the proposed removal area (based on estimated top of bedrock and top of sediment elevations) is approximately 445 cubic yards. This estimate was obtained using ArcGIS 10.6 with the Spatial Analyst Cut and Fill Tool. The current estimates of the volume of sediment within the proposed removal area are discussed in Section 2.2.

The new bathymetric survey data along with top of bedrock and TLM occurrence data from the previous investigations were used to develop 3D graphic representations of sediment thickness and TLM occurrence within the proposed removal area. The 3D figures are provided in Appendix S.

1.3.3 SCDHEC Macroinvertebrate Bioassessment

The Aquatic Biology Section of SCDHEC conducted an aquatic macroinvertebrate bioassessment in the Congaree River to determine if sediment impacted by coal tar is having an adverse impact on the indigenous macroinvertebrate fauna in the vicinity of the project area. The Aquatic Macroinvertebrate Bioassessment (Glover, J.B. 2017) completed by SCDHEC is available in the Administrative Record. The study was conducted in June 2017 and determined that the macroinvertebrate community in the vicinity of the proposed removal area was comparable to the upriver control area. Both areas received a bioclassification score of 4.5 (excellent) on the Carolina Biocondition Scale.

1.3.4 SCDHEC and SCE&G Surface Water Monitoring

In March 2017, SCDHEC conducted surface water sampling activities to determine if the Congaree River water was impacted by constituents from the TLM-impacted sediment. A total of 14 surface water samples were collected from within the project area and some nearby tributaries to the Congaree River. The SCDHEC sampling plan and the complete analytical results of the sampling activities are available in the Administrative Record. No MGP-related constituents were detected in these samples collected by SCDHEC.

SCE&G has developed a Surface Water - Sampling Analysis Plan (SW-SAP) (Apex, June 2017) based on the SCDHEC plan and will continue to collect surface water samples every six months for the near future. Appendices to the SW-SAP include the SCDHEC Surface Water Sampling Plan and the analytical results with a figure depicting the sampling locations. The SCE&G SW-SAP was approved on July 21, 2017. The intent of the sampling program is to replicate SCDHEC's efforts and collect comparable data from similar locations at routine, semi-annual intervals.

The first SCE&G event was completed in September 2017 and the second event was completed in March 2018. For all three events, no detections of constituents have been observed. Based on the results from these events, the TLM located in the sediments does not appear to be impacting the surface water of the Congaree River.

1.4 Removal Action Alternative

After the delineation activities were completed, SCDHEC requested that SCE&G complete an Engineering Evaluation / Cost Assessment (EE/CA) to discuss potential remedial alternatives to address the TLM-impacted sediment. Subsequently, a detailed evaluation of the following alternatives was presented:

- Alternative 1 - No Action;
- Alternative 2 - Monitoring and Institutional Controls;
- Alternative 3 - Sediment Capping and Institutional Controls; and
- Alternative 4 - Removal and Off-Site Disposal.

The four alternatives evolved in a very linear fashion with Alternative 1 (the "no action" alternative) as the least effective, easiest to implement and lowest cost. Conversely, Alternative 4 (removal of TLM-impacted sediment with off-site disposal) was the most effective in achieving the stated objectives. However, Alternative 4 was also the most difficult alternative to implement and had the highest cost.

The Final EE/CA (MTR, January 2013) was submitted to SCDHEC on January 15, 2013 and was approved on February 7, 2013 [please refer to the Administrative Record]. A community meeting was conducted by SCDHEC on March 21, 2013 to provide additional information about the project and discuss the proposed clean-up alternatives. The pros and cons of each alternative were discussed at the meeting, with SCDHEC presenting Alternative 4, Removal and Off-Site Disposal of contaminated sediments as the preferred cleanup alternative for this site. All of the comments received during the public comment period were in favor of Alternative 4. On May 8, 2013, SCE&G received a removal action decision letter from SCDHEC indicating that "*The Department is currently drafting an Action*

Memorandum to select Alternative 4 as the official remedy for the site". The Department also requested that *"… SCE&G begin the design and permit process*."

Design and permitting for the sediment removal action proved to be a lengthy process with numerous factors requiring consideration and the involvement of multiple stakeholders. Complicating factors included the irregular and rocky river bottom, the potential presence of UXOs and historical artifacts, and issues associated with installation of a cofferdam to isolate the areas for sediment removal.

As the process evolved, the nature of the planned remediation also evolved. The original removal area was adjusted and a modified removal action (MRA) was pursued by SCE&G as directed by SCDHEC. Due to difficulties obtaining approvals for the MRA, capping (Alternative 3) was determined to be a more appropriate approach and SCE&G obtained the USACE permit approval required for implementation. However, due to stakeholder concerns with the capping approach, SCANA has reevaluated the removal alternative and developed this PRAWP as directed by SCDHEC in the letter dated July 31, 2018.

1.5 Overview of PRAWP

This PRAWP was developed to provide an updated work plan for the removal of TLM-impacted sediment from the Congaree River. The Draft Removal Action Plan (Apex, June 2014) prepared in 2014 was utilized as a basis for the development of this plan.

New bathymetric survey information collected in 2018 was utilized in conjunction with previously collected TLM and top of bedrock information to present an updated understanding of current conditions within the proposed removal area. Preliminary details on implementation of the removal action based on the information from the Draft Removal Action Plan are provided in Section 3.0. The information prepared previously is provided for reference purposes at this time, with minor updates as appropriate (e.g., the FDP was planned at that time, but has since been conducted as summarized in Section 1.3.1).

The supporting Appendices from the Draft Removal Action Plan are also included for reference. Those appendices have been supplemented with Appendix Q - the USACE Application for the Field Demonstration Project. Pertinent information within that submittal includes the UXO management plans developed in conjunction with the USACE Huntsville Center.

Information provided in this PRAWP will be updated and detailed further following SCDHEC approval of this PRAWP and receipt of the USACE permit approval(s) required for implementation.

2.0 CONCEPTUAL APPROACH TO REMOVAL ACTION

2.1 Removal Action Objectives

Implementation of this PRAWP is designed to achieve the following objectives:

- Reduce or eliminate the potential for human health or environmental impacts related to the TLM identified in the project area;

- Physically remove TLM and TLM-impacted sediment from within the project area to the extent practicable;
- Prevent re-suspension and downstream migration of impacted material into currently un-impacted areas;
- Conduct activities in a manner that reduces, minimizes or prevents impacts to the river resources and habitat;
- Utilize the best available techniques and equipment based on the actual conditions encountered;
- Restore the project area to an acceptable or improved condition;
- Recover and preserve any potential historical properties that may be located within the project area and from the submerged lands of the State of South Carolina; and
- Safely conduct the scope of work with as minimal of an impact on the surrounding community and river environment as practicable.

2.2 Overview of the Proposed Removal Action

The removal action involves physically removing all sub-aqueous material (i.e., TLM-impacted sediment, visually un-impacted sediment, gravel, small rocks or cobble) from the river bottom within the project area. Large boulders may be moved aside if feasible, to access surrounding sediment material. As proposed, implementation of the removal action will include completing the following major components:

- Acquiring access to landside properties necessary for project implementation;
- Improving site access;
- Conducting landside clearing, grading and site setup activities;
- Addressing the historical and cultural resource management and safety issues, in particular UXO-related safety issues;
- Minimizing the impacts to aquatic resources;
- Installing a cofferdam to isolate the sediment removal area;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment using conventional methods and equipment;
- Conditioning the sediment material for transportation to the on-site and/or off-site processing facilities;
- Screening for historical artifacts;
- Addressing residual impacts on the bedrock surface of the river bottom, if present;
- Completing shoreline and riverbank restoration activities; and
- Completing site landside restoration activities.

Northern and central/southern access options are being considered at this time. The access options are depicted on Figure 2-1. For planning purposes, this PRAWP assumes that access to the central/southern locations will be obtained. These plans, or alternate plans for access from the north, will be further developed after site access agreement(s) are obtained.

Implementation of the removal action will require land-based construction activities on the eastern shoreline to improve access to the project area for personnel, equipment and material transportation trucks. These construction activities will include clearing and grading operations, gravel road and equipment/material storage and staging area construction and erection of temporary structures to house material processing operations. Site access in the form of a gravel access road that extends to the south and connects the work area to Blossom Street is also currently planned along with a concrete arch crossing over the Unnamed Tributary #2, as shown on Figure 2-1. A project compound with a site office and associated electrical power and utilities will be required, and temporary fencing and gates will be installed to restrict access to the work areas by unauthorized personnel.

Due to seasonal constraints anticipated for work within the river, the work is expected to be completed in phases over several construction seasons. The active, or in-the-river construction season for building or relocating the cofferdam, is expected to be from May through October of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year-round, with minimal site activity projected during the months of November through April.

The Congaree River sediment remediation project is located in an area of historical significance and SCE&G has been working with SCIAA and SHPO to properly address the historical and cultural resources. A listing of historic places and archaeological sites is provided in Table 2-1 and the locations are identified on Figure 2-2. Based on the delineation work, there are numerous metal anomalies that have been documented within the footprint of the cofferdam and excavation areas. Historical information suggests that these metal anomalies may be Civil War era unexploded ordnance (UXO) and/or period artifacts. Therefore, special procedures must be implemented prior to and during project implementation to ensure the safety of remediation workers and the general public and recovery of any potential artifacts, to the extent practicable.

A primary objective of this project is to minimize the impact of implementation to the river resource and habitat area. In pursuit of this objective, SCE&G has proposed a limited, active, in-the-river construction period for building or removing the cofferdam, to minimize any impact to potential sturgeon migration. Additionally, SCE&G has developed a plan to identify and relocate indigenous freshwater mussels from the project area, prior to and during the active construction phase.

A key component of this project will be the need to construct a cofferdam around the planned removal areas in order to isolate and dewater the areas prior to initiating the removal operations. Installation and movement of the cofferdam in phases is currently anticipated. As planned, the cofferdam will remain in-place, in the river, until work on the next phase can begin. Much additional information regarding the cofferdam is included herein.

After the cofferdam has been constructed, the isolated area will be dewatered. Initially, the river water will be pumped over the top of the cofferdam, directly to the river. Visually impacted water, water that may have a sheen from being in close proximity to the TLM, will be collected and diverted to the on-site water management system and subsequently to the City of Columbia Public Owned Treatment Works (POTW). To the extent practical, run-off storm water from the landside will be directed around the active project area.

A combination of removal methodologies and equipment will most likely be required to successfully complete the project due to the varying thickness of sediment and changing bathymetric conditions within the project area. Standard excavation methods coupled with vacuum removal or other techniques will most likely be employed. Figure 2-3 provides the current conceptual approach to site operations, including the phased approach to the cofferdam and sediment removal.

It is currently estimated that approximately 21,350 to 25,550 cubic yards (CY) of sediment material (or 42,700 to 51,100 tons using a 2.0 conversion factor) are present within the proposed removal area. These volume estimates were calculated using ArcGIS 10.6 with the Spatial Analyst Cut and Fill Tool and by creating a TIN volume surface using AutoCAD Civil 3D 2018. The variation in method results is attributed to the interpolation of the top of bedrock contours using the available number of points. The basis for the sediment volume estimate using ArcGIS 10.6 is provided in Figure 2-4, which presents the proposed removal area and sediment thickness contours. The ArcGIS method is more consistent with the previous estimation method. Therefore, this method was used for comparison with the estimated sediment volume present in 2010 (see Figure 1-3 and Section 1.3.2) and for the graphic presentations in this PRAWP. These volume estimates are provided for planning purposes only and are approximations due to the inherent difficulties with measuring sediment thicknesses and the variations of the river bottom within the project area. Additionally, the majority of material to be removed from the river will likely require addition of a drying agent or other bulking agent to render the material suitable for transportation to the on-site screening facility or the off-site disposal facility. Therefore, the actual final tonnage will depend on a number of variables.

Non-impacted to slightly impacted sediment material removed from the river will be screened for historical artifacts on-site by trained professionals operating under direct supervision of the project archeologist. Methods and procedures to be used have been developed and reviewed by SCIAA. A Memorandum of Agreement (MOA) between SCE&G, USACE and SCIAA was signed in May 2017 and will be updated as necessary. The more heavily TLM-impacted material may be transported directly to a prepared site at the disposal landfill for artifact screening. Recovered artifacts will be preserved in accordance with SCIAA-approved procedures.

At the conclusion of the project, the cofferdam will be removed from the river and the landside project area will be restored to its approximate pre-removal condition, with the exception of the permanent improvements that will remain. The shoreline and riverbank will be restored using both conventional erosion protection techniques in high velocity areas and bioengineered solutions to improve aquatic habitat and aesthetics in some locations.

2.3 Approach to Implementation

All of the major components listed above are addressed in detail in this PRAWP and/or the appendices. The approach to implementation was developed with consideration given to the following major constraints:

- Due to the large size of the drainage basin, the river level varies significantly in response to precipitation events;
- Seasonal work requirements may be applicable to the project, necessitating a phased approach;

- The project area is situated in a residential neighborhood with somewhat limited access for truck traffic;
- Metal anomalies are present that must be approached as potential unexploded ordnance (UXO);
- Historical artifacts are potentially present and must be managed appropriately; and
- Excavated material is expected to be high in water content and could be comingled with TLM making it difficult to handle.

Given the size of the project area and the constraints that must be managed, the project will be implemented using a phased approach over several construction seasons. The plan for implementation involves the following general elements:

- Develop details with the appropriate agency input for implementation of this PRAWP and the attached plans;
- Obtain the required permits and approvals (including access agreements);
- Develop bid specifications for solicitation of qualified contractors;
- Finalize the site operations plan with regulatory personnel and the local community;
- Construct the concrete arch crossing over the Unnamed Tributary #2 and the associated southern access road;
- Implement the project in phases utilizing a rock-filled cofferdam;
- Prepare for and adjust to adverse weather conditions, river levels and seasonal constraints;
- Identify and safely remove UXOs and preserve historical artifacts,
- Remove and dispose of the excavated material; and
- Restore the site to pre-removal action (or otherwise acceptable) conditions.

In order to achieve the stated objectives and be as proactive as possible of the current environment and protective of any sensitive species that are known to utilize the project area, either periodically or year-round, SCE&G will take the following measures;

- Conduct “in-river” construction activities during non-migration/spawning periods;
- Implement the Mussel Relocation Plan (Appendix A) to proactively remove mussels from the project area and relocate them in another suitable location;
- Limit impacts to the river and unnamed tributary riparian corridor as much as practical and conduct restoration efforts utilizing bioengineered techniques, where applicable; and
- Protect historically significant sites.

3.0 TLM REMOVAL ACTION ACTIVITIES

Details of the proposed removal action were initially developed in 2014 with the Draft Removal Action Plan (Apex, June 2014), which also included numerous support plans as Appendices along with cross-sections of the removal area (based on the latest bathymetric information available at that time) and cofferdam design drawings. This section presents preliminary details on implementation of the removal action based on the information from the Draft Removal Action Plan, and the supporting Appendices from that Plan are also included for reference. This information will be updated and detailed further following SCDHEC approval of this PRAWP and receipt of the USACE permit approval(s) required for implementation.

For planning purposes, this PRAWP assumes that site access to the central/southern locations will be obtained for the required support operations (see Figure 2-1). If necessary, alternate plans will be developed based on available access. This section specifically addresses:

- Pre-removal action activities;
- Removal area details;
- Advance screening of work areas;
- Cofferdam construction;
- Navigation;
- Water management;
- Sediment and TLM removal, conditioning and disposal; and
- Site restoration.

3.1 Pre-Removal Action Activities

Completion of several significant tasks will be necessary before the primary removal action activities (e.g., cofferdam installation, dewatering, sediment removal, etc.) are initiated. These pre-removal action activities include obtaining waste approvals, construction of the southern access route, and site preparation and operations set-up.

3.1.1 Waste Approval

Analytical data from sediment samples collected during completion of the investigative/delineation activities will be used to complete a material characterization package and obtain acceptance of the sediment/TLM for disposal at the Waste Management's Richland County facility. If required, new samples will be collected from representative material closer to the actual mobilization date in order to provide more recent representative characterization data. The final waste profile and acceptance documentation will be included in the final documentation report. Waste Management's Richland County Landfill was the disposal facility for the 125,000 tons of MGP remediation waste removed from the Huger Street site and is the currently planned disposal facility for the Congaree River project. Confirmation and finalization of the material acceptance process will be completed closer to the mobilization date.

Groundwater analytical data from the Huger Street site will be utilized to provide qualitative data for issuance of an industrial wastewater discharge permit. The data along with a general description of the proposed removal activities and water management system details will be provided to the City of Columbia Public Works Department in order to obtain permission to discharge the contact water (see Section 3.6.4) generated from site activities to the local sanitary sewer system. SCE&G has successfully obtained permission from the City of Columbia to discharge water from two previous MGP site remediation projects and is familiar with the permit application process and the discharge requirements.

The planned POTW discharge location is a sanitary sewer manhole located near the eastern perimeter of the landside support zone shown on Figure 2-3. The total gallons discharged from the site will be tracked and reported. In addition, sampling and analysis of the discharge water will be conducted, in accordance with the discharge permit, and the results will be included in the final documentation report.

As a contingency, approval from an off-site water disposal facility will also be obtained using available groundwater analytical data from the Huger Street site or from samples obtained during the removal action. The off-site facility will be used as a contingency in the event there is an on-site system malfunction or if highly impacted water is encountered or generated and is not conducive to the on-site system. The off-site water disposal approval documentation and associated manifests will also be submitted to SCDHEC in the final documentation report.

3.1.2 Site Access Plan

Based on safety related concerns expressed during the public comment period, the initial route for access to the project work area was modified so that project related traffic would be minimized in the Gist and Senate Street areas. This modified access plan is presented on Figure 3-1 and involves the following elements:

- Entry to and exit from the work area using an access route from the south off of Blossom Street;
- Improvement of the existing gravel access road to develop a roadway sufficient for the vehicular traffic necessary to support the removal action operations;
- Cut and fill operations to reduce the current grade in the southern portion of the roadway will likely impact a small portion of an adjacent wetland (Figure 3-1); and
- Installation of a crossing of Unnamed Tributary #2 that is sized and constructed to meet applicable SCDOT hydraulic requirements for a secondary road stream crossing.

Installation of the roadway, including the crossing of Unnamed Tributary #2, must be completed prior to initiation of the removal action. This portion of the project is described in detail in the USACE Preconstruction Notification (PCN) submitted to the USACE in June 2014.

3.1.3 Historical Areas Preservation

There are numerous historical and archaeologically significant areas located in the vicinity of the project area. A Cultural Resources Identification Survey (CRIS) was conducted (TRC, September 2014) that covered the general vicinity of the project area. In addition, potential historical sites were researched using ArchSite, which is a geographic information system (GIS) maintained by SHPO and SCIAA.

Two separate National Historic Register sites are located in the general vicinity of the project area along with numerous archeological sites. The historical registered sites consist of the Gervais Street Bridge and the Columbia Canal. Both properties are shown on Figure 2-2 and listed on Table 2-1. The Gervais Street Bridge is located directly upstream of the proposed removal area. Implementation of the project is not expected to adversely impact the Gervais Street Bridge. Figure 2-2 shows the approximate location of the Columbia Canal. Should the northern access option be selected, project related activities will be conducted in accordance with approved plans so that activities will not adversely impact this historic property. Previously prepared plans, including an Archaeological Data Recovery Plan, were presented in the USACE Application for the FDP (see Appendix Q). These plans will be evaluated further and modified as necessary prior to implementation.

The cultural resources survey identified several archeological sites located in the vicinity of the project area. These historically significant areas are shown on Figure 2-2 with their applicable descriptions and site ID numbers. Possible ruins from a saw mill (site ID: 38RD224) and a former structure foundation (site ID: 38RD234) are located on land adjacent to the proposed removal area. Should site access be obtained and the property utilized for site operations, the site archaeologist will locate these areas in the field and they will be avoided and protected to the extent practicable during completion of the project. An underwater deposit of historic items (site ID: 38RD278) is located within the proposed removal area. Should the northern access option be selected, project related activities will be conducted in accordance with approved plans so that activities will not adversely impact this historic property.

As shown on Figure 2-2, the Civil War era dump site (site ID: 38RD286) with its expanded boundary will be the archaeological area most affected by the sediment removal. The presence of the Civil War dump site presents two primary issues or concerns:

- The potential for the artifacts to be unexploded ordnance (UXO); and
- Recovering and properly conserving any historical artifacts encountered within the project area.

SCE&G, SCDHEC and the USACE have invested considerable time and effort into addressing these issues. As described in Section 3.3.2, multiple UXO management plans were developed to specify the potential management of such items. These plans were updated prior to implementation of the FDP and included with the USACE Application for the FDP (see Appendix Q). These plans will be further updated, as necessary, prior to initiating sediment removal activities through coordination with the USACE Huntsville Center. An archaeologist will be on-site to properly document and secure any potential historical items, if encountered during sediment removal activities. The items will be transferred to SCIAA/SHPO, in accordance with the approved plans and MOA.

3.1.4 Site Preparation and Operations

The Site Operations Plan (Appendix B) is intended to provide general procedures to safely and effectively implement the proposed TLM removal activities. Several site preparation activities will take place prior to initiating the removal work in order to assure the safe and effective implementation of this PRAWP. The conceptual approach to the site operations plan for removal activities is summarized on Figure 2-3. Some variations to the plan may occur, depending on site conditions encountered at the time of remediation. The actual layout for site operations will be finalized at the discretion of remediation personnel, provided SCE&G, SCDHEC and the current landside property owner concur with any significant modifications.

Site preparation and operations will involve the following activities:

- Site security and fencing;
- Landside support zone construction;
- Erosion and sedimentation controls;
- Work zones;

- Utility clearance and management;
- Traffic control and truck route;
- Staging areas; and
- Site office location.

3.2 Removal Area Details

The TLM located within the river sediments exhibits similar chemical and physical characteristics as coal tar, which is a byproduct of the manufactured gas plant (MGP) process. MGPs produced a flammable gas known as “town gas” that was utilized for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The Huger Street former MGP site produced such gas and is located northeast of the project area. The current conceptual site model (CSM) depicts coal tar material originating at the Huger Street site and being discharged or released into the former stream channel that flows in a meandering southwesterly direction until it discharges into the Congaree River. The drainage ditch was present during the operation of the plant and was later converted into a 72-inch buried culvert pipe when that portion of the Huger Street property was backfilled to construct a bus maintenance facility.

The Congaree River within the project area is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977). The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations. These bottom elevations fluctuate from an approximate high of 116 feet to approximately 105 feet. All elevations are referenced to NAVD ’88. Average river flow elevation is approximately 116 feet with an extreme variance of approximately 110 to 152 feet in elevation. Figure 1-2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline.

Due to the varying nature of the river bottom, the current characteristics also vary within the project area. Faster current areas consisting of riffles are intermingled with slower pool areas. The sediment grain size and type also vary due to the current velocities. Where higher velocities are encountered, coarser grained sediments are dominant and range in particle size from sand (generally fine to coarse) to boulders. Along the shoreline and where lower current velocities exist, finer grained unconsolidated sediments are encountered and range in particle size from silts (and some clay) to fine sands and naturally occurring vegetative organic material. The unconsolidated sediments within the project area range in thickness from about 0.2 feet to 6.0 feet and can be absent when the granite bedrock is exposed.

TLM occurrence and thickness is also highly variable. Appendix C contains cross-sections for the planned removal areas that were developed for use by field personnel during completion of the project. They provide the approximate sediment thickness based on the information obtained during completion of the investigation activities.

3.3 Advance Screening of Work Areas

Generally, there will be two types of advance screening of the work areas:

- Freshwater mussel relocation activities; and
- UXO clearance and management.

No intrusive removal operations will be conducted unless the planned removal area has been screened and designated as safe by the UXO management personnel. UXO screening and management will be conducted in accordance with the UXO Management Plans (Appendix D) and further discussed in the following sections. The UXO personnel will clear portions or the entire isolated and dewatered area prior to permitting the initiation of removal operations.

3.3.1 Mussel Relocation Plan

Advance screening will be completed to preserve indigenous freshwater mussels that may be present within the removal area. In 2006, a reconnaissance survey was conducted by Alderman Environmental Services, Inc. to assess the freshwater mussel populations within Lake Murray and the lower Saluda and upper Congaree Rivers in support of the Saluda Hydroelectric Project (FERC No. 516). The findings of the survey were summarized in the "Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006). The survey included two locations in the upper Congaree River that were within or directly adjacent to (downstream) the planned project area.

As a result of the previous findings from the Alderman survey, SCE&G recognizes that no threatened or endangered mussels are likely present within the project area. However, a number of sensitive mussel species are likely to exist within the cofferdam location and planned removal area. In order to complete the project with as minimal of a negative impact to the Congaree River resources as practicable, SCE&G plans to conduct mussel relocation operations prior to initiating "in-river" construction activities.

The anticipated mussel relocation activities are explained in detail in the Mussel Relocation Plan provided in Appendix A. As currently envisioned, mussel relocation will be conducted in phases for each work area. Mussels located within the planned footprint of the cofferdam will be collected and relocated by divers before the cofferdam is constructed. Once the cofferdam is in place and the isolated area is partially dewatered the remaining mussels located within the isolated area will be collected and relocated. SCE&G anticipates the continued use of Alderman Environmental Services, Inc. to conduct the mussel relocation activities. Alderman Environmental Services has extensive experience successfully completing mussel relocation projects and provided input into the Mussel Relocation Plan.

3.3.2 UXO Screening, Removal and Management

It has been confirmed that in 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were deposited into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. Archeological investigations, some conducted as recent as 1980, recovered live and unstable munitions or UXO from the project area. Reportedly, several live cannonballs from the project area were previously recovered and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson. Other potentially historically significant artifacts may be present in the project area and must be identified and preserved in accordance with procedures discussed in other sections of this PRAWP.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the project area was conducted as part of the investigative activities. Acoustic (side scan sonar) and magnetic (magnetometer) remote sensing surveying activities were completed in order to determine if potential munitions were present prior to conducting the sediment sampling activities. Magnetometer surveying of the project area was conducted over four separate phases. A total of 570 metal anomalies were identified within the project area with 425 (or approximately 75 percent of these anomalies being identified as potentially UXO). Additional plans and details to address the UXO are presented in Section 3.3.2.

SCE&G retained Explosive Ordnance Technologies, Inc. (EOTI) to address the planning phase for screening, removal and management of the UXOs. EOTI is a full-service military munitions company with the experience and expertise to provide safe and cost-effective UXO removal planning and support for this project. EOTI also has considerable experience working with Civil War Era UXO. EOTI developed the following four separate plan documents, consistent with typical USACE guidance and protocols, for the Draft Removal Action Plan (Apex, June 2014):

- Draft Work Plan for Munitions Response MEC Clearance and Support;
- Explosive Safety Submission Munitions and Explosives of Concern Clearance and Support;
- Dive Safe Practices Manual; and
- Diving Operations Plan.

These four plans are provided in Appendix D with the other support plan appendices included with the 2014 Draft Removal Action Plan. These plans were updated prior to implementation of the FDP and included with the USACE Application for the FDP (see Appendix Q). The plans and procedures are described further with the summary of the FDP (Section 1.3.1). These plans will be further updated, as necessary, through coordination with the USACE Huntsville Center. During implementation of the proposed removal action, each identified metal anomaly will be evaluated and confirmed as either UXO, historical artifact or other metallic debris and managed in accordance with the above listed approved plans.

3.4 Cofferdam Construction

A major design feature for the planned removal action is the installation of the cofferdam around the actual work area. The cofferdam will be installed in phases and progress downriver as the removal action progresses. Design considerations, construction considerations, and water quality monitoring during cofferdam installation are discussed below.

3.4.1 Design Considerations

The planned location of the cofferdam to support removal of impacted sediment and TLM is identified on the figures in Appendix E. Current plans involve installation of a rock-filled cofferdam in two phases based on the findings of a hydraulic analysis conducted to assure that no increase of the 100-year flood elevation level occurs due to the presence of the cofferdam. The design drawings for the cofferdam, prepared by Paul C. Rizzo Associates, Inc. (Rizzo), are provided as Appendix E.

Features of the design include:

- A height of 123.5 feet (NGVD 29), designed to minimize overtopping events during the primary construction season;
- A grouted riprap overtopping structure to minimize damage to the cofferdam during overtopping events;
- A phased approach to reduce the volume of material required and dewatering requirements within the cofferdam should overtopping occur;
- A level surface at the top of the cofferdam, of sufficient width and finish to provide a driving surface for project support vehicles;
- Placement of a HDPE liner within the fill to reduce leakage and associated water handling requirements;
- A PVC pipe through the downriver end of the cofferdam with a check valve, to allow for dewatering of the interior area following an overtopping event; and
- Completion of final design details will be conducted the construction/remediation contractor.

3.4.2 Construction Considerations

Considerations associated with construction of the cofferdam include:

- A starter berm will be utilized to control sediment disturbance during installation;
- Total suspended solids (TSS) monitoring will be conducted in accordance with the TSS Monitoring Plan provided in Appendix F during cofferdam construction to monitor and control sediment release from the work area;
- The river bank surface that interfaces with the cofferdam will be stripped and prepared properly during installation;
- Material will generally be placed in lifts as the cofferdam is constructed;
- Class D riprap will be placed on the outboard face for additional protection; and
- Each phase will be constructed following the same general sequence, with the method of removal for the cofferdam rock material to be addressed with the final plan.

3.4.3 Real-Time Water Quality Monitoring

Downstream and upstream (background) real-time total suspended solids (TSS) monitoring will be conducted during completion of cofferdam construction activities to ensure that the project does not contribute to elevated TSS levels within the river. Conducting real-time TSS monitoring downstream of the construction area and comparing the results to the background levels from upstream, if needed, will provide timely notification of elevated project related TSS conditions, should they occur. Mitigation measures, such as deployment of a silt curtain, will be employed if an increase above the established conservative TSS action level is indicated. Specific details with respect to the TSS monitoring, action level and the mitigation procedures are provided in the TSS Monitoring Plan located in Appendix F.

3.4.4 Inspection and Maintenance

The Cofferdam Inspection and Maintenance Plan (Appendix G) –provides a detailed daily cofferdam structure inspection plan that will be implemented by project oversight personnel. Areas of inspection include the cofferdam structural integrity, exterior conditions (such as debris buildup), riverbank tie-in locations, overall performance and leakage volumes, navigational signage and notification components, expected future river levels, etc. An inspection form/checklist will be completed on a daily basis and any potential areas in need of repairs will be documented and addressed as soon as practical. Implementation of this plan will ensure that cofferdam structural issues are identified and rectified in a timely manner and that project personnel are aware of changing river conditions and can plan accordingly to protect project assets.

3.5 Navigation

The Navigation Plan (Appendix H) was developed in accordance with the guidelines located in the "U.S. Coast Guard Aids to Navigation System" publication and through consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office. The plan provides specific methods for notifying boaters and other users of the river in advance of the construction site (upriver and downriver) and the need to take appropriate measures to avoid the cofferdam structure. It provides the specific methods for demarcating the area to be avoided and the buoy/signage/lighting scenario for the project. Completion of the project will have no adverse impact on navigation in the Congaree River.

3.6 Water Management

Management of water will be a major component of the overall remediation project. Four main categories of water requiring proper management are currently anticipated:

1. Stormwater, primarily associated with run-on/run-off from the landside;
2. Initial dewatering of the river water from the excavation area following construction of the cofferdam or after an overtopping event;
3. Leakage or seepage water, which is river water that continuously filters through the stone cofferdam; and
4. Potentially impacted water that contacts exposed impacted material (i.e., contact water).

A brief description of the types of water and anticipated management techniques are provided below. The Water Management Plan found in Appendix I provides the specific management details associated with each category of water. These details will also be included in permit applications that include:

- Notice of Intent for coverage under the South Carolina National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges from Construction Activities, which will include a Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP); and
- City of Columbia Industrial Wastewater permit application.

These documents will be reviewed and approved by the appropriate agency (SCDHEC and/or the City of Columbia). All landside stormwater management activities will be conducted in accordance with the approved C-SWPPP. Coverage under the South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities is expected to cover discharges associated with the initial dewatering and leakage/seepage water from within the cofferdam.

3.6.1 Landside Stormwater

In general, stormwater associated with the landside operations will primarily include precipitation and runoff from non-impacted areas. This stormwater will be controlled to prevent erosion following clearing and grading activities and to prevent or minimize run-on of landside stormwater into the active sediment excavation areas. Impacted sediment conditioning will be conducted at the point of excavation or on the landside within the temporary structures, which will minimize the amount of stormwater that contacts the impacted sediment. Sediment and erosion control best management practices (BMPs) will be utilized, as specified in the C-SWPPP, to control erosion associated with the project.

The landside activities will be conducted with the intent to minimize land disturbance and mature tree removal. The vegetative surface cover will be left intact where possible to minimize the potential for erosion. Where clearing and grading activities are conducted, the disturbed areas will be stabilized as soon as practical. As currently envisioned, existing drainage paths will be redirected as necessary to control stormwater flow and sediment control devices (e.g., silt fence, silt socks, etc.) will be utilized to contain potential sediment transport. The ground surface within common traffic lanes will be covered with gravel, or a similar method will be utilized to control erosion. The E&S controls will be maintained as necessary throughout the duration of the project.

3.6.2 Initial and Overflow Dewatering

Initial excavation area water will be the river water left inside the isolated area following completion of cofferdam construction. This may also be water left behind following an overtopping event, where the river levels temporarily exceeded the height of the cofferdam and resulted in a flood of the previously dewatered area. The upper portion of the water column will be considered “non-contact” water as it will not have been in direct contact with impacted sediment and will be visually un-impacted and sediment free. Currently two methods are planned for removing the initial excavation water. These include the use of an outlet structure and pumps. The outlet structure will consist of a pipe installed as part of the cofferdam that will permit gravity flow of river water from inside the cofferdam to the outside river, while preventing backflow into the dewatered area with a check valve. The outlet structure will be equipped with a valve or other device capable of stopping or regulating the discharge flow. The outlet structure will likely be located on the downstream end of the cofferdam. Outlet structure details are provided in the Water Management Plan in Appendix I. The outlet structure is expected to be the primary method for initial dewatering and any over-topping event.

Dewatering via the outlet structure will likely be supplemented with pumps stationed on top of the cofferdam or on the adjacent riverbank. These pumps will also be used to remove the additional few feet of water located below the outlet structure intake but above the water column that is in contact with the impacted sediment. The final “layer” of water, located directly on top of the sediment, will be managed as “contact water” as described in Section 3.6.4. No sampling of the initial dewatering water is planned prior to commencement of the dewatering activities.

3.6.3 Seepage Management

Leakage or seepage water will result from the continuous movement of river water from outside of the cofferdam, through the cofferdam and into the dewatered area. This seepage will most likely occur at the interface of the cofferdam with the existing river bottom. The cofferdam design has a provision for injecting a grout material at this interval, at the contractor’s discretion. Seepage water is expected to constantly move through and under the constructed cofferdam. The current design engineer’s estimate of the rate of expected leakage ranges from 0.37 to 1.42 gallons per minute per foot of the completed cofferdam. For the largest excavation area (Phase 1) this results in approximately 500-1,800 gallons per minute that could require management.

The leakage water is expected to be similar to the initial dewatering water in that it will be considered “non-contact” as it will not have been in direct contact with impacted sediment and will be visually un-impacted and sediment free. In order to collect the seepage water a concrete berm, sandbag dike or other structure will be constructed roughly parallel to the interior toe of the cofferdam slope and will be used to direct the leakage water to predetermined collection points where it will be pumped back over the structure, as appropriate As with the initial dewatering water and overflow water, the seepage water will be visually monitored by project personnel and managed as contact water if it is observed to contain excessive sediment, sheens or other potential impacts.

3.6.4 Contact Water

Contact water is expected to include:

- Entrained water that seeps from the sediment once it is excavated or disturbed;
- Precipitation that contacts the exposed impacted sediment;
- The final layer of water from the initial dewatering activities that is located directly on top of the sediment; and
- Leakage water that potentially exhibits a sheen or excessive sediment.

All contact water will be collected and pumped to the water management system located in the landside support zone where it will be managed for disposal via discharge to the City of Columbia sanitary sewer system (POTW) under an approved industrial wastewater discharge permit.

The water management system will most likely operate around-the-clock in order to maintain a steady discharge rate to the POTW sewer system. The components of the water management system will likely consist of water storage tanks (e.g., multiple 20,000-gallon frac tanks and/or larger volume modular tanks), filtration equipment such as bag filters and/or activated carbon vessels, associated piping and hoses and a totalizing flow meter. The Water Management Plan located in Appendix I provides the specific details pertaining to the planned water management system components and the approved City of Columbia Discharge Permit will be provided once obtained. The required POTW discharge reports, sampling data and other permit information will be collected during the project and provided in the final documentation report.

3.7 Sediment and TLM Removal, Conditioning and Disposal

The major objective of this project is the removal of the TLM and impacted sediment (and debris or other deleterious material) from within the delineated area to the extent practicable. Once the cofferdam is constructed, the initial dewatering operations will begin and the water from within the cofferdam will be systematically lowered. At this point coordination of multiple activities will be required in order to:

- Conduct the mussel relocation activities described in Section 3.3.1 in accordance with the Mussel Relocation Plan (Appendix A),
- Set up the contact water pumping system to transfer the final layer of water from directly on top of the impacted sediment to the water management system;
- Safely screen the planned excavation removal area for potential UXO as described in the UXO Management Plans (Appendix D); and

- Create/excavate a cleared path to the area nearest the inner toe of the cofferdam and construct a bermed area for the leakage/seepage water collection system.

Once these activities or systems have been completed and/or made operational, the removal area will be relatively water-free and suitable for safe excavation of the sediment. The remainder of this section describes the general approach to excavation, material conditioning, transportation and disposal of the excavated sediment.

3.7.1 General Approach to Excavation (including shoreline removal)

Dewatering of the planned removal area is expected to permit excavation of the sediment using conventional excavation equipment and techniques. Field personnel will determine the most expeditious and practical sequence for the excavation operations once the area is dewatered and the specific river bottom bathymetric conditions are visible. This will permit the establishment of the leakage/seepage water collection system, excavation areas, material stacking/draining areas and contact water collection areas. The anticipated extent of TLM occurrence is based primarily upon the findings of the previously conducted delineation activities. Actual subsurface conditions encountered may vary from the currently anticipated conditions. Therefore, the general approach to excavation is designed to be flexible and accommodate changes dictated by field conditions. Additionally, it is anticipated that SCDHEC will be apprised of actual field conditions either by being present for direct oversight of field activities or by frequent communications with on-site personnel. SCE&G currently plans to provide weekly reports to SCDHEC via e-mail. The reports will include the volumes of material removed from the site and documentation of conditions encountered during the excavation process. This approach will allow SCDHEC to concur with any unforeseen deviations from the general approach in a timely manner.

As currently envisioned, and after the area has been screened and cleared by the UXO contractor, the material located directly adjacent to the cofferdam toe will be excavated first. Next, the inner, leakage/seepage water berm as discussed in the water management section will be installed. This will allow personnel to further control water infiltration within the planned excavation area.

As envisioned, the excavation work will start from the northern most portion of the cofferdam area and progress southward. Figure 3-4 provides an excavation and water management scenario based on the Phase 1 work area. A grid tracking system will be employed to document excavation progress and for artifact recovery purposes. To the extent practicable, the excavated sediment will be piled or stacked in designated draining areas, where the entrained water will be allowed to flow away from the excessively wet material. This water will be directed toward the lower, southern area within the cofferdam and ultimately to the on-site water management system. This technique will reduce the amount of material conditioning required to transport the impacted sediment to the on-site screening facility or off-site disposal facility. Any contact water collected on the landside will also be pumped to the water management system. This general approach is illustrated in the attached Water Management Plan (Appendix I).

Once allowed to drain, the stacked sediment will likely be mixed with a conditioning agent such as cement kiln dust (CKD), other type of drying agent (saw dust), or a commercially available polymer to render it suitable for transport to the landside support zone (unimpacted or lightly impacted material) for further conditioning and artifact screening or off-site (material containing a significant amount of TLM) for artifact screening and disposal. If the excavated sediment is heavily impacted with TLM, and gives off a strong odor, contingency measures outlined in the Community Air Monitoring and Odor/Dust Control Plan (Appendix J) will be implemented. Material conditioning is discussed further in the next section.

The excavation program will be conducted in grids, or controlled sequences, to minimize the area of open excavation. This will limit the potential for liberation of impacted exposed sediment during an overtopping event. The sediment will be removed down to the top of the underlying bedrock. Large rocks that are visually un-impacted will be temporarily relocated within the work area to facilitate sediment removal and then returned to their approximate original locations. Visually impacted large rocks will be broken down into manageable pieces and transported off-site for disposal or may be pressure washed within the excavation. Sediment removal operations will extend inward toward the riverbank until visual impacts are no longer present.

As a final measure, SCE&G plans to pressure wash the exposed bedrock bottom of the river. Water generated during the pressure washing stage will be collected and managed as contact water. The intent is to remove any residual staining or impacts due to the presence of TLM.

To the extent practicable, the existing riverbank will remain undisturbed except where the cofferdam ties into the riverbank and where access roads are constructed, as shown on Figure 2-3. Proposed riverbank and shoreline restoration techniques are provided in the Riverbank and Shoreline Restoration Plan (Appendix K).

3.7.2 Health and Safety and Air Monitoring Activities

In accordance with the HASP (Appendix L), routine air monitoring measurements will be obtained during the excavation process within the impacted material handling areas to assure a safe working environment. The HASP is the primary source of safety related information for the project and includes a project specific evaluation of the potential hazards and the corresponding control and mitigation activities. Task specific hazard matrices are included as are air monitoring frequencies and action levels, personnel responsibilities, training requirements and emergency procedures. All personnel and visitors entering the site will be given a HASP briefing and will review the HASP prior to conducting work on the site.

The Community Air Monitoring and Odor/Dust Control Plan provided in Appendix J establishes work area and site perimeter air monitoring procedures to ensure that site related constituents of concern, dust and odors are monitored and controlled throughout completion of the project.

The Notification Plan (Appendix M) provides the planned steps that SCE&G, USACE and SCDHEC will undergo to notify the general public in the vicinity of the project area, local officials and emergency response agencies of anticipated major project milestones or changes, etc. It will ensure timely notification of important project details, as required, throughout completion of the project. In addition, the Public Safety Plan (Appendix P) provides a summary of the project’s specific safety management practices.

3.7.3 Material Conditioning

Most likely, all of the sediment excavated from the isolated areas will require some sort of conditioning to assist with removal of the moisture and render it suitable for further handling or transport. As stated above, the initial application of a conditioning agent will likely occur within the isolated river excavation area to sufficiently dry the material for transport to the landside support zone or off-site landfill screening area for further processing. Cement kiln dust (CKD), lime, fly ash, bottom ash, Portland cement, saw dust or other similar commercially available polymer drying agent will be staged on-site and used to dry excessively wet material. This procedure will minimize the amount of wet material to be staged on-site and reduce the potential for the spread of constituents and the need for landside support zone water collection and management.

The drying agent will be safely stored on-site in bermed and covered staging areas, holding tanks or one-ton sacks until it is needed. Additional drying agent will likely be added within the support zone structures as part of the continued material processing.

3.7.4 Material Screening, Removal and Management

Screening the excavated material for historical items will be conducted in either on-site temporary structures or off-site at the landfill screening facility based on the TLM content. The non-impacted to slightly impacted sediment material removed from the river will be screened for historical artifacts on-site by trained professionals operating under direct supervision of the project archeologist. Similar screening of the more heavily impacted material may be conducted off-site at the landfill facility.

Temporary on-site structures (e.g., Sprung structures) will be utilized to provide a secure location for processing the material and evaluating the presence of historical artifacts. City of Columbia approvals (e.g., building permit) will be obtained for the structures temporarily placed at the project area to facilitate the processing of material removed from the river bottom.

This secondary location will provide the following benefits to the project:

1. Increased material processing capacity, which will allow for more expedient excavation of the sediment within the isolated areas and reduction in the overall project completion time. Reduction in the project completion time will also reduce the project’s exposure to costly overtopping events;
2. Reduction in the potential for constituent migration from heavily impacted material in the landside support zone;
3. Reduction in the potential for odor and air monitoring related issues from the more heavily impacted material; and
4. Provide an environment where more thorough screening of excavated material for artifacts can be accomplished.

In order to accomplish this two-pronged material processing and screening activity the sediment containing significant amounts of TLM will be segregated as much as practical at the point of excavation, adequately stabilized and loaded directly into designated trucks that will carry it to the off-site processing facility. Segregation will be based on visual inspection at the point of excavation and determination of on-site vs. off-site processing will be made by field personnel.

The Artifact Recovery and Artifact Conservation Plan develop by TRC Environmental Corporation is provided in Appendix N. It contains the specific methodology and techniques that are currently planned for processing the sediment and TLM and segregating the potential artifacts. Recovered artifacts will be preserved in accordance with SCIAA-approved procedures.

3.7.5 Transportation

SCE&G will utilize appropriately licensed transportation companies to conduct the TLM transportation activities to the landfill. All shipments will be manifested in accordance with federal and state requirements. The proposed truck route into and away from the site entrance on Blossom Street is presented in the Traffic Control Plan, included as Appendix O. This route was specifically designed to minimize the need for trucks to cross oncoming traffic lanes to enter and exit the site and to direct traffic through non-residential areas, as much as practical. SCE&G will ensure that all driver's utilize the routes specified in the Traffic Control Plan and will periodically monitor transportation operations to maintain compliance with the Plan.

3.7.6 Disposal

SCE&G currently anticipates transporting the excavated material to the Waste Management Richland County Landfill located in Elgin, SC. The material will include impacted material from the excavations, along with debris such as rock, brick, concrete rubble, or other metal or wood debris that may be encountered. A contingency facility will also be identified in the unlikely event that the primary facility becomes incapacitated or places restrictions on the daily import volume. Disposal facilities utilized by SCE&G are typically audited and pre-approved by SCE&G's Corporate Environmental Services personnel. Material excavated and transported off-site will be manifested in accordance with applicable requirements.

3.8 Site Restoration

Completion of the project will disturb portions of the Congaree River, riverbank/shoreline and the landside support zone located directly adjacent to the planned removal area. The following sections provide details pertaining to the planned restoration activities for these areas.

3.8.1 Landside Support Zone Area Restoration

Construction and operation of the landside support zone will require clearing and grading activities in order to establish access roads, material and equipment storage and laydown areas, temporary structures and the water management system. In addition, a concrete span bridge is currently planned for construction over Unnamed Tributary #2 to complete the southern access route. As shown on Figure 2-3, SCE&G is currently planning to strategically locate landside site operations components in areas that will limit the need for clearing and grading activities, as much as practical. The planned location for the majority of site operations is the existing power line right-of-way, which has already been cleared. SCE&G is currently relocating the overhead wires within the right-of-way to accommodate future site operations. This scenario will reduce disturbance of currently forested land and further preserve the riparian corridor. It will also minimize the amount of landside restoration activities that will be required prior to final demobilization.

Prior to completion of the project, the current landside property owner will be consulted with regard to the access roadways, storage areas and other landside temporary improvements that will be left in place following completion activities. All landside disturbed areas not designated by the property owner to be left in place will be restored by removing equipment, materials, structures, etc. final grading and reestablishment of vegetative cover. The details associated with final reconstruction of the landside support zone will be included in the C-SWPPP and subsequently approved by SCDHEC. In general, the gravel and geotextile material utilized to construct the roads and laydown/storage areas will be removed and transported off-site for disposal. Final grading will be conducted, and vegetative cover reestablished utilizing an SCDHEC approved seed mixture. Erosion and sedimentation control measures will be left in place until stabilization of disturbed areas is deemed complete.

Responsibility for landside components left in place, at the discretion of the property owner, will be transferred to the property owner once restoration activities are completed.

3.8.2 River Substrate Material Replacement

The current project plan does not include replacing any sand or other backfill material within the excavated areas. The impacted sediment will be removed down to the top of the underlying bedrock. In many areas, this will only require removal of a few inches of sediment. Following completion of the removal activities, the cofferdam will be removed and over time, the natural depositional processes of the river will restore the river substrate. This process will allow for natural re-deposition of sediment within the removal area based on current river hydraulics. Not replacing the impacted sediment with fill material will also eliminate the potential for backfill materials to be washed downstream and deposited in other areas or degrade other habitats through siltation, etc.

3.8.3 Riverbank/Shoreline Restoration

SCE&G is committed to preserving as much of the current riverbank/shoreline, as practicable. Figure 3-5 provides the currently anticipated site operations plan scenario and highlights the approximate areas where the eastern shoreline of the riverbank will likely be disturbed as a result of construction activities. Efforts will be undertaken to safeguard the remainder of the areas from impacts. Portions of the riparian corridor not slated for disturbance will be demarcated with flagging or fencing to ensure that they are not damaged by removal operations or heavy equipment movement. This preservation technique will be a key component of the overall project.

In areas where shoreline impacts are unavoidable, and/or the removal of TLM impacted sediment results in slope failure, SCE&G will conduct restoration activities, which will include recreating the approximate shoreline slope, stabilization of the bank via riprap and/or bioengineered solutions and restoration of vegetative cover, where practicable. The Riverbank and Shoreline Restoration Plan (Appendix K) provides the specific details pertaining the current plans for protecting the riparian corridor in areas where no site related activities are planned and restoration of impacted areas.

4.0 PERMITS AND APPROVALS

In addition to the SCDHEC Bureau of Land and Waste Management (BLWM) approval of this PRAWP, other permits, approvals or agreements that are or may be required for implementation of the removal action include:

- An access agreement with the adjacent landside property owner(s);
- USACE approval for the activities planned within the Congaree River via issuance of an Individual Permit that will include SCDHEC Section 401 Water Quality Certification;
- USACE approval associated with the selected site access route, which is expected to be either 1) the central and southern access road improvement activities, including the concrete arch crossing

over unnamed tributary #2 and road cut and fill operations that will likely minimally impact an adjacent wetland; or 2) the northern access road improvement activities, including the culverts crossing over unnamed tributary #1;

- Acceptance of the removed material for disposal at the Waste Management Richland County Landfill, as described in Section 3.1.1;
- NPDES permit approval from the City of Columbia through submittal of a Notice of Intent for coverage under the South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities, which will include a Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP), to cover initial dewatering, leakage/seepage water from within the cofferdam, and landside stormwater management;
- Industrial wastewater discharge permit approval to discharge contact water, with on-site filtration, as necessary, to the City of Columbia sanitary sewer system for treatment at the POTW;
- Building permit(s) from the City of Columbia Planning & Development Services for the enclosed structures utilized during removal action operations, as described in Section 3.7.4; and
- United State Coast Guard (USGC) review and approval of the Navigation Plan, as described in Section 3.5.

Items not previously discussed in this document are further described in the following sections.

4.1 Access Agreements

Northern and central/southern access options are being considered at this time. The access options are depicted on Figure 2-1.

Land along the river adjacent to the proposed sediment removal area (the central/southern access option) is currently owned by Guignard and Associates, LLC. Approval from the property owner in the form of an access agreement is necessary to allow access to the sediment removal area, as well as access to the space required for setup and operation of the landside support zones. Alternate access to the proposed sediment removal area is available from the north utilizing property currently owned by the City of Columbia. Space is also available to the north for setup and operation of the landside support zones.

Permission for access from the appropriate landowner(s) will be obtained by SCE&G prior to initiating site preparation and remediation activities.

4.2 USACE Permits and SCDHEC Certification

USACE approval is required to conduct dredging and filling activities within a navigable waterway of the United States. For this project, USACE approval through issuance of an Individual Permit (IP) is required prior to initiating the sediment removal action. Approval under the IP will include SCDHEC Section 401 Water Quality Certification. Documents to be submitted are expected to include:

- Joint Federal and State Application Form for Activities Affecting Waters of the United States or Critical Areas of the State of South Carolina (Joint Application);
- Cofferdam Design;
- Backwater Analysis and Lower Flow Sensitivity Study; and
- Other supporting plans and documentation.

Activities necessary for sufficient site access, including roadways for the truck traffic needed to support the operations, will likely involve the need for additional USACE approval. Depending on the site access option selected, the additional approval may be covered by the IP for the removal action within the river or under a separate Nationwide Permit #14 approval to facilitate the project schedule.

Due to previous safety concerns and the potential for negative impacts resulting from project-related traffic on the local businesses and residential community located in the vicinity of Gist and Senate Streets, plans for site access through the southern access route were developed to supplement the central route (see Figure 2-1). If that access option is selected, USACE approval will be required because of the unnamed tributary #2 crossing and road construction activities that may impact a portion of the wetland located adjacent to the planned access road. If the northern access route is selected (see Figure 2-1), USACE approval will be required because of the unnamed tributary #1 crossing and road construction adjacent to the river.

4.3 NPDES Permit

Successful implementation of the sediment removal operations will involve the discharge of unimpacted river water from within the cofferdam area back to the Congaree River. Setup and maintenance of the landside operations necessary to support the sediment removal action will involve land disturbances, and stormwater drainage management and controls.

These activities are regulated under the South Carolina NPDES General Permit for Stormwater Discharges from Construction Activities (Permit Number SCR10000). The City of Columbia currently has the authority to regulate land disturbances and associated discharges. To obtain approval, a Notice of Intent for coverage under the NPDES General Permit will be submitted, which will include a Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP). Approval under the NPDES General Permit is expected to cover initial dewatering, leakage/seepage water from within the cofferdam, and landside stormwater management.

4.4 City of Columbia Industrial Wastewater Discharge Permit

In addition to the direct discharge of visually unimpacted river water from dewatering operations that will be covered under the NPDES General Permit, the need to manage impacted contact water from the immediate area of removed sediments is anticipated. The Water Management Plan located in Appendix I provides the specific details pertaining to the planned water management system components. A City of Columbia Discharge Permit will be obtained to allow discharge of impacted contact water to the POTW via the nearby sanitary sewer system. Information required by the POTW and conditions of the Discharge Permit will be collected during the project implementation and provided in the final Documentation Report. SCE&G has successfully obtained and operated under two previous City of Columbia discharge permits while completing MGP remediation projects at other sites in Columbia.

5.0 SCHEDULE CONSIDERATIONS

A detailed schedule of activities will be provided to SCDHEC following approval of this PRAWP and receipt of the required permit approval(s) from USACE. Key components of the schedule include:

- Obtain other required permits and approvals, including access;
- Contractor selection; and
- Implementation of the removal action, likely using a phased approach.

The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through October of each year (pending approval). As currently envisioned, the cofferdam construction and sediment removal work will require several seasons to complete. SCE&G has also requested permission to work behind the cofferdam year-round, with minimal site activity projected during the months of November through April. Conceptually, the UXO screening may be able to be completed during the off-season, assuming favorable weather/river conditions. The total duration of the project will be contingent upon factors including:

- Detailed plans of the selected contractor, developed in conjunction with SCE&G;
- Weather and river level conditions;
- The extent of UXO, historical artifact, and cultural debris presence within the project area; and
- Volume of water to be managed.

General considerations regarding the overall schedule for planning, design and implementation of the sediment removal action include:

- Engineering design and hydraulic analyses – update the cofferdam design with modifications as necessary to achieve no rise at the 100-year storm event and acceptable influences at lower river flows based on a new backwater analysis and lower flow sensitivity study. The expected duration is three to six months.
- Access agreements – Obtain agreement(s) with property owner(s) for landside operations and access to the proposed removal area. Expected timeframe necessary to obtain agreements is uncertain at this time.
- Design access routes – After site access is obtained, access routes must be designed including the hydraulic analyses needed to support the design of any tributary crossings. The expected duration is three to six months.
- Update support plans – Management plans for UXOs and historical artifacts potentially present within the removal area will need updated and approved. The expected duration is three to six months.
- USACE Permit approval – Develop the Joint Application package, submit to USACE for review including public and stakeholder comments, and receive authorization. The expected duration is uncertain at this time.
- SCDHEC approval – Prepare a Final Removal Action Work Plan, submit to SCDHEC for review including public and stakeholder comments, and receive authorization. The expected duration is uncertain at this time.

- City of Columbia approvals – Develop and submit applications to the City of Columbia and receive the required authorizations. The expected duration is two to four months.
- Remediation Contractor procurement and site operations setup – Prepare project specifications, obtain and review contractor bids, select contractor and complete site operations setup. The expected duration is six months.
- Phased sediment removal with restoration and documentation – The estimated duration is uncertain at this time.

6.0 REPORTING

Routine communications will be maintained between SCE&G and SCDHEC (and other agencies as may be required) throughout the removal action. Project reports will be provided to SCDHEC during implementation and after completion of the removal action. As currently envisioned, the reporting approach will include:

- Issuing weekly progress reports with photographs of completed activities submitted via e-mail; and
- Submitting a Final Removal Action Documentation Report.

Progress reports will include a description of completed activities, anticipated activities, problems or constraints encountered, and schedule updates.

The Removal Action Report will provide documentation of the completed removal action activities, and will address the following:

- Site preparation activities;
- UXO and historical artifact screening and management;
- Cofferdam installation;
- Water management and disposal;
- Sediment removal;
- Removed material conditioning and disposal; and
- Site restoration.

Support documentation, in the form of manifests, photographs, inventories of recovered artifacts, etc. will also be included in the final report.

7.0 REFERENCES

Alderman Environmental Services, Inc. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries.

Apex, June 2014. Draft Removal Action Plan, Congaree River Sediments, Columbia, South Carolina.

Apex, June 2017. Surface Water - Sampling Analysis Plan (SW-SAP), Congaree River Project, Columbia, South Carolina.

Glover, J.B. 2017. An investigation into the potential impacts of coal tar contamination on the invertebrate community of the Congaree river near the City of Columbia, Richland County, SC. The South Carolina Department of Health and Environmental Control Technical Report No. 0804-17. Bureau of Water, Columbia, SC.

MTR, March 2012. Project Delineation Report, Congaree River Sediments Investigation, Columbia, South Carolina.

MTR, January 2013. Final Engineering Evaluation/Cost Analysis (EE/CA), Congaree River Sediments, Columbia, South Carolina.

TRC, September 2014. Cultural Resource Identification Survey for the Congaree River Sediment Remediation Project, Richland County, South Carolina.

USACE, 1977. Congaree River Basin, Report No. 08, Navigability Study 1977.

TABLES

TABLE 1-1

MAGNETIC ANOMALY UXO CLEARING SUMMARY
SEPTEMBER 29 THROUGH NOVEMBER 19, 2015

Congaree River Sediments
Columbia, South Carolina

Anomaly Designation	Original Description	Anomaly Status	Identified Anomaly Type and Description	Offset Direction(1)	Offset Distance (inches)(1)	Notes
252	Possible Ordnance	NA(2)	Cultural Debris - UNK(3)	0	0	Redo
254	Possible Ordnance	Clear	Cultural Debris - Nail, small conduit, hot rock	W	8	Hot Rock(4)
255	Possible Ordnance	Clear	Cultural Debris - Hot Rock	S	7	Hot Rock
256	Possible Ordnance	Clear	Cultural Debris - Nail	0	0	
259	Possible Ordnance	Clear	Cultural Debris - wire, car rotor	SE	12	Backhoe Dig
260	Possible Ordnance	Clear	Cultural Debris - Metal Can	0	0	
261	Possible Ordnance	Clear	Cultural Debris - UNK	NE	15	
262	Possible Ordnance	Clear	Cultural Debris - metal plate, bolt	0	0	
263	Possible Ordnance	Clear	Cultural Debris - UNK	E	26	
264	Possible Ordnance	Clear	Cultural Debris - UNK	0	0	
265	Manhole	Clear	Cultural Debris - Manhole Cover	NA	NA	
266	Possible Ordnance	Clear	Cultural Debris - Metal	NA	NA	
267	Possible Ordnance	Clear	Cultural Debris - Wire	W	18	
268	Possible Ordnance	Clear	Negative Find	S	10	
268	Possible Ordnance	NA	Cultural Debris - magnet particles, pipe, long cable	N	18	Backhoe Dig
269	Possible Ordnance	Clear	Cultural Debris - UNK	NW	8	
269	Possible Ordnance	Clear	Cultural Debris - nail, hot rock, fish line spool, pipe, long cable, rail road spike	W	30	Backhoe Dig
487	Possible Ordnance	Clear	Negative Find	NA	NA	
492	Possible Ordnance	Clear	Negative Find	NA	NA	
499	Possible Ordnance	Clear	Cultural Debris - wire	S	48	
501	Possible Ordnance	Clear	Negative Find	NA	NA	
502	Possible Ordnance	Clear	Cultural Debris - Metal Pipe/Fence Post	NA	NA	
503	Possible Ordnance	Clear	Cultural Debris - wire	SE	20	
504	Possible Ordnance	NA	Cultural Debris - wire	NE	12	
506	Possible Ordnance	Clear	Cultural Debris - bottle cap	S	12	
507	Possible Ordnance	Clear	Cultural Debris - can	0	0	
508	Possible Ordnance	Clear	Cultural Debris - lid	0	0	
509	Possible Ordnance	Clear	Cultural Debris - razor blade, can, sheet metal	W	18	
511	Possible Ordnance	Clear	Cultural Debris - wire	SW	18	
513	Possible Ordnance	Clear	Cultural Debris - wire, hot rock, nail	N	3	
514	Possible Ordnance	Clear	Cultural Debris - hot rock	E	12	Hot Rock
515	Possible Ordnance	Clear	Cultural Debris - wire, hot rock, screw	E	8	
517	Possible Ordnance	Clear	Cultural Debris - metal wire	N	12	
518	Possible Ordnance	Clear	Cultural Debris - wire	E	20	
522	Possible Ordnance	Clear	Cultural Debris - wire	W	18	
525	Possible Ordnance	Clear	Cultural Debris - UNK	0	0	
533	Possible Ordnance	Clear	Cultural Debris - pipe	W	18	
534	Possible Ordnance	Clear	Cultural Debris - fish hook, wire, can	0	0	Hot Rock
541	Possible Ordnance	Clear	Cultural Debris - banding	W	4	
544	Possible Ordnance	Clear	Cultural Debris - small medal(?)	S	12	
545	Possible Ordnance	Clear	Cultural Debris - bottle cap	S	6	
546	Possible Ordnance	Clear	Cultural Debris - UNK	W	12	
547	Possible Ordnance	Clear	Cultural Debris - Metal plate	E	18	
552	Possible Ordnance	Clear	Negative Find	NA	NA	
554	Possible Ordnance	Clear	Cultural Debris - sheet metal, wire, bolt	NE	6	Trash Pit Outside
555	Possible Ordnance	Clear	Cultural Debris - banding	N	12	
556	Possible Ordnance	Clear	Cultural Debris - lid	NA	NA	
564	Possible Ordnance	Clear	Cultural Debris - tin can, large metal plate, wire	0	0	
565	Possible Ordnance	Clear	Negative Find	NA	NA	
566	Possible Ordnance	Clear	Cultural Debris - nail	W	14	

TABLE 1-1

MAGNETIC ANOMALY UXO CLEARING SUMMARY
SEPTEMBER 29 THROUGH NOVEMBER 19, 2015

Congaree River Sediments
Columbia, South Carolina

Anomaly Designation	Original Description	Anomaly Status	Identified Anomaly Type and Description	Offset Direction(1)	Offset Distance (inches)(1)	Notes
567	Possible Ordnance	Clear	Cultural Debris - metal, hot rock, aluminum, rubber tire	0	0	
568	Possible Ordnance	NA	Cultural Debris - magnet particles, pipe, long cable, magnet pieces	N	18	Backhoe Dig
569	Possible Ordnance	Clear	Cultural Debris - nail, hot rock, fish line spool, pipe, long cable, rail road spike	W	30	Backhoe Dig
50	Lanes	NA	Hot Water Heater	NA	NA	
51	Lanes	NA	Sheet Metal 5" x 5"	NA	NA	
52	Lanes	NA	Sheet Metal 30" x 30"	NA	NA	
53	Lanes	NA	Tent Stake	NA	NA	
54	Lanes	NA	Wire Solid Core	NA	NA	
55	Lanes	NA	Wire Bundle, Soild Core	NA	NA	
56	Lanes	NA	Old Style Cartridge Case	NA	NA	
57	Lanes	NA	Sheet Metal, Barrel Lids, Bottles	NA	NA	
58	Lanes	NA	Sheet Metal, Pipe Scrap, Wire Scrap	NA	NA	
59	Lanes	NA	Length of Cable	NA	NA	

Notes:
(1) Represents the offset direction and distance from the staked anomaly.
(2) NA - information is not available on corresponding dig sheet provided by EOTI.
(3) UNK - unknown
(4) Hot Rock is defined as stone that has a magnetic signature. Slag containing some metals was brought on-site to repair the boat ramp and generated a magnetic response.
(5) Information included in this table is from Daily Dig Sheets provided by EOTI at the end of each day.

TABLE 2-1

LISTING OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES

Congaree River Sediments
Columbia, South Carolina

Historic Place[(1,2)]	Location	Level of Significance	Area of Significance
Gervais Street Bridge	Spans Congaree River in West Columbia, SC	State	Architecture
Columbia Canal	East bank of the Broad and Congaree Rivers from the diversion dam to the southern railroad bridge in Columbia, SC	National	Industry

Archaeological Site[(3)]	Location	ID#
Underwater Civil War Era Ordnance Dumpsite	East bank of the Congaree River at the outfall of Unnamed Tributary #1 into Congaree River	38RD286
Possible Ruins of Briggs' Saw Mill	East bank of the Congaree River south of the Gervais Street Bridge and Unnmamed Tributary #1	38RD224
Late 19th to Early 20th Century Structure Foundation - House	East bank of the Congaree River south of the Senate Street Extension boat launch	38RD234
Underwater Deposit of Historic Ceramics and Metal Artifacts	Eastern portion of Congaree River south of the Alluvial Fan	38RD278
19th to 20th Century Bottle Dump/Landfill	Eastern bank of the Congaree River just Southeast of the Total Project Area	38RD223
Expanded Boundary of Underwater Civil War Era Ordnance Dumpsite	Eastern portion of the Congaree River from the Gervais Street Bridge to Unnamed Tributary #2	38RD286

Notes:

1. Table includes properties near to or coinciding with the Congaree River Sediment Project and included on the National Register of Historic Properties.
2. Historic Place Source: South Carolina Institute of Archeology and Anthropology & South Carolina Department of Archives and History.
3. Archaeological Site Source: Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC.
4. Figure 2-2 provides location of areas listed above.

FIGURES

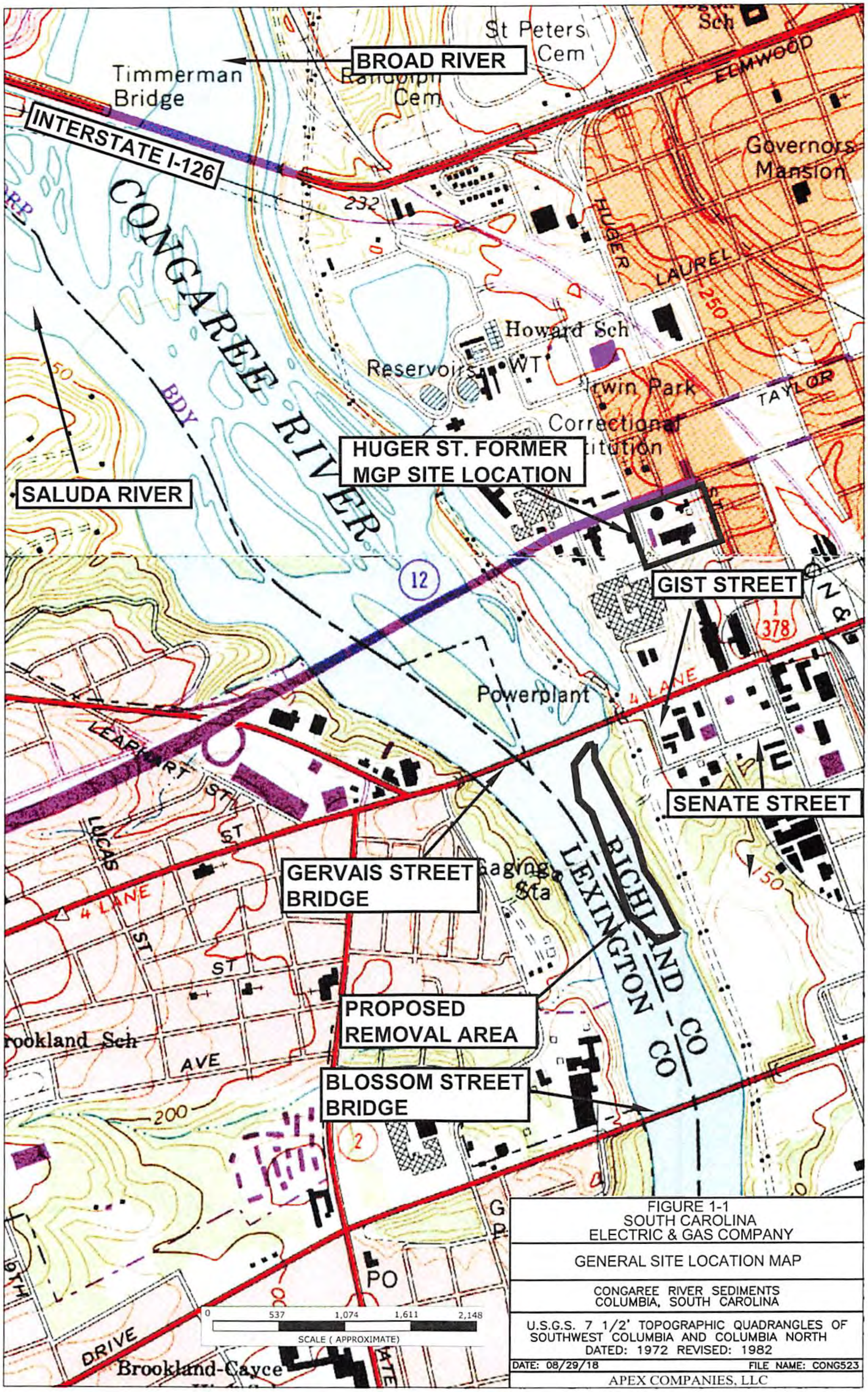


FIGURE 1-1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

GENERAL SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH
DATED: 1972 REVISED: 1982

DATE: 08/29/18 FILE NAME: CONG523

APEX COMPANIES, LLC

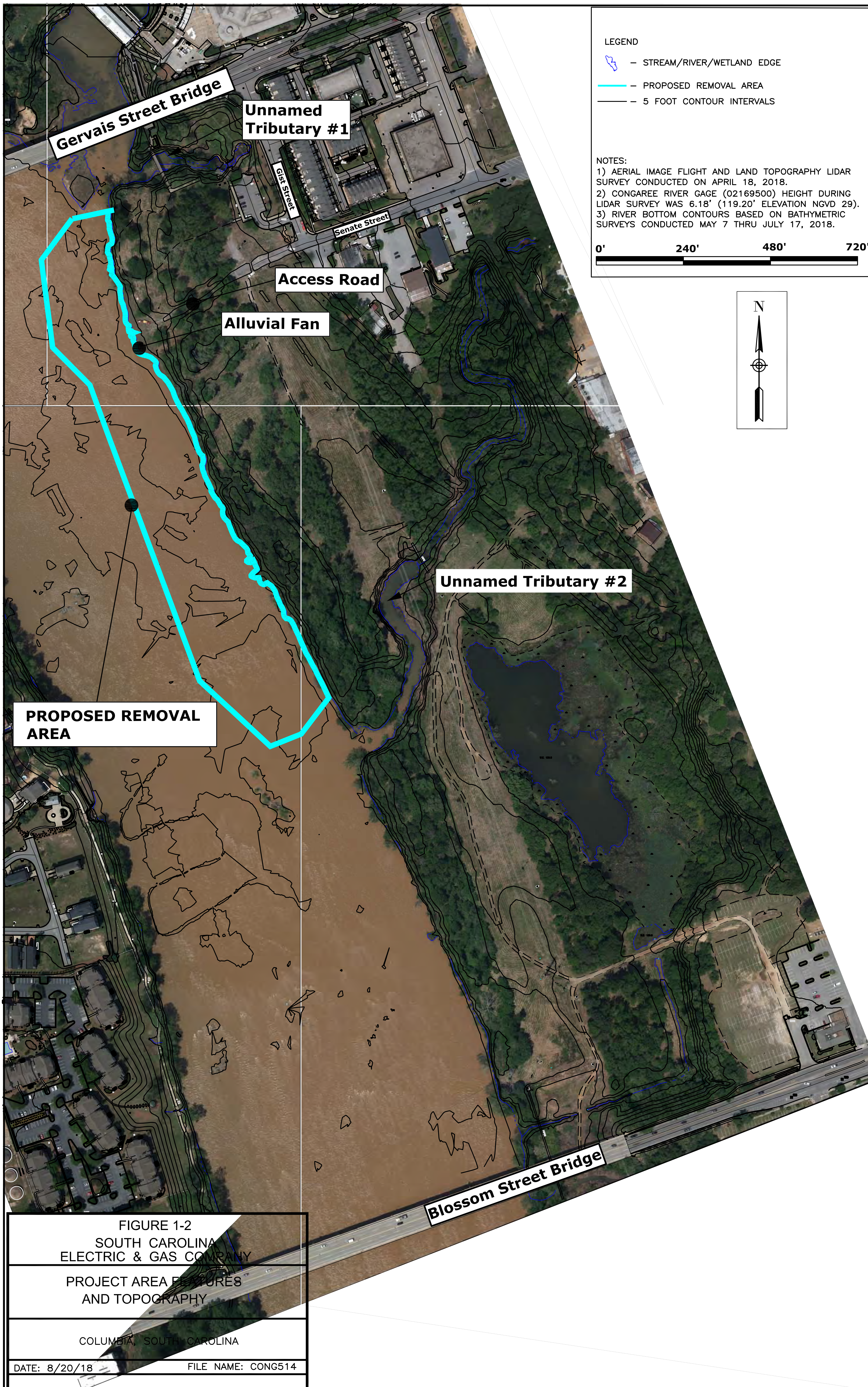


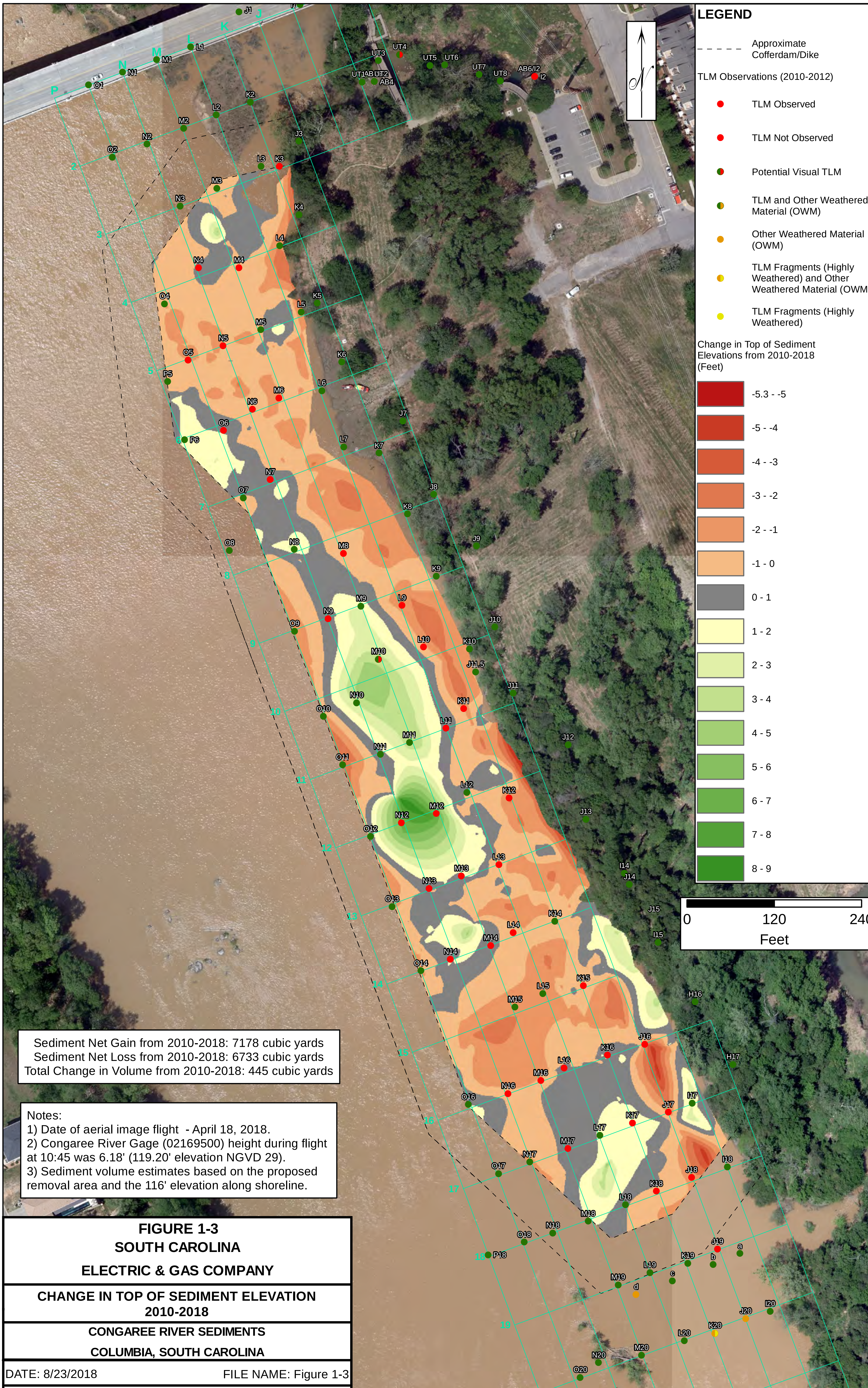
FIGURE 1-2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT AREA FEATURES AND TOPOGRAPHY

COLUMBIA, SOUTH CAROLINA

DATE: 8/20/18 FILE NAME: CONG514

APEX COMPANIES, LLC



Sediment Net Gain from 2010-2018: 7178 cubic yards
Sediment Net Loss from 2010-2018: 6733 cubic yards
Total Change in Volume from 2010-2018: 445 cubic yards

Notes:
1) Date of aerial image flight - April 18, 2018.
2) Congaree River Gage (02169500) height during flight at 10:45 was 6.18' (119.20' elevation NGVD 29).
3) Sediment volume estimates based on the proposed removal area and the 116' elevation along shoreline.

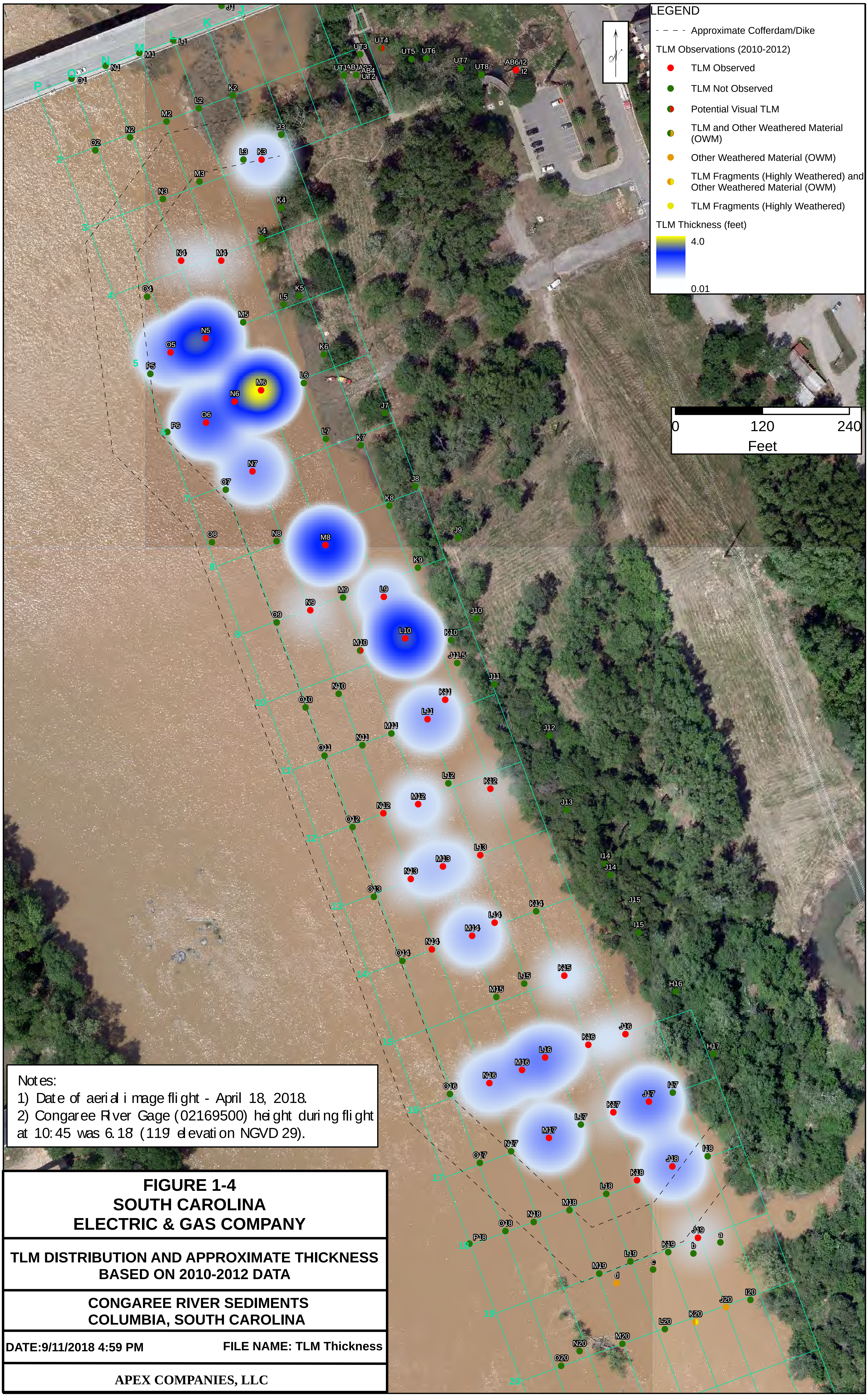
FIGURE 1-3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

CHANGE IN TOP OF SEDIMENT ELEVATION 2010-2018

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 8/23/2018 FILE NAME: Figure 1-3

APEX COMPANIES, LLC



Notes:
1) Date of aerial image flight - April 18, 2018.
2) Congaree River Gage (02169500) height during flight at 10:45 was 6.18 (119 elevation NGVD 29).

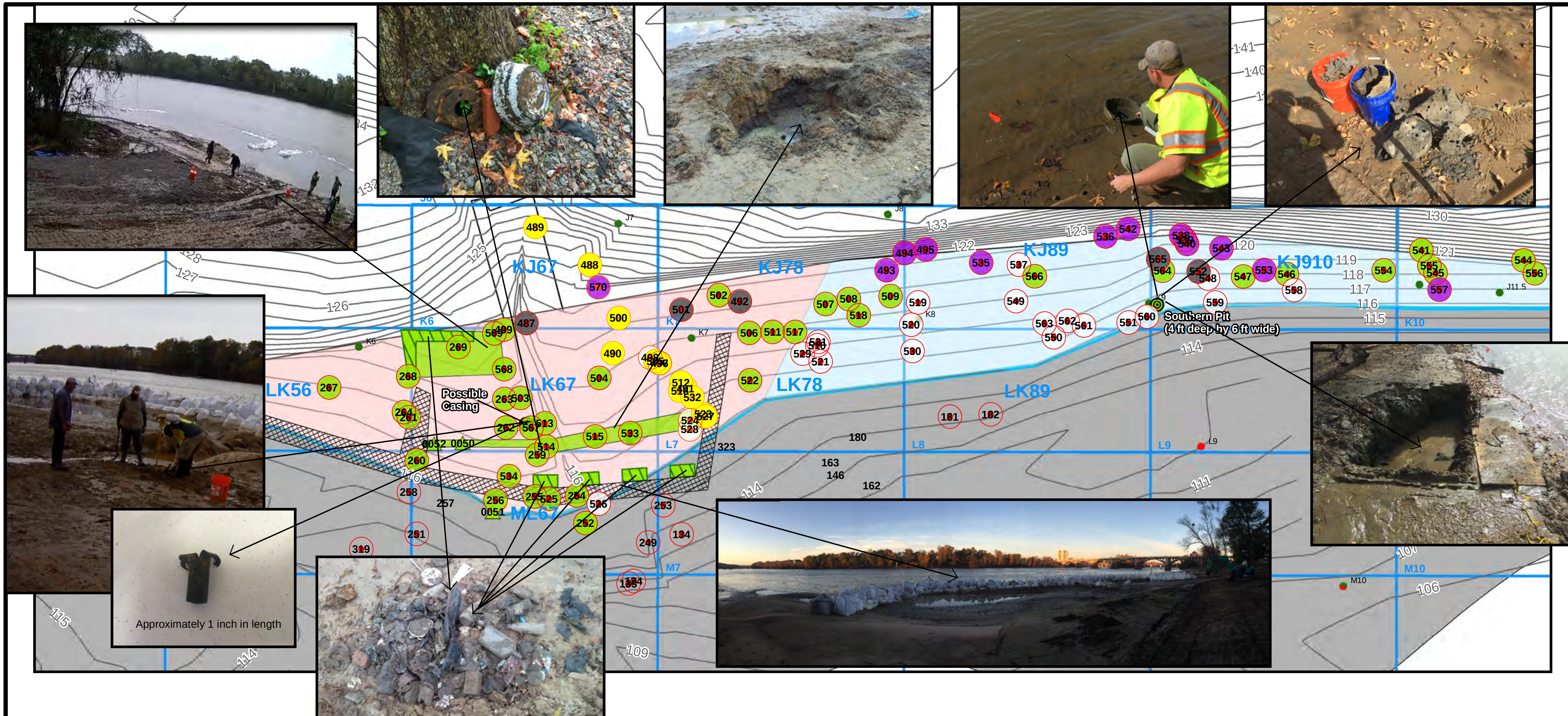
FIGURE 1-4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

TLM DISTRIBUTION AND APPROXIMATE THICKNESS BASED ON 2010-2012 DATA

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE:9/11/2018 4:59 PM **FILE NAME: TLM Thickness**

APEX COMPANIES, LLC



LEGEND

Magnetic Anomalies	Magnetic Anomaly Status	Lane Status	
Manhole Cover (1)	Location Cleared - Cultural Debris (46)	Southern Pit	Isolation Berm - Big Bags
Electromagnetic Anomaly (5)	Location Cleared - Negative Find (5)	Backhoe Investigation	Alluvial Fan
Possible Ordnance (81)	Location Not Cleared (23)	Cleared Lane (1,288 Sq. Ft.)	Southern FDP Area
Pipeline Associated (12)	Location Unable to be Located by Surveyor (13)	Location Cleared During Lane Clearing - Cultural Debris (10 total, 3 with coordinates)	**Soil Borings with TLM Observations** No Visual TLM Visual TLM Potential TLM

1 inch = 40 feet

0 40 80

Feet

FIGURE 1-5

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

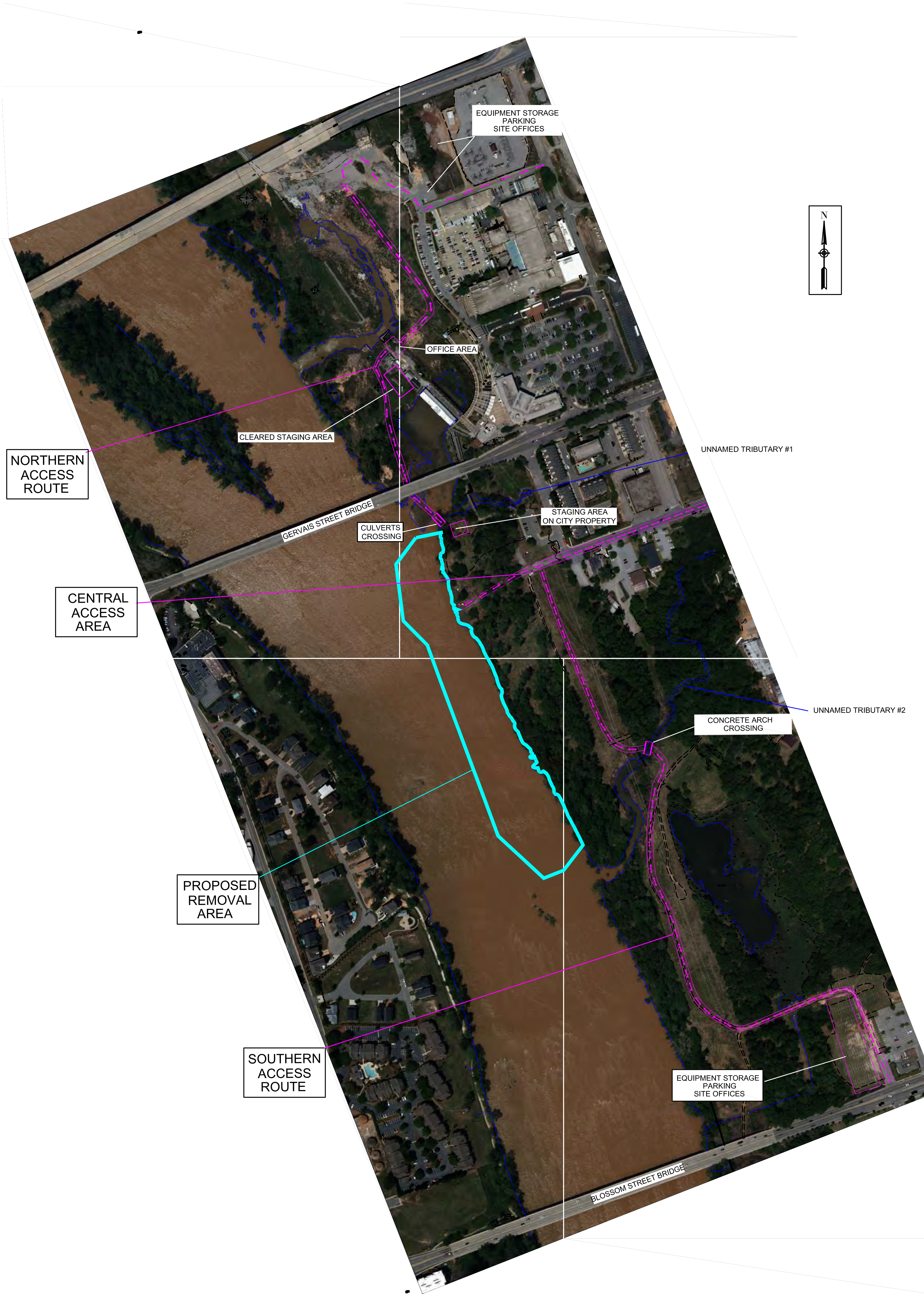
PHOTOGRAPHIC SUMMARY OF FDP FINDINGS AND ACTIVITIES

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 9/5/2018 FILE NAME: Findings and activities photos090518

APEX COMPANIES, LLC



LEGEND

– STREAM/RIVER/WETLAND EDGE

– PROPOSED REMOVAL AREA

NOTES:

1) DATE OF AERIAL IMAGE FLIGHT – APRIL 18, 2018.

2) CONGAREE RIVER GAGE (02169500) HEIGHT DURING LIDAR SURVEY WAS 6.18' (119.20' ELEVATION NGVD 29).

FIGURE 2-1 SOUTH CAROLINA ELECTRIC & GAS COMPANY
SITE ACCESS OPTIONS
COLUMBIA, SOUTH CAROLINA
DATE: 8/24/18 **FILE NAME: CONG518**
APEX COMPANIES, LLC

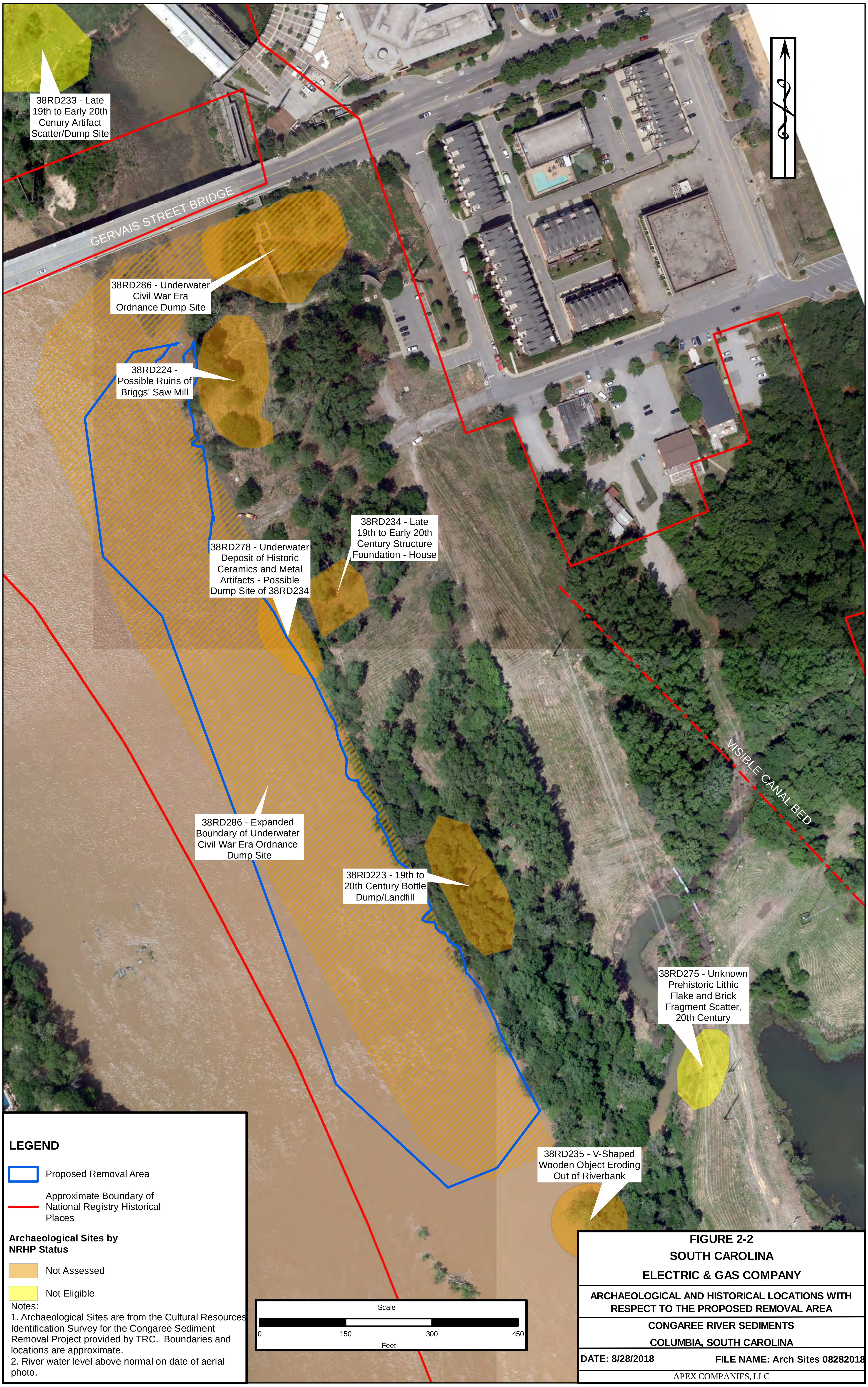


FIGURE 2-2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

ARCHAEOLOGICAL AND HISTORICAL LOCATIONS WITH RESPECT TO THE PROPOSED REMOVAL AREA

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 8/28/2018 FILE NAME: Arch Sites 08282018

APEX COMPANIES, LLC

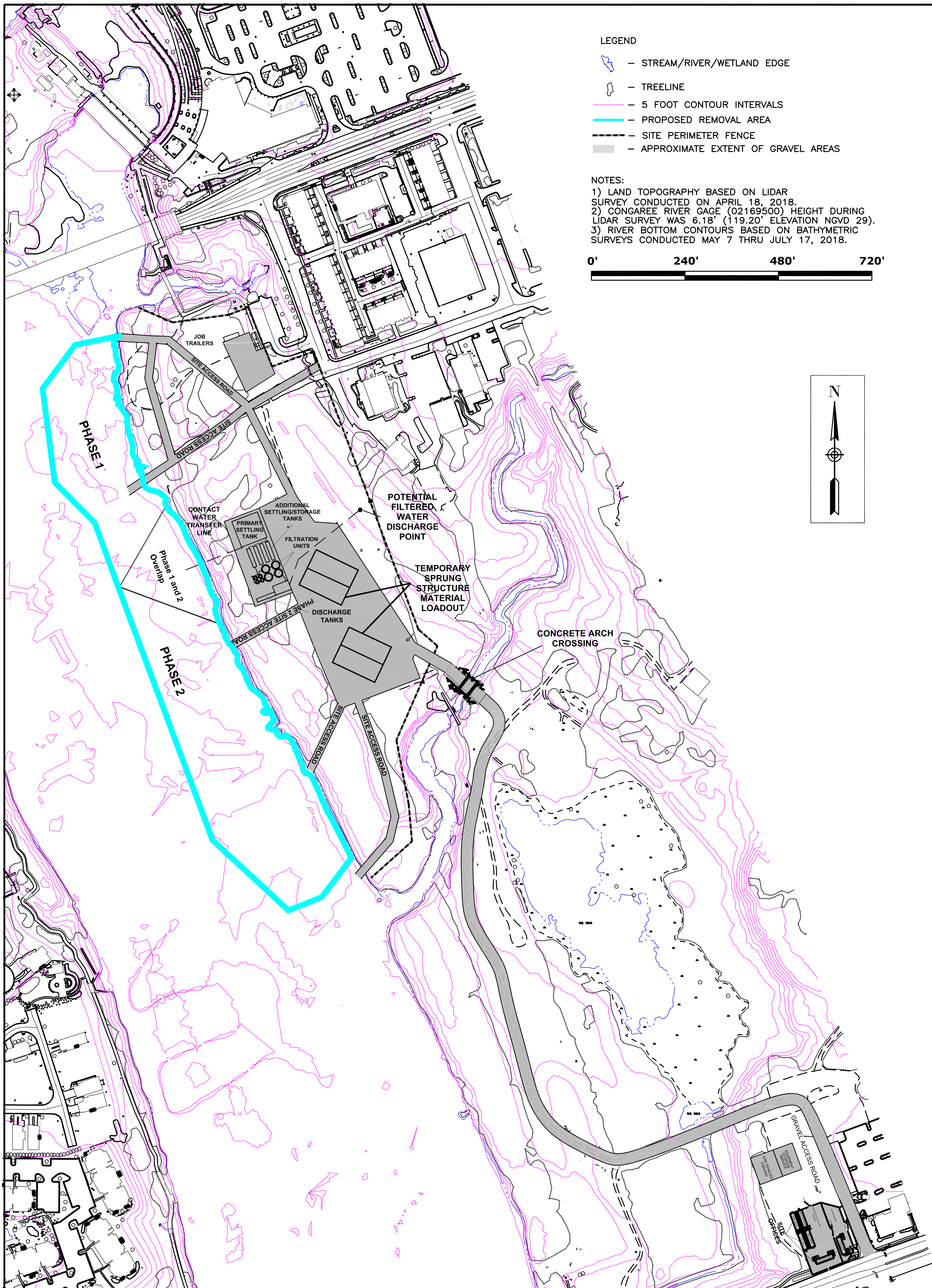


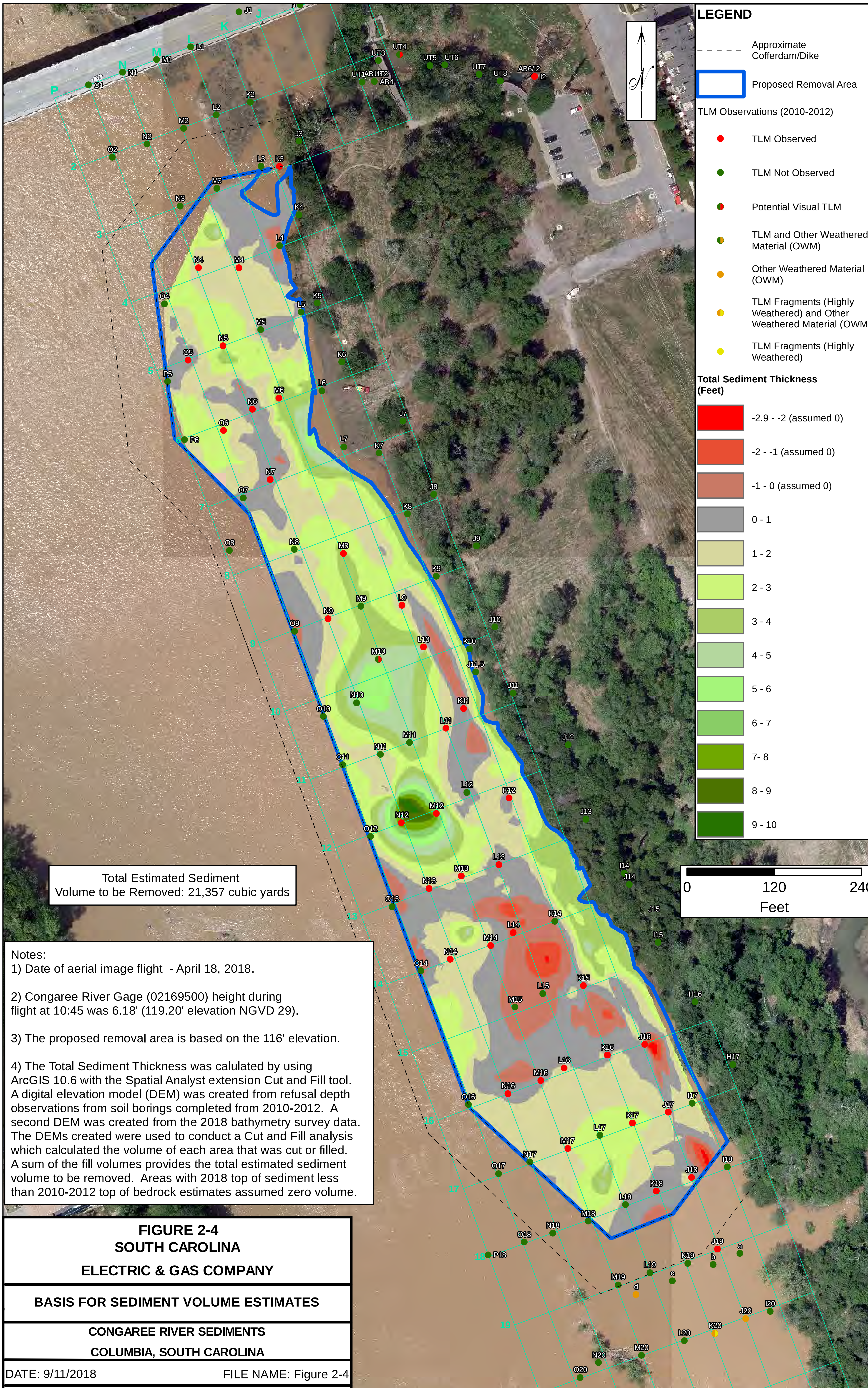
FIGURE 2-3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN
SCENARIO - ASSUMES CENTRAL AND SOUTHERN ACCESS ROUTES

COLUMBIA, SOUTH CAROLINA

DATE: 8/24/18 | FILE NAME: CONG515

APEX COMPANIES, LLC



Total Estimated Sediment
Volume to be Removed: 21,357 cubic yards

Notes:
1) Date of aerial image flight - April 18, 2018.

2) Congaree River Gage (02169500) height during flight at 10:45 was 6.18' (119.20' elevation NGVD 29).

3) The proposed removal area is based on the 116' elevation.

4) The Total Sediment Thickness was calulated by using ArcGIS 10.6 with the Spatial Analyst extension Cut and Fill tool. A digital elevation model (DEM) was created from refusal depth observations from soil borings completed from 2010-2012. A second DEM was created from the 2018 bathymetry survey data. The DEMs created were used to conduct a Cut and Fill analysis which calculated the volume of each area that was cut or filled. A sum of the fill volumes provides the total estimated sediment volume to be removed. Areas with 2018 top of sediment less than 2010-2012 top of bedrock estimates assumed zero volume.

FIGURE 2-4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

BASIS FOR SEDIMENT VOLUME ESTIMATES

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 9/11/2018 FILE NAME: Figure 2-4

APEX COMPANIES, LLC

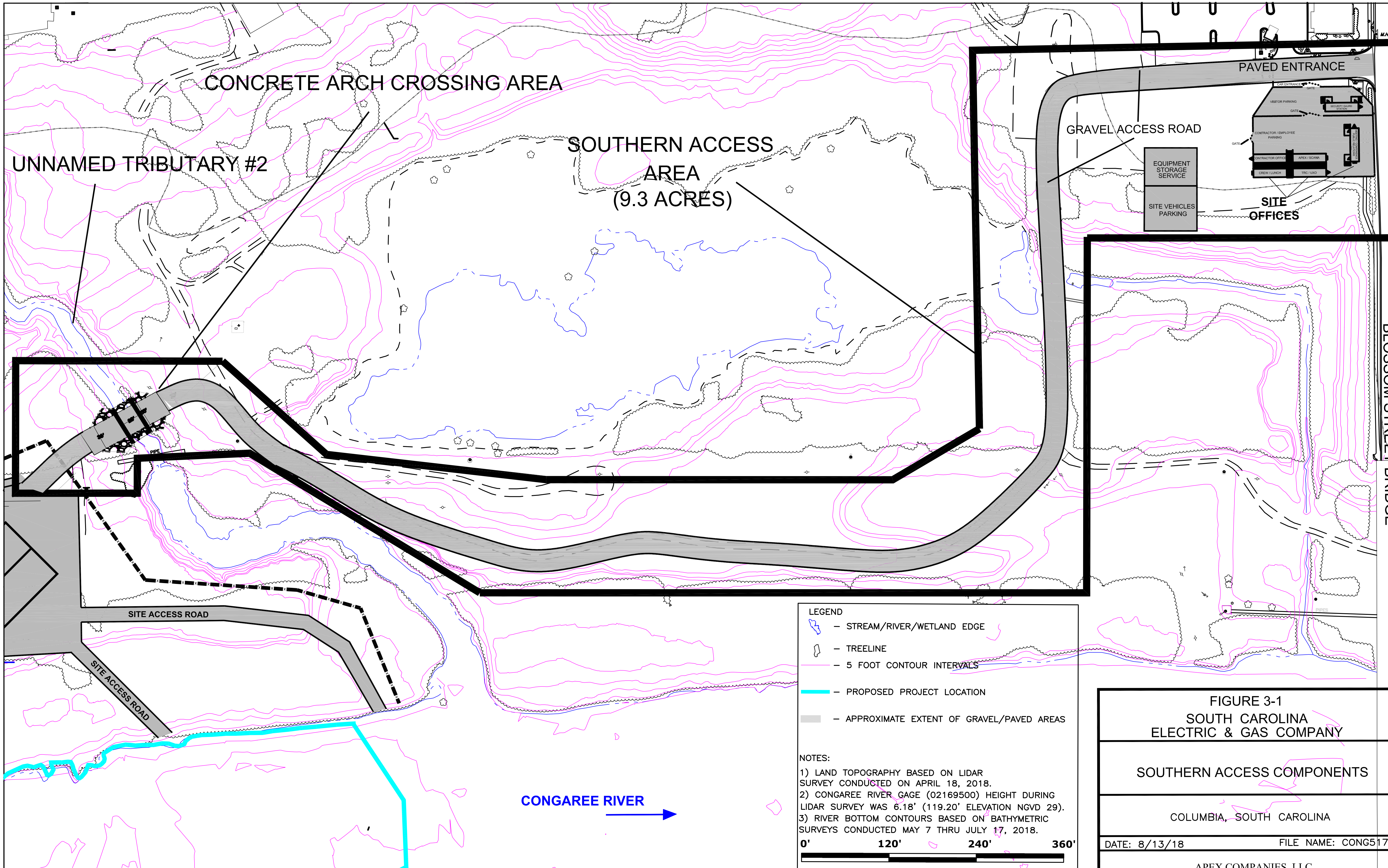


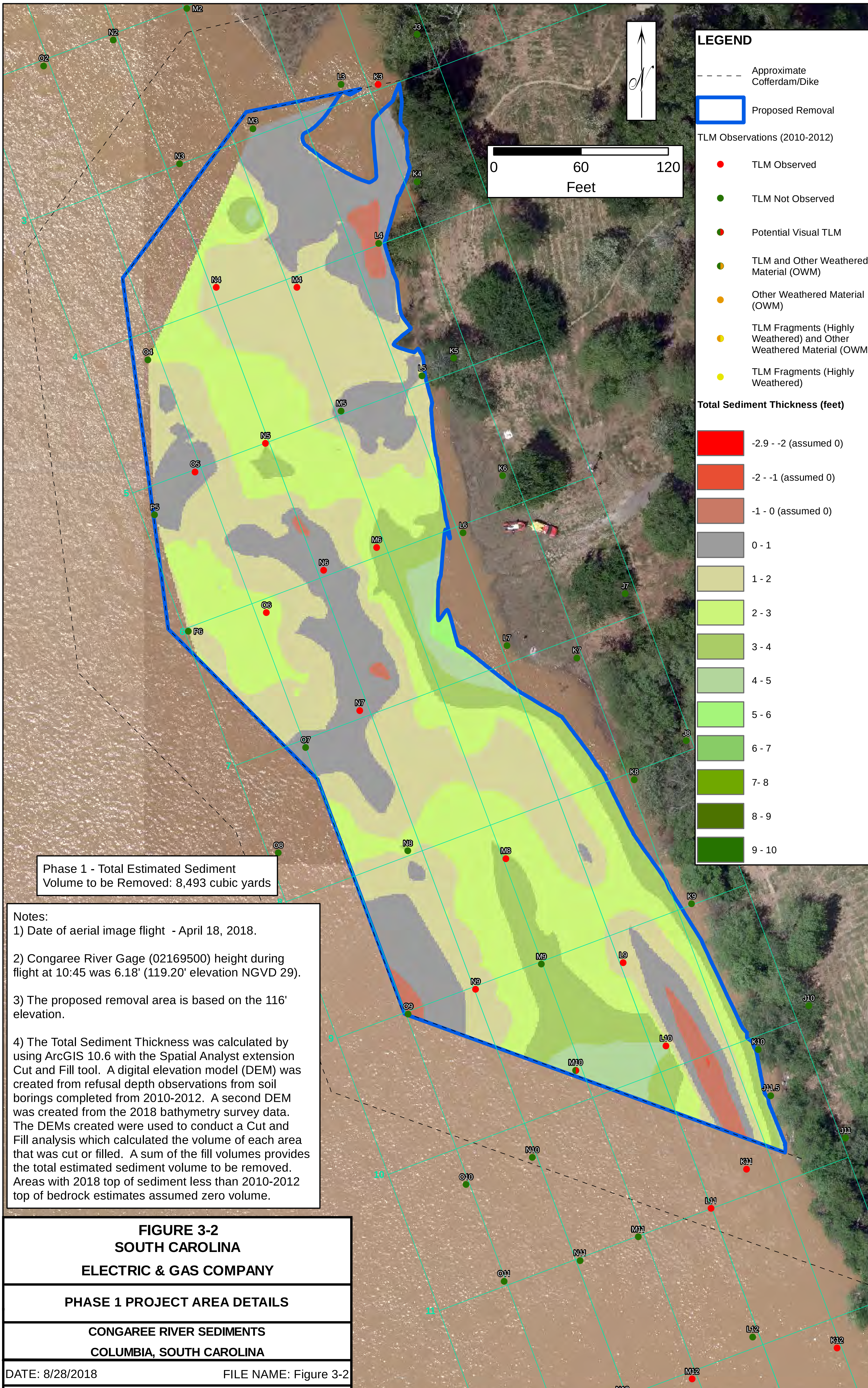
FIGURE 3-1
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTHERN ACCESS COMPONENTS

COLUMBIA, SOUTH CAROLINA

DATE: 8/13/18 FILE NAME: CONG517

APEX COMPANIES, LLC



Notes:
1) Date of aerial image flight - April 18, 2018.

2) Congaree River Gage (02169500) height during flight at 10:45 was 6.18' (119.20' elevation NGVD 29).

3) The proposed removal area is based on the 116' elevation.

4) The Total Sediment Thickness was calculated by using ArcGIS 10.6 with the Spatial Analyst extension Cut and Fill tool. A digital elevation model (DEM) was created from refusal depth observations from soil borings completed from 2010-2012. A second DEM was created from the 2018 bathymetry survey data. The DEMs created were used to conduct a Cut and Fill analysis which calculated the volume of each area that was cut or filled. A sum of the fill volumes provides the total estimated sediment volume to be removed. Areas with 2018 top of sediment less than 2010-2012 top of bedrock estimates assumed zero volume.

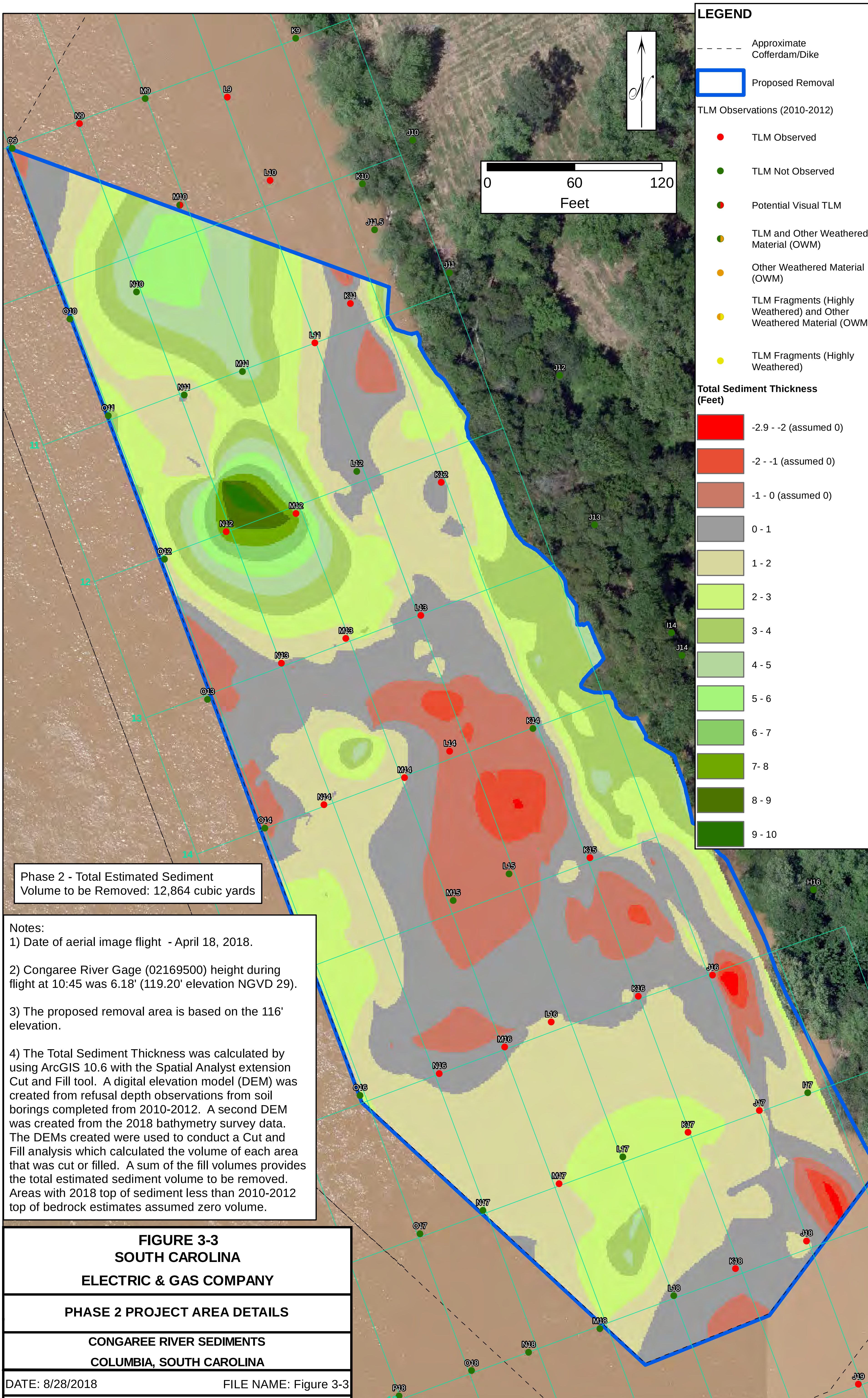
FIGURE 3-2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PHASE 1 PROJECT AREA DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 8/28/2018 FILE NAME: Figure 3-2

APEX COMPANIES, LLC



Notes:

1) Date of aerial image flight - April 18, 2018.

2) Congaree River Gage (02169500) height during flight at 10:45 was 6.18' (119.20' elevation NGVD 29).

3) The proposed removal area is based on the 116' elevation.

4) The Total Sediment Thickness was calculated by using ArcGIS 10.6 with the Spatial Analyst extension Cut and Fill tool. A digital elevation model (DEM) was created from refusal depth observations from soil borings completed from 2010-2012. A second DEM was created from the 2018 bathymetry survey data. The DEMs created were used to conduct a Cut and Fill analysis which calculated the volume of each area that was cut or filled. A sum of the fill volumes provides the total estimated sediment volume to be removed. Areas with 2018 top of sediment less than 2010-2012 top of bedrock estimates assumed zero volume.

FIGURE 3-3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PHASE 2 PROJECT AREA DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 8/28/2018 FILE NAME: Figure 3-3

APEX COMPANIES, LLC

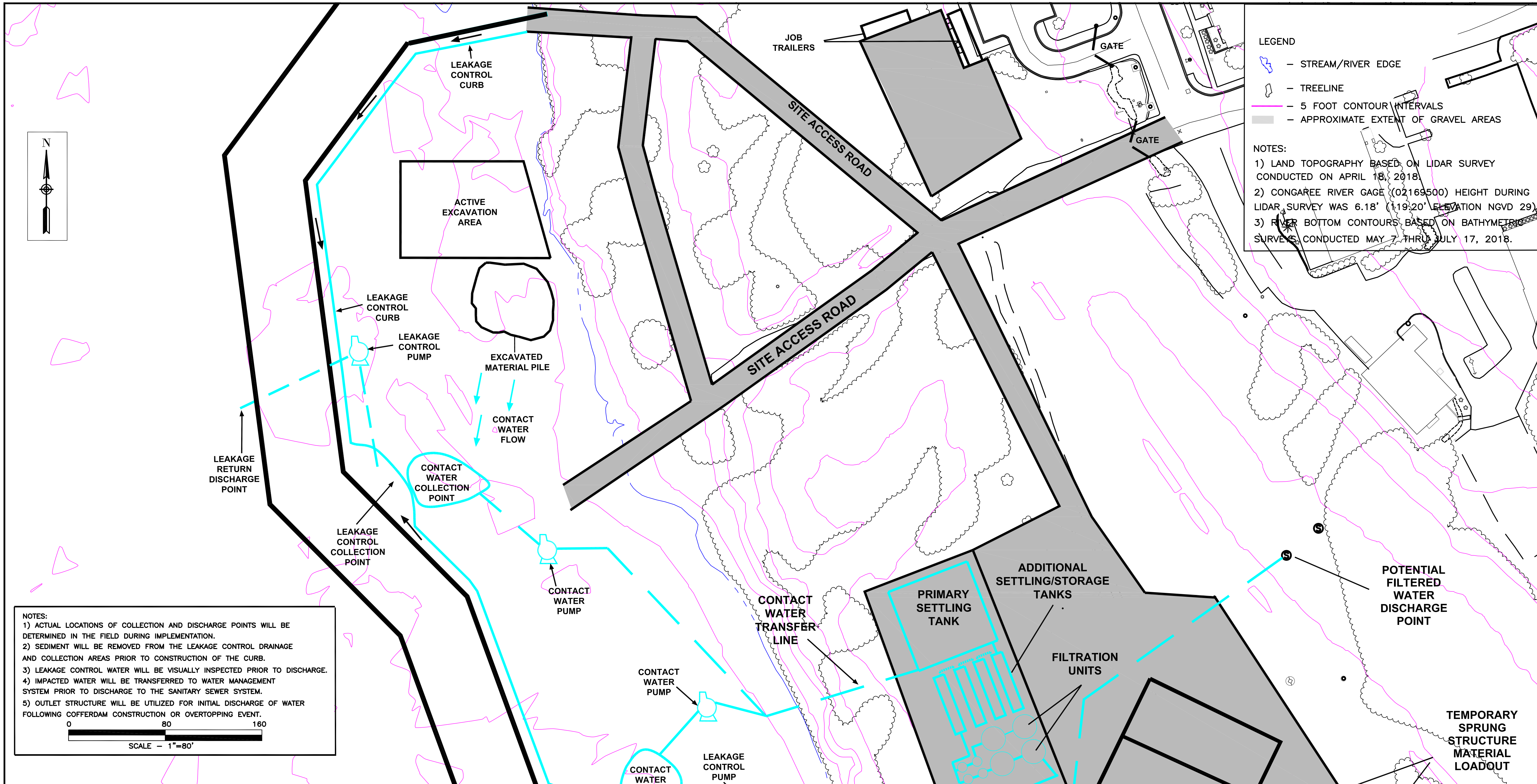


FIGURE 3-4
SOUTH CAROLINA ELECTRIC & GAS COMPANY

CONCEPTUAL WATER MANAGEMENT SCENARIO WITH PHASE I COFFERDAM

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 8/24/18 FILE NAME: CONG520

APEX COMPANIES, LLC

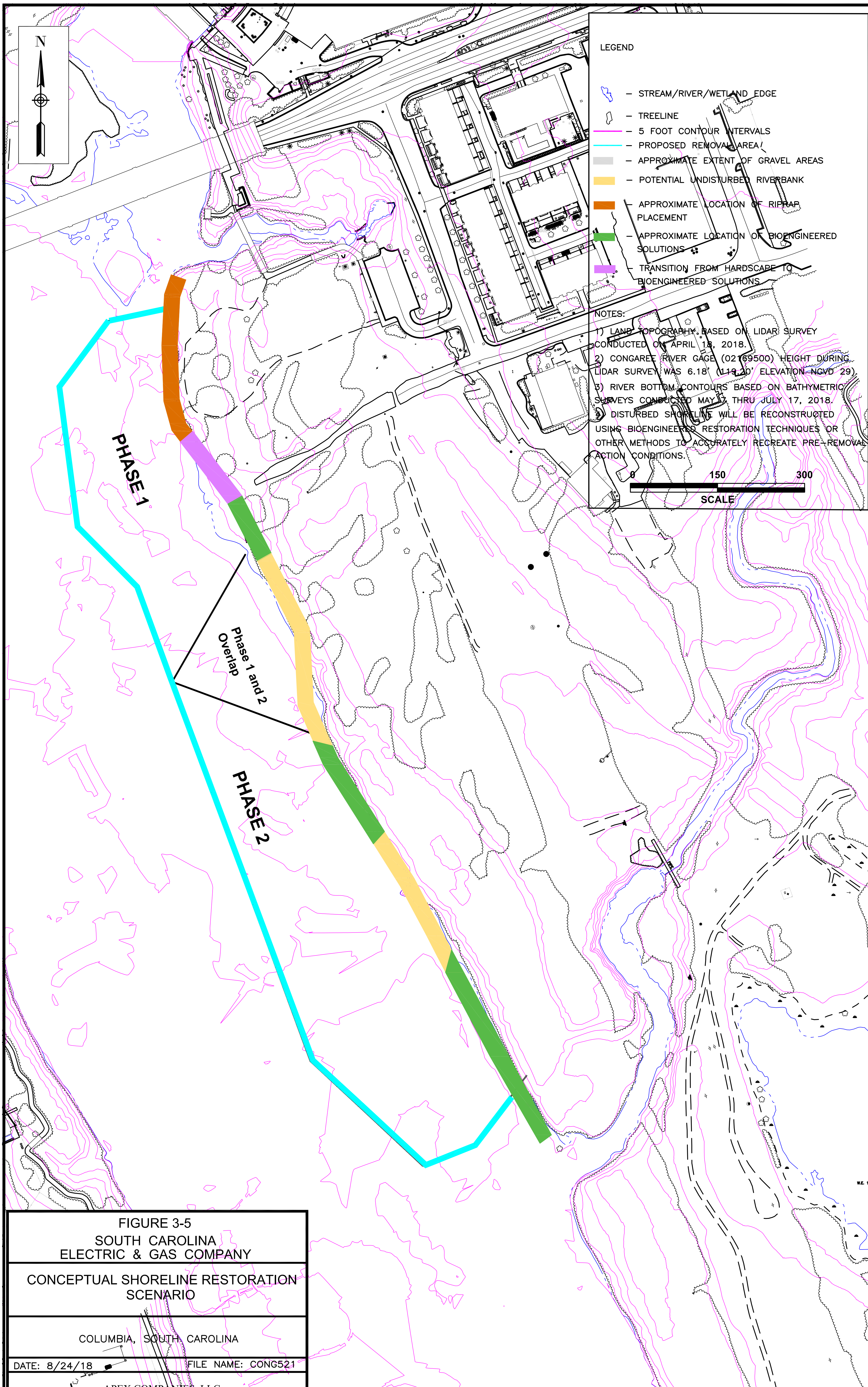


FIGURE 3-5
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

CONCEPTUAL SHORELINE RESTORATION SCENARIO

COLUMBIA, SOUTH CAROLINA

DATE: 8/24/18 FILE NAME: CONG521

APEX COMPANIES, LLC

APPENDICES

(WITH PRELIMINARY INFORMATION FROM DRAFT REMOVAL ACTION PLAN DATED JUNE 2014)

APPENDIX A

MUSSEL RELOCATION PLAN

MUSSEL RELOCATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

Elliptio complanata

Elliptio roanokensis

April 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

MUSSEL RELOCATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former manufactured gas plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. As currently envisioned, the temporary cofferdam would be constructed in two or three separate phases over two or three construction seasons. The construction seasons will range from approximately May through December of each year. Figure 2 illustrates the phased approach and the proposed cofferdam location and footprint. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

PROJECT AREA PREVIOUS MUSSEL SURVEY RESULTS

In 2006 a reconnaissance survey was conducted by Alderman Environmental Services, Inc. to assess the freshwater mussel populations within Lake Murray and the lower Saluda and upper Congaree Rivers in support of the Saluda Hydroelectric Project (FERC No. 516). The findings of the survey were summarized in the “Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006). The survey included two locations in the upper Congaree River that were within or directly adjacent to (downstream) the planned project area. Figure 2 shows these locations and Attachment A provides the applicable survey report excerpts taken from the Alderman Report.

The first survey area (Station: 20060711.5) was located in the vicinity of the Senate Street alluvial fan, which is within the planned Phase 1 removal area. This location will be impacted by project operations. The second survey area (Station: 20060712.5) was located directly south (downstream) and outside of the planned Phase 3 removal activities (Figure 3) and is not expected to be impacted by the planned project activities.

Table 1 provides a summary of the live mussels encountered at these two locations and their current global and state NatureServe ranks as listed on the South Carolina Department of Natural Resources

(SCDNR) Heritage Trust Program Rare, Threatened and Endangered Species and Communities List (Attachment B). No federal or state threatened, endangered or candidate mussel species were identified within the Congaree River during completion of the survey. A combined total of five mussel species classified as rare by the SCDNR Heritage Trust Program were identified at the two survey locations that were within or adjacent to the project area. These rare species have no legal protection under the federal or state endangered species laws but are tracked by the SCDNR Heritage Trust Program at the request of the Program's biologists.

A total of 33 live mussels of four different species were observed at the first location (Station: 20060711.5). Of the four species, three (*Elliptio congaraea*, *Elliptio angustata and Elliptio roanokensis*) are considered rare by SCDNR. The most abundant species identified at this location (*Elliptio complananta*) is not on the Heritage Trust list.

A total of 21 live mussels of six different species were observed at the second location (Station: 20060712.5). Five of the six species observed (*Elliptio angustata, Elliptio congaraea, Elliptio icterina, Lampsilis splendida,* and *Elliptio roanokensis*) are designated as rare by SCDNR. Again, the unlisted *Elliptio complananta* was also identified.

MUSSEL RELOCATION PLAN

As a result of the previous findings from the Alderman survey conducted in 2006, SCE&G recognizes that no threatened or endangered mussels are likely present within the project area. However, a number of sensitive mussel species are likely located within the cofferdam location and planned removal area. In order to complete the project with as minimal of a negative impact to the Congaree River resources as practicable, SCE&G plans to conduct mussel relocation operations prior to initiating "in-river" construction activities. The mussel relocation activities will include:

- Utilizing qualified personnel to conduct mussel survey activities, finalize project details and complete/supervise the relocation field work;
- Conducting an initial reconnaissance and assessment of the planned project area (the planned footprint of each phase plus a small buffer zone) and immediately downstream;
- Locating a suitable relocation area(s) with acceptable habitat characteristics within the Congaree River as near as possible to the project site;
- Collecting and relocating the mussels identified within the footprint of each phase of the project, to the extent practicable; and
- Providing a summary of completed mussel relocation activities in the Removal Action Report (RAR).

The assessment and relocation activities will be conducted in phases in order to properly time the work with the actual construction windows. Figure 3 provides a scenario that shows the approximate survey areas associated with each construction phase. Phase 2 and Phase 3 areas may be combined if construction and project conditions warrant.

Consultant Selection

SCE&G will procure the services of a qualified consultant with proven experience in successfully completing freshwater mussel surveys, habitat assessment and relocation activities. Once selected, this consultant will review project details and finalize the overall plan for mussel relocation.

Initial Reconnaissance and Assessment of the Project Area

The selected consultant will conduct an initial assessment of the project area to determine the approximate number, species and other characteristics of the mussels that can be realistically relocated prior to initiation of “in-river” construction activities. This initial assessment will likely be restricted to the area that will be impacted by the upcoming phase of work (as shown on Figure 3) and will likely be conducted on at least two occasions. The surveyed project area will include the planned cofferdam footprint, the interior removal area and a small buffer on the outboard side of the cofferdam (Figure 3). This buffer will account for small changes in the final cofferdam shape or location and for changes in river currents and hydraulic characteristics that are expected to result from construction of the structure. The assessment will be extended some distance downstream of the phased project areas to account for changes in river hydraulics in these areas while the cofferdam is in place and for potential disturbance during cofferdam construction.

The initial assessments will be conducted during warmer months (generally April through May, prior to cofferdam installation). The information gathered from the assessment will be utilized to determine appropriate relocation areas and other logistical components associated with the collection/relocation phase of the project.

Determine Suitable Relocation Areas

Relocation site investigation will also take place during the warmer months. The relocation site(s) will be within the Congaree River and as near to the project area as possible. Selection will be based on a number of criteria, including:

- The presence and abundance of other mussels;
- Specific habitat characteristics such as substrate and adjacent land uses;
- Flow and gradient characteristics; and
- Potential for future threats.

The Alderman survey area (Station: 20060712.5) located directly downstream of the project area contains the same species of mussels found within the project area and may be a suitable relocation point for some or all of the project area mussels. This location would be ideal, if suitable, due to its close proximity to the project area.

Once the initial reconnaissance survey and relocation site identification have been completed the consultant will prepare a brief report that outlines the results of the initial survey activities and describes the chosen relocation sites. This report will also contain the general plan for collecting and relocating the mussels. The number of these reports will correspond with the number of planned relocation phases. The reports will be provided to the agencies for review.

Collect and Relocate Mussels

As stated above, the mussel relocation efforts will likely be conducted in phases. As currently envisioned, one of two potential scenarios will be implemented based on project logistical considerations. The first scenario includes conducting the mussel collection and relocation in one mobilization per construction phase following determination of a suitable relocation site. A combination of wading and diving will be necessary in order to adequately survey the majority of the project area.

The second scenario includes mobilizing the collection and relocation team and removing the mussels from the approximate footprint of the planned cofferdam and the outboard buffer zone. Again, a combination of wading and diving would be required to cover the area to be impacted by the cofferdam. The relocation team would then demobilize until the cofferdam is constructed and the isolated area is partially dewatered. As dewatering operations lower the water level, the team would remobilize and complete the collection and relocation of the mussels within the isolated area. With this scenario, the partial dewatering will facilitate access to the mussels and potentially increase the effectiveness and overall efficiency of the process. With the water level sufficiently lowered the isolated area could be better surveyed through wading, visibility would most likely be improved in most areas and potentially more mussels will be collected.

Again, the warmer months of the year are preferred for relocation and the mussel relocation expert will determine the appropriate timeframe for completion of these operations based on the specific requirements of the mussels identified in the project area. Spawning and glochidia release timeframes will be avoided.

SCE&G plans to conduct as complete of a relocation effort as possible. Several factors may limit the potential relocation activities. They include:

- The presence of significant TLM in the substrate surrounding mussel locations may necessitate not disturbing these locations;
- Mussels that are coated with TLM will most likely be left in place because adequate decontamination may not be feasible or will overly stress the animal. Tar coated mussels can not be relocated to new unimpacted areas; and
- Other project related constraints (logistical, safety, etc.) may limit the overall relocation effort.

The mussel relocation expert will conduct and supervise the collection of the mussels from within the specified area. An effort will be made to adequately survey all areas that will be impacted by the project. More than one pass will likely be conducted depending on the expert's recommendations and other project constraints.

The mussels will be gently removed, kept cool and moist and quickly transported to the relocation area. Extreme fluctuations in temperature or other environmental factors will be avoided. Mussels will be correctly placed within the relocation area. The number and species of mussels will be documented.

Reporting

The details of the mussel relocation activities will be provided in the Removal Action Report (RAR), which will document the entire sediment removal operations. The documented activities will include:

- Results of the initial project area surveying activities;
- The relocation area characteristics and details from the relocation area decision process;
- Mussel collection, transport and relocation activities; and
- Limiting factors, if any.

Progress reports for each phase of work may also be provided, if requested by the agencies.

Post Project Completion Activities

SCE&G plans on removing all sediment (both visually impacted with TLM and visually unimpacted material) gravel, small rocks, etc. from the project area to the extent practicable. Large rocks that are visually unimpacted will be temporarily relocated within the work area to facilitate sediment removal and then returned to their approximate original locations. As an additional measure, SCE&G plans to pressure wash the exposed bedrock bottom of the river. The intent is to remove any residual staining or impacts due to the presence of TLM.

The current project plan does not include replacing any sand or other backfill material. The impacted sediment will be removed down to the top of the underlying bedrock. In many areas, this will only require removal of several inches of sediment. Following completion of the removal activities, the cofferdam will be removed and over time, the natural depositional processes of the river will be allowed to restore the river substrate to the appropriate thickness and composition. This process will allow for natural re-deposition of sediment within the removal area based on current river hydraulics. Not replacing the impacted sediment with fill material will also eliminate the potential for backfill materials to be washed downstream and deposited in other areas or degrade other habitats through siltation, etc.

SCE&G anticipates that the same river hydraulic characteristics that created the current mussel habitat within the project area will naturally recreate similar habitat characteristics given an appropriate amount of time. As a result, mussel repopulation of the project area is expected to occur naturally as the project area substrate is reestablished.

REFERENCES

Alderman Environmental Services, Inc. 2006. Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries. Alderman Survey Report.

Luzier, C. and S. Miller. 2009. Pacific Northwest Native Freshwater Mussel Workgroup. Freshwater Mussel Relocation Guidelines.

U.S. Fish and Wildlife Services and Virginia Dept. of Game and Inland Fisheries. 2013. Freshwater Mussel Guidelines for Virginia.

TABLE 1

2006 FRESHWATER MUSSEL SURVEY RESULTS FOR PROJECT AREA*

Congaree River Sediments
Columbia, South Carolina

Station	Species	Common Name	Number Identified	NatureServe Ranking	
				Global Rank	State Rank
20060711.5	*Elliptio complanata*	Common Elliptio	23	G5 - Secure	--
	Elliptio congaraea	Carolina Slabshell	1	G3 - Vulnerable	S3 - Vulnerable
	Elliptio roanokensis	Roanoke Slabshell	1	G3 - Vulnerable	S2 - Imperiled
	Elliptio angustata	Carolina Lance	8	G4 - Apparently Secure	S3 - Vulnerable
20060712.5	*Elliptio angustata*	Carolina Lance	2	G4 - Apparently Secure	S3 - Vulnerable
	Elliptio congaraea	Carolina Slabshell	1	G3 - Vulnerable	S3 - Vulnerable
	Elliptio icterina	Variable Spike	1	G5Q - Secure	S4 - Apparently Secure
	Elliptio complanata	Common Elliptio	3	G5 - Secure	--
	Lampsilis splendida	Rayed Pink Fatmucket	1	G3 - Vulnerable	S2 - Imperiled
	Elliptio roanokensis	Roanoke Slabshell	13	G3 - Vulnerable	S2 - Imperiled

Notes:

* - Information obtained from Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray and Selected Tributaries by John M. Alderman, Alderman Environmental Services, Inc. (October 2006)

- NatureServe Ranks taken from Rare, Threatened and Endangered Species Communities Tracked by the SCDNR Heritage Trust Program.
- No federal or state threatened, endangered or candidate species were identified in the Congaree River during the survey.
- Elliptio complanata is not included on the SCDNR Heritage Trust Program list.
- The "Q" qualifier for Elliptio icterina represents "questionable taxonomy that may reduce conservation priority."

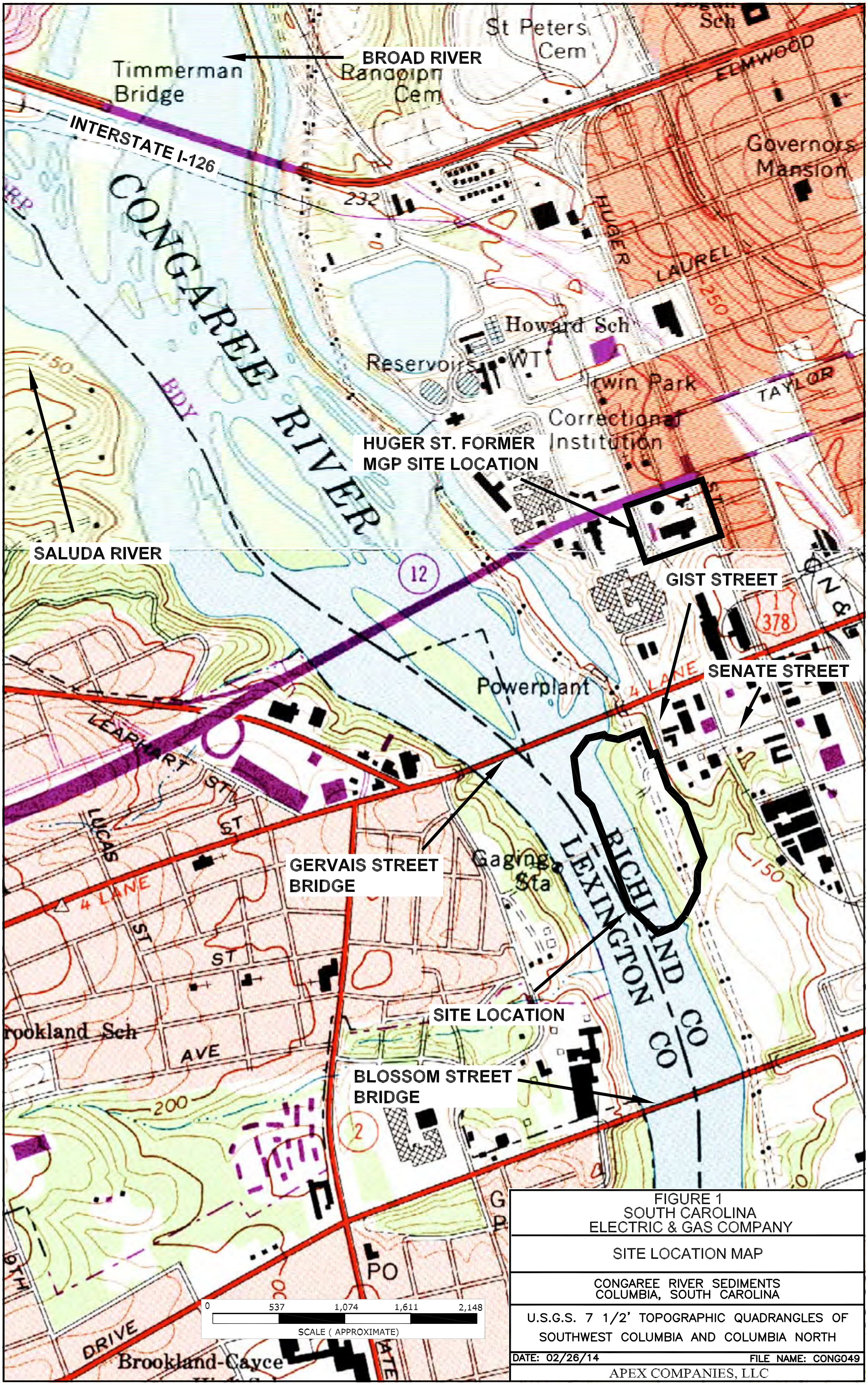


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

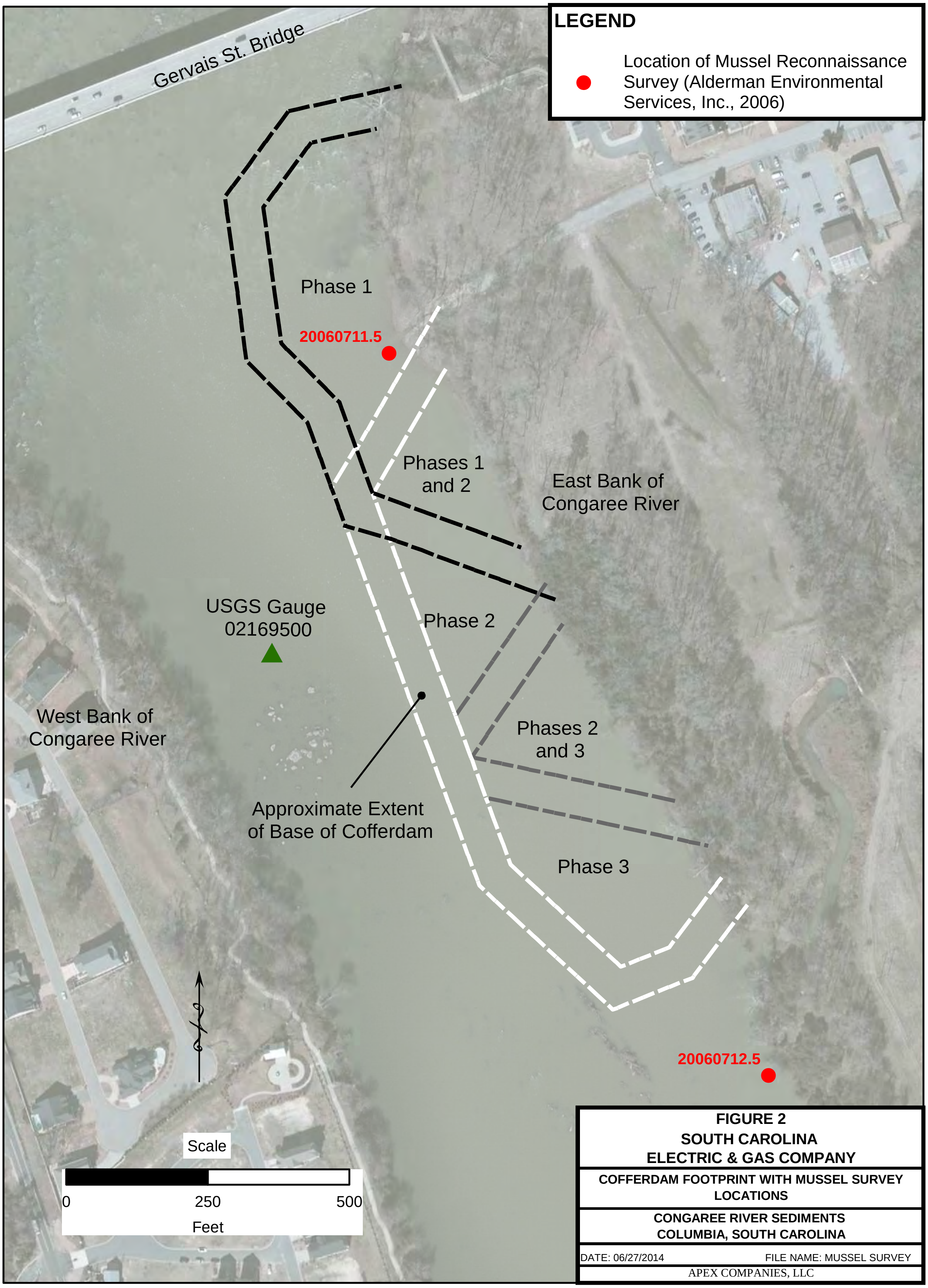


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

COFFERDAM FOOTPRINT WITH MUSSEL SURVEY LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/27/2014 FILE NAME: MUSSEL SURVEY

APEX COMPANIES, LLC

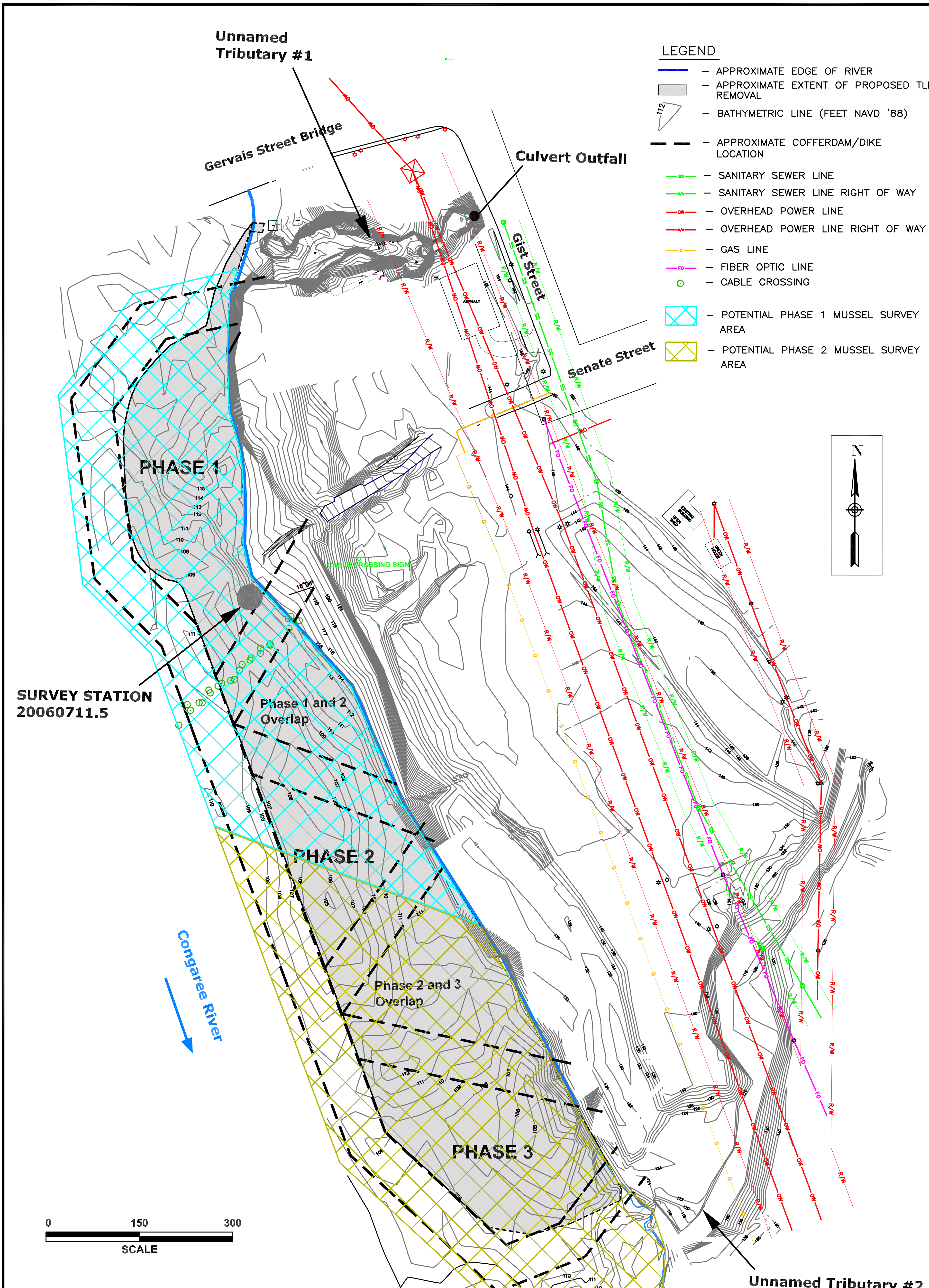


FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

POTENTIAL MUSSEL SURVEY
PHASES AND AREAS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/17/14 FILE NAME: CONG112

APEX COMPANIES, LLC

ATTACHMENT A

(Excerpts taken from “Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree Rivers, Lake Murray, and Selected Tributaries (Alderman Environmental Services, Inc. 2006)

Table 3. Freshwater mussels of the Saluda River (below L. Murray Dam), lower Broad River, and upper Congaree River

Station	Latitude Longitude	Species	Live, Shells	Substrate*
20060711.1 Saluda R.	34.05037 N 81.20573 W	None		sa,g,Co,Bo
20060711.2 Saluda R.	34.04843 N 81.19653 W	None		s,Sa,G,co,bo,b
20060711.3 Saluda R.	34.02978 N 81.13944 W	None		s,Sa,G,co,bo
20060711.4 Saluda R.	34.00969 N 81.07800 W	None		s,sa,g,co,bo,b
20060712.1 Saluda R.	34.00639 N 81.06508 W	None		s,sa,g,co
20060712.2 Broad R.	34.00714 N 81.06232 W	*Elliptio roanokensis* *Elliptio complanata* *Villosa delumbis* *Elliptio angustata* *Lampsilis cariosa*	0,2 0,5 0,1 1,1 1,0	s,sa,g,co,bo,b
20060712.3 Saluda R. (Broad R. washout area)	34.00541 N 81.06282 W	*Elliptio angustata* *Villosa delumbis* *Strophitus undulatus*	1,2 0,2 0,1	s,Sa,g
20060712.4 Congaree R. (Saluda R. side)	33.98949 N 81.04859 W	*Elliptio complanata*	1,0	s,sa,g,co,bo,b
20060711.5 Congaree R. (Broad R. side)	33.99461 N 81.04913 W	*Elliptio complanata* *Elliptio congaraea* *Elliptio roanokensis* *Villosa delumbis* *Elliptio angustata*	23,-- 1,0 1,0 0,1 8,--	s,sa,g,co,bo

Table 3 (continued). Freshwater mussels of the Saluda River (below L. Murray Dam), lower Broad River, and upper Congaree River

Station	Latitude Longitude	Species	Live, Shells	Substrate*
20060712.5 Congaree R. (Broad R. side)	33.99111 N 81.04692 W	*Elliptio angustata* *Elliptio congaraea* *Elliptio icterina* *Elliptio complanata* *Lampsilis splendida* *Elliptio roanokensis*	2,0 1,0 1,0 3,0 1,0 13,0	s,sa,go,co,bo,b
20060712.6 Congaree R. (Saluda R. side)	33.97967 N 81.04757 W	*Elliptio roanokensis* *Elliptio angustata*	2,0 1,0	s,Sa,G,co,bo
20060712.7 Congaree R. (Borad R. side)	33.98031 N 81.04546 W	*Elliptio complanata* *Elliptio congaraea* *Strophitus undulatus* *Elliptio roanokensis* *Elliptio angustata* *Lampsilis splendida* *Lampsilis cariosa* *Villosa delumbis*	5,0 2,0 1,0 19,0 9,0 1,0 2,0 0,1	S,Sa,G,co,bo
20060712.8 Congaree R. (Saluda R. side)	33.96535 N 81.03777 W	None	--	s,sa,g
20060804.1 Saluda R.	34.02287 N 81.10009 W	None	--	s,sa,g,co,bo,B
20060804.2 Saluda R.	34.01835 N 81.09807 W	None	--	s,sa,g,co,bo,b
20060804.3 Rawls Cr.	34.07949 N 81.20251 W	None	--	c,s,sa,g,co,bo,b
20060804.4 12 Mile Cr.	34.03275 N 81.16173 W	None	--	s,sa,g,co,bo

* s-silt, sa- sand, c-clay, co-cobble, b-bedrock, bo-boulder, g-gravel, r-roots, v-vegetation, d-detritus, m-mud

PROJECT: Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree River, Lake Murray, and Selected Tributaries

STATION: 20060711.5jma

BIOLOGISTS: **John M. Alderman**
Joseph D. Alderman
Jennifer M. Summerlin

U.S. FISH AND WILDLIFE SERVICE ES PERMIT: **TE065756-0**

S.C. DEPARTMENT OF NATURAL RESOURCES AUTHORIZATION: November 25, 2002

LOCATION: Congaree River, Lexington/Richland county line, South Carolina; 33.99461 N, 81.04913 W; **see Figure 4**

SURVEY DATE: July 11, 2006

SITE COMMENTS: -

HABITAT:

WATERBODY TYPE:	River
FLOW:	Run, slack, pool
RELATIVE DEPTH:	Very shallow
DEPTH (%<2 FEET):	90
SUBSTRATE:	Silt, sand, gravel, cobble, boulder
COMPACTNESS:	Compact and normal
SAND/GRAVEL BARS:	Present
WOODY DEBRIS:	Low
BEAVER ACTIVITY:	None
WINDTHROW:	Low
TEMPORARY POOLS:	None
CHANNEL WIDTH:	300+ meters
BANK HEIGHT:	Varies

HABITAT (cont.):

BANK STABILITY:	Very stable
BUFFER WIDTH:	Narrow to moderate
RIPARIAN VEGETATION:	Wooded, shrub-brush, grass
LAND USE:	Urban
PERCENT COVER:	0
WOODLAND EXTENT:	Not extensive
NATURAL LEVEES:	-
VISIBILITY:	Slightly turbid
WATER LEVEL:	Low
WEATHER:	Sun-Cloud, hot

TECHNIQUES AND SURVEY TIME:

TECHNIQUES:	Visual
SURVEY TIME:	0.5 person-hours

FRESHWATER MUSSELS:

Elliptio roanokensis – 1 live (93 mm)
Elliptio complanata – 23 live (78, 74, 71, 53, 66, 76, 60, 58, 63, 56, 55, 61, 62, 53, 55, 59, 58, 56, 58, 62, 48, 50, 36 mm)
Elliptio congaraea – 1 live (55 mm)
Elliptio angustata – 8 live (80, 69, 58, 67, 67, 58, 57, 58 mm)
Villosa delumbis – 1 old shell

OTHER DOCUMENTED TAXA:

Elimia catenaria - common
Corbicula fluminea

PROJECT: Reconnaissance Survey of the Freshwater Mussel Fauna of the Lower Saluda and Congaree River, Lake Murray, and Selected Tributaries

STATION: 20060712.5jma

BIOLOGISTS: **John M. Alderman**
Jeffrey West
Joseph D. Alderman
Christopher S. Boring
Jennifer M. Summerlin

U.S. FISH AND WILDLIFE SERVICE ES PERMIT: **TE065756-0**

S.C. DEPARTMENT OF NATURAL RESOURCES AUTHORIZATION: November 25, 2002

LOCATION: Congaree River, Lexington/Richland county line, South Carolina; 33.99111 N, 81.04692 W; **see Figure 4**

SURVEY DATE: July 12, 2006

SITE COMMENTS: Broad River side of Congaree River

HABITAT:

WATERBODY TYPE:	River
FLOW:	Run, slack
RELATIVE DEPTH:	Very shallow
DEPTH (%<2 FEET):	75
SUBSTRATE:	Silt, sand, gravel, cobble, boulder, bedrock
COMPACTNESS:	Normal
SAND/GRAVEL BARS:	Present
WOODY DEBRIS:	Low
BEAVER ACTIVITY:	Evidence (gnawed sticks)
WINDTHROW:	Low
TEMPORARY POOLS:	-
CHANNEL WIDTH:	300+ meters
BANK HEIGHT:	2.5+ meters

HABITAT (cont.):

BANK STABILITY:	Very stable
BUFFER WIDTH:	Moderate to wide
RIPARIAN VEGETATION:	Wooded, shrub-brush
LAND USE:	Urban
PERCENT COVER:	1
WOODLAND EXTENT:	Intermediate
NATURAL LEVEES:	-
VISIBILITY:	Slightly turbid
WATER LEVEL:	Low
WEATHER:	Sun-Cloud, hot

TECHNIQUES AND SURVEY TIME:

TECHNIQUES:	Visual
SURVEY TIME:	0.83 person-hours

FRESHWATER MUSSELS:

Elliptio roanokensis – 13 live (100, 111, 89, 91, 95, 108, 105, 95, 102, 107, 110, 89, 91 mm)
Elliptio complanata –3 live (93, 78, 73 mm)
Elliptio congaraea – 1 live (61 mm)
Elliptio angustata –2 live (63, 66 mm)
Elliptio icterina – 1 live (72 mm)
Lampsilis splendida – 1 live male (67 mm)
Villosa delumbis – 1 old shell

OTHER DOCUMENTED TAXA:

Elimia catenaria - common
Corbicula fluminea

ATTACHMENT B

Tracked Rare, Threatened and Endangered Species Communities List

Scientific Name	Common Name	USESA Status	State Protection	GRank	SRank
Procambarus hirsutus	a Crayfish			G4	S4
Procambarus lepidodactylus	Pee Dee Lotic Crayfish			G4	S4
Procambarus lunzi	a Crayfish			G4	S2S3
Procambarus pearsei	Sandhills Crayfish			G4	S3
Procambarus pubescens	a Crayfish			G4G5	S3?
Insects					
Agarodes griseus	a Caddisfly			G5	SNR
Amblyscirtes reversa	Reversed Roadside Skipper			G3G4	SNR
Atrytone arogos	Arogos Skipper			G3	SNR
Autochton cellus	Golden-banded Skipper			G4	S2S4
Cicindela dorsalis media	White Tiger Beetle			G4T3T4	S3S4
Dolania americana	American Sand Burrowing Mayfly			G4	S3
Macromia margarita	Margaret's River Cruiser			G3	SNR
Megaleuctra williamsae	Smokies Needlefly			G2	SNR
Polycentropus carlsoni	Carlson's Polycentropus Caddisfly			G2G3	S1S3
Protoptila morettii	Moretti's Caddisfly			G1G2	SNR
Pseudogoera singularis				G2G3	SNR
Psilotreta frontalis				G5	SNR
Somatochlora calverti	Calvert's Emerald			G3	SNR
Speyeria diana	Diana Fritillary			G3G4	S3?
Stylurus townesi	Townes' Clubtail			G3	S1S3
Wormaldia thyria				G3	SNR
Spiders					
Sphodros coylei	Coyle's Purseweb Spider			G4?	SNR
Mollusks					
Alasmidonta undulata	Triangle Floater			G4	S1
Alasmidonta varicosa	Brook Floater			G3	SNR
Anodonta couperiana	Barrel Floater			G4	S1
Elimia catenaria	Gravel Elimia			G4	SNR
Elliptio angustata	Carolina Lance			G4	S3
Elliptio congaraea	Carolina Slabshell			G3	S3
Elliptio fisheriana	Northern Lance			G4	SNR
Elliptio folliculata	Pod Lance			G2G3Q	S2S3
Elliptio fraterna	Brother Spike		SE-Endangered	G1	S1

Rare, Threatened and Endangered Species Communities Tracked by the SC DNR Heritage Trust Program

October 16, 2012

Scientific Name	Common Name	USESA Status	State Protection	GRank	SRank
Elliptio icterina	Variable Spike			G5Q	S4
Elliptio lanceolata	Yellow Lance			G2G3	SNR
Elliptio producta	Atlantic Spike			G3Q	S3
Elliptio roanokensis	Roanoke Slabshell			G3	S2
Elliptio waccamawensis	Waccamaw Spike			G2G3Q	S1
Fusconaia masoni	Atlantic Pigtoe		SE-Endangered	G2	SH
Gillia altilis	Buffalo Pebblesnail			G5	S1
Lampsilis cariosa	Yellow Lampmussel			G3G4	S2
Lampsilis radiata	Eastern Lampmussel			G5	S2
Lampsilis splendida	Rayed Pink Fatmucket			G3	S2
Lasmigona decorata	Carolina Heelsplitter	LE: Endangered	SE: Endangered	G1	S1
Leptodea ochracea	Tidewater Mucket			G3G4	S2
Ligumia nasuta	Eastern Pondmussel			G4	S2
Lioplax subcarinata	Ridged Lioplax			G4G5	S1
Pyganodon cataracta	Eastern Floater			G5	SNR
Somatogyrus virginicus	Panhandle Pebblesnail			G2G3	SNR
Strophitus undulatus	Creeper			G5	S2
Toxolasma pullus	Savannah Lilliput			G2	S1
Uniomerus caroliniana	Florida Pondhorn			G4	S3
Utterbackia imbecillis	Paper Pondshell			G5	SNR
Villosa constricta	Notched Rainbow			G3	S1
Villosa delumbis	Eastern Creekshell			G4	S4
Villosa vaughaniana	Carolina Creekshell			G2	S1
Villosa vibex	Southern Rainbow			G5Q	S2
Animal Assemblage					
Waterbird Colony				GNR	SNR
Vascular Plants					
Dicots					
Acer pensylvanicum	Striped Maple			G5	S2
Aconitum uncinatum	Blue Monkshood			G4	S2
Aesculus parviflora	Small-flowered Buckeye			G3	S1
Agalinis aphylla	Coastal Plain False-foxglove			G3G4	S1
Agalinis auriculata	Earleaf Foxglove			G3	S1
Agalinis linifolia	Flax Leaf False-foxglove			G4?	SNR

APPENDIX B

SITE OPERATIONS PLAN

SITE OPERATIONS PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

SITE OPERATIONS PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in the river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

This Site Operations Plan is intended to provide a description of the planned general procedures to safely and effectively implement the proposed sediment removal activities. Several site preparation activities will take place prior to initiating the removal work in order to assure the safe and effective implementation of the removal action. Once the site preparation activities are completed, the river-based construction and removal activities will be initiated and completed in phases. The conceptual approach to the Site Operations Plan for removal activities is summarized on the attached figures. Some variations to the plan may occur, depending on site conditions encountered at the time of remediation. The actual layout for site operations will be finalized at the discretion of remediation personnel, provided SCE&G and SCDHEC concur with any significant modifications.

PREPARATORY ACTIVITIES

<u>Landside Site Setup</u>

As currently envisioned, the southern access road, which includes the bridge over the Unnamed Tributary #2, will be the first component of the project that is constructed. The main purpose of the southern access road will be to provide access to the landside support zone and the riverside removal area via an entrance/exit point on Blossom Street. This will permit completion of the project without routing project related traffic through the Senate and Gist Streets residential area. The details pertaining to this component are included in the Pre-Construction Notification – Concrete Arch Crossing and Access Road Improvements submitted to the USACE on July 1, 2014. Once the site access road and bridge are in place the construction of the landside support zone will be initiated.

The currently planned landside support zone road and temporary structure scenario is provided on Figure 2. Landside site operations components will be placed and constructed in such a manner as to require as little clearing and grading activities as possible. The primary planned location for the majority of site operations is the power line right-of-way, which has already been cleared. SCE&G relocated the overhead wires that were located within the right-of-way to accommodate future site operations. This scenario will reduce disturbance of currently forested land and further preserve the riparian corridor.

Clearing, grading and road construction will be completed as will placement of temporary site office trailers, storage trailers, temporary structures and installation of electrical and communication utility connections.

Site Security

An important component of the overall project will be site security. The primary method for securing the site will be the installation of a temporary chain link fence around the perimeter of the landside support zone. “Restricted Area” signs will be posted at regular intervals along the fence and also posted on the cofferdam structure, as noted in the Navigation Plan (RAP). The approximate fence location is shown on Figure 2. Two locking gates, one at the corner of Senate and Gist Streets and one at the entrance to the landside support zone just north of the bridge over Unnamed Tributary #2, will restrict vehicular traffic into and away from the project area. The Senate and Gist Streets gate will only be utilized by project personnel in small personal vehicles to gain access to the site office complex. No project related heavy truck traffic will access the site through this gate.

To prevent the unauthorized or unknowing entry of third parties onto the site, access gates will remain closed during site activities to the extent practical. The gates will remain locked during non-working hours while removal activities are occurring (with the exception of the site access and egress entrance) and/or remediation equipment and material are present.

Once site construction operations are initiated, SCE&G will also post security guards on-site during non-working hours. SCE&G has previously successfully utilized off-duty City of Columbia police officers as security guards at other local sites. These guards will conduct regular patrols of the property during non-working hours and at times of low site activity when a minimal number of site personnel are present. The guards and fence will serve to keep unauthorized and untrained personnel out of the active project area.

Erosion and Sedimentation Controls

Erosion and sediment (E&S) control best management practices (BMPs) for the site are identified in the Comprehensive Site Stormwater Pollution Prevention Plan (C-SWPPP), which was developed as part of the National Pollutant Discharge Elimination System (NPDES) permit application. The NPDES permit application and the C-SWPPP will be reviewed and approved by SCDHEC prior to initiation of land disturbance activities. The C-SWPPP requirements will be maintained throughout completion of the project. The C-SWPPP and the NPDES permit as well as other pertinent documentation will be available for review on-site at all times.

Attention to overall site erosion and sedimentation controls (E&S controls) will be required. In general, the E&S BMPs specified in the C-SWPPP will be the first construction components installed and the last to be removed. The E&S controls will include the use of silt fence, drainage structures, sufficient access and roadway construction, and other measures as may be required. Temporary roadways will be constructed, as needed, to prevent the spread or release of sediments from the work area. No tracking of mud or soil will be permitted beyond the site access gates. Any such impacts will be addressed immediately through the use of street-sweepers or power brooms that will be stationed on-site at all times during completion of the project. Silt fence will be deployed and maintained, as required, to prevent sediment run-off from all disturbed areas. Remediation personnel will install and periodically inspect and repair the E&S BMPs identified in the C-SWPP in accordance with the Plan’s requirements. Deficiencies will be documented and corrected as soon as practical.

Work Zones

The exclusion zones will contain the specific areas where intrusive work is being conducted or TLM is being handled. These areas will include the active excavation areas within the cofferdam and the temporary structures. Access to the exclusion zones will be limited to trained environmental remediation personnel. Decontamination procedures will be implemented whenever equipment or personnel leave the exclusion zones on an as-needed basis to control the potential migration of constituents of concern from the work area. Equipment decontamination facilities will be available in the general work area. As necessary, a boot wash area will also be maintained at the exclusion zone boundary to control tracking of potentially impacted material across the site.

Other work zones will be determined in the field, as necessary. These areas are expected to include:

- Traffic zones for loading of trucks, construction material drop-off/delivery, delivery/pickup of roll-off boxes, etc.;
- Staging areas for equipment and material;
- Water management area; and
- Support zones outside of the primary work areas.

Utility Clearance and Management

A number of utilities are present within the planned project area. These are shown on Figure 2. For the landside support zone, the overhead high voltage electrical transmission lines were recently relocated by SCE&G to provide more clearance for site operations and the temporary structures. Underground utilities within the landside support zone footprint include buried fiber optic communication lines, sanitary sewer and a buried gas line. SCE&G believes that all buried utilities have been identified and located. However, in order to be consistent with the applicable regulations, a request for clearing and identifying potential underground utilities at the site will be submitted to the Palmetto Utility Protection Services, Inc. (PUPS) prior to initiating the southern access road and landside support zone construction activities. All site personnel will be made aware of the buried utility locations. Support zone construction activities will consist of mainly relatively shallow surficial grading activities, which are not expected to impact buried utilities. If deeper excavations are required to complete construction activities, they will be conducted in areas free of buried utilities.

The sanitary sewer line crosses the Unnamed Tributary #2 near the area where the bridge is planned for construction. This line will be protected from damage during southern access road and bridge construction activities

A large sign indicating a “cable crossing” is located on the eastern shoreline of the river just south of the current access road, as shown on Figure 2. A group of metallic anomalies was detected extending out into the river from this point during completion of the investigative phase of this project (Figure 2). SCE&G has not been able to determine the owner, type and construction of the cable crossing, as of the publication date of this Plan. Specific information on this cable crossing will be obtained and appropriate safeguards put into place prior to initiation of site construction activities.

Traffic Control

Only authorized remediation personnel will be allowed access to the work areas during the TLM removal activities. It is anticipated that most work traffic in support of the removal activities will be routed through the southern access road, which opens onto Blossom Street. The Traffic Control Plan (RAP) was developed to provide specific details pertaining to the planned routes into and away from the site. These routes were developed through consultation with local residents and local officials (police, fire department, public works, government personnel, etc.). Each truck driver will be informed of the prescribed routes for site entry and exit and an effort will be made to utilize regular drivers who are familiar with these routes. All site related vehicles will follow the specific routes and oversight personnel will conduct periodic monitoring of truck movements to ensure compliance with the Traffic Control Plan.

On-site traffic patterns will be restricted to the site roads. Trucks transporting TLM from the excavation area to the temporary structures will be inspected before they leave the river excavation area to ensure that no loose material is present or that the tires have contacted TLM. Similar inspections will be conducted before the trucks leave the temporary structures in order to return to the excavation area or travel off-site to the disposal facility. Clean, plastic lined loading areas will be utilized for truck loading operations in both the river excavation and the temporary structures. This will prevent potential migration of the TLM from the excavation and handling areas.

Staging Areas and Temporary Structures

Staging areas for the gravel road construction or riprap and other cofferdam components will be established, as needed. These will be strategically located in order to provide an efficient means of moving construction material from the staging area to the road or cofferdam construction location. Staging of excavated sediment outside of the active river work area or the temporary structures will not be permitted.

Currently, SCE&G plans to prepare the surface of the temporary structures by clearing the current surface vegetation and grading and compacting the planned floor area. The surface will be constructed by placing a heavy mil plastic or HDPE liner over the subgrade as a containment barrier, covering the liner with geotextile for protection against punctures and creating the work surface out of compacted gravel. Concrete or asphalt may also be utilized as a work surface within the structures, if required by the remediation contractor. Either construction method will effectively contain the impacted sediment, provide an area where it can be further processed and prevent constituent migration. The surface material will be removed and transported to the landfill for disposal at the end of the project.

Water Management System

The currently planned location for the water management system is shown on Figure 2. The specific details pertaining to the system, the types of water and the management methods are provided in the Water Management Plan (RAP). The water management system's primary role is to collect and prepare for disposal the impacted water that comes into contact with the sediment. It will be sized accordingly to minimize the potential for excavation downtime due to dewatering requirements. The system will most likely operate around-the-clock in order maintain a steady discharge rate to the POTW sewer system. The components of the water management system will likely consist of water storage tanks (e.g., 20,000 gallon frac tanks and/or larger volume modular tanks), filtration equipment such as bag filters and/or activated carbon vessels, associated piping and hoses and a totalizing flow meter. The storage tanks will provide flow equalization and provide residence time to allow for settling of solids. Filtration equipment will also be available to achieve acceptable water quality in the discharge. The final design for the water management system will be submitted to the City of Columbia for review as part of the industrial discharge permit request. For illustrative purposes, the general water storage tank and filtration/discharge scenario is provided on Figure 3. The planned discharge location is a sanitary sewer manhole located near the eastern perimeter of the landside support zone shown on Figure 3.

Site Office Location

Multiple mobile office and storage trailers will serve as the site offices and meeting/break areas during the construction and remediation activities. The locations of the office and storage trailers will vary based on their functions and the currently envisioned locations are provided on Figure 2. These functions include office and meeting areas, break rooms, restroom and shower facilities and equipment storage. Several trailers will likely be placed near the temporary structures in order to provide office and shower facilities for the artifact recovery and impacted material handling personnel. Storage trailers may be located near the water management system to house equipment, pumps, etc. The main group of office trailers will be located near the entrance to the site adjacent to Blossom Street and serve as general work and meeting locations. A final trailer(s) location will be near the work area and will provide meeting and break locations for remediation, UXO and other personnel near the actual work zones. The final number and locations of the trailers will be finalized prior to implementation and utility connection. The trailers will be provided with electric power and Internet services and will be equipped with air conditioning, heating, a supply of drinking water and adjacent sanitary facilities. Cellular telephones will be utilized for site communications. If utilized, the shower trailers will be connected to the City of Columbia municipal potable water system and also connected to the sanitary sewer.

Off-Site Landfill Processing Facility

SCE&G currently plans to construct an off-site TLM processing facility at the Waste Management Richland County landfill, which is the planned final disposal location for the excavated sediment. The primary purpose of the facility will be to provide a secondary location where sediment containing a significant amount of TLM can be screened for artifacts and further processed. This secondary location will provide the following benefits to the project:

1. Increased material processing capacity, which will allow for more expedient excavation of the sediment within the isolated areas and reduction in the overall project completion time.

Reduction in the project completion time will also reduce the project's exposure to costly overtopping events;

2. Reduction in the potential for constituent migration from heavily impacted material in the landside support zone;
3. Reduction in the potential for odor and air monitoring related issues from the more heavily impacted material; and
4. Provide an environment where more thorough screening of excavated material for artifacts can be accomplished.

In order to accomplish this two-pronged material processing and screening activity the sediment containing significant amounts of TLM will be segregated as much as practical at the point of excavation, adequately stabilized and loaded directly into designated trucks that will carry it to the off-site processing facility. Sediment with TLM content that is manageable on-site will also be stabilized and loaded into trucks for transport to the landside support zone temporary structures for additional screening for artifact recovery. Segregation will be based on visual inspection at the point of excavation and determination of on-site vs. off-site processing will be made by field personnel.

The Historical Artifacts Management Plan (RAP) provides the specific details pertaining to the further screening and processing of the sediment material that will occur once removed from the river.

INTRUSIVE ACTIVITIES

Following completion of the preparatory activities described above, SCE&G will commence the intrusive activities within the river. These will include:

- Advance screening of the work area for potential unexploded ordnance (UXO);
- Mussel relocation;
- Cofferdam construction; and
- Initial dewatering of the isolated area and sediment excavation.

UXO Screening and Management

No intrusive construction or removal operations will be conducted unless the planned construction/removal area has been screened and designated as safe by the UXO management personnel. UXO screening and management will be conducted in accordance with the UXO Management Plans (RAP). As currently planned, the UXO management personnel will conduct diving operations to clear the cofferdam footprint prior to the initiation of path for the cofferdam construction. The remainder of the isolated area will be cleared in sections or its entirety once the area has been adequately dewatered.

Mussel Relocation

SCE&G has agreed to conduct freshwater mussel screening and relocation operations in order to preserve indigenous freshwater mussels that may be present within the project footprint. A number of sensitive mussel species are likely to exist within the cofferdam location and planned removal area. The anticipated mussel relocation activities are explained in detail in the Mussel Relocation Plan (RAP). As currently envisioned, mussel relocation will be conducted in phases for each work area. Mussels located within the planned footprint of the cofferdam will be collected and relocated by divers before the cofferdam is constructed. Once the cofferdam is in place and the isolated area is partially dewatered, the remaining mussels located within the isolated area will be collected and relocated.

Cofferdam Construction, Dewatering and Excavation Operations

The cofferdam construction details are provided in the Cofferdam Design (RAP). The dewatering and water management aspects of the project are described in detail in the Water Management Plan (RAP). Section 3.0 of the RAP provides the currently anticipated excavation scenario and details.

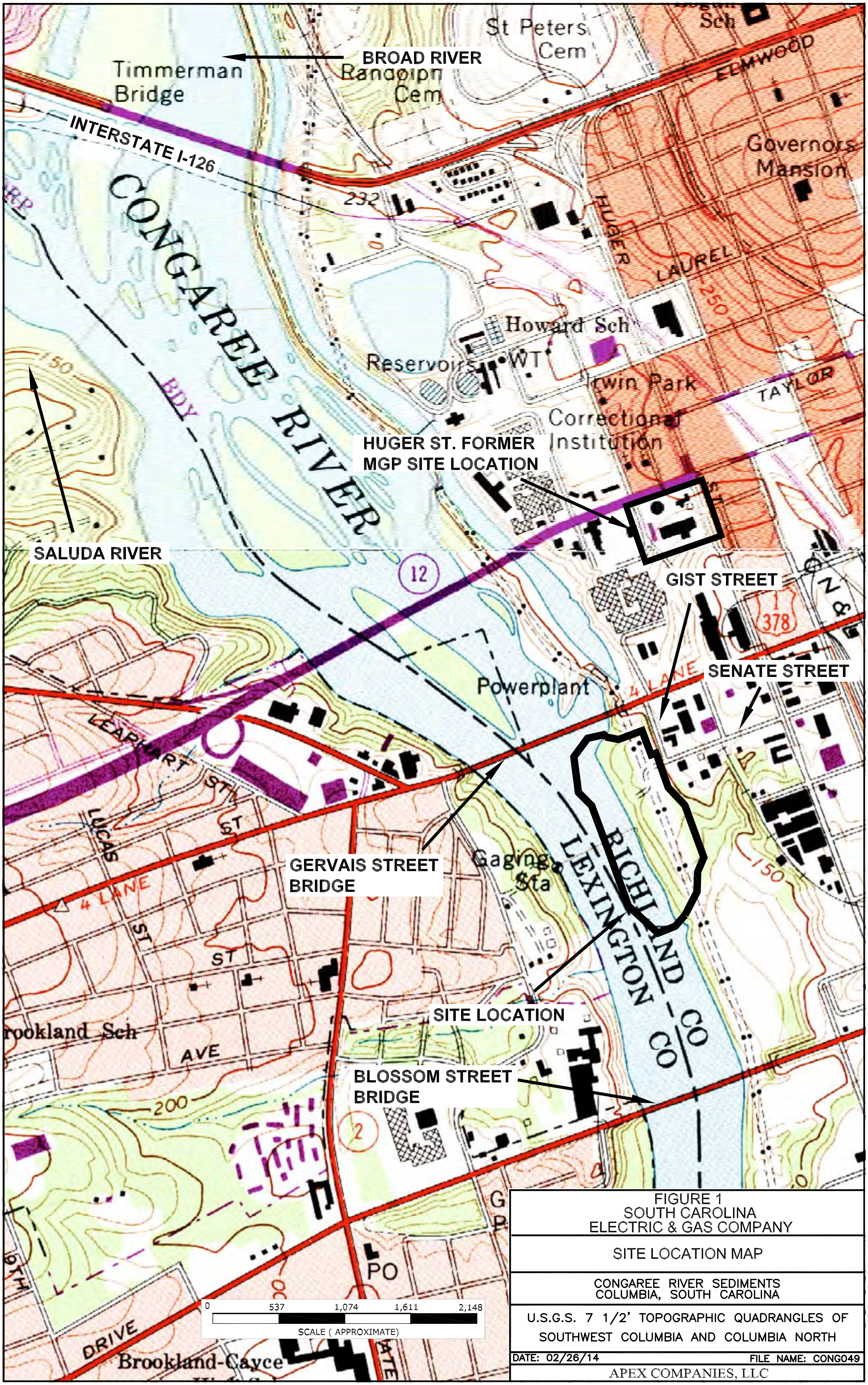


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

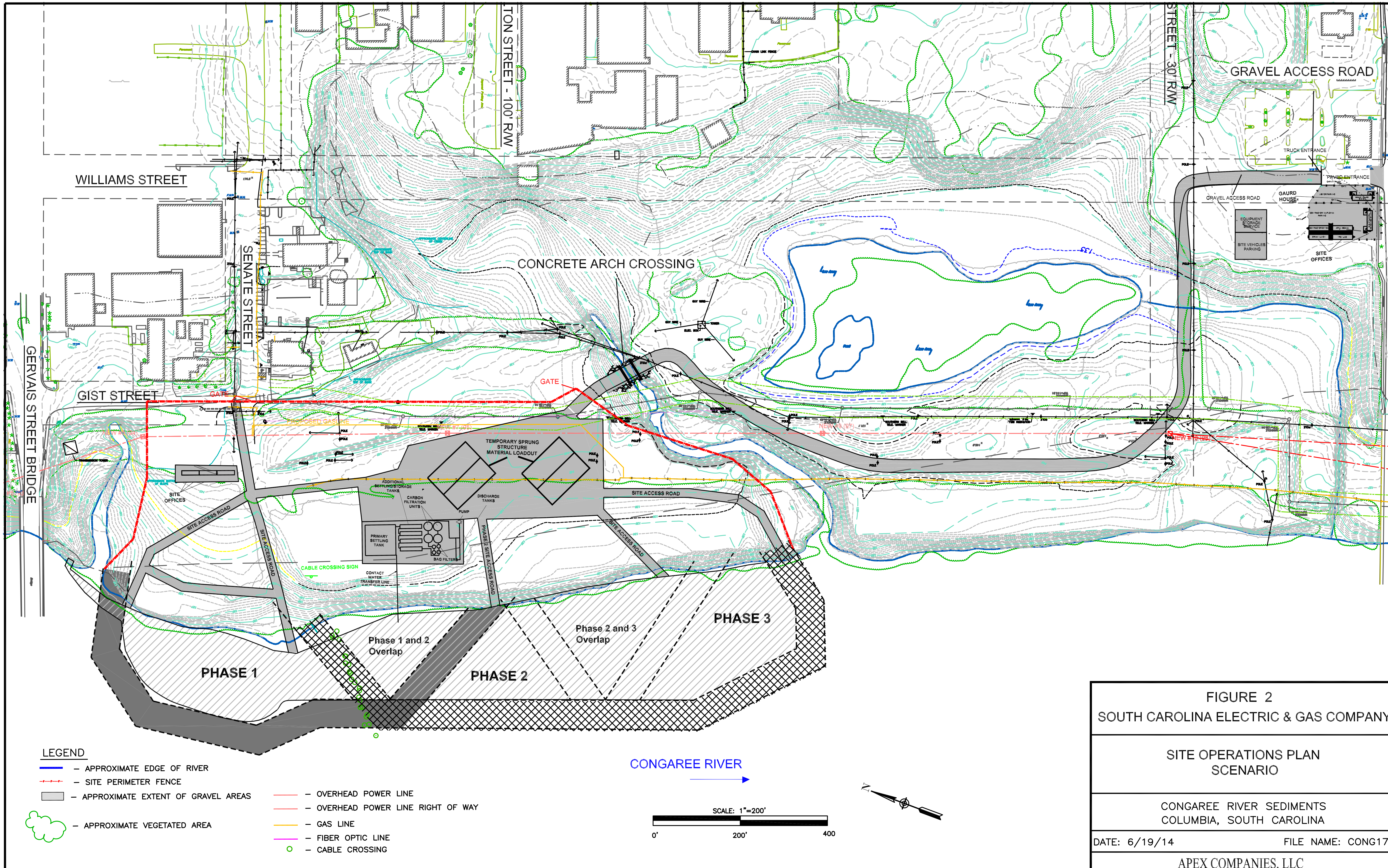
SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC



WILLIAMS STREET
SENATE STREET
GIST STREET
GERVAIS STREET BRIDGE
TON STREET - 100' R/W
STREET - 30' R/W
GRAVEL ACCESS ROAD
TRUCK ENTRANCE
PAVED ENTRANCE
GAURD HOUSE
EQUIPMENT STORAGE SERVICE
SITE VEHICLES PARKING
SITE OFFICES
CONCRETE ARCH CROSSING
GATE
TEMPORARY SPRUNG STRUCTURE MATERIAL LOADOUT
ADDITIONAL SETTLING/STORAGE TANKS
CARBON FILTRATION UNITS
DISCHARGE TANKS
PUMP
PRIMARY SETTLING TANK
BAG FILTERS
CONTACT WATER TRANSFER LINE
CABLE CROSSING SIGN
SITE ACCESS ROAD
PHASE 1
PHASE 2
PHASE 3
Phase 1 and 2 Overlap
Phase 2 and 3 Overlap
CONGAREE RIVER
SCALE: 1"=200'
0'
200'
400'
LEGEND
– APPROXIMATE EDGE OF RIVER
– SITE PERIMETER FENCE
– APPROXIMATE EXTENT OF GRAVEL AREAS
– APPROXIMATE VEGETATED AREA
– OVERHEAD POWER LINE
– OVERHEAD POWER LINE RIGHT OF WAY
– GAS LINE
– FIBER OPTIC LINE
– CABLE CROSSING
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY
SITE OPERATIONS PLAN SCENARIO
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/19/14
FILE NAME: CONG177
APEX COMPANIES, LLC

FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

WATER MANAGEMENT SCENARIO

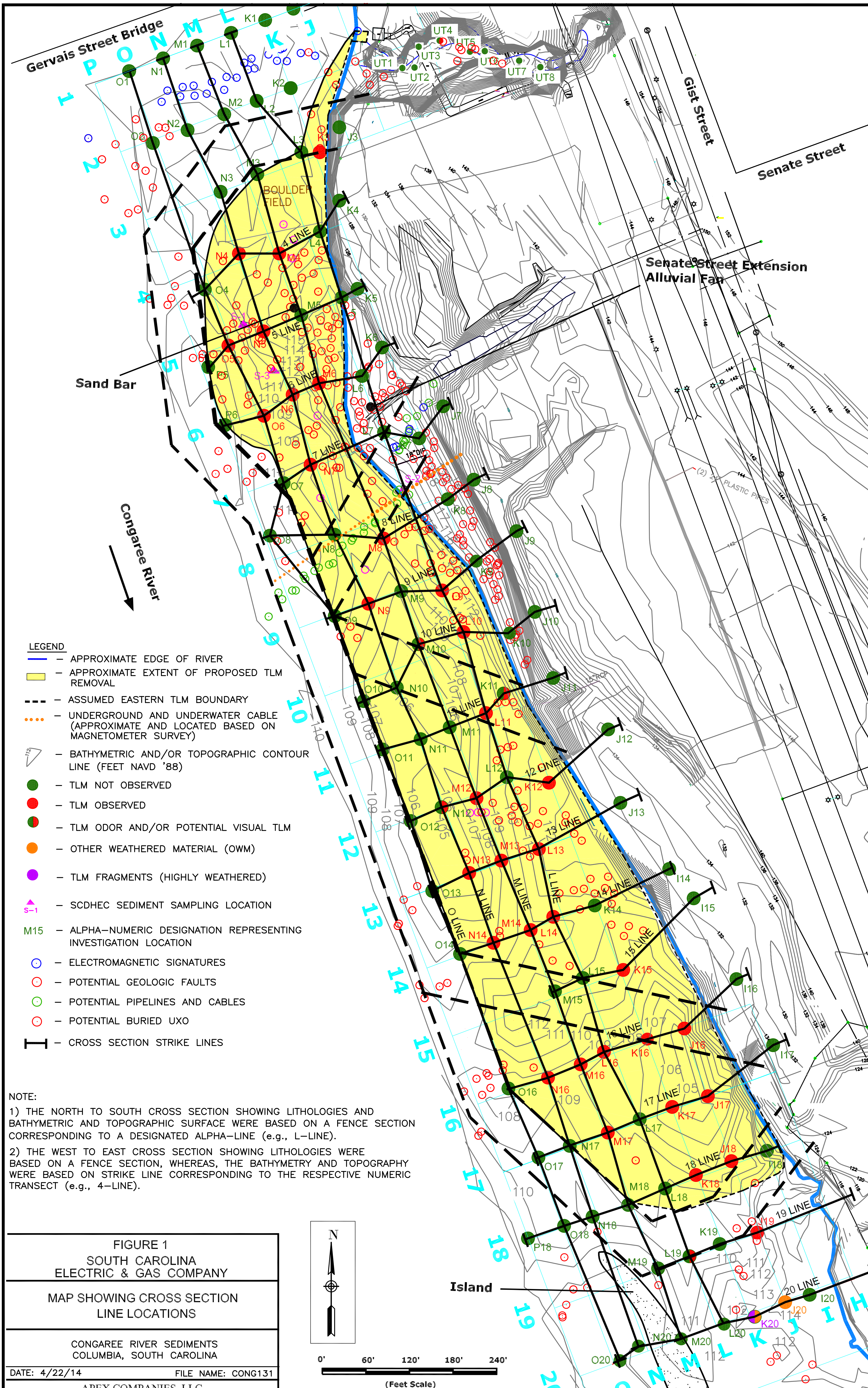
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/24/14 FILE NAME: CONG178

APEX COMPANIES, LLC

APPENDIX C

CROSS-SECTIONS OF REMOVAL AREAS



LEGEND

- APPROXIMATE EDGE OF RIVER
- APPROXIMATE EXTENT OF PROPOSED TLM REMOVAL
- ASSUMED EASTERN TLM BOUNDARY
- UNDERGROUND AND UNDERWATER CABLE (APPROXIMATE AND LOCATED BASED ON MAGNETOMETER SURVEY)
- BATHYMETRIC AND/OR TOPOGRAPHIC CONTOUR LINE (FEET NAVD '88)
- TLM NOT OBSERVED
- TLM OBSERVED
- TLM ODOR AND/OR POTENTIAL VISUAL TLM
- OTHER WEATHERED MATERIAL (OWM)
- TLM FRAGMENTS (HIGHLY WEATHERED)
- S-1 – SCDHEC SEDIMENT SAMPLING LOCATION
- M15 – ALPHA-NUMERIC DESIGNATION REPRESENTING INVESTIGATION LOCATION
- ELECTROMAGNETIC SIGNATURES
- POTENTIAL GEOLOGIC FAULTS
- POTENTIAL PIPELINES AND CABLES
- POTENTIAL BURIED UXO
- CROSS SECTION STRIKE LINES

NOTE:

1) THE NORTH TO SOUTH CROSS SECTION SHOWING LITHOLOGIES AND BATHYMETRIC AND TOPOGRAPHIC SURFACE WERE BASED ON A FENCE SECTION CORRESPONDING TO A DESIGNATED ALPHA-LINE (e.g., L-LINE).

2) THE WEST TO EAST CROSS SECTION SHOWING LITHOLOGIES WERE BASED ON A FENCE SECTION, WHEREAS, THE BATHYMETRY AND TOPOGRAPHY WERE BASED ON STRIKE LINE CORRESPONDING TO THE RESPECTIVE NUMERIC TRANSECT (e.g., 4-LINE).

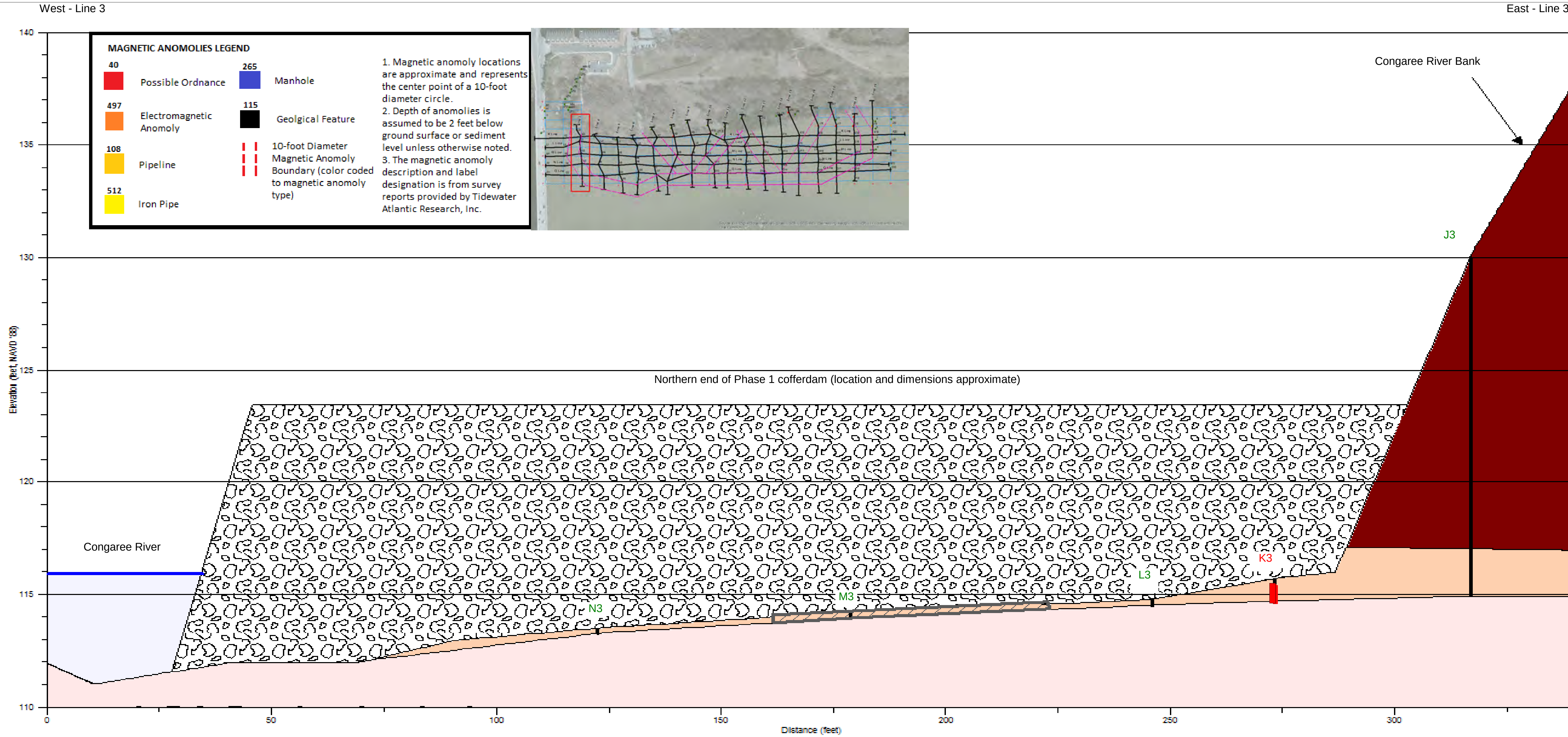
FIGURE 1
SOUTH CAROLINA ELECTRIC & GAS COMPANY

MAP SHOWING CROSS SECTION LINE LOCATIONS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 4/22/14 FILE NAME: CONG131

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "3" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of N3, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 2

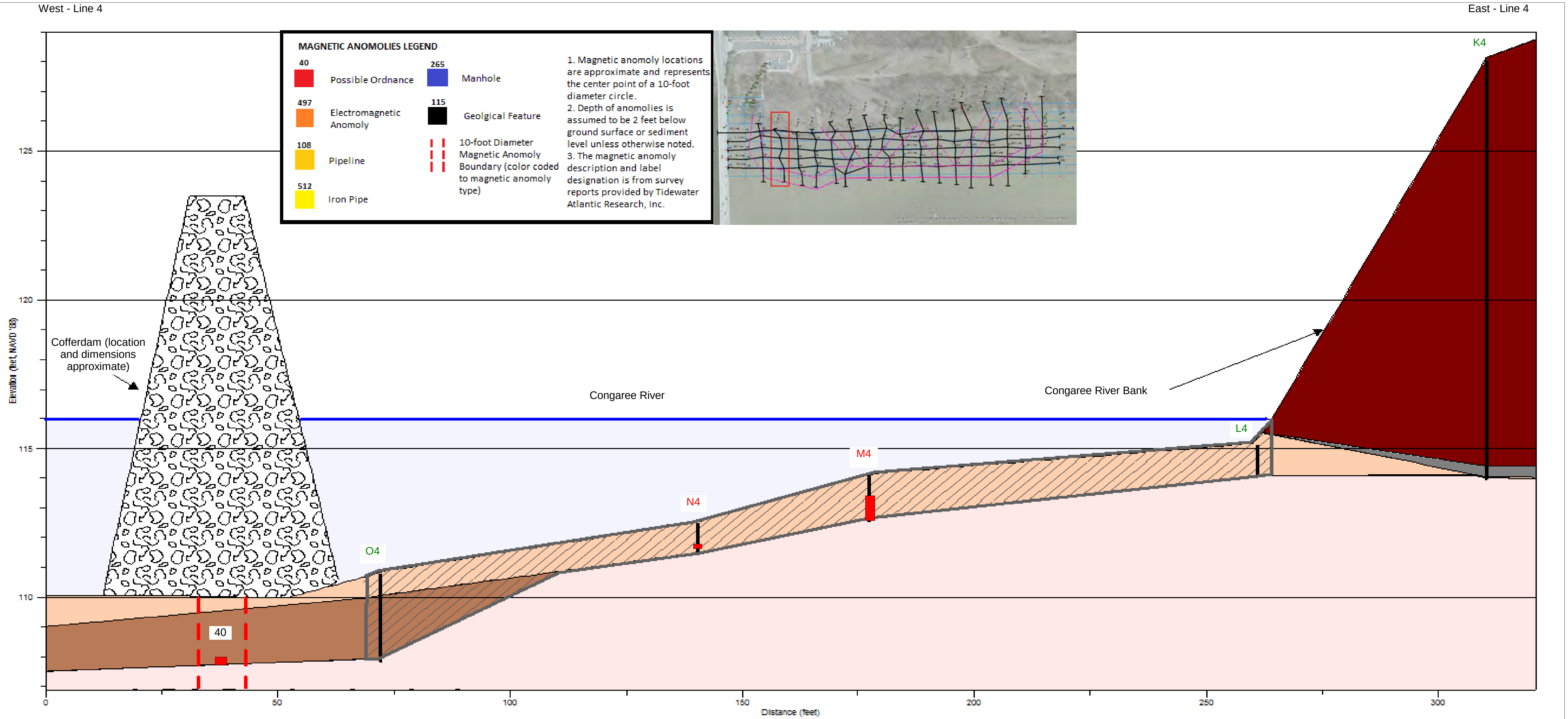
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 3

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 3

APEX COMPANIES, LLC



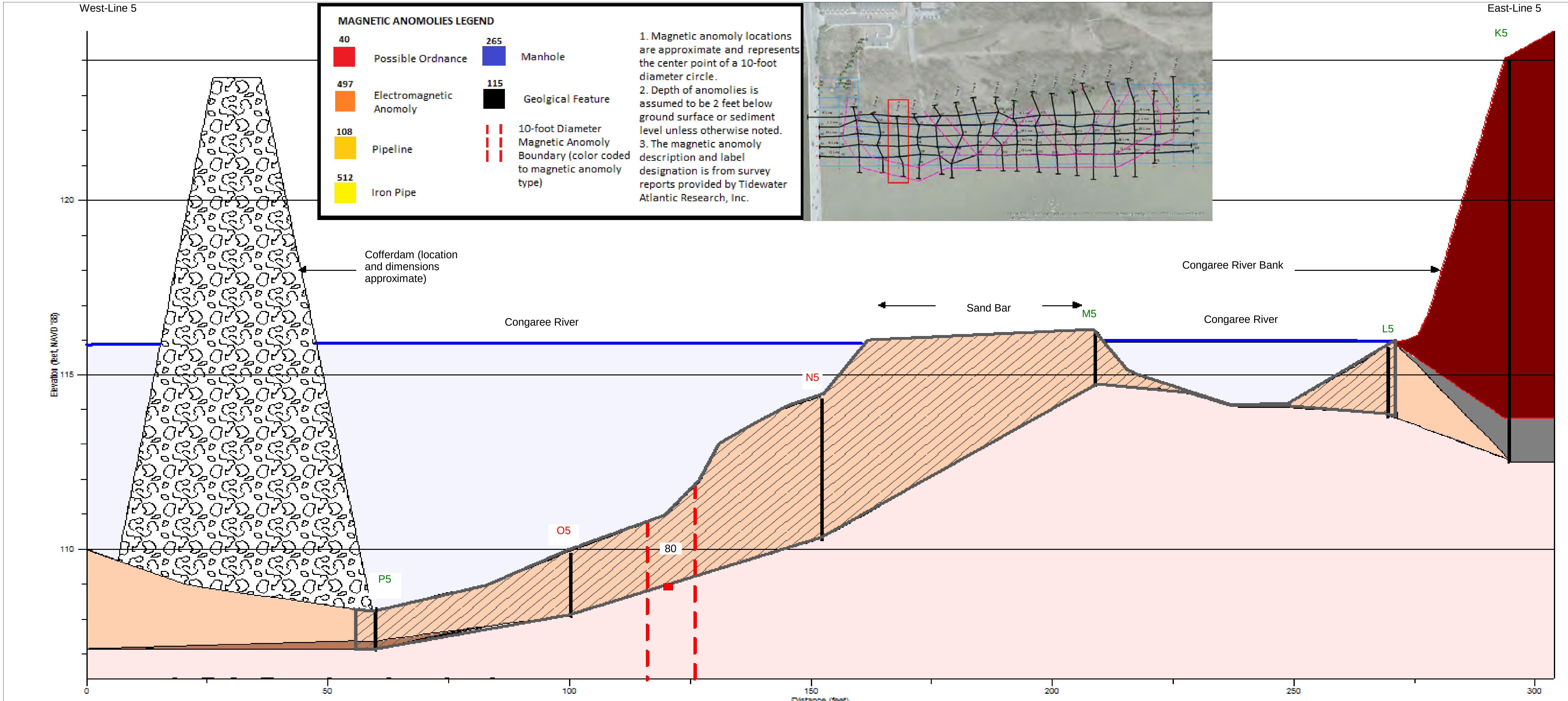
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Saprolite
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "4"-strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O4, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes and may differ to that in the final design and field.

PHASE 1

FIGURE 3
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG LINE 4
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 04/22/2014 FILE NAME: LINE 4
APEX COMPANIES, LLC



LEGEND

(dark red)	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	(brown)	Saprolite
		(light pink)	Granite bedrock and/or boulders - assumed
		(red)	Visual tar like material (TLM)
(light orange)	Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	(hatched)	Approximate extent of sediment targeted for removal
(gray)	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	O6	Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
		- - - -	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "5"-strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Corings L5 and M5 were drilled with a whacker/macrocore and depth of refusal encountered may or may not be representative of the granite bedrock surface.
5. Since no corings were collected west of P5, lithology is unknown and for illustration purposes assumed and inferred.
6. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
7. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ from that in the final design and field.

PHASE 1

FIGURE 4

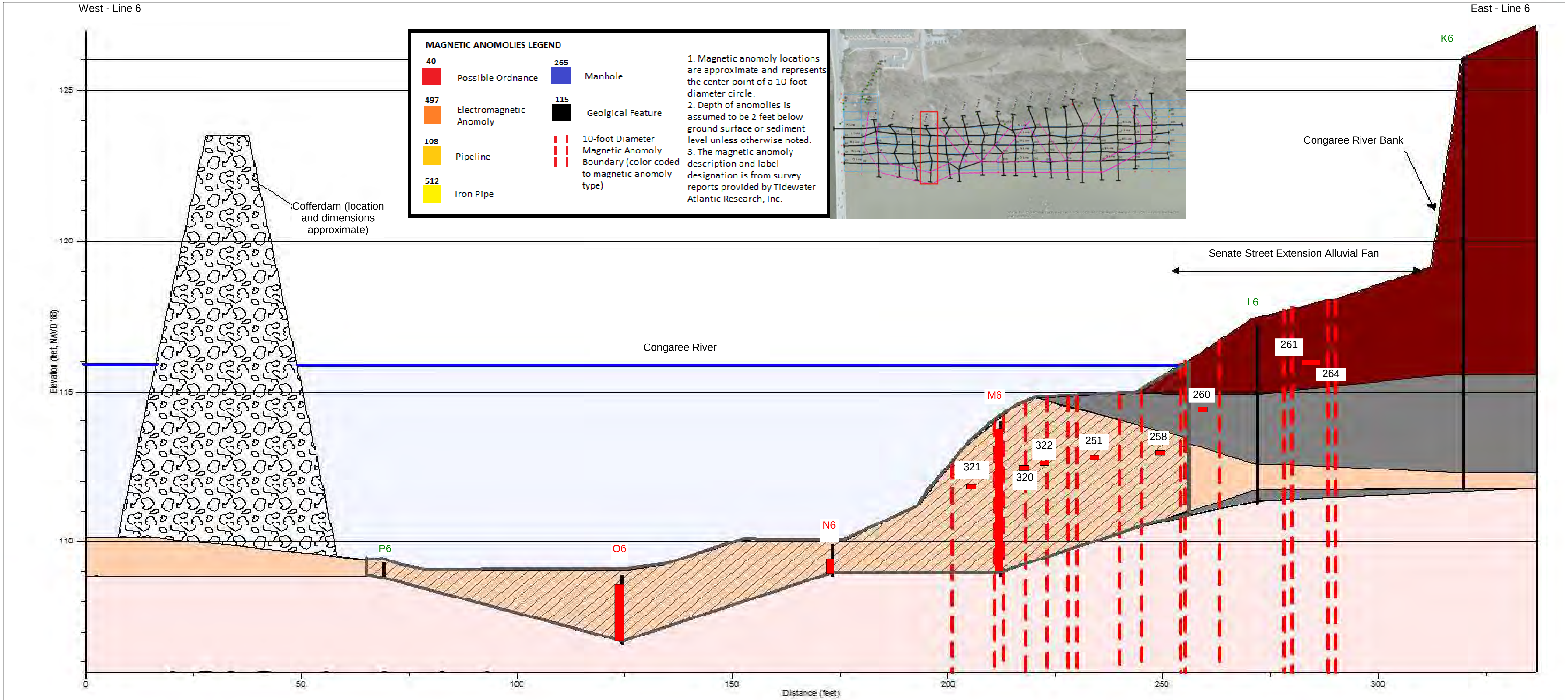
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 5

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 5

APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Saprolite
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, bathymetry and topography are from the "6" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. The 0-2.3 foot interval at L6 is assumed to be fill from the historic activities and/or washed in from erosion.
5. Since no corings were collected west of P6, lithology is unknown and for illustration purposes is assumed and inferred.
6. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As Such, interpretation between data points was based on best professio0nal judegement. Actual site conditions depictesd between existing corings/borings may vary.
7.Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 5

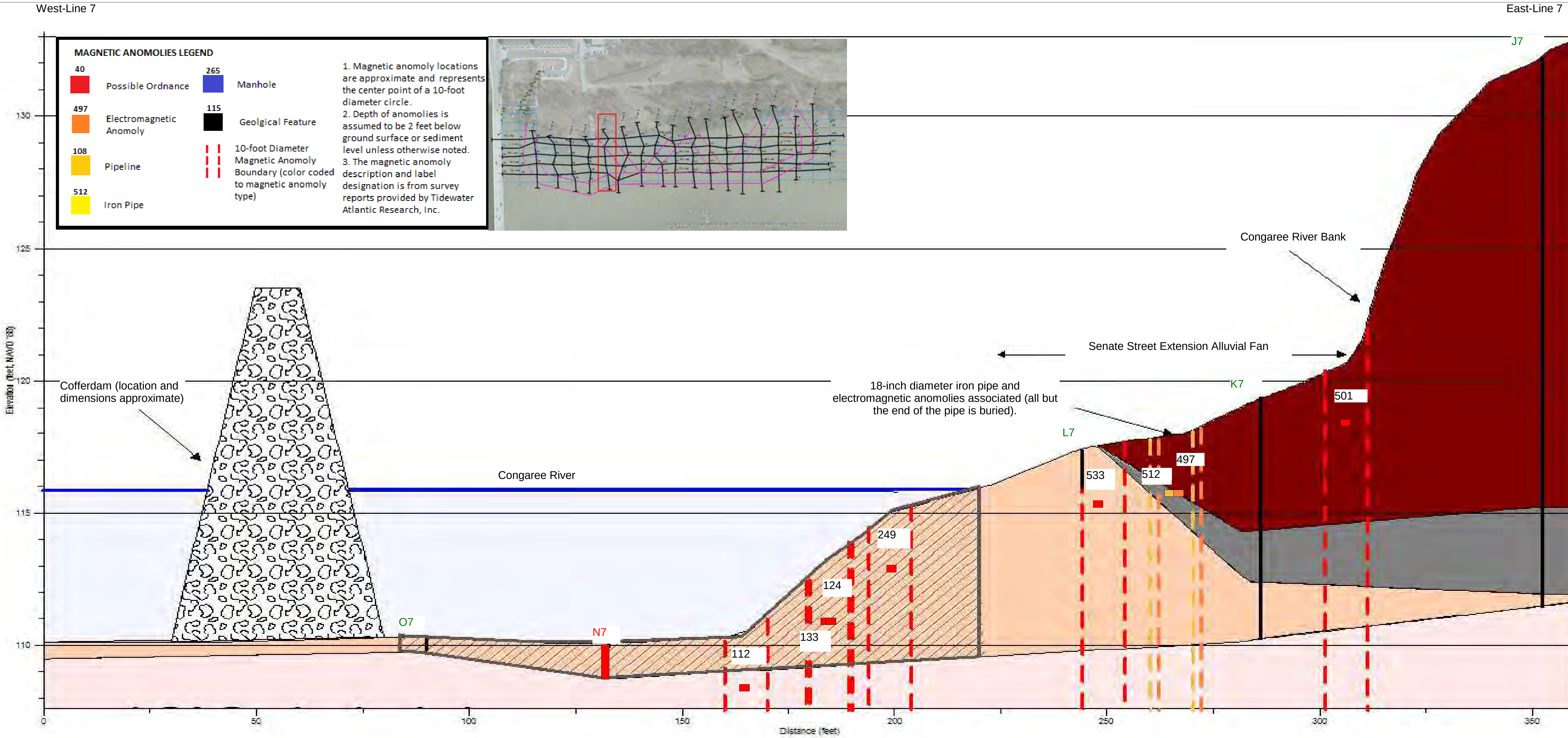
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 6

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 6

APEX COMPANIES, LLC



LEGEND

	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.		Granite bedrock and/or boulders - assumed
	Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.		Visual tar like material (TLM)
	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.		Approximate extent of sediment targeted for removal
		O6	Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
			Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "7" -strike line.
3.The Congaree River bank slope likely differs from that shown.
4. Total depth of coring L7 was only 2.1 feet and the aluminum tube used for vibra-coring may have been impeded by a large cobble and therefore depth to granite bedrock at this location is inferred.
5.Since no corings were collectedwest of O7, lithology is unknown and for illustration purposes is assumed and inferred.
6. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
7. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 6

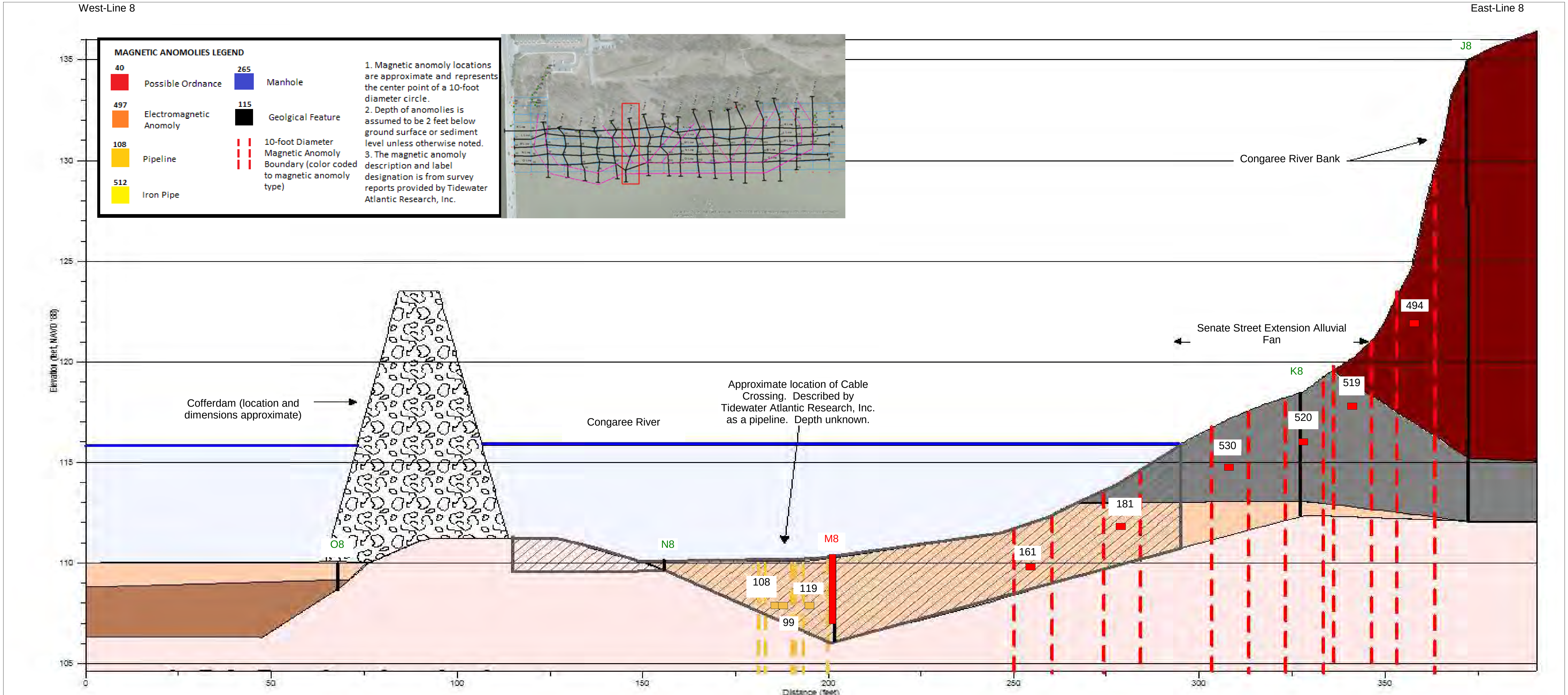
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 7

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 7

APEX COMPANIES, LLC



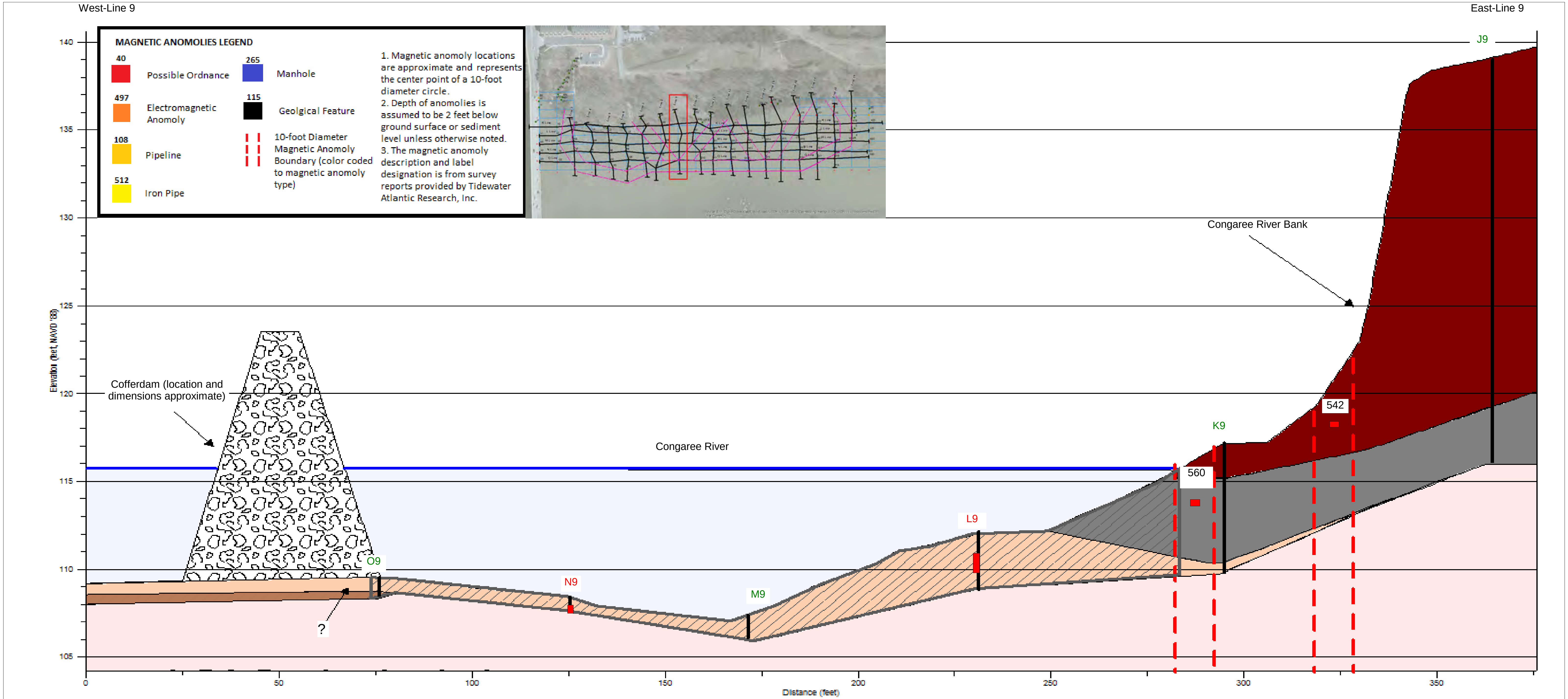
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Saprolite
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "8" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O8, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 7	
SOUTH CAROLINA ELECTRIC AND GAS CO.	
CROSS SECTION ALONG LINE 8	
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA	
DATE: 04/22/2014	FILE NAME: LINE 8
APEX COMPANIES, LLC	



LEGEND

	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.		Saprolite
	Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.		Granite bedrock and/or boulders - assumed
	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.		Visual tar like material (TLM)
			Approximate extent of sediment targeted for removal
		O6	Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
			Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "9" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. The silt and clay layer at O9 is interpreted to be saprolite.
5. Since no corings were collected west of O9, lithology is unknown and for illustration purposes is assumed and inferred.
6. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
7. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1 AND 2 OVERLAP

FIGURE 8

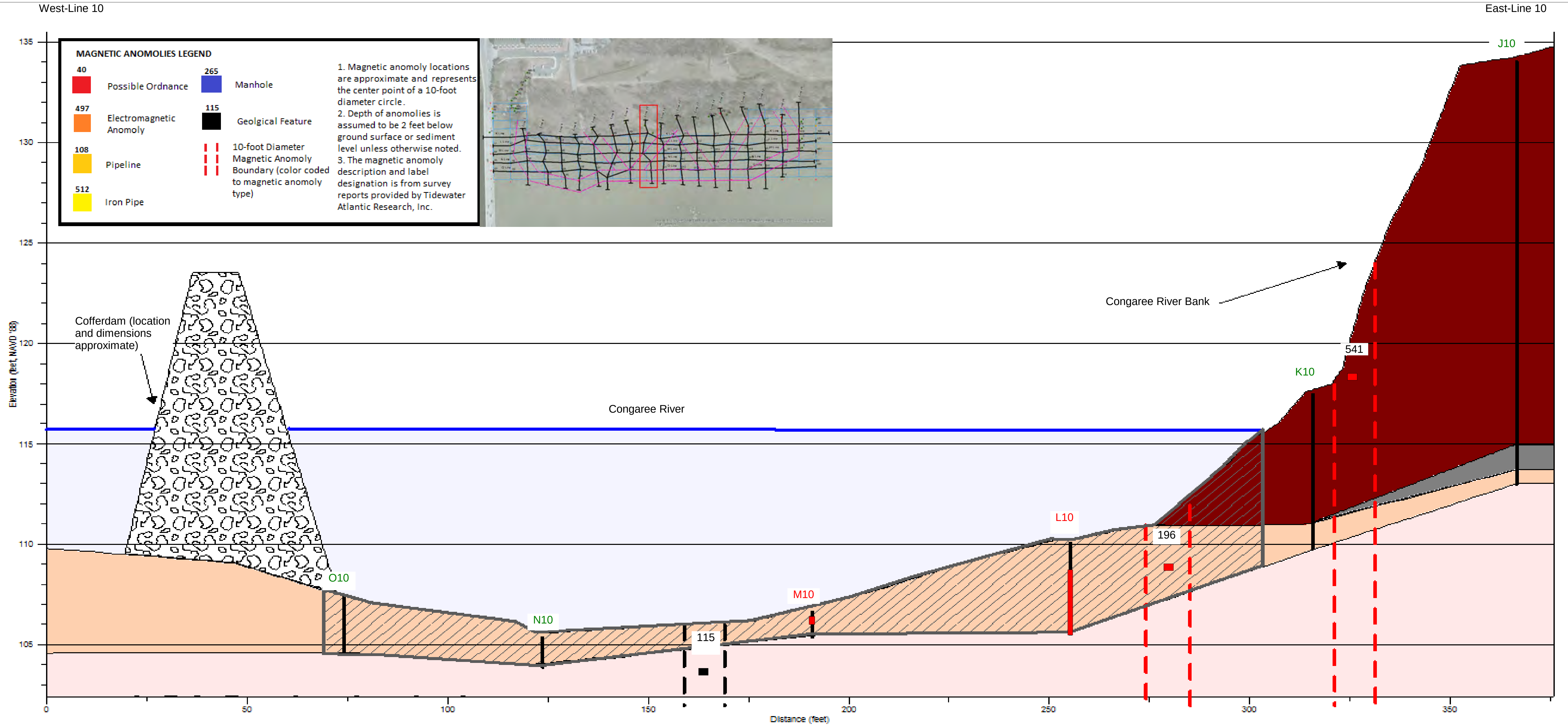
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 9

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 9

APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "10" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O10, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1 AND 2 OVERLAP

FIGURE 9

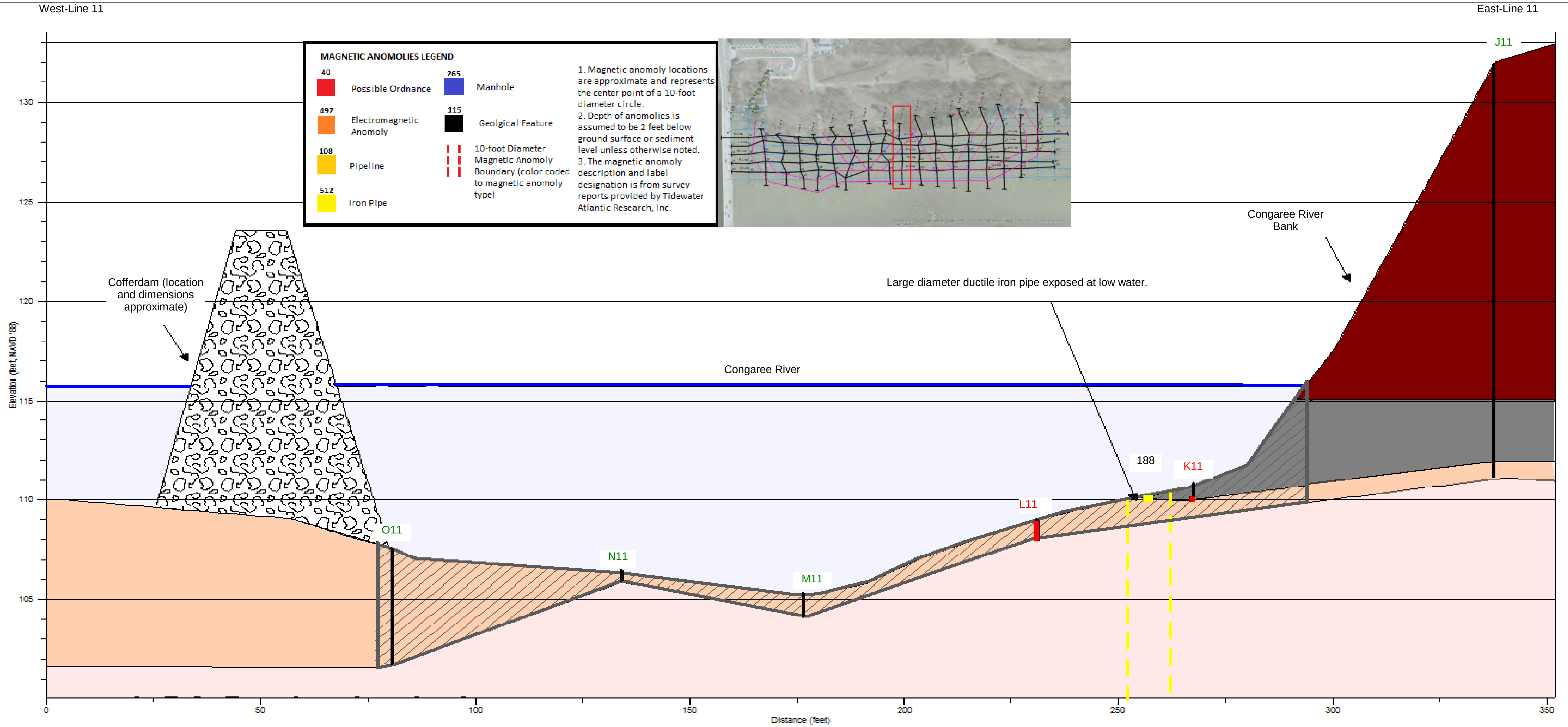
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 10

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 10

APEX COMPANIES, LLC



LEGEND

	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.		Granite bedrock and/or boulders - assumed
			Visual tar like material (TLM)
	Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.		Approximate extent of sediment targeted for removal
		O6	Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.		Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constreucted along a fence line, and bathymetry and topography are from the "11" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O11, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 10

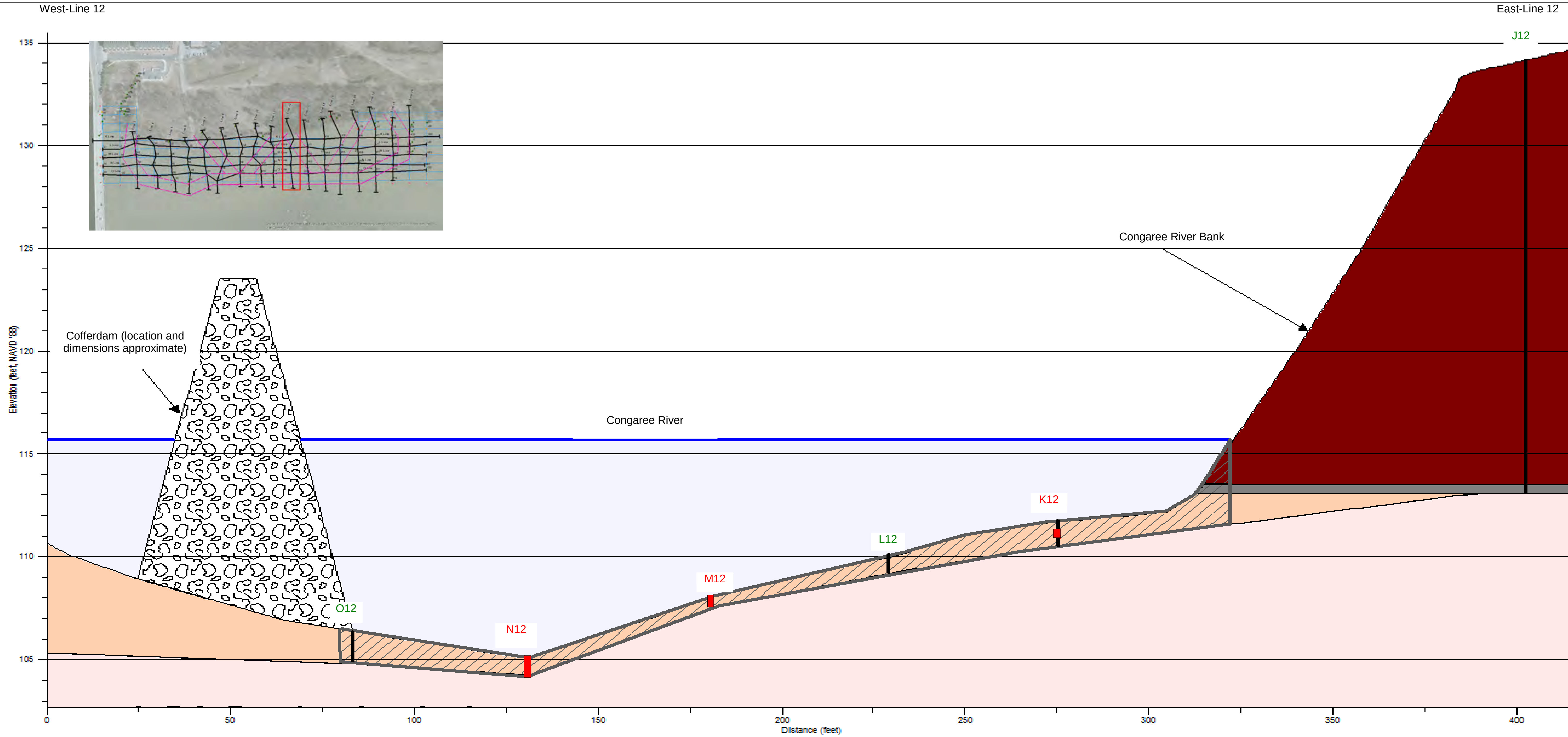
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 11

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 11

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "12" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O12, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 11

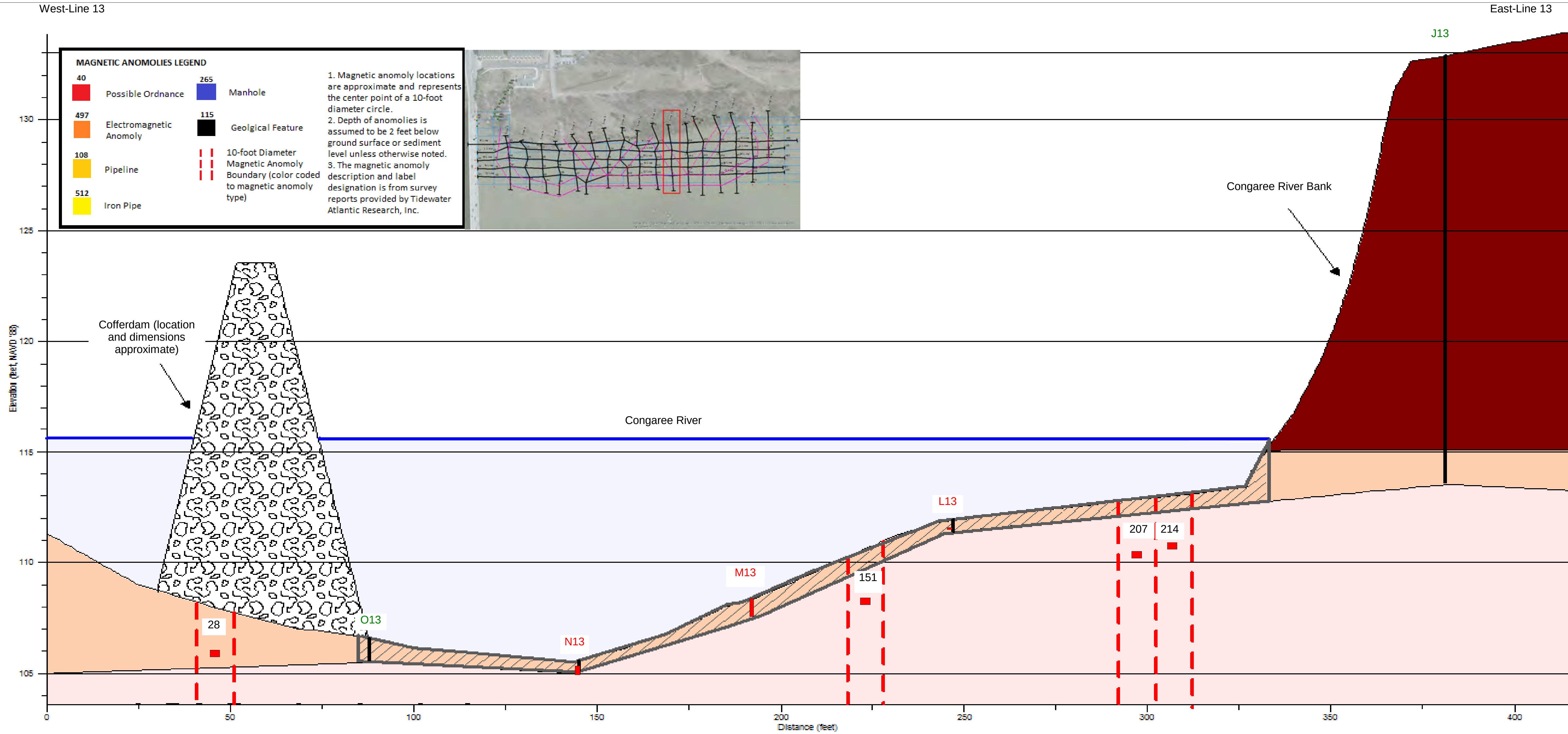
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 12

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 12

APEX COMPANIES, LLC



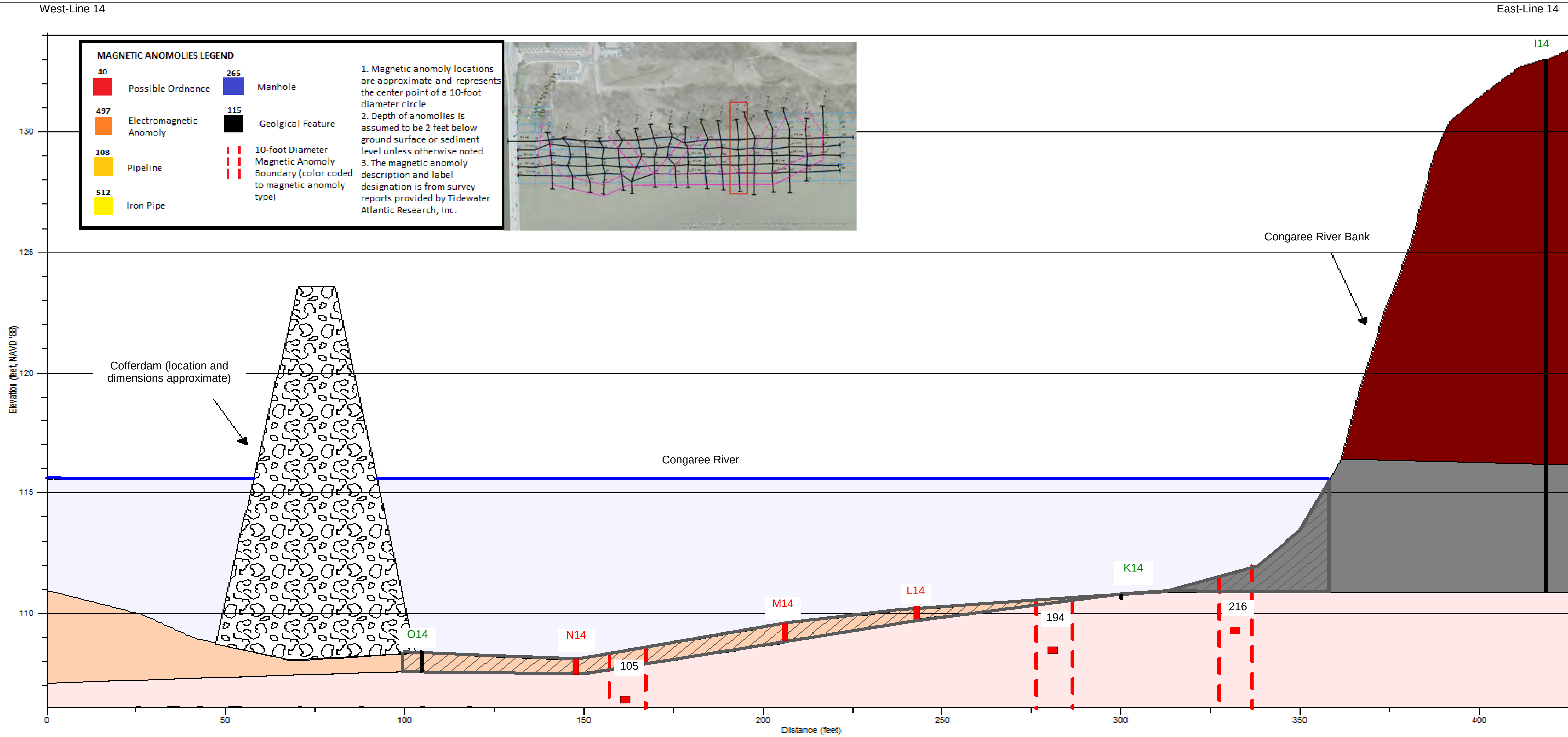
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Saprolite
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "13" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings] were collected west of O13, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgment. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 12
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG LINE 13
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 04/22/2014 FILE NAME: LINE 13
APEX COMPANIES, LLC



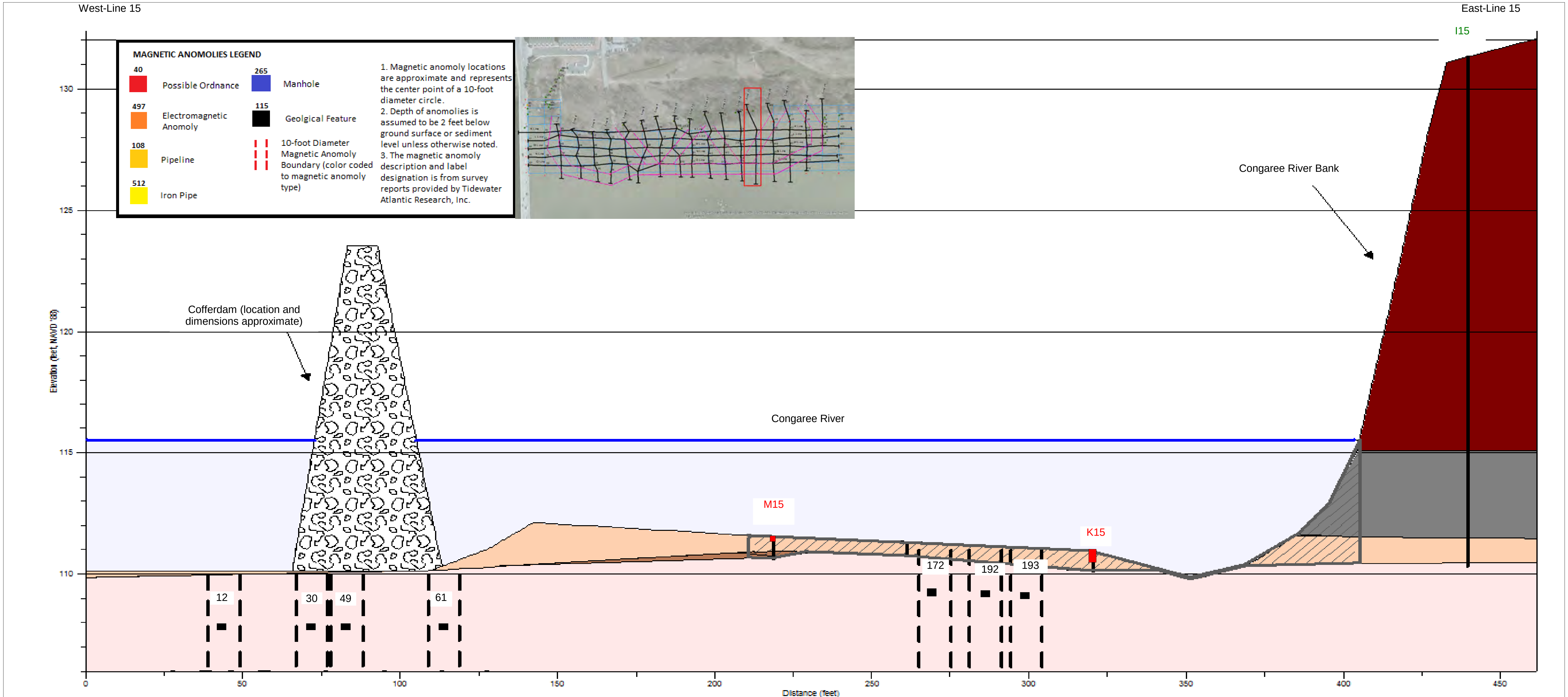
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "14" -strike line.
3. The Congaree River bank slope likely differs from that shown.
4. Since no corings were collected west of O14, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2 AND 3 OVERLAP

FIGURE 13
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG LINE 14
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 04/22/2014 FILE NAME: LINE 14
APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Saprolite
Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Granite bedrock and/or boulders - assumed
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Visual tar like material (TLM)
	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topogrpahy are from the "15" -strike line.
3. Western extent of sediment targeted for removal is approximately 100 feet west of M15 and is not shown since a data point does not exist.
4. The Congaree River bank slope likely differs from that shown.
5. Since no corings were collected west of M15, lithology is unknown and for illustration purposes is assumed and inferred.
6. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
7. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2 AND 3 OVERLAP

FIGURE 14

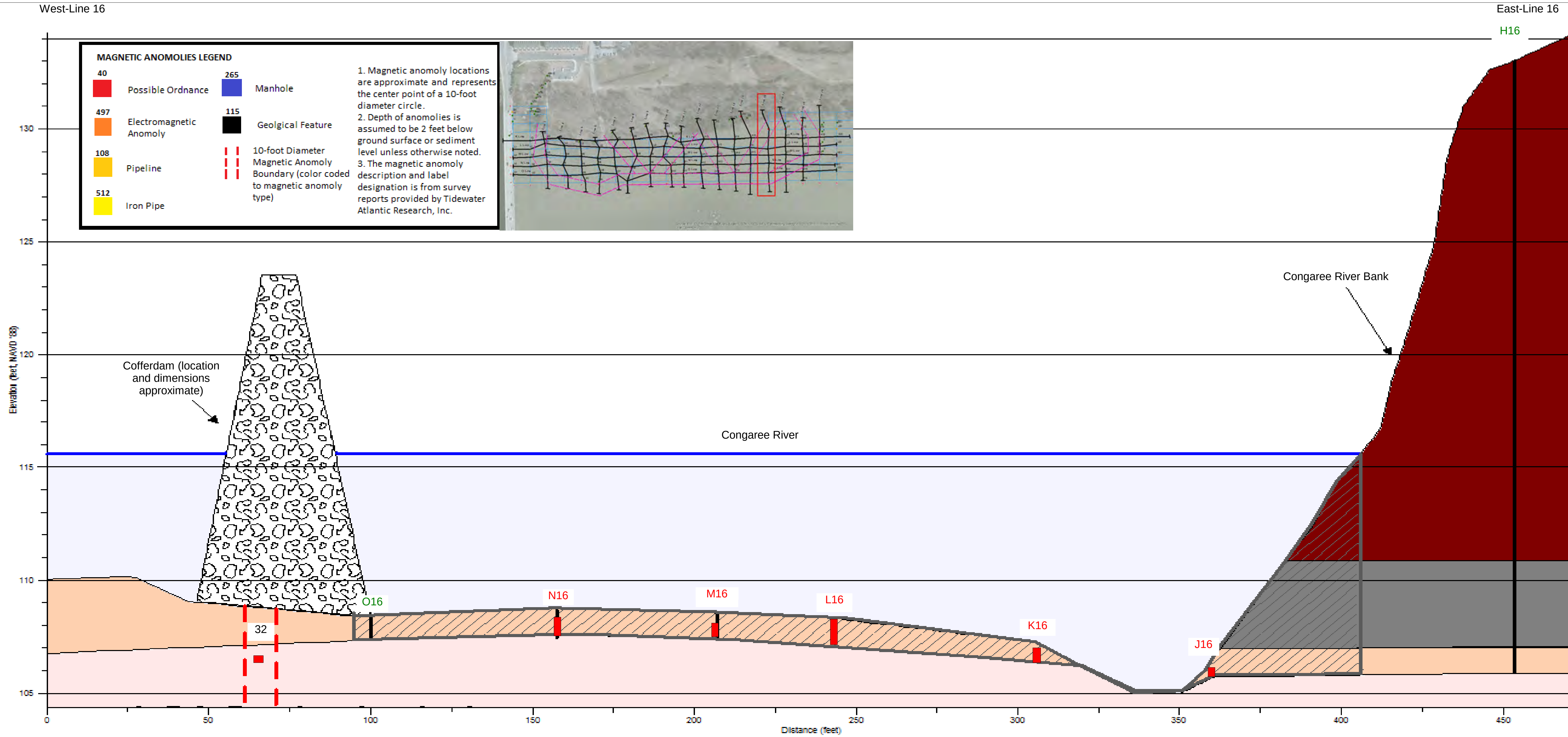
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 15

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 15

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slop (2.10 feet/mile, USACE Congaree River BAsin Navigability Study 1977) and refrencing to the elevation (112.25 feet, NAVD'88) of USGS gage 02169500, Congaree River Columbia, SC.
2. The coring/boring locations are contructed along a fence line, and bathymetry and topography are from the "16" -strike line.
3. The Congaree River bank Slope likely differs from that shown.
4. Since no corings were collected west of O16, lithology is unknown and for illustration purposes is assume and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 15

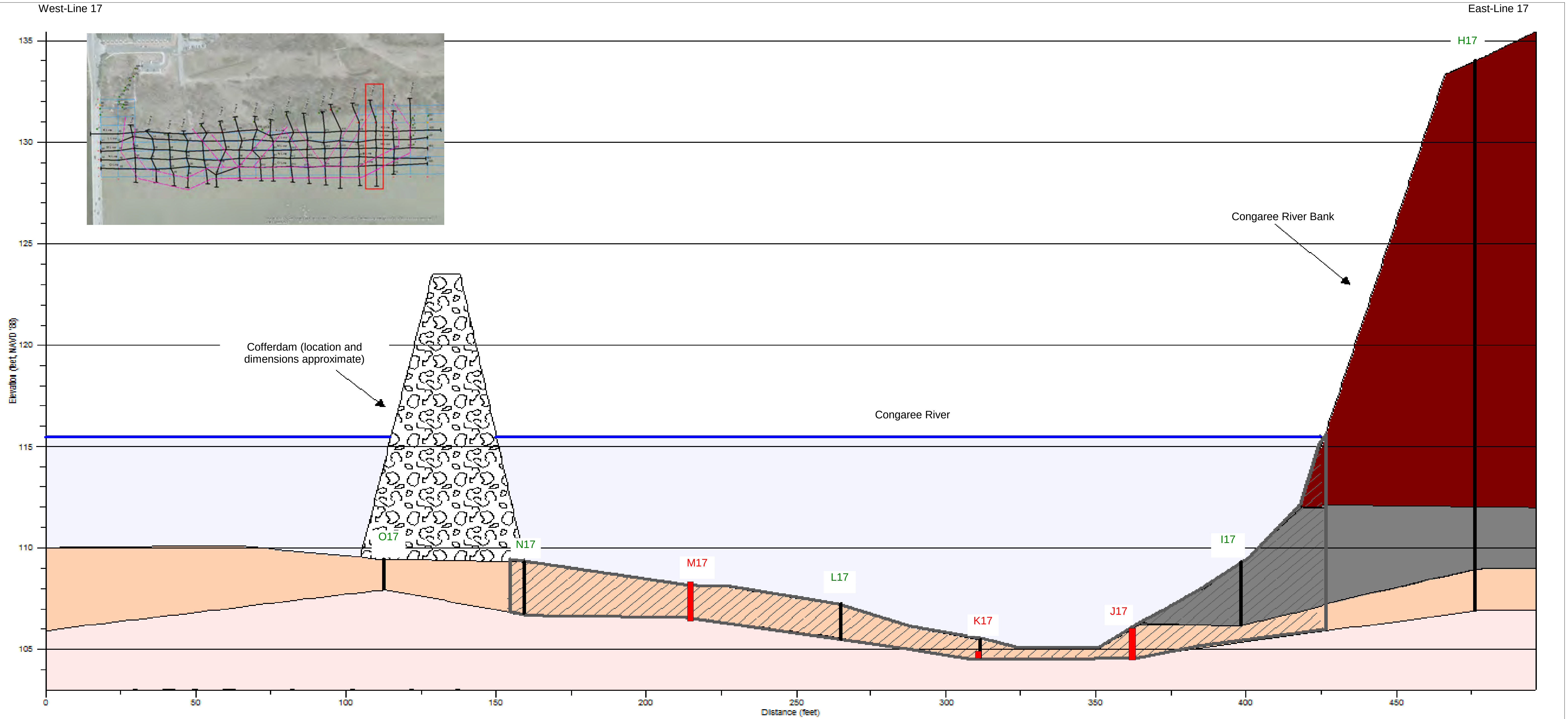
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 16

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 16

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

Approximate extent of sediment targeted for removal

O6

Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are contructed along a fence line, and bathymetry and topogrpahy are from the "17" -strike line.
3. Top of Congaree River Bank slope likely differs from shown illustration.
4. Since no corings were collected west of O17, lithology is unknown and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 16

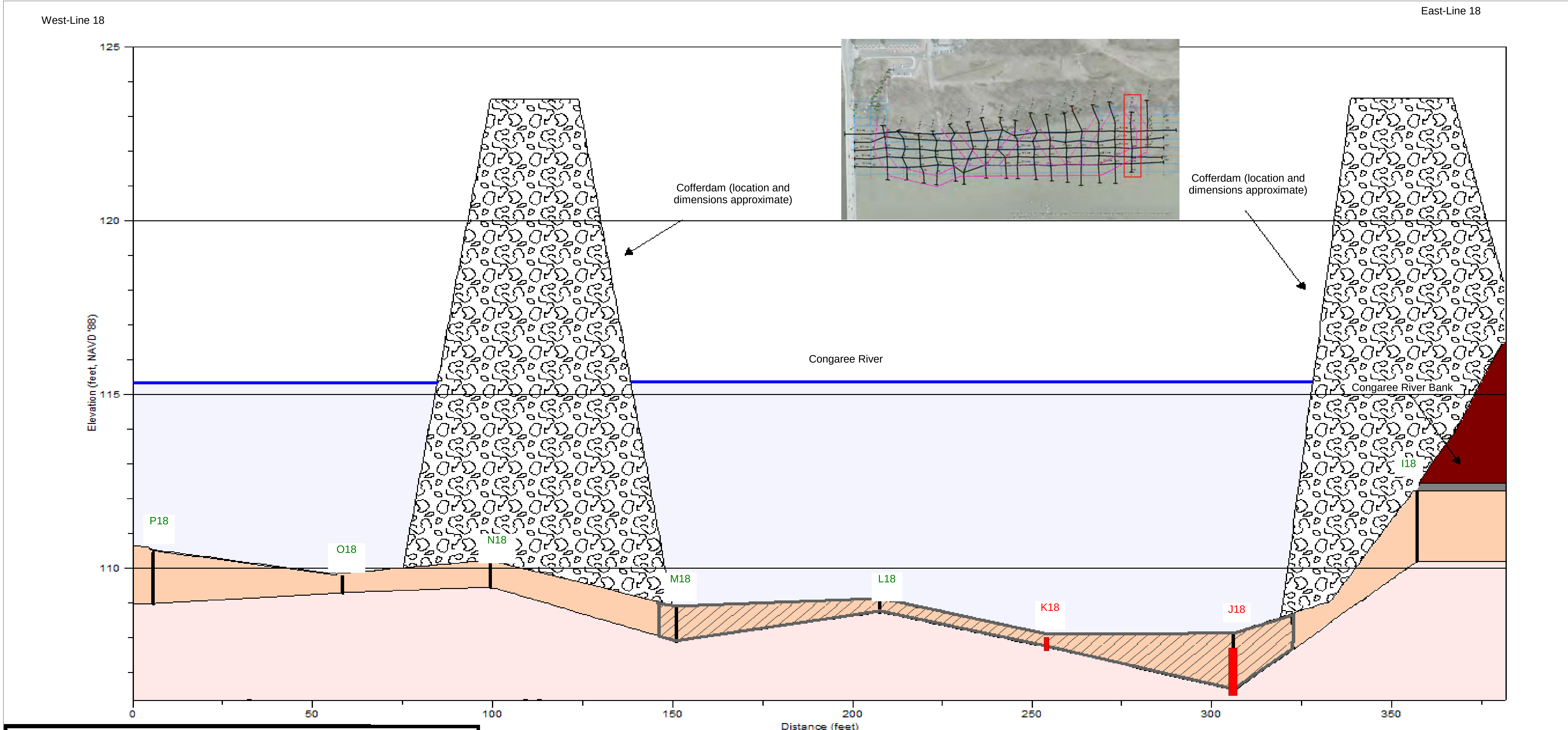
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 17

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 17

APEX COMPANIES, LLC



PHASE 3

LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

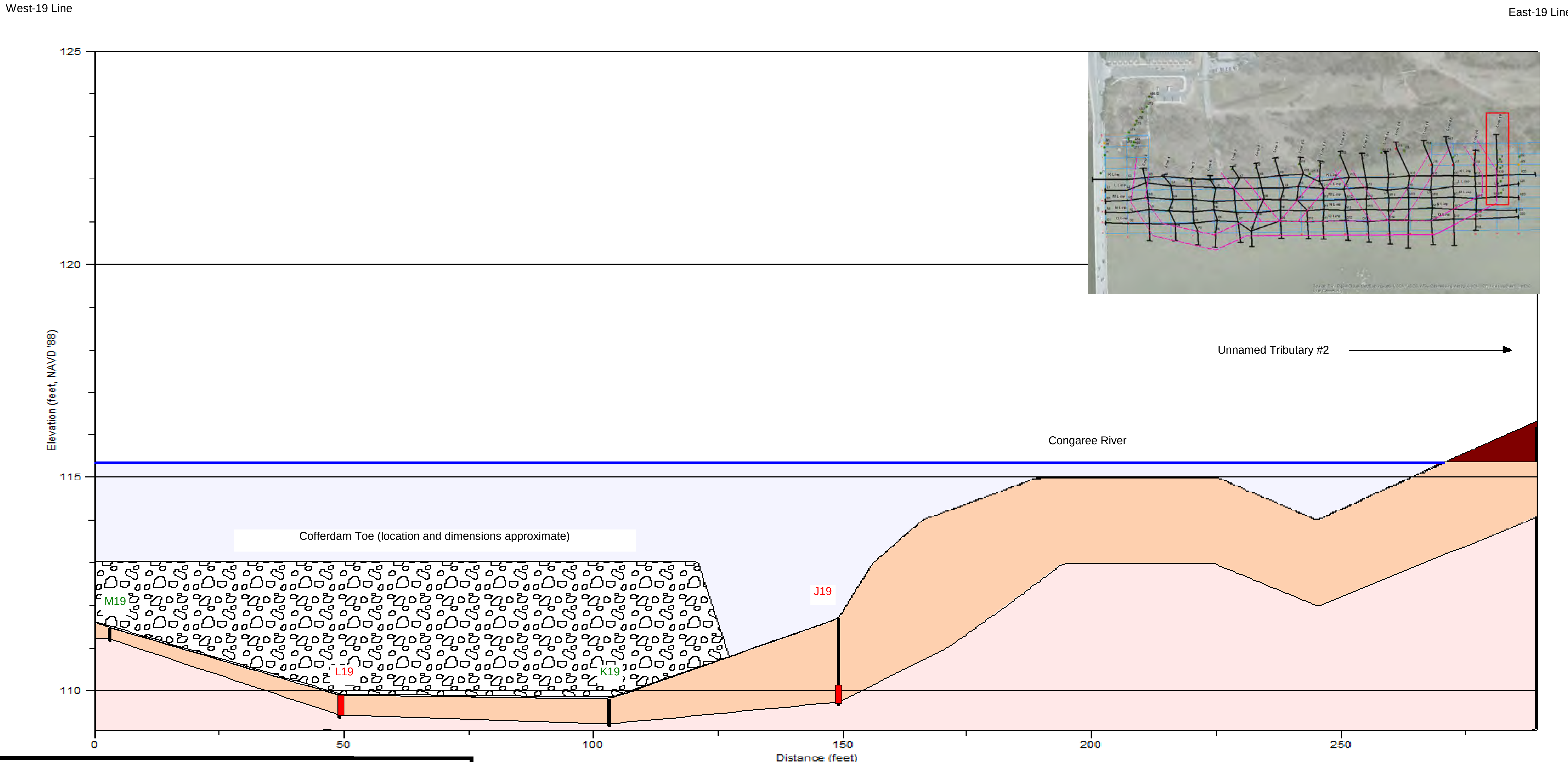
Approximate extent of sediment targeted for removal

O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are fom the "18" -strike line.
3. A limited portion of the Congaree River bank is shown, lithology is unknown and for illustration purposes is assumed and inferred.
4, This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
5. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

FIGURE 17 SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG LINE 18
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 04/22/2014   FILE NAME: LINE 18
APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

PHASE 3

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The coring/boring locations are constructed along a fence line, and bathymetry and topography are from the "19" -strike line.
3. Landside soil borings were not drilled along Line 19.
4. Lithology east of J19 is unknown, and for illustration purposes is assumed and inferred.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dim

FIGURE 18

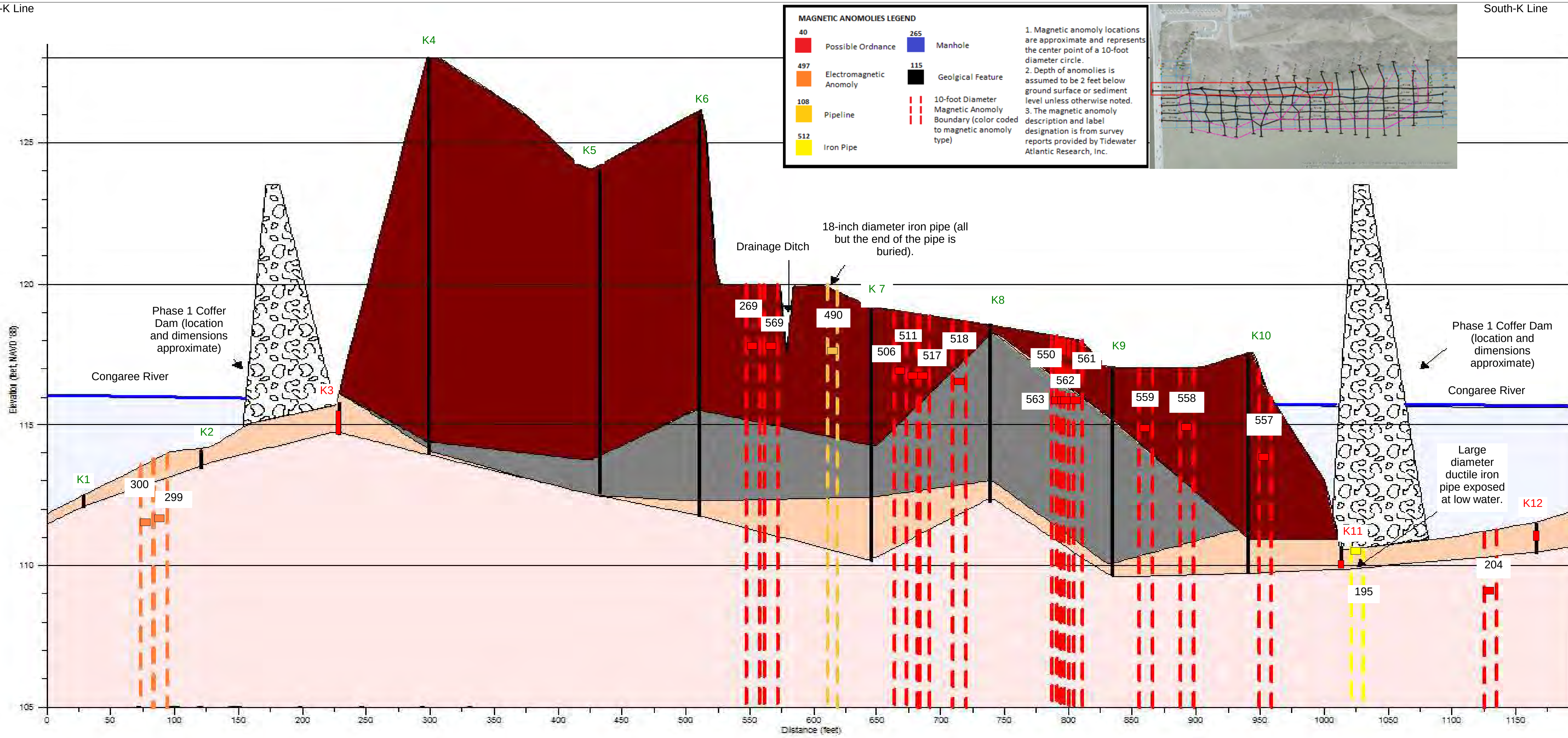
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 19

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: LINE 19

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "K" line and topography, bathymetry, and lithologies are approximately from and between K1 through K12.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
5. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 19A

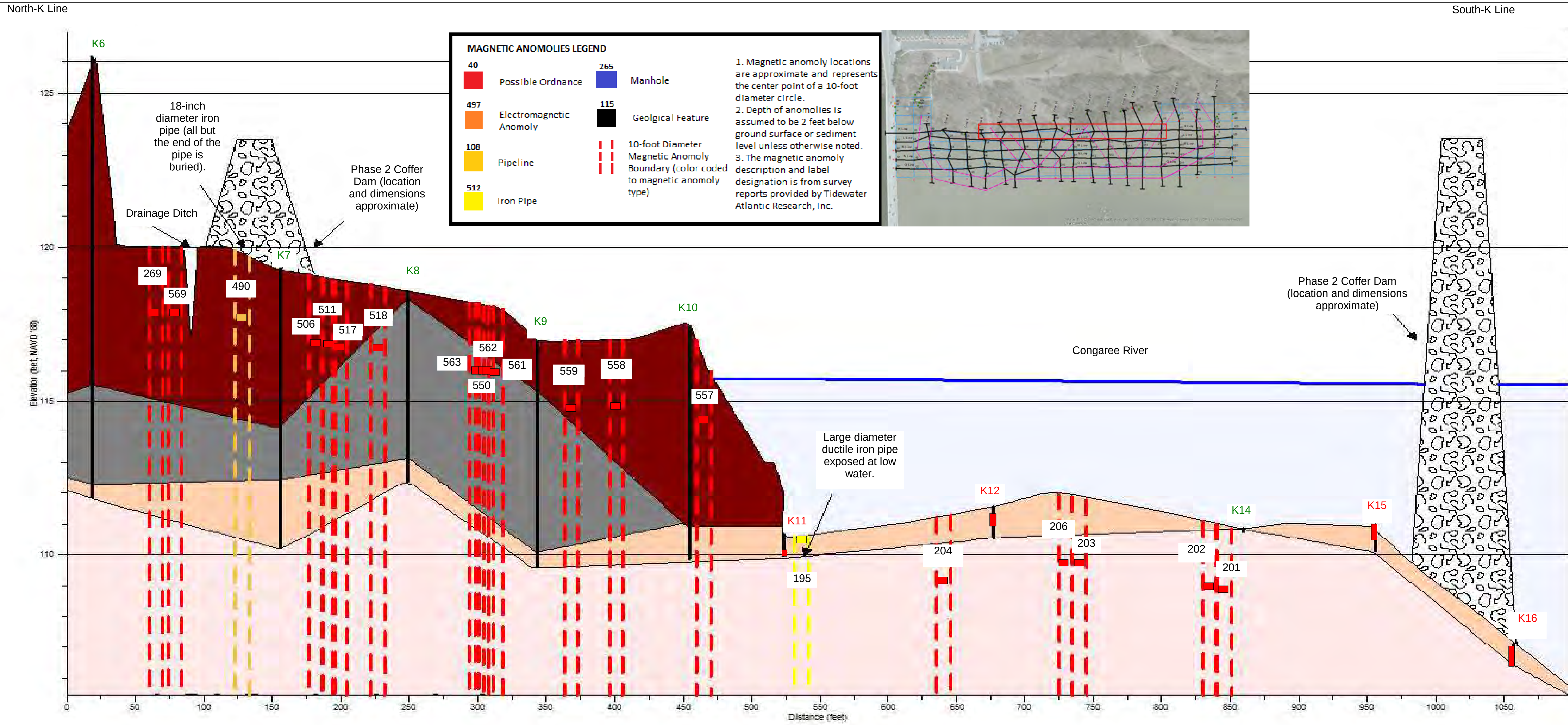
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG K, PHASE 1 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE:04/22/2014 FILE NAME:K LINE 1

APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elvation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "K" line, and the topography, bathymetry, and lithology are approximately from and between locations K6 through K16.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
5. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 19B

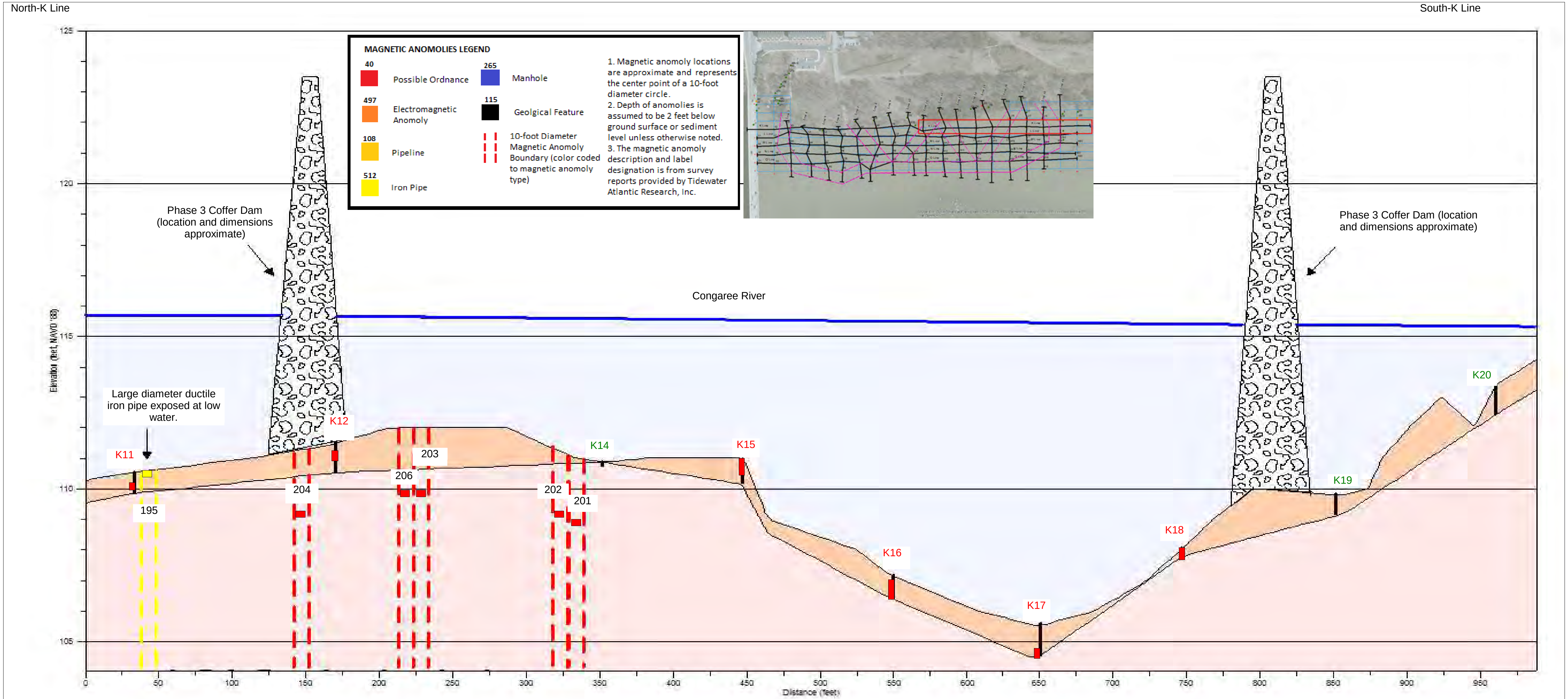
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG K, PHASE 2 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE:04/22/2014 FILE NAME:K LINE 2

APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "K" line and the topography, bathymetry, and lithologies are approximately from and between locations K11 through K20.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 19C

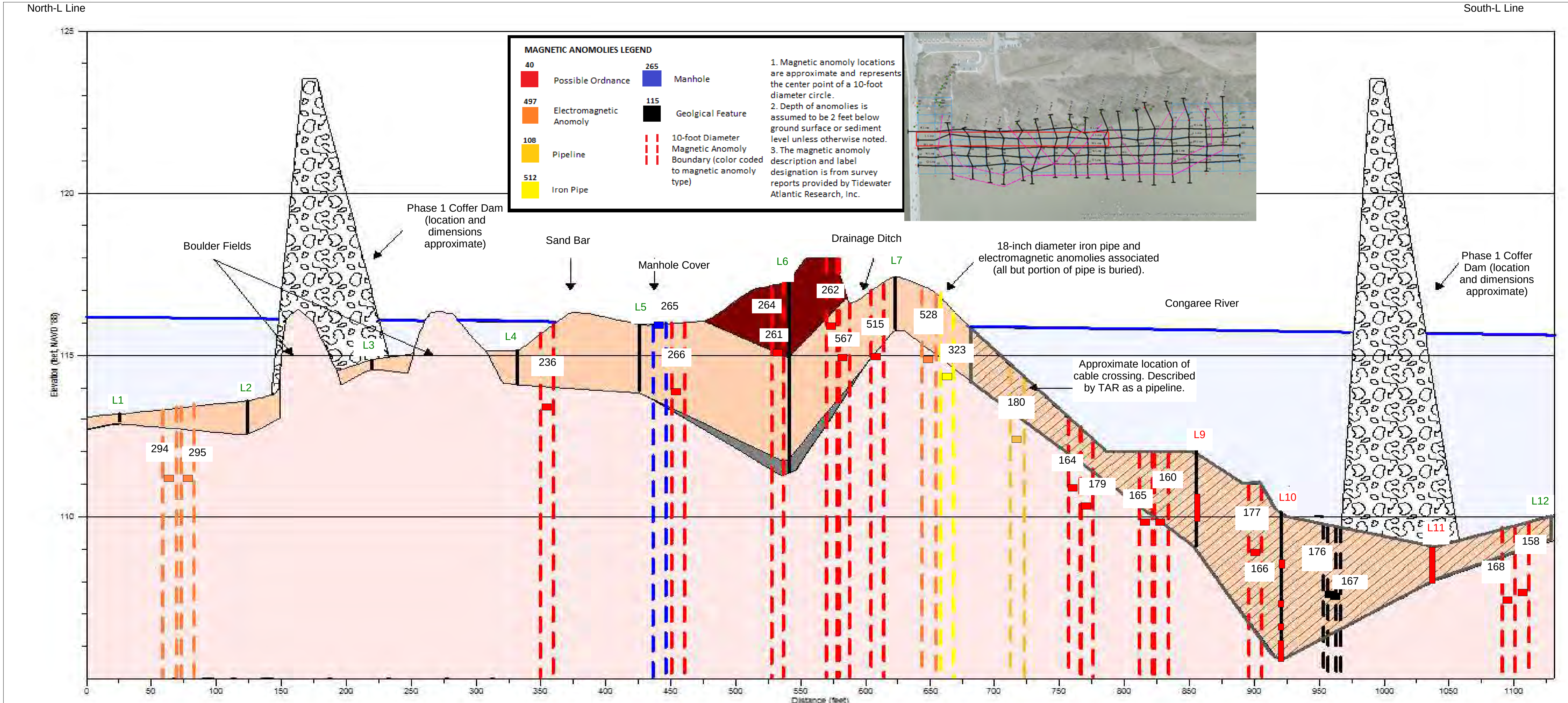
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG K, PHASE 3 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: K LINE 3

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "L" line and topography, bathymetry, and lithologies are approximately from and between locations L1 through L12.
4. The 0-2.3 interval at L6 is likely representative of a combination of river bank, river and shoreline lithologies to outwash deposition from Senate Street.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 20A

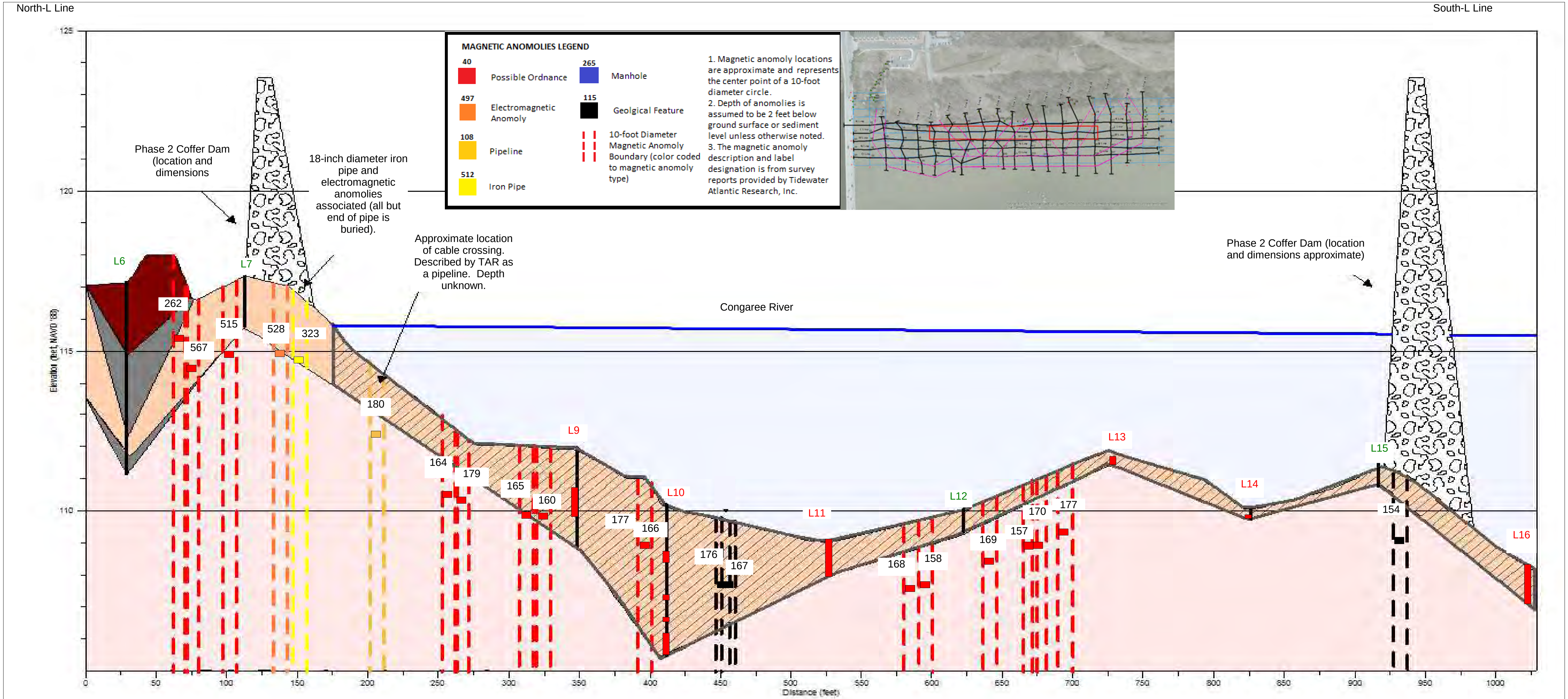
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG L, PHASE 1 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: L LINE 1

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "L" line and topography, bathymetry, and lithologies are approximately from and between locations L6 through L16.
4. The 0-2.3 interval at L6 is likely representative of a combination of river bank, river and shoreline lithologies to outwash deposition from Senate Street.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary. \
6. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 20B

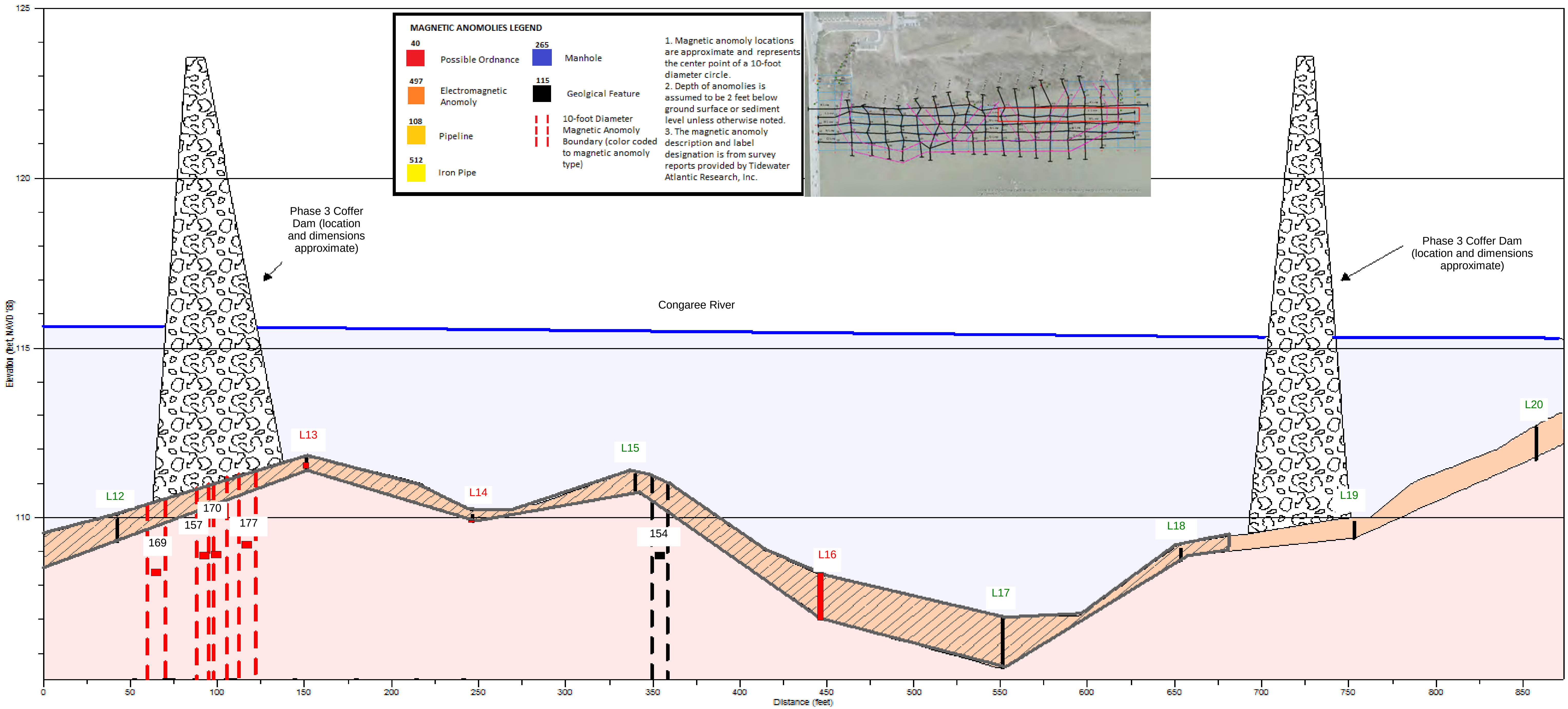
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG L, PHASE 2 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: L LINE 2

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

Approximate extent of sediment targeted for removal

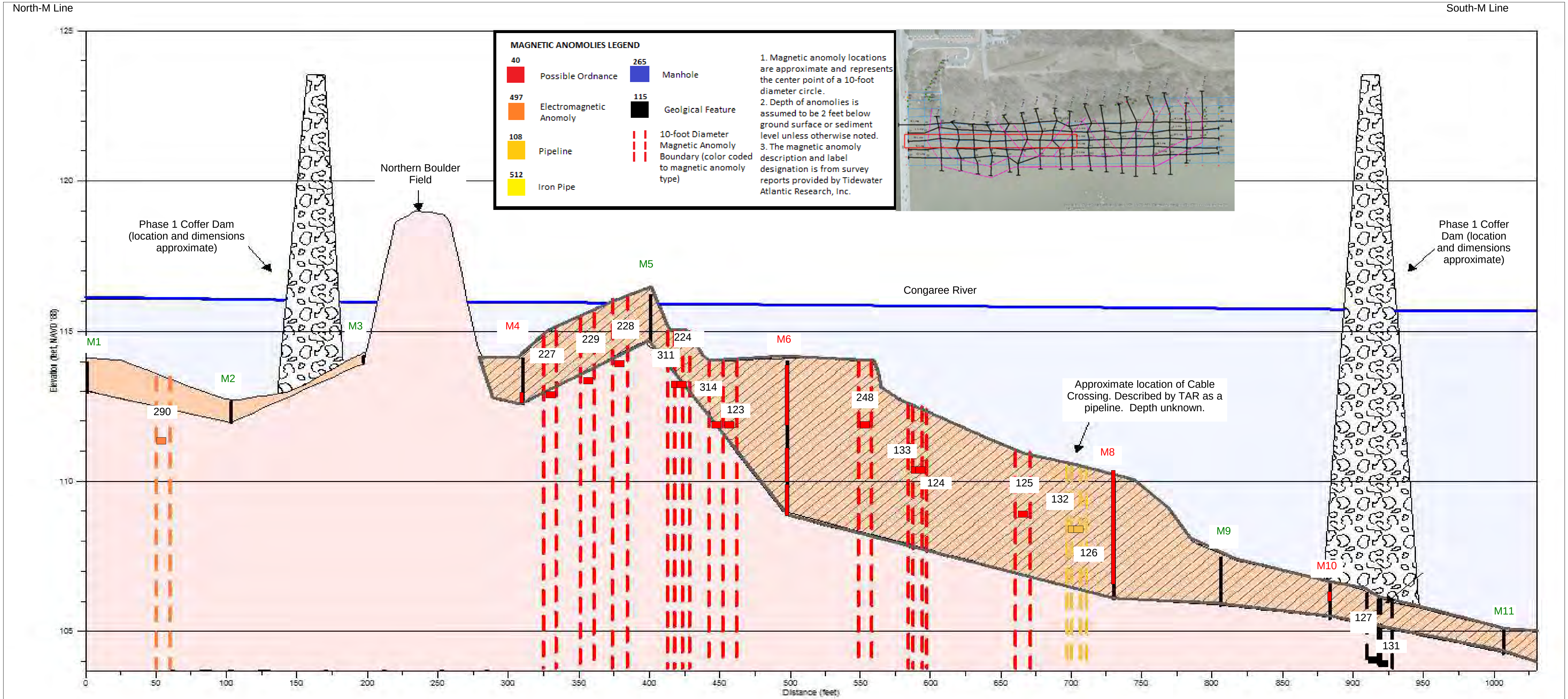
O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "L" line and bathymetry and lihtologies are approximately from and between locations L12 through L20.
3. The 0-2.3 interval at L6 is likely representative of a combination of river bank, river and shoreline lithologies to outwash deposition from Senate Street.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
5. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 20C
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG L, PHASE 3 EXTENT
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 04/22/2014 FILE NAME: L LINE 3
APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "M" line and bathymetry and lithologies are approximately from and between locations M1 through M11.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 21A

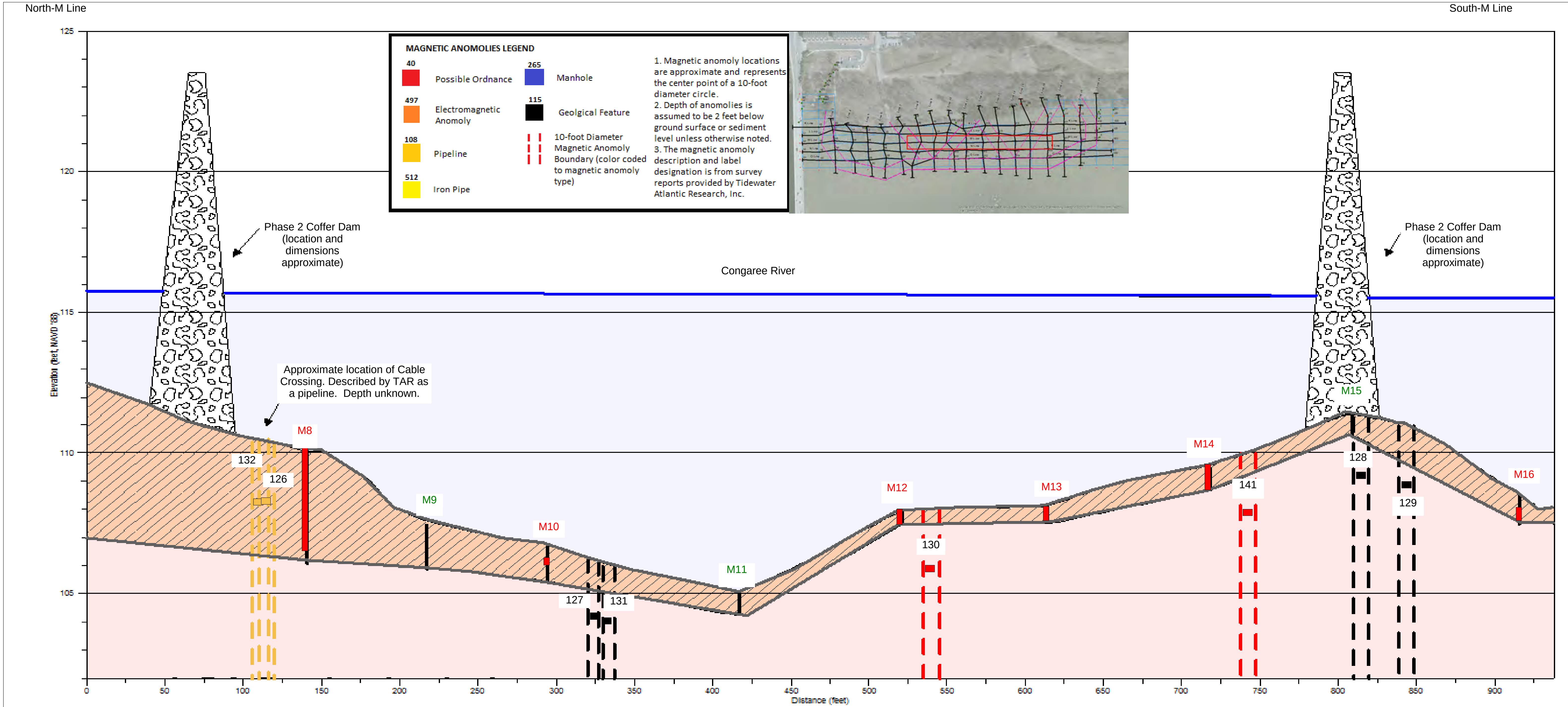
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG M, PHASE 1 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: M LINE 1

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Saprolite
Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Granite bedrock and/or boulders - assumed
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Visual tar like material (TLM)
	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "M" line and bathymetry and lithologies are approximately from and between locations M8 through M16.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 21B

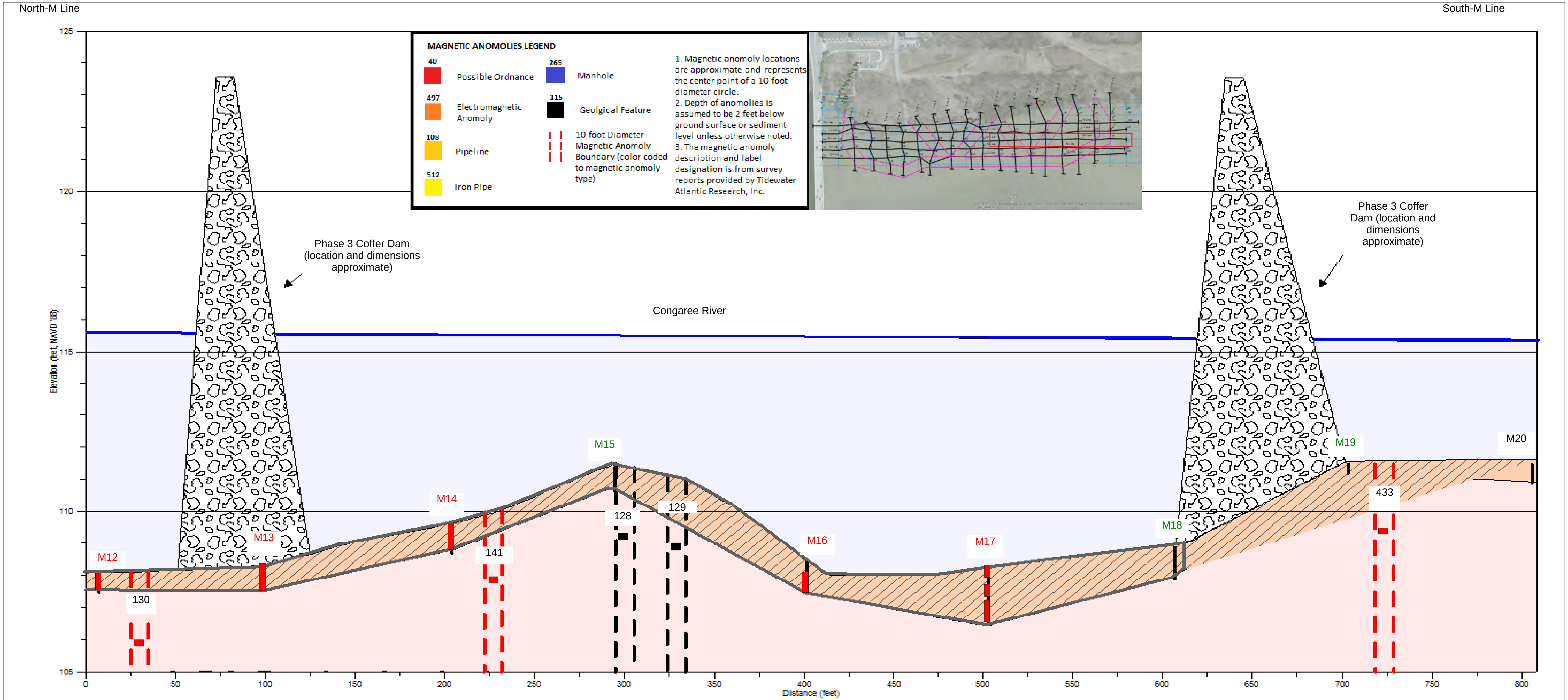
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG M, PHASE 2 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: M LINE 2

APEX COMPANIES, LLC



LEGEND

	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.		Saprolite
			Granite bedrock and/or boulders - assumed
			Visual tar like material (TLM)
	Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.		Approximate extent of sediment targeted for removal
	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	O6	Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
			Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "M" line and topography, bathymetry and lithologies are approximately from and between locations M12 through M20.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 21C

SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG M, PHASE 3 EXTENT

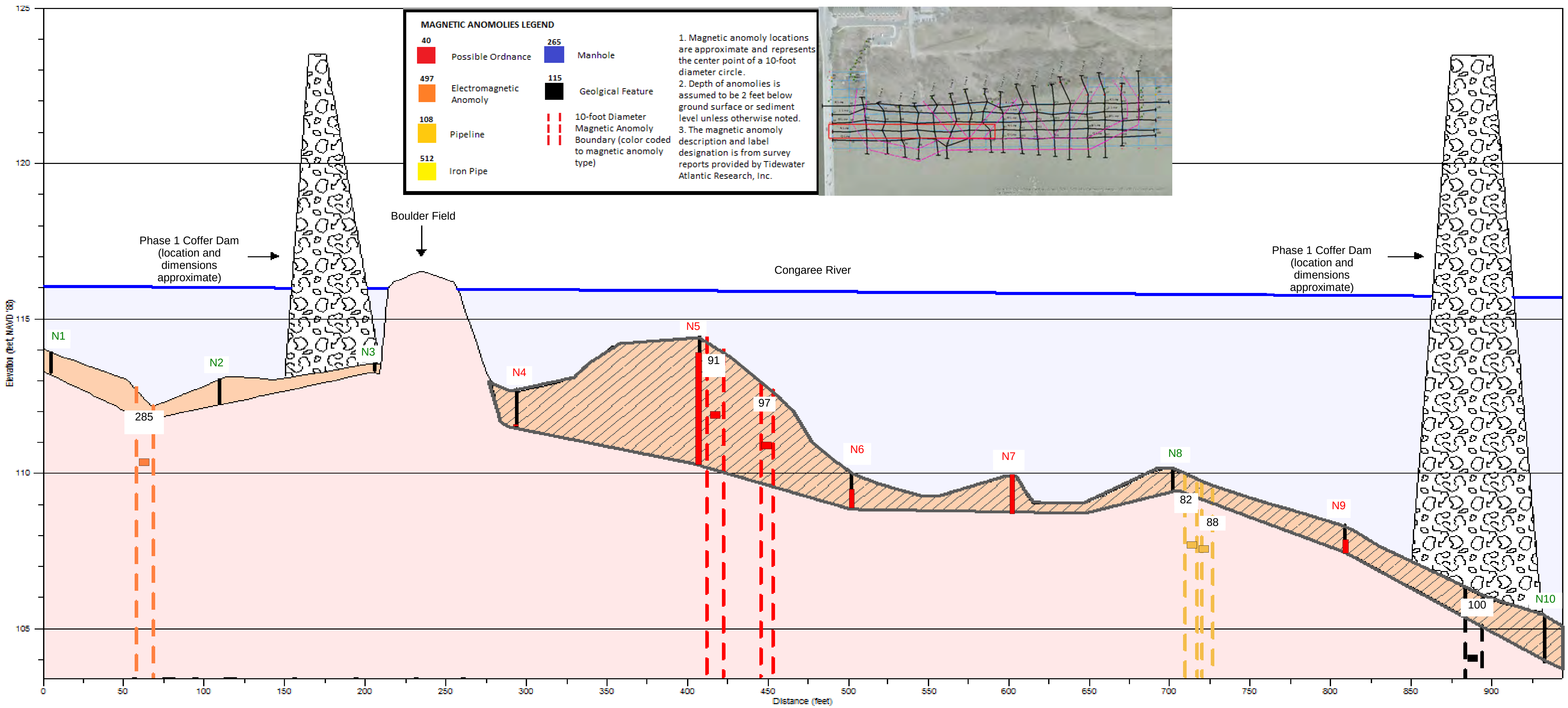
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: M LINE 3

APEX COMPANIES, LLC

North-N Line

South-N Line



LEGEND

Congaree River Bank Deposits-Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

Approximate extent of sediment targeted for removal

O6

Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "N" line and topography, bathymetry, and lithologies are approximately from and between locations N1 through N10.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points is based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE1

FIGURE 22A

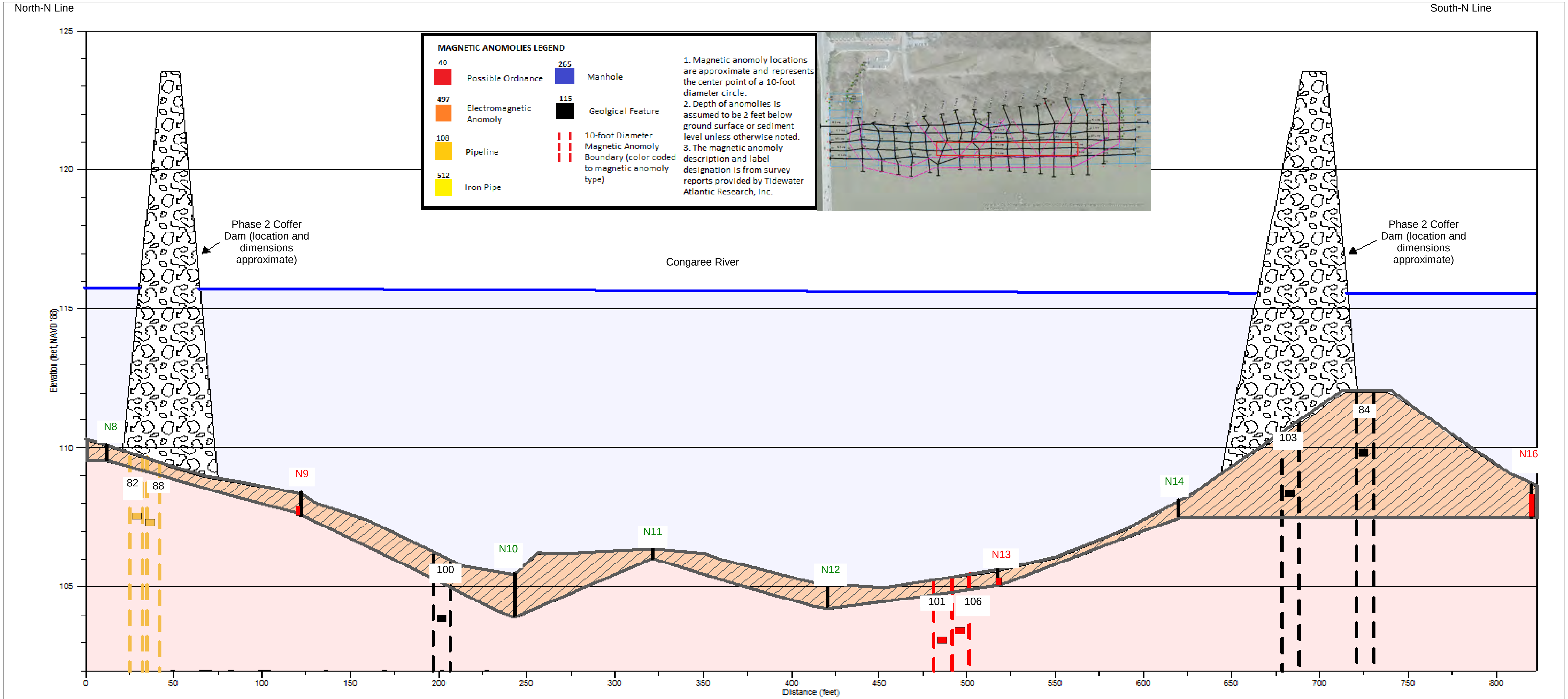
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG N, PHASE 1 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: N LINE 1

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

Approximate extent of sediment targeted for removal

O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "N" line and bathymetry and lithologies are approximately from and between locations N8 through N16.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points is based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 22B

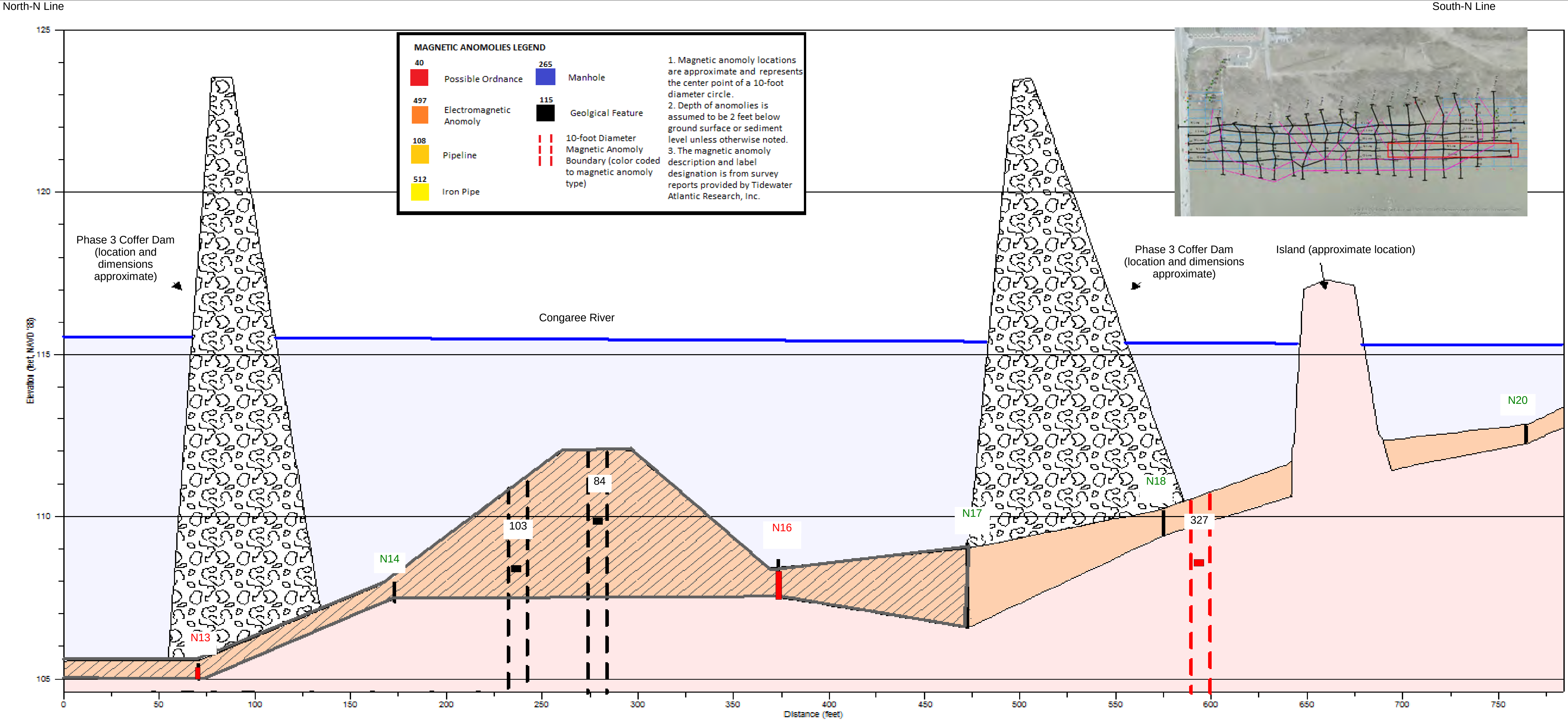
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG N, PHASE 2 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: N LINE 2

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.	Granite bedrock and/or boulders - assumed
Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.	Visual tar like material (TLM)
Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.	Approximate extent of sediment targeted for removal
	O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
	Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "N" line and bathymetry and lithologies are approximately from and between locations N13 through N20.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on best professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 22C

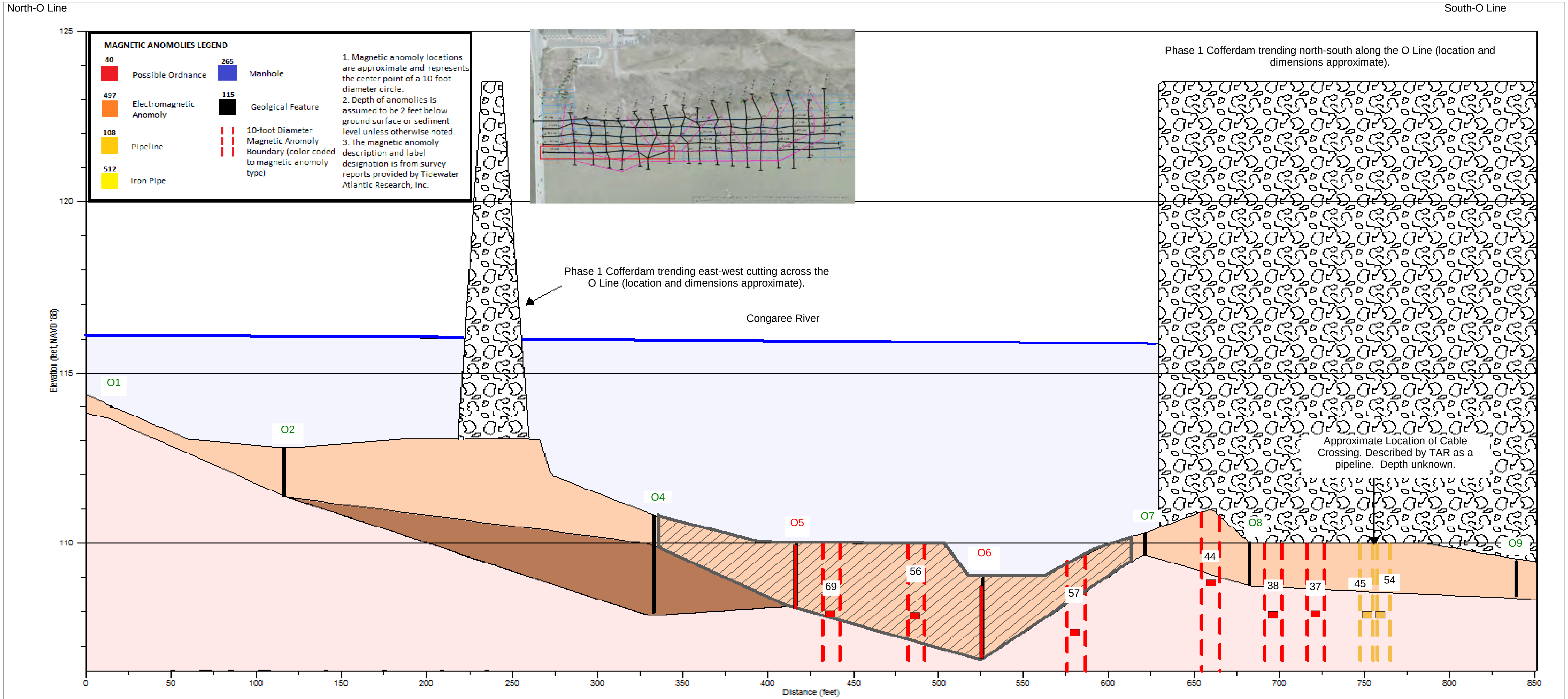
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG N, PHASE 3 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: N LINE 3

APEX COMPANIES, LLC



LEGEND

Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.

Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.

Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.

Saprolite

Granite bedrock and/or boulders - assumed

Visual tar like material (TLM)

Approximate extent of sediment targeted for removal

O6 Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.

Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximatelycorresponding to the "O" line and bathymetry and lithologies are approximately from and between locations O1 through O9.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 1

FIGURE 23A

SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG O, PHASE 1 EXTENT

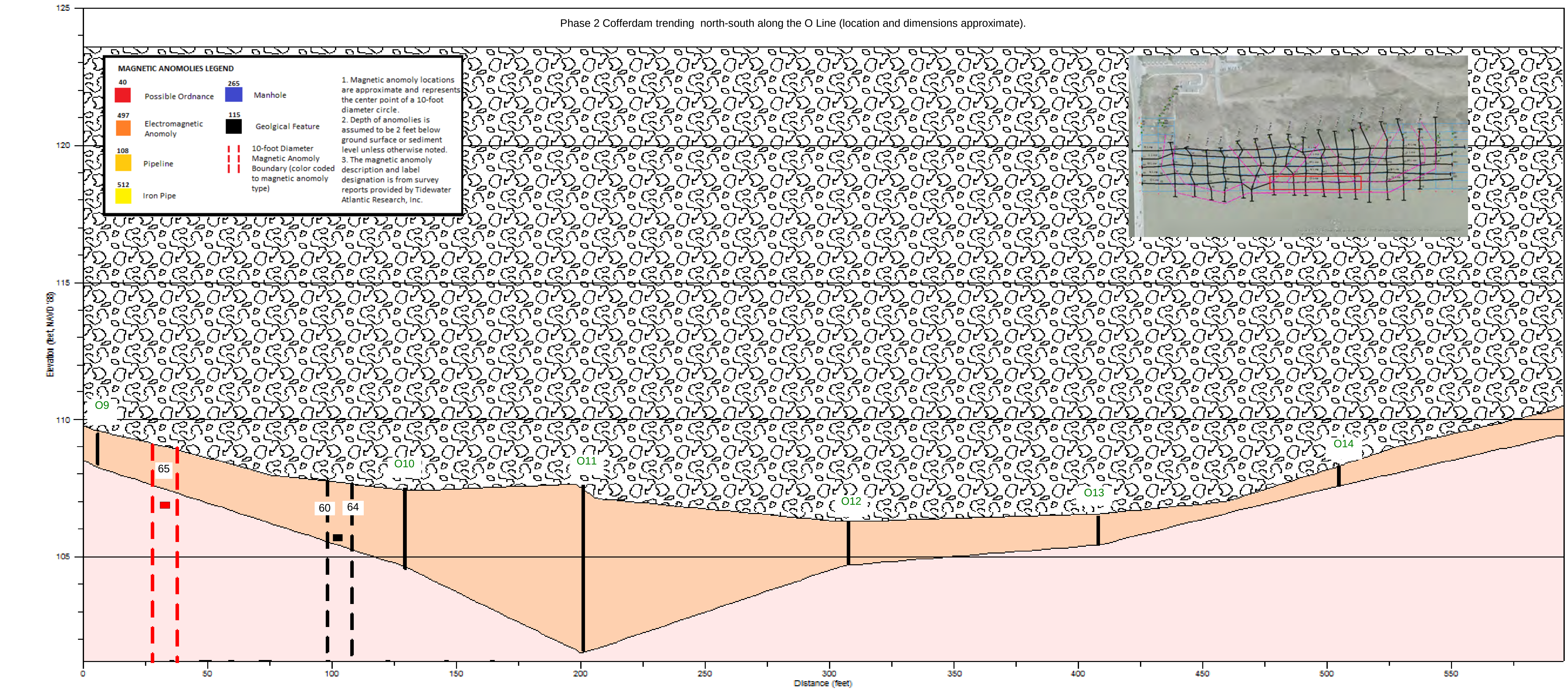
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: O LINE 1

APEX COMPANIES, LLC

North-O Line

South-O Line



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Saprolite
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring identification - vertical line represents depth, red coring or boring identifier and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "O" line and bathymetry and lithologies are approximately from and between locations O9 through O14.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 2

FIGURE 23B

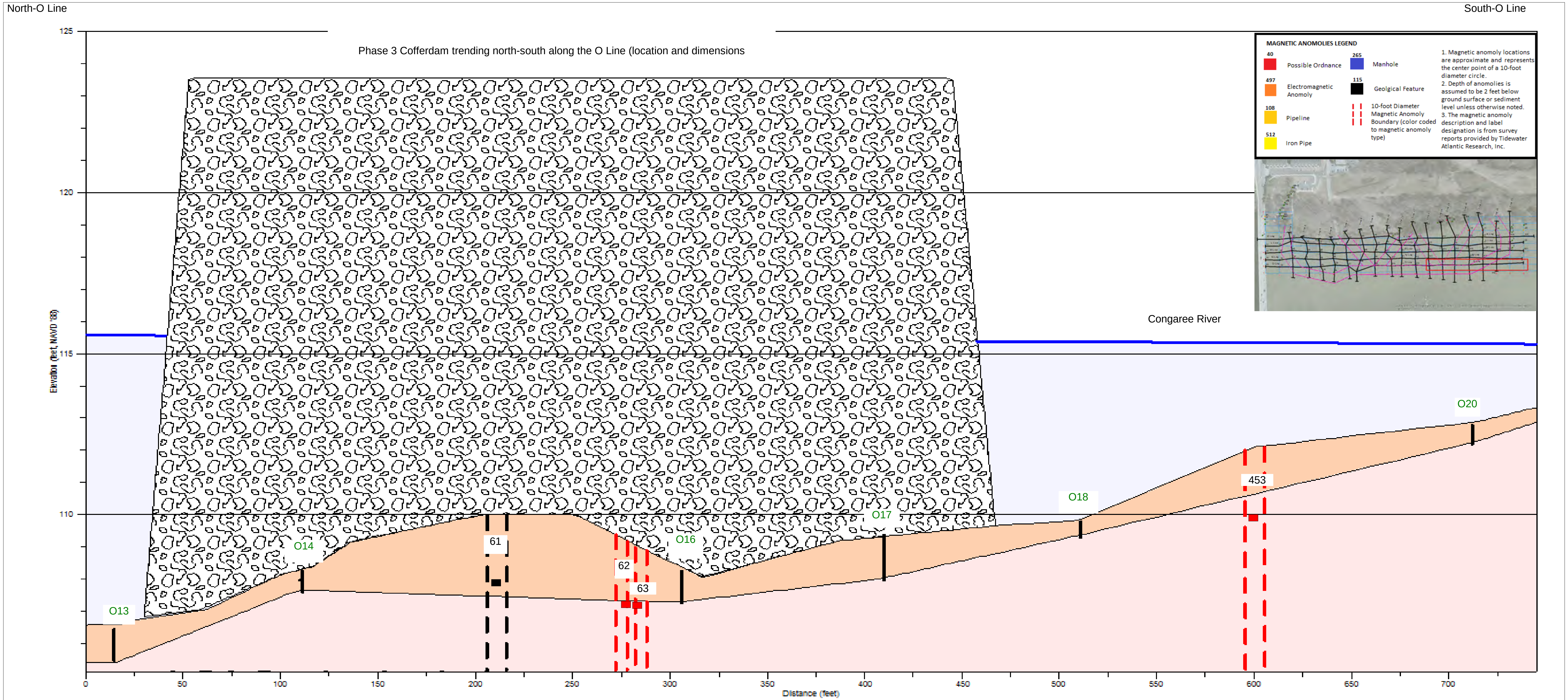
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG O, PHASE 2 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: O LINE 2

APEX COMPANIES, LLC



LEGEND

	Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.		Granite bedrock and/or boulders - assumed
	Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.		Visual tar like material (TLM)
	Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.		Approximate extent of sediment targeted for removal
		O6	Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
			Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile, USACE Congaree River Basin Navigability Study 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The cross section developed is based on a fence line approximately corresponding to the "O" line and bathymetry and topologies are approximately from and between locations O13 through O20.
3. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judegement. Actual site conditions depicted between existing corings/borings may vary.
4. Some of the information (e.g. depth of ordnance) and features (e.g. cofferdam location, cofferdam dimensions) are approximate and for illustration purposes only and may differ to that in the final design and field.

PHASE 3

FIGURE 23C

SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG O, PHASE 3 EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 04/22/2014 FILE NAME: O LINE 3

APEX COMPANIES, LLC

APPENDIX D

UNEXPLODED ORDNANCE MANAGEMENT PLAN

DRAFT WORK PLAN
FOR
MUNITIONS RESPONSE
MEC CLEARANCE AND SUPPORT
CONGAREE RIVER PROJECT

Prepared for:

Apex Companies, LLC

1600 Commerce Circle

Trafford, PA 15085

Prepared by:

Explosive Ordnance Technologies, Inc. (EOTI)

9050 Executive Park Drive Suite 106-A

Knoxville, TN 37923

June 2014

Table of Contents

Figures

Tables

ACRONYMS

°C	Degrees Centigrade
°F	Degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
Apex	Apex Companies, LLC
APP	Accident Prevention Plan
AR	Army Regulation
ATF	Alcohol Tobacco and Firearms
BATF	Bureau of Alcohol Tobacco and Firearms
BIP	Blow in Place
bpm	beats per minute
CAR	Corrective Action Request
CD	Cultural Debris
CFR	Code of Federal Regulations
CHEMTREC	Chemical Transportation Emergency Center
COR	Contracting Officer's Representative
CPR	Cardio-Pulmonary Resuscitation
CPFF	Cost Plus Fixed Fee
CQDM	Quality Control Data Management
CRP	Congaree River Project
CRZ	Contamination Reduction Zone
CSHP	Corporate Safety and Health Plan
CWM	Chemical Warfare Material
DID	Data Item Description
DDESB	Department of Defense Explosive Safety Board
DMM	Discarded Military Munition
DoD/DOD	Department of Defense
DOP	Dive Operations Plan
DOT	Department of Transportation
DQO	Data Quality Objective
EE/CA	Engineering Evaluation/Cost Assessment
EED	Electro-Explosive Device
EM	Engineer Manual
EMR	Electro-Magnetic Radiation
EMT	Emergency Medical Technician
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Incorporated
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
ERCP	Emergency Response Contingency Plan
ESS	Explosives Safety Submission
EZ	Exclusion Zone

FAR	Federal Acquisition Regulation
FFP	Firm Fixed Price
FGDC	Federal Geographic Data Committee
FUP	Fixed Unit Price
GFE	Government Furnished Equipment
GIS	Geospatial Information System
GPS	Global Positioning System
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	High Explosive
HEPA	High Efficiency Particulate Air
HF	High Frequency
HPS	Hantavirus Pulmonary Syndrome
HTRW	Hazardous, Toxic, or Radiological Waste
IAW	In Accordance With
ID	Identification
LB	Pound
MD	Munitions Debris
MDAS	Material Documented As Safe
MEC	Munitions and Explosives of Concern
MF	Modulated Frequency
MGFD	Munition with the Greatest Fragmentation Distance
MGP	Manufactured Gas Plant
MHZ	Megahertz
MM	Millimeter
MPPEH	Material Potentially Presenting Explosive Hazard
MR	Munitions Response
MRS	Munitions Response Site
MSD	Minimum Separation distance
MSDS	Material Safety Data Sheets
NEW	Net Explosive Weight
OE	Ordnance and Explosives
OESS	Ordnance and Explosives Safety Specialist (USACE)
OJT	On the Job Training
OSHA	Occupational Safety and Health Administration
PDS	Personnel Decontamination Station
PEL	Permissible Exposure Limit
PM	Project Manager
PPE	Personal Protective Equipment
PR	Pulse Rate
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QCI	Quality Control Inspection
QCIR	Quality Control Inspection Record

QCS	Quality Control Specialist
Q-D	Quantity-Distance
RCWM	Recovered Chemical Warfare Material
RDX	Cyclotrimethylenetrinitramine
RF	Radio Frequency
RFD	Remote Firing Device
RI	Remedial Investigation
RMSF	Rocky Mountain Spotted Fever
RRD	Range Related Debris
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric & Gas Company
SDSFIE	Spatial Data Standard for Facilities, Infrastructure, and Environment
SE QCI	Search Effectiveness Quality Control Inspection
SF	Square Feet
SOP	Standard Operating Procedure
SOW	Scope of Work
SSFR	Site Specific Final Report
STD	Standard
SUXOS	Senior Unexploded Ordnance Supervisor
SZ	Support Zone
TECH	Technician
TEU	Technical Escort Unit
TBD	To Be Determined
TLM	Tar Like Material
TM	Technical Manual
T&M	Time and Materials
TNT	Tri-Nitro Toluene
TP	Technical Publication
TPP	Technical Planning Process
TLV	Threshold Limit Value
UHF	Ultra High Frequency
USACE	United States Army Corps of Engineers
USAESCH	U. S. Army Engineering and Support Center- Huntsville
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOSO/QCS	Unexploded Ordnance Safety Officer and Quality Control Specialist (Dual Hat Position)
VCC	Voluntary Clean-Up Contract
VHF	Very High Frequency
WBGT	Wet Bulb Globe Temperature
WP	Work Plan

1.0 CHAPTER 1 – INTRODUCTION

1.1 General Background Information

Apex Companies, LLC (Apex) has contracted Explosive Ordnance Technologies, Inc (EOTI) to perform clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC) for the South Carolina Electric and Gas Company (SCE&G). This work plan provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of removal of MEC from land and sediments from the project site. This work plan was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014.

The purpose MEC Clearance Support of the CRP is to remove MEC in order to reduce hazards from Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area being excavated by Apex. EOTI will be performing dive operations to remove MEC from a coffer dam footprint prior to installation by Apex. The dive activities are covered under a separate Dive Operations Plan (DOP), while this work plan covers the land and dewatered sediment MEC Clearance and Support. The MEC Clearance activities will be completed IAW the U. S. Army Corps of Engineers (USACE) and the Department of Defense (DoD) Explosives Safety Board (DDESB) approved Explosives Safety Submission (ESS).

1.2 Site Location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure B-1-Site Location**.

1.3 Site History

In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with unexploded ordnance (UXO) potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. **Figure B-2-Previous Investigation Results** shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of MEC from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment. The MEC clearance area is shown on **Figure B-3-Clearance Area** and described in Chapter 3 MEC Clearance Plan**.**

1.4 Topography

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977).The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations. These bottom elevations fluctuate from an approximate high of 116 feet to approximately 105 feet. All elevations are referenced to NAVD ’88. Average river flow elevation is approximately 116 feet with an extreme variance of approximately 110 to 152 feet in elevation. Figure 2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline.

The project area abuts the eastern shoreline, which rises sharply from the water’s edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately 500 feet. Gist Street is the first paved land surface encountered to the east of the project area. The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway and is much thicker and overgrown further south.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river. The Senate Street alluvial fan, a key land feature in this area, is located at the end of the access road. The alluvial fan is a relatively flat portion of the project area that extends out into the river and appears to have developed over time. It will be the main access point during completion of future field activities unless another access point is constructed.

1.5 Climate

The climate in the vicinity of the project site is characterized on the following charts presented below the **Figure 1-Average Monthly Temperatures, Figure 2-Average Monthly Precipitation, Figure 3-Monthly Inclimate Weather Percentage and Figure 4-Average Wind Speed**.

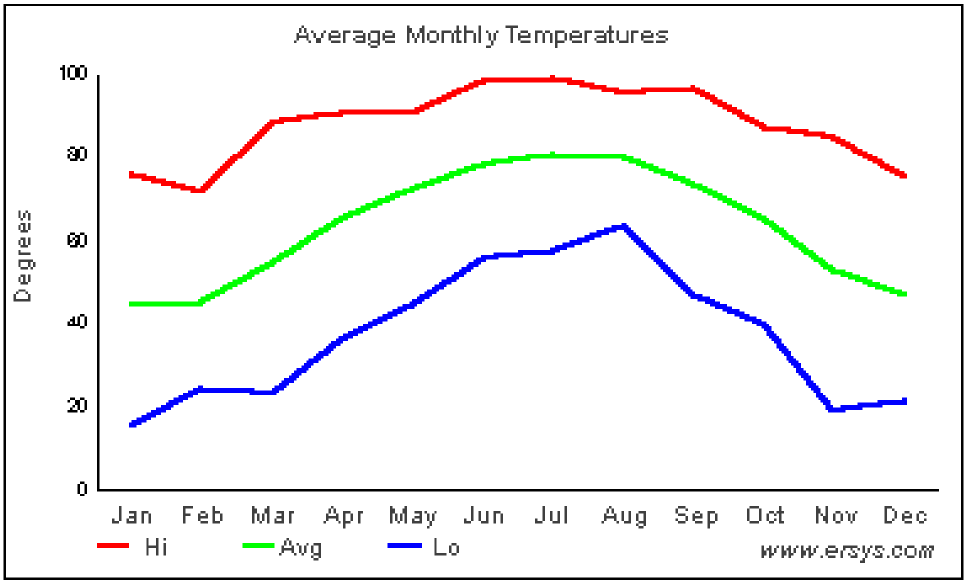


Figure 1 Average Monthly Temperatures

The two charts below show information relevant to precipitation. The first chart is the typical precipitation for the month indicated. The second chart shows the percentage of the month that inclimate weather (rain, snow, etc.) occurs. Combined the two charts give the reader a better understanding of precipitation in the area.

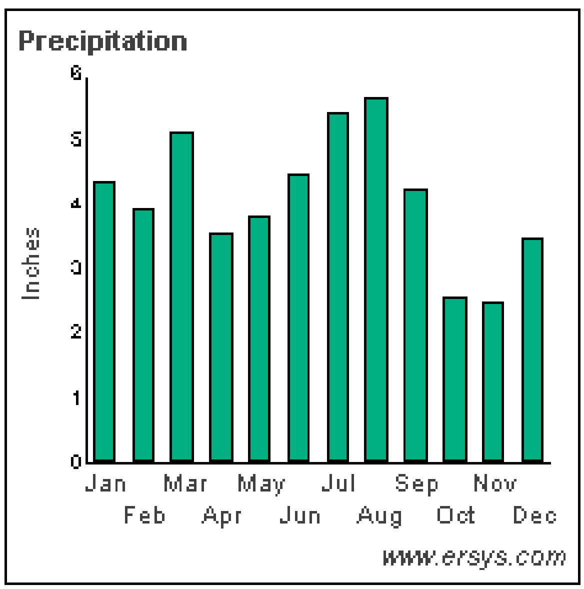


Figure 2 Average Monthly Precipitation

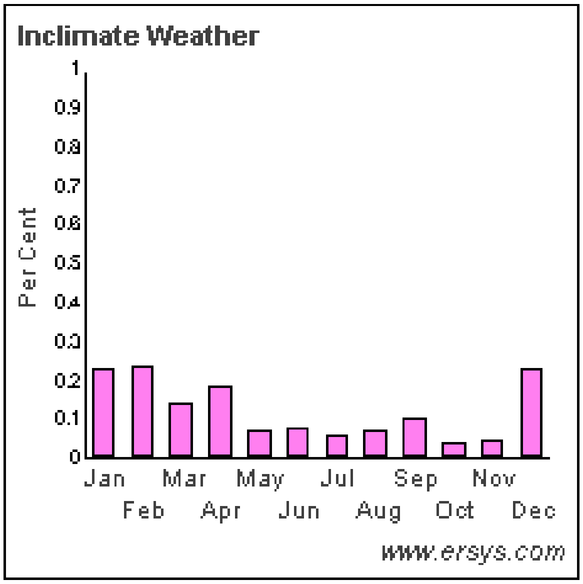


Figure 3 Monthly Inclimate Weather Percentage

The chart below illustrates typical wind speeds for the Columbia, SC area.

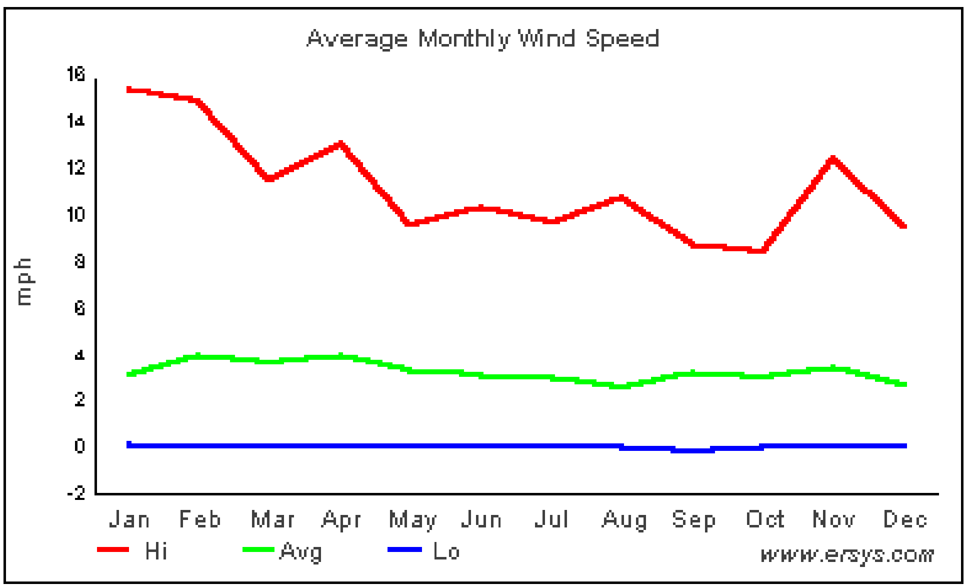


Figure 4 Average Monthly Wind Speed

1.6 Discovery of Recovered Chemical Warfare Material (RCWM)

1.6.1 The Congaree River Project site is not suspected of containing RCWM. If however, during planned MEC removal operations, EOTI identifies or suspects RCWM all personnel will immediately withdraw upwind from the work area and contact the USACE Project Manager. EOTI will secure the area and provide two personnel located upwind of the suspect RCWM to secure the site until relieved by the Department of the Army emergency response personnel.

1.6.2 If suspect RCWM is encountered, the following procedures will be followed:

- All work will immediately cease;
- Project personnel will withdraw along cleared paths upwind from the discovery;
- A team consisting of a minimum of two EOTI UXO personnel will secure the area to prevent unauthorized access;
- The supervisors will position personnel as far upwind as possible while still maintaining security of the area; and
- The USACE Ordnance and Explosives Safety Specialist (OESS) will immediately be notified.

1.7 Procedures for Change in Site Conditions

Unforeseen circumstances, such as severe weather events, may create a change in site conditions that could affect the performance of this project. Regardless of the reason for the change in site conditions, EOTI will immediately notify Apex Project Manager of the condition change and the action taken.

2.0 CHAPTER 2 – TECHNICAL MANAGEMENT PLAN

2.1 Objectives

EOTI's objective in this task order is to provide all munitions response services necessary to remove MEC from approximately 13 acres (12.65) of shoreline and within dewatered coffer dams at the Congaree River Project Site in Colombia, SC. The sediment removal will be performed in three phases over a period of three years.

This Technical Management Plan describes the approach, methods, and operational procedures to be employed by EOTI to perform MEC operations at the CRP site. USACE DID WERS-001.01 and Chapter 4 of EM 1110-1-4009 were used in addressing technical management for this MEC project. No single workday will exceed ten (10) hours.

2.2 Organization

EOTI's project organization is designed to effectively control the removal action. EOTI's Project Manager, Mr. Brian Woods, PG, PMP will be the primary point of contact with the Apex Project Manager, Mr. Rusty Contrael and will have overall responsibility for ensuring that work is completed in accordance with the Work Plan. He will prepare submittals and reports in accordance with the PWS. The project organization is presented on **Figure 5-Organization Diagram**.

The Senior UXO Supervisor (SUXOS) will be the primary point of contact in the field. He will plan and supervise work completed on the site and ensure compliance with the Work Plan and other applicable requirements. He will directly coordinate with local officials, USACE onsite safety representative, and stakeholders as necessary to minimize conflicts with scheduled activities. He will prepare and submit daily reports through the EOTI Project Manager.

The UXO Safety Officer (UXOSO) and the UXO Quality Control Specialist (UXOQCS) will be on-site when work is performed. For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS). He will be responsible to ensure that work is completed safely and to standard. He will evaluate work daily and report any safety or quality concern to the SUXOS, Project Manager and / or Corporate Safety Manager. The UXOSO/QCS will work closely with the USACE on-site Safety Representative to immediately address any issues or concerns. He always has a direct line of communication with the EOTI Corporate Safety Manager.

All UXO Technicians and team members will meet, or exceed the requirements in DDESB TP 18 for the positions they hold. The organizational chart below shows the key project positions and personnel and the relationships between them and other team members. The SUXOS, in coordination with the Project Manager, may adjust the project organization and reallocate resource as required to most effectively complete the entire scope of the project.

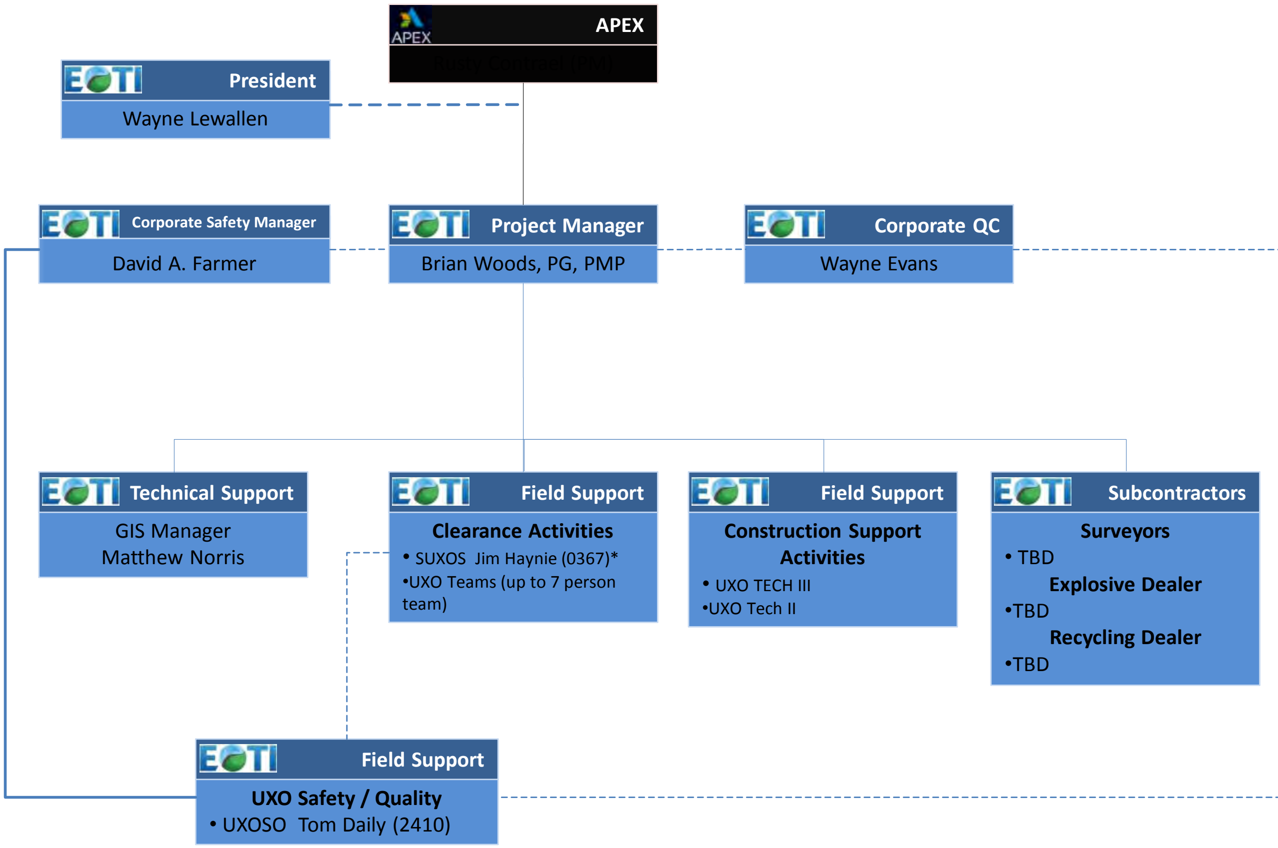


Figure 5 Organization Diagram

EOTI intends to perform this Removal Action with one UXO Team. The Team Leader will be responsible for a team of two or more personnel depending on assigned tasks and project needs. During removal operations the standard teams will consist of a UXO Tech III and up to 6 UXO Tech II/I. Team size may be reduced, at the discretion of the SUXOS. The SUXOS will make team assignments daily according to the specific needs of the project. Resumes of key personnel are included in Appendix H of this Work Plan.

2.3 Personnel

Personnel and Qualifications - Personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH. The following paragraphs describe the specific responsibilities of UXO personnel assigned to the project team.

2.3.1 Project Manager

2.3.1.1 The Project Manager is responsible for communicating with APEX Project Manager and USACE Project Manager or the USACE Safety Specialist. He will execute all directions received from the USACE Contracting Officer, managing all aspects of the project, overseeing the overall performance of all individuals on the project team, coordinating all contract and subcontract work, and resolving project problems. The Project Manager is also responsible for controlling cost and schedule milestones. The Project Manager will also coordinate the preparation of the Work Plan and the implementation of on-site field activities.

2.3.1.2 The Project Manager will interface directly with subcontractors to keep them advised of the PWS, schedule, and budgets. The Project Manager is also responsible for ensuring that the subcontractor costs are maintained within budget and that schedule commitments are achieved.

2.3.1.3 The Project Manager performs overall project management and is responsible for the following:

- Preparing and submitting purchase orders;
- Approving and forwarding accounts payable;
- Approving Daily Activity Report;
- Procuring necessary equipment and supplies;
- Establishing, maintaining and tracking petty cash expenditures;
- Reviewing and approving Time Sheets, Expense Reports, and Travel Order Request;
- Submitting Equipment Expense Report; and
- Supervising the Project SUXOS and, UXOSO/QCS.
- Prepare and conduct coordination meeting

2.3.2 Senior UXO Supervisor (SUXOS)

The SUXOS has more than 10 years of military/civilian EOD/UXO experience. The SUXOS will manage all on-site field activities. The SUXOS will keep the Project Manager informed of activities requiring his notification. The SUXOS is responsible for all daily work activities. He will brief the Project Manager daily on all project activities to include production, quality of work, safety, equipment status and personnel status. The SUXOS will directly coordinate any evacuation requirements with the USACE Safety Specialist. The responsibilities of the SUXOS include:

- Identification of personnel and equipment requirements;
- Supervision of all daily field team activities;
- Early detection and identification of potential problem areas and institution of corrective measures;
- Assisting with the preparation of all project reports;
- Preparation of a daily report, which will include man-hours expended, areas cleared, explosives expended, and any other information required by the Project Manager;
- Providing on-the-job training for selected UXO Supervisor(s) who may be called upon to temporarily perform SUXOS duties during his absence from the site;
- Supervision of UXO Technicians; and
- Scheduling and executing a daily safety meeting, scheduling and coordinating subcontractor field team activities, and oversight of all field activities.

2.3.3 UXO Safety Officer (UXOSO)

The UXOSO has more than eight years of military/civilian EOD/UXO experience. He is responsible for implementing all site SSHP requirements, on-site training requirements and recommending changes to level of personal protection equipment (PPE) to the SUXOS as site conditions warrant. He has Stop Work Authority for safety conditions. He will report all safety work stoppages immediately to the USACE Safety Specialist. The UXOSO evaluates and analyzes any potential safety problems, implements safety related corrective actions, and maintains a Daily Safety Log. The UXOSO reports to the Safety Manager. The UXOSO will:

- Perform on-the-job training for selected UXO Technicians who may be called upon to temporarily perform the duties of UXOSO during his absence from the site, upon approval of the USACE Safety Specialist; and
- Maintain daily liaison with the USACE Safety Specialist.

2.3.4 UXO Quality Control Specialist (UXOQCS)

The UXOQCS has more than eight years of military/civilian EOD/UXO experience. The UXOQCS reports to the Quality Manager. The UXOQCS will perform quality inspections/review all project operations, including explosives inventories, daily reports, time sheets and other documentation, and will inspect and approve each completed area prior to turnover to the USACE Safety Specialist.

For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS).

2.3.5 UXO Technician III

This individual, who supervises a project team, will have experience in MEC removal operations and supervising personnel, and shall have at least eight years combined active duty military EOD and contractor UXO experience. This individual must be able to fully perform all functions enumerated for UXO Tech I and II. Specific duties of the UXO Tech IIIs include:

- Reconnaissance and classification of UXO;
- Identifying fuzes and determining fuze conditions of all munitions including U.S. and foreign
    - Guided missiles,
    - Bombs and bomb fuzes,
    - Projectiles and projectile fuzes,
    - Grenades and grenade fuzes,
    - Rockets and rocket fuzes,
    - Land mines and associated components,
    - Pyrotechnic items,
    - Military explosives and demolition materials,
    - Submunitions;
- Supervising the conduct of all on-site activities directly related to MEC operations;
- Supervising the location of subsurface UXO using military and/or civilian magnetometers and related equipment;
- Supervises
    - Excavation and recovery of subsurface UXO by manual means or mechanical
    - Construction of UXO-related protective works,

  - Location of surface UXO by visual means,
  - Transporting and storing UXO/MEC assuring compliance with Federal, state, and local laws,
  - Disposal of UXO by detonation,
  - Preparation of a UXO disposal site,
  - Preparation of an on-site safe holding area for UXO,
  - Donning and doffing of personal protective equipment,
  - Operation of a personnel decontamination station,
  - Maintenance and operator checks on all team equipment,
  - Segregation of Munitions Debris (MD) and Range Related Debris (RRD) from Cultural Debris (CD) ,
  - Safe handling procedures,
  - Team preventive medicine and field sanitation procedures;

- Determine UXO-related storage compatibility;
- Preparing explosives storage plans in accordance with all applicable guidance;
- Supervise;
- Preparing required administrative reports;
- Preparing SOPs for on-site MEC operations;
- Conducting daily site safety briefings; and
- Perform Risk hazard analysis,

2.3.6 UXO Technician II

This individual will be able to fully perform all functions enumerated for UXO Tech I. In addition, the ability to perform the following functions is a requirement of the UXO Tech II:

- Identifying fuzes and determining fuze condition of all U.S. and foreign munitions, including:
  - Guided missiles,
  - Bombs and bomb fuzes,
  - Projectiles and projectile fuzes,
  - Grenades and grenades fuzes,
  - Rockets and rocket fuzes,
  - Land mines and associated components,
  - Pyrotechnics,
  - Military explosives and demolition materials, and
  - Submunitions;
- Locate subsurface UXO using military and/or civilian magnetometers and related equipment;
- Perform excavation procedures on buried UXO by
  - Manual means, and
  - Mechanical means;
- Perform operator maintenance of military and/or civilian magnetometers;
- Locate surface UXO using visual means;
- Operate motor vehicle transporting MEC material, when appropriate;
- Preparing an on-site holding area for MEC material;

- Perform storage of MEC material and demolition materials in accordance with applicable guidance;
- Prepare an MEC disposal site;
- Prepare
    - Non-electric firing system for an MEC disposal operation,
    - Electric firing system for an MEC disposal operation,
    - Detonating cord firing system;
    - Dispose of MEC/MPPEH by Detonation;
- Operate a personnel decontamination station;
- Don and doff appropriate personal protective equipment in contaminated areas;
- Construct MEC-related protective works;
- Determining a magnetic azimuth using current navigational/locating equipment; and
- Performing field expedient identification procedures to identify explosives contaminated soil.

2.3.7 UXO Technician I

The UXO Tech I's specific duties (under the supervision of a UXO Tech III or a UXO-qualified individual of higher rank than the UXO Tech III) for this project will include:

- Conducting classification of MEC materials;
- Identifying all munitions including
    - Bombs and bomb fuzes,
    - Guided missiles,
    - Projectiles and projectiles fuzes,
    - Rockets and rocket fuzes,
    - Land mines and associated components,
    - Pyrotechnics items,
    - Military explosives and demolition materials,
    - Grenades and grenade fuzes,
    - Submunitions;
- Locating subsurface MEC using military and/or civilian magnetometers and related equipment;
- Performing excavation procedures on subsurface MEC by;
    - Manual means,
    - Mechanical means;
- Locate surface MEC using visual means;
- Transporting and storing MEC and demolition materials;
- Preparing firing systems, both electric and non-electric, for destruction operations disposing of ammunition/ explosives by detonation;
- Operating Personnel Decontamination Stations (PDS);
- Donning and doffing personnel protective equipment in contaminated areas;
- Erection of MEC related protective works;
- Assist in performing operator maintenance of military and/or civilian magnetometers and related equipment;
- Operate motor vehicle transporting MEC material, when appropriate; and
- Prepare an MEC disposal site.

2.4 Communication and Reporting

2.4.1 The EOTI Project Manager and SUXOS are primarily responsible for the management of work, data and cost. The Project Manager will develop the initial schedule. The SUXOS will maintain the schedule and make adjustments as required throughout the project. The SUXOS will coordinate closely with local officials to minimize conflicts with other planned activities. He may adjust work hours / days or the order that work is completed in order to minimize conflicts and maximize productivity. The project manager will provide updated schedules throughout the project, as required.

2.4.2 The SUXOS will submit data to the Project Manager daily, as required. Data will include a daily report that will describe the activities completed and issues that arose during the workday. The project manager will post the daily reports on the project collaboration website, along with photographs and other data relating to the project. The website will incorporate GIS to better display the data and project status.

2.4.3 All task included in this project are FFP or FUP. The Project Manager will control cost by completing the project on or ahead of schedule and negotiating with vendors to ensure the best prices for equipment and material.

2.4.4 Work will be completed in accordance with the requirements of the contract. Quality Management and Quality Control requirements described in Chapter 4 will be applied to all phases of the project. EOTI will ensure strict compliance with the Accident Prevention Plan in Appendix D.

2.5 Deliverables

In addition to the Periodic Reporting requirements discussed in Section 2.7, EOTI will prepare a Site Specific Final Report.

2.6 Schedule

EOTI has prepared a Project Schedule and will be updated as necessary throughout the project. The initial schedule is based on the fixed unit price tasks and other tasks will be scheduled as they are defined. EOTI will follow the same scheduled work hours as APEX but anticipatesworking five, 10-hour days per week. The schedule is generally Monday through Friday. The schedule working days may be adjusted to better suit project needs. The SUXOS will coordinate with the Project Manager prior to adjusting the schedule.

2.7 Periodic Reporting

2.7.1 The SUXOS will prepare and submit daily reports to the EOTI Project Manager.

2.8 Costing and Billing

2.8.1 The Project Manager and SUXOS will control and manage costs through the use of Purchase Orders and Travel Orders. A record of expenditures will be maintained by the SUXOS and monitored by the Project Manager.

2.9 Public Relations Support

EOTI personnel will refer all requests for information concerning site conditions to the APEX PM.

2.10 Subcontractor Management Procedures

2.10.1 Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a South Carolina-licensed professional land surveyor to provide survey and mapping support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included Accident Prevention Plan. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO/QCS prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone while intrusive operations are ongoing.

2.10.2 Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and Accident Prevention Plan. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Suppliers will not be permitted to enter the Exclusion Zone (EZ) of the project site unless escorted by an EOTI UXO-qualified employee. Non-essential persons, including suppliers, will not be allowed in any active EZ.

2.10.3 Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site will receive a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any exclusion zone area without a UXO-qualified escort. Non-essential persons, including suppliers, will not be allowed in any active EZ. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS or UXOSO for investigation.

2.11 Field Operation Management Procedures

EOTI's Project Manager has overall responsibility for the management of the project. He will coordinate directly with the APEX Project Manager and subcontractors on project related issues, such as schedule, submittals/reports, etc. The Project Manager reports directly to the EOTI Vice President and MEC Program Manager. The Project Manager communicates frequently with the SUXOS and UXOSO/QCS. The SUXOS will coordinate all field activities. He will coordinate with the on-site USACE representatives and local officials. He will prepare and submit daily project status reports to the Project Manager. Project related reports, documents, and information will be placed on a secure project collaboration website to allow team members easy access to up-to-date project status information.

2.12 Technical Procedures to Execute Project Tasks

Detailed procedures for the execution of project tasks are contained in Chapter 3.

2.13 Data Management

2.13.1 A detailed accounting of all live MEC items encountered during the investigation / removal activities will be maintained. As MPPEH / MEC is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all live/suspected MPPEH / MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuse Description;
- Fuse Condition; and
- Additional comments, if required.

2.13.2 Each suspect MEC item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first live/suspect item (0001) encountered in the Removal grid A-3).

2.13.3 The Team Leader will provide validated data to the SUXOS at the close of each working day.

2.13.4 The SUXOS will:

- Collect and review the raw field data for accuracy.
- Provide the verified data to the Knoxville office for posting to EOTI's project collaboration website for use in the final report.
- For documentation purposes, photographs will be taken of encountered live MEC. If MEC is determined to be acceptable to move, multiple items may be included in the same photograph. The photograph will be taken to show detail and will be annotated with the location or area discovered.
- Photographic records will be used to supplement information recorded as needed.

2.13.5 Removal Report - EOTI will prepare a Removal Report IAW the contract.

2.14 DQOs

Data Quality Objectives (DQOs) are qualitative and quantitative statements developed, usually in the Technical Planning Process (TPP), to clarify study objectives, define the type of data needed, and specify the tolerable levels of potential decision errors. A DQO is used as the basis for establishing the type, quality, and quantity of data needed to support the decisions that will be made. For this project, quality objectives are discussed in Chapter 4. Specific quality objectives for Geospatial Information Systems (GIS) are discussed in Section 3.6 of this WP.

3.0 CHAPTER 3 MEC CLEARANCE PLAN

3.1 Overall Approach to Munitions Response Activities

This section describes EOTI's approach to completing the requirements of the PWS. Specific quality management standards and procedures used to control the work completed under the PWS are described in detail in Chapter 4 of this Work Plan.

All UXO/MPPEH disposal operations will be conducted in accordance with the procedures described in this plan. If unidentifiable UXO is found, the default separation distance specified in DDESB TP16 will be used to establish the appropriate exclusion zones. Unidentified UXO will not be disposed of until the munitions filler can be determined. EP 385-1-97, dated September 2008 and EP 75-1-3 provide guidance in helping to determine unknown explosive fillers. Final disposition/disposal procedures will be determined in coordination with the USACE on-site safety representative. Demolition operations will be conducted to destroy or vent UXO / MPPEH, as required for safe disposal. Detailed discussion of MEC reporting requirements and disposition methods and techniques are provided in Section 3.7.

3.1.1 All MEC items requiring blow-in-place detonation will be marked pending blow-in-place disposal. All explosive operations will be supervised by the SUXOS and coordinated with the US Army Corps of Engineers (USACE) Government OE Safety Specialist. All explosive operations will follow the procedures outlined in TM 60A-1-1-31, EM 385-1-97 "Explosives - Safety and Health Manual" dated 15 September 2008, and the manufacturer's operations manual for the remote firing device (RFD). Demolition operations will be performed daily or items properly guarded until operations can be conducted.

3.1.2 If a MPPEH is unacceptable-to-move it will be blown in place (BIP). If a MPPEH is acceptable-to-move it may be consolidated and blown in areas designated by the SUXOS, in coordination with local officials, within the site.

3.1.3 Personnel deemed non-essential to the demolition operation will be evacuated or assigned duties outside of the fragmentation zone. Electrical or nonelectrical systems will be used to initiate BIP to insure maximum control and safety. The UXOSO is responsible for ensuring all personnel are accounted for during disposal operations and that the demolition operation is conducted in strict accordance with required procedures. The EOTI SUXOS and/or UXOSO will visually inspect the demolition site with the Demo Team Leader and announce all clear upon completion of demolition operations.

3.2 Identification of Areas of Concern

3.2.1 The clearance area for this project is as shown on **Figure B-3-Clearance Areas**.

The area of concern consists of an area within the boundaries of CRP that is approximately 1 acre (.89) of land surface, 5.64 acres of Phase I sediment area, 3.56 acres of Phase II sediment area and 2.56 acres of Phase III sediment area. Total acreage is 12.65 acres as identified on **Table 1-Areas of Clearance**.

Table 1 Areas of Clearance

Area	Acreage	Type	Anticipated Clearance
Land Area	.89	Soil	Fall 2014 or Spring 2015
Phase I Area	5.64	Sediment (dewatered)	Spring 2015
Phase II Area	3.56	Sediment (dewatered)	Spring 2016
Phase III Area	2.56	Sediment (dewatered)	Spring 2017
Total	12.65	NA	3 Years

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DOD Fragmentation data base of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun
- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in "cannonball" shell has been selected as the munition with the greatest fragmentation distance (MGFD) for the project.

3.3 Geophysical Prove-out Plan and Report

Digital Geophysical Mapping (DGM) is not planned for this project. Construction and use of Test Strips to document effectiveness and proficiency with analog instruments is discussed in Chapter 4.

3.4 Geophysical Investigation

Digital Geophysical Mapping (DGM) is not planned for this project. Use of analog instruments (Schonstedt GA 52-Cx) to accomplish project objectives is discussed in Section 3.7.

3.5 Location Surveys and Mapping Plan

EOTI will subcontract to a South Carolina licensed surveyor to conduct boundary surveys of the designated clearance areas as shown in **Figure B-3**. Because no specific survey data is available for the site, EOTI personnel will determine the boundary using the best information available and conduct the MEC and MPPEH Removal within that boundary. The South Carolina Licensed Surveyor will document the boundary and provide signed clearance maps. All surveying and position data will be performed and reported in accordance with DID WERS-007.01, EM 1110-1-1004 Geodetic and Control Surveying and EM1110-1-1002 Survey Markers and Monumentation.

The surveyor will install stakes that clearly show the boundaries of the cleared area and label each stake with the proper UTM coordinate system. Flagging will be placed at the top of each stake. No stakes will be installed without approval from the UXO Tech II escort, who will check for anomalies in the location that each stake will be emplaced. The UXO Tech II will scan all stake emplacement locations with a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White's Metal Detector), or equivalent. The surveying subcontractor will maintain a field logbook detailing all field activities, including daily entries of the personnel on-site, time of day all work started and ended, weather conditions, delays, all relevant survey data, equipment used, and field sketches.

Survey data will be submitted by hard copy and digital media. The site grid data will include a map of the entire site with grids shown and other pertinent features. The surveyor will produce maps that accurately convey the clearance areas and data. These maps will be signed by the surveyor, the SUXOS, and a principle of the firm. All survey data will be included in the removal report.

MEC location data will also be submitted in Microsoft Excel. Data will include grid number where found, item number assigned, type of item, and location in appropriate UTM coordinates.

3.6 Geographic Information System (GIS) Plan

3.6.1 GENERAL

The foundation of the GIS will be derived from existing CRP data developed during previous site efforts. EOTI has acquired the existing GIS provided by APEX, and will expand it to meet the needs of the project. The GIS will be maintained through the project's life cycle and accumulate all associated geospatial data along with base map layer and analysis data.

3.6.2 ACCURACY

During removal activities, results will be collected and documented by the UXO Teams. All MEC coordinate locations will be documented using hand-held GPS such as the Trimble GeoXH or by taping in from two known points in order to determine the location of the item within plus or minus one foot.

3.6.3 GEOSPATIAL INFORMATION SYSTEMS (GIS) INCORPORATION

The foundation of the GIS will be derived from base layers collected from USACE, state GIS clearinghouses, and previous UXO related investigation/reconnaissance conducted on the site. All data will be converted or digitized into ArcGIS shapefiles and or Geodatabase formats to streamline data and avoid multiple data formats.

All data collected during field activities will be submitted to the GIS Manager. The GIS Manager will perform QC measures on all Geophysical and OE field data to elevate formatting or incorporation issues. Collected data will be incorporated into the GIS and conform to the Universal Transverse

Mercator (UTM) projection, a datum of GCS North America 1983 (NAD83), and with linear unit of measure in Meters. All Geospatial data delivered to USACE will conform to Universal Transverse Mercator projection and a datum of GCS North America 1983 (NAD83) with linear units of measure stated as specified in DID WERS-007.01.

EOTI will maintain GIS QC data for the project. QC procedures will be performed periodically on the GIS datasets for inaccuracies that may jeopardize the stability of the GIS and spatial data it contains. Any inaccuracies that arise will be reviewed to determine if the error rests in the GIS incorporation methods or if the actual field data is inaccurate. After the error assessment has been completed, the EOTI Project Manager will be made aware of the inaccuracies and a formal error assessment report will be submitted by the GIS Manager. The GIS Manager will take proper action to resolve the error and retain stability over the GIS database.

Additional data entered or modifications to the existing GIS will be noted with revision dates. This will also be captured in the geospatial dataset's Federal Geographic Data Committee (FGDC) metadata.

All Spatial data incorporated into the project specific GIS will conform to the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) standards to give all spatial datasets more compatibility with other government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for spatial layers that have been created by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigation, imagery, etc., will contain previously developed metadata created by the originator. All GIS data will be developed and incorporated in to ESRI's Shapefile or Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All Spatial Imagery during the life of the project will transferred in to geo TIFF format to help in reducing image file size.

3.6.4 PLOTTING

EOTI anticipates hard copy printouts will be utilized on the project. Hard copy map graphic scales will be based on standard mapping scales. Maps will be developed showing results of MEC found during project activities. Detailed site maps will be produced. Maps will be available in digital PDF format to the APEX.

3.6.5 MAPPING

All survey boundary points related to designated work areas will be incorporated into the project specific GIS. Maps will include true north and magnetic north arrows with the difference between them in degree and minutes shown. Tic marks at standard interval with UTM coordinate designators for the specified area that the map covers will be shown on the edge of the map. A map legend with standard mapping symbols and map index showing area covered on map in relationship to project boundary will be displayed on the map.

3.6.6 COMPUTER FILES & DIGITAL DATA SETS

EOTI utilizes ESRI's ArcGIS version 10.x in development of comprehensive and accurate geospatial data. EOTI will submit the most current GIS as part of any report submitted to APEX. This will include ArcGIS project files and metadata for the geospatial data that is referenced in the project files.

The GIS will be updated throughout the project's life.

All GIS data and ArcGIS projects will be developed and incorporated into the ESRI's Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All spatial imagery during the life of the project will be transferred into Geo TIFF/Geo JEPG format to help in reducing image file size unless stated otherwise by the Government.

All MEC items that are discovered during the removal that are determined or suspected of containing energetic material will be documented within the GIS. Coordinates for the individual items will be collected using the Geo XH GPS unit prior to BIP, consolidation, or removal operations beginning.

External tabular data that is not integrated within the Geodatabase will be provided to APEX in ANSI SQL format as well as Microsoft Access at the completion of the project. All supporting databases will be complete and single entities, with no relations or joined connections to others.

All geospatial data developed by EOTI will be incorporated into the project specific GIS and will conform to the SDSFIE standards and the USACE data standards to give all spatial datasets more compatibility with other Government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for core SDSFIE data layers that are developed by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigations, etc., will contain previously developed metadata created by the originator.

3.7 Intrusive Investigation

3.7.1 Intrusive Investigation Methodology

3.7.1.1 Mobilization

Immediately after receiving a notice to proceed for each phase, EOTI will begin the mobilization process. It is anticipated that three phases of mobilization will occur over three field seasons to accomplish the clearance task. The Project Manager will identify the personnel and equipment required, schedule a sequenced mobilization, and make the necessary travel and shipping arrangements. Personnel qualifications and certification are in Appendix H of this Work Plan.

Personnel

Personnel will be mobilized from their home to Columbia, SC as required to complete the work associated with the project in accordance with the project schedule. It is anticipated that three phases of mobilization will occur over three field seasons to accomplish the clearance task. The Project Manager and SUXOS will mobilize ahead of the main team body to help set up the project site. They will also arrange to receive equipment, coordinate with survey personnel, and insure that all signed copies of required permits are in place. After this initial mobilization of the management staff has coordinated with local personnel and set up the site, the mobilization body of the remaining field team required to complete all planned activities will occur.

Equipment

EOTI will deliver equipment to the site as required by the project schedule. Mechanical excavation and/or brush cutting equipment are not anticipated but (if required) will be rented and delivered to the site by a local vendor. Other equipment will be delivered to the site by EOTI personnel or shipped to the site by commercial carrier.

3.7.1.2 Site Setup

Immediately upon arrival on the first field day at the site, EOTI will begin site setup activities.

3.7.1.3 Office / Facilities

Due to the expected short duration of field activities and the small work force, EOTI will not establish a formal project office at the project location. Office functions and communication will be established and operated out of site management vehicles and/or from site management personnel's motel rooms. EOTI intends to utilize portable toilets to be delivered during site set-up.

3.7.1.4 Work Site

Immediately upon arrival for the first field work day, EOTI will setup the work site. EOTI will establish and survey the boundary of the designated clearance area using a subcontracted South Carolina-licensed surveyor. One week prior the start of intrusive operations EOTI's PM will notify "call before you dig" number 811 or SCE&G 1-800-251-7234 of the intent to start subsurface clearance. SCE&G will perform marking of any utilities within the clearance foot print and any required digging in those areas will be carefully conducted by hand to avoid damaging any utilities.

3.7.1.5 Survey / Site Layout

The SUXOS will coordinate with the surveyor responsible for marking the work areas to ensure that the site layout is complete and documents the clearance area. To date, the boundary information presented on **Figure B-3** has been provided for this effort. This information will be consolidated into the GIS database and will be provided to APEX PM.

As boundaries of the areas are being marked, EOTI will establish internal grids or clearance areas. The SUXOS will determine the most effective way to divide the removal area into internal grids or clearance areas. The internal areas will be established based on size and shape of the area, terrain, etc. but will generally not exceed one acre in size.

3.7.1.6 Vegetation Removal

Only minimal vegetation clearance, if any, will be required to effectively clear MEC, as described in Section 3.7.9. Only vegetation required to effectively complete the removal action will be cut. Vegetation may be cut using any combination of hand or mechanized clearance methods.

3.7.1.7 Surface Removal

Removal of surface MEC will be completed in accordance with procedures described in Section 3.7.9. The removal will include all MEC or MPPEH, regardless of size excluding small arms ammunition (.50 cal and smaller), and no munitions debris or range related debris equivalent to, or greater than 3.67 inch diameter or thickness of 3.76 inch or greater from the surface. MD and RRD removed during the surface and subsurface removal will be collected and processed as described in section 3.7.13. The surface removal will be completed in conjunction with the subsurface removal. A grid or designated clearance area will not be considered complete and will not be turned over for QC/QA checks until both surface and subsurface removal is complete.

3.7.1.8 Subsurface MEC / MPPEH Removal

The land surface and three phase sediment removal areas identified in **Figure B-3** are designated for subsurface clearance of MEC, MPPEH, and any ferrous metal items equivalent to 3.67 inch diameter or thickness of 3.76 inch to depths up to 11 times the width or diameter. The area may be subdivided by placing grid stakes throughout the clearance area in order to better control the removal action and facilitate reporting and quality control. The internal grids corners will be located with a sub-foot GPS unit or with measuring tapes and corners will be marked with stakes.

3.7.1.8.1 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed, the search lane width will be no wider than five feet. The map in **Figure B-3** shows the areas that require surface and sub-surface removal. The precise location of these areas will be marked on the ground by the state licensed surveyor. EOTI will then layout grids/divisions and search lanes in each area that allow for the most efficient removal based on the size and shape of the area.

3.7.1.8.2 Anomaly Identification and Investigation

After establishing lanes (as described above), the areas will be cleared by a team consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).

Each UXO Technician will use a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White's Metal Detector), or equivalent to identify potential subsurface MEC. If a geophysical anomaly is detected it will be investigated by the dig team using mechanical and / or manual digging methods. Mechanized excavation will be performed for anomalies deeper than 2 feet below ground surface. If mechanical methods are used, the team will excavate to the side of the anomaly and not within one foot of the anomaly. Excavation will be to the depth of the anomaly and then hand methods will be used to carefully expose the source of the anomaly. All material suspected as MPPEH, including UXO, DMM, MD, and Range Related Debris, will be inspected by the UXO Technician and Team Leader to determine if it is acceptable to move. If, after inspection, it remains MPPEH and can be safely moved, it will destroyed by detonation as described in Section 3.7.11. If it is not acceptable to move, it will be blown in place as described in Section 3.7.11. All debris removed from the site will be inspected and removed from the construction footprint.

3.7.2 MEC Accountability and Records

3.7.2.1 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all live/suspected UXO/MPPEH items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuze Description;
- Fuze Condition; and
- Additional comments, if required.

Each suspect UXO item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first live/suspect item (0001) encountered in the Removal Area/Grid A-3).

3.7.2.2 Photographs of live or suspect UXO/MPPEH items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the final report; thus, a focused, well thought out photograph is necessary.

3.7.3 UXO Personnel Qualifications

UXO personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Detailed personnel qualification requirements are in Section 2.3. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH.

3.7.4 MC Sampling Locations

MC Sampling is not a part of this project.

3.7.5 MC Sampling Procedures

MC Sampling is not a part of this project.

3.7.6 Munition with the Greatest Fragmentation Distance (MGFD)

The Munition with the Greatest Fragmentation Distance (MGFD) has been identified for clearance area in this Task Order based on historical records for the area. The MGFD for the removal action is the 10 in shell.

3.7.7 Minimum Separation Distances (MSDs)

3.7.7.1 Intentional Detonations

The Exclusion Zone (EZ) for Intentional Detonations is based on the maximum fragmentation distance of the items in the shot. The Maximum Fragmentation Distance of items expected to be present on site are shown in Appendix G. When the Q-D or MSD cannot be met, a sandbag enclosure may be used to meet the requirements. The sandbag enclosure will be constructed in accordance with (IAW) HNC-ED-CS-S-98-7, Paragraph 3.2 (A copy will be maintained on-site). The walls and sides will have a thickness equal to those listed in the Minimum Safety Distance calculation sheets in Appendix G. If items other than those identified in Appendix G are destroyed by intentional detonation, distances and enclosure thickness will be determined, using DDESB Technical Paper 16 and the associated fragmentation database. The EZ for intentional detonations is 393 feet as shown in Figure B-3 of Appendix B.

3.7.7.2 Unintentional Detonation

The EZ for unintentional detonations applies from MEC areas to non-essential personnel for ongoing surface or intrusive activities. Essential personnel are defined as those contractor and

Department of Defense employees who are onsite to conduct the removal action, plus any authorized visitors. All other personnel are considered non-essential personnel. The EZ for an unintentional detonation is the Hazardous Fragmentation Distance (HFD) for the MGFD for the area. EOTI will take appropriate measures to eliminate/reduce risk for exposures within the exclusion zone. Such measures (including the use of protective works, engineering controls, evacuation of inhabited buildings and traffic control) will be maintained on-site for the duration of the project. Any actions that require interaction with the public will be facilitated through the Columbia, SC Fire Department and the Columbia, SC Police Department. The EZ for unintentional detonations is 48 feet as shown in Figure B-3 in Appendix B.

3.7.7.3 Team Separation Distance

The Team Separation Distance is the distance that teams or similar elements of essential personnel must be separated by during the conduct of MEC activities. The Team Separation Distance is the K40 distance (48 feet) shown in Appendix G-Munitions Fragmentation Sheets.

3.7.8 MEC Identification

At least two UXO qualified personnel must be in agreement on the condition of a live or suspected live MEC item before any removal action is attempted. All available data sources will be consulted, as required to make this determination.

3.7.9 MEC Removal

3.7.9.1 Surface and Subsurface Removal

A surface removal will be conducted in conjunction with the subsurface removal in the designated clearance areas as shown in Figure B-3, in accordance with the PWS (Appendix A). UXO Technicians will visually search and use magnetometers such as Schonstedt GA52Cx, White's Metal detector, or similar equipment to locate MEC/MD. The SUXOS will assign grids/clearance areas to the team and the Team Leader (UXO Tech III) will organize his team to effectively conduct a systematic surface and subsurface clearance. If any area has heavy surface contamination the SUXOS may opt to conduct the surface clearance prior to completing the subsurface clearance.

3.7.9.2 Brush Clearance

3.7.9.2.1 Some minor brush cutting may be required EOTI will ensure effective removal in portions of the designated areas. It is anticipated that little, if any, brush cutting will be required. Brush clearance will be conducted by UXO qualified personnel. The purpose of the brush clearance is to allow an effective removal of MPPEH as required in the PWS.

3.7.9.2.2 EOTI will conduct brush-cutting operations only as necessary to allow for MPPEH detection and removal efforts to take place unrestricted from vegetation undergrowth. EOTI will perform minimum brush removal required to clear the surface and subsurface of MPPEH/MD required by the PWS. Underbrush, tall grass, shrubs, small trees, and limbs may be cut in order to allow efficient MPPEH detection and /or removal. Cut brush will be removed from the area identified for clearance, if necessary to prevent interference with site operations. EOTI's brush cutting team will use a variety of clearing techniques depending on the ground conditions and type of vegetation. Various hand and mechanical methods may be applied to complete this task. EOTI does not anticipate heavy vegetation in the project area. However, the use of mechanical brush cutting equipment, such as chainsaws and heavy-duty steel bladed weed eaters may be required in the open, lightly vegetated areas. If self-propelled brush cutting equipment is used, the cutting height will be adjusted to ensure that the blades do not strike potential MEC. UXO personnel will perform a visual sweep ahead of the mechanical equipment to identify any potential hazards on the surface of the ground. In areas with soft ground, EOTI will use a combination of mechanical and hand clearing techniques, possibly including the use of equipment such as a Bobcat Brush Cat or similar equipment and weed eaters. Chain saws and chippers may also be used to cut and reduce brush and low hanging limbs that would interfere with detection and removal operations. The EOTI brush cutting team will consist of UXO Technicians. In any case, any brush cutting team will include at least two persons, a minimum of one of whom will meet at least the requirements to be a UXO Tech II.

3.7.9.2.3 The brush clearance team(s) will be structured to safely and efficiently clear each of the designated areas. The SUXOS will designate team personnel and equipment, based on the size of the area, type of brush, terrain, MPPEH, etc. Brush cutting teams will consist of no less than two personnel.

3.7.9.3 Removal of Surface and Subsurface MEC/MPPEH

The map in Figure B-3 shows the area that requires sub-surface removal. The precise location of the area will be marked on the ground by the state licensed surveyor. EOTI will layout grids and search lanes in each area that allow for the most efficient removal based on the size and shape of the area as shown in Figure B-3.

3.7.9.3.1 After clearing brush sufficiently to allow safe, effective removal, EOTI will clear the designated areas. EOTI's removal team will consist of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members). The SUXOS will organize and make team assignments to ensure that the project is completed in an efficient and safe manner. Any team assigned to complete removal or other MEC operation will have a minimum of two UXO qualified personnel, including at least one that meets the qualification of a UXO Tech III.

3.7.9.3.2 EOTI's UXOSO/QCS will observe removal operations to ensure that safe, quality work is conducted in compliance with the requirements of the Work Plan. The UXO/QCS will conduct at least a 10% Search Effectiveness Quality Control Inspection (SE QCI) check of the area that was cleared using the same type of equipment and techniques used during the removal process. If an area fails the inspection the team will re-sweep the area and it will then be re-inspected. Complete QC procedures are contained in Chapter 4.

3.7.9.3.3 All magnetometers will be calibrated and working properly. All equipment will be tested prior to each use. At a minimum, equipment will be tested in the morning prior to beginning work and after lunch prior to resuming work. Magnetometers will be tested on a test strip in accordance with Section 4.7.3.

3.7.9.3.4 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed the search lane width will be no wider than five feet.

3.7.9.3.5 Anomaly Identification and Investigation

3.7.9.3.5.1 After establishing lanes (as described above), the areas will be cleared by teams consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).

3.7.9.3.5.2 Each lane will be cleared by qualified UXO Technicians under the supervision of the Team Leader. Each UXO Technician will use a hand held magnetometer (Schonstedt GA-52Cx, White's Metal Detector, or equivalent) to identify potential subsurface MEC. If a geophysical anomaly is detected that could be caused by MEC it will be investigated by the dig team using mechanical and / or manual digging methods. If mechanical methods are used, the team will excavate to within one foot of the anomaly and then hand methods will be used to carefully expose the source of the anomaly. All material suspected as MPPEH, including UXO, DMM, MD, and Range Related Debris, will be inspected by the UXO-Qualified Technician and Team Leader to determine if it is acceptable to move. If, after inspection, it remains MPPEH and can be safely moved, it will be consolidated and destroyed by detonation as described in Section 3.7.11. If it is not acceptable to move, it will be blown in place as described in Section 3.7.11 All MD and RRD will be handled and processed IAW Section 3.7.13.

3.7.10 MEC Holding Areas

EOTI does not plan to establish holding areas for MEC in this project. MEC/MPPEH items will be marked and will be destroyed as soon as possible in scheduled demolition operations. All demolition operations will be conducted in coordination with the local law enforcement. Demolition operations will be performed daily as required or items will be properly guarded until operations can be conducted.

3.7.11 MEC Disposal

Personnel Responsibilities

3.7.11.1SUXOS – The SUXOS has overall responsibility for reporting and disposition of MEC. He will:

- Schedule and coordinate all demolition operations;
- Ensure a MEC log is maintained;
- Assure that MD generated from demolition operations is inspected prior to placement in the holding bins; and
- Inspect all recovered MD, RRD and CD.

3.7.11.2 UXOSO and the UXOQCS – The UXOSO and the UXOQCS are responsible for insuring all MEC operations meet safety and quality requirements. They will:

- Observe and inspect all demolition operations; and
- Insure all requirements of this section are complied with.

3.7.11.3 UXO Tech III – The UXO Tech III is responsible for the supervision of the MEC disposal operation. He will:

- Post individuals at entry points (if required);
- Construct appropriate engineering controls IAW "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions," HNC-ED-CS-S-98-7, August 1998 if required;
- Assign team members to specific demolition duties;
- Assure the area is clear prior to capping in for demolition operations; and
- Check the area following each shot or series of shots.

3.7.11.4 UXO Tech II – The UXO Tech II will perform demolition duties as assigned.

3.7.11.5 UXO Tech I/Sweeper – The UXO Tech I/Sweeper will perform demolition duties as assigned.

Safety Precautions

3.7.11.6 A minimum of two personnel (buddy system) will be present during all MEC operations so that one UXO person will always act as a safety observer. Only UXO-qualified personnel will perform MEC procedures. As an exception, a UXO technician I may assist in the performance of MEC procedures when under the supervision of a UXO Technician III or higher.

3.7.11.7 During all MEC operations, only the minimum number of personnel required to safely perform the task will be allowed on-site. All non-essential personnel will remain out of the exclusion zone.

3.7.11.8 If an unidentifiable MEC is found, or toxic chemical ordnance is found, EOTI will contact the USACE Safety Specialist who will coordinate for EOD support.

3.7.11.9 UXO personnel required for this project will include qualified UXO supervisors and technicians that possess the relevant qualifications and experience. Personnel assigned to this project have been selected from a pool of available qualified UXO Technicians. All UXO personnel will meet the applicable personnel training and experience requirements.

3.7.11.10 EOTI UXO personnel will not attempt to remove any fuze(s) from the UXO. Personnel will not dismantle or strip components from any UXO. Personnel are not authorized to inert any UXO items found on-site. MEC/UXO items will not be taken from the site as souvenirs.

Off-Site Transportation

EOTI does not anticipate transporting any MEC / MPPEH items off-site for disposal.

Collection Points

Per the ESS, EOTI will not establish collection points for MEC.

Demolition and Post Demolition Operations

MEC items located during EOTI's operations that cannot be determined to be acceptable to move will be blown in place (BIP). The Exclusion Zone for Blow-in Place operations is based on the maximum fragmentation distance of the items in the shot. If this distance cannot be achieved, the EZ may be reduced through the use of engineering controls approved by the DDESB. EOTI will use DDESB Technical Paper 16 to determine the appropriate distance and engineering control thickness, when applicable. Sandbag enclosures will be constructed in accordance with HNC-ED-CS-S-98-7, *Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonations*. A copy of this reference will be maintained on-site.

Demolition activities will be in compliance with:

- USAESCH Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- EM 385-1-97, Explosives - Safety and Health Requirements Manual
- DoD 6055.9 Std., DoD Ammunition and Explosive Safety Standards;
- TM 60A 1-1-31, Explosive Ordnance Disposal Procedures; and
- Remote Firing Device with Nonelectrical and Electric Firing Procedures.

General Demolition Practices

Personnel will adhere to the following standard safe practices and procedures when conducting demolition operations:

- Review electromagnetic radiation (EMR) hazards and precautions and electrical grounding procedures;
- Carry blasting caps in approved containers and keep them out of the direct rays of the sun;
- Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons will retire to a place of safety;
- Do not use explosives or accessory equipment that are deteriorated or damaged. They may detonate prematurely or fail completely;
- Do not abandon any explosives. Fatal or serious accidents can result from such careless practice;
- Do not use unexploded dud ordnance items for demolition purposes. They may be in an extremely sensitive and hazardous condition;
- Disposal operations will not be initiated until at least one-half hour after sunrise and will be concluded by at least one-half hour prior to sunset;
- Restrict and control access to the disposal site to a minimum of authorized personnel necessary for safe conduct of the disposal operations;
- Do not carry fire- or spark-producing devices into a disposal site except as specifically authorized;
- Do not smoke except in areas specifically designated. After smoking, assure that all burning tobacco is extinguished; and
- Avoid inhaling, and skin contact with explosives, the smoke, fumes, vapors of explosives, and related hazardous materials.

Handling Demolition Materials

When handling demolition materials, EOTI UXO Technicians will observe the following rules and safe practices:

- Do not strike, tamper with, or attempt to remove or investigate the contents of a blasting cap (electric or non-electric), detonator, or other explosive initiating device. A detonation may occur.
- Do not pull on the electrical lead wires of electric blasting caps, detonators or other electro-explosive devices. A detonation may occur.
- Do not attempt to remove an unfired or misfired primer or blasting cap from a coupling base. There is a high risk of an explosion.
- Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling. This will minimize injury should the item explode.
- Shaped charges - be certain there is no obstruction in the conical cavity or between the charge and the target, as any obstruction will materially reduce the penetration effect.

Preparation for Electric Firing

When preparing firing systems, EOTI will:

- Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.
- If using electric blasting caps, all caps will be of the same manufacture, for each demolition shot involving more than one cap.
- Keep blasting caps in approved containers, located at least 7.62 meters (25 feet) from other explosives, until needed for priming.
- Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

Electric Priming

- EOTI plans to use an RFD. EOTI plans to prime with electric detonators attached to the receiver unit(s). Depending upon availability, Non-El (shock tube) detonators may be used in place of electric detonators. Non-electric procedures are included at paragraph 3.7.11.33.

EOTI will prepare electric priming systems using the following techniques and procedures:

- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.
- Unroll the lead wires so that the cap is as far as possible from the operator and pointing away from him/her. Place the blasting cap under a sandbag or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.
- Use only the special silver-chloride dry cell battery in the testing galvanometer. Other types of dry cells may produce sufficient voltage to detonate blasting caps.
- Do not connect the power source to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charges.

- Do not hold the blasting cap directly in the hand when uncoiling the leads. Hold the wires approximately 152 millimeter (6 inches) from the cap. This will minimize injury should the cap explode. The lead wires will be straightened by hand and not thrown, waved, or snapped to loosen the coils.
- Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts will ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the circuit firing unless the power ends of the circuit firing leads are shorted.
- Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- The UXO person in-charge will order the final priming of the shot.

Firing Demolition Charges

3.7.11.11 Keep the power end of the firing wire shunted until ready to connect the power source.

3.7.11.12 The signal for detonation will be given by the UXO person in-charge only after all personnel in the area have reached cover or a safe distance from the charge.

3.7.11.13 Prior to making connections to the power source, test the firing circuit for electrical continuity.

3.7.11.14 The UXO person in-charge will order the firing wires to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.

3.7.11.15 When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.

3.7.11.16 Do not complete the circuit at the power source (panel) or give the signal for detonation until directed to do so by the UXO person in-charge.

3.7.11.17 Do not attempt to fire a single electric blasting cap or a combination of electric blasting caps in a circuit with less than the minimum current required by the total circuit. Misfires can be expected where this occurs.

3.7.11.18 The UXO person in charge and a safety observer shall check the shot following the detonation.

3.7.11.19 The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting “blow-in-place” operations. Always check the “blow-hole” for secondary items and remove all MD.

3.7.11.20 Electro-Magnetic Radiation (EMR) Hazards. Prior to the application of detonation-in-place procedures, an EMR survey shall be conducted to determine if there are any transmitting antennas of radio, radar, or other electro-magnetic-generating devices located in the vicinity.

3.7.11.21 Radio Frequency (RF) EMR. RF EMR consists of waves of electrical energy. These waves are radiated in a line-of-site from the antennas of electronic devices that transmit radio, radar, television, or other communication, to include cellular telephones, or other communication or navigation radio frequency signals. Table 2-1 states the minimum safe distance from electro-explosive devices (EEDs) and the transmitting antenna of all RF emitters. Table 2-2 states the minimum safe distances, which will be maintained between Mobile RF transmitters and electric blasting operations. The factors to be considered when evaluating the degree of hazard that the EMR (RF) energy represents are:

- The strength of the field (its power);
- The frequencies transmitted;
- The distance from the transmitter antenna to the ordnance; and
- The amount or type of protection available.

Table 2 Minimum Safe Distance from Electro-explosive Devices (EEDs) and RF Transmitter Antenna Emitters

AVERAGE OR PEAK TRANSMITTER POWER IN WATTS	MINIMUM DISTANCE TO TRANSMITTER IN METERS/FEET
0 – 30	30 / 98.4
31 – 50	50 / 164.1
51 – 100	110 / 360
101 – 250	160 / 525
251 – 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3.002
20,001 - 50,000	1,530 / 5,020
50,001 – 100,000	3.050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,000 - 6,400,000	24,400 / 80,056

* When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

Table 3 Minimum Safe Distances in Feet Between Mobile RF Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	MF to 3.4 MHz Industrial	HF 28 to 29.7 MHz Amateur	VHF 35 to 36 MHz 42 to 44 MHz 50 to 64 MHz	VHF 144 to 148 MHz 150.8 to 161.6 MHz	UHF 450 to 460 MHz Cellular Car Phones above 800 MHz
5[1]	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40

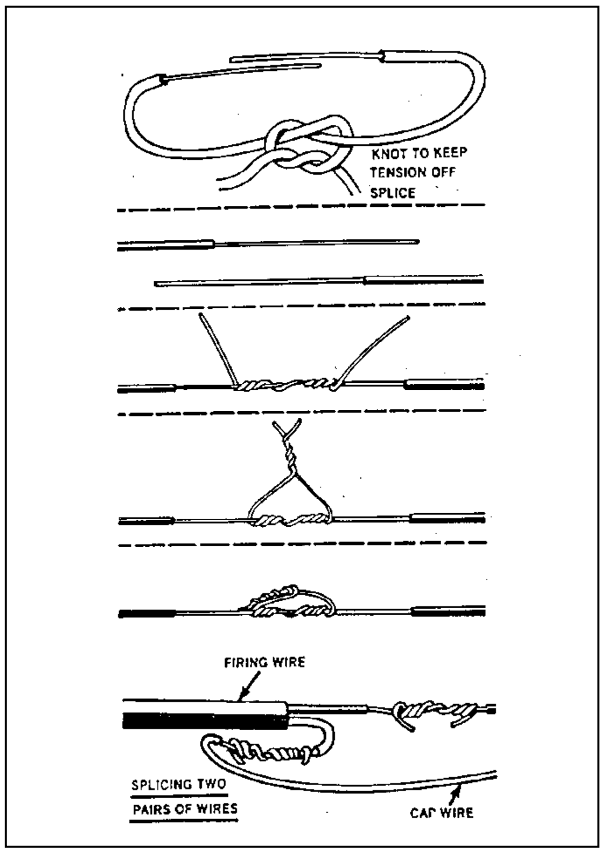
100	120	320	260	100	60
180[2]	170	430	350	130	80

[1] Citizens band radio (walkie-talkie) (26.96 to 27.41 MHz) - minimum safe distance -five feet. Double sideband - 4 watts maximum transmitter power - hand-held, 5 feet; vehicle mounted, 65 feet. Single sideband - 12 watts peak envelope power - handheld, 20 feet; vehicle mounted, 110 feet.
[2] Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).

3.7.11.22 Lightning, Electric Power Lines, and Static Electricity. Lightning is a hazard to both electric and non-electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap or other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during electrical storms and when one is impending. All blasting activities will be suspended when lightning-thunder storms are within ten miles of the project site.

3.7.11.23 Electrical firing will not be performed within 510 feet of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 510 feet to electric power lines, non-electric firing systems will be used or the power lines de-energized.

3.7.11.24 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by a great variety of causes; among them, dust storms, which have caused a large number of detonations; snow storms, less dangerous, but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.



Preparation of Demolition Shots

After determining and locating a safe location away from the charges, lay out the firing wire and prepare and place all explosive charges.

Test Firing Wire

3.7.11.25 If using the blasting galvanometer/M51 test set - check the galvanometer by holding a piece of metal across its terminals. If the battery is good, there should be a wide deflection of the needle. Check the M51 test set by holding a piece of wire across its terminals and depress handle - lamp should glow.

3.7.11.26 When using a Model "D" Blaster's Ohmmeter with the Lawrence Silver Chloride Dry Cell, a full needle indication is required. Frequently cells, which have been stored for long periods of time, will require re-activation. To obtain full-scale deflection of the meter needle, the meter contact posts should be shorted with a metal instrument such as a screwdriver or knife blade. Place the metal blade in full contact with both terminals simultaneously for a period of twenty seconds to one minute. This should activate the cell to full-scale deflection. If it does not, do not use the ohmmeter.

3.7.11.27 Separate firing wire connectors at both ends, and touch those at one end to galvanometer/test set posts. The needle should not move nor lamp glow. If either occurs, the firing wire has a short circuit.

3.7.11.28 Twist wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections. Note: Firing wire can be tested on the reel, but unnoticed broken wires could produce false readings. Firing wire must be tested after unreeling. Caution: Do not drag a firing cable over sand or other insulated surfaces as this can generate a static charge that will electrically fire blasting caps.

3.7.11.29 Twist free ends of firing wire together to prevent an electric charge from building up in the firing wire.

Test Blasting Caps

Complete the following steps in order to test the electric blasting caps:

- Test galvanometer/M51 test set as outlined above.
- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit.
- Place the cap under a sandbag or other protective device in the event that the cap accidentally functions.
- Individual conducting this test will ground himself prior to removing the shunt.
- Remove short circuit shunt.
- Touch one cap lead wire to one post and the other cap lead wire to the other post. If the galvanometer's needle deflects slightly less than it did when instrument was tested, or the lamp glows, the blasting cap is satisfactory; if not the cap is defective. Destroy it on the detonation.

Note: If the battery is fresh, the galvanometer should read at least half scale when the instrument is tested and when a good blasting cap is tested.

Connecting the circuit.

Complete the following steps when connecting an electrical firing circuit:

- At the firing position, keep the free ends of the firing wire twisted together until ready to connect the blasting machine.
- Individual will ground himself prior to performing next step.
- Splice free cap lead wires to firing wire.
- Insert cap into charge.

Firing Procedures

Complete the following steps in order when firing the shot:

- Test the entire circuit. Move to the firing position and test the entire firing circuit with the galvanometer or test set as outlined above. If the firing circuit is defective, shunt wires; go down-range and recheck circuit. If the splice is found defective, re-splice wires. If cap is found defective, replace it.
- Twist free ends of firing wire together.
- Exercise the blasting machine. Test blasting machine by actuating it several times with nothing attached to the terminals.
- Connect blasting machine.
- Sound a warning (siren, horn, etc.) and loudly call out “Fire in the hole”! three times. (Specific procedures for warnings and notifications will conform to SOP for demolition operations at CRP)
- Activate blasting machine.

Electric Misfire

3.7.11.30 Prevention of electric misfires: In order to prevent misfires, insure that:

- All blasting caps are included in the firing circuit;
- All connections between blasting cap wires, connecting wires, and firing wires are properly made;
- Short circuits are avoided;
- Grounds are avoided; and
- Number of blasting caps in any circuit does not exceed rated capacity of power source on hand.

3.7.11.31 Causes of electric misfires. Common specific causes of electric misfires include:

- Inoperative or weak blasting machines or power source;
- Improperly operated blasting machine or power source;
- Defective and damaged connections, causing either a short circuit, a break in the circuit, or high resistance with resulting low current;
- Faulty blasting caps;
- The use in the same circuit of blasting caps made by different manufacturers or different design; and

- The use of more blasting caps than power source rating permits.

3.7.11.32 Clearing electric misfires. If charge is primed electrically, proceed as follows:

- Make three successive attempts to fire;
- If unsuccessful, remove firing wires from blasting machine and check continuity of firing circuit.
- If continuity is good, reattach firing wires to blasting machine and make 3 more attempts to fire charge;
- Check firing wire connections to terminals of the blasting machine and make 3 more attempts to fire charge;
- Change blasting machine after third unsuccessful attempt with original blasting machine.
- If still unsuccessful, disconnect blasting machine from firing wire ends and shunt firing wire by twisting firing wire ends together;
- Allow a minimum of 30 minutes to elapse from the last attempt to fire, before starting to investigate;
- Remove and disconnect old blasting caps and shunt wires; Connect wires of new blasting cap(s) to firing circuit and re-prime charge; and
- Reconnect firing wire ends to blasting machine and fire charge.

Non-electric Procedures

3.7.11.33 A nonelectric (shock tube) detonator firing system is designed to initiate demolition charges when a lightweight, low-initiating explosive weight, nonelectric, nonfragmenting, and waterproof initiating system is desired. These systems are made up of nonelectric detonators with pyrotechnic leads, pyrotechnic lead initiators, firing devices, and connectors. These systems provide control similar to electric initiating systems. The nonelectric detonators are not hazards of electromagnetic radiation to ordnance (HERO) or electrostatic sensitive. Unlike standard nonelectric blasting caps, no crimping or watersealing of the detonator or pyrotechnic lead is necessary and time fuze is not required in most applications. All handling procedures for donor explosives will be done as with electric firing systems.

- After determining and locating a safe location away from the charges prepare and place all explosive charges.
- The UXO person in charge will order the final priming of the shot.
- Make sure detonator is not pointed toward personnel or explosives.
- Unspool nonelectric detonator (with pyrotechnic lead) from demolition charge to required standoff.
- Insert or attach detonator to demolition charge.
- The UXO person in-charge will order the lead to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.
- Attach lead to firing device (initiator or receiver) iaw the manufacturer’s instructions.
- When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.
- Fire the shot using the initiating device iaw the manufacturer’s instructions.
- The UXO person in charge and a safety observer shall check the shot following the detonation.

- The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting "blow-in-place" operations. Always check the "blow-hole" for secondary items and remove all MD.
- In the event of a misfire, follow the RFD manufacturer's procedures in order:
  - Do not approach the shot until 30 minutes has elapsed.
  - Igniter tip may be worn or damaged. Try a new tip.
  - There may be water on the tip. Blow out the tip and test fire the tip without any tube installed.
  - Shock tube may be damaged or defective. Cut a one-foot section beginning approximately six inches from the igniter. Hold one end of the one-foot section over the palm of your hand and gently blow through the other end. If a fine powder is blown out of the tube, reattach the pyrotechnic lead to the igniter tip.
  - Replace the detonator assembly and shock tube and attempt the detonation again.

3.7.12 Material Potentially Presenting an Explosive Hazard (MPPEH)

3.7.12.1 A UXO Tech I can tentatively identify a located item as MPPEH, followed by a required confirmation by a UXO Tech II or Tech III.

3.7.12.2 A UXO Tech II will conduct a 100% inspection of each item as it is recovered and determine the following:

- Is the item a UXO, a DMM, munitions debris, or range related debris?
- Does the item contain explosive hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization (demil) or venting to expose dangerous fillers?
- Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic, or radiological waste (HTRW) materials?

3.7.12.3 All munitions debris and range related debris will be picked up by UXO removal team during surface sweep and subsurface removal operations.

3.7.12.4 The munitions debris and range related debris will be placed into containers for collection while sweeping. When the containers are approaching full, they are transported to a predetermined location on the site.

3.7.12.5 All munitions debris and range related debris will be re-inspected by the UXO removal Team Leader (UXO Tech III) prior to transportation to the secured containers.

3.7.12.6 Items requiring demilitarization and/or venting will be segregated and processed in a timely manner and placed in securable containers.

3.7.12.7 The UXOSO/QCS will conduct daily audits of procedures for processing MPPEH and will conduct and document random checks of specific pieces.

3.7.12.8 SUXOS and UXOSO/QCS will ensure that Work Plan procedures, based on and in compliance with Chapter 14 of EM 1110-1-4009, are being followed and performed safely.

3.7.12.9 All final processed material will be placed in lockable containers, for security, before turning in for recycling. In accordance with Chapter 14 of EM 1110 dated 15 June 2007, and Errata Sheet No. 2, EOTI will dispose of all material determined by inspection not to contain an explosive hazard (munitions debris and range related debris) through an offsite recycling facility. EOTI will destroy material remaining as MPPEH after inspection.

3.7.12.10 Items that require demilitarization will be demilitarized in accordance with DoD 4160.21-M-1, Defense Demilitarization Manual. All MEC items will be investigated to insure that there are no explosives remaining in the items and that only inert filled or empty items are removed from the grid. Redundancy is built into the investigation process to assure no live items are removed from the site.

3.7.12.11 SUXOS will be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH for final disposition as UXO, DMM, munitions debris or range-related debris.

3.7.13 Munitions Debris (MD) & Range Related Debris (RRD)

3.7.13.1 SUXOS will:

- Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all munitions debris and range-related debris to be transferred for final disposition.

- Perform random checks to satisfy that the munitions debris and range -related debris are free from explosive hazards necessary to complete the Form, DD 1348-1A.

- Certify all munitions debris and range-related debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials. No range related debris is expected on the CRP project.

- Be responsible for ensuring that inspected debris is secured in a closed, labeled, and sealed in a container and documented as follows;

    - The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification number that will start with USACE/Installation Name/Contractor's Name/0001/Seal's unique identification and continue sequentially.
    - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification information if it differs from the number on the container.

- A documented description of the container will be provided by EOTI with the following information for each container: contents, weight of container, location where munitions or range-related debris was obtained, name of contractor, names of certifying and verifying individuals, unique container identification, and seal identification. EOTI will also provide these documents within the Final Report.

3.7.14 Disposal Alternatives

If MPPEH is discovered that cannot be destroyed on-site, the SUXOS will coordinate with the USACE on-site Safety Specialist to determine an appropriate method of off-site disposal. The SUXOS will present possible courses of action and a recommendation to the EOTI Project Manager. The final method of off-site disposal will be approved by USACE.

3.8 Geospatial Information and Electronic Submittal

The GIS Plan is described in Section 3.6 of this WP.

3.9 Investigative Derived Waste Plan

Investigative Derived Waste is not applicable to this project.

3.10 Risk Characterization and Analysis

Risk Characterization and Analysis is not a part of this project per the PWS.

3.11 Analysis of Land Use Controls

Land Use Controls are not associated with this project.

3.12 Preparation of the Five-Year Review Plan

A Five-Year Review is not a part of this project.

4.0 CHAPTER 4 – QUALITY CONTROL PLAN

4.1 QUALITY CONTROL OBJECTIVES

This section presents the project QC Plan as required by the PWS. The QC procedures described in this section will be used for all work performed during this MEC Removal Project. This site-specific QC plan is designed to manage, control, and document performance of work efforts and to ensure quality throughout the execution of all tasks. This QC Plan will achieve the following objectives:

- Identify QC procedures and responsibilities.
- Document the quality of work efforts via audits and independent staff reviews of deliverables.
- Ensure data integrity through implementation of data management QC procedures.
- Ensure the development of an appropriate accountability and appropriate data collection.

4.2 QUALITY POLICIES

4.2.1 All services provided will be consistent with and will meet the requirements of all applicable laws and regulations.

4.2.2 Quality Management will be applied throughout all phases of the project – from the time of the task order award, until the SSFR is accepted.

4.2.3 Emphasis will be placed on preventive actions that minimize quality failures or defects.

4.2.4 All EOTI employees and team members are empowered to identify and evaluate potential quality problem areas and are encouraged to recommend solutions or corrective actions.

4.2.5 EOTI will staff all project sites with the best qualified, trained, available personnel, based upon their knowledge and prior experience with the type of operations and hazards expected to be encountered. The minimum qualifications will meet or exceed the customer’s requirements.

4.2.6 All EOTI personnel will be provided with all of the information necessary to accomplish their assigned tasks in a safe, responsible, cost-efficient manner and they will be held accountable for the quality of their work.

4.2.7 The project team will be provided with a copy of the final approved Work Plan / SSHP prior to the performance of any MEC-related activities on a project site.

4.2.8 EOTI will take corrective actions on any complaint, quality defect, or negative result from an audit of operations.

4.3 DEFINITIONS

- Removal Standard - a specified size of MEC to a specified depth. The removal standard for this project is: No findings on the surface of the munitions response site of MEC or MPPEH regardless of size excluding small arms ammunition, and no munitions debris equivalent to, or greater than 3.67 in (6 lb shell) in diameter or width with a thickness (length) of 3.67 in or greater; and finding within the subsurface of the munitions response site no ferrous metal items (including, but not limited to MEC and MPPEH) equivalent to, or greater than 3.67 in in diameter or width with a thickness (length) of 3.67 in (6 lb shell) or greater to a depth the lesser of 11 times the item diameter (or width).

- Customer/Client - refer to the term "Purchaser" for the contract.
- Government Representative - an on-site Government employee with specified responsibilities and authority.
- Nonconformance:
    - A minor nonconformance is not likely to materially reduce the usability of the services. It is generally a departure from the approved procedures that have little bearing on the end product.
    - A major nonconformance is likely to result in failure of the services or to materially reduce the usability of the end product.
    - A critical nonconformance is likely to result in hazardous or unsafe conditions for individuals using or depending upon the services.
- Purchaser: The term purchaser shall refer to the body of the agency administering the particular contract involved, or the authorized representative of that body.
- Quality Conformance Inspection (QCI): Normal inspections/audits conducted by authorized EOTI personnel during the accomplishment of the organization's mission to determine conformance to contract requirements.
- QC: The process by which EOTI manages, controls, and documents its activities in the accomplishment of the mission.
- Quality Defect: A nonconformance issue with published policy and/or a contractual requirement that requires corrective action(s).
- Quality Management: All those control and assurance activities instituted to safely and effectively accomplish the assigned mission.
- Root Cause: The basic reason for an undesirable condition or problem if eliminated or corrected, would have prevented it from existing or occurring.
- Stop-Work-Authority: The right and obligation to stop all work when serious quality or safety concerns arise.
- Surface Removal: Locating and removing UXO items that are visible on the surface, or partially visible. This includes items that are partially exposed, which will require only minimal hand excavation to determine identification.
- Characterize: Locating, identifying, and characterizing metallic objects that caused a geophysical response.
- See Federal Acquisition Regulation (FAR) Part 2.1 for additional definitions.

4.4 QC RESPONSIBILITY

EOTI is solely responsible for the control of product quality. Only those products/services that conform to contractual requirements will be offered to Apex for acceptance.

4.5 CONTRACT SUBMITTALS

All contract submittals will be prepared by qualified personnel in accordance with the PWS and contract requirements. All documents undergo a peer review in which they will be reviewed by an equally qualified person familiar with the project and submittal requirements.

4.6 QUALITY MANAGEMENT

4.6.1 The Project Manager has the responsibility of ensuring that QC procedures are implemented in accordance with the PWS.

4.6.2 The QA/QC Manager will provide the Quality Management oversight for the project. The QA/QC Manager is a part of the project team, but is authorized to elevate any quality problems that cannot be resolved by the project team. The QA/QC Manager interacts with the Project Manager, SUXOS, UXOQCS, subcontractor QC staff, as appropriate, and Project Manager to prevent and/or correct problem situations, as necessary. Vendors and subcontractors will be monitored to assure that they supply items and services, which meet quality requirements. Periodic audits will be performed to verify that the quality system and the UXOQCS are performing as required. He also ensures that:

- Required site training is conducted prior to the start of field activities.
- The UXOQC Specialist is qualified and trained.
- QC is built into the Project Work Plan to support the MEC removal action.
- The requirements of the QC Plan are adhered to.

4.6.3 Effective day-to-day field QC management is delegated to the on-site EOTI UXOQCS. He will interact daily with the project team to ensure that all QC procedures presented in the Project Work Plan are followed in the accomplishment of all project tasks. The UXOQCS reports directly to the QA/QC Manager. Scheduled activities are coordinated with the Project Manager, SUXOS, UXOSO, and all other project team members as needed. He has the authority to:

- Initiate action to prevent the occurrence of nonconformance's relating to the provided services.
- Identify and record any problems relating to the services.
- Initiate, recommend or provide solutions through the on-site management channel.
- Verify the implementation of solutions.
- Control further actions of any nonconforming services until the unsatisfactory conditions have been corrected.
- Elevate Quality concerns, which cannot be resolved on-site to the Quality Manager.

4.6.4 All project team members are responsible for and will be held accountable for the quality of their work. Every team member has Stop-Work-Authority when an immediate safety situation is observed which could cause personal injury or damage to property and equipment. All project team members are encouraged to identify potential quality problems and are encouraged to suggest solutions or corrective actions to ensure all work conforms to the approved Work Plan and QA requirements. During site-specific training, personnel will be briefed by the QA/QC Manager or the UXOQCS, on the importance of quality work and the above stated requirements. This briefing is aimed at insuring that all site personnel understand EOTI's dedication to quality.

4.7 QC PLAN PROCESSES

This section documents the processes affecting quality. These are essential steps to ensure a quality product is delivered to the Government.

4.7.1 *Specific Procedures*

Described below are the specific procedure that will be used to assure quality in this PWS regarding; Audits, Corrective/Preventive Action, Data Management, Field Operations, Equipment Calibration and Maintenance, and Personnel Protective Equipment.

4.7.2 *Scheduled Audits*

Periodic audits will be performed by the QA/QC Manager to ensure that the requirements of this Quality Plan are being followed. This may include on-site visits as well as frequent document review activities. Training records, periodic reports, and adherence to all aspects of this QC Plan will be monitored to assure compliance.

4.7.3 *Daily QC Audits*

All instruments, vehicles/machinery, and equipment will be checked prior to the start of each workday, batteries will be replaced as needed, and instruments requiring calibration will be checked against a known source. Hand held magnetometers / metal detectors will be checked on a test plot. Daily checks will be conducted by each instrument operator using his assigned instrument on the test plot. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The UXO Team leader and UXOQCS will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test plot. If the operator displays improper techniques or is unable to accurately and consistently locate seed items, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test plot before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation. The test strip simulates site conditions. It will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. Figure 6 shows the conceptual layout of the test strip and Table 4 includes seed item placement details. The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made. The UXOQCS performs random, unscheduled QCI to ensure that personnel accomplish all work specified in the Project Work Plan. The QCI Schedule will adhere to the following Table 5. The UXOQCS has the latitude to modify this schedule based on the quality of work being performed and the frequency of noted activities.

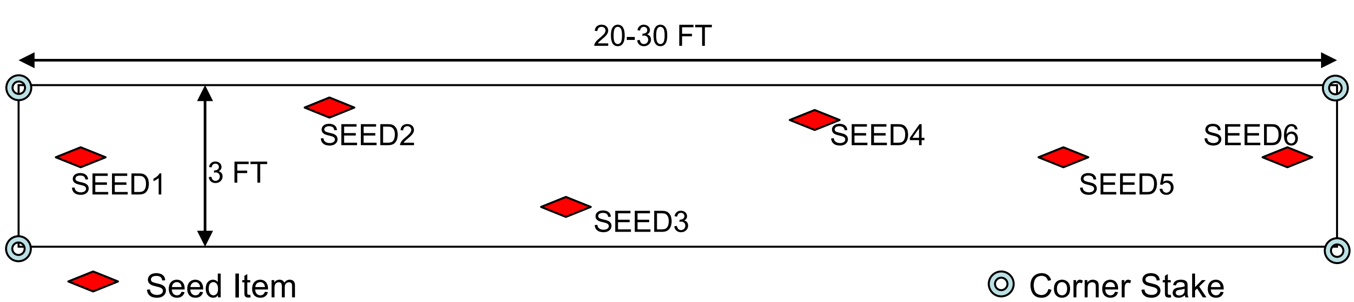


Figure 6 Test Strip Conceptual Layout

Table 4 Test Strip Seed Item Description

Test Strip Seed Item Description			
Seed Item ID	Description	Depth [in]	Notes
SEED1	10 lb Shell	32	Oriented approximately 45° from horizontal and parallel to the major axis of the test strip
SEED2	6 lb Shell	8	Oriented approximately 90° from horizontal and parallel to the major axis of the test strip
SEED3	10 lb Shell	32	Oriented approximately horizontal and approximately perpendicular to the major axis of the test strip
SEED4	6 lb Shell	8	Oriented approximately 45° from horizontal and parallel to the major axis of the test strip
SEED5	8 lb Shell	32	Oriented approximately 45° from horizontal and perpendicular to the major axis of the test strip
SEED6	6 lb Shell	8	Oriented approximately 45° from horizontal and perpendicular to the major axis of the test strip

Note: Seed items may be inert items or simulants with similar dimensions. At least two items will be blind seed items that are periodically moved by the UXOQCS.

Table 5 Frequency of QC/QA Inspections and Checks

TASK	100%	DAILY	WEEKLY	BI-WEEKLY	AS NEEDED
Personnel Qualifications	✓				
Test Plot Proficiency		✓			✓
Accident/Incident Reporting	✓				
Search Effectiveness					✓
Turn-in of Recovered Munitions Debris	✓				
Preventive Maintenance		✓			
Communications Equipment Inspection		✓			
Safety Inspections		✓	✓		
Medical Support		✓			
Communications Effectiveness		✓			
Explosives Accountability					✓
Excavation Activities	✓				
MEC Final Disposal			✓		
MEC Accountability			✓		
Fire Protection – Prevention			✓		
Project Administration			✓		
Safety and Health Programs				✓	
Visitor Briefing					✓
Site – Specific Training					✓
Hazard Assessment – Risk Analysis					✓

4.8 QUALITY ASSURANCE / QUALITY CONTROL STANDARDS

4.8.1 *Surface Removal*

Every area designated for surface removal will undergo a Search Effectiveness Quality Control Inspection (SE QCI) involving approximately 10% of the square footage. The exact location of this square footage is at the discretion of the UXOQCS. The UXOQCS will also verify that the anomalies removed from the surface are accounted for separately, properly, and weighed accurately. The UXOQCS will place seed items, as described in this Section, to verify the effectiveness of the removal.

4.8.2 *Subsurface Removal*

The UXOQCS will perform a UXO QCI on at least 10% of each area excavated by the removal team. Additionally, seed items will be used, as described in Section 4.8.3, to ensure the removal effectiveness. The UXO QCI will be performed using one of the following two methods, or a combination of the two methods.

- As available, a UXOQCS will monitor UXO Removal Teams while they acquire and excavate anomalies. He will observe the team's procedures to ensure quality standards are met.
- Following excavation, the UXOQCS will check the location using the same detection technology to ensure the team has removed all anomalies.

4.8.3 *QC Performance Requirements*

The Quality Control requirements of this project are provided in Table 4. The surface of all indicated removal areas will be cleared, in accordance with the PWS (included in Appendix A).

Table 6 Performance Requirements Matrix

Performance Requirements Matrix				
Requirement	**Applicability**	**Performance Standard**	**Frequency**	**Consequence of Failure**
Repeatability	All operators with assigned equipment	All items in the test strip detected (trains ear to items of interest).	At least daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks for the day and will be re-tested again the next working day.
Coverage	Site	100% of the area swept and anomalies removed / No MEC of any size and no RD/MD items ≥ 3.67 in (6lb shell) diameter or width. All seed items are recovered.	At least 1-2 blind seed items per operator per lot	Redo lot
Detection and Recovery	Each Sector	All MEC/MPPEH and MD/RD greater than 3.67 (6 lb) in or width removed from the surface/subsurface. All seed items are located and recovered.	At least 1-2 blind seed items per operator per lot. 10% of the area checked by UXOQCS	Redo lot
Geodetic Equipment Functionality	All	Geodetic Repeatability-Check against a known position set by a surveyor / position located within 1 foot	At least Daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks and will not operate geodetic equipment, until proficiency is demonstrated.

The UXOQCS will use blind seed items in the test plots and in the removal areas to ensure the effectiveness and completeness of the removal action. The UXOQCS will place two or three (2-3) inert MD items or surrogates (similar to those used to seed the test strip) in area to verify detection proficiency. The UXOQCS will record the location and depth of the seed items and will document the failure of any operator to accurately locate them. The location, depth, and number of items will be varied each week, when conducting intrusive operations. Additionally, the UXOQCS will place seed items on the surface and in the subsurface of the removal area. The detection seeds will also serve as coverage seeds for QC purposes. The seed items may be metallic covers for electrical junction boxes or other suitable surrogate item, painted and identified with a unique number. A lot is defined as the portion of the area assigned to the team to clear. The lots may be irregular shaped and may vary in size, depending on the shape of the removal area, but will generally be approximately one acre. The UXOQCS will record the location (grid/clearance area) of each seed item and will verify that all are located prior to the final clearance of area. Failure to recover the seed items will result in a QC failure condition that will require re-clearing of the lot.

4.9 QC FILES

4.9.1 The following two files will be established and maintained by the UXOQCS.

- QCI Record File
- Corrective Action Request (CAR) File

4.9.2 The QCI Record File will be a two-part file, containing Active and Inactive Sub-files.

4.9.3 The Inactive Sub-file will contain the Quality Conformance Inspection Record (QCIR) for tasks that were found to be in compliance with the Work Plan and those that were not in compliance, but have been re-inspected and are subsequently corrected.

4.9.4 The Active Sub-file will contain those QCIR for tasks that were found to be not in compliance with the Work Plan and have not yet been corrected.

4.9.5 The CAR File will be a two-part file containing an Active Sub-file and an Inactive Sub-file. A CAR will be maintained in the Active File until follow-up has been conducted and deemed satisfactory. Once the follow-up is completed, the CAR will be placed in the Inactive File.

4.10 CORRECTIVE/PREVENTATIVE ACTION

4.10.1 Nonconformance will be documented on a QCIR. The QCIR will document the reason for the nonconformance and describe the corrective actions taken to resolve the problem and the actions taken to prevent reoccurrence. QCI are generally intended to be preventative, rather than corrective in nature. Through preventative QCI, continuous improvement of site operations will occur.

4.10.2 The QCIR may be handwritten in ink when computer access is limited, but when practical they will be prepared electronically in Microsoft Word format.

4.10.3 A QCIR may be completed for tasks when they are in conformance with the Work Plan. QCIRs for conforming tasks will not generally be distributed off the project site.

4.10.4 A QCIR will be completed for tasks when they do not conform to the Work Plan. Nonconformance QCIRs will be forwarded by facsimile or email to the Project Manager and the QA/QC Manager.

4.10.5 A QCIR will be completed for re-inspection of nonconformance. If the re-inspection indicates that the nonconformance has been corrected, both QCIRs will be filed in the Inactive Sub-file and a copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager. If the re-inspection indicates the nonconformance has NOT been corrected, both QCIRs will be filed in the Active Sub-file. A copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager.

4.10.6 Nonconformance will be evaluated and corrective action implemented by on-site management whenever possible. The Project Manager and QA/QC Manager will track all non-conformances to assure that they have been resolved, actions to prevent re-occurrence have been implemented and that lessons learned are communicated effectively.

4.11 CUSTOMER COMPLAINTS

4.11.1 Customer complaints will be addressed immediately. The complaint may come in the form of a verbal comment or written correspondence. Whatever the vehicle, the Project Manager will conduct an investigation to analyze the complaint and assure corrective action has been initiated. The corrective action will address not only the root cause but also the application of controls to assure its effectiveness.

4.11.2 The Project Manager will document the complaint or nonconformance and the investigation. He will look for the root cause.

4.11.3 Lessons Learned will be documented on the CAR and communicated to Project personnel and the QA/QC Manager.

4.11.4 The action on the CAR is not complete until the UXOQCS and/or SUXOS have completed follow-up. The corrective/preventative actions have to be adequate to prevent reoccurrence and the customer must be satisfied with these actions.

4.11.5 The issue addressed in the CAR will be an item for a future QCI to ensure that the corrective/preventive actions have in fact addressed the issue and the solution was effective.

4.12 DOCUMENT CONTROL AND DATA MANAGEMENT

Rigid control must be maintained over the production of QC documents. The following guidelines will apply to all documentation generated by QC staff.

4.12.1 *Document Completion*

4.12.1.1 All sections of forms will be completed. Any unused spaces will be marked not applicable (N/A). In long columns of empty lines, N/A may be written in the first and last lines of that column with a single line connecting the entries. Large areas of unused spaces may be designated N/A by drawing a single line through the unused areas with the letters N and A on either side of that line.

4.12.1.2 Time and date formats: To eliminate misunderstanding, the following formats will be used on all official reports and correspondence:

- Time: 24-hour (Examples: 0730H, 1930H)
- Date: MM/DD/YY (Examples: 10/05/12, 11/15/12)

4.12.1.3 All signatures will be accompanied by the date the signature was made, either in a date block or with the date written following the signature.

4.12.1.4 White opaque correction fluids/tape may not be applied to records to correct mistakes.

4.12.1.5 Incorrect entries shall be drawn through with a single line with the initials of the author and the date of the correction immediately adjacent. Corrected entries will be placed above or immediately following the line through or otherwise entered on the document in a legible, understandable means.

4.12.1.6 Any entries or corrections to a document, other than in document control blocks, made after its date of inception, shall be considered a "late entry". Late entries will be clearly designated with the capital letters "LE", the initials of the person making the late entry, and the date the late entry is made.

4.12.1.7 Official original documents will be distinctly marked, as such.

4.13 DATA MANAGEMENT

4.13.1 Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically and data will not be stored only on one single media. Floppy disks, Zip disks, CDs or other means of storage will be used in addition to standard computer hard drives to assure data is not lost by the failure of any one device. Since conventional Document Control Practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records.

4.13.2 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and shall appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that documents registration number.

4.13.3 Changes, additions, late entries and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

4.13.4 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

4.13.5 Any document that is revised after any required distribution either off-site or to any electronic or hard copy file will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

4.13.6 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words "signature on file" shall be entered on the electronic copy, in the signature space, of all documents requiring signatures. The signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed and filed.

4.13.7 Logs maintained electronically may be updated as required for daily activities without going through the above revision process. Each day's log, however; will be saved electronically with the date included in the file name. Previous day's logs will not be deleted from the database and will serve as additional back up should the current days log be damaged or lost.

4.14 PHOTOGRAPHIC RECORDS

Photographs will be generated to document significant site activities and MEC. Photographic records will be used to supplement information recorded in the daily logs, to include photographs of equipment prior to use, and the condition of the site prior to any activity. Photographs will clearly show the task being accomplished and provide for a visual record of the operations. Operations will not be staged. Selected representative photographs will be included in the SSFR and all photos will be provided on digital media accompanying the SSFR.

4.15 LOGS AND REPORTS

Field activity logbooks will be maintained in ink. All personnel will use bound and numbered field logbooks with consecutively numbered pages. These logbooks are QA records and will be completed in accordance with this section of this QC Plan. These activity logbooks will become part of the SSFR; thus, it is imperative that they be completed clearly and legibly. Appropriate documentation will be maintained regarding the location and disposition of all MEC and munitions, range-related and cultural debris. Locations will be documented on a site map and entered in the Ordnance Accountability Log. Daily and Weekly Summary Reports will be prepared by the UXOQCS and forwarded via facsimile or email to the Project Manager on a timely basis.

4.16 DAILY ACTIVITY LOG

Daily Activity Logs will be maintained and will include the following:

- Date and recorder of field information.
- Start and end time of work activities including lunch and down time.
- Visitors.
- Weather conditions.
- Important telephone calls.
- Any deviations from planned activities.
- Equipment checks and calibrations.
- Equipment monitoring results, if applicable.
- QCI Performed.
- Nonconforming conditions.
- Lessons Learned.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.17 SAFETY LOG

Safety Logs will include the following:

- Date and recorder of log.
- Significant site events relating to safety.
- Accidents.
- Stop Work due to safety concerns.
- Lessons Learned.

- Safety Audits.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.18 TRAINING LOG

Training will be documented in the Training Log as follows:

- Date and recorder of log.
- Nature of training.
- Tailgate safety briefings (including time conducted, person conducting the briefing and attendees).
- Visitor Training (including names of visitors, description of training, and person performing training).
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.19 MEC IDENTIFICATION AND REPORTING

4.19.1 At least two UXO qualified personnel must be in agreement on the condition of a live or suspected live MEC item before any removal action is attempted. All available data sources will be consulted prior to this determination.

4.19.2 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all live/suspected MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #).
- Location.
- Nomenclature.
- Fuse Description.
- Fuse Condition.
- Additional comments, if required.

4.19.3 Each suspect UXO/MPPEH item encountered will be identified using a unique numerical identifier, such as A5–0001 (for first live/suspect item (0001) encountered in grid/area A5).

4.19.4 Photographs of live or suspect MEC items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the SSFR; thus, a focused, well thought out photograph is necessary.

4.19.5 MEC identification data will be entered into an electronic MEC Accountability Log daily. Terminology and definitions used when completing the MEC Accountability Log will be consistent with those given in the 21 April 2005 Memorandum from the Office of the assistant Secretary, Installation and Environment; Subject: Munitions Response Terminology. The UXOQCS will review this data to ensure accuracy and consistency in reporting. This review will include a comparison of photographs with recorded data. Any conflict or discrepancy will be discussed and resolved with the Team Leader. Signatures of the SUXOS and UXOQCS on the MEC Accountability Log indicate concurrence of the reported data.

4.20 LESSONS LEARNED

Lessons learned from day to day activities are an important part of the continuous improvement process. They can prove vital to prevent similar problems from occurring at other sites. Lessons learned from daily activities and from the occurrence of nonconforming conditions will be documented by the UXOQCS and UXOSO, as appropriate. Lessons learned as a result of nonconforming conditions are captured and documented on the QCIR as a result of its investigation and disposition. Other Lessons learned, from both positive and negative events will be documented in the Daily Activity Log and/or Safety Log. These items will be included in the SSFR. The QA/QC Manager will maintain a database of lessons learned for communication to other sites and for incorporation into training requirements.

4.21 TRAINING

4.21.1 The Project Manager will verify that all project personnel have completed the following training prior to their assignment:

- U.S. Naval Explosive Ordnance Disposal (EOD), Indian Head, Maryland / Eglin AFB, FL or EOD Assistance Course, Redstone Arsenal, AL / Eglin AFB, FL or other formal course of instruction meeting the requirements in DDESB TP 18 appropriate to the level of employment.
- OSHA 40 Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) in accordance with 29CFR1910.120 and 8 hour refreshers as need.
- UXOSO will have OSHA 30-hour Safety Course.
- Site Specific Training on this Work Plan and additional training, as needed, will be performed and documented on a QCIR, which will be forwarded to the Project Manager for review.
- Safety Meetings will also be documented.
- The UXOQCS will ensure that all personnel using geophysical detection equipment are properly trained to use that piece of equipment. This may include verification of past experience as well as on-site training on using specific equipment in site-specific conditions, which will be documented on a QCIR and forwarded to the Project Manager.
- If sweep personnel are employed they will receive site specific training related to the task that they will perform.

4.21.2 The UXOQCS will conduct, as necessary, site-specific training and/or review of known MEC to ensure that all site personnel are thoroughly familiar with the hazards and the general safety precautions and procedures required. All personnel and site visitors will also receive site-specific training and safety briefings, as required, to ensure safety on the project. Visitors must be briefed on all of the known or anticipated hazards of the site, required PPE to be worn while on the site, and site emergency procedures. Visitors will be escorted by a UXO qualified person whenever they enter the exclusion zone and all UXO operations will cease whenever a visitor is within the exclusion zone.

4.22 CHEMICAL QUALITY DATA MANAGEMENT (CQDM)

No Hazardous, Toxic and Radiological Waste (HTRW) or CWM is expected at this site per the PWS, therefore a CQDM sub-plan is not applicable.

4.23 QC DOCUMENTATION SUBMITTAL

All QC documentation required by this Work Plan will be submitted as part of or as supporting documentation for the SSFR.

4.24 QC RECORD RETENTION

All original QC Records and documentation will be maintained on-site and made available for government inspection upon request

5.0 CHAPTER 5 EXPLOSIVE MANAGEMENT PLAN

5.1 General

This plan details the management of explosives that may be required for the destruction or venting of live, suspected live, or inert UXO/MPPEH items at CRP. This plan was developed utilizing the guidelines specified in Federal Acquisition Regulation (FAR) 45.5, local and state laws and regulations, Alcohol Tobacco and Firearms Publication (ATFP) 5400.7, DA Pamphlet 385-64 and DOT regulations. Explosives used in the performance of this Task Order will be obtained by EOTI from commercial sources. These materials will be obtained and used for the specific purpose of disposal of live or suspect MEC and explosive venting of inert MEC items, if required, located during the MPPEH Removal activities at the CRP site. An RFD will be used with an electrical detonator system. A shock tube (pyrotechnic lead) initiator may be substituted for the electrical detonator depending upon availability from the supplier. Explosives will be delivered to the site in the quantities required on the day of planned demolition operations. All explosives delivered to the site will be consumed in the demolition operations on the same day they are delivered.

5.2 Licenses/permits

EOTI will maintain on site and, upon request, make available to any local, state, or federal authority a copy of all licenses/permits required authorizing EOTI to purchase, store, transport, or use explosives. If no other licenses or permits are required by the state, EOTI will maintain a copy of its Federal ATF license on-site.

5.3 Description and Quantities

Explosive materials used during the performance of the work on this project will be obtained from commercial sources. These explosive materials will be for the specific purpose of disposal of live or suspect UXO/MPPEH and explosive venting of inert items, if required, located during the removal action. A remote firing device with an electrical or nonelectrical (shock tube) firing system will be utilized. If a remote firing device is not available, a hard-wired electrical firing system may be used. Donor explosive materials will be delivered to the site and will be consumed in the demolition operations on the same day they are delivered.

Materials to be delivered to the site will include:

- 10 each Electric Blasting Caps (1.4B) or
- 10 each Nonelectric initiators (1.4B)
- 100 each Shaped Charge perforators, 32 gram (1.1.D)
- 1000 feet Detonation Cord, (1.1D) 50 each Cast Booster 1/2 lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed. Quantities may also vary due to minimum order quantities requirements (generally case lots).

Quantities of explosive materials required to conduct the day's operation will be ordered from the vendor, as required, and delivered to the site on the day they are required. MEC will be marked and guarded, if necessary (e.g. accessible to the public), until disposal is accomplished. EOTI estimates 2 ea. electric blasting caps (1.4B); and 2 ea. 32-gram perforators (1.1D) and/or 2 ea ½- pound cast booster

(1.1D) will be used during disposal or venting operations for a single item and detonation cord (1.1D) will be used to link perforators and/or cast boosters if multiple items are disposed of in a single demolition shot. Depending upon availability, shock tube (Non El) detonators may be used in place of electric detonators.

5.4 Acquisition Source

EOTI will obtain donor explosives from regional explosives vender or other licensed supplier, who agrees to supply and deliver the necessary quantities of demolition explosives.

5.5 List of Explosive Materials

As stated above, explosives that are expected to be used are:

- Electric Blasting Caps (1.4B) or
- Nonelectric initiators (1.4B)
- Shaped Charge perforators, 32 gram (1.1.D)
- Detonation Cord, (1.1D)
- Cast Booster ¾ lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed.

5.6 Initial Receipt Procedures

5.6.1 Upon receipt of donor materials from licensed explosive suppliers, an inventory will be conducted to ascertain:

- correct type
- serviceable condition
- correct quantity

5.6.2 A copy of the invoice(s) for the incoming donor materials will be kept in the on-site donor materials accountability file.

5.6.3 Upon receipt, a separate EOTI Memorandum will be prepared, with the following information, and retained on-site:

- Date of acquisition
- Name or brand name of manufacturer
- Manufacturer's marks of identification
- Quantity
- Description
- Name, address, and license number of the persons from whom the explosive materials are received

5.7 Procedures for Variances between quantities shipped and quantities received.

If any discrepancies of any kind should be found during the initial receipt inventory and inspection, the following procedures will be followed:

- If during the initial receipt inventory a discrepancy is found between the quantity listed on the invoice and the quantity being delivered, the quantity received will be annotated on the invoice and on the memorandum.
- The SUXOS will notify the supplier of the discrepancy before the explosives are accepted from the supplier's representative.
- The Project Manager will be notified telephonically, with a copy of the memorandum and a copy of the invoice being faxed as soon as possible.

5.8 Establishment of explosive storage facility

5.8.1 EOTI will not establish a storage facility for donor explosives at CRP. Donor explosive materials required for destruction or venting of MPPEH will be ordered from commercial suppliers and delivered to the site when needed for demolition operations. All donor explosive materials received will be used the same day or returned to the supplier.

5.8.2 MPPEH will not be stored. When discovered it will be inspected to determine if it is acceptable to move. If possible it will be consolidated for onsite detonation. If it is determined to be unacceptable to move, it will be blown in place. MPPEH will be guarded, as necessary to ensure the protection of the public (e.g. accessible to the public), until demolition operations are completed.

5.9 Physical security of explosive storage facility

5.9.1 EOTI does not plan to establish an explosives storage facility for this project. Explosives for disposal of MEC will be provided and delivered by a local vendor and delivered on an as-needed basis. While donor explosives are on site, EOTI will comply with all applicable regulations and requirements of ATF regulations, and USAESCH requirements for security of explosives.

5.10 Transportation

When transporting donor explosives within the project site to the disposal location:

- Vehicles used for transportation of explosive materials will not be loaded beyond their rated capacity and the explosive materials will be secured to prevent shifting of load or dislodgment from the vehicle; when explosive materials are transported by a vehicle with an open body, a magazine or closed container shall be securely mounted on the bed to contain the cargo.
- All vehicles transporting explosive materials shall display all placards, lettering, and/or numbering required by DOT and will have two each 10BC fire extinguishers on board.
- Explosive materials and blasting supplies shall not be transported with other materials or cargos. Blasting caps (including electric) shall not be transported in the vehicle or conveyance with other explosives unless the conditions of 49 CFR 177.835(g) are met (i.e., an IME-22 Container is used to transport the blasting caps).
- All vehicles used for transportation of explosive materials will be in the charge of and operated by a person who is physically fit, careful, reliable, able to read and understand safety instructions, and not under the influence of intoxicants or narcotics.
- Only the authorized driver and his or her helper will be permitted to ride on any conveyance transporting explosive materials or detonators.

- Explosives will not be exposed to sparking metal during transportation of materials and all electric wiring will be completely protected and securely fastened to prevent short circuits.
- Vehicles used to haul explosives will be properly inspected and an "Explosives Motor Vehicle Inspection Checklist" completed and kept on file.
- Vehicles transporting explosive materials will be operated with extreme care; full stops will be made at approaches to all railroad crossings and main highways and the vehicles shall not proceed until it is known that the way is clear.
- No vehicle will be refueled while explosive materials are on the motor vehicle except in an emergency.
- Persons employed in the transportation, handling, or other use of explosive materials will not smoke or carry on their persons or in the vehicle, matches, firearms, ammunition, or flame-producing devices.
- Vehicles transporting explosive materials will not be left unattended.

5.11 Requirements for vehicles transporting explosives to the removal site

All applicable requirements of DOT and ATF regulations that apply to transportation of explosives on the removal site will be enforced.

5.12 Receipt Procedures

5.12.1 Accountability

5.12.1.1 Upon receipt from the vendor, accountability will be established for each type of explosive material in accordance with Paragraph 5.6 above. Copies of vendor invoices will be kept with the receipt memoranda in the donor materials accountability file in the on-site project office.

5.12.1.2 Any transactions, which include receipt, issue, and/or turn-in of donor materials, will be conducted by two persons, at least one of whom will be a UXO Tech III or higher. Discrepancies will be resolved immediately. If it is determined that a theft or loss has occurred, the procedures in Section 5.14 will be followed.

5.12.1.3 All documents associated with receipt, transfer, issue, or turn –in of donor explosives will be maintained in the Donor Materials Accountability file in the on-site project office.

5.12.2 Designated Individuals

5.12.2.1 The following individuals are authorized to order and receive explosives from the supplier:

- Senior UXO Supervisor
- Site Safety and Health Officer

5.12.2.2 The following individuals are authorized to transport and use donor explosives:

- Senior UXO Supervisor
- Site Safety and Health Officer
- UXO Tech III
- UXO Tech II

5.12.3 Explosive Use Certification

5.12.3.1 At the conclusion of the intrusive activities at the CRP, the SUXOS will complete an EOTI Memorandum stating all donor explosives expended during MEC removal operations were used for their intended purpose. Any explosives remaining after a disposal operation will be disposed of in accordance with Section 5.16.

5.13 Inventory

EOTI will not store explosives on the site and therefore only the initial inventory, as described Section 5.6, will be required.

5.14 Procedures upon Discovery of Lost, Stolen, or Unauthorized Use of Explosives

Lost, stolen or unauthorized use of explosive materials will be reported as follows:

- The SUXOS will give an immediate telephonic notification to the Contracting Officer, followed up by a written report within 24 hours
- Notify the Bureau of Alcohol, Tobacco, and Firearms (ATF) at 800-800-3855, within 24 hours of discovery (complete ATF Form 5400.5, Report of Theft or Loss - Explosive Materials and mail to nearest ATF office. Instructions for completion of the form are on the reverse side.);
- Notify the local law enforcement agency.

5.15 Returning Explosives to the Explosive Storage Area

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16 Disposal of Unused Explosive Materials

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16.1 Perform an economic analysis for different alternatives

Since this is a firm fixed price (FFP) task, this requirement does not apply.

6.0 CHAPTER 6 ENVIRONMENTAL PROTECTION PLAN

This chapter of the Work Plan describes environmental concerns and describes methods used during site activities designed to minimize pollution, protect and preserve natural resources, restore damage, and control noise and dust within reasonable limits.

6.1 Identification of Environmental Concerns

6.1.1 Endangered / Threatened Species within the Project Site

There are no known endangered species within the project boundaries and planned activities are not expected to have any potential negative impact on protected species or their environment. There are one endangered animal species and three threatened plant species known to occur in Richland County, South Carolina. The Red-cockaded Woodpecker is the endangered species listed in Richland County. The Smooth Coneflower, Rough-leaved Loosestrife, and Canby's Dropwort are known to occur in Richland County. The Red cockaded wood pecker and the three plans species are not found within the project area. A description of each species is provided below.

6.1.1.1 Red-cockaded Woodpecker (*Picoides borealis*)

http://www.fws.gov/rcwrecovery/ - Photo by Michael McCloy

Red-cockaded woodpeckers are relatively small; adults measure 20 to 23 cm (7.8 to 9 inches) and weigh 40 to 55 g (1.4 to 1.9 ounces). Red-cockaded woodpeckers are relatively slender, long-tailed and small-billed woodpeckers. They are black and white with a coarsely barred back, white cheek patch and black crown. Their breasts and bellies are white to grayish-white with spots on the sides changing to bars on the flanks. Outer tail feathers are white with black barring and central tail feathers are black. Adult plumage is extremely similar between sexes and generally indistinguishable in the field. The only difference between adult males and females is the presence of the red cockade at the upper edge of the white auriculars, which is virtually invisible in field situations.

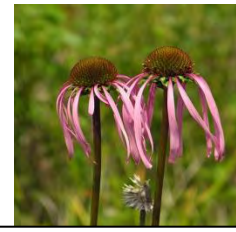
Juveniles appear similar to adults but may be distinguished in the field by duller plumage, white flecks often present just above the bill on the forehead and diffuse black shading in the white cheek patch. Juvenile males have a distinctive red patch on the crown and may be distinguished from juvenile females in this way.

6.1.1.2 Rough-leaved Loosestrife (*Lysimachia asperulifolia*)

http://upload.wikimedia.org/wikipedia/commons/thumb/1/1b/Lysimachia_asperulifolia.jpg/431px-

The Rough-leaved Loosestrife is a rhizomatous perennial herb growing erect to a maximum height around 60 to 70 centimeters. The lower stem is pinkish in color and ribbed, and the upper stem is yellowish and lacks ribs. The stem in the inflorescence is covered in reddish glands. The leaves are green, lance-shaped, and up to 5 centimeters long by 2 wide. They are borne in whorls of three or four around the stem, or sometimes in opposite pairs. The leaves are not rough in texture as the common name would suggest. Smaller, tougher, brown-colored leaves are opposite or borne in whorls of up to 7 near the stem base. The top of the stem is occupied by the inflorescence, which is a raceme of star-shaped yellow flowers interspersed with leaf-like green bracts. Each flower has 4 to 7, but usually five, yellow petals with wide bases and pointed, ragged tips. The petals and green sepals are dotted with red glands and streaked with reddish resin canals. The fruit is a red-mottled straw-colored capsule a few millimeters in length.

6.1.1.3 Smooth Coneflower (*Echinacea laevigata)*



http://www.carolinanature.com/plants/echinacealaevigata.html -Photo By Will Cook

The Smooth Coneflower, is an Endangered Species Act federally listed endangered species of plant found in the piedmont of the southeastern United States. Most populations are found on roadsides and other open areas with plenty of sunlight, often on calcium- and magnesium-rich soils. The Smooth Coneflower grows up to about 1.5 meters in height with a mostly naked, smooth, leafless stem. Any leaves are roughly lance-shaped. On top of the stem is a flower head containing narrow pink or purplish ray florets up to 8 centimeters long. The florets droop away from the center of the head. The small, tubular disc florets in the center are dark purple in color. Blooming occurs in May through July.

6.1.1.4 Canby's Dropwort (*Oxypolis canbyi*)

http://www.fws.gov/raleigh/media/tn_canbys_dropwort.jpg - *Photo By Dale Suiter*

Canby's dropwort belongs to the mint family (Apiaceae). It is a perennial herb which grows from 80 to 120 cm (30 to 50 in) tall. The "quill-like" hollow leaves and the thick, corky wings that extend out from the margins of the fruit are the most distinctive features of the plant. The stems are erect or ascending, round, and slender with arching/ascending or forking branches above the mid-stem. The flowers are monoecious or dioecious (flowers have either male or female parts or both) and small and white, sometimes tinged with red or pink. The flowers are borne on compound umbrella-like structures that extend from the base of the leaves, and the fruit is a schizocarp (fruit splits into one-seeded segments) about 4-6 mm long. The plant inhabits a variety of coastal plain communities, including pond cypress savannahs, the shallows and edges of cypress/pond pine ponds, sloughs, and wet pine savannas.

6.1.2 Wetlands within the Project Site

There are no known wetlands within the project site.

6.1.3 Cultural, Archaeological, and Water Resources within the Project Site

There are no known cultural, archaeological, or water resources within the project site that will be impacted by planned activities.

6.1.4 Coastal Zones within the Project Site

The project site is located on the Congaree River but not within a coastal zone and no impacts from UXO clearance activities will impact the project area.

6.1.5 Trees and Shrubs that will be removed within the Project Site

The vegetation clearance requirements for this project are minimal and generally limited clearance of small shrubs. Planned activities will have minimal impact on vegetation. EOTI will not cut trees that are six inches or more in diameter at a distance of 1 foot above ground level.

6.2 Mitigation Procedures

6.2.1 Manifesting, transportation, and Disposal of Waste

EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

6.2.2 Burning Activities

EOTI will not conduct burning activities during the performance of work required in the PWS.

6.2.3 Dust and Emission Control

6.2.3.1 None of the planned activities are expected to generate significant dust. Excavation operations using mechanical equipment may generate small quantities of nuisance dust. The SUXOS, UXOSO/QCS, and Team Leader will closely monitor dust emissions resulting from soil excavation operation. Dust masks will be available to workers in areas of high dust concentrations.

6.2.3.2 Other emissions will primarily result from operation of diesel engines associated with excavation equipment. These emissions will be limited by limiting the time that equipment idles when not in use. Team leaders will ensure that equipment is turned off when not in use. If excessive emissions are generated due to engine maintenance, equipment will be shut down until inspected by a mechanic.

6.2.4 Spill Control and Prevention

6.2.4.1 EOTI will inspect vehicles and heavy equipment before, during and after operation to identify any leaks of petroleum, oil and lubricants (POL). If leaks are detected, the equipment will not be used until the leak is controlled. Drip pans will be used to catch dripping POL.

6.2.4.2 POL will be stored on-site in approved containers, in approved areas with required containment. If a spill occurs it will be reported immediately. Immediate steps will be taken to contain the spill and limit contamination. Contaminated soil will be excavated and packaged for treatment or disposal.

6.2.5 Storage Areas and Temporary Facilities

6.2.5.1 EOTI may place chemical toilets on the site. These toilets will be delivered, setup and serviced by a subcontractor.

6.2.6 Access Routes

EOTI will primarily use existing roads and trails to access the work areas. These routes will allow access by foot or light vehicle to areas requiring MEC clearance. Any additional temporary access routes required to access portion of the clearance areas will be cleared of MEC / MPPEH, but will otherwise be unimproved.

6.2.7 Trees and Shrubs Protection and Restoration

EOTI will not cut trees larger than six inches in diameter measured at a distance of one foot from the ground surface and anticipates only minimal clearance of shrubs.

6.2.8 Control of Water Run-on and Run-off

EOTI does not anticipate extensive excavations that would require run-on or run-off controls.

6.2.9 Decontamination and Disposal of Equipment

Soil will be thoroughly cleaned from equipment and tools at the end of the project. Tools and equipment will be cleaned by brushing, sweeping and/or wiping dirt from them. Equipment may be further cleaned at established wash facilities.

6.2.10 Minimizing Areas of Disturbance

EOTI will minimize the areas of disturbance by working only in the areas designated in the PWS and marked by the surveyor. EOTI will limit vegetation removal and excavation to what is necessary to complete the work.

6.3 Post-activity Clean-up

After completing the project, EOTI will cleanup and restore the site to a condition as close to its original condition as possible. All equipment, tools and material will be removed from the site. EOTI will police the site to remove all trash, debris and other waste from the work site. The SUXOS will inspect the area to ensure that area is clean prior to demobilization.

6.4 Air-monitoring Plan

There is no RCWM expected at this site and no anticipated, significant exposure to other chemicals, and therefore air monitoring will be limited. The only significant air contaminant anticipated to be associated with this project is minimal dust generated as a result of excavation operations. If dust levels become a nuisance or hazard to workers, water may be used as an engineering control to lower the dust levels. Dust masks will be worn, as required to further reduce exposure to dust.

7.0 CHAPTER 7 PROPERTY MANAGEMENT PLAN

This Chapter does not apply to the work planned by EOTI.
No Government Furnished Equipment is to be used on this project.

8.0 CHAPTER 8 INERIM HOLDING FACILITY SITING PLAN FOR RCWM PROJECTS

This Chapter does not apply to the work planned by EOTI.

RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Interim Holding Facility for RCWM is required in the PWS.

9.0 CHAPTER 9 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

This Chapter does not apply to this Task Order.
RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Physical Security Plan for RCWM is required in the PWS.

10.0 CHAPTER 10 -- REFERENCES

Alcohol Tobacco Firearms (ATF), Publication 5400.7, Federal Explosives Laws
Department of Defense Explosives Safety Board (DDESB), TP-16, Methods for Calculating Primary Fragment Characteristic
DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel
Department of Defense (DOD), 4160.21-M-1, Defense Demilitarization Manual
EOTI Corporate Quality Plan
EOTI Corporate Safety Plan
ERsys.com, http://www.ersys.com/usa/45/4516000/wtr_norm.htm ; Climate Weather Norm Charts for Columbia, SC
National Fire Protection Association, NFPA 780, Standard for the Installation of Lightning Protection Systems
U.S. Army Corps of Engineers (USACE), Congaree River Basin Navigability Study, 1977.
U.S. Army Engineering Support Center Huntsville (USAESCH) OE-CX Interim Guidance 02-03
U.S. Army, AR 385-64 Explosives Safety Program
U.S. Army, TM 60-Series Training Manuals
USACE, EM 1110-1-4009, Ordnance and Explosives Response
USACE, EM 385-1-1, USACE Safety and Health Requirements Manual
USACE, EM 385-1-97, Explosive Safety and Health Requirements Manual
USACE, EP 1110-1-18, Ordnance and Explosives Response
USACE, EP 75-1-2, MEC Support During Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities
USACE, ER 1110-1-12, Quality Management
USACE, Worldwide Environmental Remediation Services (WERS), Data Item Descriptions (DIDs)
USAESCH, OE-CX Interim Guidance 08-01

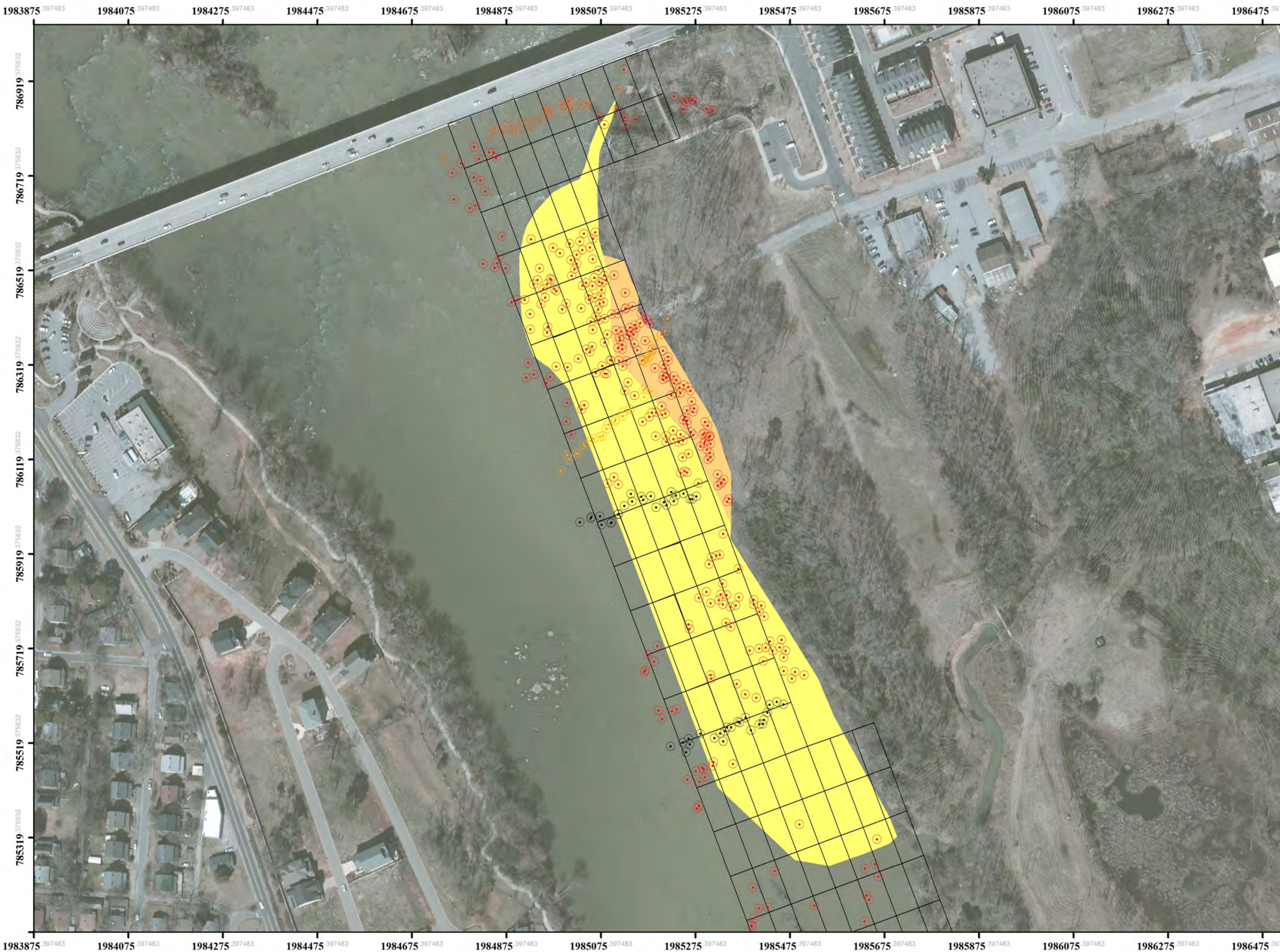
APPENDIX A
TASK ORDER SCOPE OF WORK

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

This contract is not under a USACE Task Order. The SOW will be attached at a later date.

APPENDIX B
MAPS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC



Legend

Previous Investigation Anomalies

- Geological Feature
- Pipeline
- Pipeline Associated
- Electromagnetic Anomaly
- Possible Ordnance
- Previous Investigation Grids
- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 100, 200, 400
Meters: 0, 30, 60, 120

Site Location

FIGURE B-2
PREVIOUS INVESTIGATION RESULTS

Columbia, SC

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 4/2/2014	FILE TLM Area.mxd	
PAGE # 2	SCALE 1 inch = 200 feet	

Legend

- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 175, 350, 700

Meters: 0, 60, 120, 240

Site Location

FIGURE B-1
SITE LOCATION

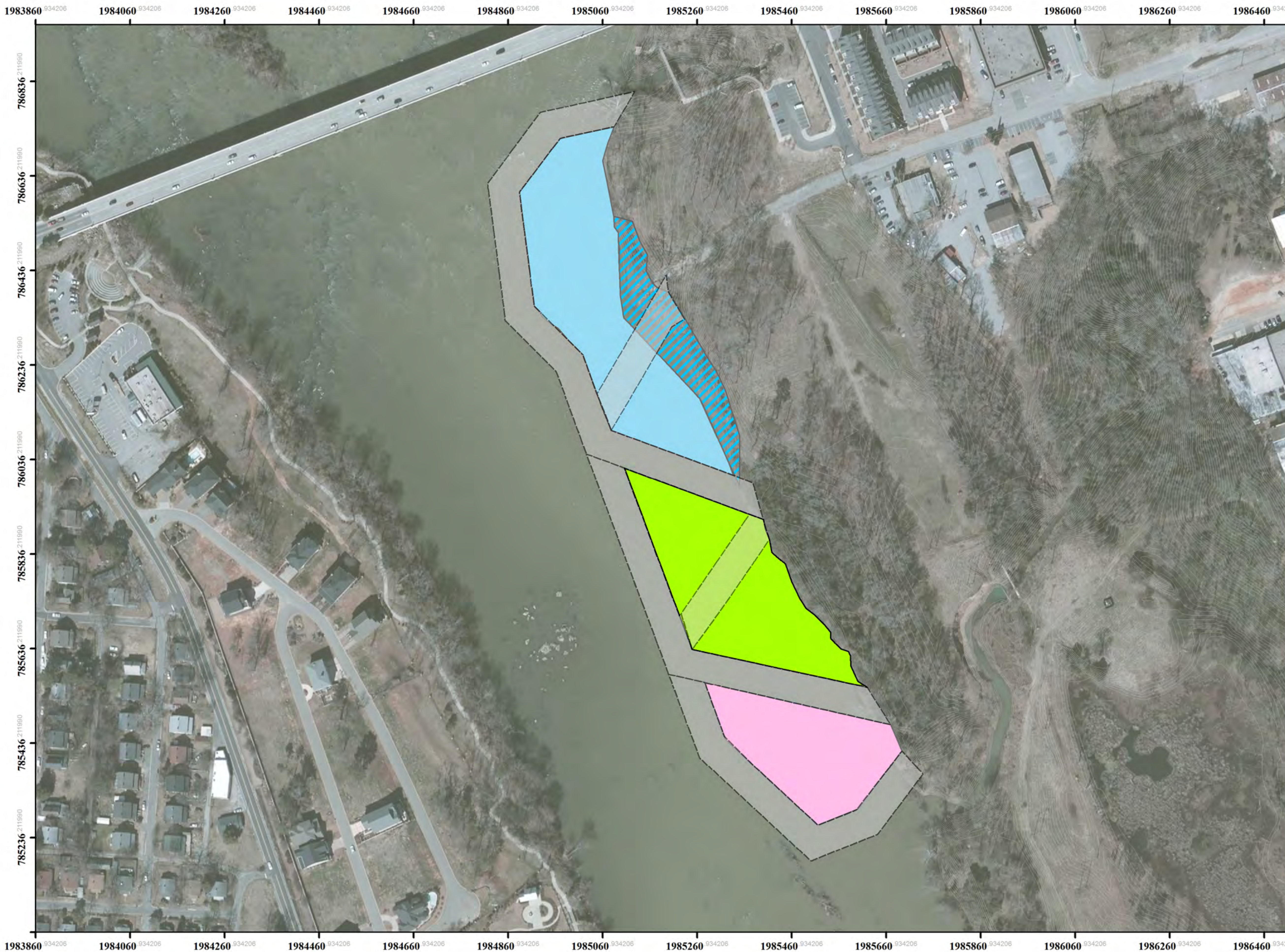
Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE Site locaiton.mxd	
PAGE # B-1	SCALE 1 inch = 350 feet	



Legend

Approximate Cofferdam Location

Phase

Phase 1 - Year 1

Phase 2 - Year 2

Phase 3 - Year 3

Approximate Demonstration Project Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 100, 200, 400

Meters: 0, 30, 60, 120

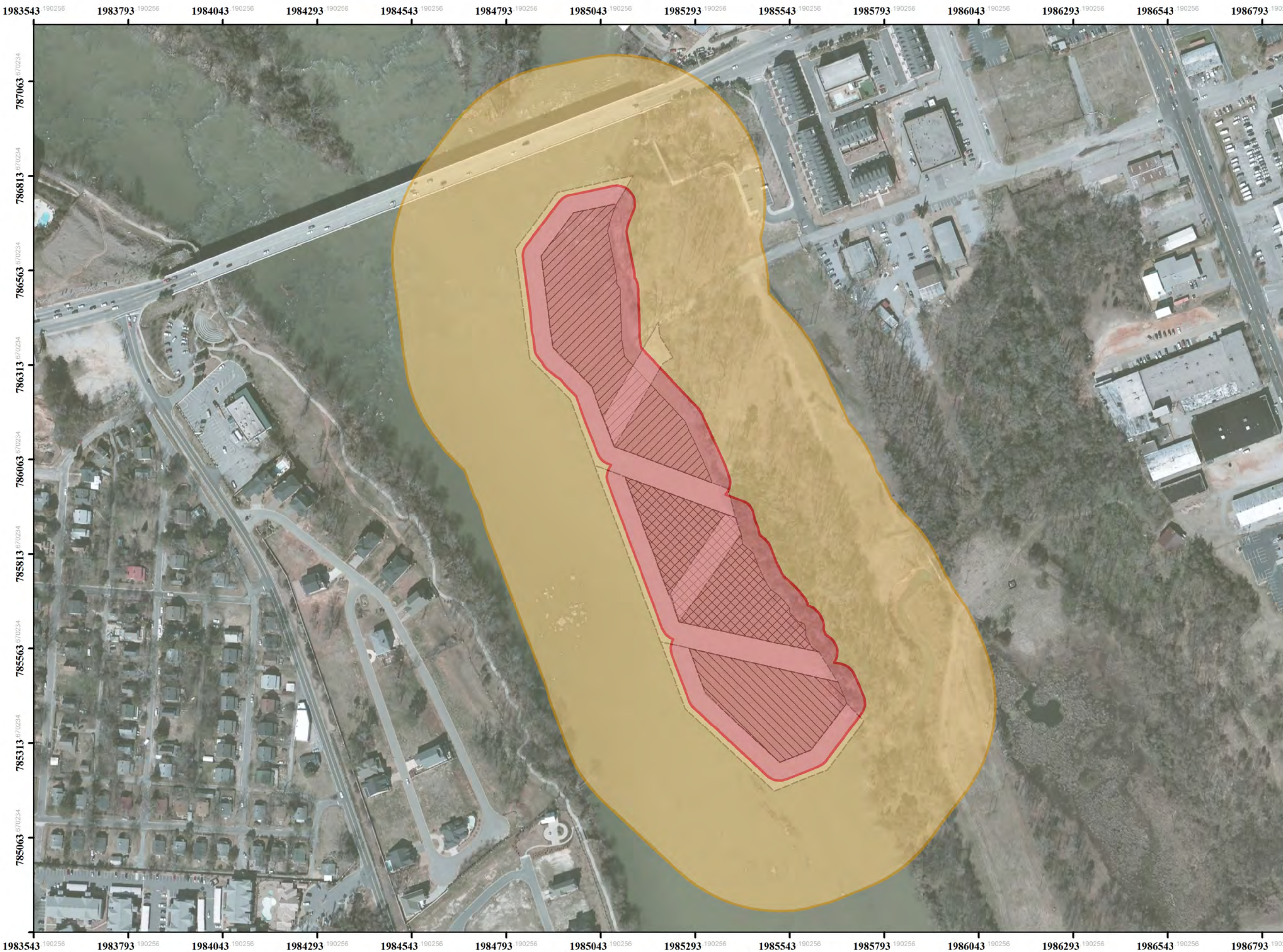
Site Location

FIGURE B-3
CLEARANCE AREAS

Columbia, SC

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE Project Area.mxd	
PAGE # B-3	SCALE 1 inch = 200 feet	



Legend

Team Seperation Distance / Unintentional Detination 48 ft

Intentional Detination 393 ft

Approximate Cofferdam Location

Clearance Phase

Phase 1 - Year 1

Phase 2 - Year 2

Phase 3 - Year 3

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 125, 250, 500

Meters: 0, 37.5, 75, 150

Site Location

FIGURE B-4
INTENTIONAL AND UNINTENTIONAL DETONATION DISTANCES

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE Project Area.mxd	
PAGE # B-3	SCALE 1 inch = 250 feet	

APPENDIX C
POINTS OF CONTACT

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

Emergency Response / Services			
Ambulance Service			911
Emergency Medical Response			911
Police*			911
Police Department – Non emergency			803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203			803-434-7000 * For Emergency Dial 911
Fire Department*			911
Fire Department – Non Emergency			803-545-3700
National Poison Control Center			800-222-1222
CHEMTREC (hazardous materials response)			800-424-9300
National Response Team (hazardous materials response)			800-424-8802
Centers for Disease Control (CDC) **http://www.cdc.gov/health/diseases**			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Brian Woods, P.G., PMP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	TBD	TBD	TBD

APPENDIX D
ACCIDENT PREVENTION PLAN

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

TABLE OF CONTENTS

Section **Page #**

APP APPROVAL

Project: Surface/Subsurface Clearance   Site: Congaree River Project

Contract Number: 875001   Site Location: Columbia, SC

We have reviewed the attached Accident Prevention Plan (APP) for the referenced site. We recognize that when this form is completed, the attached APP is approved for field activities on the referenced site. Changes to this APP will be documented in writing.

David A. Farmer   June 20, 2014

Prepared by: Date
David A. Farmer
Corporate MEC Safety and Health Coordinator
Explosive Ordnance Technologies, Inc.
(865) 220-8668

Robert J. Goodman   June 20, 2014

Prepared by: Date
Robert J. Goodman, CIH, CSP
Certified Industrial Hygiene Consultant
EnSafe, Inc.
(513)-621-7233

Wayne Lewallen   June 20, 2014

Reviewed by: Date
Wayne Lewallen
Program Manager
Explosive Ordnance Technologies, Inc.
(865) 220-8668

Reviewed by: ________________   Date __________

Reviewed by: ________________   Date __________

Reviewed by: ________________   Date __________

1.0 BACKGROUND INFORMATION

Contractor: Explosive Ordnance Technologies, Inc.

Contract Number: 875001

Project Name: MEC Clearance and Support
Congaree River Project
Columbia, South Carolina

2.0 PROJECT DESCRIPTION AND HISTORY

Explosive Ordnance Technologies, Inc. (EOTI) is to provide all Munitions Response (MR) services necessary to remove Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris from approximately 13 acres of at Congaree River Project (CRP), Columbia, SC.

Site Location: The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure B-1-Site Location**.

Site history: In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with UXO potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. **Figure B-2-Previous Investigation Results** shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the

South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former MGP located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking, and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with SC DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of TLM and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of Munitions and Explosives of Concern (MEC) from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment. The MEC clearance area is shown on **Figure B-3-Clearance Area.**

2.1 Chemical Warfare Material

The site is not suspected of containing Chemical Warfare Material (CWM). However, if a suspected Recovered Chemical Warfare Material (RCWM) is encountered during removal and / or support activities, the procedures listed below will be followed:

> Upon an unexpected discovery of RCWM, all work will immediately cease. Project personnel will withdraw along a cleared path upwind from the discovery. A team, consisting of a minimum of two personnel, will secure the area to prevent unauthorized access. Personnel must position themselves as far upwind as possible while still maintaining visual security of the area. Upon evacuation, the Senior Unexploded Ordnance Supervisor/Unexploded Ordnance Safety Officer (SUXOS)/(UXOSO) will account for all work site personnel and immediately notify the United States Army Corps of Engineers (USACE) Ordnance and Explosive Safety Specialist (OESS) with detailed information regarding the suspected RCWM and assist, if requested, in making notifications in accordance with (IAW) CEMP-CE Memorandum, Notification Procedures for Discovery of RCWM during USACE Projects. At a minimum, the SUXOS will notify the EOTI project manager (PM) who will, in turn, notify the responsible Contracting Officer. Security will be maintained on the item until relieved by a military EOD unit or Technical Escort Unit.

Once RCWM item has been removed and site plans updated according to the additional site hazards encountered, work may continue.

2.2 Hazardous Chemical Contamination

By definition, hazardous substances are those materials that can threaten human health and/or environmental well being if released into the environment. This describes those hazardous substances or chemical contaminants present in soil or air that pose a threat to the environment, and as such may pose a threat to site personnel and the public during removal actions. From what is currently known about the site and its past, chemical contamination is not expected to be a problem at this site. However, it is prudent to be particularly aware of unusual smells, soils stains, or the presence of drums/containers that might indicate hazardous materials may be present. If there is reason to believe that a chemical hazard exists, the SUXOS/UXOSO will stop work and report to the Corporate Health and Safety Staff as much information as is known (i.e., names of chemicals if containers have labels, condition of containers, extent of problem, etc.) and plans will be updated to accommodate these additional site hazards prior to resuming work on the site.

2.3 Improved Conventional Munitions.

The site is not suspected to contain Improved Conventional Munitions (ICM). If suspect ICM munitions that are not determined to be practice munitions are encountered during any phase of site activities, EOTI will immediately withdraw from the work area, secure the site, and contact the USACE Safety Office for assistance and guidance.

3.0 ACCIDENT EXPERIENCE

EOTI has an excellent safety record. Since its inception in 1997, EOTI has never had a lost time accident / injury. EOTI's current Experience Modification Rate is 0.969. EOTI's lost time injury rate is 0.

4.0 PHASES OF WORK REQUIRING HAZARD ANALYSIS

The following phases of work on this project require an Activity Hazard Analysis:

- Site-Setup/Layout
- Surface Preparation / Vegetation Removal
- Subsurface Clearance using "Mag & Dig" Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Activity Hazard Analyses can be found in this Accident Prevention Plan (APP) at Section 14.0 of this Appendix.

5.0 STATEMENT OF SAFETY AND HEALTH POLICY

The EOTI Safety Policy is the first page in the Corporate Health and Safety Program, and sets the tone for all safety efforts. It is signed by Maureen McIntyre, President EOTI.

EOTI strongly believes that our people are our most important and valuable asset. It is the actions of our personnel, working together as a team, which ultimately determines the success of our endeavors as a company.

Accidental injuries and illnesses can cause needless pain and suffering of employees and their families, as well as increasing costs and decreasing productivity and morale among employees. EOTI is committed to providing a safe and healthful work environment for all of our employees in all locations. The company's goal is an accident-free work environment. The management of EOTI is committed to doing all in our power to make this a reality.

The management staff alone cannot accomplish a goal of this magnitude. It is only with the entire organization working together as a team that we can hope to achieve this level of performance. It is up to each of us to follow applicable safety requirements and procedures while performing our job functions.

A truly successful safety program involves more than simply following procedures. It involves active participation by all employees constantly striving to make improvements. No person knows any job better than the person doing that job. No person knows the condition of the equipment, potential problems with the procedures, and the work environment of a job better than the person doing that job. It is up to all of us to be constantly observant of changes in our own work environment, and to bring any potentially harmful conditions to the attention of management as soon as possible. It is the responsibility of the management staff to promptly and effectively respond to employee concerns for their safety and health.

In addressing potential safety and health problems as soon as they are observed, we prevent these situations from developing into accidents. Keeping open lines of communication at all levels within EOTI will foster an increased understanding of the safety and health issues that face us all.

6.0 RESPONSIBILITIES AND LINES OF AUTHORITY

6.1 Identification and Accountability

The following personnel and their safety related responsibilities for this project work are listed.

President (Wayne Lewallen) is responsible for enforcement of the Corporate Safety and Health Program at all worksites within his area of responsibility. He must assure that personnel receive the required training, medical surveillance, and personal protective equipment necessary in order to perform their jobs in a safe and effective manner. The enforcement of the Corporate Safety and Health Program on the worksites will be a critical rating element for site personnel and managers.

Corporate Safety and Health Management Consultant (Robert J. Goodman) is a CIH and CSP. He assists in the development, implementation, and maintenance of the Safety Program and individual Site Safety and Health Plans (SSHPs). He visits projects as requested to ensure the effectiveness of the Health and Safety Program. He remains available for project emergencies. He develops or reviews modifications to SSHPs as needed. He evaluates occupational exposure monitoring / air sampling data and adjusts SSHP requirements as necessary. He serves as a QC staff member and approves the APP/SSHP by signature.

Corporate MEC Health and Safety Coordinator (Dave Farmer) meets all the requirements of a UXOSO, Unexploded Quality Control Specialist (UXOQCS), and SUXOS and is responsible for creating, updating, and managing the Corporate Safety and Health Program, as well as APP/SSHP for individual worksites under the direction of the Corporate Safety and Health Manager. He coordinates directly with the PM and the SUXOS/UXOSO routinely to answer technical questions and to provide assistance to the worksites. He also provides safety training, as needed, and performs safety and health program inspections with the Safety and Health Manager to assure compliance with EOTI safety and health policy.

Project Manager (Brian Woods) directly impacts the safety of the site by setting the tone for the job and encouraging safe performance among all team members. Any areas of concern or questions regarding safety and health issues are coordinated with the Corporate Health and Safety Staff, Corporate MEC Safety and Health Coordinator, and the UXOSO. In instances of noncompliance with safety requirements, the PM issues warnings and/or provides disciplinary action up to and including removal of the employee from site operations, should this action be warranted. The PM assures that every accident on the work site is investigated in order to determine the root cause(s), the accident report is filled out, and takes steps necessary to prevent recurrences.

Senior UXO Supervisor (SUXOS) is responsible for the successful accomplishment of the work on the project site. He directly supervises all site work and personnel and assures they are operating in a safe manner. He assures that all personnel, including visitors, are properly trained, qualified, equipped, and protected from the hazards associated with the worksite and site operations. The SUXOS reports directly to the Project Staff on all project issues. The SUXOS has stop work authority. The SUXOS has numerous onsite responsibilities including, but not limited to:

- Coordinating with all applicable emergency response agencies to ensure appropriate response should an emergency develop on site;
- Establish medical evacuation routes and emergency telephone number listing;
- Inventory first aid equipment, personal protective equipment (PPE), fire extinguishers and purchase replacements, as required, with concurrence from the PM;

- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;
- Designate site control zones;
- Provide visitor briefing and training; and

UXO Safety Officer (UXOSO)
He is granted the authority to administer the safety and health program on the worksite. The UXOSO reports directly to the Vice President of MEC Operations on all project safety and health issues. He coordinates with the Corporate MEC Safety and Health Coordinator for technical assistance on safety and health issues at the worksite, for assistance in ordering safety equipment, medical surveillance program issues, etc. The UXOSO has stop work authority whenever an imminent danger situation is observed. The UXOSO has numerous onsite responsibilities to support the SUXOS in maintaining a safe work environment. These responsibilities may include, but are not limited to:

- Inventory first aid equipment, PPE, fire extinguishers and purchase replacements, as required, with concurrence from the SUXOS and PM;
- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;
- Provide visitor briefing and training;
- Perform onsite monitoring, if required;
- Perform daily safety inspections of site activities to verify compliance with all safety and health requirements in this project APP/SSHP, as well as the Corporate Safety and Health Program and recording any deficiencies in the Safety Log; and
- Coordination of corrective actions for any deficiencies noted during safety inspections.
- Perform onsite monitoring, if required;

Team Members are responsible for performing their assigned tasks in a safe and effective manner. Questions must be immediately brought to the attention of their supervisor. Team members must not attempt to perform an assigned task for which they have not been properly trained. All personnel must attend required safety training and be aware of the operations going on around them at the work site. Any situations or conditions, which may affect the safety and health of any team member, must be immediately reported to their supervisor. Before, during, and after use, personnel must inspect each piece of personal protective equipment, as well as other tools and equipment, to assure it is in a safe operating condition. Any equipment that is deemed unsafe for use must be immediately turned in for repair or replacement. Personnel must know how to properly use all equipment assigned to them and must use required personal protective equipment at all times.

The minimum qualifications for on-site UXO personnel are as follows:

The SUXOS, UXOSO, UXOQCS**,** UXO Supervisors and UXO Technicians must be graduates of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, the U.S. Naval School, Explosive Ordnance Disposal (EOD), or approved UXO School. All personnel will meet or exceed the standards established by the Department of Defense Explosives Safety Board (DDESB) in DDESB TP 18.

The SUXOS must have at least 10 years combined MEC/ military EOD experience, which shall include 5 years in supervisory positions, which may be a combination of active duty military EOD functions and/or civilian MEC time. A SUXOS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III.

All UXO Supervisors (Tech III) shall have at least 8 years combined MEC/ military EOD experience. The UXO Technician III must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, and II.

The UXOSO and UXOQCS will have at least 8 years combined active duty military EOD and contractor UXO experience and documented Safety or Quality Control training. The UXOSO must have successfully completed an approved Occupational Safety and Health Administration (OSHA) 30-Hour Safety Training program.

The UXOSO and the UXOQCS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III. These individuals must have documented experience supervising UXO removal operations and personnel.

A UXO Technician II be a graduate of military EOD school of the United States or other approved nation and must have prior military EOD experience or be a graduate of an approved course of instruction as defined in TP 18 and have a minimum of 3 years experience in the UXO field. All UXO Technician II's must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I.

Any other team member(s) must be at least OSHA 40-Hour Hazardous Waste Site Trained, have received Site Specific Hazard and Ordnance Recognition Training. UXO Technician I's must also be graduates of an appropriate recognized training course and meet all requirements in DDESB TP 18. Copies of training records, including training required by 29 Code of Federal Regulations (CFR) 1910.120, will be available at the project site office.

6.2 Lines of Authority

The ultimate authority for enforcing health and safety requirements is the Vice President/UXO Program Manager. He reports directly to the President of EOTI, and he makes all decisions regarding UXO operations. The Project Manager and the Corporate Health and Safety Staff report directly to the Vice President/UXO Program Manager.

The Project Manager is responsible for all aspects of running the project, including the safety and health of employees and the general public. The SUXOS reports directly to him on all project and safety and health issues. If there are questions, he consults with the Corporate Health and Safety Staff for resolution of areas of concern. He reports directly to the Vice President/UXO Program Manager.

The Corporate Health and Safety Manager provides consultation and advice on health and safety issues to the UXOSO, MEC Safety and Health Coordinator, the Project Manager, and the Vice President/UXO Program Manager. He reports directly to the President/UXO Program Manager.

The UXOSO directly manages the health and safety issues on the site. He coordinates with client site personnel and visitors to the site regarding health and safety issues. If there are questions on safety and health policy or procedures, he consults with the Corporate Health and Safety Staff. He reports directly to the Project Manager.

6.3 SUBCONTRACTORS AND SUPPLIERS

Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a local surveying company to provide survey support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included AAP. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone (EZ) while intrusive operations are ongoing.

Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and AAP. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Supplies will not be permitted to enter the EZ of the project site unless escorted by an EOTI UXO-qualified employee.

Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site are responsible for receiving a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any EZ area without a UXO-qualified escort. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS/UXOSO for investigation.

7.0 TRAINING

Prior to commencement of site activities, the UXOSO will ensure that all employees engaged in hazardous waste operations are informed of the nature and degree of exposure to chemical and physical hazards that are likely to result from participation in site operations. EOTI will accomplish this by ensuring that all personnel entering the site have received the appropriate OSHA and site-specific training, prior to participation in site activities. The other employees working on the site in other capacities not involving hazardous waste operations will receive training on the hazards of the MEC operations on site and on MEC recognition and avoidance procedures, as well as emergency procedures. This training will be held at the time of site mobilization and will be reinforced during the daily safety briefings, to which all site workers (including subcontractor personnel) will be required to attend.

Safety Indoctrination Subjects

Safety indoctrination training will be presented by the UXOSO to all EOTI employees, as well as to subcontractor personnel who will be working on this project site. This is part of on the job training

(OJT), which includes classroom type instruction on the topics specified for site-specific training and on site participation in the following:

- Details of the APP/SSHP;
- Employee rights and responsibilities;
- Safe work practices;
- Nature and extent of anticipated chemical, biological and physical hazards;
- Measures and procedures implemented for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Safe operation of heavy excavation equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

If personnel who are not UXO-qualified come on the site, a UXO recognition and awareness training will also be presented. While there is a UXO hazard on the site, personnel will have a UXO-qualified employee escorting them. Once an area is cleared of surface UXO, these employees will be permitted to enter the area without escort as long as no intrusive operations are performed. The UXO recognition and awareness training provides an additional level of protection to these workers so that if they see something that could be ordnance related, they will know enough not to touch it and to immediately get a UXO-qualified employee to examine the item.

7.1 Initial Training

Initial site-specific training will include proper procedures to evacuate the work site. It will also provide a description of the basic characteristics, deployment and functioning of the following ordnance:

- Rockets/missiles
- Projectiles
- Bombs
- Grenades
- Small Arms

All EOTI and subcontractor employees who are involved in hazardous waste site activities receive 40 hours of OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120 (General Industry) and 29 CFR 1926.65 (Construction). If it has been more than a year since any worker has received the 40 Hour OSHA HAZWOPER training, he or she must also have a current HAZWOPER 8-Hour Refresher Training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 prior to working on the site. All production workers will also receive site-specific OJT under the direct supervision of a trained/experienced supervisor when they mobilize at the site.

7.2 Mandatory Training and Certifications Applicable to This Project

The following training and certifications are required for work on this project:

- EOD School Certificates (UXO-qualified personnel only)
- OSHA HAZWOPER 40 Hour Training

- OSHA HAZWOPER 8 Hour Refresher Training (as applicable)
- OSHA HAZWOPER Supervisor Training (Supervisors only)
- OSHA 30 Hour Safety Course (UXOSO)
- Valid vehicle operator license (All vehicle operators)
- Heavy Equipment Operator Training (Heavy Equipment Operators only)

7.3 Supervisory Training

On-site managers and supervisors, who are responsible for directing others, will receive the same training as the general site workers for whom they are responsible. They will also receive an additional 8 hours of OSHA required supervisory training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 to enhance their ability to provide guidance and make informed decisions. This additional training includes the following:

- Review of the EOTI Corporate Safety and Health Program;
- Regulatory requirements;
- Management of hazardous waste site cleanup operations;
- Management of site work zones;
- How to communicate with the media and the public;
- PPE selection and limitations;
- Spill containment; and
- Monitoring site hazards.

The UXOSO, with specific responsibilities for safety and health guidance on site, will receive the training provided to general site workers and their supervisors. He also will receive advanced training in safety and health issues, policies and techniques. The UXOSO will have completed an OSHA-approved 30-hour Construction Safety Class.

7.4 Project-Specific Training

The SUXOS and UXOSO will conduct OJT. This training will include classroom type instruction covering the topics specified for site-specific training, and on site participation in the following:

- Details of the Site Specific Health and Safety Plan;
- Employee rights and responsibilities;
- Safe work practices;
- Nature and extent of anticipated chemical and physical hazards;
- Measures and procedures for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

7.5 MEC Training

All employees performing work involving the handling and destruction of MEC must be graduates of the Naval Explosive Ordnance Disposal School or other appropriate recognized training per DDESB TP

18. A copy of their certificate of graduation will be kept on file at corporate headquarters. UXO qualified personnel must have knowledge and experience in military ordnance, ordnance components, and explosives location, identification, render safe, recovery/removal, transportation, and disposal safety precautions. UXO personnel must have the knowledge and experience to effect safe handling and transportation of found ordnance items.

7.6 Hazard Communication Training

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product and work environment hazards, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request a Safety Data Sheet (SDS) for any hazardous material on the site at any time. The location of the SDSs for this site will be in an SDS binder in the site office, and all personnel will be made aware of that fact. This training will occur as part of the initial mobilization training at the site.

7.7 Tailgate Safety Briefing

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day and will include such items as:

- Expected weather conditions;
- General site hazards;
- Biological hazards on site;
- MEC hazards;
- PPE required at each site;
- Emergency evacuation procedures;
- Heat or cold stress precautions;
- Buddy system procedures;
- A review of any safety violations from the previous day; and
- Any other significant events involving safety.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner.

7.8 Daily Debriefing

At the conclusion of each workday, debriefing for all employees will be held if appropriate, and the day’s work will be discussed to determine if changes are warranted before commencing the next day’s activities.

7.9 Periodic Site Training

On the first workday of each workweek / period or more frequently if needed, a pertinent topic will be selected and elaborated upon by the SUXOS/UXOSO during the Tailgate Safety Briefing. These safety meetings will help ensure the safety and health of site personnel in the performance of regular work activities and in emergency situations. Safety meetings will be documented in the appropriate log and the EOTI Documentation of Training Form will be completed.

7.10 Visitors

All visitors to the site, even if escorted, must receive as a minimum, a briefing on site conditions, hazards and emergency response procedures. The UXOSO will generally be the one providing the visitor briefing. All visitors to the EZ will be escorted at all times. When visitors who are not UXO qualified enter the EZ, all MEC operations will cease, and will resume again after the visitor has left the area. Visitors will not be permitted in the restricted work areas unless they have the appropriate level of OSHA training and are medically approved. Visitors not complying with the above requirements will not enter the restricted work areas; however, they may observe site conditions from a safe distance. All visitors will make appropriate entries in the Visitor's Log.

7.11 Emergency Response Training Requirements

All personnel will receive training in the Emergency Response and Contingency Procedures as part of their mobilization training. In addition to this training, First Responders will receive the following training in addition to being offered the Hepatitis B vaccine, if they have not already received it:

- First Aid/Cardiopulmonary resuscitation (CPR) Training,
- Bloodborne Pathogens Training.

7.12 Other Training Requirements

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner. Subcontractor personnel will also attend the daily tailgate safety briefings each morning.

At the conclusion of each workday, debriefings for all employees will be held if appropriate, and the day's work will be discussed to determine if changes are warranted before commencing the next day's activities.

7.13 Training Documentation

A training record will be kept in each employee's individual file to confirm that adequate training for assigned tasks is provided and that training is current. In addition, Documentation of Training Forms will be completed and kept on file at the work site for the duration of site activities, and made available for inspection upon request.

8.0 SAFETY AND HEALTH INSPECTIONS

Internal Safety and Health Inspections

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined below. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed. The following table lists the scheduled areas and frequency of inspection. More frequent inspections can be held at the discretion of the SUXOS/UXOSO.

AREA	FREQUENCY
Sanitation	Daily
Medical and First Aid	Daily
Temporary Facilities	Weekly
Personal Protective and Safety Equipment	Daily
Hazardous Substances, Agents, and Environments	Weekly
Lighting	Monthly
Accident Prevention Signs, Tags, Labels, and Signals and Piping System Identification	Monthly
Fire Prevention and Protection	Weekly
Hand and Power Tools	Daily, if applicable
Material Handling, Storage and Disposal	Weekly
Machinery and Mechanized Equipment	Daily, if applicable
Motor Vehicles	Weekly
Safe Access and Fall Protection	Weekly, if applicable
Hazardous, Toxic and Radioactive Waste (HTRW)	Daily, if applicable

External Inspections

Due to the location and type of work being performed on this site, it is anticipated that the only external inspections required would be an inspection by the USACE to confirm compliance with Work Plan and COE requirements. EOTI will also be prepared in the event that Local and State safety and health officials or other enforcement agencies may conduct inspections to ensure compliance with Local and State or Federal requirements.

9.0 SAFETY AND HEALTH EXPECTATIONS, INCENTIVES & COMPLIANCE

The goal for EOTI on this project is zero accidents. All managers and supervisors are responsible for implementing the provisions of this APP/SSHP and for answering team member questions about accident prevention. Management is responsible for ensuring that all safety and health policies and procedures are clearly communicated and understood by all team members. Managers and supervisors are expected to enforce the rules fairly and uniformly. This will be accomplished by:

- Informing team members of the provisions of the Safety and Health Program;
- Evaluating the safety performance of all team members;
- Recognizing team members who perform safe and healthful work practices;
- Providing training to team members whose safety performance is deficient; and
- Disciplining team members for failure to comply with safe and healthful work practices.

All team members are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment. EOTI recognizes that open, two-way communication between management and all team members on health and safety issues is essential to an injury-free, productive workplace. To facilitate a continuous flow of safety and health information between all team members that is readily understandable, the following will be accomplished:

- Training all new team members, during the site-specific training, on the site safety and health policies and procedures, which will include this APP/SSHP;
- Training all new team members on the hazards associated with the job site;
- Conducting daily tailgate safety meeting for all team members;
- Conducting quarterly refresher type training;
- Posting and, if applicable, distributing safety information; and
- Encouraging open communications.

9.1 Incentive Program

Safety Performance is a critical element in all performance evaluations. Managers are evaluated on the safety of all operations on their project sites. Other workers are evaluated on their own participation in the safety program and compliance with safety procedures. EOTI takes a team approach to safety and expects all personnel to participate actively in continuously looking for ways to improve safety performance.

9.2 Policy and Procedures Regarding Noncompliance with Safety Requirements

Disregard for safety and health requirements will not be tolerated. If the SUXOS, UXOSO and Project Manager determine that a team member is not sufficiently committed to conforming to established safety standards, the team member's employment agreement will be terminated.

Safety rules and practices are established for the safety of all employees and to promote the welfare of the company. If the occasion arises whereby safety rules and practices established by the APP are violated, appropriate penalties will be imposed.

Infractions are divided into two categories: "Major" and "Minor". An example of a minor violation is reporting for work without the prescribed Level D PPE. Any violation of the APP that could have or did result in an accident involving personal injury or property damage is considered a major violation. The following guidelines are imposed for penalties:

Minor Violations

First Offense: Verbal warning to individual; offense to be noted in individual and supervisor's project file; discussion with individual's supervisor.

Second Offense: Written reprimand by the SUXOS will be entered in individual's file; discussion with individual and individual's supervisor.

Third Offense: Termination of employment recommended by the SUXOS to the Project Manager, who makes the final decision after discussion with the Corporate Health and Safety Manager and SUXOS.

Major Violations

Any Offense: Minimum penalty will consist of a written reprimand to be entered in individual's file and a discussion with individual and the SUXOS will be conducted. Depending upon severity of the violation, the SUXOS may temporarily dismiss the individual from the job site. If this occurs, the UXOSO or SUXOS will immediately report the incident to the Corporate Health and Safety Staff. Upon completion of a full investigation, the individual's employment may be terminated, if deemed appropriate, through a joint decision of the Program Manager, Project Manager, Corporate Health and Safety Staff, and SUXOS.

When a violation occurs:

- An investigation of the incident will be carried out by the UXOSO to determine if a violation has in fact occurred.
- If the UXOSO determines that a violation has occurred, the following actions will be accomplished:
    - Report of the violation will be submitted to the SUXOS and Corporate Health and Safety Staff by the UXOSO.
    - The UXOSO, in conjunction with the Corporate Health and Safety Manager and SUXOS, will determine if the violation is "major" or "minor".
    - The SUXOS, in conjunction with the Corporate Health and Safety Manager and the Project Manager, will determine the appropriate disciplinary action.

9.3 Procedures for Holding Managers Accountable for Safety

In all cases, supervisors are evaluated on the safety of project sites under their control. If investigation into project site accidents/incidents indicates negligence on the part of a supervisor, the investigation results will be discussed between the President/UXO Program Manager, the Project Manager and the Corporate Health and Safety Staff. If there is concurrence, and depending on the severity of the situation, the supervisor could be given a written reprimand or could be removed from duty in the case of serious negligence.

10.0 ACCIDENT REPORTING

10.1 Exposure Data

Exposure data on man-hours worked on a project, will be collected by the Project Manager. The Corporate Health and Safety Staff will be provided this information from the Project Manager in order to prepare accident statistics for the company and exposure reports for individual projects as required.

10.2 Accident Investigations, Reports, Logs

Investigation and documentation of emergency responses shall be initiated by the SUXOS/UXOSO. This is important in all cases, but especially so when the incident has resulted in personal injury, property damage, or environmental impact. The documentation will be a written report and will be inclusive of the following:

- Accurate, concise and objectively recorded information;
- Authentic Information: Each person making an entry must sign and date that entry. Nothing is to be removed or erased. If details are changed or revised, the person making the change should strike out the old material with a single line and initial and date the change;
- Titles and names of personnel involved;
- Actions taken, decisions made, orders given, to whom, by whom, when, what, where, and how, as appropriate;
- Summary of data available;
- Possible exposure of personnel; and
- Copies of the Employer's Report of Occupational Injury or Illness (OSHA Form 300) or the EOTI Accident Report, as appropriate will be completed and forwarded to the Corporate Health and Safety Manager.

Reportable injury and occupational illnesses fall into one of the following categories:

- Fatality, including missing and presumed dead;
- Permanent total disability;
- Lost workday case involving days away from work;
- Recordable case without lost workdays;
- Recordable first-aid case; and
- Non-recordable injury/illness.

The following unplanned events will also be investigated and reported:

- Damage to military property;
- Damage to contractor property; and
- Unplanned functioning of UXO.

All recordable and reportable accidents will be recorded on the OSHA Form 300, Log of Federal Occupational Injuries and Illnesses, which will be maintained at the EOTI Safety Office. [29 CFR 1904.2]

All accidents will be investigated and immediate steps will be taken to prevent recurrence. The USACE Project Manager will be notified of any accidents occurring on this project site.

Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in EOTI's Oak Ridge, TN Office.

10.3 Immediate Notification of Major Accidents [29 CFR 1904.8]

Within 8 hours after the death of any employee from a work-related incident or the in-patient hospitalization of three or more employees as a result of a work-related incident, the employer shall orally report the fatality/multiple hospitalization by telephone or in person to the nearest Area Office of OSHA. This will be accomplished by the Health and Safety Staff. In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations.

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the response and coordination with responding off-site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Health and Safety Staff as soon as the situation is under control.

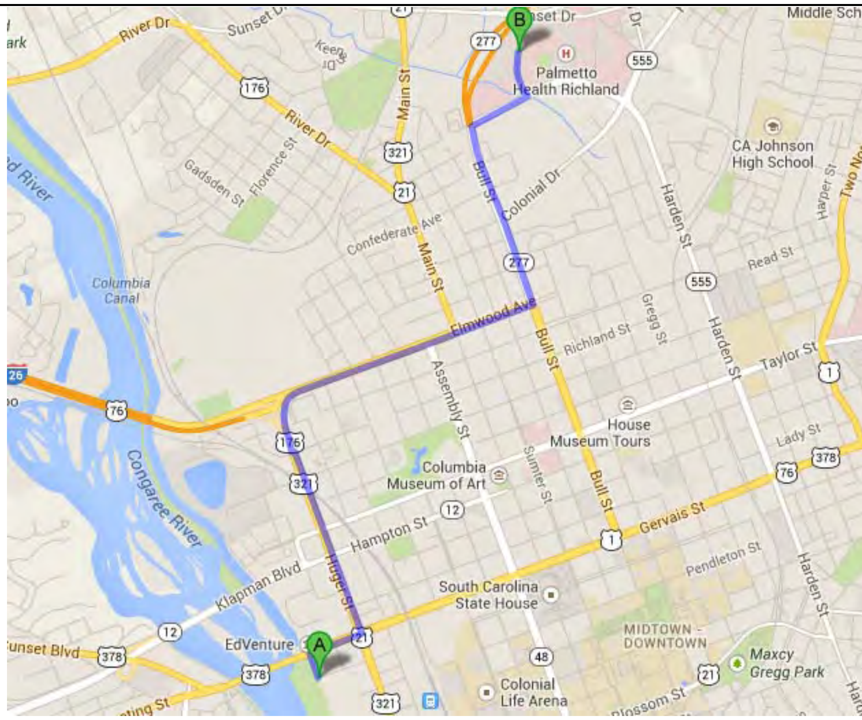
If the emergency involves employee injury, the UXOSO will complete the ENG Form 3394 Accident Report. The Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies where required. Once the emergency has been resolved, the UXOSO, Project Manager and Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

11.0 MEDICAL SUPPORT

A first aid kit will be placed in the site vehicles and the project office. A CPR mask and a bloodborne pathogen kit will also be kept with each first aid kit. The SUXOS will have final authority on the decision to require additional professional medical services (i.e., paramedics, hospital visit, etc.) for any illness or injury. Two site employees will be certified in First Aid and CPR. They will be the first responders to any site emergency and will render first aid/CPR as needed until medical assistance arrives on the scene. A Trauma First Aid Kit will be kept in the UXOSO vehicle.

All supervisory personnel shall maintain a phone listing of the nearest available medical assistance in the event of an accident. This telephone listing will be kept beside each telephone. The SUXOS will ensure that an Emergency Medical Assistance list is updated and provided to all supervisors. Directions to the nearest medical facility will be kept in each vehicle.

The nearest medical facility address is: **Palmetto Health Richland**
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 ** For Emergency Dial 911*



Driving directions to Palmetto Health Hospital

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N

0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E

1.1 mi

5. Turn left onto **Bull St** 0.7 mi

6. Turn right onto **Harden Street Extension**(signs for **Harden St**) 0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right

0.2 mi

12.0 PLANS, PROGRAMS AND PROCEDURES

12.1 PERSONAL PROTECTIVE EQUIPMENT PLAN

Whenever feasible, engineering controls as a priority and work practices, or a combination thereof, will be utilized to protect site workers from safety and health hazards and maintain personal exposures to hazardous substances below established exposure limits. The exposure limits used by EOTI will be the lower of the OSHA Permissible Exposure Limits (PELs) found in 29 CFR 1910 Subpart G and 29 CFR 1910.1000, or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Other recognized published exposure levels, such as those found on SDSs, will be used if the substance is not listed by OSHA or the ACGIH. EOTI will not utilize a system of employee rotation as a means of complying with the PEL, TLV, or other published limits.

Due to the expected hazards at this site during most operations, modified Level D PPE will be the requirement. Level D PPE is a work uniform affording minimal protection, used for nuisance contamination only. The following modified Level D equipment will be required on this site:

- Leather gloves.
- Face shields – when working around chain saws, weed whackers and vegetation removal equipment.
- Tinted or clear safety glasses with side shields or goggles.
- Hearing protection, where required by high noise levels, in the vicinity of heavy equipment operations, and vegetation clearance operations involving gas-powered equipment.
- Leather work boots with ankle support and non-slip soles (no steel toes that interfere with magnetometers).
- Cotton work clothes.
- Leg chaps – when working around vegetation removal equipment or snakes.
- Hard hat – when working around heavy equipment, and in the vicinity of chain saws, weed whackers and powered vegetation removal equipment.

Selection of PPE

Each task outlined in the Statement of Work will be assessed prior to its initiation to determine the potential of personnel exposure to safety and health hazards, which may be encountered during its conduct. The hazard assessment will be based on available information pertaining to the historical use of the site, site contaminant characterization data and the anticipated operational hazards. This information will be provided to, or collected by EOTI site personnel. The PPE assigned as a result of the hazard assessment represents the minimum PPE to be used during initial site activities. Since hazard/risk assessment is a continuing process, changes in the initial types and levels of PPE will be made in accordance with information obtained from the actual implementation of site operations and data derived from the site monitoring. As a general rule, the levels of PPE will need to be reassessed if any of the following occur:

- Commencement of a new work phase, or work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.
- Change in work scope, which affects the degree of contact with contaminants.

During the selection of PPE the Health and Safety Staff and UXOSO will also take into consideration the following factors:

- Limitations of the equipment.
- Work mission duration.
- Temperature extremes.
- Material flexibility.
- Durability/Integrity of the equipment.

12.1.1 Eye and Face Protection

All personnel will use appropriate eye or face protection when exposed to eye or face hazards from flying particles, liquid chemicals, or other eye hazards. All personnel will use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) or goggles meeting the pertinent requirements of this section are acceptable. If there is a likelihood for glare, tinted safety glasses are recommended.

All personnel who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer. Protective eye and face devices will comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection," which is incorporated by reference as specified in Sec. 1910.6.

12.1.2 Head Protection

When working in the vicinity of heavy equipment, as well as vegetation clearance equipment, hard hats will be worn. While there is not expected to be a danger of impact to the head due to falling or flying objects during other operations, it is recommended that personnel wear caps or some type of head covering for protection from the sun.

12.1.3 Foot Protection

Due to the uneven working surfaces and potential for tripping hazards common to a UXO site, all EOTI personnel shall wear sturdy leather, work boots with ankle support and non-slip soles. Personnel using magnetometers for the detection of buried MEC will not wear steel-toe safety shoes, as they will affect the readings of the equipment. While working around heavy equipment, UXO personnel will wear steel or composite toe boots or slip on toe caps.

12.1.4 Hand Protection

EOTI selects and requires employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; thermal burns; and harmful temperature extremes. For most operations on this site, leather gloves will provide adequate protection against minor cuts, which are a hazard in most site operations.

12.1.5 Hearing Protection

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels (OSHA Action Level) or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

12.1.6 Emergency Equipment

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, and bloodborne pathogen kit, will be kept in each site vehicle. Portable eyewashes will be located in the work area and in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. A Trauma First Aid Kit will be maintained in the UXOSO vehicle.

12.1.7 Upgrading/Downgrading PPE

If work tasks are added or amended after completion and approval of the APP, the SUXOS/UXOSO will conduct the task hazard assessment and consult with the Corporate Health and Safety Manager. The level and type of PPE to be used will be identified. The Corporate Health and Safety Staff will allow any changes in PPE, which involve downgrading of the level of PPE, only after review of documentation demonstrating that the conditions and/or potential for hazardous exposure are reduced enough to justify the downgrade.

12.1.8 Purchasing PPE

The MEC Safety and Health Coordinator will maintain a list of sources for purchasing PPE and will assist the Project Manager in ordering the correct type and amounts of the PPE to accomplish the project objectives.

12.1.9 General Requirements

All personal protective equipment will be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary. PPE is required due to hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact. All PPE will be used in the manner for which it was designed. The assignment of PPE will be based upon hazard analysis, and the equipment will be selected based on its protection factor against site hazards.

12.1.10 Inspection

Each piece of PPE will be inspected daily prior to use. Defective or damaged personal protective equipment will not be used. It will be removed from service and turned in for repair, or removed from the site for disposal and replaced with new PPE.

12.1.11 Training

EOTI will provide training to each employee who is required by this section to use PPE. Each affected employee will demonstrate an understanding of the training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE. Each such employee will be trained to know at least the following:

- The decisions and justifications used to select each piece of PPE.
- The nature of the hazards and the consequences of not using PPE.
- What PPE will be required to conduct each task.
- When PPE will be required during the performance of each task.
- How to properly don, doff, adjust and wear each piece of PPE.
- The proper inspection, cleaning, decontaminating, maintenance and storage of each PPE item used.
- The limitations of the PPE.

All personnel receiving PPE training will be required to demonstrate an understanding of the training topics and the ability to correctly use the PPE. This will be accomplished through the UXOSO supervising and visually inspecting each individual's ability to properly don and use the PPE during initial use of the PPE.

When the SUXOS or UXOSO has reason to believe any affected employee who has already been trained does not have the understanding and skill required he should retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete; or
- Changes in the types of PPE to be used render previous training obsolete; or
- Inadequacies in an affected employee’s knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

Upon completion of the training and after each employee has successfully demonstrated the requisite understanding, the SUXOS or UXOSO will complete the Documentation of Training form. This identifies: the employees who attended the training course and successfully demonstrated the required knowledge; the date(s) of the training and demonstration session(s); and the PPE covered by the training session.

12.1.12 Cleaning and Decontamination

The UXOSO will be responsible for ensuring that PPE is in good, clean, working order prior to issuing the PPE the first time. Once issued, site personnel will ensure that re-usable articles of PPE are maintained in a clean and sanitary fashion. For items used inside an EZ, site personnel will ensure that the PPE is properly decontaminated as appropriate before removing the item from the EZ or Contamination reduction Zone (CRZ).

12.1.13 Maintenance

Maintenance of PPE can vary greatly, based upon the complexity of the PPE and the intricacy of the repair involved. The UXOSO will become familiar with the manufacturer's recommended maintenance and when possible repair defective PPE. If unable or unauthorized to conduct the repair, the UXOSO will return the item to the manufacturer for repair, or procure a replacement.

12.1.14 Storage

PPE will be stored in a location, which is protected from the harmful effects of sunlight, damaging chemicals, moisture, extreme temperatures, impact or crushing. If needed, the SUXOS will designate a specified area for the storage of PPE.

12.2 LAYOUT PLANS

Layout plans are not applicable for this project, as temporary structures are not being constructed.

12.3 EMERGENCY RESPONSE PLANS

12.3.1 Procedures and Tests

The SUXOS and UXOSO will coordinate to perform the following pre-emergency tasks before starting field activities and during the mobilization and site specific training phase of the project, and will coordinate emergency response with emergency medical technician (EMT)/police/fire/adjacent industry personnel or other emergency response personnel when appropriate:

- Locate telephone stations;
- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the Emergency Response Contingency Plans (ERCP); and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

Before normal activities are resumed, onsite personnel must be prepared and equipped to handle another emergency. These follow-up activities should be completed:

- The Corporate Health and Safety Staff will notify appropriate government agencies as required (Reminder: OSHA must be notified if there have been any fatalities or three or more hospitalizations).
- All equipment and supplies restocked, serviced and inspected; and
- Review and revise all aspects of the Health and Safety Plan as necessary to address and prevent future emergencies of this type.

12.3.2 Spill Plans

In the event of a spill or leak of any potentially harmful material (regardless of quantity) on site personnel will:

- Notify the SUXOS immediately;

- The SUXOS shall notify the Project Manager of the spill/leak with relative information (location, time, chemical identity, quantity, hazards listed on the SDS), and any corrective actions/measures taken;
- Locate the source and stop the leak/spill if it can be done safely (as dictated by the SUXOS);
- Begin containment and recovery of spilled material (as directed by the SUXOS), using appropriate PPE and spill clean-up equipment and materials; and
- Once notified, the EOTI Project Manager will in turn notify the USACE Project Manager and / or the Contracting Officer.

12.3.3 Firefighting Plans

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SUXOS and UXOSO and based on whether the fire is small, large or involves explosives.

12.3.4 Small Fires

A small fire is defined as a fire that can most likely be extinguished by site personnel using portable extinguishers. A small fire must also be free and clear of explosive materials, especially MEC. If a small fire occurs, the SUXOS or UXOSO will direct site personnel to perform the following, if safe to do so:

- Evacuate unnecessary personnel to an upwind position;
- Attempt to extinguish the fire using portable fire extinguishers or by smothering;
- Remove any essential or flammable items from the path of the fire; and
- Notify emergency response services (fire, police, ambulance, hospital, etc.) as needed.

If a fire extinguisher is used, this must be immediately reported to the SUXOS. The fire extinguisher must be immediately removed from service until it can be recharged. Another fire extinguisher must be made available to the operating area. The area around where the fire occurred must be watched for a minimum of 30 minutes after the fire has been extinguished to assure re-ignition does not occur. If personnel are not working in the area, the SUXOS should check the area of the fire periodically to assure re-ignition does not occur.

12.3.5 Large Fires

A large fire is defined as a fire, which due to its size, cannot be extinguished using portable fire extinguishers. In the event that a large fire occurs and the fire does not involve explosive materials, the SUXOS/UXOSO will direct personnel to conduct the following, if safe to do so:

- Evacuate all non-essential personnel from the site to an upwind location;
- Notify the Fire Department and other emergency response services (police, ambulance, hospital, etc.) as needed;
- Notify adjacent industries and neighbors;
- Order the appropriate level of protective equipment to be worn by personnel responding to the fire;
- Attempt to control the fire to the extent possible; and
- Remove any essential or flammable items from the path of the fire.

12.3.6 Fires Involving Explosive Materials

If a fire occurs which involves explosive materials such as chemicals, fuels or MEC, the SUXOS will order the immediate evacuation of all site personnel to an upwind assembly point at least maximum fragmentation distance from the fire site. The SUXOS will then notify the Fire Department, adjacent industries and any other emergency services (police, ambulance, hospital, etc.) as needed. At no time will EOTI personnel fight a fire involving explosive materials, nor will they allow outside emergency personnel to do so. The Fire Department personnel may not enter any closer than maximum fragmentation distance from the fire and they may spray water to surrounding buildings, structures, etc. in order to prevent the spread of fire.

After the fire has burned itself out, the site must be barricaded and entry prohibited until adequate cooling time has passed (at least 24 hours for a large fire). Explosive materials that may not have discharged during the fire may still be liable to function in the presence of extreme heat. After the site has cooled down, the SUXOS and UXOSO will inspect the site and conditions of any MEC involved in the fire, and make a determination as to whether or not the site is safe for others to enter.

If non-UXO qualified personnel must enter the site for purposes of fire investigation, etc. they must receive a briefing on the potential hazards of MEC on the site. They must be accompanied at all times by a UXO-qualified employee of EOTI. NO OUTSIDE PERSONNEL WILL BE PERMITTED ONTO THE SITE WHILE THERE IS A KNOWN MEC HAZARD PRESENT. If, during the course of the investigation, MEC is observed, the site will be evacuated of all non-UXO qualified personnel until the site can be rendered safe for re-entry.

12.3.7 Explosions

In the event of an explosion, the SUXOS will order the evacuation of all site personnel to a safe, upwind assembly point at least fragmentation distance away. The SUXOS will then notify all necessary emergency response services. After an explosion has occurred the site will remain barricaded a minimum of 30 minutes before entry is permitted. The SUXOS/UXOSO will enter the site with a team member and inspect for presence and condition of MEC. Non-UXO qualified personnel may not enter the area until all known MEC has been removed or destroyed. If non-UXO qualified personnel need to enter the site, they must first be briefed on the potential hazards of the site. They must be accompanied at all times by an UXO-qualified employee. If MEC is discovered during the course of their visit, they must immediately leave the site until it can be rendered safe for re-entry.

12.3.8 Posting of Emergency Telephone Numbers

Emergency Response / Services	
Ambulance Service	911
Emergency Medical Response	911
Police*	911
Police Department – Non emergency	803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203	803-434-7000 * For Emergency Dial 911
Fire Department*	911
Fire Department – Non Emergency	803-545-3700
National Poison Control Center	800-222-1222
CHEMTREC (hazardous materials response)	800-424-9300
National Response Team (hazardous materials response)	800-424-8802

Centers for Disease Control (CDC) **http://www.cdc.gov/health/diseases**			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Brian Woods, P.G., PMP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	TBD	TBD	TBD

12.3.9 Wild Land Fire Prevention Plan

A Wild Land Fire Prevention Plan is not expected to be needed on this site. It is anticipated that heavy vegetation will be cut prior to beginning work that could result in an accidental fire and therefore excess vegetation that could contribute to a fire is not expected. However, fire extinguishers will be present at the job site and would be used to immediately put out any small fire that would start in the area, thereby preventing large fires from developing.

12.4 Man Overboard/Abandon Ship

As work covered under this project will be conducted on dry land, a Man Overboard/Abandon Ship plan is not required.

12.5 Hazard Communication Program

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations, and all site personnel will be made aware of that fact. This SDS binder will be available on request to all site personnel during all working hours. If site workers have further questions about any of the hazardous materials they encounter, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product, proper labeling of secondary containers, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request an SDS for any hazardous material on the site at any time. This training will occur as part of the initial mobilization training at the site and will be documented on the EOTI Documentation of Training Form.

12.6 Respiratory Protection Plan

Due to the type of work taking place, respirators are not expected to be required on this site. Should unforeseen hazards develop, which would require a respirator, the EOTI Respiratory Protection Program would be followed per Chapter 16 of the EOTI Corporate Health and Safety Program.

12.7 Health Hazard Control Program

Due to the type of work that will be taking place on this project site, toxic, high hazard environments are not anticipated.

12.8 Lead Abatement Plan

As lead is not expected to be a contaminant on this site, a Lead Abatement Plan will not be required. However, if lead should be encountered, a Lead Abatement Plan will be prepared in accordance with the requirements of Chapter 38 of the EOTI Corporate Health and Safety Program.

12.9 Asbestos Abatement Plan

As asbestos is not expected to be encountered on this site and therefore, an Asbestos Abatement Plan is not required.

12.10 Abrasive Blasting Plan

Abrasive blasting is not required on this project.

12.11 Confined Space Plan

Work in confined spaces is not expected to occur on this project, as the depth of excavation is not expected to exceed 48 inches. If deeper excavations are required, sides of the excavations will be sloped at a ratio of at least 2 horizontal feet for every 1 vertical foot of excavation to protect workers from cave-ins and allow easy in and out of the excavated areas. However, if confined space work becomes necessary, it will be accomplished in accordance with the EOTI Confined Space Program.

12.12 Power Tool and Equipment Hazardous Energy Control Plan

The work on this project may require the use of power tools and excavation equipment that would require a Tool and Equipment Hazardous Energy Control Plan.

By their very nature, power tools and heavy equipment have the capability of inflicting serious injury upon site personnel if they are not used and maintained properly. To control the hazards associated with power tool and equipment operation, the requirements outlined in USACE EM 385-1-1, Section 12 and the safe work practices listed below shall be observed when using power tools and equipment:

- Operation will be conducted by authorized personnel familiar with the tool or equipment, its operation, and safety precautions.
- Power tools and equipment will be inspected prior to use, and defective equipment will be removed from service until repaired or replaced.
- Power tools and equipment designed to accommodate guards will have such guards properly in place prior to use.

- Loose fitting clothing or unrestrained long hair will not be permitted around moving parts of power tools or equipment.
- Hands, feet, etc. will be kept away from all moving parts.
- Maintenance and/or adjustments to equipment will not be conducted while it is in operation; the power will be locked out according to the Lock Out/Tag Out protocol in OSHA 29 CFR 1910.147 prior to maintenance activities.
- All maintenance activities will be performed by personnel experienced and authorized to make the repairs, or it will be sent to the manufacturer for repair.
- An adequate operating area will be provided, allowing sufficient clearance and access for operation.
- Good housekeeping practices will be followed at all times.
- Safety glasses with side shields, goggles, or face shields shall be worn at all times while operating power tools and equipment or when working in the vicinity of operating power tools and equipment.

12.13 Critical Lift Procedures

EOTI will not be performing any crane operations on this project, so critical lift procedures will not be required. Should the scope of work change, EOTI will prepare critical lift procedures in accordance with the EOTI Heavy Equipment Program found in the EOTI Corporate Health and Safety Program.

12.14 Contingency Plan for Severe Weather

Rain, dust storms, electrical storms, and tornadoes in this geographic area can constitute a safety hazard to field operations at the project site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so windy, wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS and UXOSO determine it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

12.15 Access and Haul Road Plan

There are no plans to create access and haul roads for this project, so the Access and Haul Road Plan is not required.

12.16 Demolition Plan (Engineering and Asbestos Surveys)

As work on this plan does not involve demolition of buildings containing asbestos containing material, the Demolition Plan is not required.

12.17 Emergency Rescue (Tunneling)

As work on this project does not involve tunneling operations, this Emergency Rescue plan is not required.

12.18 Underground Construction Fire Prevention and Protection Plan

As underground construction is not required on this project, the Underground Construction Fire Prevention and Protection Plan is not required.

12.19 Compressed Air Plan

As there are no plans to use compressed air on this project, a Compressed Air Plan is not required.

12.20 Formwork and Shoring Erection and Removal Plans

As this project will not involve formwork and shoring erection and removal, this plan is not required.

12.21 Jacking Plan (Lift) Slab Plans

As there will be no Lift Slab work on this project, this plan is not required.

12.22 Blasting Plan

EOTI will destroy MPPEH and potentially hazardous MEC by detonation in either consolidated shots or by Blow-In-Place (BIP) (if items are unacceptable to move). EOTI will also use explosive or mechanical means to vent MEC scrap prior to disposal. A detailed description of EOTI's Blasting plan and procedures is given in Section 3.7 of the Work Plan.

12.23 Diving Plan

Diving portions under this project are covered under a Diving Plan with accident prevention that has been submitted separately and is under a separate approval process.

12.24 Plan for Prevention of Alcohol and Drug Abuse

The use, sale, dispensing, possession, or manufacture of illegal drugs, alcohol, and narcotics on EOTI premises or work sites is prohibited. Employees will be subject to disciplinary action, up to and including termination, for bringing illegal, non-prescribed drugs and narcotics or alcoholic beverages to the workplace; being under the influence of such substances while working; using such substances while at work; or dispensing, distributing, or illegally manufacturing or selling these substances on EOTI premises and work sites.

EOTI does not regulate the conduct of employees during personal time off. However, misconduct due to the abuse of drugs, narcotics, or alcohol may bring discredit to EOTI its subcontractors and its clients. If, in the judgment of EOTI management, an employee's abuse of drugs, narcotics, or alcohol adversely affects his/her ability to perform the duties intended, that employee may be terminated for cause.

Any employee who notices another employee demonstrating unusual behavioral patterns that appear to be drug, narcotic, or alcohol related must report the observed behavior to management.

Employees may be required to submit to a test, whenever reasonable cause exists, to determine the presence of drugs, narcotics, or alcohol unless law prohibits such tests. Refusal to submit to testing constitutes grounds for termination of employment for cause. An employee judged to be under the influence of drugs, narcotics, or alcohol will be required to leave the premises. The Employee's Supervisor will arrange to have the employee escorted home.

Drug screening will occur as part of the annual physical. If the drug screen is positive for illegal drugs, the employee will not be permitted to work on the EOTI project site.

An employee who is diagnosed as an alcohol or drug abuser may be terminated or required to take a leave of absence without pay to undergo rehabilitation. The employee will not be permitted to return to work until medical certification is presented as evidence that the employee is drug-free and capable of performing his/her duties. Failure to cooperate with an agreed-upon treatment plan may result in disciplinary action, up to and including termination.

The status of an employee on drug/alcohol rehabilitation leave-of-absence will be reviewed by management on a case-by-case basis. Absences extending beyond six months will require medical recertification. Employees on leave for more than one year will be considered for termination without prejudice.

If an employee is taking prescription drugs for a medical condition while under a doctor's care, the SUXOS should be made aware of the situation. The side effects of some medications can reduce alertness and judgment, and may cause a potential safety hazard to the employee and/or others working in the vicinity, such as a heavy equipment operator becoming drowsy while operating equipment. In cases such as this, the SUXOS has the discretion to re-assign the individual to a less hazardous position on the site until the condition is cleared and medication is no longer required. If there are no other positions available on the site, which would be safe for the individual to perform, he may be placed on sick leave or leave without pay until the condition clears up and he is medically approved to resume work.

12.25 Fall Protection Plan

As work will be occurring at ground level and below, a Fall Protection Plan is not required. Excavations will be well marked with tape and/or barricades and personnel will be advised to stay away from the perimeter, as will the operators of the heavy equipment. Work will not occur during hours of darkness, when personnel might be less likely to see the excavation.

12.26 Steel Erection Plan

As no steel erection will be taking place on this project, this plan is not required.

12.27 Night Operations Lighting Plan

As there are no plans to operate during hours of darkness, there is no requirement for a Night Operations Lighting Plan.

12.28 Site Sanitation Plan

Adequate sanitation facilities will be provided at the work site to ensure proper personal hygiene. Site sanitation will be established and maintained in accordance with OSHA 29 CFR 1910.120(n).

An adequate supply of potable (drinkable) water shall be provided on site at all times, and will be supplied in accordance with the following provisions:

- Containers used for potable water shall be capable of being tightly closed, equipped with a tap and maintained in a clean and sanitary condition.
- A container used for distribution of drinking water shall be clearly labeled as to its contents and not used for any other purpose.
- Water shall not be dipped from the container and use of a common cup will not be allowed.
- Where single service cups are provided, separate sanitary containers will be provided for the storage of the unused cups and for the disposal of the used cups.

Outlets and storage containers for nonpotable water, such as water for firefighting or decontamination will be clearly labeled to indicate that the water is not suitable for drinking, washing or cooking. There will at no time be a cross connection or open potential between a system furnishing potable water and a system furnishing nonpotable water.

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the support zone (SZ), as required to support field personnel. Toilets will be appropriately maintained, vented and will be capable of being locked from the inside. There will be at least one toilet for every 15 site personnel.

Hand and face washing facilities will be set up in the SZ of the work area. These will be utilized by all personnel exiting the EZ prior to eating, drinking, using tobacco or other hand to face activities. Portable eyewash will be available in site vehicles and the office trailer.

12.29 Fire Prevention Plan

Fire Protection: Portable fire extinguishers are rated and classified with NUMERAL and LETTER designations, based on fire tests conducted by the Underwriters Laboratories, Inc. (UL) or other nationally recognized testing laboratories. The numeral rating indicates the relative extinguishing effectiveness of extinguishers classified for Class A and B fires only. The Letter classified coincides with the class of fire. Extinguishers found to be effective on more than one class of fire have multiple letter classifications. Example: B:C

The rating of hand-portable fire extinguishers is based on the following:

- Class A fire extinguisher is used for ordinary combustible materials.
- Class B fire extinguisher is for flammable liquids.
- Class C fire extinguisher is for electrical fires.
- Class D fire extinguisher is for combustible metal fires.

Many fires are small at origin and may be extinguished by the use of proper hand-portable fire extinguishers. The fire department will be notified as soon as fire is discovered. This alarm should not be delayed awaiting result of application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

- The extinguisher is properly located and in working order.
- The extinguisher is of proper type for a fire, which may occur.
- The fire is discovered while still small enough for the extinguisher to be effective.
- The fire is discovered by a person ready, willing, and able to use the extinguisher.

- Class A fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Those extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.
- Water or water-mixture type extinguishing agent must not be used under any circumstances on energized electrical equipment (Class C) fires. Whenever possible, electrical equipment and circuits should be de-energized before attacking a Class C fire. Due to its corrosive nature, dry chemical is not recommended for use on computerized, electronic or other equipment with extensive circuitry.

Fire Prevention: In order to prevent fire from occurring in the first place, every step will be taken to keep the site neat and clean. All equipment and materials not in use will be put away in designated locations. There will be trash cans with lids at the site, which will be emptied on a daily basis to keep trash from accumulating. All flammable liquids will be stored in approved flammable liquid cans in order to prevent spillage and ignition of the material. Bonding and grounding procedures will be in place whenever transferring flammable liquids from their designated containers and into equipment. Equipment will never be fueled in the back of a pick-up truck with a bed liner in it. Personnel handling explosive and/or flammable materials will wear cotton under and outer garments to prevent build-up and transfer of static electricity.

13.0 CONTRACTOR INFORMATION

EOTI is the prime contractor on this project. This APP has been prepared by EOTI based on EOTI procedures. In addition, subcontract site personnel will be familiar with and will comply with Project procedures and safety requirements.

14.0 HAZARD ANALYSIS

An activity hazard analysis (AHA) has been conducted and documented as outlined below for each activity warranted by the hazards associated with the activity. For this project, the following AHA have been prepared for all anticipated field operations:

- Site-Setup/Layout
- Surface Preparation/ Vegetation Removal
- Subsurface Clearance using “Mag & Dig” Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Should conditions, equipment, or types of operations change during the course of the project work, the Corporate Health and Safety Staff will review an updated existing AHA for continuing work, or prepare a new one for new types of operations.

Risk management is and will continue to be integrated into the planning, preparation, and execution of work at the site. Risk management is a dynamic process, and is continuously improved upon, as personnel become more familiar with the site operations, equipment, environment, etc. Personnel are urged to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the SUXOS/UXOSO. Control measures will be developed and coordinated. All personnel are responsible to continuously assess variable hazards and implement risk controls.

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Site Setup/ Lay-out</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• UXO personnel will accompany subcontracted survey personnel responsible for marking the work areas.
• UXO personnel will lead the team into area and will clear the path of entry into the site. If MEC is encountered, path will be routed around it.
• If live MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.
• Where intrusive operations, such as driving stakes, are required UXO personnel, using geophysical equipment, will determine if there are potential MEC beneath the ground surface.
• If potential MEC is located below the ground surface, the area for the intrusive operations will be moved.
• Magnetometers will be used for each two feet of depth for intrusive operations to assure accuracy of readings.</td><td>• MEC hazards
• Experience Modification Rate (EMR) for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Muscle strain carrying instruments
• Heat/Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Sunburn
• Glare of sun</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy, leather, work boots with ankle support and non-slip soles.
• Follow appropriate lifting/ carrying procedures. (Corporate Safety and Health Plan) CSHP Chp21)
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold.
• Training in biological hazards avoidance. (CSHP Chp 21)
• Long sleeved shirts, long pants, cap, and use sun screen.
• Tinted glasses.
• SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with of the Work Plan.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Appropriate geophysical equipment / magnetometer.
• Footwear with ankle support and non-slip soles.
• Back braces (optional).
• Communications to determine Wet Bulb Globe Temperature (WBGT) Index, drinking water.
• Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves and leg chaps).</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.
• Equipment inspected daily prior to use.
• PPE inspected daily prior to use</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific MEC training will be presented to all site personnel.
• Site specific training, slip/fall hazards.
• Site-specific training/lifting techniques.
• Heat Stress / Cold Stress symptoms/first aid.
• Site-specific flora/fauna to include first aid.
• PPE training.
• Current HAZWOPER Training.</td></tr>
</table>

ACTIVITY HAZARD ANALYSIS

ACTIVITY: Surface Preparation / Vegetation Removal (if required)

ANALYZED BY/DATE: D. Farmer June 2014

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• UXO personnel will visually examine the surface for MEC. • If there are areas where dense vegetation prevents a visual surface clearance, geophysical equipment (hand held magnetometers) may be used to detect surface MEC. • If vegetation is extremely dense in some areas, vegetation clearing may be required using rotary mowers, chain saws and weed whackers. • If live MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan. • Following the surface clearance, the area will be cleared for entry.	• MEC hazards • EMR for Electric Fuzes • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress/Cold Stress • Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes. • Muscle strain carrying instruments/equipment. • Lacerations and cuts from vegetation clearing equipment. • Eye/face injuries due to use of vegetation clearing equipment. • Noise • Sunburn • Glare of sun	• Training on MEC and equipment on site. • Controlled use of radios and cell phones. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold. • Training in biological hazards avoidance. (CSHP Chp 21) • Follow appropriate lifting/ carrying procedures. (CSHP Chp21) • PPE – leather gloves and leg chaps during vegetation clearance operations. • PPE – safety glasses and hard hat with face shield during vegetation clearance operations. • PPE – hearing protection during vegetation clearance operations • PPE – wear long sleeved shirts, long pants and a cap, use sunscreen • PPE – wear tinted glasses. • SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with the Work Plan.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
• Geophysical equipment (handheld magnetometers). • Vegetation removal equipment: Rotary mowers, chain saws and weed whackers. • Footwear with ankle support and non-slip soles. • Communications to determine WBGT Index, drinking water. • Appropriate clothing / PPE (to include protective eyewear, gloves, and chaps if necessary) • Hard hat, face shield, hearing protection and leg chaps during vegetation clearance operations. • Steel toe or composite toe boots, or slip on toe guards	**SUXOS/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use	• UXO personnel will be properly trained / qualified. • Site-specific MEC training will be presented to all site personnel. • Site specific training, slip/fall hazards. • Heat Stress / Cold Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • Training in proper lifting techniques. • Training in use of equipment. • Noise prevention training • PPE training. • All site personnel will have current HAZWOPER training.

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Subsurface Clearance using “Mag and Dig” Methods</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Lanes will be established throughout the footprint of each work site.
• UXO personnel will walk down each lane with handheld magnetometers to identify subsurface anomalies.
• If anomalies are identified that may be caused by MEC / MPPEH, it will be investigated by mechanical and / or hand digging.
• If live MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.</td><td>• MEC hazards
• EMR for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Heat Stress/Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Muscle strain carrying instruments/equipment.
• Lacerations and cuts from frag or tools.
• Eye/face injuries due to use of vegetation clearing equipment.
• Noise
• Sunburn
• Glare of sun
• Heavy equipment operation (noise, crushing, etc.)</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy leather, work boots with ankle support and non-slip soles.
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold.
• Training in biological hazards avoidance. (CSHP Chap 21)
• Follow appropriate lifting/ carrying procedures. (CSHP Chap 21)
• Training in heavy equipment operation and excavation procedures.
• PPE – leather gloves and leg chaps during vegetation clearance operations.
• PPE – safety glasses and hardhat with face shield during vegetation clearance operations.
• PPE – wear long sleeved shirts, long pants and a cap, use sunscreen
• Maintain minimum team separation distances and exclusion zones to protect workers and the public from unintentional detonation.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Geophysical equipment (handheld magnetometers).
• Excavation equipment: Shovels / backhoe/ excavator.
• Footwear with ankle support and non-slip soles.
• Back braces, optional.
• Communications to determine WBGT Index, drinking water.
• Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves, and leg chaps if snakes are a problem)
• Hardhat, face shield, hearing protection and leg chaps during vegetation clearance operations.</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.
• Equipment inspected daily prior to use.
• Ensure safety features such as backup warnings, seatbelts, lights, gauges, etc. are in place and functioning properly.
• PPE inspected daily prior to use.</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific MEC training will be presented to all site personnel.
• Site specific training, slip/fall hazards.
• Heat Stress / Cold Stress symptoms/first aid.
• Site-specific flora/fauna to include first aid.
• Training in proper lifting techniques.
• Training in use of equipment.
• Noise prevention training
• PPE training.
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Transport of Explosives (If Required)</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Inspect vehicles to ensure proper working condition.
• Ensure vehicles are properly equipped with seat belts, placards, fire extinguishers, and equipment for securing load
• Explosives will be packed so items are not touching one another.
• Explosives transported on public roads will be packed and labeled in accordance with Department of Transportation rules and regulations.
• Boxes are secured to prevent shifting.
• Transport to designated disposal location</td><td>• Explosive hazards
• Vehicle accidents
• Fire
• Heat stress</td><td>• Complete motor vehicle inspection form.
• Licensed driver
• Driver and all passengers will use seat belts when vehicle is in operation.
• Vehicle will be placarded while traveling on public roads.
• Explosives will be placed securely in back of vehicle and anchored to prevent movement.
• Vehicles will not be left unattended.
• Driver will observe posted speed limits.
• A minimum of 2 persons in vehicle during transport.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Vehicle
• Safety Equipment: seat belts, first aid kit, two-way communication, emergency eyewash kit, bloodborne pathogen kit, Hazard Material spill response kit, 2 fire extinguishers
• Explosive placards
• Explosive storage boxes
• Roadside emergency markers
• Level D PPE: Cotton clothing, leather gloves, leather work boots, safety glasses
• Drinking water and cups</td><td>UXOSO/QC will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.

• Equipment inspected daily prior to use.
• PPE inspected daily prior to use.
• Inspect packing, labeling, and security of explosives.</td><td>• UXO personnel will be properly trained / qualified.
• Driver must have valid driver’s license
• Training in fire extinguisher usage and trained not to fight fire involving explosives.
• Site-specific UXO training will be presented to all site personnel.
• Heat stress training and first aid
• Training in small quantity spill clean-up
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td>ACTIVITY: Disposal of MEC</td><td colspan="2">ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Establish EZ based on MEC item around disposal area.
• Make required notifications of demolition/venting operations.
• Retrieve donor explosives.
• Set up demolition charges IAW procedures
• Use engineering controls, if required, to reduce the fragment travel range.
• Post sentries outside Fragmentation Zone on all access roads
• Ensure sentries have a full view of demolition and access areas.
• Contact sentries to ensure that no pedestrian traffic is in the vicinity
• Evacuate demolition crew to a safe location
• Demolition occurs.
• Inspect demolition site to ensure that demolition/venting has been completed properly.</td><td>• MEC hazards
• Slips, trips and falls
• Biological hazards – plants, spiders, ticks, mosquitoes, snakes, rodents, etc.
• Heat stress
• EMR/static electricity hazards
• Overpressure hazards due to blast.
• Fragmentation hazard due to blast.
• Eye hazard
• Noise hazard
• Cuts and abrasions hazard
• Unauthorized personnel entering EZ during operations
• Sunburn</td><td>• Training on MEC on site.
• Be observant when walking, and wear leather, work boots with ankle support and non-slip soles.
• WBGT readings, drinking water, work/rest schedule.
• Clothing, radios and cell phones will not be used in the area once the pit is primed or during the priming process, unless radios are at the firing point and the firing line is shunted.
• Establish EZ to reduce blast and overpressure hazards.
• Use PPE and distance to relieve fragmentation and overpressure hazards.
• EZ sentries will be posted at access road barricades to prevent unauthorized entry.
• EZ sentries will wear orange vests during operations and maintain radio communications with demolition team supervisor
• Demolition crew will observe frag distance when seeking shelter from blasting.
• Hearing protection.
• Procedures for demolition operations in Work Plan will be followed.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Donor explosive materials
• Blasting circuits
• PPE (Orange safety vests, cotton clothing, leather gloves, leather work boots with non-slip soles, safety glasses, hearing protection.
• Radio communications</td><td>UXOSO/QC will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.

• Equipment inspected daily prior to use.
• PPE inspected daily prior to use</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific UXO training will be presented to all site personnel.
• Heat stress training.
• Training in safe operating procedures, emergency procedures and PPE requirements during demolition operations.
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Mechanical Excavation (if required)</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Establish exclusion zone around project site footprint.
• Prior to intrusive operations, locate large anomalies using hand held magnetometer equipment.
• Investigate when within one foot of anomalies using hand-digging methods.
• Carefully dig around the item, so that it can be identified and examined for condition.
• Excavate soil in lifts of up to 1 foot and re-sweep the area for large anomalies
• If live MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.
• If inert Munitions Debris (MD) is encountered, it will be inspected and certified as inert and secured at a collection point</td><td>• MEC hazards
• EMR for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Muscle strain carrying instruments
• Heat Stress / Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Unauthorized personnel entering site during operations
• Heavy equipment operations (noise, dust, exhaust, crushing hazards).
• Fueling hazards
• Pinching/crushing hazards from moving equipment
• Moving equipment hazards within arc of bucket</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles.
• Follow appropriate lifting/ carrying procedures. (CSHP Chp21)
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization.
• Training in biological hazards avoidance; PPE. (CSHP Chp 21)
• Site control measures will be implemented and exclusion zone established.
• Training in heavy equipment operations and excavation procedures, PPE.
• Follow fueling precautions in Section 15.9.
• No one will be within the arc when equipment is operating.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Geophysical equipment (handheld magnetometers).
• Footwear with ankle support and non-slip soles.
• Communications to determine WBGT Index, drinking water
• Appropriate clothing and PPE to include hard hats Hi-Visibility vests and hearing protection (around heavy equipment operations), leather gloves and leg chaps (as required), dust masks (as Required).
• Backhoes and/or Mini Excavators will be used for excavation</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.

• Equipment inspected daily prior to use.
• PPE inspected daily prior to use.</td><td>• UXO personnel will be properly trained / qualified.
• Site specific MEC training.
• All UXO personnel will receive refresher training in excavating of anomalies.
• Site specific training on slip, trip and fall hazards.
• Training-lifting techniques.
• Heat/Cold Stress symptoms.
• Site specific flora/fauna to include first aid.
• All site personnel will have current HAZWOPER training.
• Heavy equipment training.</td></tr>
</table>

SITE SAFETY AND HEALTH PLAN

The following procedures are attached and intended to address Site Specific hazards and controls for the CRP project. The Site Description and History for this site are in Section 2.0 of the APP. AHA's are located in Section 14.

15.0 GENERAL SAFETY

Due to the nature of planned site operations, the potential risk for exposure to safety hazards is high. Anticipated safety hazards, which may be encountered during site activities, and precautions to be followed are listed below and in individual Activity Hazard Analyses, above.

15.1 Slips, Trips, and Fall Hazards

The project site is located between a river and a park area. Site conditions consist of light to moderate terrain and light brush, which make for the possibility of slips, trips, and fall hazards. Site personnel shall be instructed to make themselves aware of the placement of their feet at all times to avoid site conditions that attribute to slips, trips, and falls. As there will be some shallow excavation work taking place, site personnel will be instructed to stay at least two feet away from the edge of excavations. The use of sturdy leather work boots with ankle support and non-slip soles will reduce the risk of slips, trips and falls.

15.2 Cuts/Laceration Hazards

Power tools, MD surfaces and other buried debris can be expected to have sharp and rusted surfaces. Project personnel should expect a high likelihood of cuts/lacerations if proper care is not taken. During all activities involving the handling of MEC, scrap, and site materials, personnel will wear leather work gloves to prevent injury to hands.

15.3 Pinched/Crushed Fingers and Toes

The weight of MEC scrap expected to be recovered and handled during surface sweep and MEC inspection activities is expected to pose only a light to moderate hazard to fingers and toes. The mishandling of even light materials can cause injuries to site personnel. All site personnel are required to wear leather work boots and gloves while activities are being conducted. Personnel will utilize proper lifting techniques and when appropriate, will use additional personnel or material handling equipment for heavy objects.

15.4 Hand Tool Operation

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects prior to each use.
- Defective hand tools will be removed from service and repaired or discarded.
- Tools will be selected and used in the manner for which they were designed.
- Be sure of footing and grip before using any tool.

- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.
- Gloves will be worn whenever they increase gripping ability or if cut, laceration or puncture hazards may exist during the use of hand tools.
- Safety glasses with side shields, goggles, or a face shield will be used if tool use presents an eye/face hazard.
- Do not use makeshift tools or other improper tools.
- Use non-sparking tools where there are explosive vapors, gases, or residue.

15.5 Material Lifting

Many types of objects are handled in normal day-to-day operations. Care shall be taken in lifting and handling heavy or bulky items because they are the cause of many upper extremity and back injuries. The following fundamentals address the proper lifting of materials to avoid upper extremity and back injuries:

- The size, shape and weight of the object to be lifted must be considered. Site personnel will not lift more than 50 lbs, or any uncomfortable weight, individually. The lift will otherwise be performed mechanically or with additional personnel.
- A firm grip on the object is essential; therefore, the hands and object shall be free of oil, grease and water, which might prevent a firm grip.
- The hands and especially the fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees and the object lowered.
- If the item to be lifted is too large, bulky, or heavy for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, use the equipment instead of trying to lift it yourself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

15.6 Munitions and Explosives of Concern

MEC may be present and located during CRP site activities. UXO qualified personnel will follow the requirements of the EOTI Safety Program, EP 385-97, and the EP 385-1-95a Basic Safety Concepts and Considerations for MEC Response Action Operations, which outline the safety and health precautions to be taken if MEC are encountered and/or destroyed. All non-UXO qualified personnel will follow the safe work practices listed below:

- Non-UXO qualified personnel will receive site-specific MEC recognition training prior to participation in site activities.
- No soil penetrating activities will be allowed without the area first being cleared by UXO qualified personnel.
- Non-UXO qualified personnel will be escorted on site by UXO qualified personnel, until such time as the area is cleared.
- Once an area has been cleared and flagged, non-UXO qualified personnel may perform non-intrusive duties in the area unescorted, but shall not leave the cleared area unescorted.
- Non-UXO qualified personnel will not touch or disturb any object, which could potentially be MEC, related, and will immediately notify the nearest UXO qualified person of the presence of the object.

EOTI will establish an EZ based on the Hazardous Frag Distance of the Munition with the Greatest Fragmentation Distance (MGFD) for all CRP UXO operations other than MEC Disposal. For MEC Disposal Operations, the EZ will be based on the Maximum Frag Distance of the MGFD. If unexpected hazardous MEC is located, a review of the MGFD may result in an adjustment to the size of the EZ. EOTI will have control of the entrance to the project area until the area has been cleared. Should personnel not associated with the project operations need to enter the EZ in order to gain access to the area, all MEC operations will halt for the duration of time the person is within the EZ. Once they have departed the area, MEC operations may resume.

Hazardous MEC disposal operations will be performed by EOTI. MPPEH will be inspected and, if determined to be inert, certified as non-hazardous, and will be collected in a secured location until the conclusion of the project work. After the project work has been completed, the non-hazardous scrap will be transferred to metal recycling facility.

15.7 Chemical Hazards

The only anticipated chemical hazards expected during CRP site activities are those fuels and oils brought on-site, for equipment maintenance. All site personnel will follow the procedures and precautions outlined in appropriate SDS. The SDS binder will be kept in the site office and will be available to all employees on request. CWM procedures are outlined in Section 2.1 of this appendix, but are not anticipated as necessary during this site operation.

15.8 Physical Hazards

For the planned site activities to be conducted, the potential for exposure to physical hazards is high. The physical hazards that may be encountered during site operations and precautions to be taken are listed below.

15.9 Flammable/Explosive Hazards from Fueling Equipment and Site Vehicles

The chance of fire and/or explosion during vehicle and equipment refueling and maintenance is high when improper procedures are used. All site vehicles will be equipped with a portable fire extinguisher readily available to fight a fire. Equipment will never be refueled on the back of a pick-up truck with a bed liner. Cellular phones will not be used around Flammable Liquids. Grounding and bonding procedures will be used during all fueling operations.

15.10 Noise Hazards

Protection against the effects of noise exposure shall be provided when the sound pressure levels exceed those shown below when measured on the A-scale of a standard sound level meter at slow response. When employees are subjected to sound exceeding those listed in the following table, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels to within these levels, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. If the variations in noise level involve maximal intervals of 1 second or less, it is to be considered continuous.

PERMISSIBLE NOISE EXPOSURES (1)	
Duration per Day, (Hours)	**Sound level dBA (Slow Response)**
8.00	90
6.00	92
4.00	95
3.00	97
2.00	100
1.50	102
1.00	105
0.50	110
0.25	115
Footnote (1). When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C1./T1. + C2./T2. C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C(n) indicates the total time of exposure at a specified noise level, and T(n) indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.	

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

15.11 Cold and Heat Stress

Due to the duration, location and the time of year of this project, there is a moderate probability of encountering extreme heat. Precautions for prevention of cold stress are also provided for the possibility of unseasonable cold temperatures. For unseasonable cool temperatures, workers will dress in warm layered clothing to protect against low temperatures. Fluids will be available on site and workers will be encouraged to drink frequently. If required for cold temperatures, workers will be given opportunities to warm up in heated facilities base on the ACGIH recommended Work-Warming Regimen.

Heat Stress

Heat stress is one of the most common (and potentially serious) illnesses that affect hazardous waste site workers. When site personnel are engaged in operations involving hot environments and/or the use of semi- or impermeable clothing, a number of physiological responses can occur which may seriously affect the health and safety of the workers. These affects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program.

Level D PPE is being used at this site, so the heat stress program will be implemented if the ambient temperature exceeds 75°F according to the ACGIH Heat Stress Recommendations for unacclimatized workers.

Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75°F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines for Heat Stress.

Causes of Heat Stress

The most common cause of heat stress during site activities is the affect that PPE has on the body's natural cooling mechanism. Impermeable or semi-impermeable PPE interferes with the evaporation of perspiration and causes the body to retain metabolic and environmentally induced heat. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors including environmental condition, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital.

Factors, which may predispose a worker to heat stress, include:

- Lack of physical fitness.
- Lack of acclimatization to hot environments.
- Degree of hydration.
- Level of obesity.
- Current health status (i.e., having an infection, chronic disease, diarrhea, etc.).
- Alcohol or drug use.
- The worker's age and sex.
- Sunburn.

Prior to initiating site activities each day, and periodically throughout the day, the UXOSO will inspect the site personnel for evidence of the previously mentioned factors to determine those personnel who are at increased risk for heat stress related disorders. Evidence of extreme dehydration, illness or drug or alcohol use may require the SUXOS/UXOSO to restrict the worker's activities until such time as the worker is fit for duty. Personnel identified as being at high risk for heat stress, who are allowed to participate in site operations, will be monitored frequently by the UXOSO throughout the day.

Heat Stress Disorders

This Section outlines the major heat related illnesses that may result from exposure to high heat environments and/or the use of semi- or impermeable clothing. For the purpose of this Program, reference to "liquids" will indicate the use of water or an electrolyte replacement solution, and not tea or coffee (unless it is decaffeinated) or carbonated soft drinks.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

Symptoms: Mild red rash, especially in areas of the body, which sweat heavily.

Treatment: Decrease the amount of time in protective gear and provide powder such as cornstarch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

Heat Cramps

Heat cramps are caused by a profuse rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

Symptoms: Acute, painful spasms of voluntary muscles such as the back, abdomen and extremities.

Treatment: Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have patient drink one to two cups of liquids immediately and every twenty minutes thereafter. Consult with physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with liquids. For maximum benefit this should be taken in at least a 2:1 ratio with at least two glasses of water to one glass of electrolyte replacement liquid.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by increased stress on various organs to meet increased demands to cool the body due to excessive loss of fluids from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated heat exhaustion can quickly develop into heat stroke.

Symptoms: Symptoms of heat exhaustion include pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. The body's temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache, be dizzy or nauseated.

Treatment: Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet and allow individual to rest. Consult a physician, especially in severe cases. Have the patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Total liquid consumption should be about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, immediate medical attention will be required.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The failure of the individual's temperature control system causes the perspiration system to stop working correctly. When this occurs the body core temperature rises very rapidly to a point (105+°F) where brain damage and death will result if the person is not cooled quickly.

Symptoms: The victim's skin is hot, and may or may not be red and dry, (due to the fact that the individual may still be wet from having sweat while wearing protective clothing earlier), nausea, dizziness, confusion, extremely high body temperatures, rapid respiratory and pulse rate, delirium, convulsions, unconsciousness or coma.

Treatment: Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. The victim should be moved to a shady area; lie down and keep the head elevated. Gradually cool the victim by either sponging or immersing the victim in cool water to reduce the core temperature to a safe level (<102°F). If they are conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not give the victim caffeinated or alcoholic beverages. Heat stroke is considered a medical emergency. Medical emergency assistance must be summoned.

Heat Stress Preventive Measures

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat exhaustion, that person may become predisposed to additional heat injuries. In order to avoid heat related illnesses proper preventive measures will be implemented whenever environmental conditions dictate the need. These preventive measures represent the minimal steps to be taken and will include the following procedures:

- SUXOS/UXOSO will examine each site worker prior to start of daily operations to determine the individuals susceptible to heat induced stress. Workers exhibiting factors ,which make them susceptible to heat stress will be closely monitored by the UXOSO.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms and treatment of heat stress disorders as outlined in this program.
- In order to maintain workers' body fluids at normal levels, workers will be encouraged to drink, as a minimum, approximately sixteen ounces of liquids prior to start of work in the morning, after lunch and prior to leaving the site at the conclusion of the day's activities.
- Disposable four (4) to twelve (12) ounce cups and liquids will be provided on site.
- Acceptable liquids will include water and an electrolyte replacement solution, with the recommended intake being two cups of water to each cup of electrolyte replacement solution.
- Liquids containing caffeine are to be avoided.

When ambient conditions and site workload requirements dictate, as determined by the SUXOS, workers will be required to drink a minimum of sixteen (16) to thirty-two (32) ounces of liquids during each rest cycle. The normal thirst mechanism is not sensitive enough to ensure that enough water will be taken to replace lost sweat. When heavy sweating occurs, workers should be encouraged to drink even though they may not be thirsty. The following strategies may useful in encouraging fluid intake:

- Maintain water temperature at 50°F to 60°F (10°C to 15.6°C).
- Provide small disposable cups that hold about 4 ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluids (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this Program. Site workers will be given time to acclimatize to site work conditions, temperature, and workload. Acclimatization usually takes about a week of continued work in hot environments, and allows the worker's body to become adjusted to this level and type of work. This process involves a gradual increase in the workload over the required period, the length of which depends upon the nature of the work performed, the ambient temperatures and the individual's susceptibility to heat stress. Work schedules will be adjusted as follows:

- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.
- Add additional personnel to work teams.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

Supplemental Preventive Measures

Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.

Administrative Controls and Work Practices

Training is the key to good work practices. Unless all employees understand the reasons for new or changing old work practices, the chances of such a program succeeding are greatly reduced. The following will be discussed during the site-specific training and repeatedly as determined by the SUXOS/UXOSO:

- Knowledge of the hazards of heat stress;
- Recognition of predisposing factors, danger signs, and symptoms;
- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment;
- Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs; and
- Dietary effects on heat stress.

Because the incidence of heat stress depends on a variety of factors all workers, even those not wearing protective equipment, should be monitored. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 15.1). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), recommendations for monitoring requirements and suggested work/rest schedules in the current ACGIH TLVs for Heat Stress shall be followed. If the actual clothing worn differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules accordingly.

The goal of all heat stress monitoring is to ensure that the worker's body temperature does not exceed 100.4°F. The physiological monitoring methods listed below are to be implemented based upon the severity of the heat and workload. As a minimum the UXOSO will perform WBGT monitoring. He may also choose to monitor the worker's heart rate as an indication of potential heat stress. The frequency of physiological monitoring will be determined using the information presented in Table 15.1.

Heart Rate Monitoring

The worker's baseline heart rate should be recorded prior to initiation of site activities by measuring the radial pulse rate for thirty seconds. After each work cycle the heart rate should be measured by taking the pulse rate (PR) for 30 seconds as early as possible into the resting period. Taking the radial (wrist) pulse rate is the preferred method however the carotid (neck) pulse rate may be taken if a worker has difficulty finding the radial pulse. The PR at the beginning of the rest period should not exceed one hundred and ten (110) beats per minute (bpm). If the PR is higher than 110 bpm, the next work period should be shortened by thirty-three percent, while the length of the rest period stays the same. If the PR exceeds 110 bpm at the beginning of the next rest period, the work cycle should be further shortened by thirty-three percent. This procedure will be continued until the worker's PR at the beginning of the rest cycle is maintained below 110 bpm.

Wet Bulb, Dry Globe Temperature (WBGT) Monitoring

For CRP site conditions where personnel are working in Level D PPE, and the ambient temperature is greater than 75°F, the UXOSO will conduct WBGT monitoring to assist in controlling the potential for site workers experiencing heat related adverse health affects. The SUXOS will use WBGT monitor readings obtained from the monitoring equipment, and after estimating the workload, use the values expressed in Table 15.2, to determine the work/rest schedule to be implemented. The values outlined in this table are designed such that nearly all acclimatized, fully clothed workers with adequate salt and water intake will be able to function without the body temperature exceeding 100.4°F.

Acclimatization is the adaptive process that results in a decrease of the physiological response produced by the application of a constant environmental stress. On initial exposure to a hot environment, there is an impaired ability to work and evidence of physiological strain. If the exposure is repeated on several successive days, there is a gradual return of the ability to work and a decrease in physiological strain. Within 4 to 7 days following initiation of the acclimatization process, a dramatic improvement in the ability to perform work is noticed, subjective discomfort practically disappears, body temperature and heart rate are lower, there is a more stable blood pressure, and the sweat is more profuse and dilute.

Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

Heat Stress Documentation

Should it be required due to site conditions, the UXOSO will be responsible for recording all heat stress related information. This will include training sessions and monitoring data. Training sessions will be documented using the Documentation of Training Form. Pulse rate monitoring data will be recorded on the Heat Stress Monitoring Log, with the WBGT being recorded in the Site Safety Log and/or Site Monitoring Log.

Table 15.1
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

ADJUSTED TEMPERATURE[b]	NORMAL WORK ENSEMBLE[c]	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-28.1°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
75°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

a For work levels of 250 kilocalories/hour.
b Calculate the adjusted air temperature (at adj) by using this equation: at adj °F = ta °F + (13 x % sunshine). Measure air temperature (at) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Table 15.2
SCREENING CRITERIA WBGT HEAT EXPOSURE THRESHOLD LIMIT VALUES

Work - Rest Regimen	WORK LOAD Light*	WORK LOAD Moderate	WORK LOAD Heavy
Continuous work	(29.5)	(27.5)	(26.0)
75% Work - 25% Rest, each hour	(30.5)	(28.5)	(27.5)
50% Work - 50% Rest, each hour	(31.5)	(29.5)	(28.5)
25% Work - 75% Rest, each hour	(32.5)	(31.0)	(30.0)

Consult the ACGIH TLV booklet for definitions of Light, Moderate and Heavy workloads. Values are given in (^{0}C) WBGT, and are intended for workers wearing single layer summer type clothing. Use of semi or totally impermeable clothing requires monitoring IAW the EOTI Heat Stress Prevention Program. As workload increases, the heat stress impact on a non-acclimated worker is exacerbated. For non-acclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5^{0}C.

15.12 Ionizing Radiation Hazards

Ionizing radiation is not expected to be an issue on this project site.

15.13 Biological Hazards

Biological hazards, which are usually found on site, include insects, such as ticks, spiders, poisonous snakes and hazardous plants. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

15.14 Hazardous Plants

During the conduct of CRP site activities the number and variety of plants that may be encountered is large and extensive. However, the plants presenting the greatest degree of risk to site personnel (i.e. potential for contact vs. affect produced) are those, which produce skin reactions and skin and tissue injury.

15.15 Plants Causing Skin and Tissue Injury

Contact with splinters, thorns and sharp leaf edges is of special concern to site personnel, as is the contact with the pointed surfaces found on branches, limbs and small trunks. This concern stems from the fact that punctures, cuts and even minor scrapes caused by accidental contact may result in non-infectious skin lesions, and the introduction of fungi or bacteria through the skin or eye. Personnel receiving any of the injuries listed above, even minor scrapes will report immediately to the UXOSO for initial and continued observation and care of the injury.

15.16 Plants Causing Skin Reactions

The poisonous plants of greatest concern are poison ivy, poison sumac and poison oak. Both poison ivy and poison oak thrive in all types of light and usually grow in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has shiny pointed leaves that grow in clusters of three. Poison oak can have shiny or dull, pointed leaves that grow in clusters of three. Poison oak leaves are more rounded rather than jagged and the underside of poison oak leaves are covered with hair. Poison sumac has smooth leaves, grows only in wetlands and has 7-9 leaves per stem.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact.
- Reddening, swelling, itching and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

If the rash is scratched, secondary infections can occur. The rash usually disappears in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe. Preventive measures, which can prove effective for most site personnel, are:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify report and mark poisonous plants found on site.
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday.
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing.
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.
- If burning of these plants occurs, make sure personnel are located upwind of the smoke, as inhalation of the smoke or contact with airborne particles from these plants can still cause a reaction to occur.

15.17 Snakes

When site activities are conducted in warm weather on sites that are located in wooded, grassy or rocky environments, the potential for contact with venomous snakes becomes a very real danger. There are 38 snake species in South Carolina, only six of which are venomous. These are Copperhead, Coral Snake, Cottonmouth, Pigmy Rattlesnake, Eastern Diamondback Rattlesnake and Timber Rattlesnake. Normally, if a person is approaching a snake, the noise created by the person is usually sufficient to frighten the snake off. However, during the warm months, extreme caution must be exercised when conducting site operations around areas where snakes might be found (i.e. rocks, bushes, logs, or in holes, crevices, and abandoned pipes). If venomous snakes are identified on the CRP site, EOTI will issue protective clothing, such as snake leggings, to site personnel. The rules to follow if a snake bites someone are:

- DO NOT cut “Xs” over the bite area, as this will intensify the effect of the venom.
- DO NOT apply suction to the wound since this has a minimal effective in removing venom.
- DO NOT apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area.
- If possible, try to get a good look at the snake so it can be identified for proper selection of anti-venom.
- DO NOT allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body.
- Keep the victim calm and immobile.
- Have the victim hold the affected extremity lower than the heart while waiting for medical assistance. Do not delay evacuation.

- Transport the victim to medical attention immediately.

15.18 Tick Bites

The Centers for Disease Control (CDC) has noted the increase of Lyme Disease and Rocky Mountain Spotted Fever (RMSF) which are caused by bites from infected ticks that live in and near wooded areas, tall grass, and brush. Ticks are small, ranging from the size of a comma up to about one quarter inch. They are sometimes difficult to see. The tick season extends from spring through summer. When embedded in the skin, they may look like a freckle.

Lyme disease has occurred in 43 states, with the heaviest concentrations in the Northeast, the upper Midwest, and along the northern California coast. It is caused by deer ticks and the lone star ticks which have become infected with spirochetes. Female deer ticks are about one quarter inch in size, and are black and brick red in color. Male deer ticks are smaller, and completely black. Lone star ticks are larger and chestnut brown in color.

Rocky Mountain Spotted Fever has occurred in 36 states, with the heaviest concentrations in Oklahoma, North Carolina, South Carolina, Texas, and Virginia. It is caused by Rocky Mountain wood ticks, and dog ticks which have become infected with rickettsia. Both are black in color.

Symptoms: The first symptoms of either disease are flu like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur.

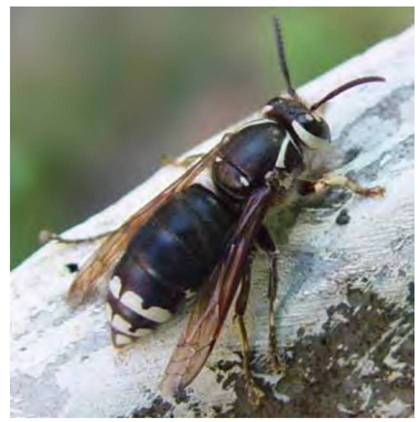
If you believe a tick has bitten you, or if any of the signs and symptoms noted above appear contact the UXOSO, who will authorize you to visit a physician for an examination and possible treatment.

Protective Measures: Standard field gear (work boots, socks and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. Light-colored coveralls allow easier identification of ticks on clothing. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:

- When in the field, check yourself often for ticks, particularly on your lower legs and areas covered with hair.
- Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin or permanone. Apply deet (vapor-active repellent) to any exposed skin surface (except eyes and lips), and apply permethrin repellent spray to field clothing. Allow the permethrin to dry before using treated clothing. The repellent system, deet and permethrin, offer maximum protection.
- When walking in wooded areas, wear a hat, and avoid contact with bushes, tall grass, or brush as much as possible.
- If you find a tick, remove it by pulling on it gently with tweezers.
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers.
- DO NOT use matches, a lit cigarette, nail polish or any other type of chemical to “coax” the tick out.

- Be sure to remove all parts of the tick's body, and disinfect the area with alcohol or a similar antiseptic after removal.
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area, frequently seen with a small welt in the center.
- Also look for the signs of the onset of RMSF, such as an inflammation which is visible in the form of a rash comprising many red spots under the skin, which appears 3 to 10 days after the tick bite.

15.20 Bees, Hornets and Wasps



Contact with stinging insects like bees, hornets and wasps may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas.
- The nests can be situated in trees, rocks, and bushes or in the ground, and are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling, which can leave the worker incapacitated and in need of medical attention.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again.

With these things in mind, and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, he must inform the UXOSO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the UXOSO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged off and site personnel will be notified of its presence.

- If stung, site personnel will immediately report to the UXOSO to obtain first aid treatment and to allow the UXOSO to observe them for signs of allergic reaction. If a breathing emergency (anaphylactic shock) occurs as a result of the sting, immediately call 911.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times, and will let the SUXOS, UXOSO and co-workers know where it is kept.

15.21 Spiders

A large variety of spiders may be encountered during CRP site activities. While most spider bites merely cause localized pain, swelling, reddening and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous. These species include the black widow and the brown or violin spiders.

The black widow is a coal-black bulbous spider about ¾-inch in length, with a bright red hourglass on the underside of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite.
- Appearance of small punctures (but sometimes none are visible).
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities.

The brown recluse or violin spider is brownish to tan in color, rather flat, about 5/8-inch long with a dark brown “violin” shape on the top. Of the brown spider, there are three varieties found in the United States, which present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite.
- Formation of a large, red, swollen, postulating lesion with a bull’s-eye appearance.
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting.
- Pain may become severe after 8 hours, with the onset of tissue necrosis.

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, these spider bites are not considered to be life threatening; however, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Scorpions are stinging arachnids found over much of the United States. All known scorpion species possess venom and use it primarily to kill or paralyze their prey so that it can be eaten; in general, it is fast-acting, allowing for effective prey capture. It is also used as a defense against predators. The venom is a mixture of compounds (neurotoxins, enzyme inhibitors, etc.) each not only causing a different effect, but possibly also targeting a specific animal. Each compound is made and stored in a pair of glandular sacs, and is released in a quantity regulated by the scorpion itself. Of the 1000+ known species of scorpion, only 25 have venom that is dangerous to humans.

The SUXOS/UXOSO will brief site personnel as to the identification and avoidance of the spiders and scorpions. As with stinging insects, site personnel shall report to the SUXOS/UXOSO if they locate either of these spiders or scorpions on site or notice any type of bite or sting while involved in site activities.

15.22 Hantavirus Pulmonary Syndrome

Basic Transmission Cycle – some rodents are infected with a type of Hantavirus that causes Hantavirus Pulmonary Syndrome (HPS). In the United States, deer mice (plus cotton rats and rice rats in the southeastern states and the white-footed mouse in the Northeast) are the rodents carrying hantaviruses that cause hantavirus pulmonary syndrome. Common house mice do not carry Hantavirus.

These rodents shed the virus in their urine, droppings and saliva. The virus is mainly transmitted to people when they breathe in air contaminated with the virus. This happens when fresh rodent urine, droppings or nesting materials are stirred up. When tiny droplets containing the virus get into the air, this process is known as aerosolization.

There are several other ways rodents may spread Hantavirus to people:

- If a rodent with the virus bites them, the virus may be spread this way – but this is very rare.
- Researchers believe that you may be able to get the virus if you touched something that had been contaminated with rodent urine, droppings, or saliva, and then touched your nose or mouth.
- Researchers also suspect that if virus-infected rodent urine, droppings or saliva contaminates food that you eat, you could also become sick.

Symptoms of HPS: Early symptoms include fatigue, fever, and muscle aches, especially the large muscle groups – thighs, hips, back, sometimes shoulders. These symptoms are universal. There may also be headaches, dizziness, chills and/or abdominal problems, such as nausea, vomiting, diarrhea and abdominal pain. About half of all HPS patients experience these symptoms.

How long could it be between the time you get the virus, and the time you start showing these symptoms? Because there have been so few cases of HPS, it is not quite clear what this “incubation time” is. However, it appears right now that it may be between one to five weeks after you are exposed to potentially infected rodents and the rodent’s droppings before you will show any symptoms.

Late symptoms – 4-10 days later – symptoms include coughing and shortness of breath, with the sensation of, as one survivor put it, a “tight band around my chest and a pillow over my face” as lungs fill with fluid.

MINIMIZE RISK - do not disturb rodents, burrows, or dens.

Preventive Measures: If there are signs of a rodent nest or rodent droppings, make it known to the SUXOS/UXOSO. To clean and disinfect the area, spray a disinfectant on the area and leave a waiting time of 20 minutes. Then clean it up using rubber or plastic gloves, coveralls, rubber boots or disposable shoe covers, protective goggles, and a half-face mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter. Bag the cleaning materials and dispose of it. Then, re-clean the area with disinfectant.

15.23 Mosquitoes

Mosquitoes are responsible for transmitting diseases such as malaria and West Nile Virus through bites to the skin. While malaria is much more contagious, it is not normally found in North America. West Nile virus is commonly found in Africa, West Asia and the Middle East. In recent years, West Nile virus has been increasingly found in the continental United States. It is believed to have first appeared in the United States in 1999. It is most common in late summer or early fall, which is the active season for mosquitoes, but in warmer southern climates where the temperatures are milder, West Nile virus can be transmitted year round.

Transmission Cycle: Mosquitoes become infected with the virus when they feed on infected birds, which may circulate the virus in their blood for a few days. Infected mosquitoes can then transmit the virus to humans and animals while biting to take blood. The virus is located in the mosquito's salivary glands, and may be injected into the animal or human, where it can multiply, possibly causing illness. Even in areas where the virus is circulating, few mosquitoes are infected with the West Nile virus. Even if the mosquito is infected, less than 1% of people who get bitten and become infected will get seriously ill. The majority of cases of West Nile virus have been identified in birds, it has also been found in horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits. It was recently found in a horse in New Mexico. Once West Nile virus has been contracted, the survivor of this illness is believed to carry a lifelong immunity to it. At this time there is no vaccine against West Nile virus.

Symptoms: West Nile virus is encephalitis, which causes an inflammation of the brain. Following transmission by an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. Fatality rates range from 3%-15% of persons who develop severe illness, and rates are highest among persons over 50 years of age and those with weakened immune systems. This disease is not transmitted from person-to-person, so touching or working in the vicinity of someone with the disease will not increase the risk.

The incubation period for West Nile virus is normally 3-15 days. Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

If symptoms develop, seek medical attention immediately.

Preventive Measures: Prevention and control of West Nile virus is most effectively accomplished through vector management programs. Be alert for dead animals on the site, particularly birds. If a dead bird or other animal is found on site, bare-handed contact should be avoided. Using gloves or double plastic bags, wrap animal and call the Health Department. If the Health Department wants to test the bird, they will come and pick it up. If they are not testing the bird, it should remain wrapped in the plastic and disposed of in accordance with established procedures.

Other ways of reducing risk of becoming infected with West Nile Virus include:

- Implement mosquito control measures on the site.
- Make sure that there are no open containers of standing water on the site in which mosquitoes can breed.
- Wear long sleeved shirts and long pants while outdoors.
- Stay indoors at dawn, dusk, and in the early evening when mosquitoes are most active.
- Spray clothing with repellants containing permethrin or DEET.
- Apply insect repellant sparingly to exposed skin. An effective repellant will contain 35% DEET. Higher concentrations of DEET provide no additional protection. Always read the manufacturer's directions on the repellant prior to applying it to the skin.
- Vitamin B and "ultrasonic" devices are NOT considered to be an effective deterrent to mosquito bites.

Treatment: If symptoms have developed that are consistent with West Nile virus, a blood sample will be taken and sent for analysis. There is currently no specific therapy. In more severe cases, intensive supportive therapy is indicated, normally involving hospitalization, intravenous fluids, airway management, respiratory support (ventilator), prevention of secondary infections (pneumonia, urinary tract, etc.) and nursing care.

15.24 Hazard Mitigation

The hazards listed above will be addressed through a combination of training, engineering controls, and personal protective equipment, with engineering controls as the method of preference, when feasible.

Implementation of Engineering Controls and Work Practices

Training for site procedures and the use of site equipment is instrumental in preventing accidents from occurring. Training in MEC recognition will be given to all site workers, and all will be watchful for MEC or pieces of MEC, which could be hazardous. When MEC or pieces of MEC are encountered, it is everyone's duty to contact a UXO-qualified person to handle the situation. Other controls include the EZ, which will be used to keep unauthorized personnel out of the project site and shielding material to protect the operators of heavy equipment.

Upgrades/Downgrades in Levels of Personal Protective Equipment

Due to the types of hazards at the CRP site, Level D PPE will be required. This type of PPE is used for levels of contamination that may present a nuisance, but not an identifiable hazard. This consists of a hard hat, safety glasses, hearing protection, leather work gloves, rubber over-boots and non-steel-toed work boots to prevent interference with metal detectors. The hard hat will only be worn in head hazard areas, such as in the vicinity of the heavy equipment operations and during vegetation clearance operations. Rubber over-boots will only be worn over leather boots in watered areas. If hazards are encountered that are greater than estimated, the PPE level will be increased. This will be accomplished by the Corporate Health and Safety Staff, and the decision will be based on documented evidence of the hazards. If excessive dust levels near heavy equipment warrant via exposure monitoring, appropriate respiratory protection will be implemented in accordance with EOTI's corporate respiratory protection program. If the site is not as hazardous as originally anticipated, the level of PPE can be downgraded by the Corporate Health and Safety Staff. This decision would also be based on definitive data that demonstrates the conclusion that the PPE can be lessened. Normally to downgrade PPE would require at least one week's worth of data, during consistent site operation, demonstrating that the site is not as hazardous as originally suspected. PPE levels will conform to Section 5 of EM 385-1-1.

Work Stoppage and/or Emergency Evacuation of On-Site Personnel

All personnel are trained to be constantly aware of their work environment. Anyone has the ability to stop operations for safety reasons. No worker is expected to perform any operation for which he has not been trained, or to perform any operation that is considered to be unsafe. After operations are stopped for safety reasons, the SUXOS and UXOSO will be notified and they will evaluate the situation. The SUXOS will, in consultation with the Corporate Health and Safety Staff, determine what steps need to be taken to make the situation safe for operations to continue.

Emergency Evacuation

In the event of an emergency that requires evacuation of the site, verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point, which will be the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, advise and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;
- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS.

Prevention and/or Minimization of Public Exposure to Hazards Created by Site Activities

Establishment and maintenance of an EZ creates separation between the CRP site footprint and the general public acts as a safety cushion to protect the public against site hazards. Controlling access to the site, closing roads, signs and barricades are all means of keeping the general public from accidentally wandering into the site during site operations. Training all site workers in the hazards of MEC will have more eyes looking for MEC. Any worker observing MEC or pieces of MEC will not touch or handle it in any way. He will inform a UXO-qualified EOTI worker, who will then handle the situation. If unauthorized personnel are observed in the EZ, all MEC operations will cease until the area is cleared of unauthorized personnel.

16.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

Descriptions of qualifications and responsibilities of Safety Staff members are contained in Section 6.0 of the APP.

17.0 PERSONAL PROTECTION EQUIPMENT

PPE requirement are contained in Section 12.1 of the APP. PPE requirements will be reevaluated as appropriate per Section12.1 and section 15.24 and will comply with Section 5 of EM 385-1-1.

18.0 MEDICAL SURVEILLANCE

Medical surveillance of EOTI employees will be conducted IAW the requirements of OSHA 29 CFR 1910.120(f)(HAZWOPER), 29 CFR 1910.134(b)(10)(Respiratory Protection) and other established guidelines. Personnel to be included in the Medical Surveillance Program will be those who perform hazardous waste operations that may potentially expose the worker to hazardous substances or other significant safety and health threats. All EOTI personnel on the project site will be part of the EOTI Medical Surveillance Program. Visitors desiring entry into the EZ must be on their employer's Medical Surveillance Program and must have a current physician's statement prior to entry.

18.1 Baseline Health Assessment Physical or Annual Physical

A baseline health assessment physical or annual physical will be conducted prior to participating in site operations, to determine the worker's ability to perform hazardous waste operations in a safe and healthful manner. The Project Manager, in conjunction with the SUXOS/UXOSO, will ensure that all health assessments address the site-specific health hazards to which workers may be exposed.

Physicals will be scheduled through the services of a board certified occupational medicine physician in the vicinity of the employee's home or job site. The designated physician will perform the medical assessments and review medical examination results to determine each worker's ability to perform his assigned hazardous waste duties. The physician will also be responsible for determining if supplemental or follow-up examinations are required and for maintaining medical and exposure records IAW OSHA 29 CFR 1910.120(d).

The purposes of the Medical Surveillance Program are to:

- Assess the individual's health status prior to participation in hazardous waste operations; determine the individual's ability to perform work assignments requiring the use of personal protective equipment (PPE) and clothing;
- Establish baseline data for comparison to future medical data in order to provide a means of monitoring a worker's health status;
- Establish facilities and procedures for emergency and non-emergency medical treatment;
- Establish procedures for maintenance and storage of medical and exposure records.

18.2 Physician's Statement

The results of this examination will be made available to the employee and a written physician's statement will be sent to EOTI. A copy of the physician's statement will be kept in each employee's file at the project site for the duration of site operations. The physician's statement will include the following:

- The physician's opinion regarding any conditions which would place the employee at an increased risk from working in hazardous waste operations;
- The physician's recommended limitations upon the employee's assigned work, if any; and
- A statement that the employee has been informed by the physician of the results of the examination, and any conditions which may require further examination or treatment.

18.3 Supplemental Examination

Any site worker will undergo a supplemental examination if they have been:

- injured;
- received health impairment;
- developed signs or symptoms from possible over-exposure; or
- received a documented over-exposure without the use of respiratory protection.

The contents of this examination will be based upon the type of injury, illness, signs or symptoms of exposure involved and will be determined by the physician. Prior to reassignment to site activities, the physician will certify that the employee is fit to return to work. If necessary, the physician will specify in writing any activity restrictions or additional tests, which may be required.

18.4 Follow-up Health Assessments

If, during any pre-assignment, annual or supplemental examination, a condition is detected which requires follow-up tests, the physician will notify EOTI and the employee as to the nature of the follow-up health assessment. The physician will determine the schedule and content of the follow-up health assessment. A statement outlining the employee's fitness for work will be provided to EOTI and the employee upon conclusion of the follow-up health assessment.

18.5 Emergency and Non-emergency Medical Treatment

The medical treatment facility for use at this project site will be:

Hospital-Palmetto Health Richland
5 Richland Medical Park Dr
Columbia, SC 29203(803) 434-7000 ** For Emergency Dial 911*

Directions to the hospital can be found at Section 11.0 of this Appendix.

18.6 Record Keeping

EOTI will retain and maintain copies of all physician statements, exposure records, and associated information for all employees involved in hazardous waste operations. These records will be kept at the project site for the duration of site operations. When the site work is complete, the records will be retained by EOTI at the Knoxville, TN office. Examining physicians will be responsible for maintaining records related to laboratory and other tests for each employee examined. All records, whether maintained by EOTI or by the examining physician, will be kept on file for a period of thirty (30) years beyond an employee's termination OSHA 29 CFR 1910.1020(d).

18.7 Exposure Monitoring/Air Sampling Program

Due to the fact that there is not expected to be any significant exposure to hazardous chemicals or excessive levels of dust at this site, exposure monitoring will not be required. As the workers on this site will normally be in Level D PPE, heat stress monitoring will be required if the temperature goes above 75°F. Should it be required, site monitoring data will be recorded using the Site Monitoring Log and will be maintained as part of the project record.

18.8 Dust Monitoring

Dust or particulates created during excavation operations may be a nuisance to operators and those working around the equipment, but are not expected to exceed a permissible exposure level according to OSHA guidelines for total or respirable particulates. The team leaders will monitor the dust levels in the areas that their teams are working if airborne levels seem excessive.

18.9 Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75^{o}F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines detailed in Section 15 above.

18.10 Meteorological Monitoring

Rain and/or other weather conditions can constitute a safety hazard to field operations at this site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS determines it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

19.0 STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

Using common sense and following safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities.

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and constantly be aware of the MEC, chemical and physical hazards that are or may be present.
- The number of personnel in the EZ will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- Team members will be familiar with the physical characteristics of each site including wind direction, site access, and the location of communication devices and safety/emergency equipment.
- The location of overhead power lines and underground utilities must be established.
- Contact with potentially contaminated surfaces, walking through puddles or pools of liquid, kneeling on the ground, or leaning, sitting, or placing equipment on the contaminated soil should be avoided.
- Detection or appearance of unusual liquids, odors or discolored soil could indicate the presence of contaminants and should be reported to the SUXOS/UXOSO immediately.

- Site personnel are to report any other unusual or potentially hazardous condition to the SUXOS/UXOSO for investigation and/or corrective action.

All personnel on site will be required to follow the safe work practices contained in this Program, as they relate to the hazards encountered during site activities. All site personnel will be required to read, understand and comply with the provisions of this APP. If new tasks or hazards are identified during site operations, which pose additional hazards, the APP will be amended by the Corporate Health and Safety Staff to include additional safe work practices and other control methods as needed.

19.1 Site Rules/Prohibitions

Safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities. General personnel requirements include:

- Horseplay or fighting is prohibited.
- Eating, drinking, smoking, chewing gum, tobacco, or any other hands-to-face activities are prohibited on-site, except in designated areas after both face and hands have been washed.
- Wearing contact lenses is prohibited in the EZ.
- When required to sit or kneel on the ground, avoid contaminated surfaces.
- Placing equipment on contaminated surfaces should be avoided.
- Climbing on or over obstacles is prohibited. Stacks of materials can be unstable and could cause injury.
- Open flames of any type are prohibited on-site.
- Bringing defective or unsafe equipment on-site is prohibited.
- Only authorized employees may enter the work site. Only essential personnel will be admitted within the EZ during MEC operations. Visitors must check in with the SUXOS, receive an appropriate safety briefing, and be escorted by UXO-qualified personnel at all times while on-site.

19.2 Buddy System

The buddy system is a safety practice in which each individual is concerned with the health and well being of co-workers. The buddy system will be implemented during all on-site activities and will be incorporated whenever workers may be isolated or as determined by the SUXOS/UXOSO. The objective of the Buddy System is to insure that no individual is ever alone on-site.

- A minimum of two UXO-qualified personnel will be present during all MEC operations. A UXO Technician I may assist in MEC operations with the supervision of a UXO Technician III or higher. Non-UXO-qualified personnel who have been determined essential for the operations being performed may be utilized to perform MEC-related procedures when supervised by a UXO Technician III or higher.
- At no time will an individual desert his assigned team unless while working in pairs, his partner goes down, and it is considered too hazardous to render assistance. Technicians will enter and exit EZ together and frequently monitor one another for signs of fatigue, heat stress, and any other problems. In such cases, the worker in danger may not even be aware he/she is having a problem. The technicians must always be alert to changes in the behavior of his teammate so that he can remove him from the situation immediately.

- Technicians should inspect each other's equipment, including PPE, to ensure that it is adequate and in proper working order.

19.3 Work Permit Requirements

At this time EOTI does not anticipate work permits for its work on this project. Under the contract there are no requirements for hot work. All site personnel, to eliminate the hazards from ignition sources, will utilize the general, fire safety precautions and procedures. Excavation work is generally expected to be less than four feet in depth, and there are expected to be no confined spaces or radioactive work on this project. Should this situation change, this SSHP will be updated to include these additional hazards, and shall handle them in accordance with the EOTI Corporate Health and Safety Program, which addresses all of these issues.

19.4 Material Handling Procedures

Many types of objects are handled in normal day-to-day operations. Care will be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably. They will use mechanical lifting equipment for lifts greater than 50 lbs that are unassisted.
- A firm grip on the object is essential; therefore, the hands and object will be free of oil, grease, and water, which might prevent a firm grip.
- The hands, and especially the fingers, will be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees, and the object lowered.
- If the item to be lifted is too large, bulky, or heavy (over 50 lb) for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, the employee should use the equipment instead of trying to lift the object himself/herself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

19.5 Spill Containment

Major spills are not expected on this site. Hazardous materials, where necessary, are being brought to the site in small quantity containers. This will minimize the amount of material involved, should a spill occur, as well as reducing the amount of hazardous material on hand to the minimum amount consistent with efficient operations. If a small amount of liquid hazardous material is spilled, it will be cleaned up with absorbent material by site personnel wearing appropriate chemical resistant gloves. It will then be containerized, labeled, and sent for disposal at an approved facility.

19.6 Drum/Container/Tank Handling

EOTI does not anticipate the use of drums/containers/tanks during activities under the PWS.

19.7 Comprehensive Activity Hazard Analysis of Treatment Technologies

Treatment technologies are not expected to be used on this project.

20.0 SITE CONTROL MEASURES

20.1 Site Map

A site map will be utilized during the Tailgate safety briefing to inform the workers of the location of hazardous areas on the site, the assembly areas to be used in the event of site evacuation, and any other information relevant to the day's activities. The site map will include:

- Site topography
- Site work zones
- Location of unusual/hazardous areas
- Prevailing winds
- Ingress and egress corridors
- Evacuation routes and assembly points
- Location of emergency supplies

20.2 Work Zone Delineation and Access Points

Site work zones will be established by the SUXOS/UXOSO prior to initiating operations to control site access. Establishment of site work zones is based upon site conditions, activities and exposure potentials. A site EZ will be set up, which includes the footprint of the area where work will take place and a distance based on the MGFD around that to protect areas outside the site from potential fragmentation, depending on the site activities. Site work zones will be marked using barricades and signage closing roads into the area to unauthorized vehicular traffic. Barricades and signs will remain in place for the duration of site work.

20.3 Site Access Control

The SUXOS will control access to each work zone and will ensure that all site workers and visitors have received the proper training and medical surveillance required to enter a specific zone. Access will be denied to any potential entrant not meeting these requirements.

20.4 Exclusion Zone

The EZ includes all areas where significant hazards do or could occur and includes all areas where PPE is required to control worker exposure to chemical or physical hazards. All personnel entering the EZ will be logged in/out by the SUXOS. All visitors to the EZ must be escorted by a UXO-qualified EOTI employee. The EZ of this site will be designated as the footprint area of actual project operations and the required separation distance surrounding the area. This distance is based on the MGFD during specifically defined site operations. When non-essential personnel are required to enter within the EZ, all UXO operations will cease until nonessential personnel are beyond the hazardous fragmentation area of the EZ.

20.5 Support Zone

The SZ is the area outside the EZ where site support activities are conducted. This zone includes break areas and sanitation facilities. Visitors desiring entry into the EZ must first meet with the SUXOS or UXOSO and receive the appropriate safety and emergency procedures briefing in the SZ before gaining admittance to the EZ, and they will be escorted at all times by a UXO-qualified employee while in the EZ.

Site access control will be implemented by the SUXOS/UXOSO and will be accomplished through a program that limits movement and activities of people and equipment at the project site. This control will be based on site-specific characteristics to include:

- Potential chemical, biological, physical or explosive hazards
- Terrain
- Expected weather conditions
- Planned site activities
- Site proximity to populated areas

The degree of site access control will include the following:

- Controlled site ingress/egress points – Work area will be clearly visible to anyone approaching the site and vice versa. Only authorized personnel will be permitted within the EZ during MEC operations. All others will remain in the SZ.
- Worker/visitor registration – All personnel working on the site sign in daily at the time of their daily safety briefing in the morning. All visitors to the site must sign the visitor log when they report to the site for their visitor briefing.
- Escort of visitors – All visitors to the site will be escorted by a UXO-qualified employee. Visitors will be briefed on site hazards, PPE requirements, and emergency procedures. Visitors who are not deemed essential will not be permitted within the EZ during MEC operations. If visitors need to access the EZ, all MEC operations will cease while they are in the area and the visitors will be escorted at all times.
- PPE requirements – PPE requirements have been established based on the site hazards. Personnel working in areas requiring PPE will wear required PPE for the duration of the operation. Visitors to the area will be required to have the required PPE for the area they will be visiting.

20.6 On and Off-Site Communication System

On and off-site communication will be established through the use of cellular telephones and radios. All personnel will have emergency phone numbers and understand how and under what conditions they are to be used. Cell phones will not be used around MEC where EMR may present a hazard, but will remain in the site vehicles with the emergency telephone number list for access during operating hours. Radios can be used to communicate to personnel on the site and in the site office.

21.0 PERSONAL HYGIENE AND DECONTAMINATION

Sanitation facilities will be provided in the SZ area so that employees can wash prior to eating, drinking, smoking, or engaging in any other hand-to-face activities. Chemical toilets may be available in the SZ of the work area and there are plumbed toilets. As chemical contamination is not expected to be an issue at this site, basic washing of equipment and standard hygiene practices are all that will be required. Site sanitation will be established and maintained in accordance with OSHA 29 *CFR* 1910.120(n) and USACE EM 385-1-1, Section 2. In particular:

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the SZ, as required to support field personnel. Chemical toilets used in these locations and will be serviced every week. Each temporary toilet will be naturally lighted, have a toilet seat with a seat cover, have a urinal, have ventilation with vents screened, and be lockable from the inside. There will be at least one toilet for every 15 workers at the work site, if required.

Hand and face washing facilities will be set up at the EOTI work site and will be utilized by all personnel exiting the EZ prior to eating, drinking, tobacco use, or other hand-to-face activities. Paper towels will be provided for drying. A trash receptacle will be provided for discarded paper towels. In accordance with ANSI Z358.1-1998, eye-wash facilities will be available on the work site where operations in any of the work zones involve handling substances, which could be hazardous to the eyes. An eyewash kit will also be located in each site vehicle.

General work practices include the following:

- Safe work practices will be implemented whenever possible to eliminate or reduce the potential for employee exposure.
- Employees will wash their hands immediately or as soon as feasible after removal of gloves or other PPE.
- Employees will wash hands and any other skin with soap and water, or flush mucous membranes with water immediately following contact with blood or potentially infectious materials.
- If potentially contaminated sharps are encountered, the item will immediately be disposed of in an appropriate container or decontaminated.
- Eating, drinking, smoking, applying cosmetics or lip balm, handling of contact lenses, or storage/handling of food are prohibited in all areas where potentially infectious materials are present.
- Equipment that has become contaminated will be decontaminated prior to servicing or storage, unless decontamination is not feasible, in which case the equipment will be disposed of properly.

22.0 EQUIPMENT DECONTAMINATION

Due to the fact that chemical contamination is not anticipated at this site, basic washing of equipment is all that will be required.

23.0 EMERGENCY EQUIPMENT AND FIRST AID

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, bloodborne pathogen kit, and spill control kit will be kept in the UXOSO vehicle. Portable eyewashes will be located in the work area in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. This equipment will be inspected on a weekly basis to assure they are maintained and ready to use. Any used items will be replaced immediately.

First aid kits are assigned by the Safety Office and approved by the Occupational Health Physician. The size and number of first aid kits shall be sufficient to accommodate the maximum number of people on site at any given time. First aid kits will be located in all operational vehicles, each team, and the site office. A large medical kit, with trauma supplies, will be located with the UXOSO.

Biohazard kits will be available in each operational vehicle and with each team working inside the EZ. The kit will be used any time an injury occurs or where there is the release of body fluids.

Portable kits of eyewash will be available during operations at the site where the potential for hazardous materials may contact the eyes. Portable eyewash bottles will be used while the injured person is being transported to the site eye wash station or medical attention.

Fire extinguishers will be stored where they are well marked and readily accessible. Fire extinguishers shall be protected from the damaging affects of environmental elements. The SUXOS is responsible to ensure that all fire extinguishers are visually inspected monthly and that these inspections are documented. All site personnel will be familiar with the locations of fire extinguishers and will be trained in their use.

24.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

The ERCP address the emergencies, which could occur during site operations, and outlines the appropriate response actions. EOTI will investigate magnetic anomalies to locate, identify, and dispose of MPPEH. MPPEH will be destroyed by site personnel using donor explosive charges obtained from commercial sources.

24.1 Pre-Emergency Planning

The SUXOS and UXOSO will perform pre-emergency planning before starting field activities and will coordinate emergency response with EMT/police/fire personnel and the servicing medical facility when appropriate. Pre-emergency planning meetings shall be used to inform local authorities of the nature of site activities that will be performed under the PWS and the potential hazards that activities may pose to site workers, the environment, and the public. An agreement will be established between EOTI and emergency response personnel and the hospital regarding responsibilities of each party in responding to a project site emergency. The UXOSO will verify all on-site emergency services information, to include telephone numbers and procedures for requesting services. It will be the UXOSO's responsibility to post these procedures and telephone contact numbers IAW the requirements of this APP. Pre-emergency planning tasks include:

- Locate telephone stations;

- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the ERCP; and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

24.2 Personnel and Lines of Authority

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the ERCP and coordination with responding off site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Corporate Health and Safety Staff as soon as the situation is under control.

If the emergency involves employee injury, SUXOS and UXOSO will complete the ENG Form 3394 Accident Report. The Corporate Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies. Once the emergency has been resolved, the SUXOS, UXOSO, Project Manager, and Corporate Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

24.3 Criteria and Procedures for Emergency Recognition and Evacuation

Prevention of emergencies will be aided by the effective implementation of this SSHP, personnel awareness, contingency planning, and onsite safety meetings. Anticipated emergencies may include physical injury, fire, explosion, chemical spill or release, inclement weather and natural disasters. The SUXOS and UXOSO will use the site-specific briefing and/or the Tailgate Safety Briefings to inform site workers of the recognition, prevention, and response procedures for each anticipated emergency.

In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations and adjacent industries.

In the event of an emergency that requires evacuation of the site verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, counsel with and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;

- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS/UXOSO.

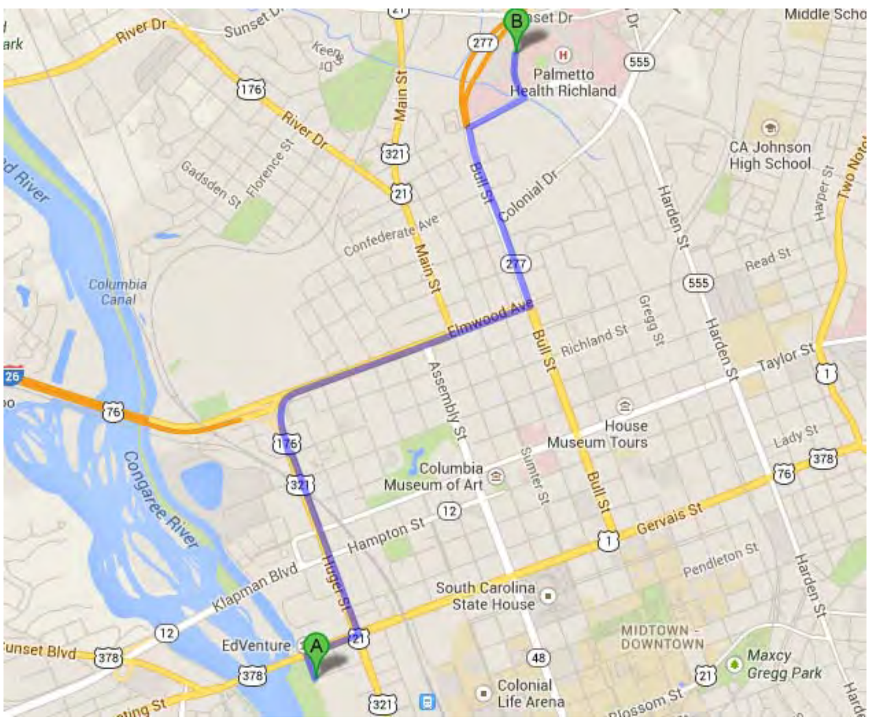
24.4 Decontamination and Medical Treatment of Injured Personnel

It is not anticipated that hazardous waste decontamination shall be required during any activities under the PWS. This determination has been made based upon archival documentation and past activities conducted at the site.

24.5 Emergency Medical Facilities

The nearest medical facility address is:

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 * *For Emergency Dial 911*



Driving directions to Palmetto Health Hospital

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N
0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E
1.1 mi

5. Turn left onto **Bull St**
0.7 mi

6. Turn right onto **Harden Street Extension**(signs for **Harden St**)
0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right
0.2 mi

The emergency telephone list can be found at Section 12.3.8 of this Appendix.

24.6 Criteria for Alerting the Local Community Responders

In the event of an on-site emergency the individual team leader or first person aware of the emergency will contact the SUXOS by field radio, cellular phone, or in person, as circumstances allow. The SUXOS will normally be responsible for requesting emergency services. If the order is given to evacuate the site of all personnel, each on-site team leader will assemble, account for, and evacuate all team personnel to the pre-designated staging area. The SUXOS/UXOSO will initially instruct the on-site CPR/First Aid trained personnel to respond to the emergency. These individuals shall render emergency first aid treatment and stay with the injured until relieved by off-site emergency services personnel, who would be called in at the discretion of the SUXOS.

24.7 Material Safety Data Sheets

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations. This SDS binder will be available on request to all site personnel during all working hours of the site. If site workers have further questions about any of the hazardous materials they come into contact with, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

24.8 Safe Distances and Places of Refuge

Normally, during an evacuation, personnel would evacuate to the office trailer and staging area in the SZ, where the SUXOS would take roll and account for all site personnel. An exception to this rule would be in the case of encountering a CWM item, in which case personnel would evacuate at least 450 feet upwind of the item. This location would change with the shifting winds, so it cannot be specifically identified.

24.9 Site Security and Control

During emergency procedures, the UXOSO will direct emergency vehicles into the site. The site personnel will also be notified that emergency vehicles are coming and be ready to assist where necessary. The UXOSO will assure that Fire Department personnel approach at no closer than fragmentation distance from any fire that might start in the area. EMT/ambulance personnel will be instructed by the UXOSO as to where to safely proceed to get to the injured worker. Site personnel will assist if required, at the direction of the SUXOS.

24.10 Evacuation Routes and Procedures

In the event of an emergency that requires evacuation of the site, an alarm will be sounded or verbal instruction given by the SUXOS/UXOSO to evacuate the area to the work site “Staging Areas.” This point will be established outside the EZ and in the SZ. Personnel will be shown the location of the staging areas daily, during the Site Safety Briefing. The location of the assembly point may change as work activity progresses within the project area. However, it will normally be at the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency, and advise responding on-site personnel. The SUXOS will contact, advise, and coordinate with responding off-site emergency personnel and points of contact for adjacent industries, if deemed necessary by the situation or the client Safety and Health Representative. In all situations that require evacuation, personnel will not re-enter the work area until the conditions causing the emergency have been corrected; the hazard reassessed; the APP has been revised and reviewed with on-site personnel, if needed; and instructions have been given for authorized re-entry by the SUXOS.

The route directions to the medical facility will be posted in the EOTI office, at the work site, and in site vehicles. This map also will indicate the evacuation route.

24.11 Decontamination

Due to the type of work on this project, it is not expected that a major chemical spill would occur that would require personnel decontamination prior to leaving the site. If a worker is accidentally injured using chemicals brought onto the site, the first aid procedures described in the SDS would be followed by co-workers to clean as much of the chemical off as possible before the ambulance arrives. In a case like this the SDS will be sent to the hospital with the worker to inform the medical staff of the exposure and how best to treat it.

24.12 Emergency Medical Treatment and First Aid

A minimum of two persons on the project site will be certified in First Aid/CPR. These persons will act as First Responders to any site emergency. First Aid kits will be available for their use in that capacity. The First Responders will perform first aid and/or CPR until medical personnel arrive on site. The SUXOS will contact the EMT/ambulance based on the type of injury received and send the injured worker to the designated emergency treatment facility. If the injury is not so serious, the SUXOS may ask a co-worker to take the injured worker to the hospital for treatment. Maps and directions to the hospital will be kept in all site vehicles. Directions to the hospital can be found in Section 11 of this Appendix.

Major hazardous substance spills are not expected due to the type of work taking place on this project. In the event of a minor hazardous substance spill causing an injury, the first responders would provide first aid based on the instruction in the SDS for the substances. The SDS would be taken with the injured worker to the hospital to provide information on treatment of that chemical.

24.13 Spill Alerting and Response Procedure

The emergency alerting procedure on the site will normally be a verbal warning to evacuate the site and the evacuation procedures outlined above would be implemented. Due to the fact that there should be no large quantities of chemicals found on this site, the only type of chemical spill would be a small one. If a small spill occurs, the individual who caused the spill will inform the SUXOS. He will then get the spill control kit, and use the absorbent material, clean up most of the spill. If some of the soil is contaminated, that soil will be dug up and placed with the rest of the spill clean-up materials. It will all be disposed of in a licensed hazardous waste disposal facility. Personnel involved in this clean-up will wear chemical resistant gloves. Larger spills might require the use of Tyvek suit and respirator as well, but spills of that size are not anticipated on this site.

24.14 Critique of Response and Follow-Up

After any type of site emergency, the SUXOS/UXOSO, the Project Manager, MEC Safety and health Coordinator, and the Corporate Health and Safety Staff will review the situation and determine if changes need to be made to the emergency procedures to make them more effective. Applicable changes will be made to the APP and these changes will be reviewed with all employees, so they are aware of the new procedures.

24.15 Emergency Response Team

There will be a minimum of two persons on the project site who are certified in first aid and CPR. These persons will serve as the first responders. They will respond to any site emergency and assist the victim until medical assistance arrives. The SUXOS will call for outside emergency assistance if it is needed. As soon as the professional emergency response services arrive onsite, the first responders will turn over medical care of the injured worker to them. They will be on stand-by to assist the ambulance crew if requested to do so.

24.16 Personnel Training Requirements

Personnel acting as first responders will be certified in First Aid and CPR from the American Red Cross or a similar other training entity. They will be qualified to provide basic first aid and CPR and will relinquish authority to the EMT/ambulance crew when they arrive on site.

24.17 Emergency Response Team Responsibilities

The responsibility of the emergency response team is to respond to on-site emergencies. They will provide only first aid and CPR, and they will attempt to calm and stabilize the patient until the professional help arrives.

25.0 LOGS, REPORTS AND RECORD KEEPING

Each person on the site will have an individual file folder, which contains a copy of the following:

- 40 hr HAZWOPER Certificate.
- Current 8 hr HAZWOPER Annual Refresher Certificate.
- 8 hr HAZWOPER Supervisor Certificate, if applicable.
- EOD/UXO Training Certificate
- Any other applicable training certificates.

Personnel folders will be maintained by the SUXOS on-site. Training/Tailgate Safety Record will be completed for all on-site daily training. The SUXOS/UXOSO will maintain the file, which will be made available for the client as requested. This form may be completed in ink, but it is preferred that it be completed with a computer in Word.

25.1 Daily Safety Inspection Logs

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined in Section 8.0. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed.

25.2 Visitor Log

The Visitor's Log will be maintained by the SUXOS. The log will document the visitor's name, company name, date, time, and reason for visit. There will also be documentation that the visitor was given a visitor safety briefing prior to being permitted to enter the EZ of the site. Visitors will be escorted at all times within the EZ and MEC operations will cease during the time they are within the EZ.

25.3 Medical Surveillance Records and Certifications

A copy of the Physician Statement from a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine, regarding the current annual HAZWOPER physical examination will be maintained in the personnel folder with the other HAZWOPER certificates. The Physician Statements will remain in the individual's file on the project site for the duration of site operations. The files will then be transferred to the Knoxville Office.

25.4 Air Monitoring Results

Due to the operations being performed on this project, air monitoring is not required.

25.5 Personal Exposure Records

As there is no chemical work taking place on this project, personal exposure records are not expected to be required.

25.6 Records Maintenance

All personal exposure and medical monitoring records, if generated, will be maintained in accordance with applicable OSHA standards, 29 CFR 1904, 1910, and 1926.

25.7 Final Report

EOTI will develop, retain and submit as part of the final report, all visitor registration logs, training logs, and daily safety inspection logs as part of the daily QC Reports.

25.8 Site Monitoring Results

All site-monitoring results will be documented. This will be kept in a file at the project site for reference, and will become a part of the permanent site record at the conclusion of site activities. At this site, heat exposure monitoring is the only monitoring anticipated to occur and that is dependent upon the site temperature.

25.9 Accident Reporting Records

Accidents/incidents shall be reported in accordance with DID MR-015 and EM 385-1-1 using the ENG Form 3394 Accident Report form in Appendix F. Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the Knoxville EOTI Office.

25.10 Safety Exposure Report

A Safety Exposure Report, a tabulation of field labor hours, lost workday accidents, and number of lost workdays shall be submitted.

26.0 UNFORESEEN HAZARDS

Should any unforeseen hazard become evident during the performance of work, the SUXOS and UXOSO shall bring such hazard information to the attention of the Corporate Health and Safety Staff and the on-site government representative (both verbally and in writing) for resolution as soon as possible. In the interim, necessary action shall be taken to reestablish and maintain safe working conditions until the procedures to address the new hazards can be put into place and the APP updated accordingly.

APPENDIX E
MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS PLAN

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

NOT APPLICABLE

APPENDIX F
SITE FORMS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

NOT APPLICABLE

TABLE OF CONTENTS

NOTE:

A CD containing all Contractor-specific forms will be maintained on site. The forms in this appendix are examples of the forms that the Contractors will be using during this project. Forms may be modified to meet specific project reporting needs.

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.
DOCUMENTATION OF TRAINING

Training Course Name: ______________________________
(General, UXO Equipment, Visitor, Special)

Presented By: ________________ **Date:** ________________

Topics Discussed

Work Plan/SSHP/APP: ______________________________

UXO/MEC Hazards: ______________________________

Chemical Hazards: ______________________________

Physical Hazards: ______________________________

Emergency Procedures: ______________________________

Weather Conditions: ______________________________

Other: ______________________________

____

____

Attendees

Printed Name	Signature	Date

Trainer: ______________________ **Date:** ________________

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

SSHP ACKNOWLEDGMENT

Project: Removal Action ________ Site: ________
Contract Number: ________ Site Location: ________

Project Manager: ________
SUXOS: ________
UXOSO: ________

I acknowledge that I understand the requirements of this SSHP and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions concerning the SSHP and its requirements answered prior to performing field activities. Health and Safety Training and Medical Surveillance requirements applicable to my field activities at this site are current and will not expire during onsite activities.

EOTI PERSONNEL:

SIGNATURE	EMPLOYEE NO.	DATE

OTHER PERSONNEL:

SIGNATURE	ORGANIZATION	DATE

SSHP Acknowledgment Form

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

WEEKLY SAFETY CHECKLIST

Location: ______________________

Site: _________________________

Description	Findings	Remarks
1. Personal Protection (PPE) per SSHP/APP	Pass/Fail	
2. Work Practices Follow SSHP/APP	Pass/Fail	
3. Site Control/Decon per SSHP/APP	Pass/Fail	
4. Eyewash Station(s)	Pass/Fail	
5. First Aid Kit(s)	Pass/Fail	
6. Fire Extinguisher(s)	Pass/Fail	
7. Monitoring Equipment	Pass/Fail	
8. Calibration	Pass/Fail	
9. Communications	Pass/Fail	
10. Overall Cleanliness of Site	Pass/Fail	
11. Other	Pass/Fail	

Printed Name: _____________________________

Signature: ___________________________

Date: ___________________

REMARKS: ____

____

____

____

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

QUALITY CONFORMANCE INSPECTION (QCI) RECORD

See Reverse for Completion Instructions

DATE: __________________ PROJECT SITE: ________________________________

QC SPECIALIST: ________________________________

TASK INSPECTED:

____

SCHEDULED INSPECTION ( ) REINSPECTION ( )
DAILY ( ) WEEKLY ( ) OTHER ( ) ______________________

RESULTS:
( ) TASK **IS** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.
( ) TASK **IS NOT** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE NOTED NONCONFORMANCE IS AS FOLLOWS: ____________________

____
____
____
____
____
____
____

REINSPECTION:

TASK AND DATE OF NONCONFORMANCE BEING REINSPECTED:

____
____

RESULTS:
( ) TASK **IS** BEING ACCOMPLISHED IN CONFORMANCE TO THE WP/SSHP.
( ) TASK **IS NOT** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE RE-OCCURRING NONCONFORMANCE IS AS FOLLOWS:

____
____

QUALITY CONFORMANCE INSPECTION (QCI) RECORD

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

INSTRUCTIONS FOR COMPLETION

A QCI record will be completed on each task inspected.

Date: Enter the date the inspection took place.

Project Site: Enter the project site's name.

QC Specialist: Name of the QC Specialist conducting the QCI.

Task Inspected: Enter the name of the task being inspected as per the QCI Schedule.

Scheduled Inspection: Place a "X" in the appropriate ( ). If Other is applicable, note the reason for the QCI.

Results:
Enter a "”X" in the appropriate ( ).
If the task is in conformance, no other information is required on this form.
If the task is not in conformance, continue with the explanation in space provided.

Reinspection:
Date and Task being reinspected: Enter the date and pertinent task.
Results: Enter a "X" in the appropriate ( ).
If the task is still not in conformance, continue with the explanation in space provided.

Distribution of completed forms:

Conformances: 1- Project Manager
1 - On-site QC File (Inactive)

Nonconformances: 1 - Project Manager
1- Quality Manager
1 - On-site QC File (Active)

Reinspections: 1 - Project Manager
1 - Quality Manager
1 - On-Site QC File (Inactive) (if compliant)
(Active) (if noncompliant)

QUALITY CONFORMANCE INSPECTION (QCI) RECORD

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

EOTI
Quality Control
Corrective Action Log

Project:______________________
Location:_____________________
SUXOS:______________________
UXOQCS:_____________________

Non Conformance			Correction		
Date	Activity	Nature	Action Taken	Completed By	Date

Quality Control Corrective Action Log

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

MEC Accountability Log

Identification					Description			Disposition			
ID #	Anomaly #	Date	Grid/Area	Location	Nomenclature	Fuze Description	Fuze Condition	Method	Date	By Whom	Photo #

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

27. ADDITIONAL DATA

26. RIC (4-6)
UI (23-24)
QTY (25-29)
CON CODE (71)
DIST (55-56)
UP (74-80)

25. NATIONAL STOCK NO. & ADD (8-22)

24. DOCUMENT NUMBER & SUFFIX (30-44)

DOC IDENT | RI FROM | M&S | UNIT ISS | QUANTITY | SUPPLEMENTARY ADDRESS | SIG | FUND | DISTRIBUTION | PROJECT | PRI | REQD DEL DATE | ADV | RI | O/P | COND | MGT | UNIT PRICE DOLLARS CTS

1. TOTAL PRICE DOLLARS CTS
2. SHIP FROM
3. SHIP TO
4. MARK FOR
5. DOC DATE
6. NMFC
7. FRT RATE
8. TYPE CARGO
9. PS
10. QTY. REC'D
11. UP
12. UNIT WEIGHT
13. UNIT CUBE
14. UFC
15. SL
16. FREIGHT CLASSIFICATION NOMENCLATURE
17. ITEM NOMENCLATURE
18. TY CONT
19. NO CONT
20. TOTAL WEIGHT
21. TOTAL CUBE
22. RECEIVED BY
23. DATE RECEIVED

PerFORM (DLA)

PREVIOUS EDITION MAY BE USED

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

EOTI WEEKLY VEHICLE INSPECTION CHECKLIST

(This form to be used weekly for all site vehicles, EXCEPT explosive carriers, which must be inspected prior to EACH explosive transport)

Site Location: ______________________________

Inspector: ______________________________

Vehicle: ______________________________ **Owner:** ______________________________
(MAKE AND LICENSE PLATE #) (RENTAL, EOTI, GRE, CONT.)

Date Inspected: ____________________ **Mileage:** ____________________

Use [✔] For Pass, Use [X] For Discrepancy

1. DOCUMENTATION:		**2. BRAKES:**	
Registration	[ ]	Hand/Emergency	[ ]
Insurance	[ ]	Service	[ ]
Emergency Route Map/ Phone Numbers	[ ]		
3. TIRES:		**4. BELTS:**	
Pressure	[ ]	Proper tension	[ ]
Condition	[ ]	Condition	[ ]
5. EQUIPMENT:		**6. LIGHTS:**	
Fire extinguishers	[ ]	Headlights (high & low)	[ ]
First Aid/CPR/Burn/		Brake Lights	[ ]
Eyewash kits	[ ]	Parking	[ ]
*Tie downs	[ ]	Back-up	[ ]
*Chocks	[ ]	Turn Signals	[ ]
*Placards	[ ]	Emergency Flashers	[ ]
7. FLUID LEVELS:		**8. GENERAL:**	
Oil	[ ]	Windshield Wipers	[ ]
Coolant	[ ]	Horn	[ ]
Brake	[ ]	Seat Belts	[ ]
Steering	[ ]	Steering	[ ]
Transmission	[ ]	Windshield/Windows	[ ]
Windshield Wiper	[ ]	Gas Cap	[ ]
Fluid Leaks	[ ]	Mirrors	[ ]
		Exhaust System/ *Spark Arrester	[ ]
		Cleanliness	[ ]

(Note: Items marked with * apply to explosive carriers only)

Description of deficiencies: ______________________________
____
____
____

Deficiencies corrected by: ____________________ Date: ____________________

EOTI WEEKLY VEHICLE INSPECTION FORM

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

Site Name:______________________

Site Location:____________________

Date:__________________________

SITE VISITOR'S LOG

PRINT NAME	SIGNATURE	AGENCY	PURPOSE OF VISIT	PHONE #	DATE/TIME ARRIVED	DATE/TIME DEPARTED

Site Visitor's Log

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives

Federal Explosives License/Permit
(18 U.S.C. Chapter 40)

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555), you may engage in the activity specified in this license or permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. THIS LICENSE IS NOT TRANSFERABLE UNDER 27 CFR 555.53. See "WARNINGS" and "NOTICES" on reverse.

Direct ATF Correspondence To	ATF - Chief, FELC 244 Needy Road Martinsburg, WV 25405-9431	License/Permit Number	8-NJ-025-33-5D-12250
Chief, Federal Explosives Licensing Center (FELC) Christopher R. Reeves		Expiration Date	April 1, 2015

Name
EXPLOSIVE ORDNANCE TECHNOLOGIES INC

Premises Address (Changes? Notify the FELC at least 10 days before the move.)
185 RUMSON RD
RUMSON, NJ 07760-

Type of License or Permit
33-USER OF EXPLOSIVES

Purchasing Certification Statement

The licensee or permittee named above shall use a copy of this license or permit to assist a transferor of explosives to verify the identity and the licensed status of the licensee or permittee as provided by 27 CFR Part 555. The signature on each copy must be an original signature. A faxed, scanned or e-mailed copy of the license or permit with a signature intended to be an original signature is acceptable. The signature must be that of the Federal Explosives Licensee (FEL) or a responsible person of the FEL. I certify that this is a true copy of a license or permit issued to the licensee or permittee named above to engage in the business or operations specified above under "Type of License or Permit."

Licensee/Permittee Responsible Person Signature　　Position/Title

Printed Name　　Date

Mailing Address (Changes? Notify the FELC of any changes.)

EXPLOSIVE ORDNANCE TECHNOLOGIES INC
185 RUMSON RD
RUMSON, NJ 07760-

Previous Edition is Obsolete

ATF Form 5400.14/5400.15 Part 1
Revised October 2011

Federal Explosives License (FEL) Customer Service Information

Federal Explosives Licensing Center (FELC)
244 Needy Road
Martinsburg, WV 25405-9431

Toll-free Telephone Number: (877) 283-3352
Fax Number: (304) 616-4401
E-mail: FELC@atf.gov

ATF Homepage: www.atf.gov

Change of Address *(27 CFR 555.54(a)(1))*. Licensees or permittees may during the term of their current license or permit remove their business or operations to a new location at which they intend regularly to carry on such business or operations. The licensee or permittee is required to give notification of the new location of the business or operations not less than 10 days prior to such removal with the Chief, Federal Explosives Licensing Center. The license or permit will be valid for the remainder of the term of the original license or permit. **(The Chief, FELC, shall, if the licensee or permittee is not qualified, refer the request for amended license or permit to the Director of Industry Operations for denial in accordance with § 555.54.)**

Right of Succession *(27 CFR 555.59)*. (a) Certain persons other than the licensee or permittee may secure the right to carry on the same explosive materials business or operations at the same address shown on, and for the remainder of the term of, a current license or permit. Such persons are: (1) The surviving spouse or child, or executor, administrator, or other legal representative of a deceased licensee or permittee; and (2) A receiver or trustee in bankruptcy, or an assignee for benefit of creditors. (b) In order to secure the right provided by this section, the person or persons continuing the business or operations shall furnish the license or permit for for that business or operations for endorsement of such succession to the Chief, FELC, within 30 days from the date on which the successor begins to carry on the business or operations.

(Continued on reverse side)

Cut Here

Federal Explosives License/Permit (FEL) Information Card

License/Permit Name: EXPLOSIVE ORDNANCE TECHNOLOGIES INC

Business Name:

License/Permit Number: 8-NJ-025-33-5D-12250

License/Permit Type: 33-USER OF EXPLOSIVES

Expiration: April 1, 2015

Please Note: Not Valid for the Sale or Other Disposition of Explosives.

APPENDIX G
MUNITIONS FRAGMENTATION SHEETS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

Fragmentation Data Review Form

Database Revision Date 4/16/2013

Category:	Black Powder Rounds
Munition:	10 in Cannonball Shell
Case Material:	Cast Iron, Grey, CL35
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Civil War Era
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	11/2/2009
Record Created By:	SDH
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	4
Diameter (in):	9.8500
Cylindrical Case Weight (lb):	93.88430
Maximum Fragment Weight (Intentional) (lb):	3.5556
Design Fragment Weight (95%) (Unintentional) (lb):	0.8186
Critical Fragment Velocity (fps):	1659

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.43
TNT Equivalent Weight - Impulse (lbs):	1.720
Kinetic Energy 10^6 (lb-ft²/s²):	4.8957

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275.000
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	237
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3060
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2087

Overpressure Distances

TNT Equivalent (Pressure):	0.43
TNT Equivalent Weight - Pressure (lbs):	1.720
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	22
Public Traffic Route Distance (2.3 psi); K24 Distance:	29
Inhabited Building Distance (1.2 psi), K40 Distance:	48
Intentional MSD (0.0655 psi), K328 Distance:	393

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.80	7.40
Mild Steel:	2.21	1.23
Hard Steel:	1.81	1.01
Aluminum:	4.07	2.36
LEXAN:	11.35	7.93
Plexi-glass:	9.75	6.06
Bullet Resist Glass:	9.20	5.43

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

APPENDIX H
CONTRACTOR PERSONNEL QUALIFICATIONS CERTIFICATION LETTER

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

RESUMES OF KEY PERSONNEL

The following personnel are proposed as key personnel for the activities on this project:

Brian Woods	Project Manager	Resume included
Jim Haney	SUXOS	CEHNC # 0364
John S. Wilson	UXOSO/QCS	CEHNC # 0123
Wayne Madsen	UXO Technician III	CEHNC # 0184
Jay Johnson	UXO Technician II	CEHNC # 1418
Phillip Lewallen	UXO Technician II	CEHNC # 1843
Logan Daily	UXO technician I	CEHNC # 1989
De La Von Conner	UXO technician I	CEHNC # 2333

Personnel Qualifications Certification Letter

I, Matthew S. Norris, Assistant Project Manager, certify that the personnel listed above meet or exceed contract requirements for the function they will perform.

If changes in the identified personnel are required, due to the availability of the proposed personnel or schedule conflicts, EOTI will propose fully qualified personnel to fill the position. Resumes of proposed key personnel that are not in the CEHNC database will be submitted for review and approval.

C. Brian Woods, PG, PMP / Project Manager

Years Experience: With EOTI: 1 With Other Firms: 14

Education:

B.S., Environmental Science/Plant & Soil Science (Geology Minor)—University of Tennessee (1999)

Active Registration:

Project Management Professional (PMP)/Project Management Institute (#1230698; 2009)
Licensed Professional Geologist (PG)/Tennessee (#5559; 2008)

Chronological Job History:

2014-Present EOTI; Knoxville, TN; Project Manager

2011-2013 WESTON; Norcross, GA, TN; Project Manager

2005-2011 EODT; Lenoir City, TN; Project Manager

2004 HydroGeoLogic, Inc.; San Antonio, TX; Project Manager

1999-2004 TN & Associates, Inc. Project Geologist; and Project Manager

Program / Project Management: Mr. Woods

- 15 years of total experience performing both MMRP (8 years) and environmental project work.
- 12 years of experience as Project Manager.
- Managed 20 MMRP projects ranging from preliminary assessments and remedial investigations/feasibility studies to removal actions.
- Project experience in over 15 states for federal, commercial, state, and city government clients.
- Served as a speaker and facilitator at a dozen technical project planning and public meetings.
- Has routinely managed projects over $2M and multiple projects over $10M in the last 6 years.
- Clients include DOD, DOE, USACE, AFCEE, Navy, Air Force, Air National Guard, commercial, and city and state.

Key Projects

Tyndall AFB, FL, AFCEE. Project Managed 5 project areas involving petroleum soil and groundwater contamination under a large performance based base-wide project. Project involved development of work plans to meet state of Florida POL requirements. (2012-2013; Weston).

Former Hammond Bombing Range, LA, Private Client. Project involved review of historical documents and preparation of a professional opinion report to be used in a legal dispute over the level of potential contamination on Former Hammond Bombing range land. Because of report and deposition given by team member the case was settled out of court. (2012 Weston)

Munitions and Explosives of Concern (MEC) Remedial Investigation/Feasibility Study (RI/FS), Former Conway Bombing and Gunnery Range, Conway, SC, U.S. Army Corps of Engineers (USACE) Huntsville District, Project Manager. Supported and managed planning with stakeholders, public meetings, and field investigation to determine the nature and extent of MEC. Overall goal of contract was to obtain a decision document acceptable to stakeholders. [7-09 to 2-11; EODT]

MEC RI/FS, Former Camp Claiborne, Alexandria, LA, USACE Huntsville District, Project Manager. Supported and managed planning with stakeholders, public meetings, and field investigation to determine the nature and extent of munitions constituents using multi increment sampling and discrete sampling methods. [7-09 to 2-11; EODT]

MEC RI/FS, Former Five Points Outlying Field, Arlington, TX, USACE Huntsville District, Project Manager. Project work involved producing a RI/FS report based upon previous investigations and removal actions at the site. Five Points is located within a residential area (large subdivision). Challenges involved getting regulatory support for no further action after removal action has been completed. [7-09 to 2-11; EODT]

MEC Engineering Evaluation/Cost Assessment (EE/CA), Ft. McClellan, AL, USACE Huntsville District, Project Manager. Project work involved performing MEC investigation using geophysical transect and grid data collection to define the nature and extent of the Charlie Area at Ft. McClellan. Prepared and attended weekly planning phone calls with the McClellan BRAC team and USACE Huntsville. Brought the project through the critical planning and work plan stage. [7-10 to 12-10; EODT]

Unexploded Ordnance (UXO) Avoidance/Construction Support San Antonio Military Medical Centre, San Antonio, TX, USACE Huntsville District, Project Manager. Project involved a high probability of encountering munitions containing white phosphorus (a smoke and burning agent) in downtown San Antonio in the immediate vicinity of highways and a hospita . Mobilization of personnel and equipment was required in less than a days notice. Project performed safely. [6-09 to 12-09; EODT]

Ft. Benning Modified Record Firing Ranges 1, 5 & 7, MEC Removal Action, Ft. Benning, GA, USACE Huntsville District, Project Manager. Managed scope schedule and budget for this project which involved MEC clearance of 88 acres at former training ranges including securing, certifying, and disposing of scrap. [5-09 to 12-09; EODT]

UXO Avoidance/Construction Support, Crab Orchard National Wildlife Refuge, Marion, IL, Conastoga Rovers & Associates, Project Manager. Project Manager performing MEC clearance and support for site characterization. Work activities were performed at the Former Illinois Ordnance Plant. Successfully completed first phase (5-06 to 11-07) and awarded second phase [1-09 to 10-09; EODT]

MEC RI/FS, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget and planning with stakeholders, public meetings, and field investigation to determine the nature and extent of MEC munitions constituents (MC) contamination. Overall goal of contract was to obtain a decision document acceptable to stakeholders. [8-08 to 2-11; EODT]

UXO Avoidance/Construction Support, Conway, SC, Wild Wing Development Company, Project Manager. Managed scope, schedule, and budget on the project objectives for performing UXO removal and construction support for the Wild Wing Land Developer. Project activities are currently on hold because the current economic housing crisis has halted development. [6-08 to 2-11; EODT]

MEC Clearance of Remote Ranges, Eielson Air Force Base (AFB), AK, AFCEE, Project Manager. Project involved abbreviated mobilization of 8 days after award, which required acquiring and mobilizing staff, equipment, and supplies to a remote locations in Alaska without roads or lodging. One of the first UXO projects for AFCEE and received great accolades for execution. All UXO and munitions debris removal from range targets was completed on time, under budget, and at the satisfaction of Eielson AFB. Contract fulfilled and closed out**.** [6-08 to 9-08; EODT]

Non-Time Critical Removal Action, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Took over as project manager during report development stage and coordinated with USACE Huntsville Center (CEHNC) in achieving comment resolution, and produced an acceptable final report to regulators. Contract was fulfilled and closed out. [7-07 to 9-08; EODT]

Former Camp Bowie MEC EE/CA, Brownwood, TX, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget for the finalization of the EE/CA Report and Action Memorandum. Project work included development of EE/CA report and Action Memorandum based upon geophysical investigation activities. Work also involved close coordination with USACE, and state and local stakeholders through email, letters, phone conferencing and public meetings. Contract was fulfilled and closed out. [4-06 9-08; EODT]

Former Camp Wolters MEC EE/CA, Mineral Wells, TX, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget for the finalization of the EE/CA Report and Action Memorandum. Took over project during the draft EE/CA report stage and worked with USACE Huntsville Center technical staff to reach comment resolution. Worked as the primary technical writer in revising the EE/CA and creating an action memorandum. Presented EE/CA results at the public meeting. Contract was fulfilled and closed out. [10-06 to 9-08; EODT]

MEC EE/CA, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Took over as Project Manager and Primary Technical Writer during the reporting stage for the EE/CA at the Former Camp Wheeler, Macon, GA. Report elements included analyzing geophysical data, anomaly dig results, creation of ordnance operable units (OOUs), ordnance and explosives (OE) risk assessment, comparative analysis of response alternatives, institutional control plan, and developing a detailed engineering cost assessment. Contract was fulfilled and closed out. [7-07 to 7-08; EODT]

UXO Avoidance and Construction Support, Ft. Polk, LA, General Dynamics, Project Manager. Project included UXO Avoidance support to General Dynamics during construction/installation of fiber-optic lines and target installation at an improvised explosive device (IED) training course. Contract fulfilled and closed out. [5-08 to 6-08; EODT]

Former Camp Elliott MEC EE/CA, San Diego, CA, USACE Huntsville District, Project Manager. Project included development of EE/CA report, Abbreviated Feasibility Study, Proposed Plan, and Decision Document based upon geophysical investigation activities. Served as primary technical writer for the Abbreviated Feasibility Study, Proposed Plan, and Decision Document. Work involved close coordination with USACE, state and local stakeholders through email, letters, phone conferencing, and public meetings. All documents have been accepted by the government. Contract was fulfilled and closed out. [3-06 to 5-08; EODT]

UXO Avoidance, Milan Army Ammunition Plant, Milan, TN, Arcadis, Inc., Project Manager. Project included UXO Avoidance support to Arcadis Inc. during site characterization of an open burn/open detonation area. Contract was fulfilled and closed out. [3-08 to 5-08; EODT]

MEC Historical Site Assessment, Former Whittaker-Bermite Facility, Santa Clarita, CA, Whittaker Corporation, Project Manager. Project Manager for the remedial investigation and clearance activities at the former Whittaker-Bermite Facility. Served as primary researcher and technical writer on historical site assessment. This work required a review of historical documents, aerial photographs, drawings, site interviews, and site walk inspections. The Historical Site Assessment Report was accepted by State of California regulators, and subsequent activities have been awarded to execute report recommendations. Planning and execution of these recommended activities is currently ongoing. [3-05 to 1-08; EODT]

MEC and Scrap Processing, St. Juliens Creek Annex, Portsmouth, VA, USACE Huntsville District, Project Manager. Project work included inspection, segregation, demilitarization of two MEC areas located at a naval defense reutilization, and marketing office (DRMO) facility. One of these two areas involved inspection and demilitarization of palletized projectiles and bombs. Project was completed on time with full client satisfaction, as well as accident free. Project included unexpected discovery of 43 potentially explosive rounds, which were safely handled and removed without affecting the schedule or additional government costs. St. Juliens Creek received an exceptional rating in all categories (a perfect score) for its Past Performance Information Management System (PPIMS) rating. [01-06 to 6-06; EODT]

Historical Site Assessment/Remedial Investigation, Iowa Army Ammunition Plant, Burlington, Iowa, USACE Omaha District, Project Manager. Performed a self-obtained subcontract with Shaw E&I to lead their technical team on the development of a RI Investigation. The contract was obtained from previous experience and reputation with USACE Omaha District. [4-04 to 8-04; HGL]

Former Nansemond Ordnance Depot Remedial Action, VA USACE-Norfolk District, Project Geologist. Performed duties of Task Manager and primary technical writer on a pesticide soil removal action work plan. Work Plan elements involved excavation, sampling, soil and sediment control, waste management, health and safety, and construction quality control. This plan received a review of excellent, and was considered by HGL program management as an example of quality documents HGL should strive to produce. [4-04 to 5-04; HGL]

Substrate Injection for Chromates Bioremediation, Former Kelly AFB, TX, AFCEE, Project Geologist. Field Team Leader/project geologist in the injection of hydrogen release compound (HRC) into the saturated zone of a chromates contaminated aquifer area. Field elements included: bore-hole logging, identification of injection interval, as well as oversight of a drilling subcontractor. [6-04 to 8-04, HGL]

Soil Vapor Extraction (SVE) Installation and Maintenance, George AFB, CA, AFCEE, Project Geologist. Task Manager on the preparation of a construction quality control plan for the installation of SVE system and long-term maintenance at George AFB, CA. Work elements included implementing design specifications, SVE construction, initial operation and proving stage, and long-term maintenance operations. [4-04 to05-04; HGL]

Project and Administrative Record Research, USACE-Albuquerque Office, USACE Albuquerque District, Project Geologist. Collected and prepared administrative records of completed projects for the USACE Albuquerque Office. Work elements included the review of all project records, determination of applicable permanent project/administrative records, and set up a USACE data management system for cataloging purposes. [5-04 to 6-04; HGL]

Remedial Investigation/Feasibility Study, Iowa Army Ammunition Plant (AAP), Burlington, IA, USACE Omaha District, Project Manager. Performed as the Project Manager (12-02 to 02-04), Task Manager and primary technical writer on three historical site assessment and soil sampling analysis work plans/RI reports over a period of 4 years at this over 19,000-acre facility. This facility is the nation's second largest ammunition plant. Involved research of over 60 years of plant historical records. Thousands of drawings, over 200 aerial photographs, and over 500 historical documents were reviewed and summarized into encyclopedia-like documents, along with historical narratives of plant historical operations. EPA Region 7 commented that the historical site assessment work plans were the most comprehensive compiled to date associated with Iowa AAP investigations (over a 20-year period). The histories of the subject sites involved nuclear weapons production, conventional weapons production, research laboratories, and conventional weapon and nuclear weapon component test firing. Performed duties as a field team leader in the collection of 1,400 soil samples, from over 300 sample locations, in an active mile long production facility containing over 250 buildings. Responsibilities also included a 3.5-hour presentation to regulators, plant commander and government contractors on the plant history and possible areas of environmental contamination. EPA Region 7 commented that they had been waiting 10 years for someone to comprehensively pull together site history and potential waste streams. Additionally, EPA Region 7 commented that the historical site assessment reports "provide an excellent reference for describing past operating practices in specific buildings at IAAAP." "We will use this report,"…"as a benchmark for the type of effort and level of detail needed to complete similar evaluations of historical activities at the site." [5-00 to 2-0; TN&A]

Phase II Site Investigation, Former Gadsden Ordnance Plant, Mobile, AL, USACE Mobile District, Project Manager. Project Manager/Field Team Leader on a Phase II Site Investigation at the Former Gadsden Ordnance Plant. Project scope included soil sampling, well installation, groundwater sampling, well abandonment, and report writing. [7-03 to 7-04; TN&A]

Lead Contaminated Soil Remedial Action/Groundwater Sampling Lake City Army Ammunition Plant (LCAAP), Lake City, MI, USACE Kansas City District, Project Geologist. Served as primary technical writer on the LCAAP Area 18 Lead Contaminated Soil Remedial Action Work Plan. Duties included reviewing design specifications and creating a work plan based on those specifications. Work Plan elements involved excavation, sampling, soil and sediment control, waste management, health and safety, and construction quality control. Field team member in the collection of groundwater samples from over 160 wells using low flow bladder pump and data logging technology. [10-02 to 1-03; TN&A]

UST Removal/TN&A Underground Storage Tank Closure, Great Smoky Mountains National Park National Park Service, Project Geologist. Technical writer on the preparation and submittal of a UST Removal Action Work Plan for the Great Smoky Mountains National Park. Work Plan elements included: UST Closure Application preparation, CADD figure design, excavation, waste management, sampling, environmental protection, health and safety, and construction quality control. Field team member and sample coordinator during field activities. [7-02 to 1-03; TN&A]

Abandoned Landfill Interim Removal Action Management Work Plan, LCAAP, Lake City, MI, USACE Kansas City, Project Geologist. Technical support/contributing designer for the LCAAP Area 16 abandoned landfill interim removal action management work plan. Elements included construction of a leachate storage and transfer facility, landfill regrading and capping, environmental protection plan, installation of passive gas vents and leachate recovery trench, waste management, Health and Safety Plan, CQC Plan, and SAP Plan [5-01 to 2-02; TN&A]

Remedial Action Decontamination and Decommission (RADD), Y-12 Security Complex, Bechtel Jacob,; Oak Ridge, TN, Site Supervisor. Site Supervisor for decontamination and closure of 11 large waste storage tanks containing low-level mixed radioactive sludge. Served as responsible party at the site, and ensured that the work plan elements were followed. Duties also included sampling and tank inspection. [6-01 to 7-02; TN&A]

RADD Drum Removal Action Work Plan, Oak Ridge K-25 DOE Plant, Oak Ridge, TN, Bechtel Jacobs, Project Geologist. Designer of the RADD Task 20 Drum Removal Action Work Plan by reviewing DOE documents and designing an outline and figures. This report received good reviews for organization and for following DOE guidelines. [4-01 to 5-01; TN&A]

Limited RI Groundwater/Soil Sampling, Former Herington Army Airfield Herington, KS, USACE, Kansas City District. Performed monitoring well micro-purge groundwater sampling and soil sampling to support a Limited Remedial Investigation. Provided technical writing support and designed all figures for the report after field activities, including geologic cross sections, fence diagrams, potentiometric maps, and contamination plume maps. Used gINT software to create project boring logs. [10-00 to 1-01; TN&A]

Inert Disposal Area Well Installations, Iowa Army Ammunition Plant Middletown, IA, USACE Omaha District, Project Geologist. Task Manager, Field Team Leader, and technical writer on both the well installation work plan and well installation report. Supported and later led field team in well installation fieldwork. [4-00 to 11-00; TN&A]

Well Abandonment Project, Former K-25 Facility, Oak Ridge, TN, U.S. Department of Energy (DOE), Project Geologist. Field Team Leader and Health and Safety Officer: Technically advised and managed the abandonment of wells at a current DOE installation. Job was performed accident-free in the presence of radiological contamination and overhead hazards [5-00 to 6-00; TN&A]

Inert Disposal Area Annual Groundwater Report, Iowa Army Ammunition Plant, IA, USACE Omaha District, Project Geologist. Task Manager and technical writer for an annual groundwater study report. This report included hydrogeological result interpretation, groundwater data quality asesssment, and statistical comparisons between monitoring data and background data. Many graphical models and figures were created for this report using a CAD program. [11-99 to 1-00; TN&A]

Remedial Design Reports, Massachusetts Military Reserve, Cape Cod, MA, AFCEE, Project Geologist. Technical support and contributing designer in the design of figures and writing of text for Pre-Design and 100% Design Reports. These reports included sections on data and equipment evaluation for soil vapor extraction/biosparging design, asphalt batching design, wetland determination and delineation studies, geophysical survey for drum investigation, and contaminants of concern. [11-99 to 7-02; TN&A]

APPENDIX I
SCHEDULE

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
MEC CLEARANCE AND SUPPORT
COLUMBIA, SC

To be determined

EXPLOSIVE SAFETY SUBMISSION

MUNITIONS AND EXPLOSIVES OF CONCERN

CLEARANCE AND SUPPORT

CONGAREE RIVER PROJECT

COLUMBIA, SOUTH CAROLINA

June 27, 2014

Prepared by

Explosive Ordnance Technologies, Inc.

Table of Contents

1.0 Site:

Name: Congaree River Project (see Figure 1-1)
State and closest city: Columbia, South Carolina

2.0 Anticipated Dates:

Start date:
Completion date:

3.0 Purpose:

The objective in this task order is to provide all munitions response services necessary to remove MEC from approximately 13 acres (12.65) of shoreline and within dewatered coffer dams at the Congaree River Project Site in Colombia, SC. The sediment removal will be performed in three phases over a period of three years.

Clarifies that Department of Defense Explosives Safety Board (DDESB) Technical Paper (TP) 18 qualified Unexploded Ordnance (UXO) personnel will perform all Munitions and Explosives of Concern (MEC) disposal activities at the site.

4.0 Site Background and Current Conditions:

In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with unexploded ordnance (UXO) potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material might be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013, a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of MEC from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment.

5.0 Executing Agencies:

US Army Corps of Engineers
Apex Companies, LLC
South Carolina Electric and Gas Company

6.0 Scope of Removal Action:

A surface and subsurface (to depth of detection) removal will be performed within an area of concern (AOC) of 12.56 acres within an approximate 1 acre (.89) land surface area and 11.65 acre sediment dewatered area within the river channel.

No Mechanized MEC Activities will be performed during this removal action.

Approved detection systems for this project include Schondstedt 52-CX and the Fisher 1280x. Both systems have similar detection capabilities and can be expected to detect MEC and MEC related items that are anticipated within the AOC. All approved instruments can easily detect the anticipated MEC items in access of one foot. Other passive geophysical instruments maybe approved for use by the USACE.

7.0 Safety Criteria:

The 10 inch cannonball was chosen as the Munitions with the Greatest Fragmentation Distance (MGFD) for the AOC based on the historical documentation and manifests dating to the relocation of the ordnance items from the a nearby ammunition storage area to the river by Confederate soldiers. Additionally, previous Archeological investigations recovered live and unstable munitions from the river area that correlated with the above MGFD munitions type.

See Appendix B for Fragmentation Data Sheets.

See Table 7-1 for Minimum Separation Distances. Quantity-Distance (Q-D) arcs are shown in Appendix A on Figure 4-1.

Table 7-1								
Minimum Separation Distances (MSD)								
Area	MEC	MSD (ft)[1]						
		For Unintentional Detonations			For Intentional Detonations			
		Team Separation Distance (K40)	Hazardous Fragment Distance (HFD)	To Sides and rear using MOFB	Without Engineering Controls	Using Sandbag Mitigation[2]	Using Double sandbag Mitigation[2]	Using Water Mitigation[2]
AOC	10" Cannonball	48	237	2087	3060	220	220	275
Notes:								
All Values in Bold Italics are the MSDs for unintentional detonations that must be used on-site for the Area.								
[1]See Appendix B for calculation sheets documenting MSDs.								
[2] See Appendix B for required sandbag thickness (HNC-ED-CS-S-98-7) and water containment system (HNC-ED-CS-S-00-3).								

The MSD restrictions from MEC areas to non-essential personnel will be applied during all MEC operations. The MSD identified by the US Army Engineering and Support Center, Huntsville (USAESCH) for the TCRA Area is presented in Table 7-1. Preliminary site work such as surveying, laying grid lanes and anomaly detection do not require the establishment of a MSD for Q-D purposes. Essential personnel are defined as those on-site contractor and DoD personnel required to participate in the MEC removal, along with those approved and authorized visitors. All other personnel are non-essential personnel. The outer boundaries of the MSD arcs are depicted on the Q-D map in Figure 4-1. The team separation distance at this site will be the K40 overpressure distance shown in Table 7-1. Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the contractor will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations.

The Miniature Open Front Barricade (HNC-ED-CS-S-8 Revision 1) or Open Front Barricade (HNC-ED-CS-S-99-1) may be used to reduce the MSD as shown in Table 7-1.

Any occupied buildings or public roadways in the MSD areas during MEC operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. In addition, spotters may be used to stop work when non-essential personnel enter the MSD on a roadway during the conduct of MEC operations.

7.0 Methods of Disposal:

If disposal activities are required, they will be performed by personnel qualified in accordance with TP 18 within the MRS. The MSDs for intentional detonations are shown in Table 7-1 and Q-D Arcs are shown on Figure 4-1.

On-call explosives delivery will be used for disposal of any MEC items recovered during operations. A local vendor on an as-needed basis will provide explosives. MEC will be marked and guarded until disposal is accomplished. The contractor will not maintain control of any explosive storage magazines.

MPPEH procedures will be IAW DoDI 4140.62 and EM1110-1-4009. All Material Potentially Presenting an Explosive Hazard (MPPEH) will be assessed and its explosives safety status determined and documented prior to transfer within the DoD or release from DoD control. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective.

Sandbags (HNC-ED-CS-S-98-7 Revision 1, HNC Safety Advisory dated 7 November 2011, and the DDESB Memorandum "Clarifications Regarding Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions", Nov. 29 2010) or Water Mitigation (HNC-ED-CS-S-00-3) may be used to reduce the intentional detonation MSD in accordance with the munitions specific fragmentation calculations in the Fragmentation Database in the event that MEC items with smaller fragment kinetic energies are recovered. Tamping (single or multiple items) may be used in accordance with DDESB Technical Paper 16 and the Buried Explosion Module (BEM) version 6.3.2. These reports will be available on site for all mitigation methods used. If the BEM is used, on-site authority based on specific conditions will determine depth of burial.

The MGFD for the Camp Wheeler TCRA Area is shown in Table 7-1. Items with smaller fragmentation distances may be found. Demolition of these items may be done using the item-specific minimum separation distances and engineering controls in accordance with DDESB TP 16 Fragmentation Database. For items not in the DDESB TP 16 Fragmentation Database, the maximum fragment distance may be calculated in accordance with the generic equations in DDESB TP 16. (Note: the Fragmentation Database and the Generic Equation Calculator (GEQ) are available on the DDESB's secure website at http://www.ddesb.pentagon.mil/.)

All explosive operations will follow the procedures outlined in TM 60A-1-1-31 and EM 385-1-97, Explosives Safety and Health Requirements Manual, demolition operations will be performed daily or items properly guarded until operations can be conducted.

All vehicles transporting explosives will be properly inspected, equipped, and placarded prior to the loading of explosives onto the vehicle, and DD Form 626 "Motor Vehicle Inspection" completed.

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown in "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites". The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area (see Table 7-1, footnote 1).

If determined acceptable to move by the SUXOS and UXOSO, consolidating multiple MEC within the MRS is anticipated for this project. US Army Engineering and Support Center, Huntsville (USAESCH) publication “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites”, dated March 2000 will be used and a copy of this report will be available on site. The maximum net explosive weight (NEW) for a consolidated shot will be limited such that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MFD-H for the intentional detonation."

Appendix A
Maps

Legend

- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 175, 350, 700

Meters: 0, 60, 120, 240

Site Location

FIGURE B-1
SITE LOCATION

Columbia, SC

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

APEX EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE Site locaiton.mxd	
PAGE # B-1	SCALE 1 inch = 350 feet	

Legend

Previous Investigation Anomalies

- Geological Feature
- Pipeline
- Pipeline Associated
- Electromagnetic Anomaly
- Possible Ordnance
- Previous Investigation Grids
- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 100, 200, 400
Meters: 0, 30, 60, 120

Site Location

FIGURE B-2
PREVIOUS INVESTIGATION RESULTS
Columbia, SC

APEX

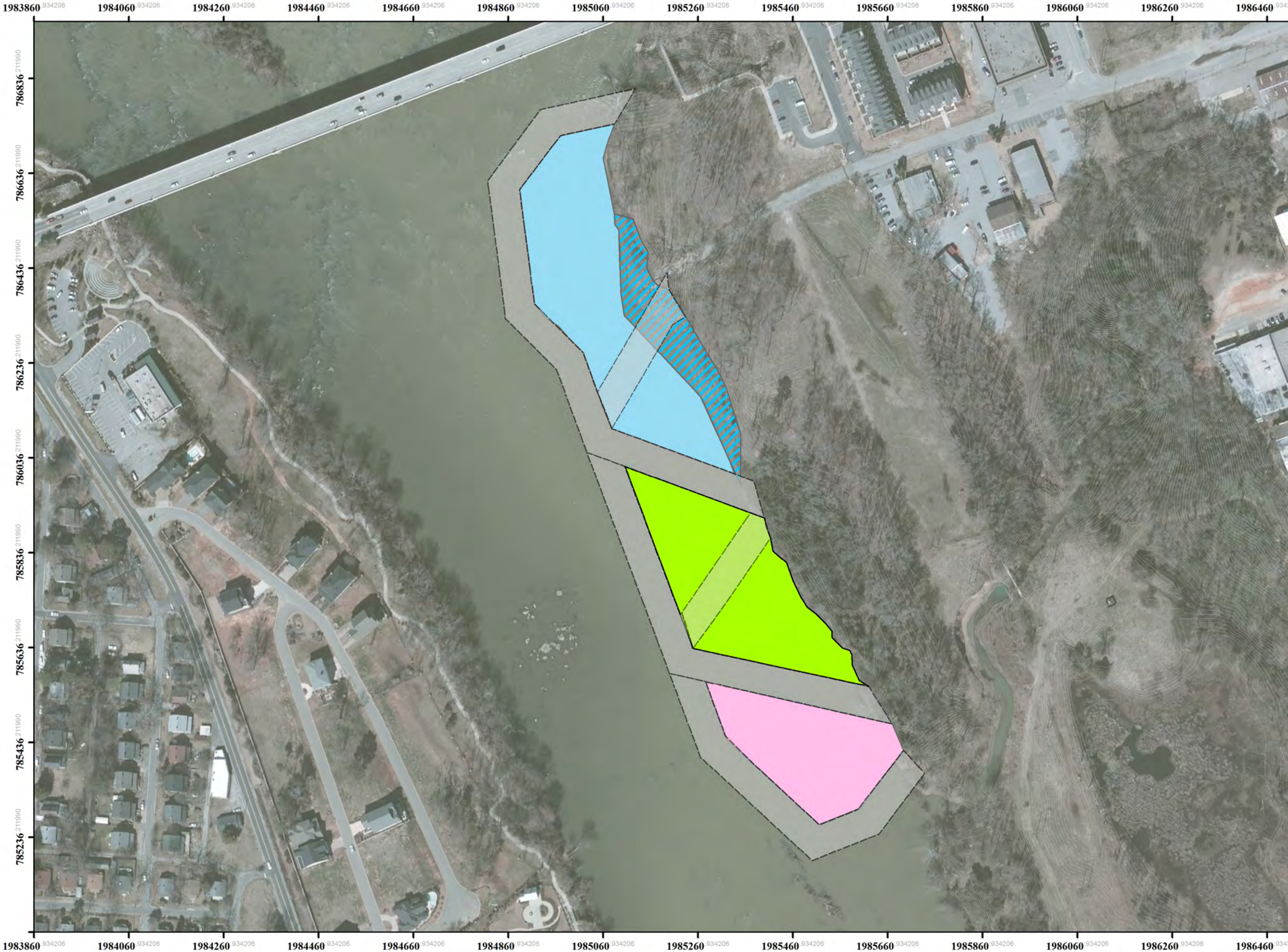
Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods

DATE	FILE
4/2/2014	TLM Area.mxd

PAGE #	SCALE
2	1 inch = 200 feet



Legend

Approximate Cofferdam Location

Phase

Phase 1 - Year 1

Phase 2 - Year 2

Phase 3 - Year 3

Approximate Demonstration Project Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 100 200 400

0 30 60 120
Meters

Site Location

Richland

Lexington

FIGURE B-3 CLEARANCE AREAS

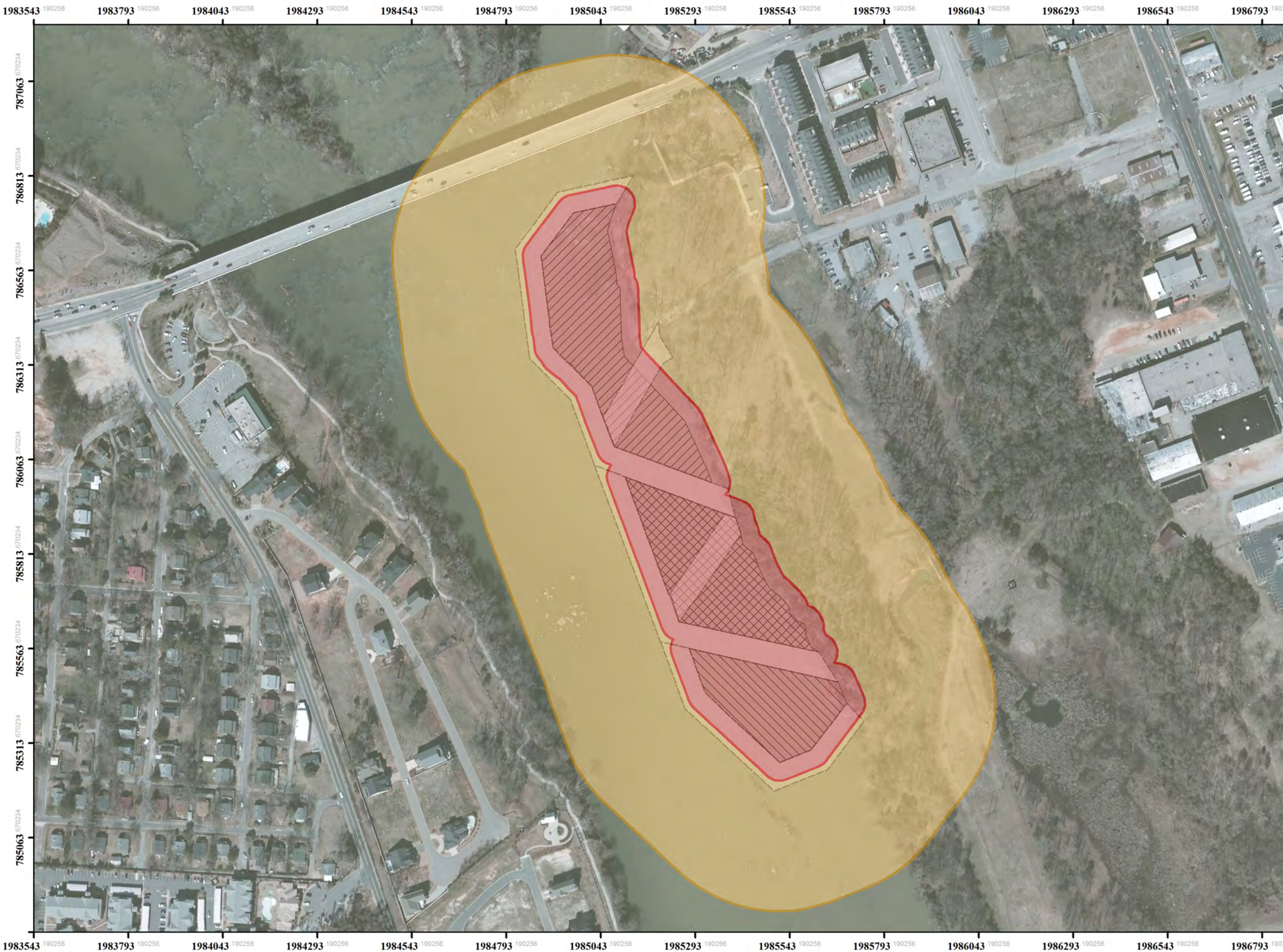
Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE Project Area.mxd	
PAGE # B-3	SCALE 1 inch = 200 feet	



Legend

Team Seperation Distance / Unintentional Detination 48 ft

Intentional Detination 393 ft

Approximate Cofferdam Location

Clearance Phase

Phase 1 - Year 1

Phase 2 - Year 2

Phase 3 - Year 3

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 125 250 500

0 37.5 75 150
Meters

Site Location

FIGURE B-4
INTENTIONAL AND UNINTENTIONAL DETONATION DISTANCES

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 6/2/2014	FILE **Project Area.mxd**	
PAGE # B-3	SCALE 1 inch = 250 feet	

Appendix B
MSD Calculation Sheets

Fragmentation Data Review Form

Database Revision Date 4/16/2013

Category:	Black Powder Rounds
Munition:	10 in Cannonball Shell
Case Material:	Cast Iron, Grey, CL35
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Civil War Era
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	11/2/2009
Record Created By:	SDH
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	4
Diameter (in):	9.8500
Cylindrical Case Weight (lb):	93.88430
Maximum Fragment Weight (Intentional) (lb):	3.5556
Design Fragment Weight (95%) (Unintentional) (lb):	0.8186
Critical Fragment Velocity (fps):	1659

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.43
TNT Equivalent Weight - Impulse (lbs):	1.720
Kinetic Energy 10^6 (lb-ft²/s²):	4.8957

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275.000
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	237
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3060
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2087

Overpressure Distances

TNT Equivalent (Pressure):	0.43
TNT Equivalent Weight - Pressure (lbs):	1.720
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	22
Public Traffic Route Distance (2.3 psi); K24 Distance:	29
Inhabited Building Distance (1.2 psi), K40 Distance:	48
Intentional MSD (0.0655 psi), K328 Distance:	393

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.80	7.40
Mild Steel:	2.21	1.23
Hard Steel:	1.81	1.01
Aluminum:	4.07	2.36
LEXAN:	11.35	7.93
Plexi-glass:	9.75	6.06
Bullet Resist Glass:	9.20	5.43

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

Explosive Ordnance Technologies Inc.

Diving Safe Practices Manual

Underwater MEC Investigation/Removal
Using SCUBA

EOTI

Diving Safe Practices Manual

Underwater MEC Investigation/Removal
Using SCUBA

Prepared Date
April 15, 2014

Reviewer Acknowledgment

EOTI Safety Manager	**Signature**	**Date**
EOTI Dive Safety Reviewer	**Signature**	**Date**
Prepared By	**Signature**	**Date**

Table of Contents

List of Attachments

Acronyms and Abbreviations

ACDE	Association of Commercial Diving Educators
AED	Automatic Emergency Defibrillator
AHA	activity hazard analysis
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
fpm	feet per minute
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
MD	munitions debris
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
No.	number
OE	Ordnance and Explosives
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
QC	quality control
SCUBA	self-contained underwater breathing apparatus
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
U.S.	United States
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

1. INTRODUCTION

This manual establishes the Dive Operations guidelines for Explosive Ordnance Technologies, Inc. (EOTI) personnel engaged in munitions response diving operations. This manual combines and conforms to requirements outlined in Occupational Safety and Health Administration (OSHA) regulations, the United States (U.S.) Navy Diving Manual (Volume I) and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual Engineering Manual (EM) 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 Code of Federal Regulations (CFR) 1910 Subpart T, Commercial Diving Operations has been integrated into this manual. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examination, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where documents are conflicting in policy, the most stringent regulations take precedence. A site-specific Diving Operation Plan is established for each project.

Safety is the primary consideration in planning and executing all jobs. The underwater investigation and removal of munitions and explosives of concern (MEC) adds a degree of complexity and additional hazards, not present in land based operations. All personnel engaged in these operations are screened carefully for the required training, experience, and physical capabilities required to perform underwater MEC work. Each individual is responsible for personal safety and for the safety of coworkers. Each individual must know their physical limits and technical capability and must immediately notify the Dive Supervisor if unable to safely complete assigned tasks. Site-specific dive plans and safety plans will be developed for each project.

This Safe Practices Manual will be available to Government representatives and all dive team members at all times at all diving locations.

2. DIVE SAFETY PROCEDURES (1910.422)

The success of any diving operation is a direct result of careful and complete planning. The procedures and checklist presented below are intended to help ensure careful planning and safe execution of dive operations. The Dive Supervisor shall comply with the following requirements during diving operations:

- A means capable of supporting the diver will be provided for water entry and exit when conducting dive operations from a boat. The means provided for exiting the water will extend below the water's surface; a means will be provided to assist an injured diver from the water to the dive boat; see Attachment A (Emergency Management Plan) for guidance.
- An operational two-way voice communication system will be used for communication between each diver and a member of the dive team at the dive location. Line-pull signals meet this requirement for SCUBA-diving mode.
- If line-pull signals are used in SCUBA mode, only Navy approved line-pull and hand signals will be used. (See Attachment B);
- Have operational two-way communications (handheld portable radios and cell phones) available at the dive location to obtain emergency assistance;
- Dive profiles will be kept at the dive location for each diver (See Attachment C).
- Explosives shall not be detonated while a diver is in the water;
- The Dive Supervisor will be on the site for all diving operations.
- The Dive Supervisor will devise a means for emergency diver recall. It must be a distinct, sure method and every diver must be made aware of the system being used.
- A standby diver will be utilized on all diving operations. Gear must be ready for immediate donning (i.e., harnesses adjusted, regulators attached, and air on etc.).
- Personnel involved in diving operations shall not hesitate to ditch, abandon, or destroy gear or equipment if, at any time, such action would, in the divers mind, be the proper course of action for his own safety or the safety of others;
- U.S. Navy Standard Air Decompression Tables will be used and available at the dive locations;
- Repetitive and no-decompression tables will be at the dive location; and
- Use a timekeeping device for recording the diving times of all SCUBA diving operations. The Dive Supervisor will ensure that a diver does not exceed the approved bottom time on any dive.
- Plan the dive, dive the plan.

2.1 PRE-DIVE PROCEDURES (1910.421)

The Dive Supervisor shall comply with the following requirements prior to each diving operation.

2.1.1 Emergency Aid

An Emergency Management Plan (Attachment A) shall be completed prior to diving operations and kept at the dive location that includes the telephone or call numbers of the following:

- Location of an operational recompression chamber;
- Location of accessible hospitals;
- Available means of emergency transportation; and
- The nearest U. S. Coast Guard Rescue Coordination Center.

2.1.2 Dive Operation Planning and Assessment

The planning of a dive operation shall include an assessment of the safety and health aspects of the following:

- Diving mode;
- Surface and underwater conditions and hazards;
- Breathing air supply (including reserves);
- Thermal protection;
- Diving equipment and systems;
- Dive team assignment, training in diving equipment/procedures and physical fitness of dive team members (including any impairment known to the employer);
- Dangerous marine life;
- Repetitive dive designation or residual air status of dive team members;
- Decompression and treatment procedures (including altitude corrections) as necessary; and
- Emergency procedures.

2.1.3 Pre-dive Brief

The Dive Supervisor shall brief the dive team members on the following prior to diving:

- Mission and location which will include drawings and/or photographs pertinent to the mission
- Safety procedures for the diving mode;
- Equipment and materials to be used or installed as part of the mission;
- Maximum working depth with estimated bottom times and water temperature;
- Names and duties of personnel on the team;
- Discussion of pertinent activity hazard analyses (AHAs) or new AHAs
- Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;
- Any modifications to the Dive Plan necessitated by the specific diving activities (NOTE: If for any reason the Dive Plan is altered in the mission, depth, personnel, or equipment, the USACE Designated Dive Supervisor (DDC) will be contacted in order to review and accept the alteration prior to actual operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation); and

- Emergency procedures

Prior to making individual dive team member assignments, the Dive Supervisor will inquire into the dive team member's current state of physical fitness, and indicate to the dive team members the procedure for reporting physical problems or adverse physiological effects during and after the dive.

2.2 TERMINATION OF DIVE

The working interval of a dive shall be terminated when:

- A diver requests termination;
- A diver fails to respond correctly to communications or signals from a dive team member;
- Communications are lost and cannot be quickly re-established between the diver and a dive team member at the dive location, and between the Dive Supervisor and the boat operator; or
- A diver begins to use diver-carried reserve breathing gas;
- Emergency recall device is activated; or

2.3 POST-DIVE PROCEDURES

The Dive Supervisor shall comply with the following requirements after each diving operation.

- Check the physical condition of each diver;
- Instruct each diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;
- Advise each diver of the location of a recompression chamber which is ready for use;
- Alert each diver to the potential hazards of flying after diving (12 hours before flying after any dive and 24 hours following multiple days of repetitive dives);
- Each diver shall remain at the dive location or in close proximity to the Dive Supervisor for at least 30 minutes after completing dive; and
- Ensure that no diver has a bottom time longer than authorized for each dive.

2.4 RECORD OF DIVE

The following information shall be recorded (use Attachment C) and maintained for each diving operation.

- Names of dive team members including Dive Supervisor;
- Date, time and location of dive (s);
- Diving mode used;
- General nature of work performed;

- Surface and underwater conditions (visibility, water temperature and current);
- Maximum depth and bottom time for each diver; and
- Attachment C will be filled out for each dive operation by Dive Supervisor and filed in the permanent project files.

For each dive in which decompression sickness/pulmonary barotraumas are suspected or symptoms are evident, the following additional information will be recorded and maintained:

- Description of decompression sickness symptoms (including depth and time of onset);
- Description and results of treatment;
- Name, address and phone number of attending physician

A decompression procedure assessment shall be conducted by the Dive Supervisor to include the following.

- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression table used and individual susceptibility;
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness;
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness; and
- Written evaluations will be retained by EOTI for a period of five years and then forwarded to OSHA.

2.5 SCUBA DIVING REQUIREMENTS

2.5.1 Equipment

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet Department of Transportation (DOT) 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of

the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;

- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and

- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.

- Skin suit to protect from cuts and abrasions and thermal protection as required

- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

2.5.2 Requirements While Engaged In SCUBA Diving Operations

SCUBA diving shall not be conducted**:**

- Against currents, exceeding one (1) knot;

- In an enclosed or physically confining spaces unless line-tended;

- In water visibility less than one (1) meter unless line tended with diver/surface two-way voice communications

- When the diver does not have direct access to the surface

2.5.3 Procedures

- Divers will not exceed designated bottom time;

- Will have a layer of skin protection to prevent injury from cuts and scratches and thermal protection if water temperatures are below 75 degrees Fahrenheit.

- A standby diver shall be available while a diver is in the water;

- A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operation; and

- A diver-carried reserve breathing air supply shall be provided for each diver consisting of:

    - An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

    - The valve of the reserve breathing gas supply shall be in the closed position (lever in the up position) prior to the dive.

- All personnel will remain aware of conditions or hazards that might affect diving operations and will inform the Dive Supervisor and/or terminate the dive as necessary;

- Divers will use proper rates of descent/ascent during the dive (75 feet per minute [fpm] descent/30 fpm ascent).

- If communications are lost between a tender and diver and cannot be regained quickly, metal-on-metal audible recall signal will be sounded in the water and line pull signals will be used to recall the diver. If the diver does not surface in a reasonable amount of time after the audible re-call signal and line-pull signals have been initiated, the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately without waiting for the recall signal. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive. The Emergency Plan in Attachment A describes emergency procedures that apply to a situation where there is a lost diver in the water.

2.6 LIVE BOATING

EOTI will operate a safety boat in the area of dive operations. The boat will be positioned to monitor the dive operation and to help maintain a safety exclusion zone around the operation. Personnel on the safety boat will assist in emergency response as requested by the Dive Supervisor. The dive boat will be anchored during dive operations.

2.7 SEARCH METHOD (CIRCLE-LINE AND STATIONARY JACKSTAY)

The purpose of a munitions response dive is to locate and identify underwater MEC. The search shall be conducted using a circle-line search method described in the following paragraph; the diver will be equipped with an all metals detector and hand tools as necessary. The area to be searched will be located using the Global Positioning System (GPS) to locate the points provided by an aero-detection mapping operation.

The circle-line search method will be used to locate underwater MEC when the search area is small. A single clump attached to a buoy line will be lowered to the bottom. A second line with knots tied every four- or five-feet apart of a specified length will be attached to the clump. The diver will then use this second line to circle around the clump at increasing or decreasing radii while searching. After one complete circle, the diver moves out or in one knot as required. This search method can be utilized to reacquire single targets previously electronically positioned (see Figure 2.1).

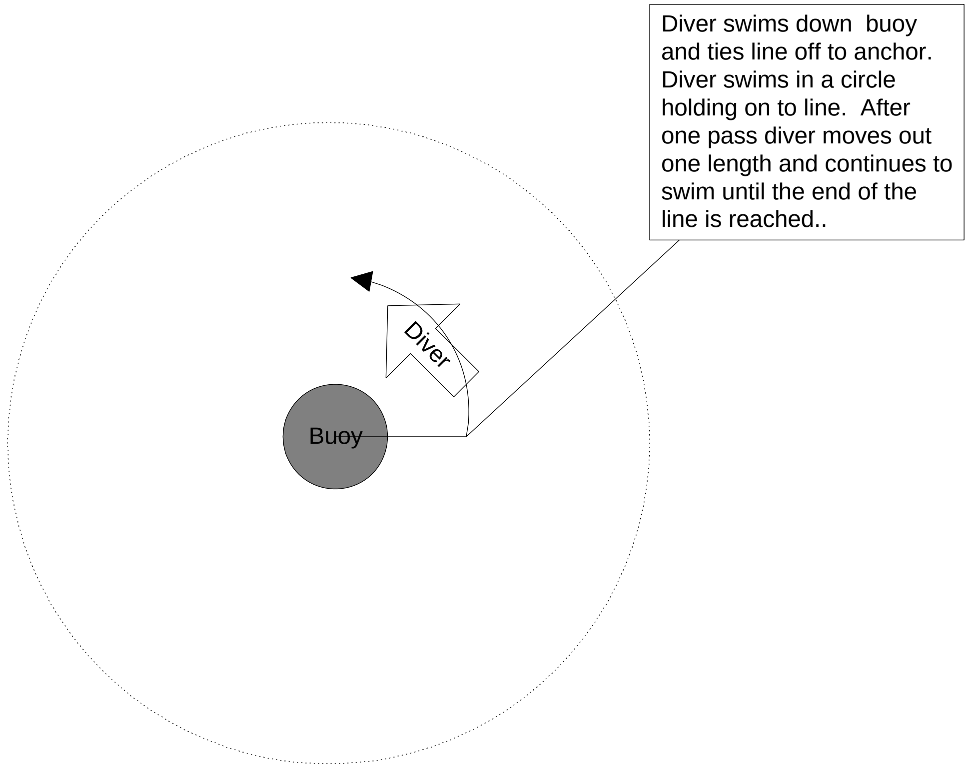


Figure 2.1 Circle Line Search Method

The Stationary Jackstay search method will be used to locate underwater MEC in the areas where specific anomaly locations are unknown. A diver will use a line as a guide as he sweeps a lane that is approximately five feet wide. At the end of the line he will turn around and swim the opposite direction, clearing a five feet wide lane on the other side of the line. The line will then be repositioned and the process is repeated until the entire area is cleared. Figure 2.2 shows how the Stationary Jackstay method is employed.

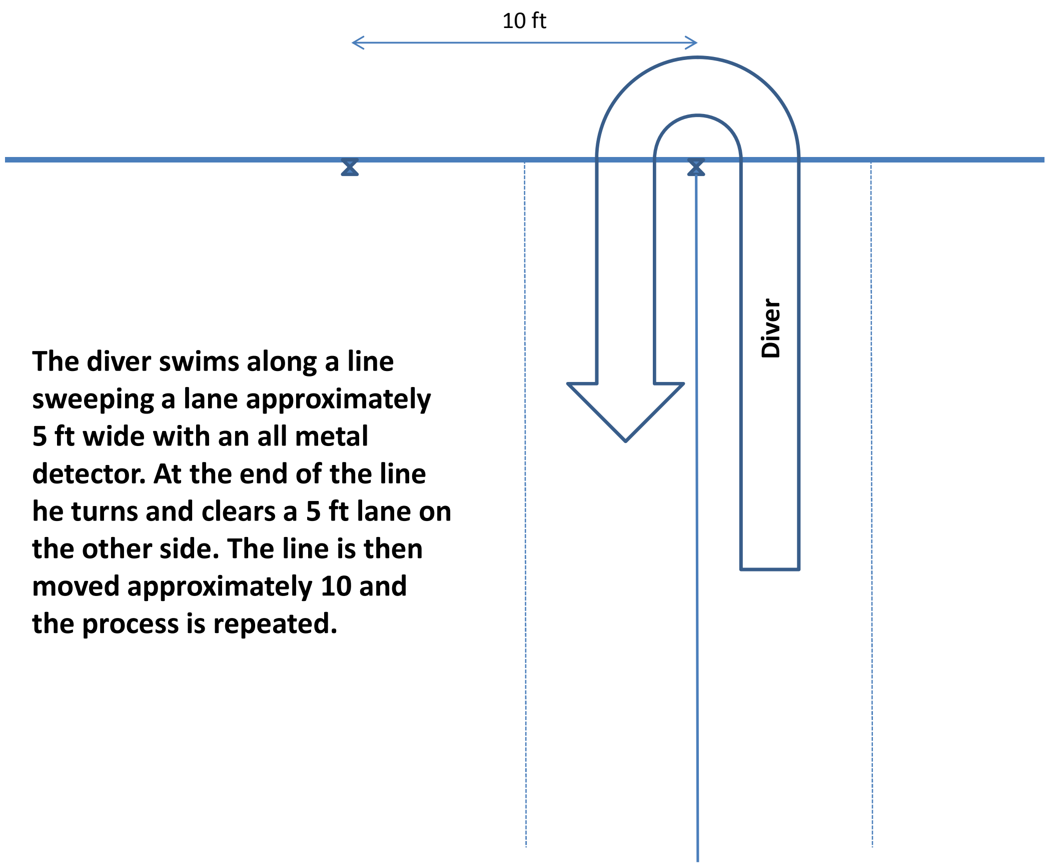


Figure 2.2 Stationary Jackstay Search Method

NOTE: If an item is identified as potential MEC, an attempt will be made to verify if the item is acceptable or unacceptable to move. If the item is acceptable to move the item will be removed to a safe location. If the item is unacceptable to move, it will be marked with a means to identify its location and left in place and the Senior Unexploded Ordnance Supervisor (SUXOS) will be notified immediately in order to coordinate with the Project Manager, Unexploded Ordnance Safety Officer (UXOSO), USACE Ordnance and Explosives (OE) Safety Specialist and/or others as appropriate to determine final disposition.

2.8 DIVE OPERATION CHECKLISTS

2.8.1 The General Planning Checklist

The *General Planning Checklist* (Attachment E) is used by the Dive Supervisor when planning dive operation and should be reviewed and updated prior to each dive.

2.8.2 The Dive Project Supervisor Checklist

The *Dive Project Supervisor Checklist* (Attachment F) is used by the Dive Supervisor to document basic data and to document pre-dive checks. It is completed prior to each dive.

2.8.3 The Project Dive Plan Checklist

The *Project Dive Plan Checklist* (Attachment G) is used by the Dive Supervisor to record basic information from the Dive Plan and to document specific team assignments and dive-specific information. It is completed prior to each dive.

2.8.4 The Dive Supervisor Pre-dive

The *Dive Supervisor Pre-dive Checklist* (Attachment H) is used by the Dive Supervisor to individual diver's readiness. It is completed prior to each dive.

2.8.5 The Dive Boat Operation

The *Dive Boat Operation Checklist* (Attachment I) is used by the Dive Supervisor or Boat Operator to inspect the dive boat. It is completed daily prior to operation of the boat.

3. TEAM MEMBERS

The Project Manager and Project UXO Dive Supervisor are responsible for ensuring all dive team members and boat support personnel, read, understand, and follow all the procedures outlined in this manual. All dive team personnel are responsible for ensuring that they read and follow the procedures outlined in this manual as it pertains to their individual work assignments. If discrepancies are found with procedural steps or any safety issues in this manual they will immediately be brought to the attention of the Project UXO Dive Supervisor and Project Manager for clarification and or corrective action.

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the USACE DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation.)

3.1 Qualifications of Divers Engaged in MEC Operations

Each dive team member will be certified as appropriate for the type of diving to be conducted through formalized military training and will have the experience or training necessary to perform these assigned tasks. In addition, each dive team member shall have the experience and training in the following:

- Have documentation showing that the dive team members have successfully completed training to the appropriate level (e.g. SSA diver's certification, surface supplied mixed-gas diver certificate). Such training shall:
  - Be military school, Federal school, or an Association of Commercial Diving Educators (ACDE) accredited school, or
  - Meet the requirements contained in American National Standards Institute (ANSI)/ACDE-01.
- Have at least one (1) year commercial experience in the applicable position;
- Have completed at least four (4) working dives using the diving techniques and equipment to be used;
- Must demonstrate that at least one (1) of the four (4) qualification dives was performed in the last 6 months prior to the contract award date;
- A graduate of U.S. Naval School Explosive Ordnance Disposal, if engaged in munitions response diving operations;
- Trained in the use of tools, operation, and maintenance of equipment and systems relevant to assigned tasks;
- Trained in the techniques of the assigned diving mode;
- Trained in diving operations and emergency procedures;
- Trained in tasks to be accomplished (to include purpose and function);

- Trained in cardiopulmonary resuscitation (CPR) using emergency oxygen, Automatic Emergency Defibrillator (AED) and first aid as defined by OSHA; and
- All dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.
- 40-hour Hazardous Waste Operations (HAZWOPER) training with an 8-hour annual refresher training as required.

3.2 ASSIGNMENTS

Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to a person undergoing job orientation; provided that these tasks are performed under the direct supervision of an experienced dive team member.

EOTI will not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

The Dive Supervisor will not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition, which is known to the Dive Supervisor and is likely to affect adversely the safety or health of a dive team member.

The minimum manning level for dive teams shall be in accordance with Appendix O of EM 385-1-1.

3.3 RESPONSIBILITIES

3.3.1 Dive Supervisor

The Dive Supervisor will review this Safe Dive Practices Manual with the dive team prior to conducting any diving operations. This manual shall be made available at the dive location to each dive team member. The Safe Practices Manual includes:

- Safety Procedures and checklists for diving operations;
- Assignments and responsibilities of the dive team members; and
- Equipment procedures and checklists; and
- Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

The EOTI Project Manager will designate the Dive Supervisor in writing. The Dive Supervisor is responsible for ensuring complete compliance with the provisions of this manual, the Site Safety and Health Plan (SSHP), and the Project Work Plan. He is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs), and assisting in the preparation of progress reports. The Dive Supervisor shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of the dive team members. The Dive Supervisor shall have the experience and training in the conduct of the assigned diving operation. The Dive Supervisor will be responsible for all diving operations described herein. The Dive Supervisor will:

- Ensure all dive team members possess current certification and are qualified for the type of diving operation;

- Ensure that the dive team is briefed on the appropriate ordnance safety precautions for ordnance that may potentially be present;

- Ensure safety and emergency equipment is in working order at the dive site;

- Brief the dive team prior to each dive on:

  - Dive objectives;

  - Unusual hazards or environmental conditions likely to affect the diving operation; and

  - Any modifications to the Dive Plan or Emergency Management Plan made necessary by conditions or the specific diving operation.

- Suspend diving operations if in his opinion, conditions are unsafe;

- Draft a site-specific Project Dive Plan and an Emergency Management Plan in accordance with Attachments G and A respectively prior to each diving operation;

- Determine the equipment requirements for all diving operations and ensure that adequate means are taken to make such equipment available at the scene;

- Plan the diving operation considering the job requirements, equipment and personnel available, and condition of the diving operation area utilizing the General Planning Checklist (Attachment E);

- Ensure that the Project Dive Supervisor Checklist, Project Dive Plan and Pre-Dive Checklist (Attachments F, G, H) are completed and adhered to for all diving operations including training;

- Act as timekeeper and maintain a Project Dive Log (Attachment C) at the diving location which will become part of the project official records;

- Obtain a copy of the certificate of analysis showing the breathing air meets the minimum acceptable criteria listed in section 30.F.05c of EM 385-1-1;

- Ensure that all AHA's are available and on site. The AHA will contain hazards associated with each phase of the work and includes hazards associated with flying before and after diving; and

- Maintain direct communications between the dive site, project office, and the EOTI Corporate Office.

- Implementing quality control (QC) for technical data provided by the field staff including field measurement data
- Adhering to work schedules
- Implementing and documenting corrective action procedures and provisions of communication between team and upper management

3.3.2 Diving UXO Specialist (Diver)

The Diver will be a trained and experienced diver, as well as trained in (UXO). The Diver responsibilities and experience will include:

- Required knowledge and experience to perform assigned tasks;
- Keep topside personnel informed of conditions on the bottom and progress of the task(s);
- Obey all signals from the surface and repeat all commands given from topside personnel;
- Acting as a tender for other divers;
- Notifying the Dive Supervisor of any symptoms that may be construed as diving sickness or a mechanical injury;
- Maintaining a personnel dive log which will include:
    - Inform Dive Supervisor or alternate if taking any medications;
    - Full name;
    - Date, time, and location of the dive;
    - Maximum depth and bottom time;
    - Surface interval between dives;
    - Breathing medium and type of equipment used;
    - Group classification at the beginning and the end of each interval and repetitive dive worksheet;
    - Underwater and surface conditions;
    - Depth(s) and duration(s) of any decompression stops (there will be no decompression dives and will only be required in emergency situations);and
    - Date and time of last previous dive.
    - Name of Dive Supervisor(s) during dive.
- Maintaining personal dive equipment (Attachment D);
- Identify and stop any operation that, in their opinion is unsafe

3.3.3 Standby Diver

A standby diver is a fully qualified diver and will be on station whenever a diver(s) is in the water to serve as immediate emergency assistance to the primary diver(s). A standby dive will deploy only after the dive supervisor has assessed the situation and instructed him/her to do so. The Standby Diver receives the same briefings and instructions as the working Diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The SCUBA Standby Diver shall be equipped with a second regulator, referred to as an octopus.

The standby diver will:

- Be fully equipped to dive and readily available the entire time the diver is in the water;
- Don all specific gear (suits, harnesses, and equipment) up to mask they will wear/use and be checked by the Dive Supervisor;
- Test all gear for proper operation before the primary diver leaves the surface;
- The Standby Diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the Dive Supervisor, the Standby Diver may remove the tank.
- Be dressed appropriately for the water and air temperature.

3.3.4 Tender

For each dive, a Diver will be designated as tender. The tender will:

- Assist the primary diver and the standby diver in donning, doffing, and checking gear;
- Be a diver prepared to dive each day;
- Maintain communications with the diver;
- Keep the Dive Supervisor informed of communications from and to the Diver;
- Tend the tether line for the diver;
- Monitor the diver's progress and status;
- Remain undistracted so he can monitor the surface for danger from boat traffic and any other hazards

If it becomes necessary for the standby diver to enter the water to assist the diver, the Dive Supervisor will immediately assume the role of tender for the standby diver.

3.3.5 Dive Team Support

The dive team is supported by a UXOSO/Quality Control Specialist (QCS) who is trained as a diver. When used, a safety boat will be positioned to safely observe dive operations and to direct other boat traffic away from the operation. The boat operator will be trained and proficient in the operation of the safety boat. He will position the boat as directed by the UXOSO/QCS to support the operation and will be aware of other boats operating in the area and other potential hazards or risk to the operation. The UXOSO/QCS will:

- Maintain communication with the Dive Supervisor;
- Monitor the operation with respect to worker safety and health and quality control;
- Monitor and maintain copies of certificates of training and medical surveillance;
- Verify certifications and conduct periodic audits of personnel qualifications;
- Conduct quality and safety inspection;
- Provide input to after action reviews of the operation;
- Assist in maintaining proper exclusion zones;

- Inspect munitions debris (MD) and material potentially presenting an explosive hazard (MPPEH) recovered;
- Ensure all project safety and quality requirements are met and documented and reports and potential nonconformance to the EOTI corporate quality or safety manager.

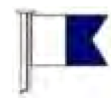
The UXOSO/QCS reports to the Corporate Quality Manager for quality related issues and to the Corporate Safety Manager for safety related issues. He also coordinates site activities with the Dive Supervisor and ensures that quality and safety requirements are met and documented.

4. EQUIPMENT

EOTI's policy on diving equipment is to use quality and state-of-the-art equipment to ensure the safety and well-being of the divers. Equipment used in diving operations, particularly those items which are classified as life-support equipment, must be properly maintained and kept in good working order.

4.1 EQUIPMENT INSPECTION

Prior to any dive, all equipment must be carefully inspected for signs of deterioration, damage, or corrosion and must be tested for proper operation. Pre-dive preparation procedures must be standardized, not altered for convenience, and must be the personal concern of each diver. All divers must always check their own equipment. An inspection of all dive gear and associated equipment will be conducted before each use, using Attachment D as a guide. Any equipment not in good working order will be removed from use.



4.2 DIVE FLAGS

In accordance with ER 385-1-86, an appropriate dive flag at least one meter in height, visible in all directions, and will be displayed at the dive location during dive operations. In accordance with 29 CFR 1910.421(h), the signal will be a rigid replica of the international code Alpha Flag.

A traditional red and white "Diver Down" flag will also be displayed in addition to the code Alpha Flag.

4.3 SCUBA EQUIPMENT

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet DOT 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;
- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and
- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.
- Skin suit to protect from cuts and abrasions and thermal protection as required

- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

4.4 FIRST AID SUPPLIES

The following first aid supplies will be available on the dive boat:

- First aid kit appropriate for the diving operation;
- American Red Cross standard first aid handbook or equivalent;
- Emergency oxygen with transparent mask will be available at the dive location; and
- A Stokes litter or backboard.
- AED

5. EMERGENCY PROCEDURES

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

5.1 FIRE

Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.2 EQUIPMENT FAILURE

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.3 ADVERSE WEATHER

All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.4 MEDICAL ILLNESS OR INJURY

See Attachment A, *First Aid for Diving Related Injuries*, to this plan as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.

5.5 EMERGENCY PROCEDURES DURING DIVE OPERATIONS

5.5.1 Entrapped or Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

5.5.2 Loss of Vital Support Equipment

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.5.3 Loss of Gas Supply

- Signal dive partner and abort dive;

- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repaired (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

5.5.4 Loss of Communication

If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.

5.5.5 Lost Diver Plan

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and
- Ensure stricken divers recovered get immediate, effective treatment.

5.5.6 Injured Diver Plan

If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

5.5.7 Actions upon Discovery of Fire

Recall the diver. Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.5.8 Diver Blow-up/Over Rapid Ascent to Surface

Depths of dives typical of MEC projects performed by EOTI are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted.

The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.

5.5.9 Diver Loss of Consciousness

Slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver. Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and ensure the stricken diver gets immediate, effective treatment.

5.5.10 Injury or Illness of Surface Crew Member

If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.

5.5.11 Explosive Detonation with Diver (s) in the Water

- Attempt to establish communications with the diver via tending line;
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

5.5.12 Decompression Sickness (“The Bends”) or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify the Project Office and EOTI Corporate Office of circumstances;
- Perform neurological exam and record on (Attachment J); and
- Treat for shock.

6. Internal Safety Inspection

A Site Specific Accident Prevention Plan is prepared for all projects. A qualified Site Safety and Health Officer (SSHO) is assigned to each project. The SSHO reports directly to the Corporate Safety Officer and is responsible for ensuring compliance with all site safety requirements. When the project involves potential underwater MEC the SSHO will be a Navy-trained diver and UXO technician who has the qualifications of a UXOSO. The UXOSO will be on site any time work is performed. The UXOSO provides initial training to all assigned personnel and visitors to ensure that they are familiar with the hazards and controls associated with the site and specific tasks that they may perform. The UXOSO performs daily safety inspection to ensure compliance with safety requirements and to identify unsafe conditions or acts that may present a hazard to workers or visitors. The UXOSO facilitates daily tailgate safety meetings and after action reviews in order to review potential hazards and the effectiveness of controls with all site personnel. The UXOSO makes on the spot corrections as required and works with the site supervisor to address potentially unsafe conditions or actions. He reports potential nonconformance issues to the Corporate Safety Officer and conducts or supports investigation of accidents or near misses.

7. Safety Compliance

EOTI dive operations are conducted in conformance with requirements outlined in OSHA regulations, the U.S. Navy Diving Manual (Volume I) and the USACE Safety and Health Requirements Manual EM 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 CFR 1910 Subpart T, Commercial Diving Operations has been integrated into this manual and a complete copy is included in Attachment K. U.S. Navy No- Decompression Dive Tables are included in Section 7. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examinations, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where regulatory and guidance documents conflict, the most stringent requirement takes precedence.

It is EOTI's policy that all employees engaged in commercial dive operations, review the requirements of this safe practices manual (including 29 CFR 1910 Subpart T), as well as site specific dive and safety plans. Site-specific requirements and hazards are reviewed during the initial on-site training and throughout the project during daily safety meetings. The UXOSO ensures compliance with all safety requirements. Failure to comply is unacceptable.

8. Applicable Navy Tables

8.1 No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives

No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595	
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	60	7	12	17	22	28	33	39	45	51	57	60					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	30	4	7	11	14	17	21	24	28	30							
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	10	2	4	6	9	10											
140	10	2	4	6	8	10											
150	5	2	3	5													
160	5		3	5													
170	5			4	5												
180	5			4	5												
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

8.2 Residual Nitrogen Timetables for Repetitive Air Dives

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

Repetitive Group at Beginning of Surface Interval	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																:10 2:20 *
B															:10 1:16	1:17 3:36 *
C														:10 :55	:56 2:11	2:12 4:31 *
D													:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *
E												:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *
F											:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *
G										:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *
H									:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *
I								:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *
J							:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 7:00	7:01 8:16	8:17 10:36 *
K						:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *
L					:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:44	8:45 10:01	10:02 12:21 *
M				:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *
N			:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *
O		:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

8.3 Standard Air Decompression

Air Decompression Table.
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop 100	90	80	70	60	50	40	30	20	Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
30 FSW														
371	1:00	AIR									0	1:00	0	Z
		AIR/O_2									**0**	1:00		
380	0:20	AIR									5	6:00	0.5	Z
		AIR/O_2									**1**	2:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
420	0:20	AIR									22	23:00	0.5	Z
		AIR/O_2									**5**	6:00		
480	0:20	AIR									42	43:00	0.5	
		AIR/O_2									**9**	10:00		
540	0:20	AIR									71	72:00	1	
		AIR/O_2									**14**	15:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
600	0:20	AIR									92	93:00	1	
		AIR/O_2									**19**	20:00		
660	0:20	AIR									120	121:00	1	
		AIR/O_2									**22**	23:00		
720	0:20	AIR									158	159:00	1	
		AIR/O_2									**27**	28:00		
35 FSW														
232	1:10	AIR									0	1:10	0	Z
		AIR/O_2									**0**	1:10		
240	0:30	AIR									4	5:10	0.5	Z
		AIR/O_2									**2**	3:10		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
270	0:30	AIR									28	29:10	0.5	Z
		AIR/O_2									**7**	8:10		
300	0:30	AIR									53	54:10	0.5	Z
		AIR/O_2									**13**	14:10		
330	0:30	AIR									71	72:10	1	Z
		AIR/O_2									**18**	19:10		
360	0:30	AIR									88	89:10	1	
		AIR/O_2									**22**	23:10		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
420	0:30	AIR									134	135:10	1.5	
		AIR/O_2									**29**	30:10		
480	0:30	AIR									173	174:10	1.5	
		AIR/O_2									**38**	44:10		
540	0:30	AIR									228	229:10	2	
		AIR/O_2									**45**	51:10		
600	0:30	AIR									277	278:10	2	
		AIR/O_2									**53**	59:10		
660	0:30	AIR									314	315:10	2.5	
		AIR/O_2									**63**	69:10		
720	0:30	AIR									342	343:10	3	
		AIR/O_2									**71**	82:10		

9. Repetitive Dive Worksheets

The Diving Profile Log is a chronological record of all dives conducted during a project. It contains information related to the specific dive operation conducted each day and to specific divers specific divers involved. A sample form is included in Attachment C.

Information recorded on the log includes:

- Date of dive
- Location of the dive
- Environmental conditions affecting the dive
- Equipment used
- Purpose of the dive
- Identification of divers and standby divers
- Times left and reached surface, bottom time
- Depth
- Decompression time
- Air and water temperature
- Signatures of Diving Supervisor

10. Fitness for Duty

10.1 DIVE PHYSICAL FREQUENCY

All divers must have a certificate signed by a licensed physician, stating that they have been medically examined within the last 12 months and have been determined fit and approved to dive. The dive medical examination will be repeated every 12 months with verifications submitted to the DDC as appropriate.

10.2 PHYSICAL EXAMINATIONS

Initial and Periodic Re-examinations – All ages, require the following:

Medical History Complete

Physical Examination

Chest X-ray

Spirometry

Urinalysis

Vision

Other testing as required

10.3 DIVE PHYSICAL CONSIDERATIONS

The physician conducting the examination should consider the following disorders, which may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

- History of seizure disorder other than early febrile convulsions.
- Malignancies (active) unless treated and without recurrence for 5 yrs.
- Chronic inability to equalize sinus and/or middle ear pressure.
- Cystic or cavitary disease of the lungs.
- Impaired organ function caused by alcohol or drug use.
- Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood-altering drugs, or insulin).
- Meniere's disease.
- Hemoglobinopathies.
- Obstructive or restrictive lung disease.
- Vestibular end organ destruction.
- Pneumothorax.
- Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).
- Juxta-articular osteonecrosis.

11. Administration and Recordkeeping

11.1 DIVING RECORD KEEPING REQUIREMENTS

The Dive Supervisor will provide to the SUXOS all project diving records for the project to be incorporated into the project files; these records will be kept in the project site office. Diving Related Injury or Illness.

The Dive Supervisor and the UXOSO/QCS will record and report any diving-related occupational injury and illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of the injury or illness on applicable EOTI Incident Report Forms. All injuries and illnesses will be immediately reported to the UXOSO and Project Manager.

11.2 AVAILABILITY OF RECORDS

Records and documents required by 29 CFR 1910 Subpart T shall be provided upon request to the:

- Assistant Secretary of Labor for Occupational Safety and Health (OSH);
- Director, National Institute for OSH; and
- Employee or his designated representative.

11.3 DIVING RECORD RETENTION PERIODS

Records and documents required by 29 CFR 1910 Subpart T shall be retained by EOTI for the following periods.

- Dive team member medical records – five (5) years;
- Safe Practices Manual - current document only;
- Depth-time profile - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;
- Recording of dive – one (1) year, except five (5) years when there has been an incident of decompression sickness;
- Decompression procedure assessment evaluations – five (5) years;
- Equipment inspections and testing records - current entry or tag, or until equipment is withdrawn from service;
- Records of hospitalization – five (5) years;
- After the expiration of the retention period of any record required for five (5) years, EOTI will forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

12. References

Department of the Army (DA). 2008. Technical Manual (TM) 60A-1-1-31, Explosive Ordnance Disposal Procedures, General Information on EOD Disposal Procedures (Revision 5). October.

Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum ualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.

Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M

Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.

DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.

Revision 4. AugustUnited States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)

United States Army Corps of Engineers (USACE) 2013. Safety and Health Requirements Manual EM 385-1-1

United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.

United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Department of the Army Memorandum, Subject: Munitions Response Actions – Minimum Separation Distances (Relative to Impulse Water Pressure) from Underwater Detonations, 16 Sep 13

13. Glossary of Diving Terms

ACFM	Actual cubic feet per minute.
Alternate Project Dive Supervisor	Alternate designated, in writing, by the Project Manager to act on behalf of the Project Dive Supervisor.
ASME Code or equivalent	ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
ATA	Atmosphere absolute.
Bottom time	The total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time that the diver begins ascent.
Bursting pressure	The pressure at which a pressure containment device would fail structurally.
Circle line search	Descending line leading to a clump with a second line attached used by divers to rapidly search small areas.
Cylinder	A pressure vessel for the storage of gases.
Decompression sickness	A condition with a variety of symptoms which may result from gas of bubbles in the tissues of divers after pressure reduction.
Decompression table	A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure.
Dive location	A surface or vessel from which a diving operation is conducted.
Dive team	For all diving operations, the dive team will consist of a minimum of four people, including a Dive Supervisor, who are assigned to diving duty in writing by EOTI. The dive team members will be required to be graduates of an approved course of instruction.
Dive-location reserve breathing gas	A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.
Diver	An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
Diver Orientation	Diver orientation will be scheduled by the Project Dive Supervisor in order to familiarize or train diver personnel on new or unfamiliar technical functions to be performed by the dive team.
Diving Mode	A type of diving requiring specific equipment, procedures and techniques

	(SCUBA, surface-supplied air).
Dive Supervisor	The person in charge of diving operations. May be the Project UXO Dive Supervisor or an Alternate Dive Supervisor.
Diving Time/Water Time	Time spent in or underwater while engaged in a diving operation. Diving time will start at the time the diver enters the water and ends when the diver exits the water and returns to the pier, dive boat, or diving platform.
Diving Training	Training prescribed by the Project Dive Supervisor in order to maintain diver proficiency.
Diver	A graduate of U.S. Naval School Explosive Ordnance Disposal engaged in munitions response diving operations.
FSW	Feet of seawater (or equivalent static pressure head).
Hyperbaric condition	Pressure conditions in excess of (1 ATA) surface pressure.
Live boating	The practice of supporting a SCUBA, surface-supplied air, mixed-gas diver, from a vessel that is underway.
No-decompression limits	The depth-time limits of the "no-decompression limits and repetitive diving group designation table for no-decompression air dives", U. S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.
Observer/Assistant	A team member able to assist them in the water
Post-Dive preparation time	Time spent in the breakdown, cleaning, preservation, and maintenance of diving equipment upon completion of a diving operation.
Pre-Dive preparation time	Time spent by diver personnel preparing diving equipment for a diving operation.
Dive Supervisor	This person is responsible for the safe and efficient operation of all divingfunctions at the location to which he is assigned. The Dive Supervisor must be knowledgeable of diving operations in general and all specific diving assignments involved. He is assigned in writing by EOTI.
psi(g)	Pounds per square inch (as measured using a gauge).
Recompression chamber	A pressure vessel for human occupancy such as a surface recompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

SCUBA	A diving mode independent of surface air supply in which the diver uses open circuit Self-Contained Underwater Breathing Apparatus.
Standby diver	A diver at the dive location available to assist a diver in the water.
Stationary Jackstay grid search	Four clumps with buoy/buoy lines and four bottom lines connecting the four clumps used by divers to systematically and thoroughly search large areas.
SSA	A diving mode in which a diver uses Surface Supplied Air.
Underwater stage	A suspended underwater work platform, which supports a diver in the water.
Volume tank	A pressure vessel connected to the outlet of a compressor and used as air reservoir.
Walking Jackstay grid search	Two clumps with descending lines and a line of a specified length connecting the clumps used by divers to systematically and thoroughly search large areas.
Working pressure	The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

Attachments

A – Emergency Management Plan

B - Line Pull and Hand Signals

C – Diving Profile Log

D – Personal Dive Equipment Checklist

E – General Planning Checklist

F – Project Dive Supervisor Checklist

G – Project Dive Plan

H – Dive Supervisor Pre-dive Checklist

I – Checklist for Dive Boat Operations

J – Neurological Examination Checklist

K – 29 CFR 1910 Subpart T

Attachment A – Emergency Management Plan

A.1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

A.1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

Disorientation or Fatigue

Skin Itch

Chest Pain

Numbness, Tingling, Paralysis or Weakness

Dizziness, Vertigo, or Ringing in the Ears

Blurred Vision

Personality Change

Signs (one or more of the following)

Bloody froth from nose or mouth

Paralysis or Weakness

Unconsciousness

Convulsions

Shortness of Breath or Cessation of Breathing

Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

CPR, if required

Open airway, prevent aspiration, and incubate if trained person available

Give O^2; remove only to open airway or if convulsion ensue

If conscious, give nonalcoholic liquids

Place in horizontal, neutral position

Restrain convulsing person loosely and resume O^2 as soon as airway is open

Protect from excessive cold, heat, water, or fumes

Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

A.1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

Tired Feeling

Itching

Pain, arms, legs or trunk

Dizziness

Numbness, tingling or paralysis

Chest compression or shortness of breath

Anything unusual after the dive

Signs (one or more of the following)

Blotchy Rash

Paralysis or weakness anywhere in the body

Coughing Spasms

Staggering or instability

Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

A.2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

A.2.1Pneumothorax

Symptoms (one or more of the following)

Pains in the chest

Shortness of breath

Signs (one or more of the following)

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

Emergency Actions:

Call for help and immediate transport

A.2.2 Mediastinal Emphysema (Lung over pressure accident)

Recognition - Always associated with pneumothorax

Symptoms (one or more of the following)

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

Signs (one or more of the following)

Obvious difficulty breathing

Brassy change in voice

Emergency Actions:

Transport to medical facility for evaluation

A.2.3 Drowning-Near Drowning

Recognition

Unconsciousness

Lack of respiration

Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing

Assess ABC's airway, breathing and circulation

Removal of gear

Transport to the boat or shore

Immediate call for help and transport to facility

Start CPR

A.2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by

Convulsions

Symptoms (one or more of the following)

Nausea

Dizziness

Ringing in the ears

Abnormal Vision

Confusion

Prevention

Avoidance of gases with high O^2 concentrations (as in Nitrox at inappropriate depth)

Avoid CO^2 retention that can precipitate O^2 convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

A.2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport
- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

A.2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

A.2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport

- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

A.2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50^{o} C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

A.2.9 Hypothermia

- Keep core temperature above 95^{o} F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

A.2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)

- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

A.2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet
- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

A.3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

A.3.1 Nitrogen Narcosis

<u>Signs (one or more of the following)</u>

Inappropriate behavior at depth

Ignoring hand signals and instructions

Stupor or coma

<u>Symptoms (one or more of the following)</u>

Inflexible thinking and attitude

Decrease or loss of judgment

False sense of security

Lack of concern for safety

Inability to think through problems

Panic

Near unconsciousness or loss of consciousness at depth

Treatment

Ascend until free of symptoms

Surface with controlled ascent

Transport to medical facility for evaluation

A.3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

Rapid breathing

Feeling of suffocation or shortness of breath

Headache, nausea, dizziness

Rapid heartbeat

Confusion and unclear thinking

Signs (one or more of the following)

Slowed responses

Muscle irritability (twitching)

Loss of consciousness

Treatment

Remove the cause (over-exertion, equipment failure, rebreathers, etc.)

Stop and rest during early symptoms to avoid loss of consciousness

Surface; Transport to medical facility for evaluation

A.3.3 Ear Disorders

Middle Ear Barotrauma

Keep quiet and calm

Without DCS or rupture of the round or oval windows, give Benadryl 25 mg

Transport to medical facility for evaluation

Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)

Keep head up and affected ear elevated

Discourage straining

Transport to medical facility for evaluation

EMT evaluation, no more diving until cleared by EMT

A.3.4Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

Attachment B - Line Pull and Hand Signals

LINE PULL SIGNALS - Line Pull Signals will be distinct pulls on the line which are strong enough to be felt by the diver but not strong enough to pull the diver away from the work. Acknowledgment consists of replying with the same signal. If a signal is not acknowledged, the signal will be re-sent. Continued absence of confirmation will be assumed to mean one of three things:

The line is fouled.

Too much slack in the line.

Diver in trouble.

If communication is lost, the Project Dive Supervisor will take immediate steps to identify the problem.

Line Pull Signals - From Tender to Diver:

1 Pull	"Are you All right?"
	When diver is descending, one pull means, "STOP".
2 Pulls	"Going down"
	During ascent, 2 Pulls means, "You have come up too far, go back down until we stop you"
3 Pulls	"Standby to come up"
4 Pulls	"Come up"
2-1 Pulls	"I understand" or "Answer the telephone"
3-2 Pulls	"Ventilate"
4-3 Pulls	"Circulate"

Line Pull Signals - From Diver to Tender:

1 Pull	"I am All right"
	When diver is descending, one pull means, "STOP" or "I am on the bottom"
2 Pulls	"Lower" or "Give me slack"
3 Pulls	"Take up my slack"
4 Pulls	"Haul me up"
2-1 Pulls	"I understand" or "Answer the telephone"
3-2 Pulls	"More Air"

4-3 Pulls "Less Air"

Special Line Pull Signals from the Diver:

1-2-3 Pulls "Send me a square mark"

5 Pulls "Send me a line"

2-1-2 Pulls "Send me a slate"

Line Pull Searching Signals - Without Circling Line

7 Pulls "Go on/off searching signals"

1 Pull "Stop, search where you are"

2 Pulls "Face the line and move away from the weight"

3 Pulls "Face the weight and go right"

4 Pulls "Face the weight and go left"

Emergency Line Pull Signals from the Diver:

2-2-2 Pulls "I am fouled and need the assistance of another diver"

3-3-3 Pulls "I am fouled but can clear myself"

4-4-4 Pulls "Haul me up immediately"

All Emergency Signals will be answered as given, EXCEPT 4-4-4.

Attachment C – Diving Profile Log

EOTI
DIVING PROFILING LOG

Date of Last Previous Dive: **Time of Last Previous Dive:**

Date	Geographic Location	Air Temp(^oF)
Equipment Used	Dress	Wave Height (ft)
Breathing Medium	Platform	Water Temp (^oF)
Breathing Medium Source		Current (kts)
Depth of Dive (fsw)	Bottom Type	Bottom Visibility (ft)

Diver	LS	RB	LB	RS	TBT	TDT	TTD	Sched Used

Purpose of Dive, Tools Used, etc.	Repet Group
	Surface Interval
	New Repet Group
	RNT

Dive Comments
Signature (Dive Supervisor)

Attachment D – Personal Dive Equipment Checklist

_____Air Cylinders	Inspect air cylinders exteriors and valves for rust, cracks, dents, and any evidence of weakness. Remove valve cover and inspect O-ring.
_____Cylinder pressure	Gauge the cylinder and record pressure reading: __________ psig.
_____ Harness straps	Check for signs of rot and excessive wear. Adjust straps and backpack for individual use, and test quick release mechanisms. Check backpack for cracks and other unsafe conditions.
_____ Hoses	Check the hose(s) for cracks and punctures. Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose. Check the clamps for corrosion and damage, replace as necessary.
_____ Regulator	Attach regulator to the cylinder manifold and ensure it is seated correctly. Open cylinder valve slowly all the way and back off one-quarter turn. Check that there are no leaks by listening for the sound of escaping air. Check that the regulator breathes properly by breathing the regulator for thirty seconds. If any leaks are noted or regulator does not breathe properly, inform the Project Dive Supervisor and remove regulator from service.
_____Emergency air supply	Ensure that it has no damage to the mouth piece, bottle, regulator body, purge valve or regulator. Ensure that the pressure indicator is showing a filled tank or gauge is reading a full tank (3000 psi) or in the safe (green) zone.
_____Life Preserver or BC	Orally inflate preserver to check for leaks, and then squeeze out air. Inspect the carbon dioxide cartridges to ensure they have not been used and are the proper size for the vest being used and for the depth of the dive. Firing pin(s) will not show wear and will move freely. The firing lanyards and life preserver straps must be free of any signs of deterioration.
_____ Dry Suit	Inspect the exterior of dry suit for holes, rips or tears. Inspect cuffs and neck dam for dry rot, rips, and tears. Ensure zippers are in good working order and no teeth are missing. Test the air fitting connection with an air hose and ensure it locks in place. Inspect air relief valve for damage.
_____CO_2 Cartridges	Weigh carbon dioxide cartridges and record weight: ________________. Weight will be within 10% of stamped weight.

	If weight is not within tolerance remove from service and notify Dive Supervisor.
_____Facemask	Check the seal of the mask and the condition of the head strap. Check for cracks in the skirt and faceplate.
_____Swim Fins	Check straps and inspect blades for signs for cracking.
_____Dive Knife	Test the edge of the knife for sharpness, and ensure the knife is fastened securely in the scabbard. Verify the knife can be removed from the scabbard.
_____Weight Belt	Check the condition of the weight belt and that the proper number of weights are secure and in place. Verify that the quick-release buckle is functioning properly.
_____Wristwatch	Ensure wristwatch is wound and set to the correct time. Inspect the pins and strap of the watch for wear.
_____Depth Gauge	Inspect pins and straps. If possible, check compass with another compass. Make comparative checks on depth gauges to ensure depth gauges read zero fsw on the surface.
_____Miscellaneous Equipment	Inspect any other equipment which will be used on the dive as well as any spare that may be needed during the dive including spare regulators, cylinders and gauges. Check all protective clothing, lines, tools, flares, and other optional gear.
______ Dive Lights	Checked to ensure they work
______ Metal Detector	Surface check to ensure it powers up
______ Standby Diver	Inspect line to make sure it is proper length and no deterioration
______ Observer/Assistant	Check line for proper length and no deterioration
______ Observer/Assistant	Properly stowed on board Throw bag or Ring Buoy

Attachment E – General Planning Checklist

E.1.0 STEPS IN PLANNING DIVING OPERATIONS

E.1.1. Analyze the Mission for Safety

Advanced planning is the greatest single safety precaution that can be taken. The following points must be considered individually and in depth:

- Objective definition;
- Environmental conditions;
- Emergency assistance (Recompression chamber and medical assistance);
- Route familiarization for all personnel; and
- Relevant instructions.

E.1.2 Pinpoint potential hazards

Atmospheric

_____ Extreme exposure of personnel to elements

_____ Adverse exposure of equipment and supplies to elements

_____ Delays or disruption caused by weather

Surface

_____ Sea sickness

_____ Water entry and exit

_____ Handling of heavy equipment in rough water

_____ Maintaining location in winds and currents

_____ Flotsam, kelp, petroleum disrupting operations

_____ Delays or disruption caused by water state

Underwater and Bottom

_____ Depth exceeds diving limits or limits of available equipment

_____ Exposure to cold temperatures

_____ Bottom obstructions

_____ Dangerous bottom conditions (mud, drop-offs, sewer outfalls, etc.)

_____ Visibility reduced or obstructed by suspension of bottom sediment

“On-site” Hazards

_____ Unusual site conditions

_____ High powered, active sonar

_____ Other conflicting water or shore operations

_____ Radiation contamination

_____ Pollution

Mission Hazards

_____ Decompression sickness/Pulmonary Barotraumas

_____ Communications problems

_____ Drowning

_____ Other trauma (injuries)

_____ Equipment malfunctions

Other Hazards

_____ Entrapment

_____ Entanglement

_____ Pollution, toxic

_____ Explosives or other ordnance

_____ Shifting or “working” of object

_____ Handing branches or limbs

E.1.3 Minimize Hazards and Plan for Emergencies.

E.1.3.1 Diving Personnel

_____ Assemble a complete and properly qualified Diving Team

_____ Assign each task to the most trained and experienced personnel

_____ Verify that each member of the Diving Team is properly trained and qualified for the equipment and depths involved

_____ Determine that each diver is physically fit to dive, paying attention to:

_____ General condition

_____ Last record of medical exam

_____ Ears and sinuses

_____ Severe cold or flu

_____ Use of stimulants or intoxicants

_____ Fatigue

_____ Last Repetitive Dive

_____ Time since last air travel

_____ Determine each person’s emotional fitness to dive (as far as possible):

_____ Motivation (willingness)

_____ Stability

E.1.3.2 Diving Equipment

_____ Verify that the type of diving gear chosen (and diving technique) is adequate for the mission and particular task meeting OSHA and USACE requirements

_____ Verify that the type of equipment and diving technique is appropriate for the depth involved

_____ Verify that all equipment has been tested and approved

_____ Determine that all necessary support equipment and tools are readily available and are the best for accomplishing the job efficiently and safely

_____ Determine that all related support equipment such as winches, boats, cranes, floats, etc., are operable, safe, and under the control of trained personnel

_____ Check that all diving equipment has been properly maintained with appropriate records, and is in full operating condition

E.1.3.3 Provide for Emergency Equipment

_____ Obtain suitable communications equipment with sufficient capability to reach "outside help". Check all communications for proper functioning

_____ Verify that a recompression chamber is ready for use, or notify the nearest location having one that its use may be required within a given time frame

_____ Verify that a First Aid Kit is near at hand, and is completely stocked.

_____ If a resuscitator will be used, check the apparatus for function

_____ If conducting boat operations, check that all fire-fighting equipment is readily available and in full operating condition

_____ Verify that Emergency transportation is either standing by, or on immediate call

_____ Verify AED is on Site and personnel are trained in its use

E.1.3.4 Establish Emergency Procedures

_____ Know how to obtain medical assistance immediately

_____ Assign specific tasks to the Diving Team and support personnel for different emergencies

_____ Develop and post the emergency assistance checklist and ensure that all personnel are familiar with its location and use

_____ Verify that a copy of the latest U. S. Navy Standard Air Decompression, repetitive and no-decompression tables are available at the dive location

_____ Be sure that all divers, boat crews, and other support personnel understand all diver hand signals

_____ Verify that all personnel are familiar with emergency recall signals and procedures

______ Pre-determine distress signals and call-signs with all members of the diving team, boat crews, and other activities

______ Be sure that all divers have removed anything from their mouths which might choke them during a dive (gum, dentures, tobacco)

______ Thoroughly drill and train all personnel in Emergency Procedures, with particular attention to cross training. Drills will include:

- Fire, for boat operations
- First Aid
- Decompression Sickness
- Embolism
- Restoration of Breathing
- Drowning
- Entrapment
- Lost Diver
- Unconscious Diver Recovery

E.1.4 Establish Safe Diving Operational Procedures

______ Determine that all other means of accomplishing the mission have been considered before deciding to use divers.

______ Be sure that contingency planning has been conducted.

______ Carefully state the goals of each mission, and develop a flexible plan of operations.

______ Completely brief the Diving Team and support personnel.

______ Designate a properly qualified Dive Supervisor to be in charge of the mission.

______ Designate a timekeeper and verify that he understands his duties and

responsibilities.

______ Determine the exact depth at the job-site through the use of an electronic depth finder, lead line or fathometer.

______ Verify the existence of an adequate supply of compressed air available for all planned diving operations plus an adequate reserve for emergencies.

______ Be sure that operations or action on the part of the Diving Team, support personnel, boat crews, technicians, winch/crane operators, etc., do not start without the knowledge and direct command of the Project Dive Supervisor.

______ All efforts must be made through proper planning, briefings, training, organization and other preparations to minimize “bottom-time”. Remember in all cases, water depth and the condition of the diver (especially fatigue) rather than amount of work to be done will govern the diver’s bottom time.

______ Decompression tables will be on hand, be up-to-date, and be used in all planning and scheduling of diving operations.

______ Instruct all divers and support personnel not to cut any lines until that action is approved by the Dive Supervisor.

______ Be sure that the ship, boat, or diving craft is properly manned and in position to permit the safest and most efficient operation (except in the case of emergency).

______ Ensure that, when conducting SCUBA operations, the boat can be quickly cast off and moved to a diver in distress.

______ Ensure that each diver checks his own equipment in addition to checks made by tenders, technicians, or other support personnel.

______ Designate a standby diver for all SCUBA operations~~,~~ and check that the standby diver is equipped and ready to enter the water if needed.

______ All efforts will be made to prevent divers from being fouled on the bottom. If work is to be conducted inside a wreck or similar underwater structure, designate a team of divers to accomplish the task. One diver will enter the water; the other will tend his lines from the point of entry.

______ When using explosives, take appropriate measures to ensure that no charge will be fired while divers are in the water.

______ Brief all divers on the planned decompression schedules for each particular dive. Check provisions made for decompressing diver.

______ Verify that the ship, boat, or diving craft is displaying the proper signals, flags, or lights to indicate diving operations are in progress.

______ Ensure that proper protection against harmful marine life has been provided.

______ When using the air compressor to fill air cylinders check that the intake hose is not near the exhaust of the compressor.

______ Thoroughly brief the boat crew using the Diving Boat Operations Checklist.

_____ Verify that proper safety and operational equipment is aboard small diving boats or craft.

E.1.5 Notify Proper Parties that Dive Operations are Ready to Commence

_____ Local officials, military or civilian

_____ Cognizant Navy Organizations

_____ U. S. Coast Guard (if present).

If deemed necessary by the Dive Supervisor, notify emergency facilities having recompression chambers, as well as sources of emergency transportation that Diving Operations are under way and their assistance may be needed.

Attachment F – Project Dive Supervisor Checklist

F.1. Dive Supervisor: ____

F.2. Dive Location: ____

F.3. Dive Operation Scheduled: ____

F.4. Time Scheduled for Dive: ____

F.5. Chamber Location:

Primary: ____

Secondary: ____

Phone Number:____

F.6. Route to Chamber/Hospital: ____

____

F.7. U. S. Coast Guard Rescue Coordination Center:____

F.8. Pre Operational Checks:

_______ All equipment Pre-Dive maintenance accomplished

_______ Boat set-up

_______ Recompression Chamber notified

_______ Weather conditions checked

_______ Scuba bottles with gauge signifying pressure reading is no less than 90% of the capacity

_______ Personal dive gear inventoried

_______ Required equipment loaded

_______ Radio check with command center

______ Standby Diver Line loaded

F.9. Dive Supervisor checks:

_______ Dive flag posted

_______Verify water depth

_______ Conduct dive brief

_______ Divers properly dressed

_______ Fill in rough dive log

______ Emergency Equipment is checked, loaded and/or readily available

Attachment G – Project Dive Plan

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation)

Name of Dive Supervisor: ______________________ Date/Time: _____________________________

Locations of Operation:_________________________ Durations of Operation: ___________________

G.1. Dive team Assignments: --

A. Dive team # _________ Dive Mission # ________

Name of Primary	Physical condition
Name of Secondary	Physical condition
Name of Standby	Physical condition
Observer/Assistant:	Remarks:

B. Support Personnel:

Communications:	First Aid/CPR certified person on site
Boat Operator:	Tender

G.2. Emergency Data: (See Emergency Management Plan in Appendix F)

A. DUTY CHAMBER:_______________ PHONE:_____________

B. AIR TRANSPORT:______________ PHONE:_____________

C. ROUTE TO CHAMBER:____

____

G.3. Diver Physical Fitness (Aches/Pains/Numbness/Medications):

____

G.4. TASK:

A. PURPOSE OF THE DIVE: ____

B. NATURE OF THE WORK TO BE PERFORMED: _________________________________

C. DIVING MODE (ie. SSA, SCUBA,) ____

D. MAXIMUM DEPTH PER DIVE: No dive will be no more than 100 feet

E. BOTTOM TYPE :____(no dive will exceed 45 minutes in length)

F. TABLE & SCHEDULE (All dive will be no-decompression dives):______________________________

G. WEATHER/RIVER STATE (visibility, water temperature, etc.):
____
____

H.TYPE OF PLATFORM TO BE USED (boat, platform, shore): ______________________________

I. TOOLS AND MATERIALS INVOLVED: ____

Note:

1. All dives will be no-decompression dives and the following rates of ascent and descent will be observed: 30 FPM Ascent/75-FPM Descent.

2. Direct communications will be made available at all times between the dive site and the URS project office, the EOTI corporate office, the contracting officer, and the USACE project manager via hand-held two-way communication and or cell phone.

Attachment H – Dive Supervisor Pre-dive Checklist

_____ DIVERS (AND STAND-BY) ARE PHYSICALLY/MENTALLY FIT TO ENTER THE WATER?

_____ ANY DIVES WITHIN THE LAST 12 HOURS?

_____ ALL DIVERS HAVE MINIMUM EQUIPMENT (FINS, MASK, LIFE PRESERVER, WEIGHT BELT, KNIFE, SCUBA CYLINDER, DEPTH GAUGE, WATCH, REGULATOR, DIVE LIGHT)

_____ CYLINDERS HAVE BEEN GAUGED.

DV1: ________PSI **DV2:** ________PSI **STBY:** ________PSI

_____ ALL QUICK-RELEASE BUCKLES AND FASTENINGS CAN BE REACHED BY BOTH HANDS AND ARE RIGGED FOR PROPER RELEASE.

_____ WEIGHT BELT IS OUTSIDE OF ALL OTHER EQUIPMENT, BELTS, AND STRAPS?

_____ LIFE PRESERVER IS NOT CONSTRAINED, FREE TO EXPAND. CO2 CARTRIDGES ARE PROPERLY INSTALLED AND ALL AIR HAS BEEN REMOVED FROM VEST.

_____ KNIFE POSITIONED SO IT CANNOT BE JETTISONED.

_____ CYLINDER VALVE IS FULLY OPENED AND THEN BACKED OFF ¼ TURN. (DIVER PERFORM)

_____ CYCLE RESERVE MECHANISM AND ENSURE LEVER IS IN THE UP POSITION. (DIVER PERFORM)

_____ DIVER BREATHES FOR 30 SECONDS. ANY IMPURITIES?

_____ CONDUCT FINAL BRIEF.

_____ PROPER DIVING SIGNALS ARE BEING DISPLAYED.

_____ DIVER ENTER THE WATER WHEN READY AND CONDUCTS SURFACE CHECKS.

Attachment I – Checklist for Dive Boat Operations

All personnel involved in the operation of dive boats, launches, barges, floats, and other types of secondary small craft will be briefed and must understand the following safety precautions.

I.1. Inspect the specified boat or craft and determine its suitability for the intended mission and operating environment; ensure that:

_____ Boat (craft) is sound, and seaworthy.

_____ Engine is running well and fully tested.

_____ Required safety and running equipment is onboard and in workable condition.

_____ Proper gear for diving operation is onboard and operational.

_____ The assigned boat crew is fully qualified to operate that particular craft.

I.2. Know the details of the Emergency Assistance Checklist. Make sure it is completely filled out for small craft operations, with a legible copy placed onboard.

I.3. Inspect all communications gear, radios, underwater communications, power sources, walkie-talkies, cell phones, and ensure that they have been fully tested and are operational.

I.4. Determine that all non-powered communication equipment (flags, sounds signals, flares, air horn, etc.) are onboard, are complete and are operational.

I.5. Know all pre-determined signals, proper call signs, etc.

I.6. Know routine and emergency signals (for divers).

I.7. Determine that adequate and safe mooring equipment is onboard and personnel are familiar with proper mooring techniques.

I.8. Know who is in charge of the boat and responsible for giving orders to "Stop" and "Start". Orders to commence boat operations that affect divers are given only by the Dive Supervisor.

I.9. Before getting underway, check with the Dive Supervisor for:

_____ An "all aboard" head count

_____ Approval that all diving equipment lines, safety equipment, etc. are onboard.

I.10. Plans for various Boat Handling Procedures during Dive Operations include:

_____ Dropping off of divers (On small boat drop off both sides)

_____ Picking up divers s

_____ Towing divers, if applicable

_____ Getting underway in an emergency have anchors lines attached to buoys

_____ Handling of divers lines during descent, ascent, hanging-off, raising or lowering tools and gear drop-off/pick-up.

_____ Setting/retrieving of buoy markers.

_____ Moving or towing of platforms, rafts, rubber boats, search sleds, etc.

I.11. Ensure that stowage of diving supplies and gear does not block access to:

_____ Fire Extinguishers

_____ Life Preservers

_____ Ground tackle

_____ Engine spaces

_____ Communication gear

_____ Bilge pump or switch

_____ Boat hook

_____ Heaving line

_____ Emergency Lights

_____ Flares

_____ First Aid Kit

_____ Diving platform

I.12. Know these general safety precautions that apply to Boat Operations:

_____ Place all intakes for the diving air compressor upwind of engine or auxiliary power plant exhausts

_____ Ensure safety of the boat

_____ Handling gasoline, or other dangerous material

_____ Shoring and handling of heavy equipment

_____ Securing gear for heavy weather

_____ Cutting or other operations involving fire

When divers are in the water:

(1) Do not change moor if attached to divers

(2) Do not set anchors

(3) Do not drop heavy items overboard

(4) NEVER START ENGINES WHEN DIVERS OR SNORKLERS ARE ALONGSIDE OR DIRECTLY UNDER BOAT

I.13. The Dive Supervisor will ensure that the below listed equipment is ready and available for each Diving Operation:

_____	Boat Tool Box (if required)	_____	Descent Line & Clumps
_____	Binoculars	_____	Cell Phones/Radio Frequency
_____	SCUBA Bottles	_____	Litter (Stokes)
_____	Standby Bottle	_____	U/W Dive Lights (as required)
_____	Water Jug	_____	Ladder
_____	First Aid Kit	_____	Outboard Motor Oil (if required)
_____	Communications Line	_____	Underwater Metal Detector
_____	Tools required for job	_____	Gas Cans (if required)
_____	Paddles	_____	Circle Line/with Snap hooks
_____	Marker Buoys & Lines	_____	Anchors & lines
_____	Stand By Diver Tending Line		
____	Diver Tending Line	_____	Observer/Assistant Throw Line
____	Lost Diver Buoy, Line and Clump	_____	Search Buoys
____	Observer/Assistant Throw Bag or Ring Buoy		

I.14. The Dive Supervisor will ensure that the information contained below is recorded in the Diving Log:

Time Departed Shore/Pier (if applicable)___________

Time Commenced Dive ________

Time Completed Dive _________

Time Returned Shore/Pier (if applicable)___________

Notify URS Field Office upon completion of daily operation.

Attachment J – Neurological Examination Checklist

NEUROLOGICAL EXAMINATION CHECKLIST

(Sheet 1 of 2)

Patient's Name: ____________ Date/Time: ____________

Describe pain/numbness: ____________

HISTORY

Type of dive last performed: ________ Depth: ________ How long: ________

Number of dives in last 24 hours: ____________

Was symptom noticed before, during or after the dive? ____________

If during, was it while descending, on the bottom or ascending? ____________

Has symptom increased or decreased since it was first noticed? ____________

Have any other symptoms occurred since the first one was noticed? ____________

Describe: ____________

Has patient ever had a similar symptom before? ________ When: ________

Has patient ever had decompression sickness or an air embolism before? ____ When: ________

MENTAL STATUS/STATE OF CONSCIOUSNESS

COORDINATION

Walk: _____
Heel-to-Toe: _____
Romberg: _____
Finger-to-Nose: _____
Heel Shin Slide: _____
Rapid Movement: _____

CRANIAL NERVES

Sense of Smell (I): _____
Vision/Visual Fld (II): _____
Eye Movements, Pupils (III, IV, VI): _____
Facial Sensation, Chewing (V): _____
Facial Expression Muscles (VII): _____
Hearing (VIII): _____
Upper Mouth, Throat Sensation (IX): _____
Gag & Voice (X): _____
Shoulder Shrug (XI): _____
Tongue (XII): _____

STRENGTH (Grade 0 to 5)

Upper Body

Deltoids L _____ R _____
Latissimus L _____ R _____
Biceps L _____ R _____
Triceps L _____ R _____
Forearms L _____ R _____
Hands L _____ R _____

Lower Body

Hips
Flexion L _____ R _____
Extension L _____ R _____
Abduction L _____ R _____
Adduction L _____ R _____

Knees
Flexion L _____ R _____
Extension L _____ R _____

NEUROLOGICAL EXAMINATION CHECKLIST

(Sheet 2 of 2)

REFLEXES

(Grade: Normal, Hyopactive, Hyperactive, Absent)

Biceps	L _____	R _____
Triceps	L _____	R _____
Knees	L _____	R _____
Ankles	L _____	R _____

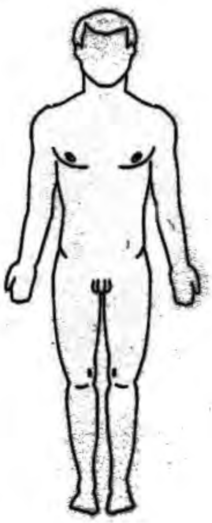
Ankles

Dorsiflexion	L _____	R _____
Plantarflexion	L _____	R _____
Toes	L _____	R _____

Sensory Examination for Skin Sensation

(Use diagram to record location off sensory abnormalities — numbness, tingling, etc.

LOCATION



Indicate results as follows:

|||| Painful Area

☰ Decreased Sensation

COMMENTS

____

____

____

____

____

____

____

____

Examination Performed by: ______________________________

Attachment K – 29 CFR 1910 Subpart T

NFPA 70E–2000 *Standard for Electrical Safety Requirements for Employee Workplaces. (See also NFPA 70E–2004.)*

NFPA 77–2000 *Recommended Practice on Static Electricity.*

NFPA 80–1999 *Standard for Fire Doors and Fire Windows.*

NFPA 88A–2002 *Standard for Parking Structures.*

NFPA 91–2004 *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.*

NFPA 101–2006 *Life Safety Code.*

NFPA 496–2003 *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*

NFPA 497–2004 *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*

NFPA 505–2006 *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.*

NFPA 820–2003 *Standard for Fire Protection in Wastewater Treatment and Collection Facilities.*

NMAB 353–1–1979 *Matrix of Combustion-Relevant Properties and Classification of Gases, Vapors, and Selected Solids.*

NMAB 353–2–1979 *Test Equipment for Use in Determining Classifications of Combustible Dusts.*

NMAB 353–3–1980 *Classification of Combustible Dust in Accordance with the National Electrical Code.*

[72 FR 7221, Feb., 14, 2007]

Subpart T—Commercial Diving Operations

AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Sec. 107, Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); Sec. 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Secretary of Labor's Order No. 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 3–2000 (65 FR 50017), or 5–2002 (67 FR 65008) as applicable; 29 CFR part 1911.

SOURCE: 42 FR 37668, July 22, 1977, unless otherwise noted.

GENERAL

§ 1910.401 Scope and application.

(a) *Scope.* (1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) *Alternative requirements for recreational diving instructors and diving guides*. Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of §1910.423 and paragraph (b)(1) of §1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

(b) *Application in emergencies*. An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) *Employer obligation*. The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

Acfm: Actual cubic feet per minute.

ASME Code or equivalent: ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elasped time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.

Cylinder: A pressure vessel for the storage of gases.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.

Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Fsw: Feet of seawater (or equivalent static pressure head).

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.

Hyperbaric conditions: Pressure conditions in excess of surface pressure.

Inwater stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psi(g): Pounds per square inch (gauge).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

PERSONNEL REQUIREMENTS

§ 1910.410 Qualifications of dive team.

(a) *General.* (1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode: and

(iii) Diving operations and emergency procedures.

(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments*. (1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge*. (1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

GENERAL OPERATIONS PROCEDURES

§ 1910.420 Safe practices manual.

(a) *General*. The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents*. (1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General*. The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid*. A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies*. (1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment*. Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(7) Repetitive dive designation or residual inert gas status of dive team members;

(8) Decompression and treatment procedures (including altitude corrections); and

(9) Emergency procedures.

(e) *Hazardous activities.* To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing.* (1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection.* The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal.* When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General.* The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit.* (1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications.* (1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables.* Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles.* A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment.* (1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning.* (1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(h) *Explosives*. (1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §1910.109 and §1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) *Termination of dive*. The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

(a) *General*. The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions*. (1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability*. (1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive*. (1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.* The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

SPECIFIC OPERATIONS PROCEDURES

§1910.424 SCUBA diving.

(a) *General.* Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.* (1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§1910.425 Surface-supplied air diving.

(a) *General.* Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* (1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.* (1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of

the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General.* Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures.* (1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General.* Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits.* Diving operations involving liveboating shall not be conducted:

(1) With an inwater decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly inpede diver mobility or work function; or

(5) In other than daylight hours.

(c) *Procedures.* (1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement

of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

EQUIPMENT PROCEDURES AND REQUIREMENTS

§ 1910.430 Equipment.

(a) *General.* (1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.* (1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO_2) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.* (1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.* (1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.* Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(f) *Decompression chambers.* (1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.* (1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.* (1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety.* (1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.* (1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

RECORDKEEPING

§ 1910.440 Recordkeeping requirements.

(a)(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.* (1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon

request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)–(e) and (g)–(i). Safe practices manuals (§1910.420), depth-time profiles (§1910.422), recordings of dives (§1910.423), decompression procedure assessment evaluations (§1910.423), and records of hospitalizations (§1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (§1910.411)—5 years;

(ii) Safe practices manual (§1910.420)—current document only;

(iii) Depth-time profile (§1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§1910.423)—5 years;

(vi) Equipment inspections and testing records (§1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§1910.440)—5 years.

(4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006]

Appendix A to Subpart T to Part 1910—Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitary disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, moodaltering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

Juxta-articular osteonecrosis.

Appendix B to Subpart T to Part 1910—Guidelines for Scientific Diving

This appendix contains guidelines that will be used in conjunction with §1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.

2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.

4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[50 FR 1050, Jan. 9, 1985]

APPENDIX C TO SUBPART T TO PART 1910—ALTERNATIVE CONDITIONS UNDER §1910.401(a)(3) FOR RECREATIONAL DIVING INSTRUCTORS AND DIVING GUIDES (MANDATORY)

Paragraph (a)(3) of §1910.401 specifies that an employer of recreational diving instructors and diving guides (hereafter, "divers" or "employees") who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under §§1910.423(b)(2) or (c)(3) or 1910.426(b)(1).

1. EQUIPMENT REQUIREMENTS FOR REBREATHERS

(a) The employer must ensure that each employee operates the rebreather (*i.e.*, semi-closed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, "SCUBAs")) according to the rebreather manufacturer's instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers' respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer's instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer's instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO_2 sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO_2 sensor in the breathing loop;

(ii) The CO_2 sensor is integrated with an alarm that operates in a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO_2 alarm remains continuously activated when the inhaled CO_2 level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day's diving operations, and more often when necessary, the employer must calibrate the CO_2 sensor according to the sensor manufacturer's instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO_2 concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer's instructions; and

(iii) The calibration of the CO_2 sensor is accurate to within 10% of a CO_2 concentration of 0.005 ATA or less.

(g) The employer must replace the CO_2 sensor when it fails to meet the accuracy requirements specified in paragraph 1(f)(iii) of this appendix, and ensure that the replacement CO_2 sensor meets the accuracy requirements specified in paragraph 1(f)(iii) of this appendix before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO_2 sensor, the employer may use a schedule for replacing CO_2-sorbent material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO_2-sorbent replacement schedules, the employer must ensure that each rebreather uses a manufactured (*i.e.*, commercially pre-packed), disposable scrubber cartridge containing a CO_2-sorbent material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes CO_2 from the diver's exhaled gas; and

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(iii) Maintains the CO_2 level in the breathable gas (*i.e.*, the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO_2 scrubber cartridges manually with CO_2-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO_2-sorbent material using a replacement schedule developed under paragraph 1(h) of this appendix; and

(iv) The employer demonstrates that manual filling meets the requirements specified in paragraph 1(i) of this appendix.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (*e.g.*, low battery voltage);

(ii) For a semi-closed circuit rebreather, a visual display for the partial pressure of CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: partial pressures of O_2 and CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA and a preset O_2 partial pressure of 1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(l) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

2. SPECIAL REQUIREMENTS FOR CLOSED-CIRCUIT REBREATHERS

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O_2 and diluent (*i.e.*, air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O_2 sensors are located in the inhalation side of the breathing loop; and

(ii) The O_2 sensors are: functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O_2 sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O_2 fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O_2 fraction by volume;

(iv) Replace O_2 sensors when they fail to meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix; and

(v) Ensure that the replacement O_2 sensors meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O_2-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O_2 or diluent gas to the breathing loop; and

(iv) Separate O_2 and diluent-gas cylinders to supply the breathing-gas mixture.

3. O_2 CONCENTRATION IN THE BREATHING GAS

The employer must ensure that the fraction of O_2 in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O_2 in compressed air (*i.e.*, exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O_2 of 40% by volume or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes divers to less O_2; and

(c) For a rebreather, never exceeds a maximum O_2 partial pressure of 1.40 ATA.

4. REGULATING O_2 EXPOSURES AND DIVING DEPTH

(a) Regarding O_2 exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O_2 between 0.60 and 1.40 ATA does not exceed the 24-hour single-exposure time limits specified either by the 2001 National Oceanic and Atmospheric Administration Diving Manual (the "2001 NOAA Diving Manual"), or by the report entitled "Enriched Air Operations and Resource Guide" published in 1995 by the Professional Association of Diving Instructors (known commonly as the "1995 DSAT Oxygen Exposure Table"); and

(ii) Determine a diver's O_2-exposure duration using the diver's maximum O_2 exposure (partial pressure of O_2) during the dive and the total dive time (*i.e.*, from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the "bail-out" system specified in paragraph 7(a) of this appendix, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in §1910.424(c)(4); or

(ii) For a semi-closed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

8. TREATING DIVING-RELATED MEDICAL EMERGENCIES

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health-care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four (4) hours travel time from the dive site.

(b) The employer must ensure that portable O_2 equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O_2 that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G-4.3-2000 ("Commodity Specification for Oxygen");

(ii) The equipment delivers this O_2 to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient O_2 is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O_2 treatment, are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

9. DIVING LOGS AND NO-DECOMPRESSION TABLES

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a non-employee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) ("Record of dive") of §1910.423; and

(ii) Maintain a record of the dive according to §1910.440 ("Recordkeeping requirements").

(c) The employer must ensure that a hardcopy of the no-decompression tables used for the dives (as specified in paragraph 6(a) of this appendix) is readily available at the dive site, whether or not the divers use dive-decompression computers.

10. DIVER TRAINING

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: recognizing the effects of breathing excessive CO_2 and O_2; taking appropriate action after detecting excessive levels of CO_2 and O_2; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

11. TESTING PROTOCOL FOR DETERMINING THE CO_2 LIMITS OF REBREATHER CANISTERS

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO_2-sorbent material meets the specifications of the sorbent material's manufacturer:

(i) The North Atlantic Treating Organization CO_2 absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit ("NEDU")-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O_2 fraction maintained at 0.28 (equivalent to 1.4 ATA of O_2 at 130 fsw, the maximum O_2 concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O_2 concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO_2-injection rates, provided for each ventilation rate):

TABLE I—CANISTER TESTING PARAMETERS

Ventilation rates (Lpm, ATPS [1])	Breathing machine tidal volumes (L)	Breathing machine frequencies (breaths per min.)	CO_2 injection rates (Lpm, STPD [2])
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

[1] ATPS means ambient temperature and pressure, saturated with water.
[2] STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (*i.e.*, breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO_2-injection rates;

(vi) Performance of the CO_2 injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four (4) water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the "chrome T" connector), and ensuring that this temperature conforms to the temperature of a diver's exhaled breath at the water temperature and ventilation rate used during the testing trial; [1]

(ix) Implementation of at least eight (8) testing trials for each combination of temperature and ventilation-CO_2-injection rates (for example, eight testing trials at 40 degrees F using a ventilation rate of 22.5 Lpm at a CO_2-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than ± 2.0 degrees F (± 1.0 degree C) *between* each of the eight testing trials, and no more than ± 1.0 degree F (± 0.5 degree C) *within* each testing trial;

(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO_2 (*i.e.*, the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2–99;

(xiii) Specification of the replacement schedule for the CO_2-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.

[69 FR 7363, Feb. 17, 2004]

Subparts U–Y [Reserved]

§§ 1910.901–1910.999 [Reserved]

[1] NEDU can provide the manufacturer with information on the temperature of a diver's exhaled breath at various water temperatures and ventilation rates, as well as techniques and procedures used to maintain these temperatures during the testing trials.

DRAFT

Diving Operations Plan

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Project: Congaree River Project UXO Support

Accepted by USACE Designated Dive Coordinator:

Name:____

Title: ____

Signature: ____

Date:____

Diving Operations Plan

This Diving Operations Plan is a general overview of the underwater diving operations to be performed while conducting underwater intrusive activities at Congaree River Project in Columbia, SC.

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the Designated Diving Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

Plan prepared by:

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EOTI

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Plan reviewed by:

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SCANA Services, Inc.

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AHA	activity hazard analysis
AOC	area of concern
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRP	Congaree River Remediation Project
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DFW	definable feature of work
DoD	Department of Defense
DOP	Diving Operations Plan
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
ESP	Explosives Site Plan
EZ	exclusion zone
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
HE	high explosives
IAW	in accordance with
IRA	Interim Removal Action
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
NAVFAC	Naval Facilities Engineering Command
No.	number
NWS	Naval Weapons Station
OSHA	Occupational Safety and Health Administration
PM	Project Manager
QA	quality assurance

QC	quality control
RI	Remedial Investigation
SCUBA	self-contained underwater breathing apparatus
SI	Site Investigation
SOW	scope of work
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SWMU	solid waste management unit
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard USN
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

1. Project Introduction

1.1 PROJECT WORK AUTHORITY

Apex Companies, LLC (Apex) has contracted EOTI to perform underwater clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC).

This Diving Operations Plan (DOP) is a living document. A living document is one that can be modified, as necessary, to best achieve the goals and objectives stated within. Based on field observations, site conditions, and other unknown circumstances or conditions, this document may be modified in order to best achieve the objectives of the underwater intrusive activities. If for any reason the DOP is altered in procedures, depth, personnel, or equipment, the USACE Designated Dive Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

This DOP provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of the underwater clearance activities during the CRP, Columbia, SC. This DOP was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014 and EOTI proposal dated March 3, 2014.

1.2 PROJECT PURPOSE

The purpose of the CRP diving activities in remediation area shown on **Figure 1**, is to remove MEC in order to reduce hazards from Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area. EOTI will be performing dive operations to remove MEC from a coffer dam footprint prior to installation by Apex. The underwater intrusive activities will be completed IAW the USACE and the Department of Defense (DoD) Explosives Safety Board (DDESB) approved Explosives Safety Submission (ESS).

1.3 PROJECT LOCATION

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The underwater intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure 1**.

Legend

- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0 175 350 700
Meters: 0 60 120 240

Site Location

FIGURE 1
SITE LOCATION

Columbia, SC

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

APEX

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 4/2/2014	FILE Site locaiton.mxd	
PAGE # 1	SCALE 1 inch = 350 feet	

1.4 SITE BACKGROUND, AND DESCRIPTION

In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

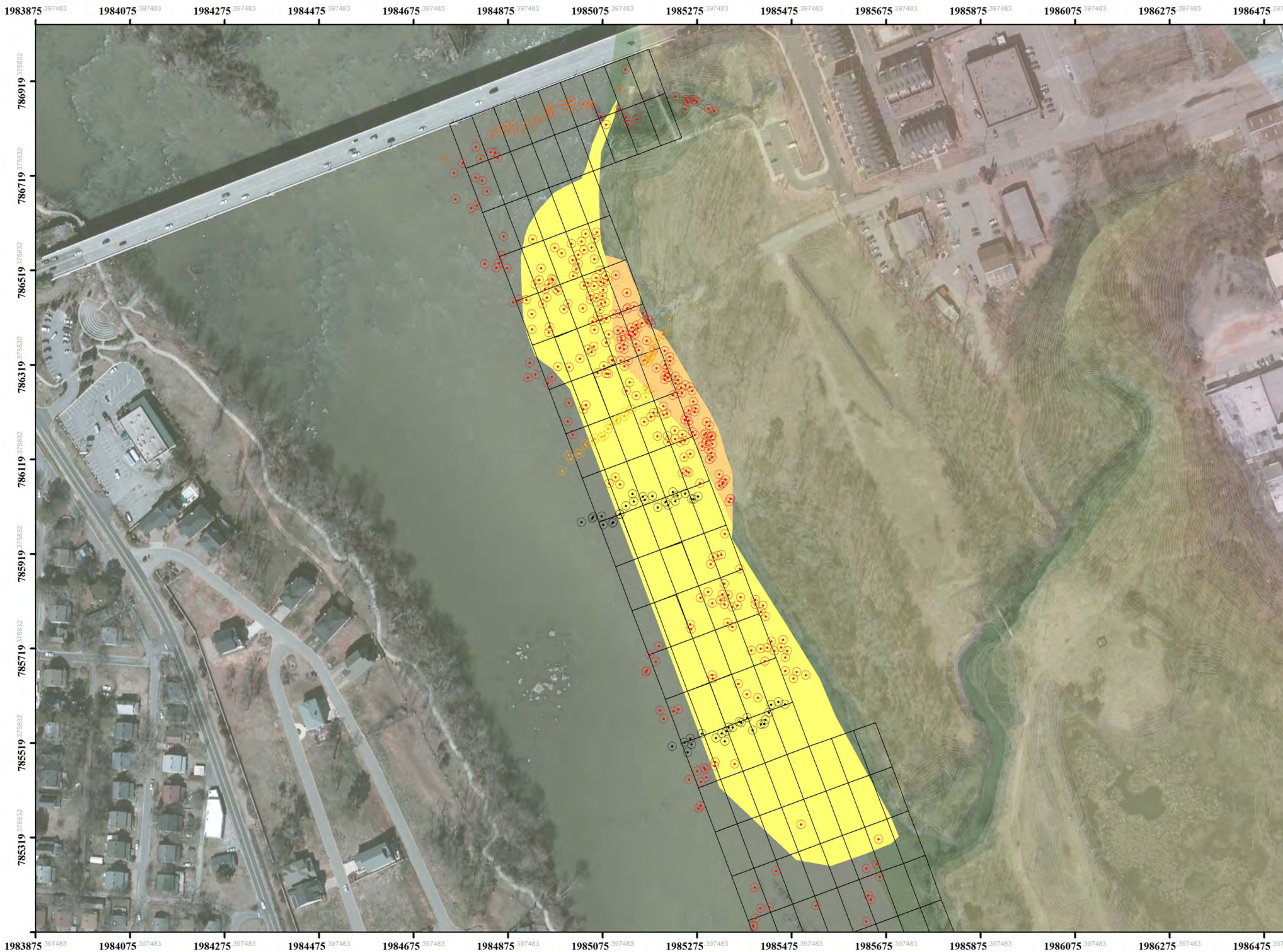
Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with unexploded ordnance (UXO) potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. Figure 2 shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of South Carolina Electric & Gas (SCE&G) beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.



Legend

Previous Investigation Anomalies

- Geological Feature
- Pipeline
- Pipeline Associated
- Electromagnetic Anomaly
- Possible Ordnance

Previous Investigation Grids

Approximate Demonstration Project Location

Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 100 200 400

0 30 60 120
Meters

Site Location

FIGURE 2
APPROXIMATE CONTAMINATION EXTENT

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 4/2/2014	FILE TLM Area.mxd	
PAGE # 2	SCALE 1 inch = 200 feet	

Legend

Phase

- Phase 1 - Year 1
- Phase 2 - Year 2
- Phase 3 - Year 3
- Approximate Cofferdam Location
- Approximate Demonstration Project Location
- Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 100 200 400

0 30 60 120
Meters

Site Location

FIGURE 3
INVESTIGATION PHASED APPROACH

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

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M. Norris	J. Daffron	B. Woods
DATE 4/2/2014	FILE Project Area.mxd	
PAGE # 3	SCALE 1 inch = 200 feet	

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original preimpacted state.

The removal of MEC from the impacted sediments under the coffer dam structures under this dive plan is to protect worker safety, environment and assist in the segregation and disposal of impacted sediment.

1.5 Removal Objectives

The objective of this dive plan is to locate and remove MEC from underwater sediment in the location of future cofferdam area footprints. The cofferdams are to be installed prior to coal tar contaminated soil/sediment removal. The dive clearance of the cofferdam footprints will be performed in three separate phases in coordination with Apex three phase cofferdam installations. Figure 3 shows the location of the footprint to be cleared during each phase of the project. The project is performed in three phases “to minimize the potential for over-topping events and impacts on potential endangered species in the river, the “in-river” construction season will start on May 1 and continue through October 31 for each of the three years.” The overall objective of removing MEC is to reduce the risk to environmental construction workers and reduce the potential of MEC within the removal action area boundaries.

1.6 Schedule

The underwater intrusive activities are tentatively scheduled to begin in Spring/Summer 2015. The preliminary schedule is as follows:

- Respond to comments and finalize DOP in May 2014.
- Begin Phase 1 coffer dam underwater intrusive activities in May to October 2015.
- Begin Phase 2 coffer dam underwater intrusive activities in May to October 2016.
- Begin Phase 3 coffer dam underwater intrusive activities in May to October 2017.
- Project reporting activities November to December 2017.

During the course of the underwater intrusive activities, modifications to the schedule may be necessary. The schedule modifications will be submitted to USACE, and will include:

- Reasons for the modification
- Descriptions of the alternatives evaluated to increase productivity (e.g., increase manpower, lengthen work days, more efficient equipment, etc.)
- Methods that will be used to prevent similar delays from happening again

1.7 Diving Operations Plan Organization

This DOP is organized as follows:

- **Section 1 – Introduction**. Presents the authority, purpose, project description and general scope, personnel, site description and history, removal objectives, and tentative schedule for CRP underwater intrusive activities.
- **Section 2 – Dive Team**. Summarizes the names and duties of personnel involved with diving operations for CRP.
- **Section 3 – Equipment**. Provides a description of required equipment and platform to be utilized during diving operations.
- **Section 4 – Tasks**. Summarizes the tasks for underwater intrusive activities.
- **Section 5 – Dive Operations**. Details the procedures to be followed during diving operations, underwater intrusive activities, field Quality Control (QC) procedures and requirements to be followed.
- **Section 6 – Key Personnel**. Describes project key personnel and organization for diving activities.
- **Section 7 – Project Records and Reporting**. Lists project reporting deliverables for the CRP underwater intrusive activities.
- **Section 8 – References**. Provides references used to develop this DOP.

This section provides information on the CRP Dive Operations Team for underwater intrusive activities.

2. Dive Team

2.1 PERSONNEL

Listed in the Table 2-1 below are the team requirements, as defined in Appendix O of EM 385-1-1, that will be met for self-contained underwater breathing apparatus (SCUBA) diving operations:

TABLE 2-1

DIVE TEAM PERSONNEL COMPOSITION

Personnel Assignments	**Number of personnel**
Dive Supervisor (Dive qualified, unexploded ordnance [UXO] qualified)	1
Stand-By Diver	1
Diver in the water (tethered with communications)	1
Tender	1
Total Team Requirements	**4**

It is anticipated that one diver will be in the water at a time. The diver in the water will be tethered using a safety harness equipped with a positive buckling device, an attachment point for the safety line, and a lifting point to distribute the weight over the diver's body while maintaining a heads-up attitude if unconscious. The safety line will be a positive control link to the surface that can also be used for line pull signals and diver recall. The tender will maintain constant communication with the tethered diver using two way voice communications or using line pull signals as described in Attachment B of EOTI's Diving Safe Practices Manual. In visibility of less than three feet two way voice communication will be maintained and the diver will be line tended. The tender will not perform any other duties while the diver is in the water. This will ensure that the diver is in constant contact with at least one other member of the dive team. If it becomes necessary for the stand-by diver to enter the water, the Dive Supervisor will serve as his tender.

The Project Dive Operations Team is identified on **Table 2-2.**

TABLE 2-2

DIVE TEAM PERSONNEL AND DUTIES

NAME	DUTIES
Nelson Figeac	Dive Supervisor , Diver, Standby Diver, Tender, Senior Unexploded Ordnance Supervisor (SUXOS)-Qualified, Safety Boat Operator
Tom Dailey	Dive Supervisor, Diver, Standby Diver, Tender, UXOQCS
Rickey Hammer	Diver, Standby Diver, Tender, UXO Technician
Harry Craig or Kevin Kerns	Diver, Standby Diver, Tender, UXO Technician

If for some reason a diver is unable to complete the project (e.g., health, family problems, etc.) a qualified alternate diver will be substituted. Alternate diver qualification will be submitted to the USACE DDC prior to a new diver joining the dive operations.

Dive station will be manned by no less than a Dive Supervisor, Diver, Standby Diver and Tender. Under normal operations, one diver will be in the water at a time. The tender will maintain constant contact with the diver, tend the tether and monitor potential hazards to the diver. A standby diver will be dressed and ready to assist in an emergency any time that a diver is in the water. The primary Dive Supervisor is Nelson Figeac. He is the person responsible for all dive operations.

The Dive Supervisor is responsible for all dive-planning, briefings, monitoring diver depths and dive times, and recovering and deploying the dive teams accordingly.

Prior to mobilization, personnel training and requirements will be confirmed to ensure that dive personnel have the appropriate training, licenses, certifications, and experience. Copies of certifications/qualifications will be submitted for review prior to beginning dive operations and copies will be maintained on site and available for review by APEX and USACE representatives. The relevant personnel requirements for underwater intrusive activities at CRP will include the following:

- Workers who may be exposed to contaminated media will have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification, 8-hour HAZWOPER refresher certification as appropriate, and medical monitoring set forth in 29 Code of Federal Regulations (CFR) 1910.120. Workers who are not in direct contact with contaminated media will be exempt from this requirement. Exempt workers include Quality Assurance (QA) representatives and project management, as long as they are protected from exposure to contaminated media and remain outside the exclusion zone (EZ) for intrusive activities.[1]

[1] 29 CFR 1910.120(e)(3)(i) defines employees who are required to have 40-hour HAZWOPER training. It requires workers "…engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards…" to receive 40 hours of HAZWOPER training. An OSHA Interpretation Letter dated November 19, 1991 states that "if potential for exposure is extremely unlikely the standard would not apply." Employees protected from exposure and that remain outside of the exclusion zone during intrusive operations are extremely unlikely to be

- Divers will meet or exceed the minimum qualification in accordance with DDESB Technical Paper (TP) 18.
- Site supervisors must successfully complete the Occupational Safety and Health Administration (OSHA) 8-hour HAZWOPER Supervisor Course.
- Diver personnel have completed the OSHA-approved basic 40-hour health and safety training HAZWOPER course, annual refreshers of the same, military diver course for the apparatus utilized onsite, oxygen administrator, first aid, and cardiopulmonary resuscitation (CPR). Field personnel, required training, and the most current completion date of training are presented in a separate stand-alone document submitted to USACE and are not included in this DOP.
- Diver will meet or exceed the training and experience requirements of EM 385-1-1, Section 30.A.08.

All workers will be required to read and understand the Site Safety and Health Plan (SSHP), Diving Safe Practices Manual, Emergency Management Plan, Activity Hazards Analysis (AHA), and daily safety briefings will be completed as work progresses.

exposed to safety hazardous substances or health hazards associated with the hazardous waste operations.

This section provides information on the anticipated diving and support equipment to be utilized at CRP.

3. Equipment

3.1 Dive Equipment and Platform

The diving method will utilize SCUBA. The associated equipment to support SCUBA operations will include the following:

- SCUBA Tank -80 CF Steel or Aluminum Construction
- Diver Communications – Two way voice communication similar to Ocean Technologies System Model OTS-BUD-D2
- Emergency Gas Supply – 30 CF with separate regulator
- Diver Knife
- Full Face Diving Mask – with integral regulator
- Surface Communications
- Thermal Protection –Wet Suit or Dry Suite
- Diver Swim Fins
- Buoyancy Compensator
- Diver Computer
- Underwater Light

The minimum support equipment to be utilized will include the following:

- Dive Flag
- Medical Kit
- Underwater Camera
- Current Flow Probe
- Oxygen Kit
- Marine Radio
- Fathometer
- Litter/Backboard
- Cellular Phone

The diver will be walking in from the shore with safety boat attending in the water.

This section provides the required tasks for underwater intrusive activities at CRP.

4. Tasks

4.1 TASK 1 MOBILIZATION AND DEMOBILIZATION

Once pre-mobilization activities are complete, the dive crew and all associated materials and equipment necessary to perform the underwater intrusive activities will mobilize to CRP. The personnel and operations-specific equipment are summarized in **Sections 2** and **3**.

Demobilization of all diving-related personnel and equipment will occur after all underwater intrusive objectives have been safely completed and accepted by Apex and USACE.

4.2 TASK 2 DOCUMENTATION

EOTI will prepare all USACE required diving-related documents and plans for review by Apex and USACE. All plans will be approved by Apex and accepted by USACE prior to mobilization to CRP. Required documents include the Diving Safe Practices Manual and this Diving Operations Plan with its attachments including an Emergency Management Plan and AHA.

4.3 TASK 3 CRP REMOVAL ACTION

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint. The Dive Operations Team will perform underwater mag and dig of anomalies encountered using the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each anomaly identified will be manually investigated not to exceed 12 inches below river bottom.

This section details the procedures to be followed during diving operations, underwater intrusive activities.

5. Dive Operations

Diving operations shall be performed IAW with USACE Engineering Manual (EM) 385-1-1 and dive activity will be coordinated with the USACE Dive Safety Office. If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation.

Direct communications between the dive sites, project office, Apex Project Manager (PM), DDC and other involved personnel will be via cell phone. Divers will have communication with the surface, and diver-to-diver. Dive supervisor will positively control diver movement within the designated work area. Divers will be monitored by thru-water communication system.

Familiarization dives may be conducted to verify competency of the overall dive team.

5.1 CRP Removal Action

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint in three separate phases, as shown on **Figure 3**. The Dive Operations Team will perform underwater mag and dig of anomalies encountered. Each anomaly identified will be manually investigated not to exceed 12 inches below river bottom. Removal of MEC from the area between the coffer dams will be done after the water has been removed under a separate effort covered under a work plan for dry land portion of the MEC clearance.

Divers will gather information describing the source of each anomaly, including the following; item description, item weight, MEC condition, MEC nomenclature, bottom type/condition, and any other notable features. Acceptable to move MEC and MD will be transferred to land for final disposition. Unacceptable to move MEC will be detonated in place. Non-munitions-related debris will be left in place during this task.

Each MEC or MD item found will be marked using a GPS unit to an accuracy of +/- 3 meters. Once an item has been positively identified, and determined acceptable to move, it will be relocated within the land portion of the removal area. The final explosives safety status of a discovered MEC item as acceptable or not acceptable to move will be made by the SUXOS-qualified Dive Supervisor in consultation with the diver who investigated the item. Information such as the munition type, nomenclature, condition, and surrounding environment will be considered when determining if an item is acceptable to move or not.

Divers will use an all metals locator along grid lines established as part of the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each target anomaly location will be manually investigated and resolved not to exceed 12 inches below river bottom. The anticipated maximum depth of dives is 30 fsw. Divers will be utilizing a “no decompression limit” of 30 fsw for a maximum bottom time of 371 minutes (U.S. Navy Diving Manual, Rev. 6, 15 April 2008). A maximum single dive bottom time will be no greater than 180 minutes.

Munitions Constituent (MC) sampling of the sediment is not required for this field effort. Should MC sampling be needed it may be conducted by divers either during the removal process or as a separate dive. In the event that sediment sampling is needed, the EOTI Dive Supervisor will coordinate underwater sampling activities.

At the end of each diving day, all data including field notes, site photographs, and positioning data will be consolidated and submitted to the EOTI PM.

5.2 DIVING CONDITIONS

The Dive Operations Team will perform all assigned tasks during daytime within allowed current restrictions. Other factors that affect diving operations include:

- Surface conditions - No diving will be performed if the surface conditions do not permit the diver to maintain depth control. Dive operations will be suspended at Beaufort scale Sea State 3.
- Boat Traffic – Anticipate some boat traffic during the operation period. Whenever boat traffic is present in the vicinity of diving operations, the EOTI safety boat will keep other boats away from the area of dive operations. The safety boat will be positioned with visibility of the dive operation and avenues for approaching boats. Communication will be maintained between the safety boat and dive location. If possible the safety boat will divert boat traffic around the exclusion zone. If a boat enters the exclusion zone the dive supervisor will be notified and will immediately halt intrusive operation until the boat is safely outside of the exclusion zone.
- Underwater conditions – Shallow dives are heavily influenced by the surface conditions and may impact diving operations. No dives will be performed if conditions do not permit the diver to maintain depth control. The dive supervisor will have ultimate decision to cease diving operations if unsafe conditions occur.
- Visibility – Visual survey will be suspended when nominal visibility is less than 1 foot. A tactile survey with tethered divers may be conducted if visibility is degraded below 3 feet.
- Water Temperature – Thermal protection for the divers will be provided by a wetsuit or dry suit, as needed, to ensure diver protection and comfort. Divers will choose dive dress, and selection will be approved by the EOTI Dive Supervisor/SUXOS.
- Currents – Prior to conducting dive operations and prior to deploying any divers, the Dive Supervisor will measure current velocity using an FP 211 Global Flow Probe or similar instrument. If currents exceed 1-knot, divers will not be deployed and dive operations will be suspended until the current falls below 1-knot.

5.3 QUALITY ASSURANCE OVERSIGHT

Oversight of field activities may be requested by Apex or other stakeholders. At least 48 hours prior notice will be given to EOTI by those requesting oversight for purposes of coordination.

It is anticipated that Apex will have one person assigned in a safety and quality oversight role and may also be present during diving operations. If there is a need to answer questions, etc. the EOTI dive team leader/SUXOS will be the primary point of contact.

This section presents the project team, key personnel, and responsibilities for underwater intrusive activities during the MEC clearance dive activities.

6. Key Personnel

6.1 RESPONSIBILITIES

Project team responsibilities are discussed below.

6.1.1 Dive Supervisor

The Dive Supervisor is responsible for implementing the DOP, Diving Safe Practices Manual, Emergency Management Plan, and applicable AHA's. The Dive Supervisor is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs) to the EOTI PM and Apex PM, and assisting in the preparation of progress reports.

The Dive Supervisor will report directly to the EOTI PM and is responsible for leading and coordinating the day-to-day activities of the various resource specialists. Specific Dive Supervisor responsibilities are identified in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.2 Diving UXO Specialist (Diver)

The diving UXO Specialist is the diver in the water. He is a U.S. Navy trained diver that is UXO qualified with the proper diving and MEC experience to perform assigned tasks. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.3 Standby Diver

The standby diver meets all of the requirements of the Dive UXO Specialist and is dressed and prepared to enter the water to assist the diver anytime the diver is in the water. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.4 Tender

A dedicated tender will be assigned to the diver while he is in the water. If the standby enters the water, the Dive Supervisor will serve as his tender. Responsibilities of the Tender are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

This section presents the Project Records and Reporting for underwater intrusive activities during the MEC clearance diving activates.

7. Project Records and Reporting

7.1 PROJECT RECORDS

7.1.1 Field Documentation

Field documentation includes daily reports for each day of fieldwork that present information pertaining to field activities. These reports will be maintained by the Dive Supervisor and include field notes, photographs and positioning data. Reports are submitted to the EOTI PM and the Apex PM.

7.1.2 Dive Logs

Dive logs/records will be completed for each diver on each diving day during underwater intrusive activities. The individual dive logs will document conditions and exposure to diving. Dive logs will be maintained by members of the dive team and crosschecked for completeness at the end of each day by the Dive Supervisor. They will be signed and dated by each individual diver making their personal entries, their dive buddy (if applicable), and the Dive Supervisor. Dive logs will be submitted to USACE upon completion of dive operations per EM 385-1-1, Sec. 30.A.28.

7.2 PROJECT REPORTING

Project reporting requirements include preparation of reports that document all diving-related field activities completed at CRP. These will include draft/draft final deliverable project reports, as well as documents summarizing field activities. These reports will be based on project records that include field logbooks; discrepancy reports; and records of conversations, meetings, and correspondence.

8. References

Apex Companies, LLC. 2013. Design Drawings Figures 1 through 5. February - November

Department of the Army (DA). 2008. Technical Manual (TM) 60A-1-1-31, Explosive Ordnance Disposal Procedures, General Information on EOD Disposal Procedures (Revision 5). October.

Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.

Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M

Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.

DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.

Management and Technical Resources, Inc. 2013. Final Engineering Evaluation/Cost Analysis (EE/CA), Congaree River Sediments, Columbia, South Carolina. January.

Revision 4. August United States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)

South Carolina Department of Health and Environmental Control (SCDHEC) 2013. Public Notice-Congaree River Project. 21 August.

Tidewater Atlantic Research, Inc. 2012. A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase IV Report, Columbia, South Carolina. 8 February.

United States Army Corps of Engineers (USACE) 2013. Safety and Health Requirements Manual EM 385-1-1

United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.

United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Note: *This Emergency Management Plan is to be used in conjunction with the Site Safety and Health Plan. Ensure that all personnel are familiar with the policies, procedures, and requirements outlined in both plans.*

Emergency Service (Ambulance, Fire, Police)—911

Columbia Fire Dept.
1800 Laurel St
Columbia, SC
(803) 545-3700

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Nearest Hyperbaric Chamber Facility

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Divers Alert Network (D.A.N.)
Emergency +1-919-684-9111 Phone 1-800-446-2671

Poison Control Center
(800) 962-1253

United States Corps of Engineers
(Name)
Office:
Email:

District Ordnance and Explosives Safety Specialist (OESS)
(Name)
Cell:
Email:

Apex Project Manager
Rusty Contrael
Office: 412-829-9650
Cell: 412-721-6494
rcontrael@apexcos.com

EOTI Project Manager
James Daffron, PE
Office: 865-200-8081
jdaffron@eoti.net

Nearest Hospital Information and Route

Name: **Palmetto Health Richland**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

See description and map of the route below.

Nearest Recompression Chamber

Name: **Palmetto Health Richland Hyperbaric Medicine**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

From the Project Area

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N

0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E

1.1 mi

5. Turn left onto **Bull St**

0.7 mi

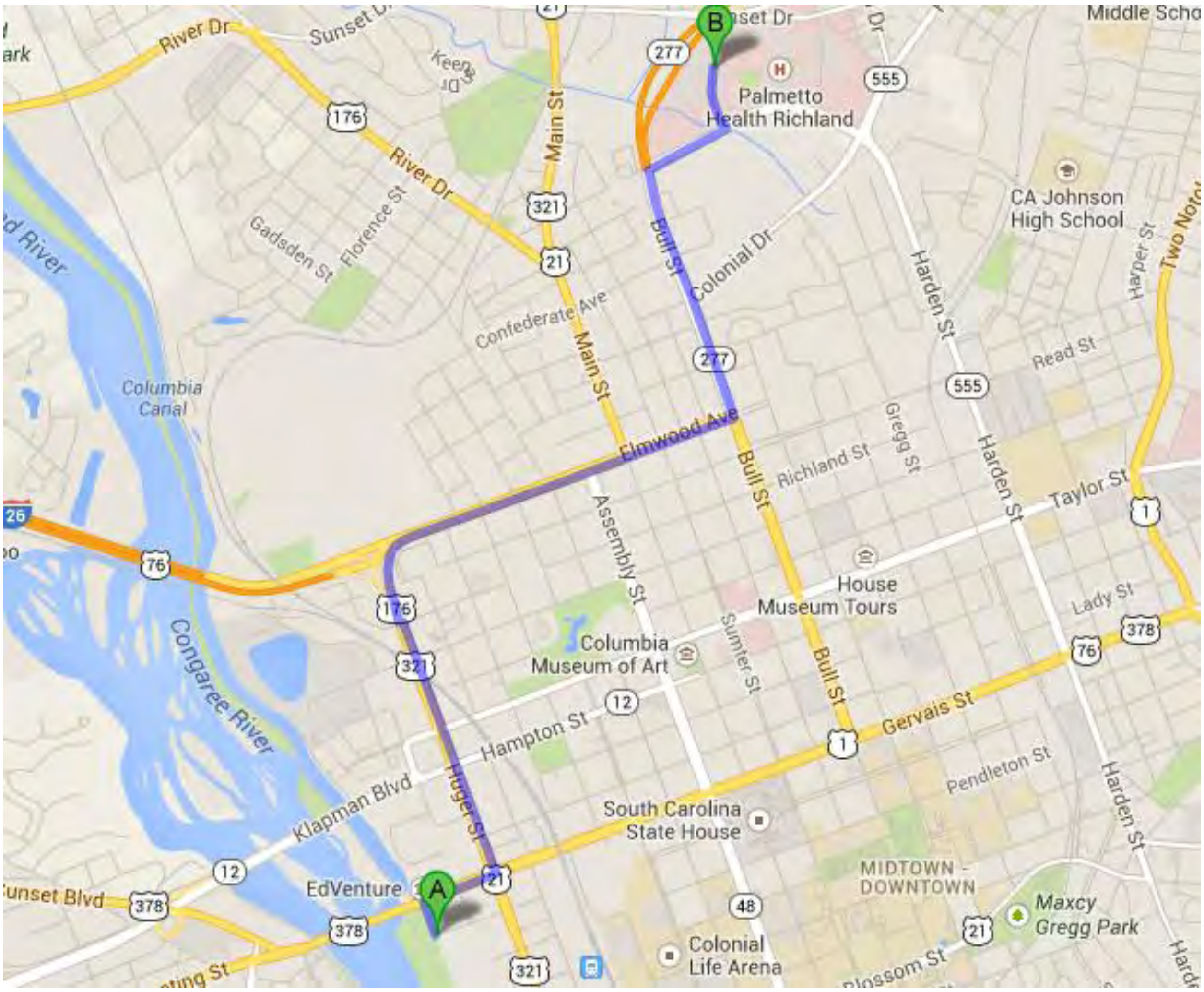
6. Turn right onto **Harden Street Extension**(signs for **Harden St**)

0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right

0.2 mi

B **5 Richland Medical Park Dr**
Columbia, SC 29203



Emergency Procedures

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

1. **Buddy Separation**

- The divers will look/feel 360 degrees around for his dive partner; and
- Both divers will come to the surface with one hand above head.

2. **Lost Diver**

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to Apex Project Office and EOTI Corporate Offices; and
- Ensure stricken divers recovered get immediate, effective treatment.

3. Loss of Air/Equipment Malfunction

- Signal dive partner and abort dive;
- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repaired (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

4. Mechanical Injury

- Diver will inform the Dive Supervisor of any mechanical injuries no matter how slight they may seem;
- Dive Supervisor will rule out any doubt of decompression sickness; and
- If immediate treatment is required, recall all divers and transport to recompression chamber/emergency Room.

5. Decompression Sickness ("The Bends") or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify Apex Project Office and EOTI Corporate Office of circumstances;

- Perform neurological exam and record on (EOTI Diving Safe Practices Manual, Attachment J); and
- Treat for shock.

6. Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

7. **Explosive Detonation with Diver (s) in the Water**

- Attempt to establish communications with the diver via tending line:
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

8. **Diver Emergency Recall**

- If diver is tended use standard line-pull signals to recall diver (See Attachment B of the EOTI Diving Safe Practices Manual);
- If diver is untended use diver audible (Metal-on-metal in the water) or mechanical recall; and
- Upon notification of recall by any means the diver will surface immediately.

9. **Injured Diver:** If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

10. **Fire:** Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

11. **Inclement weather:** All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

12. **Medical Injury or Illness:** See Attachment A to the EOTI Diving Safe Practices Manual as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.

13. **Critical Equipment Failure:** In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

14. **Injury/illness of surface crew:** If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.

15. **Dive Blow Up / Over Rapid Ascent to the Surface:** Depths of dives for the project are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted. The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.

16. **Loss of Communications:** If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.

17. **Emergency Victim Transportation:** If an injury or illness requires treatment beyond first aid, the victim will be transported to the appropriate medical facility, identified above (or as determined by first responders). The first aid-trained technician treating the victim will make the initial assessment related to the need for additional treatment. First responders will be notified of the situation through a call to 911. If the situation requires transportation by ambulance the victim will be moved (if determined safe and necessary to do so) to a pick-up location where first responders can be directed. Two personnel will remain with the victim until emergency responders arrive. One will administer first aid and monitor the victim and the other will maintain communication with the first responders. If it is appropriate or necessary for EOTI to transport a victim for follow-up care, three personnel will accompany the victim. One will administer first aid and monitor the victim, one will drive and the third will maintain communication with the treatment facility, as necessary.

FIRST AID FOR DIVING RELATED INJURIES

1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

Disorientation or Fatigue

Skin Itch

Chest Pain

Numbness, Tingling, Paralysis or Weakness

Dizziness, Vertigo, or Ringing in the Ears

Blurred Vision

Personality Change

Signs (one or more of the following)

Bloody froth from nose or mouth

Paralysis or Weakness

Unconsciousness

Convulsions

Shortness of Breath or Cessation of Breathing

Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

CPR, if required

Open airway, prevent aspiration, and incubate if trained person available

Give O^2; remove only to open airway or if convulsion ensue

If conscious, give nonalcoholic liquids

Place in horizontal, neutral position

Restrain convulsing person loosely and resume O^2 as soon as airway is open

Protect from excessive cold, heat, water, or fumes

Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

Tired Feeling

Itching

Pain, arms, legs or trunk

Dizziness

Numbness, tingling or paralysis

Chest compression or shortness of breath

Anything unusual after the dive

Signs (one or more of the following)

Blotchy Rash

Paralysis or weakness anywhere in the body

Coughing Spasms

Staggering or instability

Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

2.1 Pneumothorax

<u>Symptoms (one or more of the following)</u>

Pains in the chest

Shortness of breath

<u>Signs (one or more of the following)</u>

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

<u>Emergency Actions:</u>

Call for help and immediate transport

2.2 Mediastinal Emphysema (Lung over pressure accident)

<u>Recognition</u> - Always associated with pneumothorax

<u>Symptoms (one or more of the following)</u>

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

<u>Signs (one or more of the following)</u>

Obvious difficulty breathing

Brassy change in voice

<u>Emergency Actions:</u>

Transport to medical facility for evaluation

2.3 Drowning-Near Drowning

<u>Recognition</u>

Unconsciousness

Lack of respiration

Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing

Assess ABC's airway, breathing and circulation

Removal of gear

Transport to the boat or shore

Immediate call for help and transport to facility

Start CPR

2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by

Convulsions

Symptoms (one or more of the following)

Nausea

Dizziness

Ringing in the ears

Abnormal Vision

Confusion

Prevention

Avoidance of gases with high O^2 concentrations (as in Nitrox at inappropriate depth)

Avoid CO^2 retention that can precipitate O^2 convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport

- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50^{o} C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

2.9 Hypothermia

- Keep core temperature above 95^{o} F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)
- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet

- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

3.1 Nitrogen Narcosis

Signs (one or more of the following)

Inappropriate behavior at depth

Ignoring hand signals and instructions

Stupor or coma

Symptoms (one or more of the following)

Inflexible thinking and attitude

Decrease or loss of judgment

False sense of security

Lack of concern for safety

Inability to think through problems

Panic

Near unconsciousness or loss of consciousness at depth

Treatment

Ascend until free of symptoms

Surface with controlled ascent

Transport to medical facility for evaluation

3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

Rapid breathing

Feeling of suffocation or shortness of breath

Headache, nausea, dizziness

Rapid heartbeat

Confusion and unclear thinking

Signs (one or more of the following)

Slowed responses

Muscle irritability (twitching)

Loss of consciousness

Treatment

Remove the cause (over-exertion, equipment failure, rebreathers, etc.)

Stop and rest during early symptoms to avoid loss of consciousness

Surface; Transport to medical facility for evaluation

3.3 Ear Disorders

Middle Ear Barotrauma

Keep quiet and calm

Without DCS or rupture of the round or oval windows, give Benadryl 25 mg

Transport to medical facility for evaluation

Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)

Keep head up and affected ear elevated

Discourage straining

Transport to medical facility for evaluation

EMT evaluation, no more diving until cleared by EMT

3.4 Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): M

Prepared By: Brian Woods Reviewed By: James Daffron

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Minimum Protective Clothing and Equipment:
PPE Level D (outside exclusion zone): General work clothes, traffic vest, safety glasses, hard hat, steel-toed boots, hearing protection, work gloves

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Movement of materials to the site Installation of temporary facilities and utilities, to include: Ground preparation for trailer (site	Driving/vehicle movement (including trucks, heavy equipment)	• Obey traffic rules. • 15 miles per hour is the maximum speed allowed in the work area. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). • Do not use cell phones when operating vehicles. • Secure all loads, including equipment within the cab, containerize small equipment and secure container. • Wear seat belts, including those provided in cabs of heavy equipment. • Use caution and wear orange vests if working near active roads or around heavy equipment.	18.A 18.B 08.B

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Mobilization**   Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
office) and milvan pads, dumpsters, and sanitary stations, Electricity connections to site office Explosive storage establishment Field engineering (survey of preliminary conditions)		• Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; "blind spots" of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. •	18.B.03 18.B.03 16.B.02 18.B
		•	
	Dust	• Minimize generation of dust. • Stay out of visible dust clouds. • Wet soil if necessary to eliminate visible dust.	06.A.04

ATTACHMENT B
MOBILIZATION
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Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	• Reduce the volume of detection equipment before donning a headset. • Site-specific training and daily tailgate briefing.	05.C.01
	Electricity	• Assure electrical work is performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements.	11.A.01.c
	Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. • Inspect areas daily and findings are recorded on daily inspection reports. • Personnel will wear sturdy all leather work boot with traction sole and composite safety toe.	14.C
	Hand tools	• Inspect tools prior to use. • Use tools for their intended use only. • Don't use damaged tools. • Push, don't pull wrenches.	13.A.02 13.A.02 13.A.02

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Biological hazards	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes. • Check the area for poisonous plants, insects, snakes, spiders, and scorpions. • Avoid animal droppings they may contain the Hanta Virus. • Avoid holes and rocks that are potential animal habitats. • If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. • Avoid walking through dense foliage. • Wear protective clothing in areas where poison oak and poison ivy are present. • Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. • Site-specific training and daily tailgate briefings.	06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.02 06.D.02 06.D.01
	Material handling	• Use safe lifting techniques, bending at the knees and lifting with the legs. • Use caution and do not twist the back when carrying a load. • Use mechanical devices to move loads when possible. • Wear protective gloves when handling materials. •	14.A.01 14.A.01 14.A.04 05.A

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	• Wear cold weather clothing and provide shelter as needed based on site conditions. • Conduct temperature monitoring when temperatures fall below 45°F. • Site-specific training and daily tailgate briefing.	06.J.10 06.J.11
	Heat stress	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Adjust work/rest regimens during hot weather. • Use sun screen. • Avoid consuming caffeine. • Site-specific training and daily tailgate briefings.	06.I.03 06.I.04
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Monitor conditions and will call a safety stand down in the event of inclement weather.	06.J.01
	Fire	• Provide portable fire extinguishers in all equipment and in the field trailer. • Inspect fire extinguishers monthly. • Obtain hot work permits prior to any welding or torch cutting activities.	09.E 09.E 06.C

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary facilities (if used, not anticipated)	• Anchor trailers with rods and cables or by steel straps to ground anchors designed to withstand winds and meet applicable standards. • Post signs warning of the presence of construction hazards every 300 feet. • Provide one portable toilet with adequate ventilation on site. • Provide washing facilities at the portable toilet location to maintain sanitary conditions. • Provide type II 16-unit first aid kits and make these kits accessible at the site.	04.A.03 04.A.04/08.A 02.C 02.D 03.B
	Powered machine tools	• Use, inspect, and maintain power tools according to manufacturer's recommendations. • Equip power tools with designed guards. • Provide electrical power control on each power tool to make it possible for the operator to cut off the power without leaving the point of operation. • Connect all electrical power tools to an in-line GFCI.	13.A.02 13.A.03 13.A.15 11.C.05

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Mobilization**   Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary haul roads (if used, not anticipated)	• Construct haul roads with suitable width for safe operation at the speed anticipated. • Post speed limits on haul roads.	08.D.05 08.D.06

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

Prepared By: Brian Woods Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:
PPE Level D: General work clothes, safety glasses, hard hat, safety-toed boots, leather work gloves, and respirator (when working in dry, dusty conditions).

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Boat Use**   Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization, Demobilization, Loading and Unloading	Driving/vehicle movement (including truck/trailer bringing the boat to the job site) Unloading the boat from the trailer Loading the boat onto the trailer	• Obey traffic rules. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). • Do not use cell phones when operating vehicles. • Secure all loads, including equipment within the cab, containerize small equipment and secure container. • Wear seat belts, including those provided in cabs of heavy equipment. • Use caution and wear orange vests if working near active roads or around heavy equipment. • Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; "blind spots" of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. •	16.A/18.A 08.B 16.B.08/18.B.03 16.B.01/18.B.03 16.B.02 16.B/18.B 16.B.12b

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Boat Use**   Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Boat Use	Potential MEC (If in an area where MEC is suspected)	• Observe MEC/anomaly avoidance procedures in accordance with EP-75-1-2	
	Boat Operations to include: Diving, Sediment Sampling, water sampling, and surveying	• Boat shall be equipped with Coast Guard Approved Type III Personal Flotation Devices with attached whistles for each passenger/worker onboard. • Boat shall be equipped with at least one Coast Guard Approved Type IV Personal Flotation Device, first aid kit large enough for the crew, charts, compass, GPS, cell phone or radio, survival kit, anchor, and paddles. • For off-shore operations the boat shall be equipped with marine band radios, radars, bow hook, spotting mirrors, flare gun, and flares. • A qualified boat operator will be in charge of boat operations • The boat engine shall be placed in neutral prior to splashing divers (as conditions permit). • The boat engine shall be turned off (if conditions permit) when recovering divers. •	

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. • Inspect areas daily and findings and recorded on daily inspection reports. • Sturdy all leather work boots with traction sole and safety toe.	14.C
	Biological hazards	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes. • Check the area for poisonous plants, insects, snakes, spiders, and scorpions. • Avoid animal droppings they may contain the Hanta Virus. • Avoid holes and rocks that are potential animal habitats. • If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. • Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. • Site-specific training and daily tailgate briefings.	06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.02 06.D.02 06.D.01

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Boat Use**   Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	• Wear cold weather clothing and provide shelter as needed based on site conditions. • Conduct temperature monitoring when temperatures fall below 45°F. • Site-specific training and daily tailgate briefing .	06.J.10 06.J.11
	Heat stress	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Adjust work/rest regimens during hot weather. • Use sun screen. • Avoid consuming caffeine. • Site-specific training and daily tailgate briefings.	06.I.03 06.I.04
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Monitor conditions and will call a safety stand down in the event of inclement weather.	06.J.01
	Fire	• Provide Coast Guard Approved portable fire extinguishers onboard. • Inspect fire extinguishers monthly.	09.E 09.E

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Boat Use**   Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	• Wear hearing protection when operating or working near the mower. • Site-specific training and daily tailgate briefing.	05.C.01

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): M

Prepared By: Brian Woods Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:
Dry Suit/ Wet Suit, Tether, Reserve air. Dive flags, Dive boat, Hand tools, Back Board, Breathing gas supply, Buoys, Dive

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
MEC Dive Operations for Anomaly Investigation and Removal	**Radiation Hazards:** Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	06.J.13
	Chemical Hazards: Marine Battery- Lead Acid	Keep containers tightly closed when not in use. If battery case is broken, avoid contact with internal components. Do not handle near heat, sparks, or open flames. Protect containers from physical damage to avoid leaks and spills. Place cardboard between layers of batteries to avoid damage and short circuits. Do not allow conductive material to touch battery terminals. Use protective acid resistant gloves and eye protection if coming in contact with battery acid	05.A 05.B

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		from leaks or spills.	
	Biological Hazards: Stinging and biting Insects Animals and Reptiles	Use appropriate insect repellents. Training to avoid poisonous insects and avoid contact. A poster indicating various types of biological hazards will be displayed in the site trailer. Training on symptoms of rabies and avoidance of animals.	06.D.01 06.D.02
	Physical Hazards: Slips, trips, and falls while walking on uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility	Care will be exercised during off-loading and loading of boats to reduce slip, trip or fall hazards associated with the landing or docking area. Work areas will be kept organized; ice, snow, and mud will be cleared to reduce hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel will use the “buddy system” at all times.	14.C
	Underwater Hazards from stepping in holes or on sharp objects	Be observant while in the water and move cautiously.	14.C
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Heavy loads will be carried with assistance. Verify the path of travel is clear prior to the lift.	14.A.01 14.A.04 05.A

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Dive Operations**   Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Hands or fingers caught between objects; abrasions and lacerations	Personnel will be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions will be taken to avoid contact with rough or sharp edges. Personnel will wear work gloves and avoid placing hands between objects.	05.A
	Hand tools, manual	Tools will be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose.	13.A.02
	Inclement weather, heat and cold stress	When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. UXOSO will monitor conditions and will call a safety stand down in the event of inclement weather. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to ACGIH and NIOSH guidelines. Personnel will be monitored. Dive gear will include appropriate thermal protection.	06.J.01
	Fire	Fire prevention will be a priority through awareness. A 1A:10BC extinguisher will be required to be on the boat during boating and diving activities.	09.E
	MEC Hazards	On-site MEC training will be conducted. UXO personnel will be EODS graduates. Perform MEC intrusive investigation using approved methods and techniques. EM-385-1-97 will be followed for performing MEC work.	

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Drowning Hazards	Two way communications system will be employed. Review dive procedures in the Safe Practices Manual. Standby diver will be dressed and ready when a diver is in the water. U.S. Navy No-Decompression tables will be used. All dive gear will be inspected and serviceable. Check lists will be used to insure all procedures are followed.	30.A 30.B
Post Diving	Decompression Stress resulting from Flying After Diving	Divers will not fly within 12 hours after diving or within 24 hours after multiple dives.	30.A.11

APPENDIX E

COFFERDAM DESIGN DRAWINGS

500 Penn Center Boulevard
Pittsburgh, PA 15235, USA
Phone: (412) 856-9700
Fax: (412) 856-9749
www.rizzoassoc.com

June 23, 2014
Project No. 11-4708

Mr. William Zeli
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

TRANSMITTAL
UPDATED COFFERDAM DRAWINGS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

Dear Mr. Zeli:

Transmitted herewith are updated drawings for the Congaree River Remediation. The drawings have been updated to include the flooding structure and to include two phases for the cofferdam instead of three.

If you have any questions or require any additional information, please contact me at 412-825-2014 or email me at jared.deible@rizzoassoc.com.

Respectfully submitted,
RIZZO Associates

Jared Deible, P.E.
Managing Principal

JDD/kam

Attachments

CONGAREE RIVER REMEDIATION
SOUTH CAROLINA ELECTRIC & GAS
COLUMBIA, SC

PREPARED BY

PAUL C. RIZZO ASSOCIATES, INC.
SUITE 100, BUILDING 5
500 PENN CENTER BLVD.
PITTSBURGH, PENNSYLVANIA 15235

LIST OF DRAWINGS

SHEET 1 OF 14

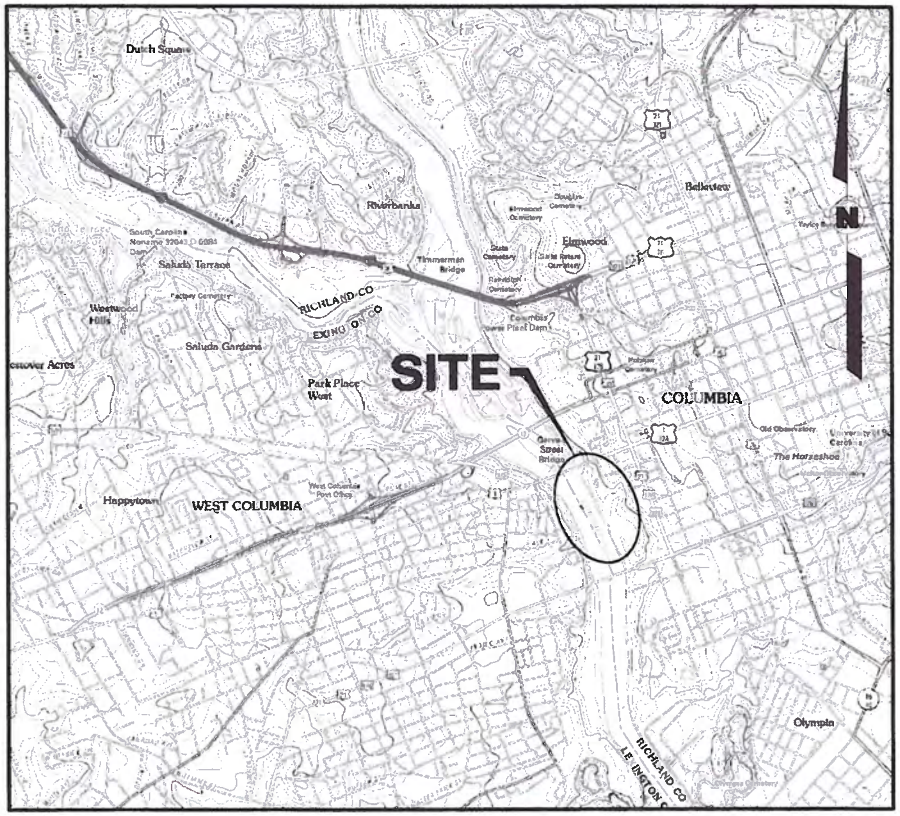
TITLE SHEET

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

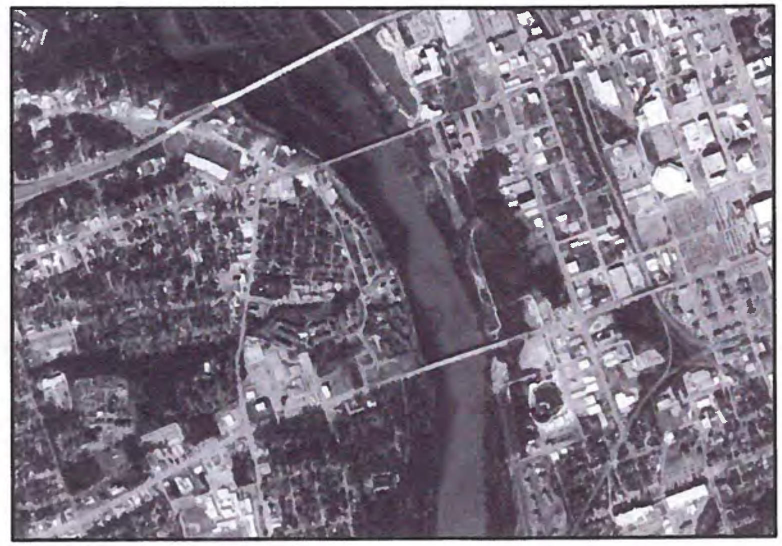
PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A2
1:1	DATE	07-09-12	APPROVED BY	JDD	6/23/14		



VICINITY MAP

SCALE

5000 0 5000 FEET



AERIAL IMAGE

SCALE

2500 0 2500 FEET

SHEET 2 OF 14

SITE VICINITY MAP & AERIAL MAP

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

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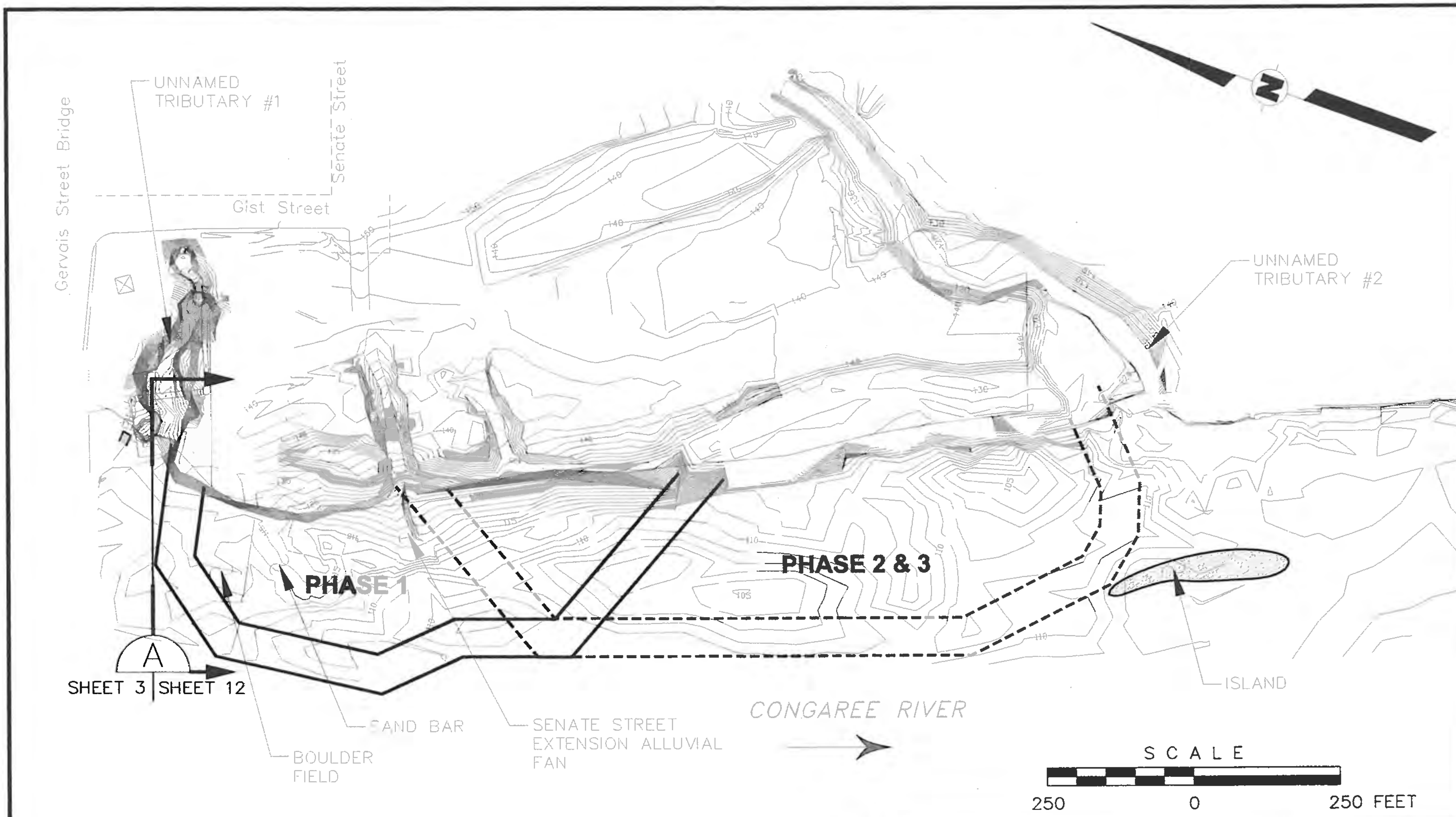
PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A3
1:1	DATE	07-03-12	APPROVED BY	JDD	6/23/14		



LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM LIMITS–PHASE 1

APPROXIMATE COFFERDAM LIMITS–PHASE 2 & 3

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

SHEET 3 OF 14

GENERAL ARRANGEMENT PLAN

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

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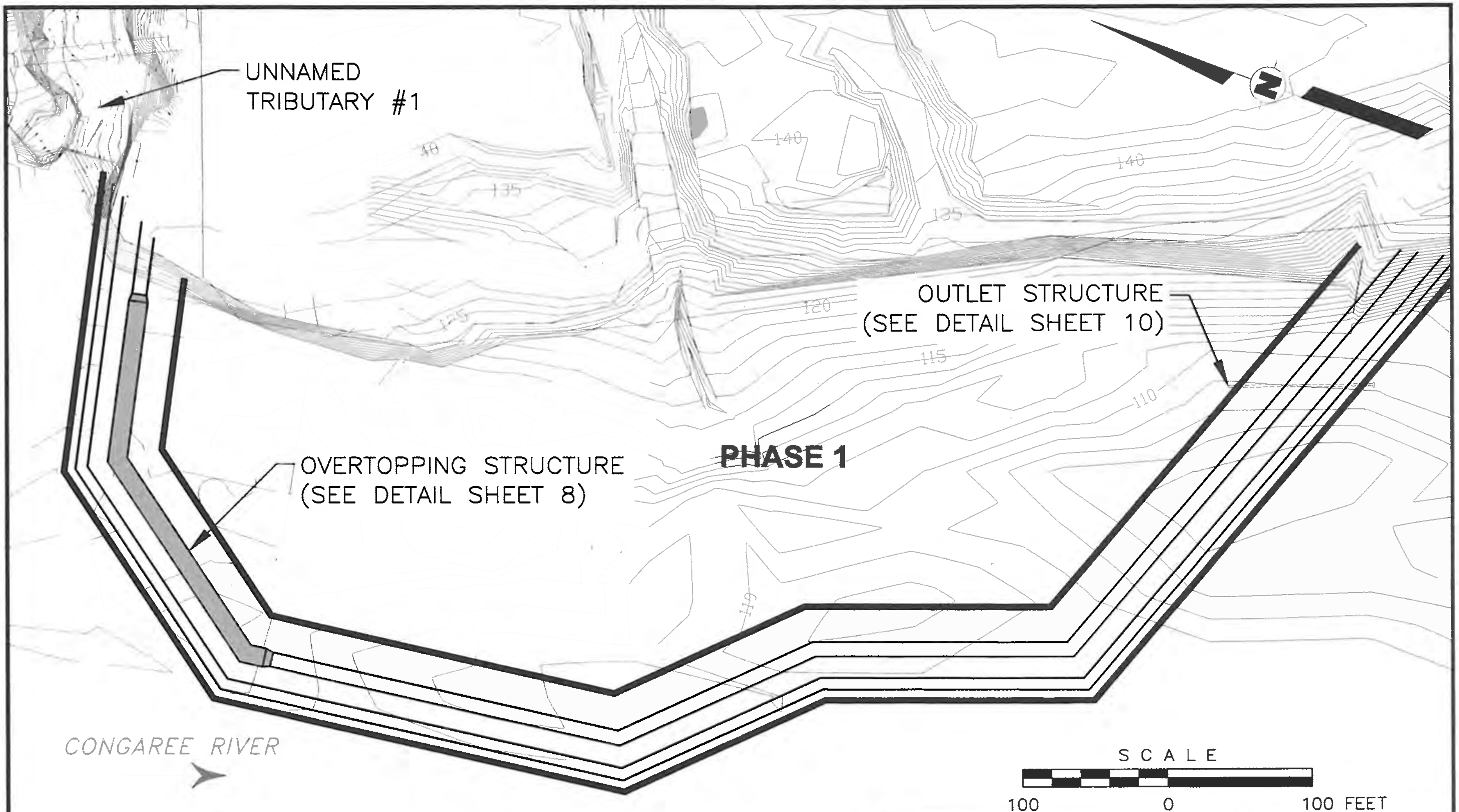
PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A4
1:1	DATE	07–11–12	APPROVED BY	JDD	6/23/14		



LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM FOOTPRINT

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A5
1:1	DATE	07–11–12	APPROVED BY	JDD	6/23/14		

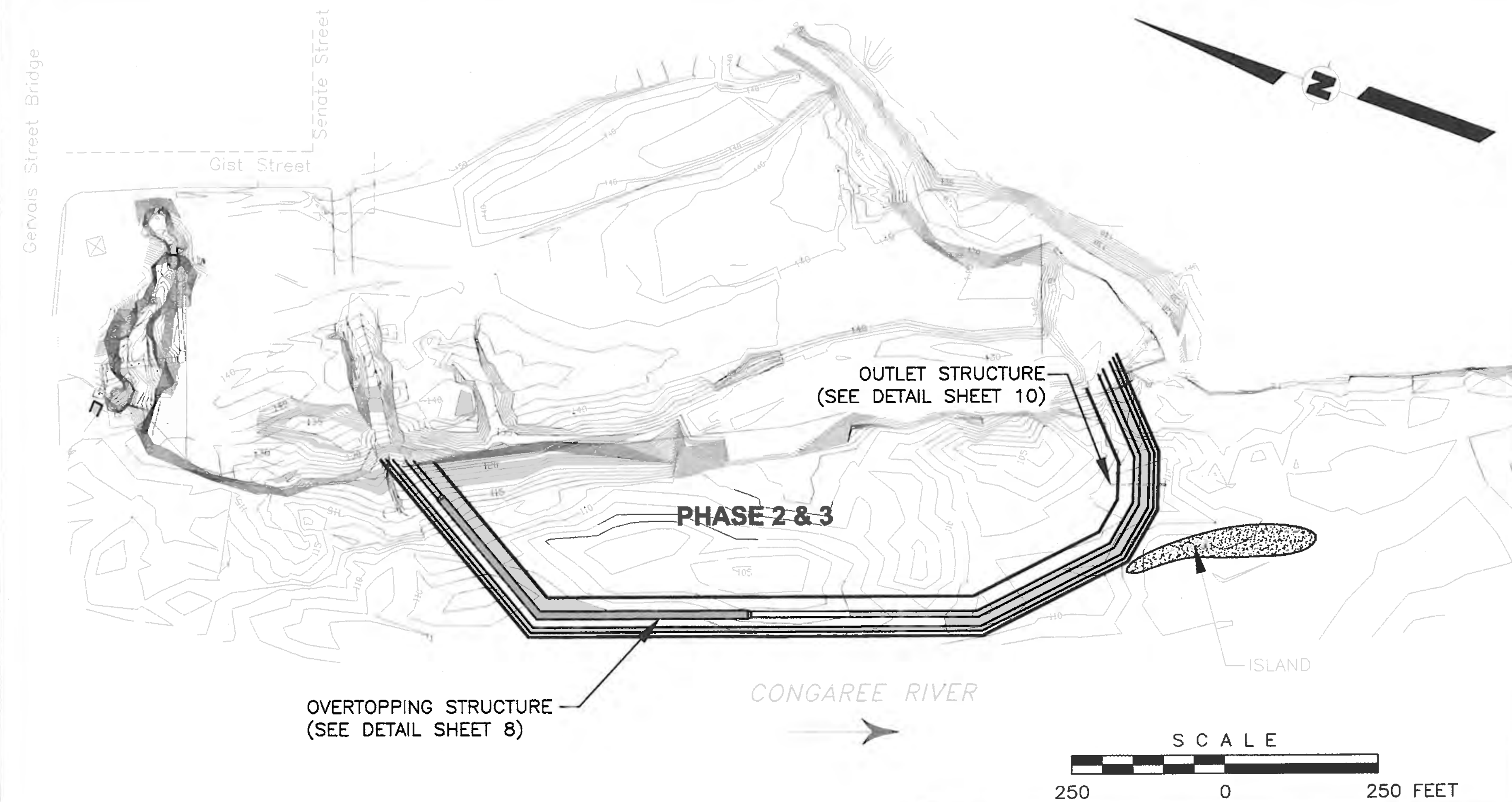
SHEET 4 OF 14

CONSTRUCTION PHASE 1

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES



LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM FOOTPRINT

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

SHEET 5 OF 14

CONSTRUCTION PHASE 2

PREPARED FOR

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CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

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PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A6
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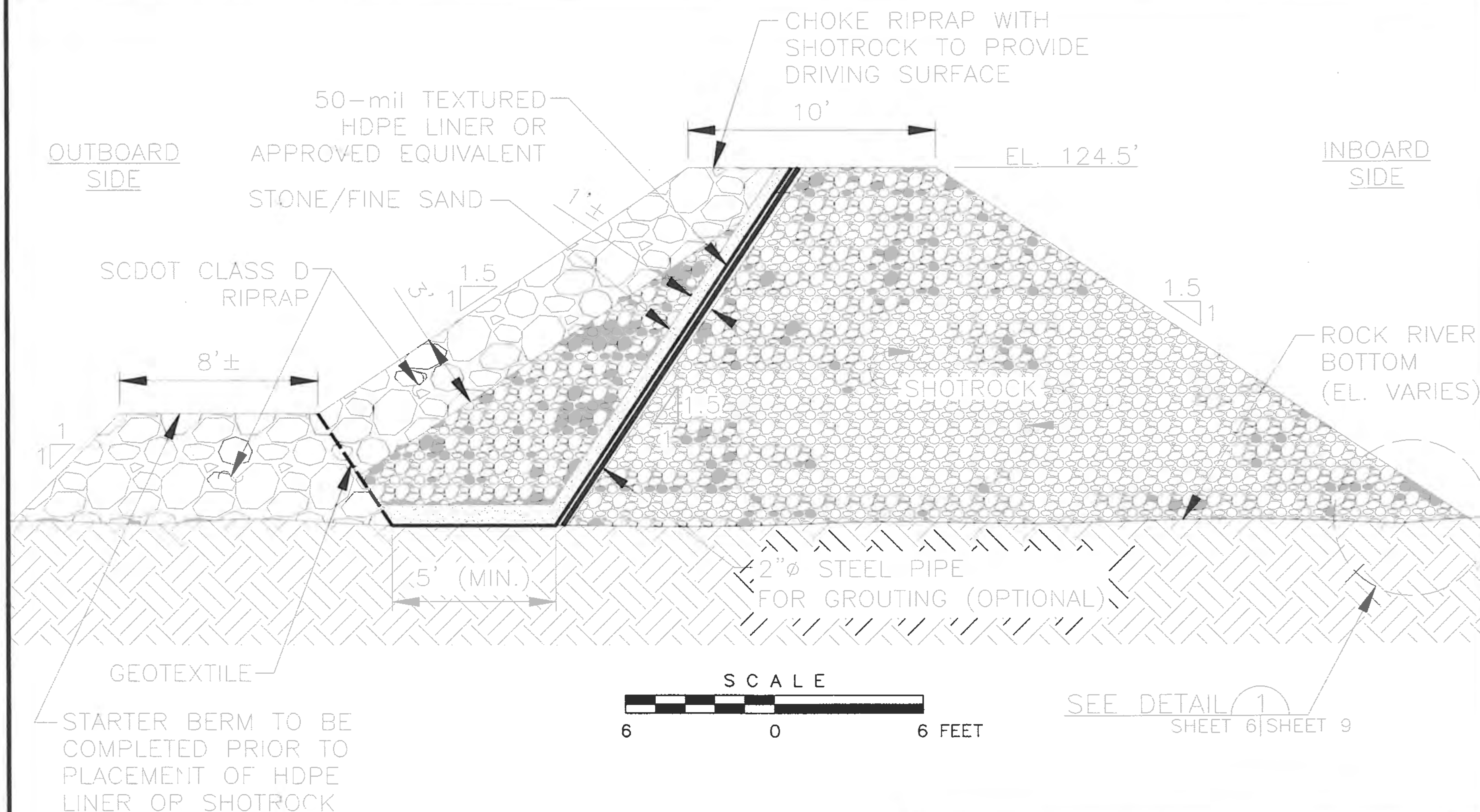

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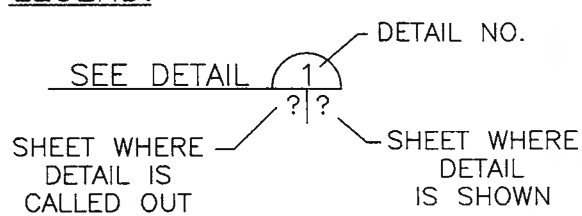

SHEET 6 OF 14

TYPICAL COFFERDAM SECTION

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A8
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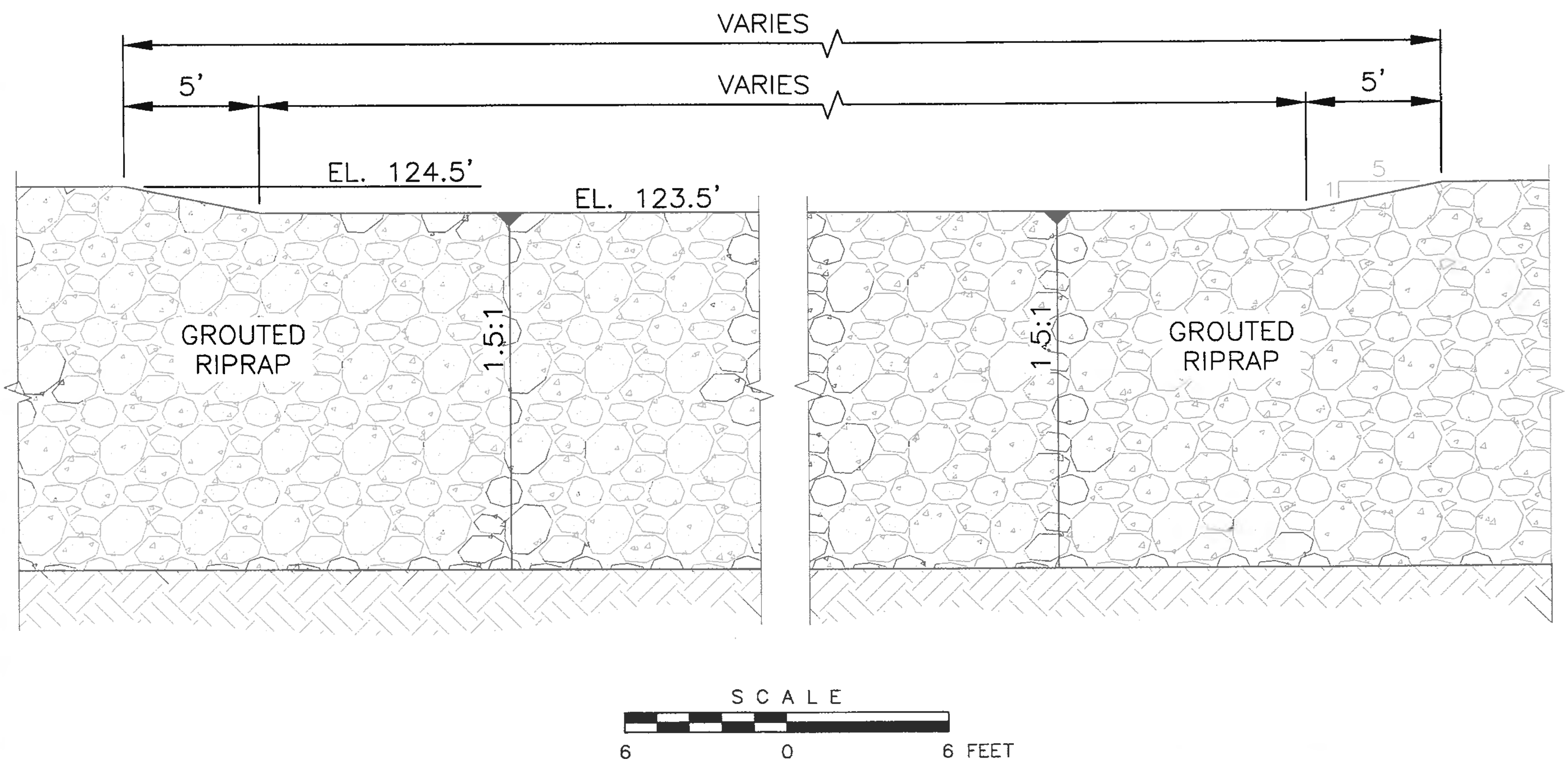

SHEET 7 OF 14

TYPICAL OVERTOPPING STRUCTURE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	J.S.S.	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A18
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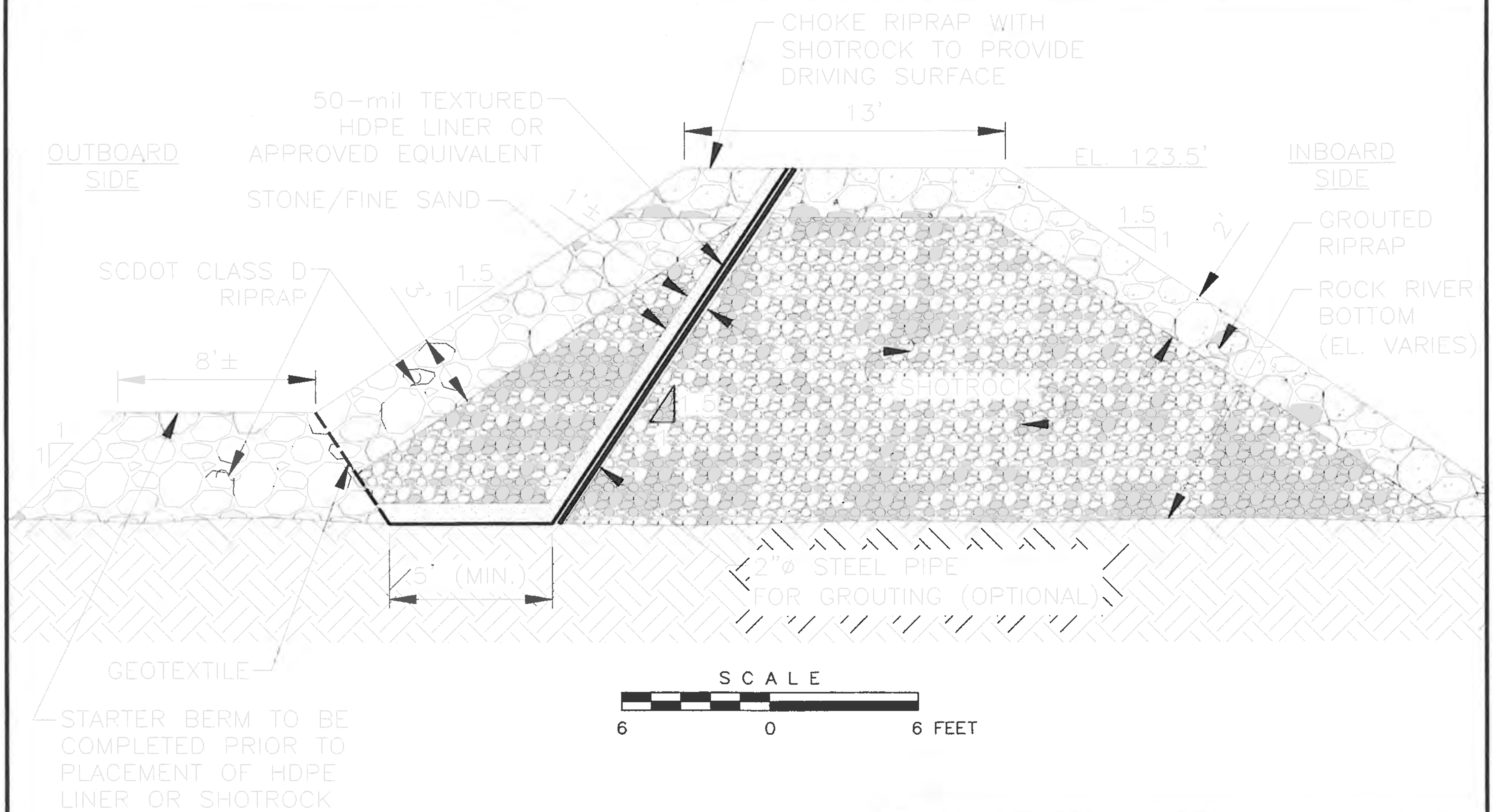

SHEET 8 OF 14

TYPICAL OVERTOPPING SECTION

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CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CLM	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A21
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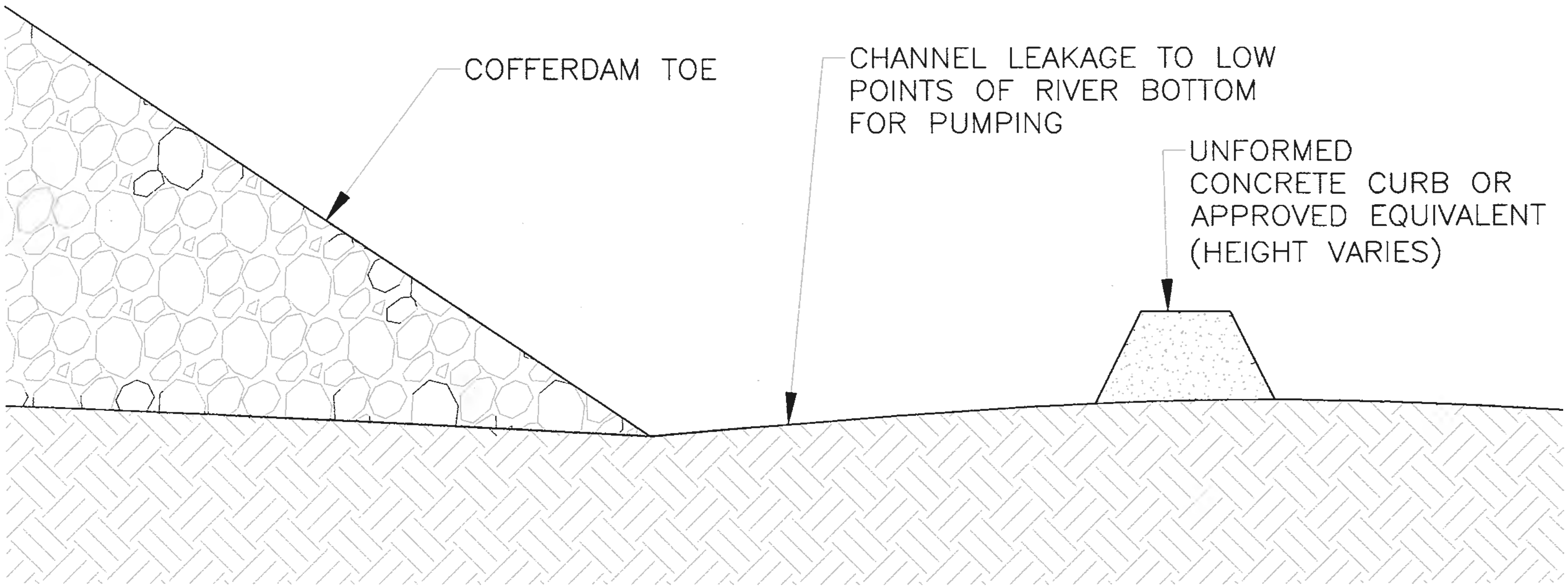

DETAIL 1
SHEET 6 | SHEET 9

SCALE
1 0 1 FOOT

LEGEND:

DETAIL 1 — DETAIL NO.
? | ?
SHEET WHERE DETAIL IS CALLED OUT
SHEET WHERE DETAIL IS SHOWN

SHEET 9 OF 14

DETAIL–LEAKAGE CONTROL

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A9
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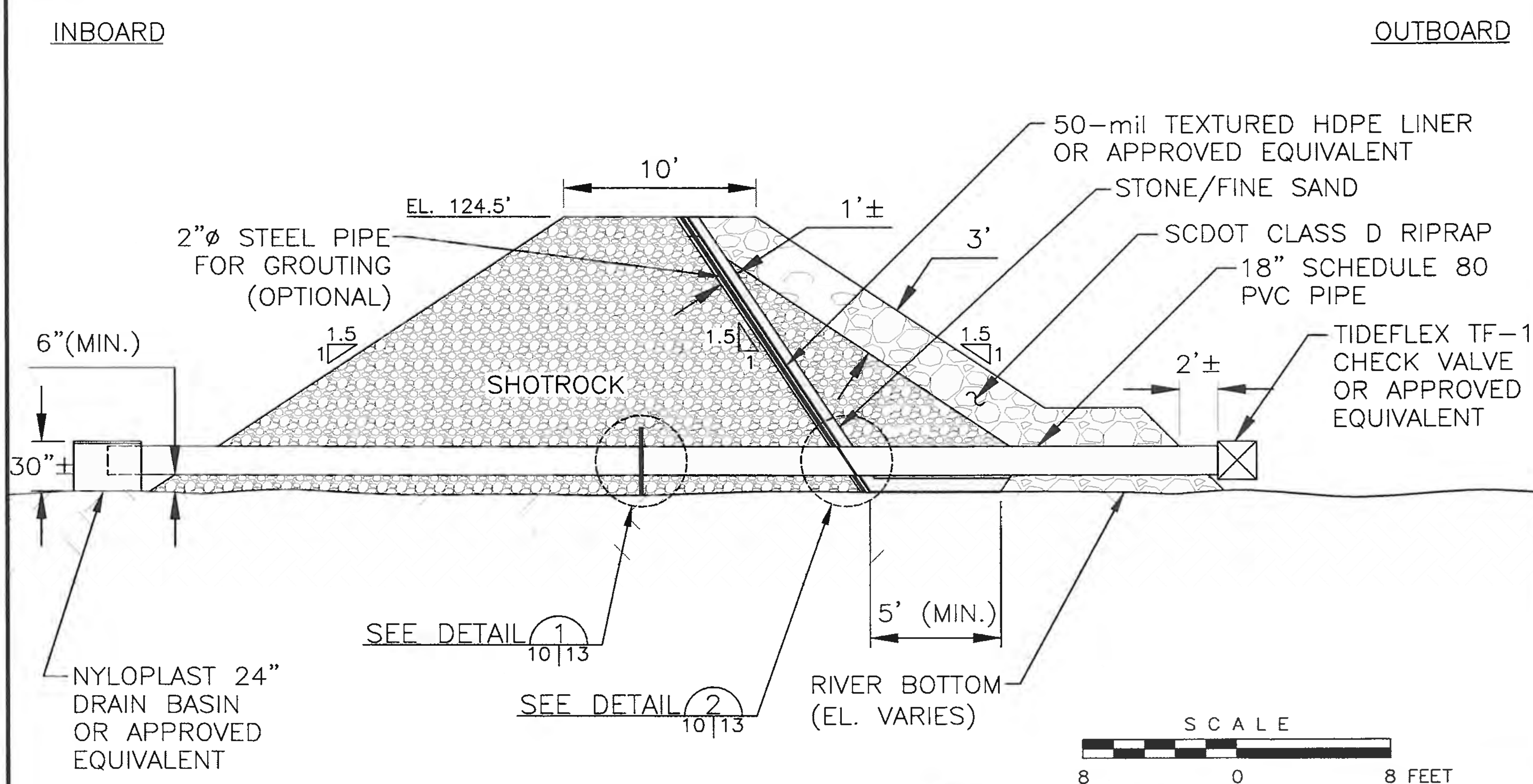


LEGEND:

SEE DETAIL 1 ?|?

DETAIL NO.

SHEET WHERE DETAIL IS CALLED OUT

SHEET WHERE DETAIL IS SHOWN

SHEET 10 OF 14

OUTLET STRUCTURE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	DDD	6/23/14	CAD FILE NUMBER	114708A10
1:1	DATE	07-23-12	APPROVED BY	DDD	6/23/14		

NOTES:

1. PHASE TWO AND PHASE THREE OF THE REMEDIATION MAY BE COMBINED.

2. COFFERDAM MATERIAL TO REMAIN IN PLACE FOR EACH PHASE UNTIL REQUIRED FOR NEXT PHASE.

3. HDPE LINER MATERIAL AND OUTLET STRUCTURE MAY BE REUSED BETWEEN PHASES AT OWNER'S APPROVAL.

4. STEEL PIPES MAY BE EMBEDDED IN THE STONE SURROUNDING THE HDPE LINER. AT CONTRACTOR'S OPTION, PIPE MAY BE USED TO GROUT AFTER COFFERDAM COMPLETION TO REDUCE LEAKAGE.

5. SCDOT CLASS D RIPRAP HAS D_{50}= 1.80'.

6. CONTRACTOR TO MAINTAIN MEANS OF STOPPING FLOW THROUGH OUTLET STRUCTURE.

7. HDPE LINER TO BE WELDED OR LAPPED AT JOINTS. IF LINER IS LAPPED, MINIMUM OVERLAP IS ONE FOOT.

8. FINAL DESIGN OF COFFERDAM TO BE PREPARED BY CONTRACTOR.

9. MAXIMUM LIFT THICKNESS FOR SHOTROCK IS 18". SHOTROCK TO BE COMPACTED WITH MINIMUM FOUR PASSES OF EARTH MOVING EQUIPMENT OR 10–TON ROLLER.

10. MAXIMUM STONE SIZE FOR SHOTROCK IS 6".

11. CONTROL OF SEDIMENT WILL BE ACCOMPLISHED USING THE STARTER BERM SHOWN ON SHEET 7. THE ENTIRE STARTER BERM WILL BE PLACED PRIOR TO THE PLACEMENT OF ANY SHOTROCK.

12. LARGE BOULDERS IN THE FOOTPRINT OF THE COFFERDAM OR NEAR THE COFFERDAM MAY BE MOVED AS REQUIRED.

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A11
1:1	DATE	07-09-12	APPROVED BY	JDD	6/23/14		

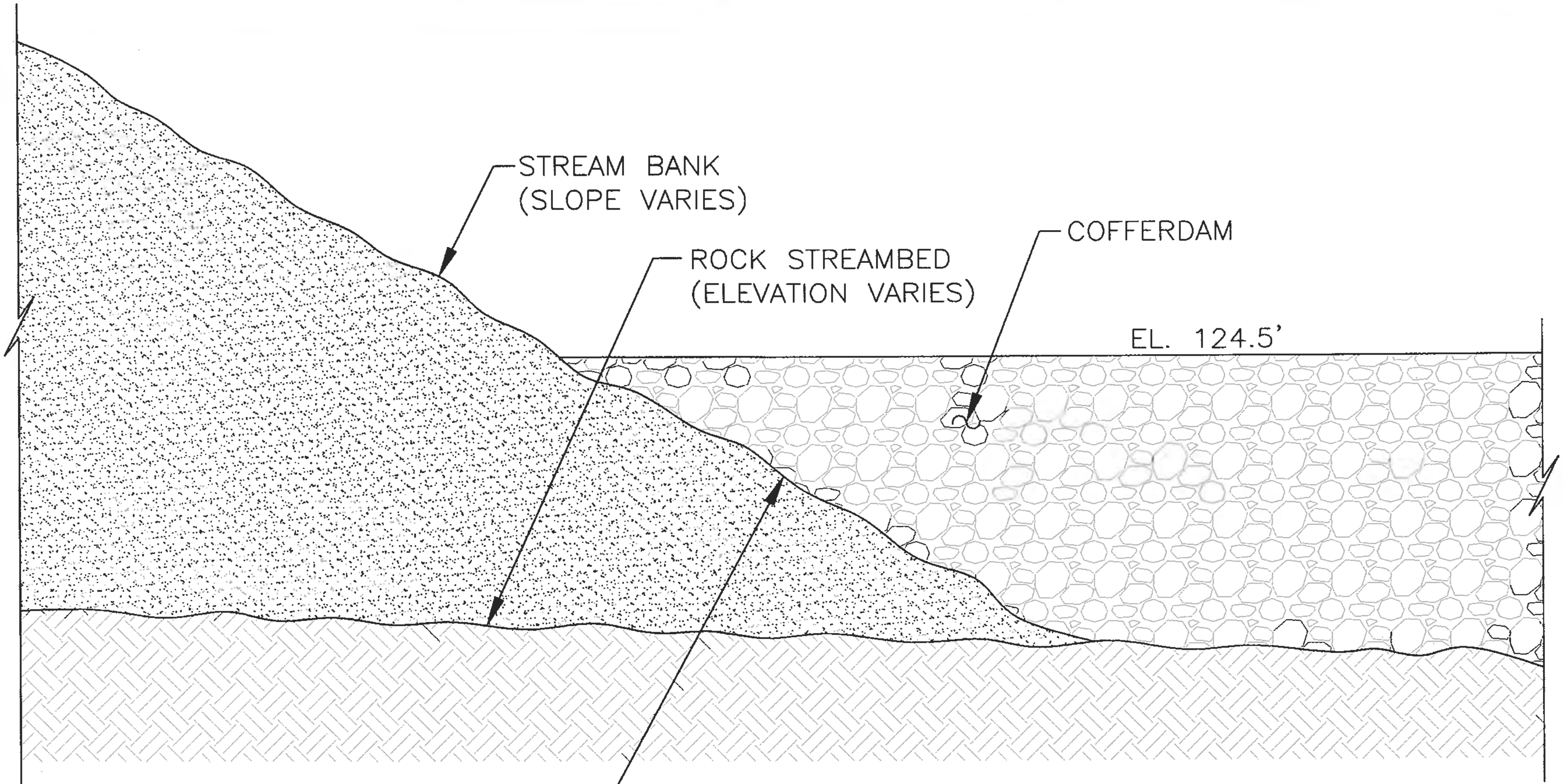
SHEET 11 OF 14

NOTES

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES



PREPARE STREAMBANK PRIOR TO COFFERDAM CONSTRUCTION. PREPARATION TO CONSIST OF REMOVAL OF ALL ORGANIC MATERIAL AND TOPSOIL AND COMPACTION OF PREPARED SURFACE AS COFFERDAM IS CONSTRUCTED

(NOT TO SCALE)

SHEET 12 OF 14

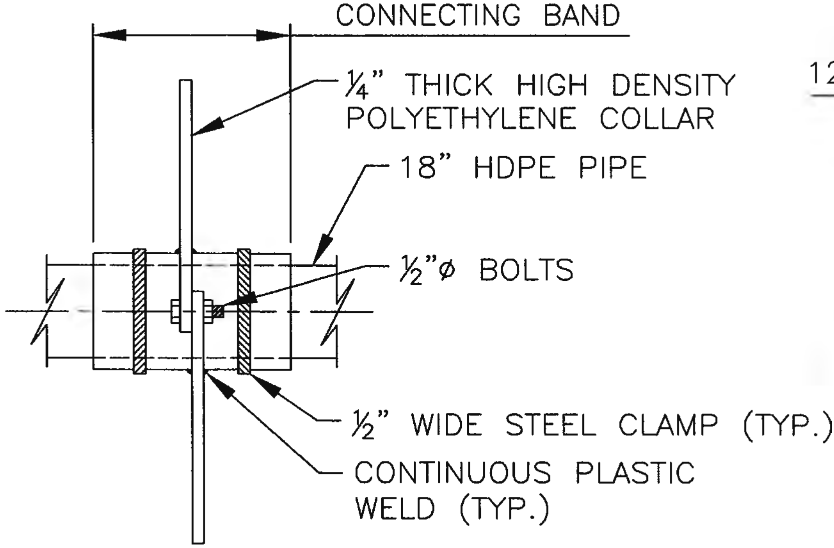
TYPICAL STREAMBED PROFILE

PREPARED FOR

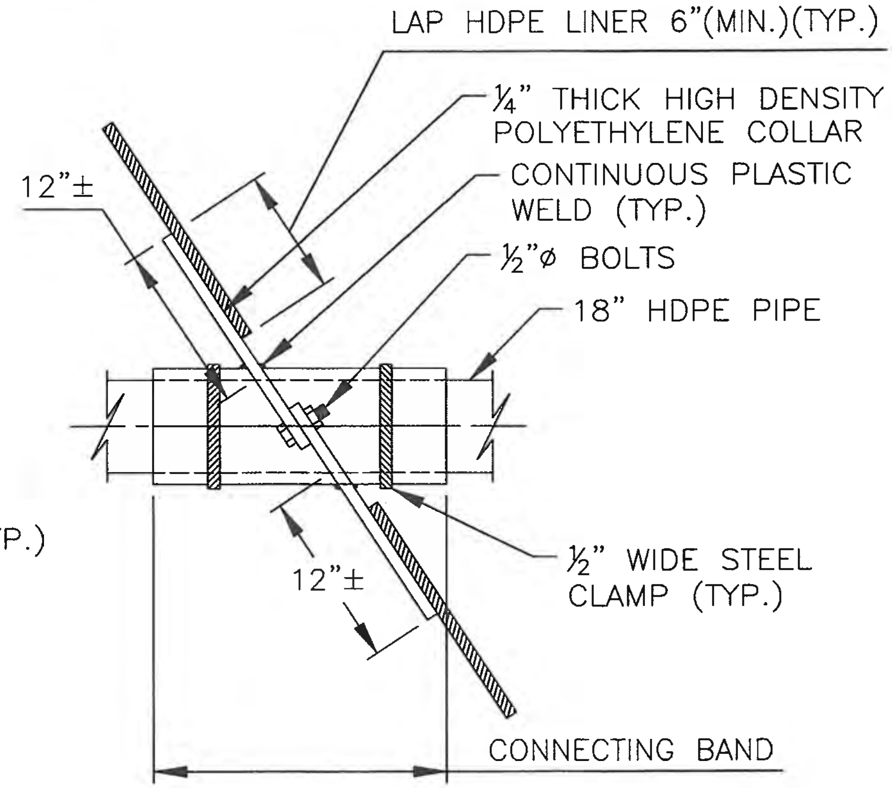
SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A12
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		



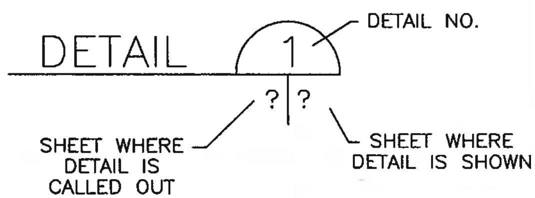
DETAIL 1
10 | 13



DETAIL 2
10 | 13

(NOT TO SCALE)

LEGEND:



SHEET 13 OF 14

HDPE COLLAR DETAILS

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A13
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		

CONSTRUCTION SEQUENCE:

1. CONSTRUCT STARTER BERM AROUND ENTIRE PHASE ONE WORK AREA.
2. STRIP STREAMBANK IN AREA WHERE COFFERDAM WILL BE CONSTRUCTED.
3. PLACE GEOTEXTILE AGAINST STARTER BERM, PLACE SHOTROCK IN LIFTS AND PLACE HDPE LINER ON STREAM BOTTOM. PLACE HDPE LINER AND STONE/FINE SAND AS SHOTROCK IS PLACED.
4. INSTALL OUTLET STRUCTURE AS SHOTROCK IS BEING PLACED.
5. PLACE CLASS D RIRRAP ON OUTBOARD FACE.
6. CONSTRUCT STARTER BERM AROUND ENTIRE PHASE TWO WORK AREA.
7. CONSTRUCT PHASE TWO COFFERDAM FOLLOWING SAME CONSTRUCTION SEQUENCE WHILE MOVING SHOTROCK AND OTHER MATERIAL FROM PHASE ONE TO PHASE TWO.
8. CONSTRUCT PHASE THREE COFFERDAM FOLLOWING SAME CONSTRUCTION SEQUENCE WHILE MOVING SHOTROCK AND OTHER MATERIAL FROM PHASE TWO TO PHASE THREE.

SHEET 14 OF 14

CONSTRUCTION SEQUENCE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A14
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		

APPENDIX F

TOTAL SUSPENDED SOLIDS (TSS) MONITORING PLAN

TOTAL SUSPENDED SOLIDS (TSS)
MONITORING PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

TOTAL SUSPENDED SOLIDS (TSS)
MONITORING PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary stone/rip rap cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

Obviously, it would be impossible to install, remove or relocate the rock cofferdam in the river without generating any visual sediment-related impacts. For example, as soon as the starter berm is placed in the river, a “cloud” of dust washing off the material is anticipated. The starter berm is a riprap material that will be placed in the river first to provide sediment containment prior to installing the actual cofferdam. Please see the Rizzo Design in the Cofferdam Inspection and Maintenance Plan. The sediment release during construction will be temporary, with no long-term chronic effects. Therefore, a critical element of this plan will be to incorporate a mixing zone approach. The mixing zone will provide an allowable area for the short-term effects from constructing the cofferdam.

TSS MONITORING PLAN OBJECTIVE

The objective of this Total Suspended Solids (TSS) Monitoring Plan is to ensure that the construction operations do not directly cause the addition of significant or uncontrolled amounts of suspended solids within the Congaree River. SCE&G has experience successfully conducting river-based construction activities at another MGP site in South Carolina and does not anticipate that this project will generate significant levels of TSS. However, implementation of this Plan will provide a means to measure, collect and document real-time TSS information and compare the results to conservative action levels as described herein. This Plan also establishes the appropriate response/mitigation activities to be implemented in the event that elevated readings are observed.

Currently, SCE&G plans to conduct TSS monitoring during operations that have the potential to generate or liberate sediment when constructing or removing the cofferdam structure. These portions of the project have the greatest potential to generate elevated TSS readings. Project related TSS increases could result from:

- Placement or removal of the riprap starter berm (for the cofferdam) in the river may liberate bottom sediments;
- Release of rock dust or small, loose rock particles from the riprap when it is first placed into the river;
- Disturbance of the sediment during construction or removal of the cofferdam; and
- Disturbance of the shoreline during cofferdam tie-in construction and removal operations.

The planned location of the cofferdam is shown on Figure 2 and the planned cofferdam cross-section detail is shown on Figure 3. The complete cofferdam design is provided in the Cofferdam Inspection and Maintenance Plan.

It is important to note that the planned location of the cofferdam structure is outside of the delineated (known) TLM area and the sediment from the cofferdam construction area is expected to not contain any site-related constituents of concern. In addition, no TLM or constituents of concern were identified in the riverbank soil and the rock/riprap components of the cofferdam will be from an off-site source and will be clean and free of contamination. As a result, release of the sediment, soil or rock dust, etc. will not pose a potential for migration of the TLM or constituents of concern downriver. Impacted sediment will only be disturbed once the cofferdam is in place and the confined area has been dewatered. The cofferdam will serve as a containment structure for work inside of the structure. Thus, SCE&G is implementing this Plan in order to minimize the potential for increased TSS within the river due to construction and does not anticipate the potential for liberation and downstream migration of impacted material during completion of the project.

Once the cofferdam is fully constructed and the only intrusive work is occurring within the isolated structure, which will contain any disturbed sediment, SCE&G may discontinue the TSS monitoring. SCDHEC and USACE will be notified prior to the cessation of TSS monitoring and no changes to the monitoring activities will occur without SCDHEC/USACE approval. If planned project activities will pose a potential to liberate sediment, SCE&G will notify SCDHEC and the USACE and initiate monitoring activities, as required.

The TSS monitoring plan consists of the following:

- Establishment of a mixing zone;
- Determination of an action level for TSS exceedances;

- Real-time field measurements of TSS during completion of river-based construction activities that have the potential to generate or liberate sediment or other construction related material;
- Background monitoring of TSS; and
- Contingency and mitigation procedures to implement if it is determined that site related activities are contributing the significant TSS concentrations.

MIXING ZONE

As described above, visual impacts related to sediment-generating activities from construction of the cofferdam will be readily apparent and are unavoidable. However, these impacts will be temporary in duration and will be controlled to the extent practical. Because these impacts are unavoidable, a mixing zone of 300 feet in length will be established. Sediment "clouds" will be permitted within the mixing zone. The mixing zone will be measured from where the stone placement is actually occurring to 300 feet downriver. It is anticipated that as a sediment cloud moves down river with the current, the sediment will drop out and the cloud will dissipate in the slow moving water, assuming the river is normal elevation (approximately 113.5 at the USGS river gage). The remainder of this Plan addresses sediment impacts outside of the mixing zone.

TSS ACTION LEVEL

According to the SCDHEC Water Classifications and Standards, Regulations 61-68, no explicit standards for TSS exist. However, the document does state that turbidity in freshwater is "not to exceed 50 NTUs provided existing uses are maintained". TSS and turbidity can be correlated to arrive at an action level based on the following definitions from SCDHEC:

- Turbidity is an expression of the scattering and absorption of light through water. The presence of clay, silt, fine organic and inorganic matter, soluble colored organic compounds, and plankton and other microscopic organisms can increase turbidity. Increasing turbidity can also be an indication of increased runoff from land.
- Total Suspended Solids (TSS) are the suspended organic and inorganic particulate matter in water.
- Although increasing TSS can also be an indication of increased runoff from land, TSS differs from turbidity in that it is a measure of the mass of material in, rather than light transmittance through, a water sample.

Therefore, to illustrate the correlation between turbidity and TSS within the Congaree River, a plot of historical analytical results for turbidity and TSS from SCDHEC from January 1999 to December 2000 at the water monitoring station CSB-001L (located just south of the Blossom Street Bridge) was developed. Figure 2 shows the location of CSB-001L in relation to the project area and the plot of turbidity vs. TSS is provided on Figure 4. By plotting turbidity against TSS and using the linear equation created by the relationship of the data, it is determined that the turbidity of 50 NTU is equal to a TSS reading of 56.3 mg/L within the Congaree River. As a result of this determination, SCE&G proposes a conservative TSS action level of 50 mg/L.

Action Level Triggers

The Congaree River exhibits highly variable flow rates and corresponding turbidity/TSS concentrations based on a number of factors including; the large drainage basin, upstream precipitation events, runoff from upstream sources for both the Broad River and the Saluda River. Due to this large variability, exceedance of the conservative action level (TSS > 50 mg/L) occurs on a regular basis. Generally, as the river elevation increases so does the turbidity/TSS due to these upstream effects. Therefore, the objective of this Plan is to determine the increase in TSS based solely on construction activities related to this project. Subsequently, a “background” reading will be collected directly upstream of the project area. This data will be a necessary component of the Plan in order to determine any increase due to project-related activities. As a side note, when river levels are elevated and sediment loads are heavy (based on the brown color of the water) there will likely be no in-the-river construction activites.

For the purposes of this project, SCE&G proposes that a significant increase in TSS concentration is defined as a reading of 25% higher than the background monitoring results. Measuring equipment and procedures are defined later in this Plan. In summary, upstream (background) data will be compared with downstream (work area) monitoring results, measured after the 300 foot mixing zone allowance. If downstream TSS concentrations are less than 1.25 times the upstream results, then work can proceed. If the downstream TSS levels are greater than 1.25 times the upstream background measurement, then work will cease and contingency measures will be employed.

If a significant increase is noted between comparison of the upstream (background) and downstream concentrations, then mitigation/control measures will be implemented as described below. Exceedance of the action level below the mixing zone must be a sustained reading for at least 15 minutes. Transient readings, or one time “spikes” will not constitute a Stop Work Order. Also, if an action level exceedance can be attributed to a non-project related condition, or unusual, natural or man-made event, the exceedance will be recorded in the field notes and no contingency measures will be employed and work may continue.

The following scenarios are provided to illustrate the potential monitoring and mitigation activities.

Scenario 1 – Readings < 50mg/L

The downstream TSS monitoring activities produce results below 50 mg/L work will continue as planned without mitigation measures. Continued real-time monitoring and visual observations of river conditions directly downstream of the active work zone and the mixing zone will continue to be conducted on a daily basis as the project progresses.

Scenario 2 – Readings >50mg/L but <1.25 X Background

The downstream TSS monitoring activities produce results above 50 mg/L, but below the (1.25 times background in mg/L) action level. Work will continue as planned without mitigation measures. Continued real-time monitoring and visual observations of river conditions directly downstream of the active work zone and the mixing zone will continue to be conducted on a daily basis as the project progresses.

Scenario3 – Readings > than 1.25 X Background

The downstream TSS monitoring activities produce consistent (sustained for 15 minutes) results above the (1.25 times background in mg/L) action level. A Stop Work Order will be implemented and mitigation/control measures will be employed, as described below. Downstream and background monitoring will continue and mitigation measures remain in place until TSS concentrations below the mixing zone are reduced to less than 1.25 times the background concentration or below 50 mg/L for a period of two hours.

MEASUREMENT OF TSS

SCE&G plans to conduct real-time monitoring of total suspended solids (TSS) concentrations in the vicinity of the project area during construction activities that have the highest potential to liberate sediments. Obviously, the area located directly downriver of the active construction zone, below the 300 foot mixing zone, will be the most representative location to collect the real-time TSS data. Figure 5 provides a monitoring scenario using the Phase 1 cofferdam footprint as an example of potential monitoring locations. This area will change as the ongoing construction activities progress and as a result the mixing zone and monitoring locations will need to be transient.

In order to fulfill the monitoring requirements and objectives, SCE&G currently anticipates utilizing a combination of instruments and techniques. Measurements will be obtained by either a hand held instrument and/or remote monitoring equipment positioned in the river. Since the river is readily accessible from the shoreline, site personnel will be able to wade into the shallow water and collect readings via a handheld TSS meter. The data will be downloaded or manually recorded. If the water is too deep, site personnel may use a small boat or kayak to collect the data. As a third option, a wireless buoy system may be employed. Examples of the proposed monitoring instruments are described below and additional information is provided in Attachment A.

Hand Held Instrumentation

As currently planned, the Royce Model 711 portable Suspended Solids / Interface Level analyzer or similar hand held instrument will be used to collect real-time measurements in the river. The instrument is a rugged and waterproof device that provides reliable operation in rivers, lakes and other aqueous environments. SCE&G has utilized this instrument to conduct TSS monitoring at previous MGP related sediment remediation projects. Readings will be periodically obtained by project oversight personnel by lowering the instrument’s probe into the water column and recording the results in a field logbook or daily monitoring form.

Remote Buoy Mounted Instrumentation

Project personnel may utilize the bouy system when the hand held instrument will not provide representative TSS information and/or the appropriate monitoring location is not readily accessible. The remote buoy will contain a portable monitoring instrument capable of conducting continuous TSS monitoring and transmitting the real-time data to shore where it can be viewed and compared to the applicable action level.

Currently SCE&G envisions utilizing the YSI EXO1 Sonde multiparameter portable instrument and the EXO Turbidity Sensor with TSS functionality. The EXO1 can continuously collect data and store it onboard the instrument, transfer it to a data collection platform (DCP), or relay it directly to a PC or EXO handheld device. Communication to the instrument is accomplished by using a field cable, Bluetooth® wireless connection, or a USB connection. Since the instrumentation will likely be staged or moored within the Congaree River and access may be limited or difficult, the Bluetooth® wireless connection will be the likely method for data transmission.

If the remote system is utilized the data will be downloaded or collected on a periodic basis throughout the day by oversight personnel and compared to the action level. For both handheld and the remote system, an effort will be made to place the sensor at approximately the midpoint of the water column in order to obtain a representative sample.

The same instrumentation and techniques will be employed to conduct the background monitoring, if required. Handheld devices will likely be utilized, if possible, and the remote system will be installed if adequate and representative background TSS concentrations cannot be obtained using the handheld device.

Measurement Frequency

Pre-construction readings will be taken on a daily basis in order to document river TSS levels prior to commencement of construction activities. Once construction activities begin for the day the TSS readings will be obtained at approximate two-hour intervals. Either handheld readings will be conducted by field personnel or the remote buoy will be deployed and the data downloaded or checked on the two-hour intervals. Monitoring will continue at this frequency while work is being conducted and one final reading will be obtained after river construction activities are completed for the day to document post construction conditions. If the action level is exceeded at any point during the day, background monitoring will be initiated and the results compared to determine if mitigation measures are required.

If the downstream readings are less than the 1.25 times the background threshold, work will continue and downstream monitoring frequencies will remain at the approximate two-hour frequency. If the 1.25 threshold is exceeded, the appropriate mitigation measures will be employed and monitoring will be conducted on an hourly basis until work is completed for the day or the action levels are no longer exceeded.

CONTINGENCY MEASURES

After an exceedance of the action level has been observed and it can be readily attributed to project activities, the following contingency measures will be implemented:

- A Stop Work Order will be issued to the construction contractor;
- A silt curtain, also referred to as a turbidity curtain, will be installed and maintained around the work area and work will continue;
- If the action level exceedance continues, another Stop Work Order will be issued, an immediate inspection of the silt curtain will be performed and repairs, and redeployment or replacement of the silt curtain will be made as appropriate;
- If the exceedance can be attributed to a damaged or dislocated silt curtain and repairs or redeployment are completed to the satisfaction of on-site personnel (QA/QC, regulatory agency representatives, or others) – work can then continue;
- If required, a second silt curtain will be deployed (outside of the first) and work will continue; and

- If the action level exceedance persists after the above measures have been implemented, another Stop Work Order will be issued, the situation will be re-evaluated by field personnel to determine additional contingency measures.

REPORTING

Daily reports of TSS monitoring results will be maintained on-site. Sustained action level exceedances, should they occur, (and any subsequently implemented contingency measures) will be communicated via telephone to the appropriate SCDHEC representative within 24 hours of the exceedance.

REFERENCES

SCDHEC, June 22, 2012, R. 61-68, Water Classifications & Standards.

SCDHEC, Water Quality Indicators.

EPA, STORET Data Warehouse, http://www.epa.gov/storet.

FIGURES

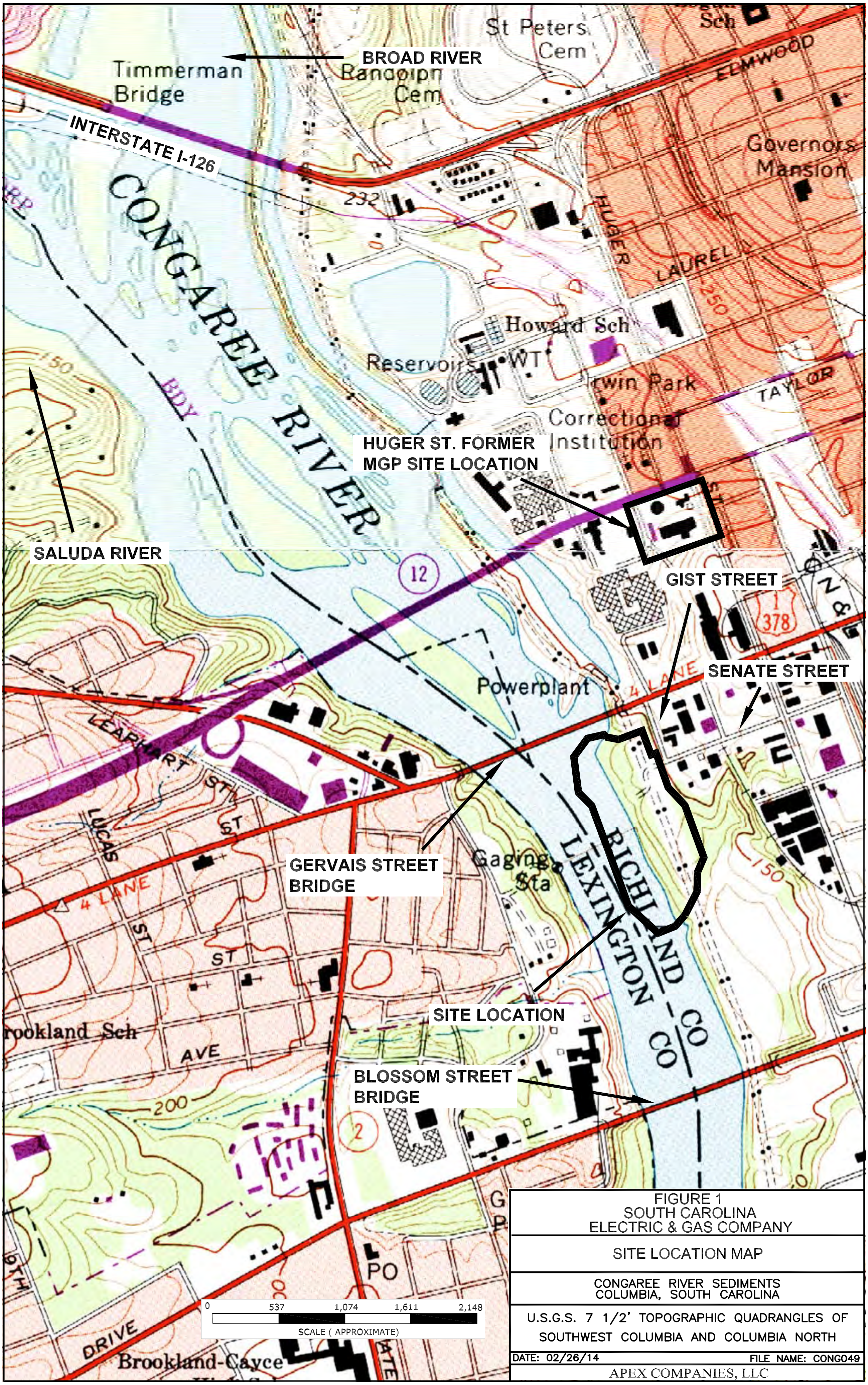


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

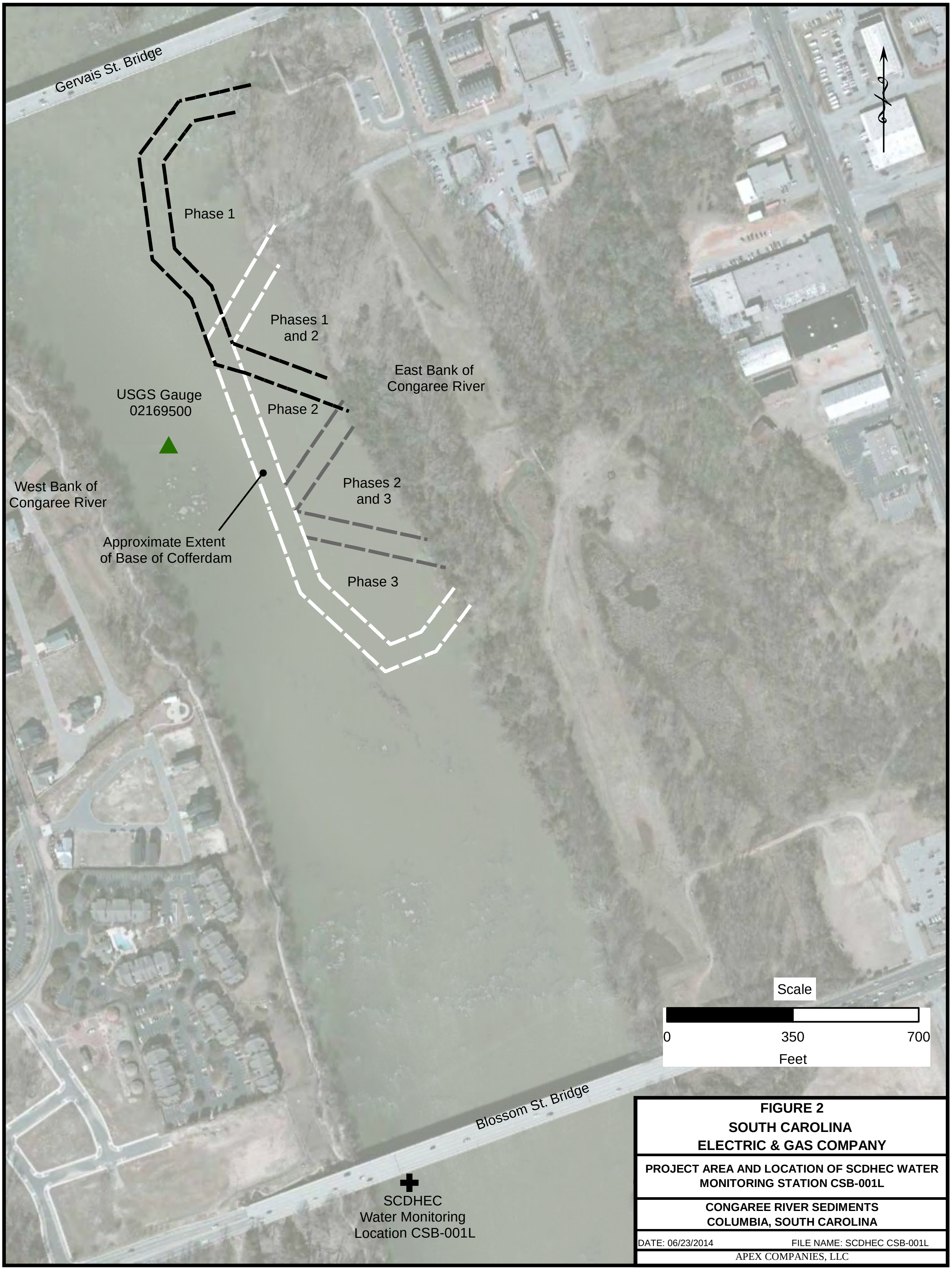


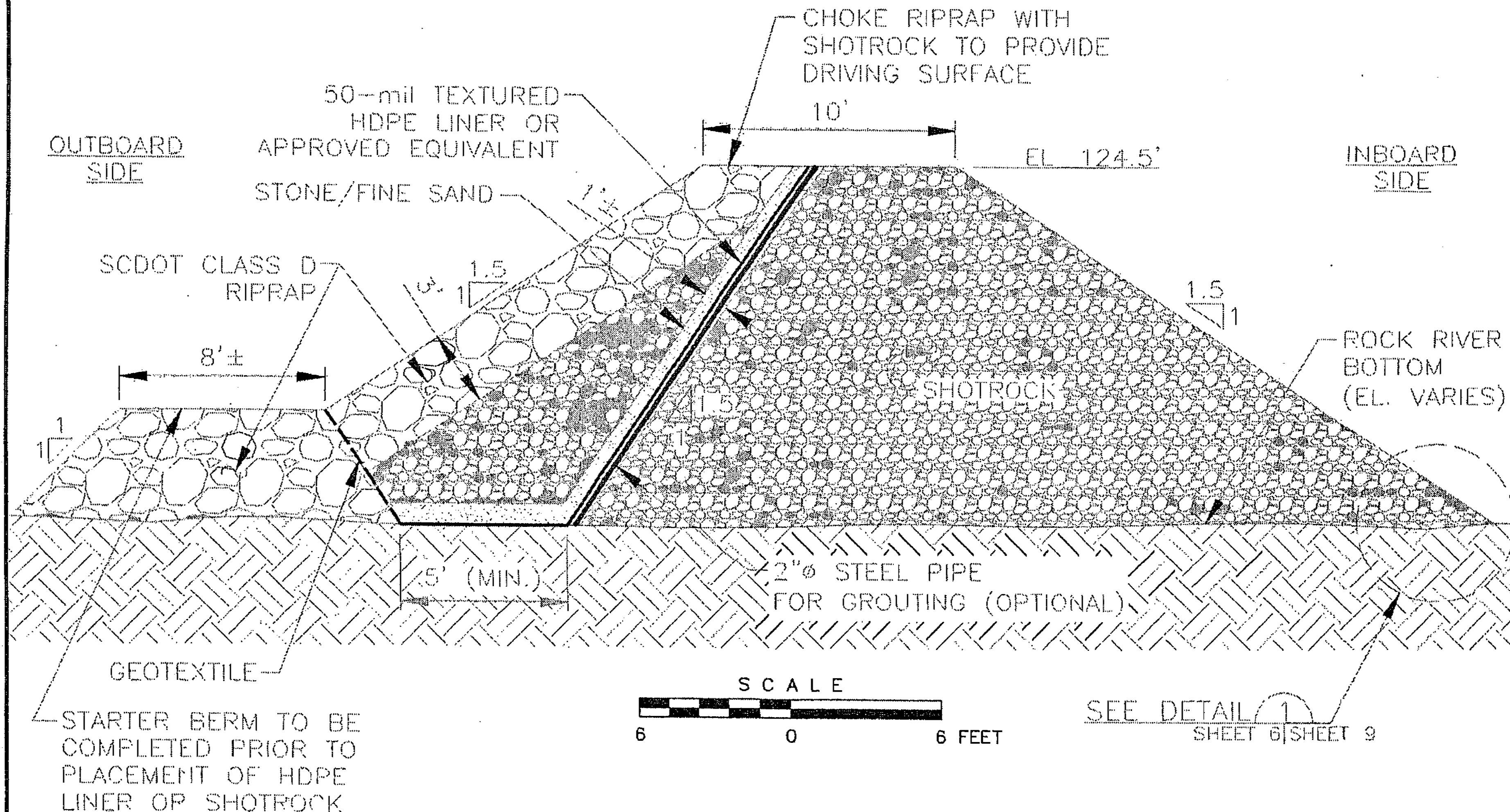
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PROJECT AREA AND LOCATION OF SCDHEC WATER MONITORING STATION CSB-001L

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/23/2014 FILE NAME: SCDHEC CSB-001L

APEX COMPANIES, LLC



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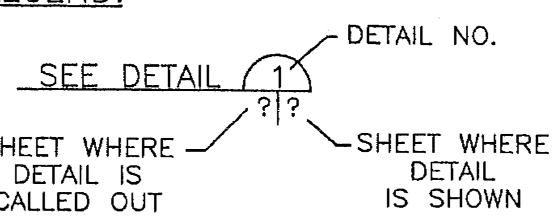


FIGURE 3

TYPICAL COFFERDAM SECTION

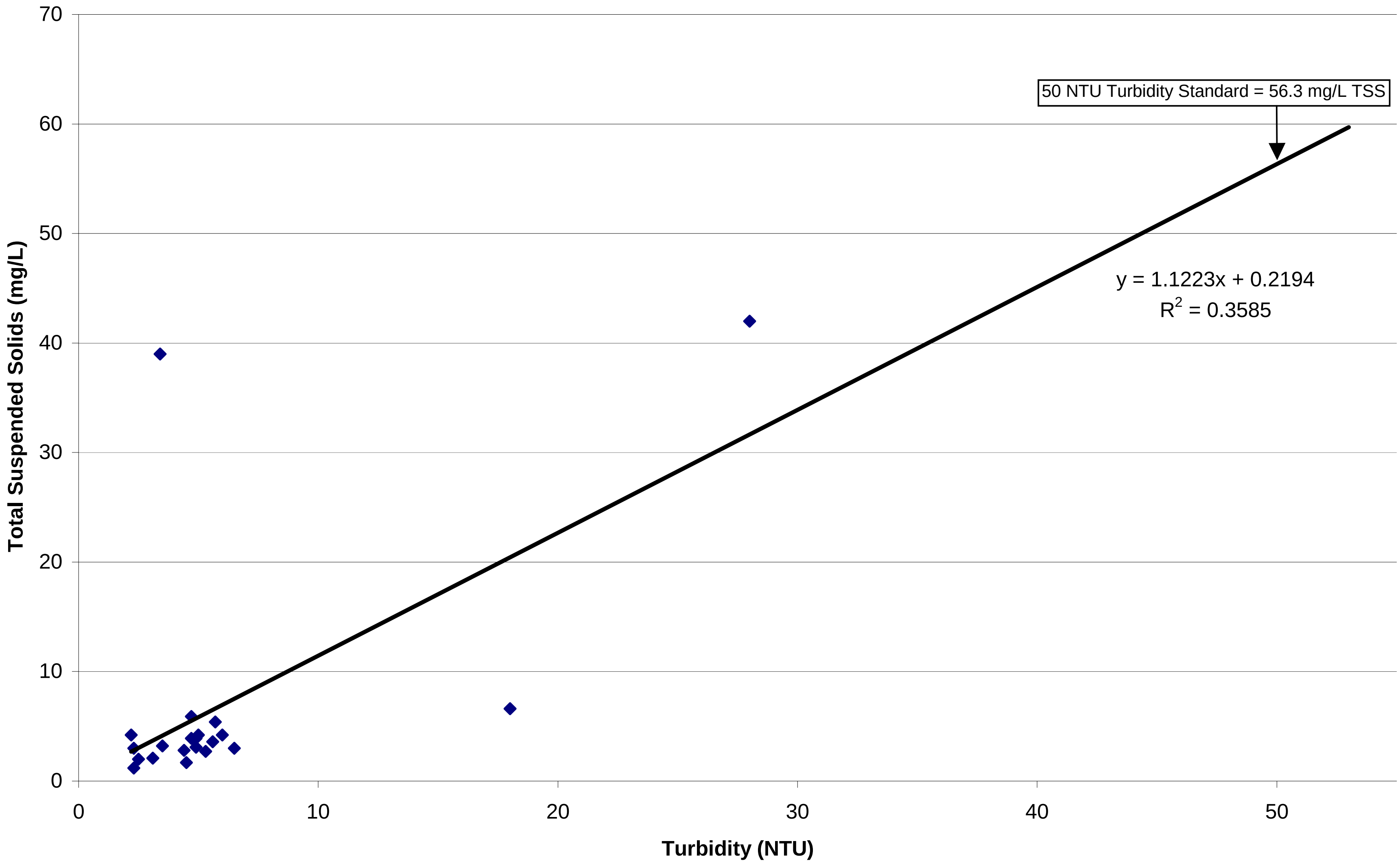
PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A8
1:1	DATE	07-09-12	APPROVED BY	JDD	6/23/14		

FIGURE 4
Total Suspended Solids vs. Turbidity
at SCDHEC Water Monitoring Station CSB-001L



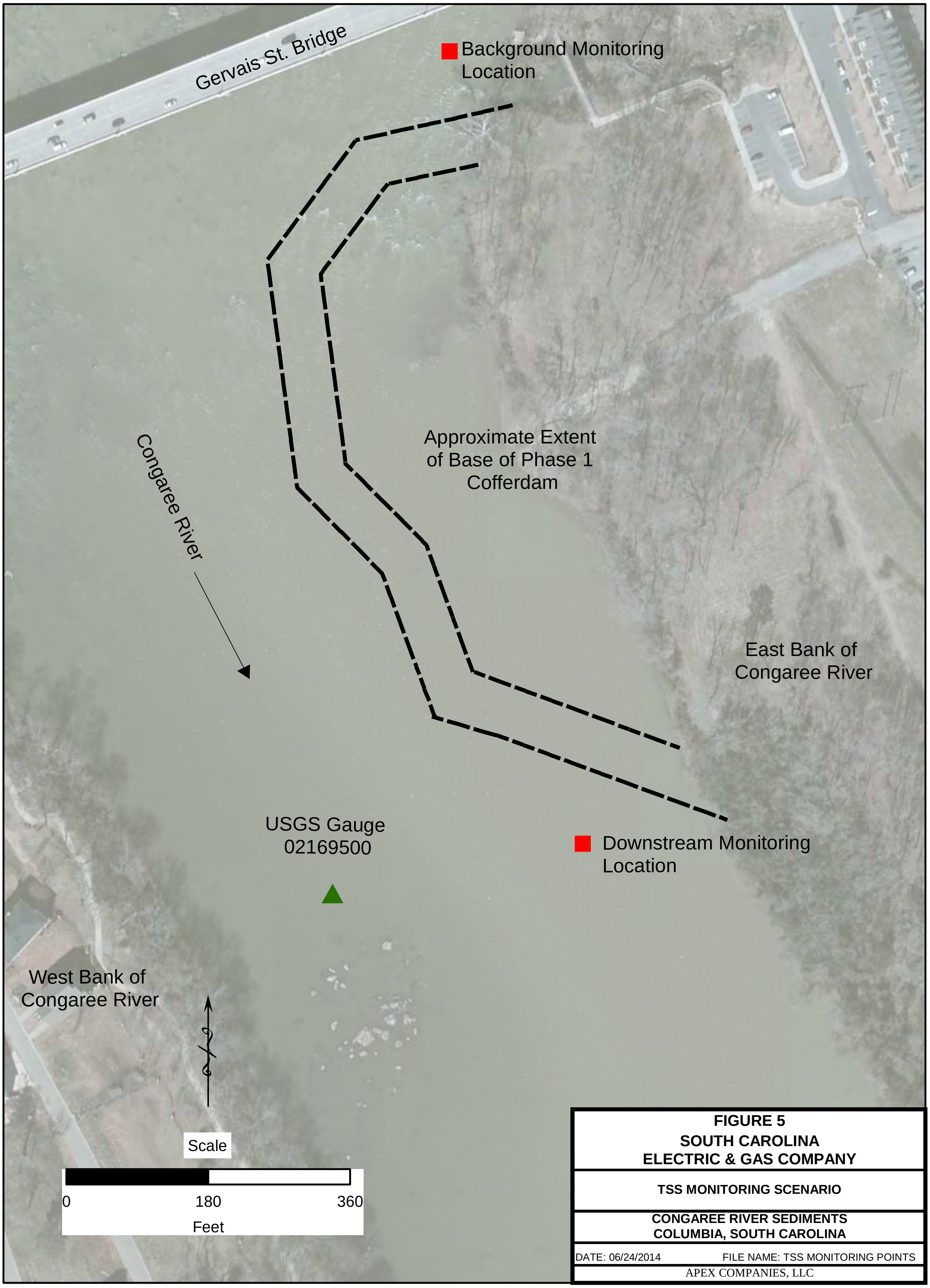


FIGURE 5
SOUTH CAROLINA ELECTRIC & GAS COMPANY

TSS MONITORING SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/24/2014 FILE NAME: TSS MONITORING POINTS

APEX COMPANIES, LLC

ATTACHMENT A

Enhance Data Collection with these EXO Components

EXO Handheld

The EXO handheld provides an extremely durable, portable, weather-proof interface to the EXO sondes. The handheld uses a mobile version of the KOR interface software.

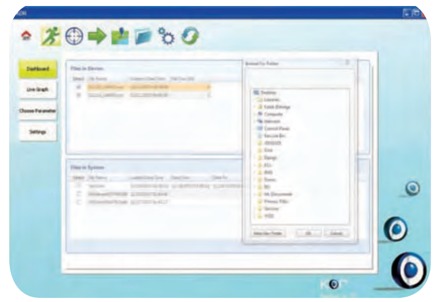
Additional standard features:

- GPS
- Temperature-compensated barometer
- Backlit alphanumeric keypad
- Microphone/speaker
- Wet-mate wireless connector
- Bluetooth communication
- Color LED screen
- 2 GB of storage
- Rechargeable battery capable

Interface with the EXO Sonde using the EXO Handheld Display

KOR Interface Software

The KOR Software offers users the capability to easily manage, visualize, and organize large amounts of field data. KOR also provides an interface to the EXO products for fast calibration, configuration, QA/QC or data collection.



- New calibration processes for long-term monitoring
- Graphical user interface for quick data analysis
- Multiple languages

Multiple Data Output Options

Sonde output is readable by YSI handheld instruments, interface software, and data telemetry modules. In addition to the cable (standard), these communication interfaces are also available:

DCP Signal Output Adapter

Wires into the end of the YSI field cable via flying leads and converts signal to RS-232 or SDI-12 for datalogger applications.

USB Adapter

Allows connections between an EXO sonde and a PC.

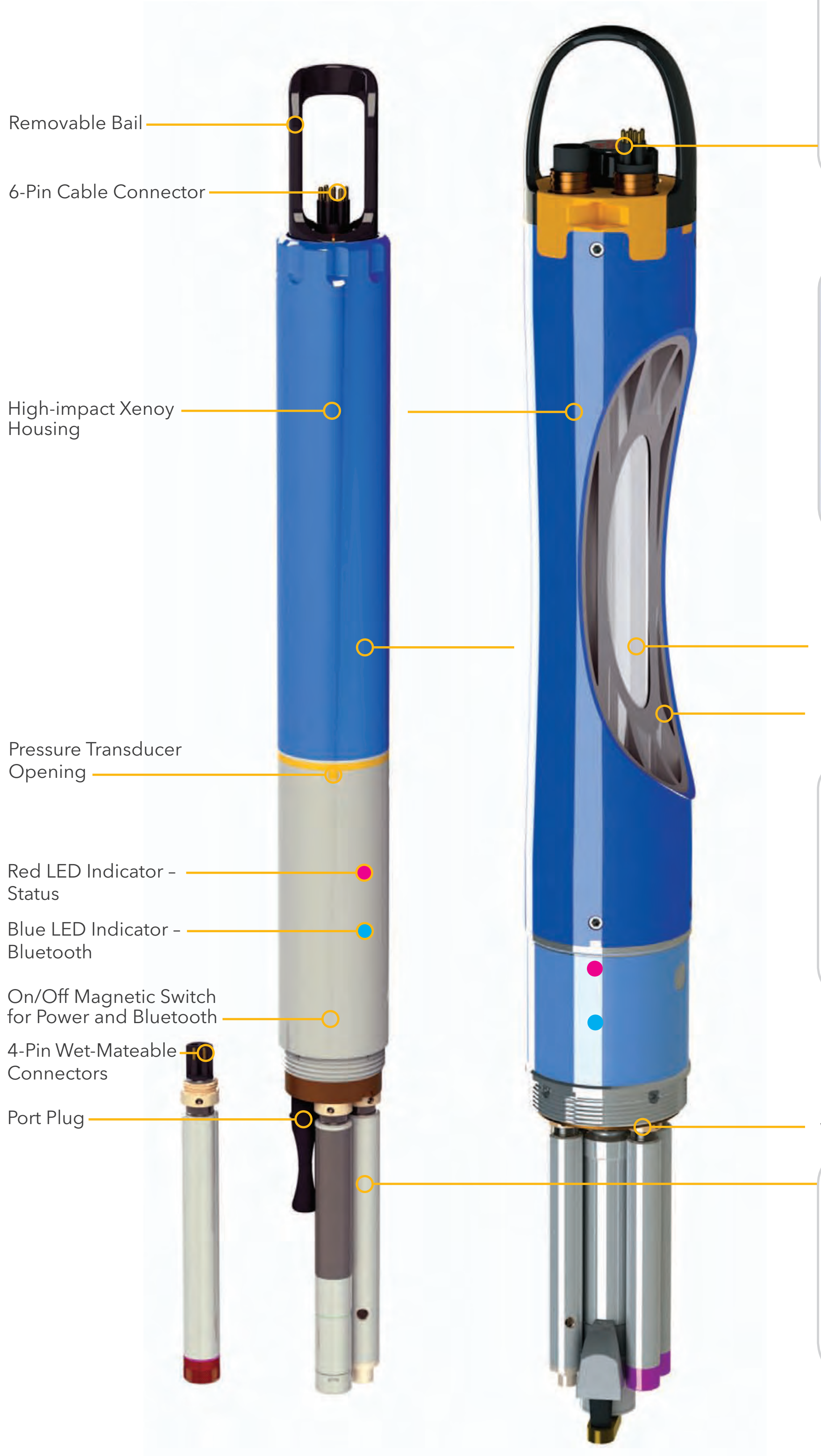
Bluetooth Wireless Technology

Enables communication between a sonde and a user in the lab and pre-deployment in the field.

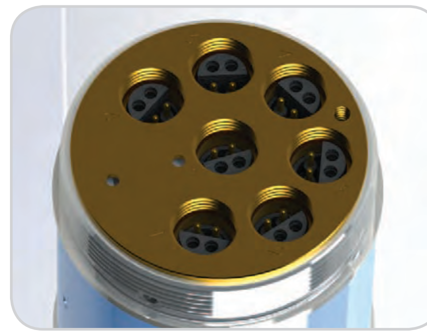
DCP Signal Output Adapter

USB Adapter

Sondes: EXO1 EXO2



Cable connector, battery valve, and expansion port for an additional sensor



EXO2 sonde contains 6 universal sensor ports plus a central port for an anti-fouling wiper

Wiper keeps sensors clear of biofouling

EXO1 sonde contains 4 universal sensor ports

Instrument Specifications*

EXO1 Sonde		
Ports	4 sensor ports Peripheral port: 1 power communication port	
Size	Diameter: 4.70 cm (1.85 in) Length: 64.77 cm (25.50 in)	
Weight	1.42 kg (3.15 lbs) with 4 probes, guard and batteries installed	
EXO2 Sonde		
Ports	7 sensor ports (6 ports available when central wiper used) Peripheral ports: 1 power communication port; 1 auxiliary expansion port	
Size	Diameter: 7.62 cm (3.00 in) Length: 71.10 cm (28.00 in)	
Weight	3.60 kg (7.90 lbs) with 5 probes, guard and batteries installed	
Sondes		
Operating Temperature	-5 to 50°C	
Storage Temperature	-20 to 80°C (except 0 to 60°C for pH and pH/ORP sensors)	
Depth Rating	0 to 250 m (0 to 820 ft)	
Communications	Computer Interface: Bluetooth wireless technology, RS-485, USB Output Options: USB with signal output adapter (SOA); RS-232 & SDI-12 with DCP-SOA	
Sample Rate	Up to 4 Hz	
Battery Life	90 days**	
Data Memory	512 MB total memory; >1,000,000 logged readings	
Sensors		**Calculated Parameters**
Ammonium**	ORP	Salinity
Chloride**	pH	Specific Conductance
Conductivity	Temperature	Total Dissolved Solids
Depth	Total Algae (Chlorophyll + BGA-PC or PE**)	Total Suspended Solids
Dissolved Oxygen	Turbidity	
Fluorescent Dissolved Organic Matter (fDOM)	Vented Level**	
Nitrate**		
EXO Handheld		
Size	Width: 12.00 cm (4.72 in) Height: 25.00 cm (9.84 in)	
Weight	0.71 kg (1.56 lbs) without batteries	
Operating System	Windows CE 5.0	
Operating Temperature	-10 to 50°C	
Storage Temperature	-20 to 80°C	
IP Rating	IP-67	
Data Memory	2 GB total memory; >2,000,000 data sets	
Accessories		
Cables (non-vented)	Flow cells	Sonde/sensor guard
Carrying case	KOR software	Calibration cup
DCP Signal Output Adapter	USB Signal Output Adapter	Anti-fouling components
Warranty		
1 Year	pH, ORP, and optical DO membranes	
2 Years	Cables, sondes (bulkheads), handheld, and the following sensors: conductivity, temperature, depth, and optical sensors	

* Specifications indicate typical performance and are subject to change. Please check EXOwater.com for up-to-date information.

** Typically 90 days at 20°C at 15-minute logging interval; temperature/conductivity, pH/ORP, DO, and turbidity sensors installed on EXO1; or temperature/conductivity, pH/ORP, DO, total algae, and turbidity sensors installed with central wiper that rotates once per logging interval on EXO2. Battery life is heavily dependent on sensor configuration.

EXO Bluetooth modules comply with Part 15C of FCC Rules and have FCC, CE Mark and C-tick approval. Bluetooth-type approvals and regulations can be country specific. Check local laws and regulations to insure that the use of wireless products purchased from Xylem are in full compliance.

** Release in 2013. BGA-PE specs TBD.

Sensor Specifications*

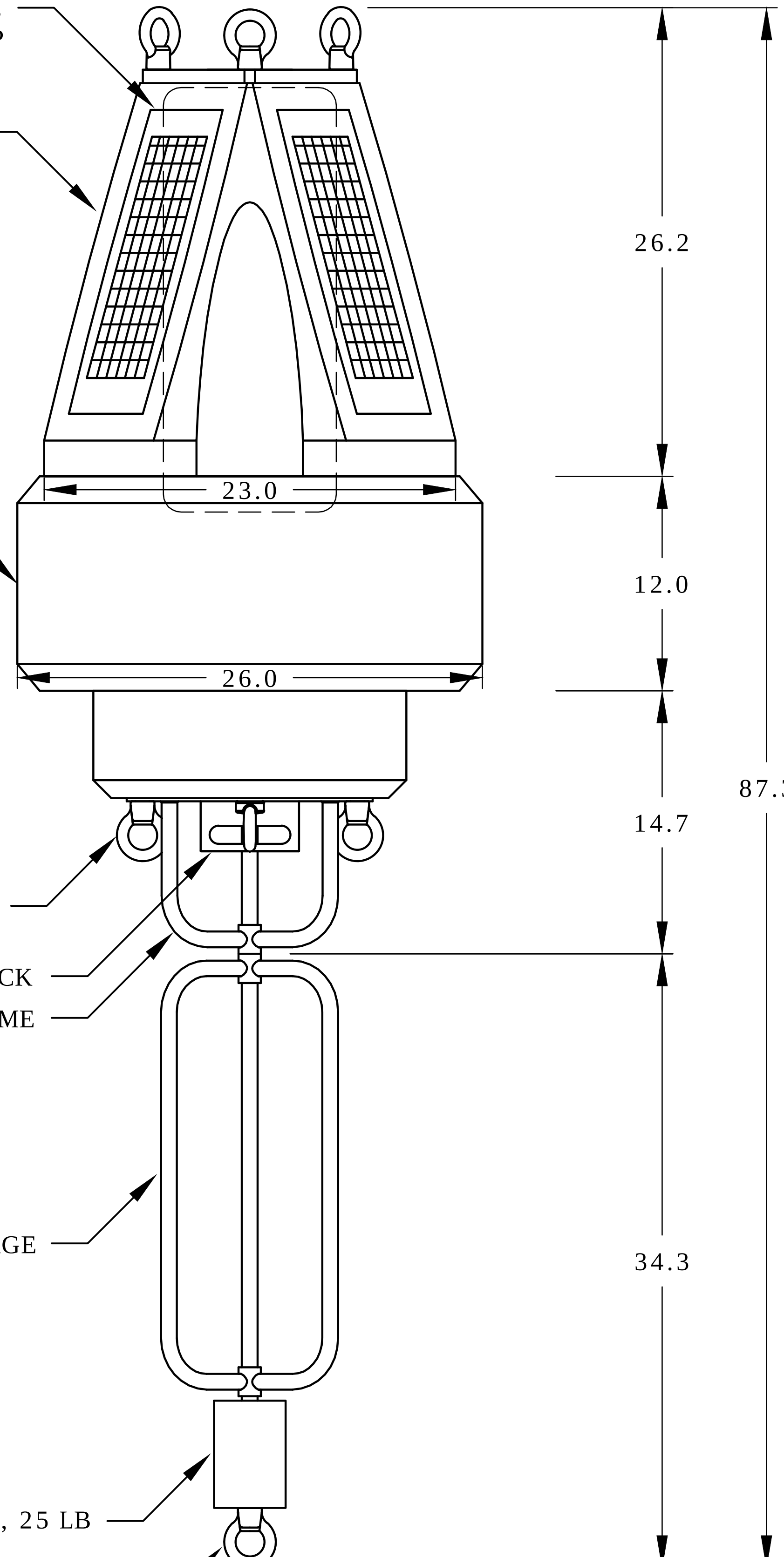
Sensor	Range	Accuracy*	Response	Resolution
Ammonium** [11] (ammonia with pH sensor)	0 to 200 mg/L [1]	±10% of reading or 2 mg/L-N, w.i.g.	-	0.01 mg/L
Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	–	0.1 mmHg
Blue-green Algae Phycocyanin (PC) or Phycoerythrin (PE)** (part of Total Algae sensor)	0 to 100 µg/L PC; 0 to 100 RFU	Linearity: $R^2 > 0.999$ for serial dilution of Rhodamine WT solution from 0 to 100 µg/mL PC equivalents Detection Limit: 0.04 µg/L PC	T63<2 sec	0.01 µg/L PC; 0.01 RFU
Chloride** [11]	0 to 1000 mg/L [2]	±15% of reading or 5 mg/L, w.i.g.	–	0.01 mg/L
Chlorophyll (part of Total Algae sensor)	0 to 400 µg/L Chl; 0 to 100 RFU	Linearity: $R^2 > 0.999$ for serial dilution of Rhodamine WT solution from 0 to 400 µg/L Chl equivalents Detection Limit: 0.09 µg/L Chl	T63<2 sec	0.01 µg/L Chl; 0.01 RFU
Conductivity [3]	0 to 200 mS/cm	0 to 100: ±0.5% of reading or 0.001 mS/cm, w.i.g.; 100 to 200: ±1% of reading	T63<2 sec	0.0001 to 0.01 mS/cm (range dependent)
Depth [4] (non-vented)	0 to 10 m (0 to 33 ft)	±0.04% FS (±0.004 m or ±0.013 ft)	T63<2 sec	0.001 m (0.001 ft) (auto-ranging)
	0 to 100 m (0 to 328 ft)	±0.04% FS (±0.04 m or ±0.13 ft)		
	0 to 250 m (0 to 820 ft)	±0.04% FS (±0.10 m or ±0.33 ft)		
Vented Level**	0 to 10 m (0 to 33 ft)	±0.03% FS (±0.003 m or ±0.010 ft)		
Dissolved Oxygen Optical	0 to 500% air saturation	0 to 200%: ±1% of reading or 1% saturation, w.i.g.; 200 to 500%: ±5% of reading [5]	T63<5 sec [6]	0.1% air saturation
	0 to 50 mg/L	0 to 20 mg/L: ±0.1 mg/L or 1% of reading, w.i.g.; 20 to 50 mg/L: ±5% of reading [5]		0.01 mg/L
fDOM	0 to 300 ppb Quinine Sulfate equivalents (QSE)	Linearity: $R^2 > 0.999$ for serial dilution of 300 ppb QS solution Detection Limit: 0.07 ppb QSE	T63<2 sec	0.01 ppb QSE
Nitrate** [11]	0 to 200 mg/L-N [1]	±10% of reading or 2 mg/L-N, w.i.g.	–	0.01 mg/L
ORP	-999 to 999 mV	±20 mV in Redox standard solutions	T63<5 sec [7]	0.1 mV
pH	0 to 14 units	±0.1 pH units within ±10°C of calibration temp; ±0.2 pH units for entire temp range [8]	T63<3 sec [9]	0.01 units
Salinity (Calculated from Conductivity and Temperature)	0 to 70 ppt	±1.0% of reading or 0.1 ppt, w.i.g.	T63<2 sec	0.01 ppt
Specific Conductance (Calculated from Conductivity and Temperature)	0 to 200 mS/cm	±0.5% of reading or .001 mS/cm, w.i.g.	–	0.001, 0.01, 0.1 mS/cm (auto-scaling)
Temperature	-5 to 50°C	-5 to 35°C: ±0.01°C [10] 35 to 50°C: ±0.05°C [10]	T63<1 sec	0.001 °C
Total Dissolved Solids (TDS) (Calculated from Conductivity and Temperature)	0 to 100,000 g/L Cal constant range 0.30 to 1.00 (0.64 default)	Not Specified	–	variable
Total Suspended Solids (TSS) (Calculated from Turbidity and TDS)	0 to 1500 mg/L	Not Specified	T63<2 sec	variable
Turbidity [11]	0 to 4000 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, w.i.g.; 1000 to 4000 FNU: ±5% of reading [12]	T63<2 sec	0 to 999 FNU: 0.01 FNU; 1000 to 4000 FNU: 0.1 FNU

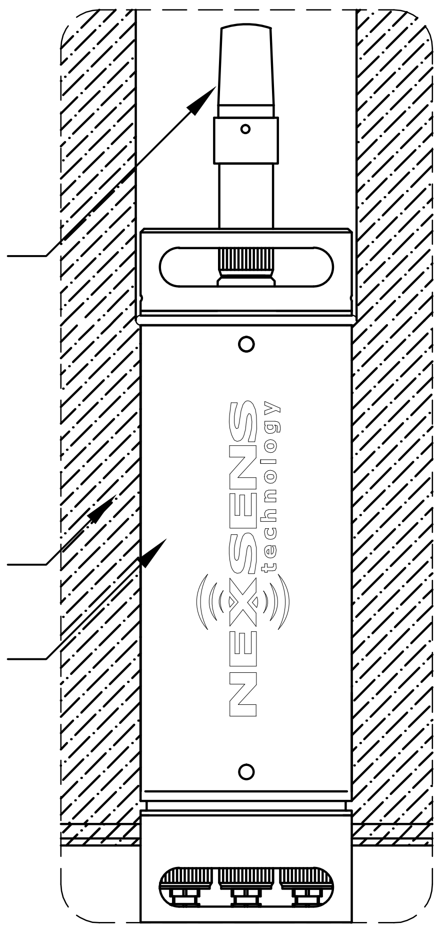
All sensors have a depth rating to 250 m (820 ft), except shallow and medium depth sensors and ISEs. EXO sensors are not backward compatible with 6-Series sondes.

* Specifications indicate typical performance and are subject to change. Please check EXOwater.com for up-to-date information.
Accuracy specification is attained immediately following calibration under controlled and stable environmental conditions. Performance in the natural environment may vary from quoted specification.

[1] 0-30˚C [2] 0-40˚C w.i.g. = whichever is greater
[3] Outputs of specific conductance (conductivity corrected to 25˚C) and total dissolved solids are also provided. The values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (Ed. 1989).
[4] Accuracy specifications apply to conductivity levels of 0 to 100,000 µS/cm.
[5] Relative to calibration gases
[6] When transferred from air-saturated water to stirred deaerated water
[7] When transferred from water-saturated air to Zobell solution
[8] Within the environmental pH range of pH 4 to pH 10
[9] On transfer from water-saturated air to rapidly stirred air-saturated water at a specific conductance of 800 µS/cm at 20˚C; T63<5 seconds on transfer from water-saturated air to slowly-stirred air-saturated water.
[10] Temperature accuracy traceable to NIST standards
[11] Calibration: 1-, 2-, or 3-point, user-selectable
[12] Specification is defined in AMCO-AEPA Standards

** Release in 2013. BGA-PE specs TBD.





BUOY HOOD SECTION CUT
(2X SCALE)

CB-200 DATA BUOY DIMENSIONAL VIEW

SCALE: 1:10

DRAWN BY: MHD
DATE: 8/6/13
SHEET: 1 of 1

ITEM: NEXSENS CB-200 COASTAL DATA BUOY
SHEET TITLE: DATA BUOY DIMENSIONAL VIEW
REV: 01
DRAWING NUMBER: NEX177

Model 711 Portable
Suspended Solids and Interface Level Analyzer

Model 711 Specific Features

- **Two analyzers in one package:**
  Switch from Solids measurement to Interface level without losing calibration.
- **Automatic ranging:**
  Goes completely over the operating range of the analyzer with manual adjustment.
- **Simple, insitu calibration:**

The Royce **Model 711** Portable Suspended Solids/ Interface Level Analyzer is a rugged, waterproof instrument designed for the rigors of remote sampling. The meter provides reliable operation in waste treatment plants, rivers, lakes and other aqueous systems. the meter will read in either grams per liter when in the suspended solids mode or relative density percentage while in the interface level mode of operation.

The **Model 711** stores the calibration values for suspended solids and interface level in two separate non-volitale memory locations allowing the user to switch between operational modes without having to recalibrate. The net effect is two analyzers in one.

Due to the full utilization of the microprocessor, calibration values are stored so that recalibration is not required on a daily basis. If the sensoris cleaned after use, monthly calibration is usualyy more than sufficient for proper operation in eithermode of calibration.

The **Model 711** analyzer utilizes the **Model 71** medium range sensor. The **Model 71** is a rugged, reliable sensing element that has polymer optical grade lenses. It was designed specifically to meet the rigorous demands that are a requirement for a portable sensor.

Model 711 / 71 Specifications

Range:
0 - 10 grams per liter (o to 10,000 mg/l)
Readout Device:
Harsh environment, 1/2" LCD digital display
Input Power:
Standard 9V battery
Enclosure:
Waterproof
Size:
7 inches long
3.2 inches wide
1.5 inches deep
Weight:
1.5 pounds (.68 kgms)

Type:
Single Gap, Optical
Accuracy: ± 5% of reading or ± 100 mg/l, whichever is greater
Repeatability:
± 1% of reading or ± 20 mg/l, whichever is greater
Range:
0 - 10 g/l
Operating Limits:
Temperature, 0 - 65^{o} C
Pressure, o - 50 PSIG
Size:
4 inches long
2 inches diameter
Weight:
1 pound (.45 kgms)
Construction:
Polyurethane body
Optical grade ploymer lenses

Supplied Standard with Model 711 System

- **Model 711** rugged Suspended Solids analyzer
- **Model 71** rugged SS sensor with 8 meters or 25 feet of cable and waterproof, military connector.
  Cable is scaled in one foot increments.
- Velcro "grip strap" which can convert to a handy belt holder.
- 9V battery.
- Detailed instruction manual.

APPENDIX G

COFFERDAM INSPECTION AND MAINTENANCE PLAN

COFFERDAM INSPECTION AND MAINTENANCE PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

COFFERDAM INSPECTION AND MAINTENANCE PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment in phases. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in the river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

It is important to note that completion of the dewatering and water management aspects of the project are addressed in detail in the Water Management Plan included in the Removal Action Plan (RAP).

COFFER DAM CONCEPTUAL DESIGN

The conceptual design for the cofferdam was completed by Paul C. Rizzo and Associates, Inc. A copy of the most recently updated design is provided in Attachment A. Some key elements of the cofferdam design that are applicable to this plan include:

- An outlet structure, which provides drainage of the cofferdam due to an overtopping event; and
- An overtopping structure, which is intended to minimize the impact of a relatively minor overtopping event.

The outlet structure will be the primary means of dewatering the cofferdam area for each phase or after an overtopping event. As designed, the outlet structure is an 18-inch diameter, Schedule 80, PVC pipe that extends from within the cofferdam, through the wall of the cofferdam on the down gradient side, and will discharge to the river. A collection device (i.e., drainage basin) will be installed inside the cofferdam. A Tideflex (or equivalent) check valve will be installed at the discharge point. The contractor will also be required to provide a means to control (i.e., stop and/or regulate) the discharge rate.

The overtopping structure will be constructed on top of the cofferdam. As designed, the overtopping structure will add approximate 1 foot of elevation to the cofferdam at the upstream locations. Riprap will be placed at the top of the dam and grouted into place. This surface finish is intended to provide additional protection from a relatively minor overtopping event.

COFFERDAM CONCEPTUAL DESIGN AND STABILITY ANALYSIS

In addition to the conceptual design, a stability analysis was also completed by Rizzo and Associates and is included as Attachment B. The Cofferdam Stability Analysis and calculations were prepared to analyze the stability of the proposed cofferdam, as constructed with the various planned materials (i.e., shotrock, SCDOT Class D riprap, stone/fine sand and native bedrock).

The slope stability analysis for the proposed cofferdam was performed with the water surface at the crest of the cofferdam for the upstream side, which corresponds to Elevation 123.5 (NAVD ‘88). The cofferdam analysis was performed at the location of the tallest section of the cofferdam with the water level at the crest on the outboard (upstream) side and no water on the inboard (downstream) side. As shown in the calculations, the conceptual design of the cofferdam meets the recommended factors of safety.

As stated in Attachment B, no additional analyses are required and the design of the cofferdam is considered suitable for the conditions analyzed. However, based on recent comments received from the USACE, an evaluation of potential failure scenarios is provided at the end of this document.

INSPECTION AND MAINTENANCE

Overview

Initial project activities will consist of constructing the landside support zone and installing the cofferdam around the planned Phase 1 excavation area. Figure 2 shows the cofferdam phases, current site operations plan scenario and the landside support zone components. The landside support zone will consist of a series of gravel roads and equipment/material storage areas and at least two temporary structures.

As designed, the cofferdam will consist of a starter berm, stone riprap shotrock and HDPE liner, with provisions for adding grout through multiple 2-inch diameter steel pipes to seal the bottom interface. The cofferdam will be constructed around the planned work area to isolate it from the remainder of the river and permit dewatering and excavation of the impacted sediment. Figure 3 shows a cross-section of the cofferdam to illustrate how it will be constructed. Once the cofferdam is in place and the area dewatered, the sediment removal activities will commence. The cofferdam is designed to significantly restrict the flow of water into the planned work area, although it is not anticipated to be watertight. As a result, an estimated 500–1,800 gallons per minute of leakage water is expected to penetrate the cofferdam for the Phase 1 work. This leakage water will require management by remediation personnel on a daily basis. Water management activities are addressed in a separate plan.

During construction and operation of the cofferdam, a number of factors will need to be routinely monitored in order to ensure that remediation personnel complete the project safely and that the cofferdam structure functions as intended. Two main factors that could adversely impact the cofferdam and the remediation process are leakage and overtopping events. [Please see the discussion below regarding various types of failures for the cofferdam.] Leakage, as described above, will need to be closely monitored in order to ensure that dewatering activities are sufficient and that the water management system capacity is adequate. Overtopping events are situations when the river level will rise above the top of the cofferdam and flood the interior of the structure. The riprap cofferdam structure was selected for this project due to its resistance to damage from overtopping events. In addition, the design elevation for the top of the cofferdam at 123.5 feet will be sufficient to resist a significant increase in the river water height. However, overtopping is anticipated and advance notice will be important in order to evacuate personnel and equipment and secure exposed impacted material prior to being overtopped.

Real time Inspections

Obviously, all personnel working at the site will be keenly aware of the river conditions and the potential for leakage/overtopping events. Visual observations by on-site personnel will be the primary means for inspection of the cofferdam. During working hours, on-site personnel will serve as continuous visual monitors to providing real time observations to detect any potential problems as they may arise. For non-working hours, site security officers will provide oversight and contact remediation personnel in the event of uncontrolled leakage or an overtopping event. Depending upon the actual leakage rate, remediation personnel may be required to staff the dewatering equipment 24 hours per day. Obviously, as the river rises and the forecast is for additional precipitation, on-site personnel will increase their vigilance for motoring the effects on the cofferdam.

Routine Inspections – Active Construction Season

In order to ensure that the integrity of the cofferdam structure remains intact and that it adequately performs its intended functions, a competent member of the project team will conduct visual inspections of both the structure and surrounding area on a daily basis during the active construction season. The inspections will begin at the onset of the construction activities and end once the final portion of the cofferdam is removed following completion of each phase of work. Findings and observations will be documented and the contractor will be advised on any recommended/required repairs. Specific components of the cofferdam and the removal action that will be evaluated during the inspections will include:

- Inspecting the exterior (riverside) of the cofferdam for damage, erosion or a buildup of debris such as logs and other items deposited by the river;
- Inspection of the two riverbank tie-in locations where the cofferdam structure meets the shoreline for erosion or other potential issues;

- Obtaining photographs of potential problem areas in need of repairs and post-repair documentation;
- Inspection of the restricted access signage, solar powered lights, river buoy locations and other navigational aids installed to ensure that the general public and other river users are aware of the cofferdam and its specific access restrictions and navigational requirements;
- Notation of the river height and comparison of this height to the respective gage readings published by the USGS river gage number 02169500 located directly across the river (Figure 4);
- Review of the USGS projected river flows for that specific date and review of the planned river flows for the next 5 days to obtain advance notice of any river height fluctuations that may impact the project;
- Monitoring of planned flow modifications from the Saluda River Hydroelectric Dam located approximately 12 miles upriver to determine if a change in release volumes is planned within the next several days;
- Qualitatively assessing the volume of leakage water and comparing this volume to the previous few days to determine if the leakage volume is increasing, decreasing or remaining relatively constant;
- Identifying areas of significant leakage; and
- Reviewing the sediment excavation process to ensure that the riverbank sections not identified for removal are protected from damage from remediation activities.

The cofferdam and excavation area will be visually inspected daily. An inspection form/checklist will be completed on each date and any potential areas in need of repairs will be documented. A draft inspection form/checklist is provided as Attachment C. The daily report and a description/photographs of the area in need of repairs will be provided to the contractor to be addressed as soon as practical. The form can be revised, if required, once the project begins to better meet the needs of the inspection/contractor personnel. Completion of the inspection activities and use of the inspection form/checklist will result in:

- Resolving potential issues with the cofferdam structure or work area in a timely manner; and
- Providing a means for tracking river level fluctuations in order to help prepare for potential overtopping events.

Inspections will also be undertaken following an overtopping event and will continue as the river levels subside. Potential cofferdam damage, which occurred as a result of the overtopping event, will be rectified as soon as practical to allow for efficient dewatering of the isolated area and continuation of sediment removal activities.

Routine Inspections – “Standby Mode”

As currently planned, the cofferdam, once constructed, will remain in-place year round until it is relocated for the next phase of excavation. The active, or in-the-river construction season, will be May through December (pending approval). Cofferdam construction/relocation activities will be limited to this approved period. However, SCE&G is also seeking approval to work behind (or within) the cofferdam on a year round basis.

Overtopping events are much more likely to occur in the “winter months” (i.e., from December thru April), thereby limiting productivity. In the event that the cofferdam is overtopped during the winter months and the longer-term forecast does not appear to be conducive to re-starting the work, the project may enter a "standby mode". When in the standby mode, routine (daily) inspections will still occur, to the extent feasible given the cofferdam may be submerged under multiple feet of water. Once the water has receded, the integrity of the cofferdam structure will be re-evaluated by the project team. With consideration for the long-range forecast, the decision will be made to either remain in standby mode or resume working activities.

Routine inspections will continue during standby mode and the findings and observations will be documented.

COFFERDAM FAILURE EVALUATION

This cofferdam failure evaluation was developed in response to a recent comment from the USACE. A summary of cofferdam failure scenarios is presented on Table 1. Although these scenarios are referred to as "failures" in this evaluation, based on the Stability Analysis presented in Attachment B, "… the design of the cofferdam is considered suitable for the conditions analyzed" and therefore, the term "failure" may be a misnomer.

Basically there will be three types of failure considered, all attributed to an overtopping event:

- Minor overtopping;
- Major overtopping; and
- Catastrophic failure.

Leakage is not considered failure since it is anticipated and will be addressed appropriately, as discussed previously.

Table 1 presents some additional information relative to each type of failure listed above and correlates the overtopping event to a general river elevation. The summary table evaluates various degrees of potential failure of the cofferdam and discusses the likely extent of relative damage and provides an estimate of lost productivity.

TABLE 1

SUMMARY OF COFFERDAM FAILURE SCENARIOS
COFFERDAM INSPECTION AND MAINTENANCE PLAN

Congaree River Sediments
Columbia, South Carolina

Type of Failure	General River Elevation	Overtopping Height	Anticipated Extent of Damage
Minor Overtopping Event	> 123.5 to 124.5	0-1'	Minor erosion at the top of the cofferdam Minimal damage due to installation of overtopping structure and drainage outlet structure Dewatering efforts would be substantial, but manageable Minor damage to aids to navigation Estimated 1 week of lost productivity
Major Overtopping Event	> 124.5 to 130.5	1-7'	Likely more damage than a minor event, more erosion of the top of the cofferdam would be expected. The interface of the cofferdam and shoreline may be more susceptible to erosion After the river returned to below elevation 123.5, Dewatering efforts would be substantial, but manageable Aids to navigation will likely be damaged or lost and will need replaced Access roads into the excavation area would likely sustain moderate damage Estimated 2 weeks of lost productivity
Catastrophic Event	> 130.5 and above	>7'	For the most part, base of the coffer dam will remain intact. The riprap starter berm and wide base (~40 to 60 feet) will keep most of the structure in place. However, the smaller stone will likely be swept down stream, but remain with in the confines for the cofferdam. Access roads into the excavation area would likely sustain moderate damage. Site support facilities could be inundated/damaged Estimated 4 weeks of lost productivity

Notes:
Comparisons are relative and actual conditions may vary.
The rate of increase in the Congaree River may affect the impact on the cofferdam.

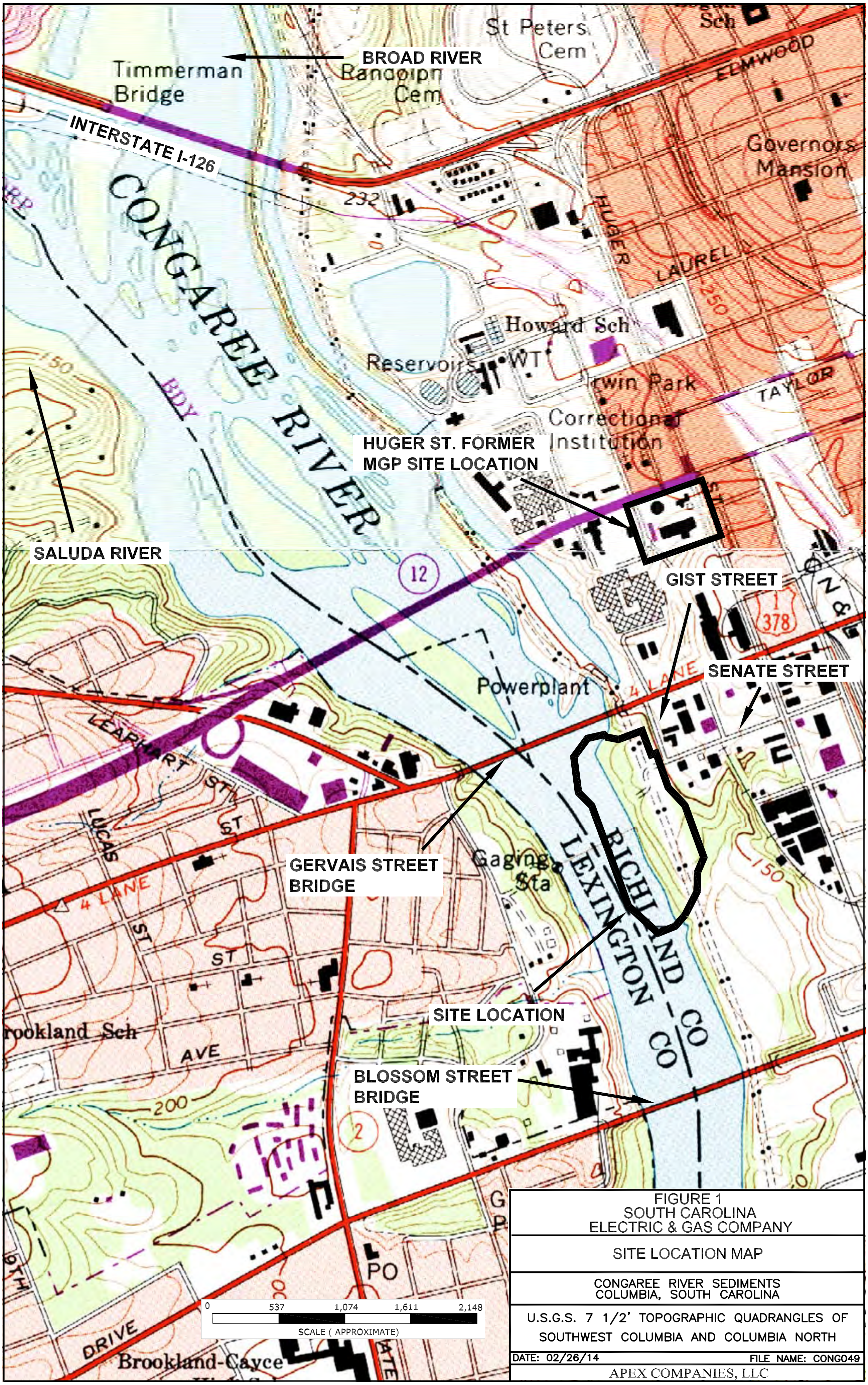


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

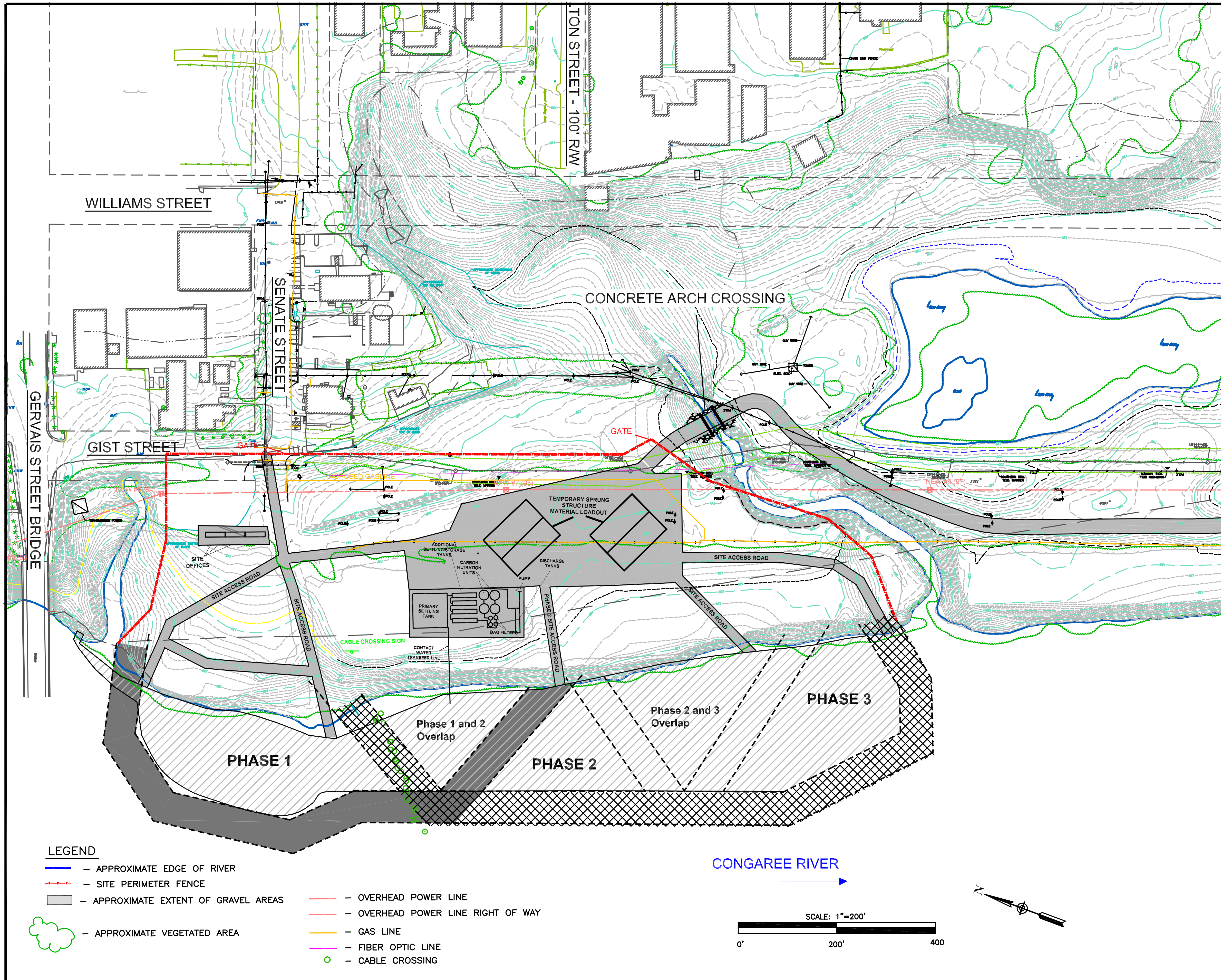


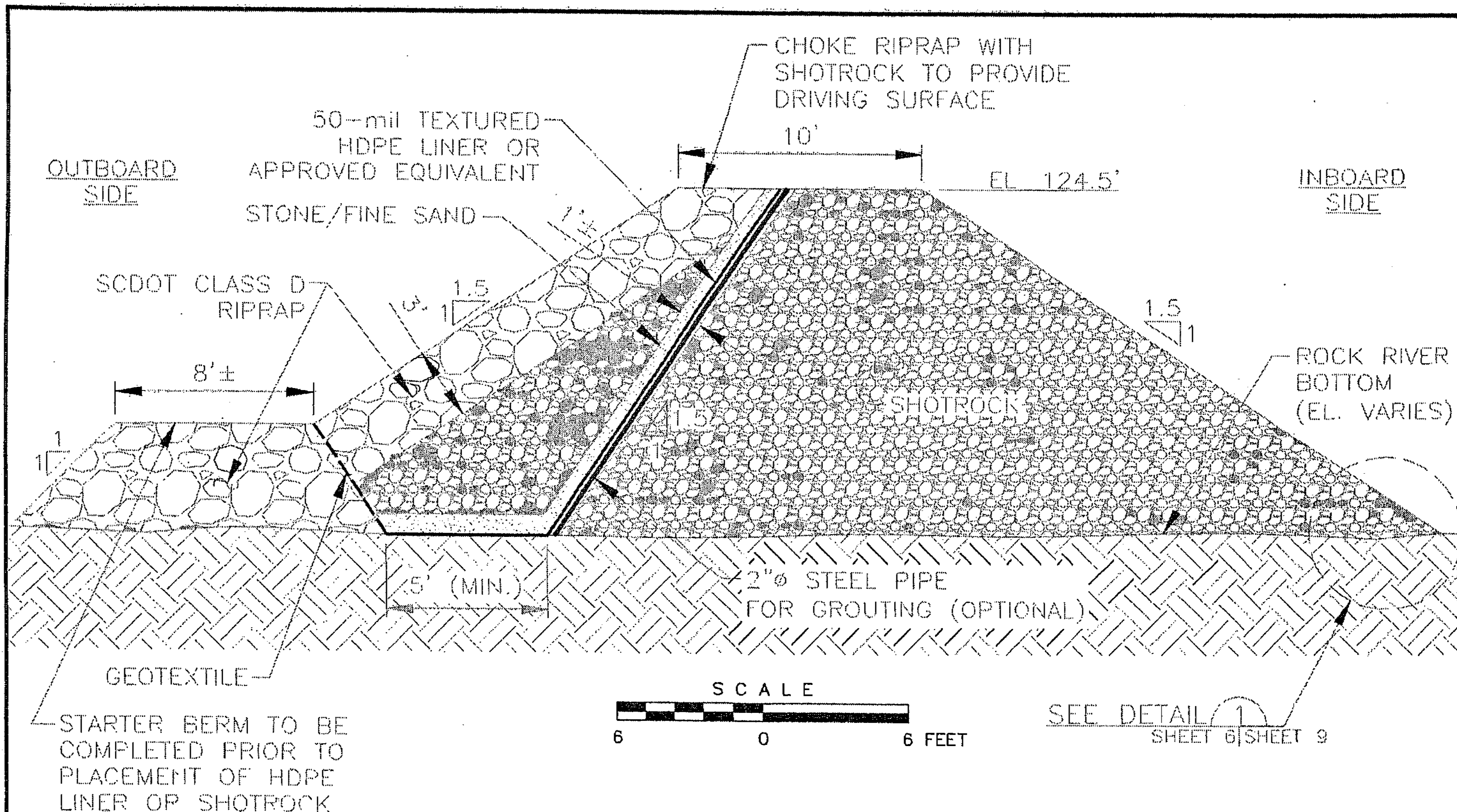
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN
SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/19/14 FILE NAME: CONG177

APEX COMPANIES, LLC



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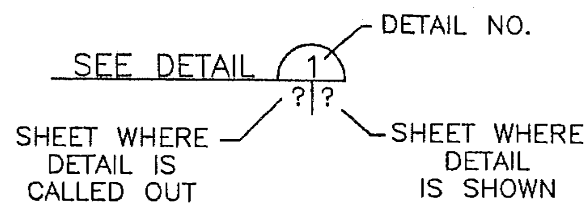

FIGURE 3

TYPICAL COFFERDAM SECTION

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

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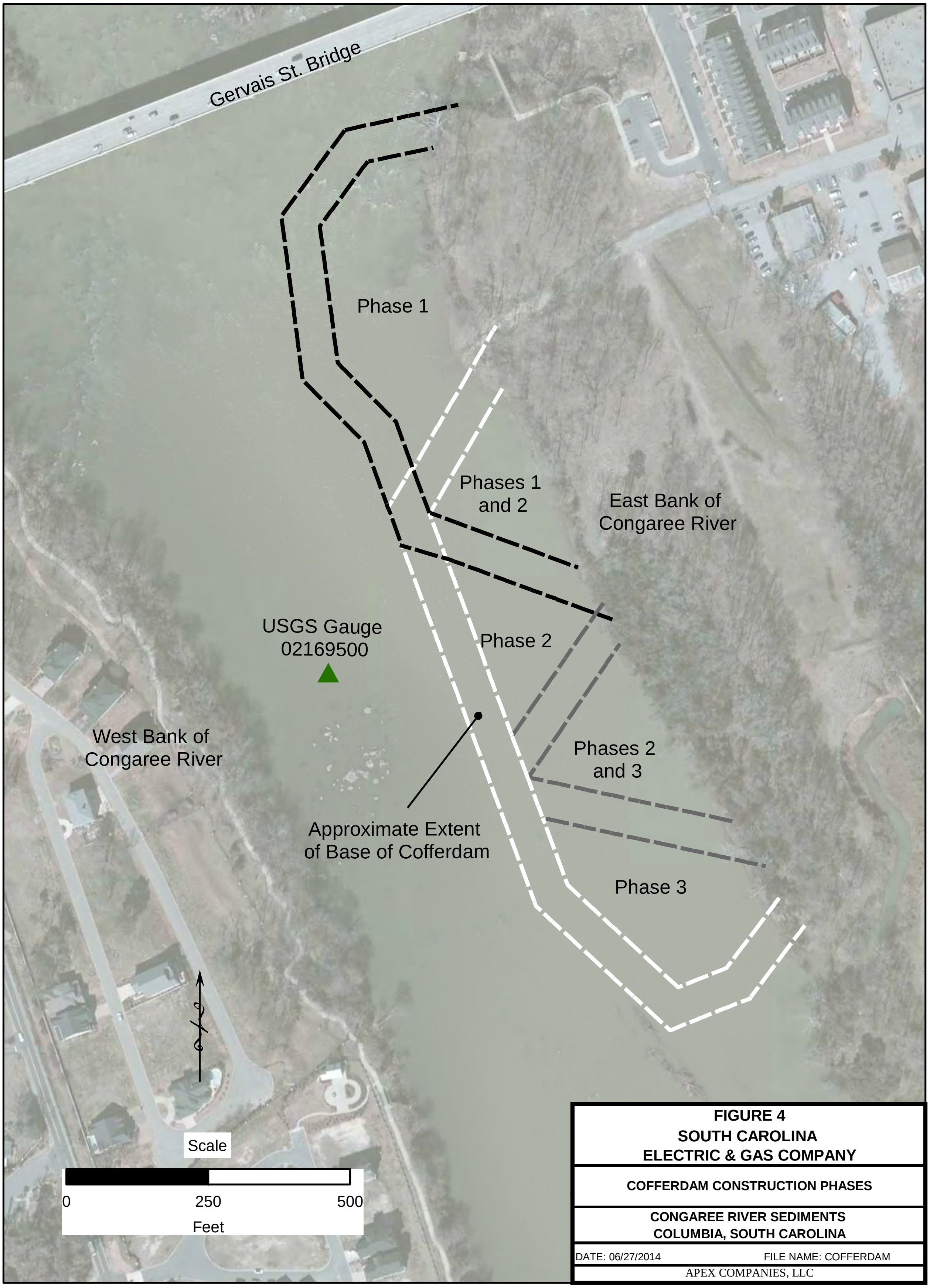


FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

COFFERDAM CONSTRUCTION PHASES

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/27/2014 FILE NAME: COFFERDAM

APEX COMPANIES, LLC

ATTACHMENT A

COFFERDAM DESIGN DRAWINGS

CONGAREE RIVER REMEDIATION
SOUTH CAROLINA ELECTRIC & GAS
COLUMBIA, SC

PREPARED BY

PAUL C. RIZZO ASSOCIATES, INC.
SUITE 100, BUILDING 5
500 PENN CENTER BLVD.
PITTSBURGH, PENNSYLVANIA 15235

LIST OF DRAWINGS

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A2
1:1	DATE	07-09-12	APPROVED BY	JDD	6/23/14		

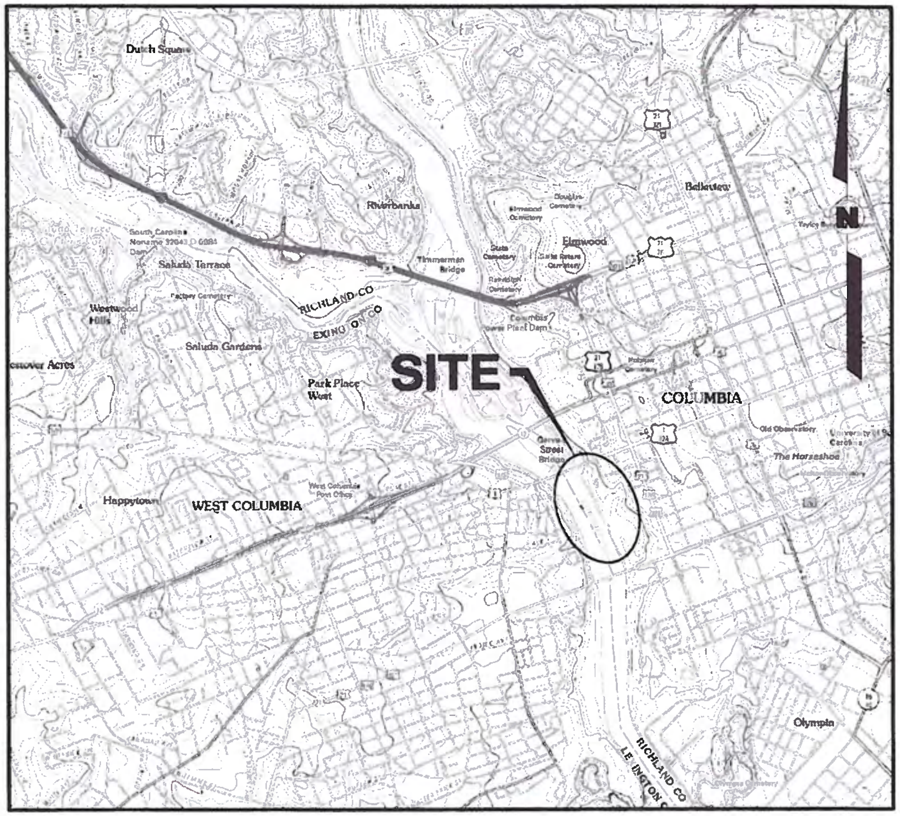
SHEET 1 OF 14

TITLE SHEET

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES



VICINITY MAP

SCALE

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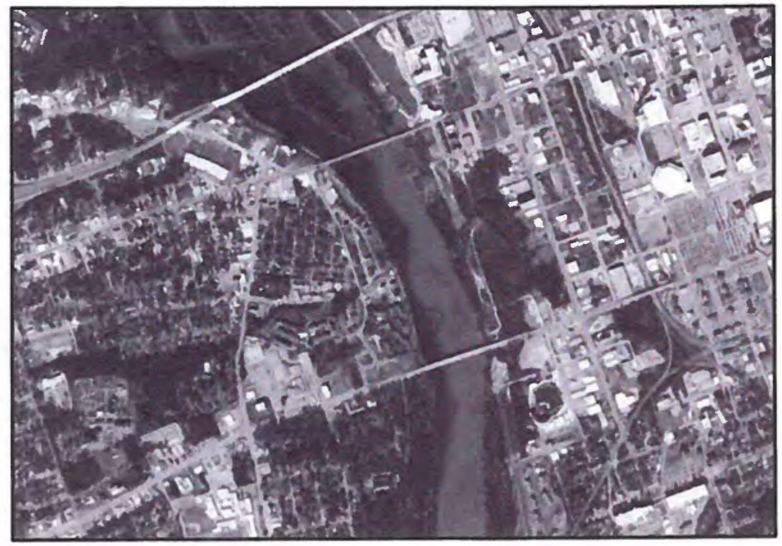

AERIAL IMAGE

SCALE

2500 0 2500 FEET

SHEET 2 OF 14

SITE VICINITY MAP & AERIAL MAP

PREPARED FOR

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CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

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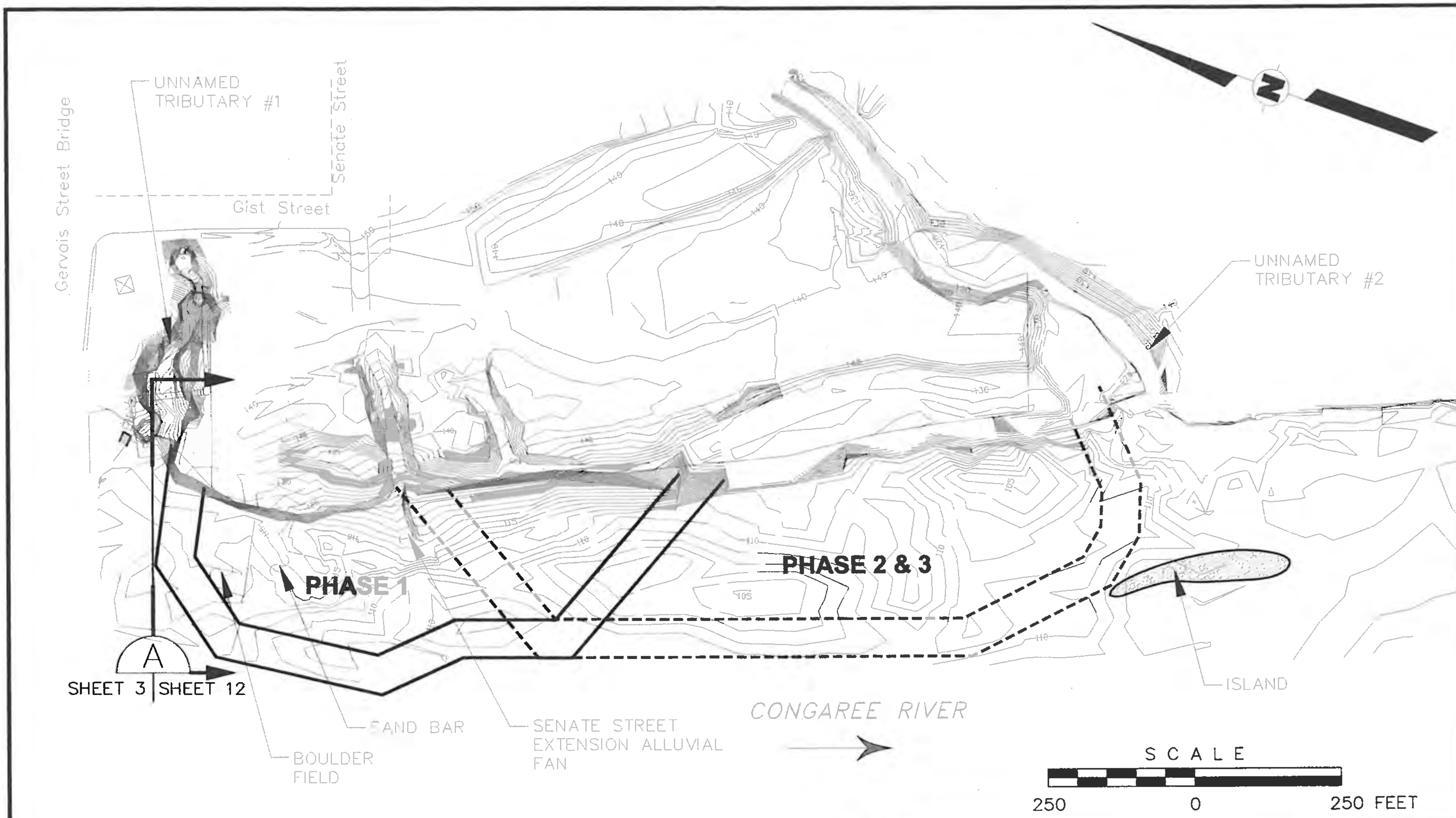

LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM LIMITS–PHASE 1

APPROXIMATE COFFERDAM LIMITS–PHASE 2 & 3

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

SHEET 3 OF 14

GENERAL ARRANGEMENT PLAN

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	DDD	6/23/14	CAD FILE NUMBER	114708A4
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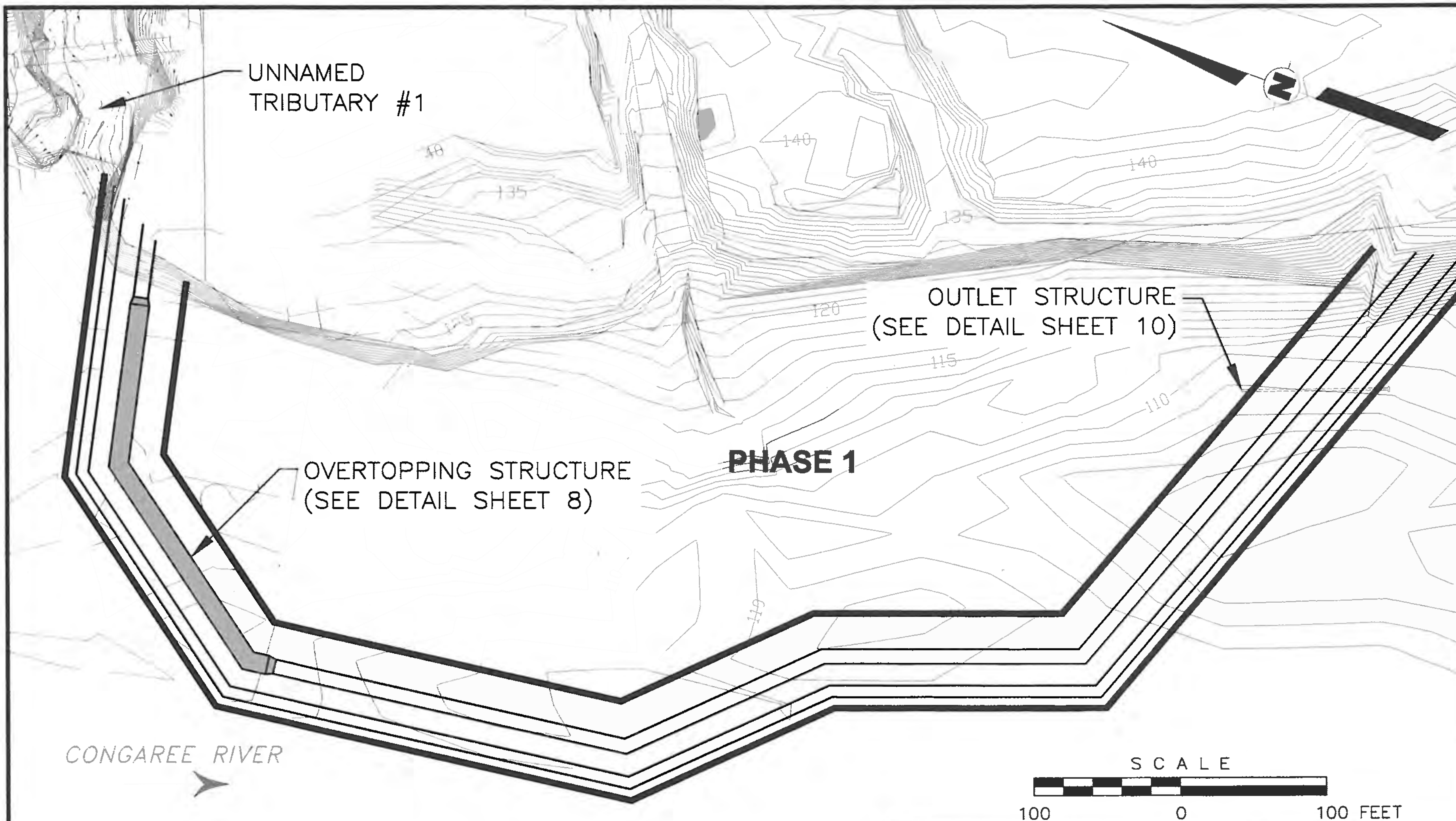


LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM FOOTPRINT

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A5
1:1	DATE	07–11–12	APPROVED BY	JDD	6/23/14		

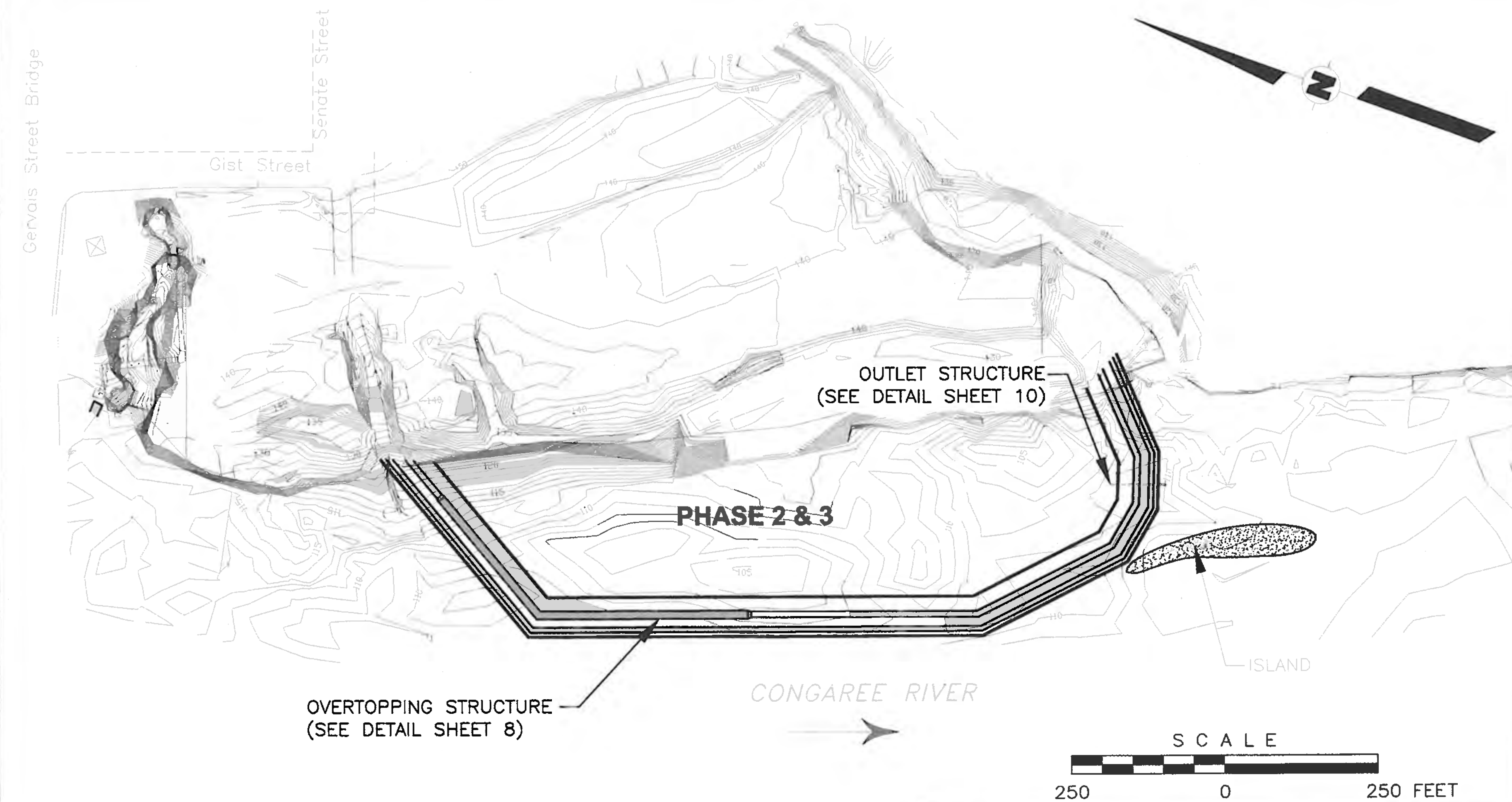
SHEET 4 OF 14

CONSTRUCTION PHASE 1

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES



LEGEND

BATHYMETRIC LINE (FEET NAVD '88)

APPROXIMATE COFFERDAM FOOTPRINT

REFERENCE

DRAWING: ALTERNATIVE 4–REMOVAL ACTION
FILE NAME: 1027
MANAGEMENT & TECHNICAL RESOURCES, INC.
DATED: 5/16/12

SHEET 5 OF 14

CONSTRUCTION PHASE 2

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

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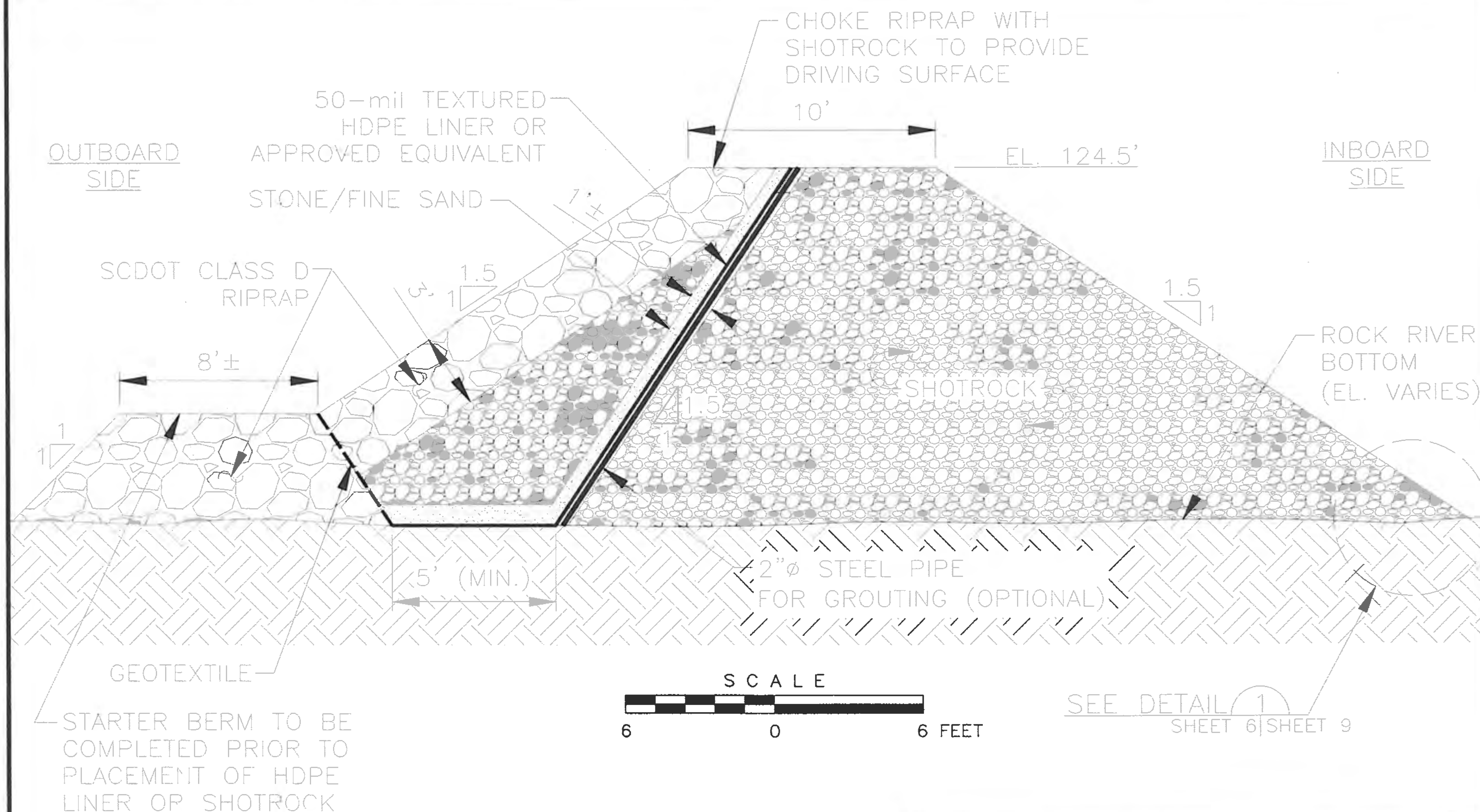

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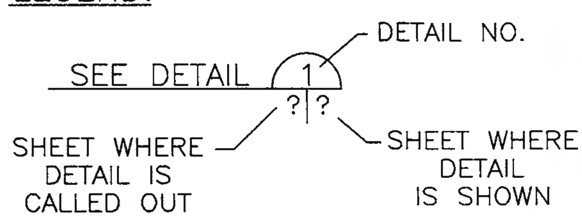

SHEET 6 OF 14

TYPICAL COFFERDAM SECTION

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A8
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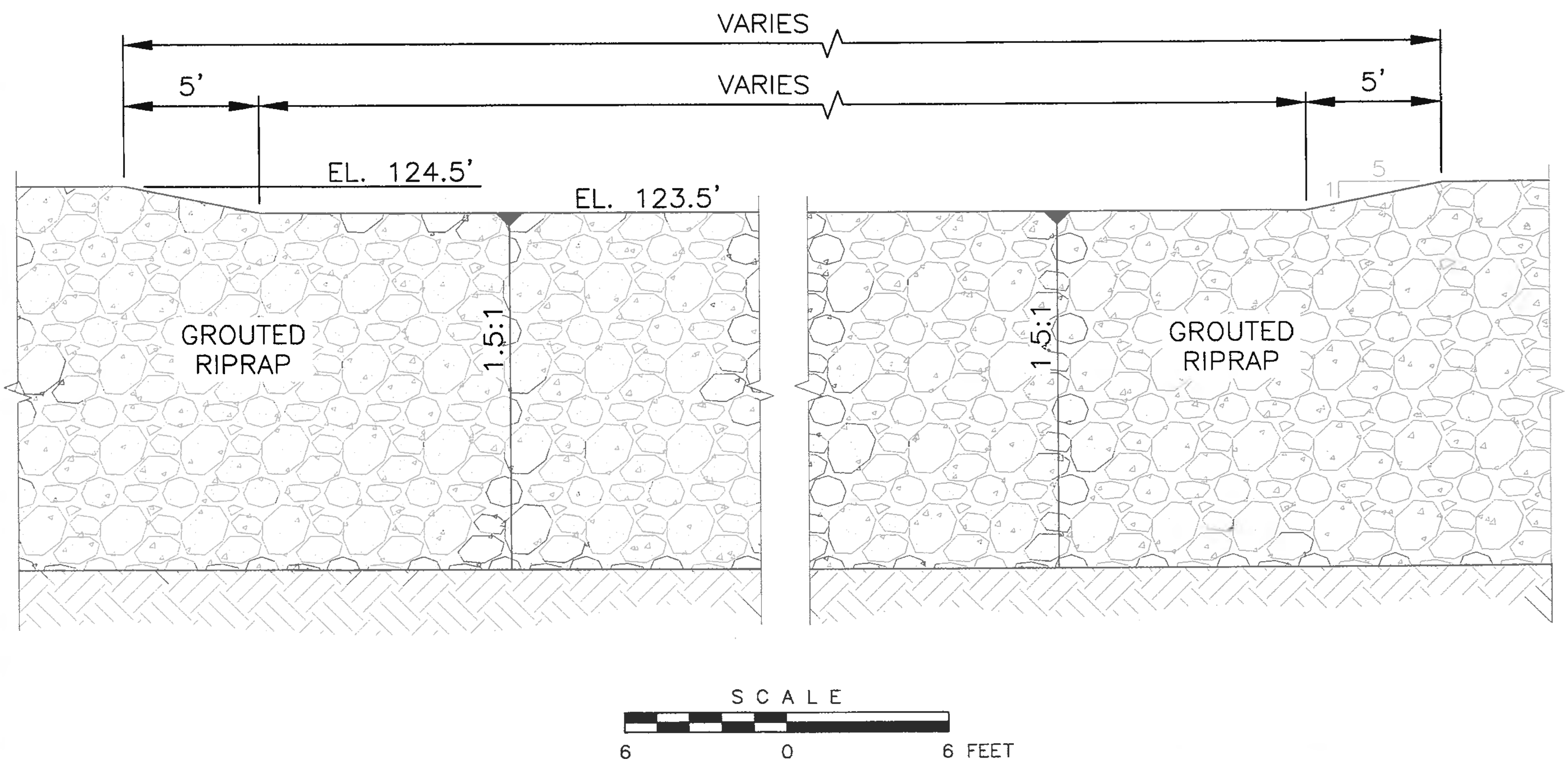

SHEET 7 OF 14

TYPICAL OVERTOPPING STRUCTURE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	J.S.S.	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A18
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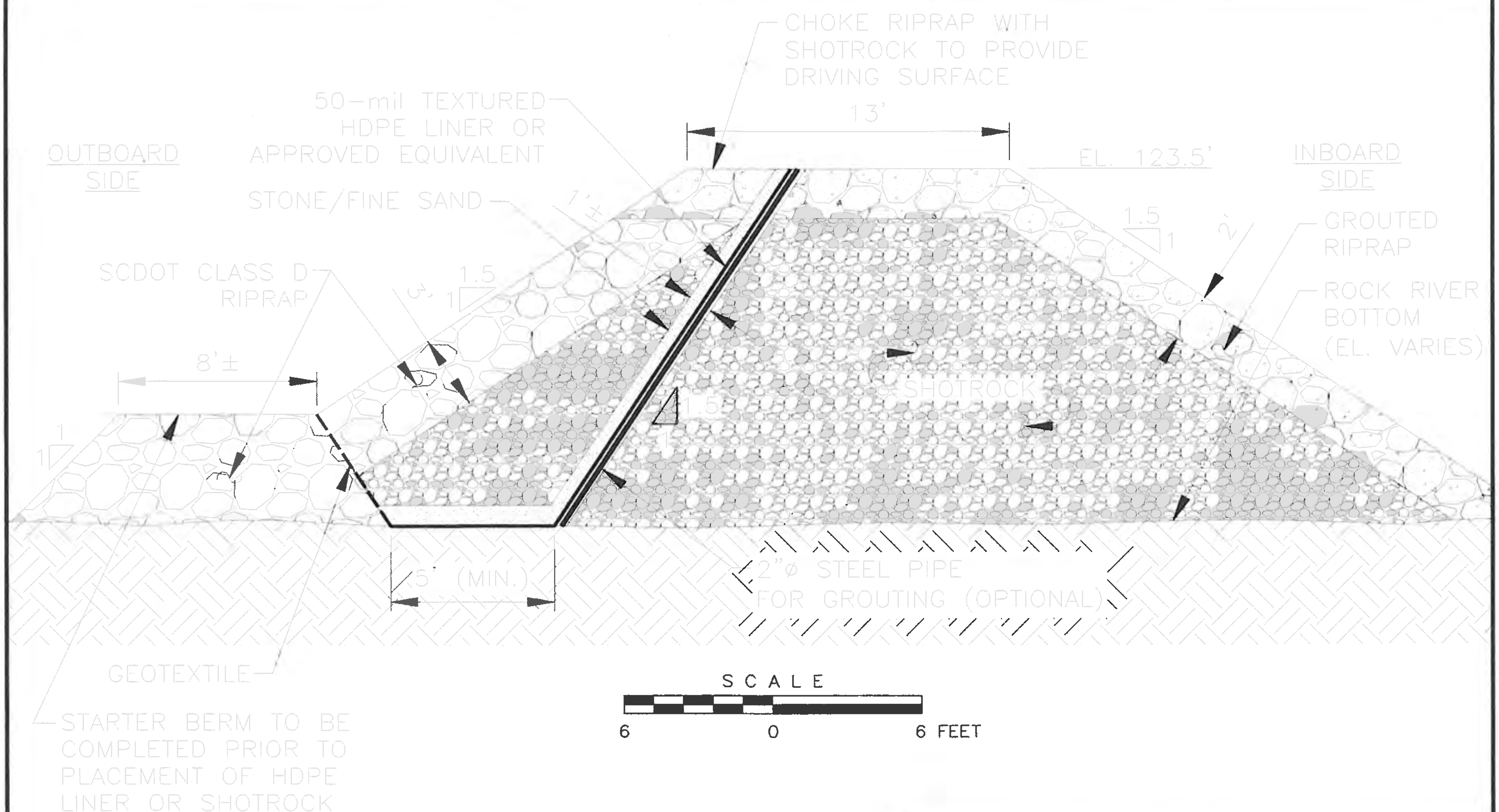

SHEET 8 OF 14

TYPICAL OVERTOPPING SECTION

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CLM	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A21
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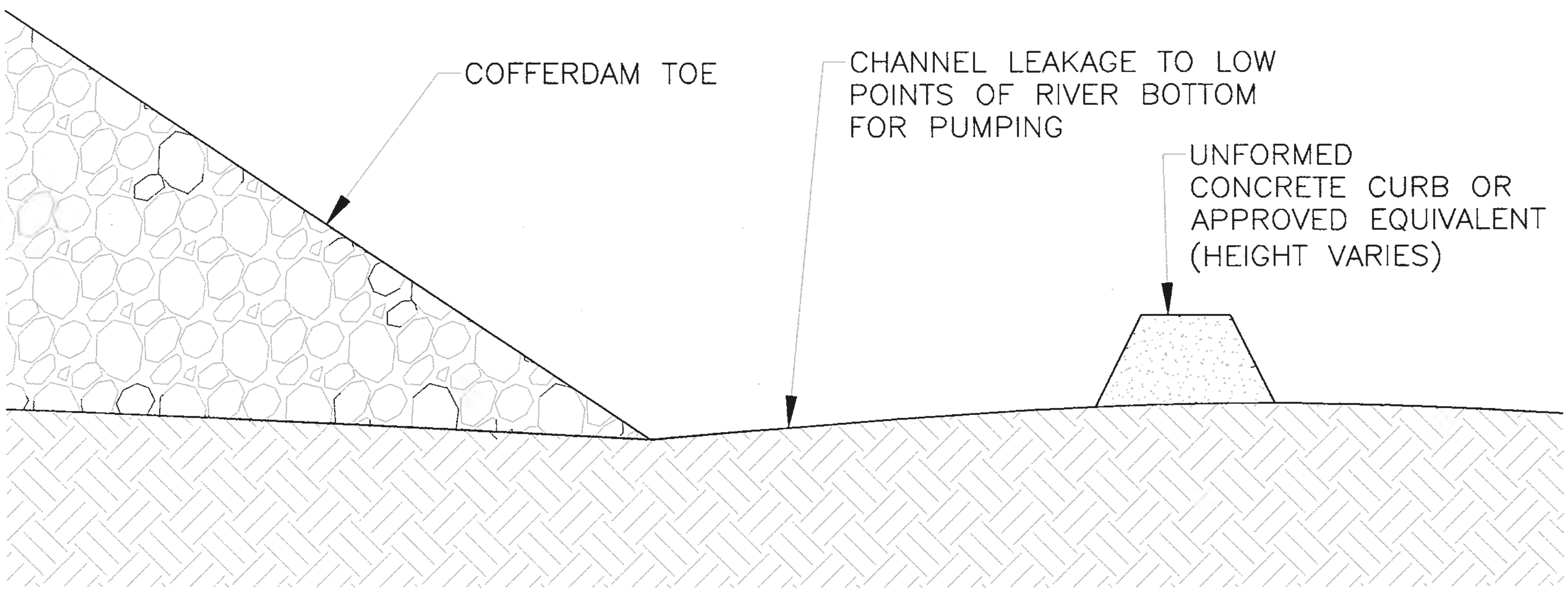
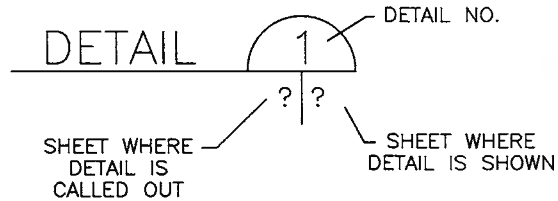


DETAIL 1
SHEET 6 | SHEET 9

SCALE
1 0 1 FOOT

LEGEND:



SHEET 9 OF 14

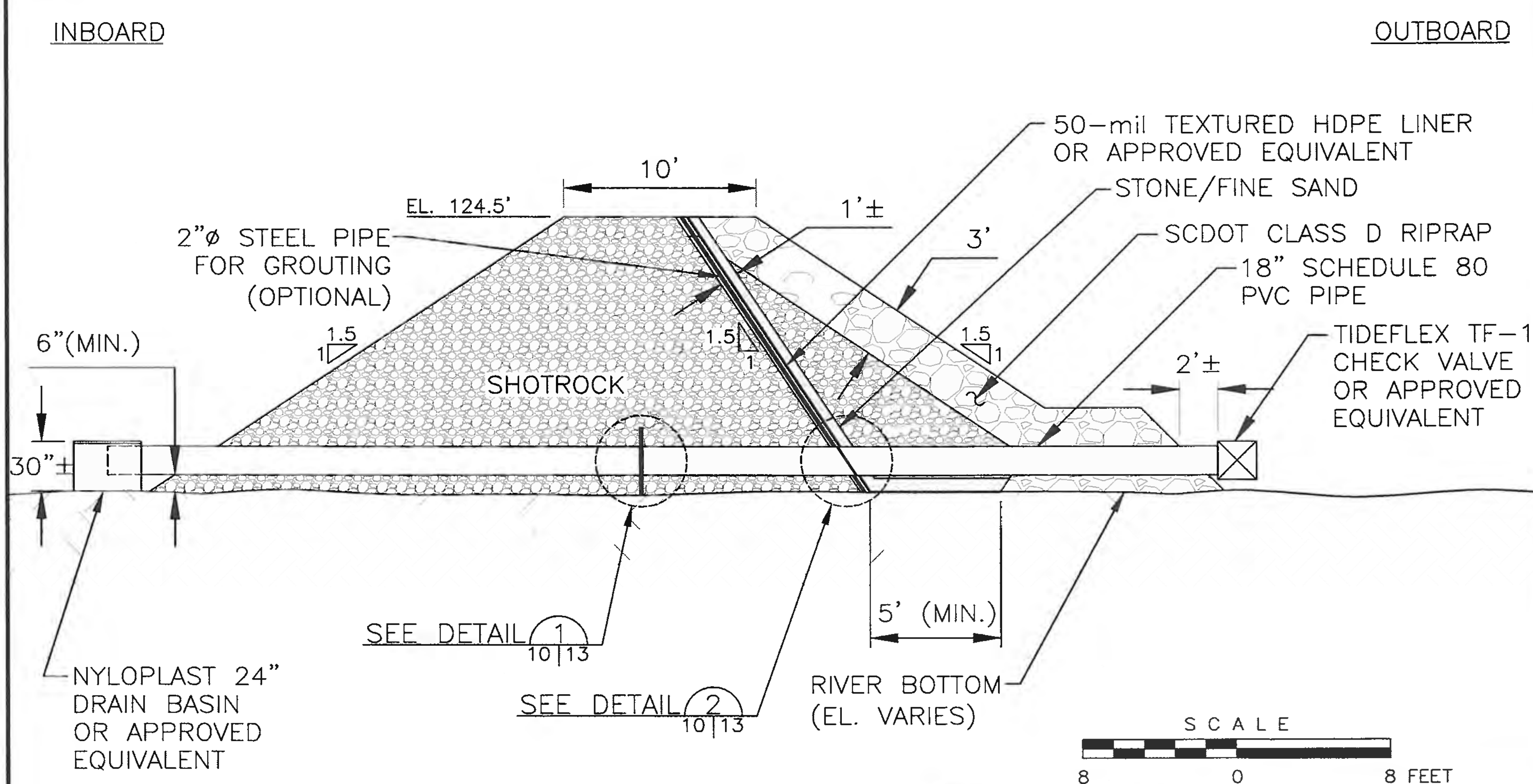
DETAIL–LEAKAGE CONTROL

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A9
1:1	DATE	07–23–12	APPROVED BY	JDD	6/23/14		



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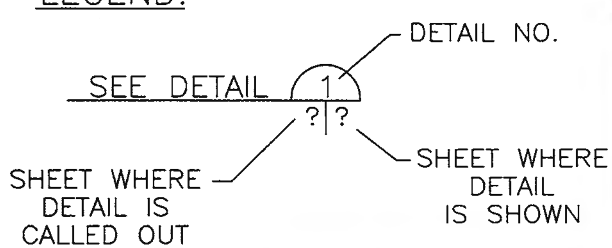


SHEET 10 OF 14

OUTLET STRUCTURE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	DDD	6/23/14	CAD FILE NUMBER	114708A10
1:1	DATE	07-23-12	APPROVED BY	DDD	6/23/14		

NOTES:

1. PHASE TWO AND PHASE THREE OF THE REMEDIATION MAY BE COMBINED.

2. COFFERDAM MATERIAL TO REMAIN IN PLACE FOR EACH PHASE UNTIL REQUIRED FOR NEXT PHASE.

3. HDPE LINER MATERIAL AND OUTLET STRUCTURE MAY BE REUSED BETWEEN PHASES AT OWNER'S APPROVAL.

4. STEEL PIPES MAY BE EMBEDDED IN THE STONE SURROUNDING THE HDPE LINER. AT CONTRACTOR'S OPTION, PIPE MAY BE USED TO GROUT AFTER COFFERDAM COMPLETION TO REDUCE LEAKAGE.

5. SCDOT CLASS D RIPRAP HAS D_{50}= 1.80'.

6. CONTRACTOR TO MAINTAIN MEANS OF STOPPING FLOW THROUGH OUTLET STRUCTURE.

7. HDPE LINER TO BE WELDED OR LAPPED AT JOINTS. IF LINER IS LAPPED, MINIMUM OVERLAP IS ONE FOOT.

8. FINAL DESIGN OF COFFERDAM TO BE PREPARED BY CONTRACTOR.

9. MAXIMUM LIFT THICKNESS FOR SHOTROCK IS 18". SHOTROCK TO BE COMPACTED WITH MINIMUM FOUR PASSES OF EARTH MOVING EQUIPMENT OR 10–TON ROLLER.

10. MAXIMUM STONE SIZE FOR SHOTROCK IS 6".

11. CONTROL OF SEDIMENT WILL BE ACCOMPLISHED USING THE STARTER BERM SHOWN ON SHEET 7. THE ENTIRE STARTER BERM WILL BE PLACED PRIOR TO THE PLACEMENT OF ANY SHOTROCK.

12. LARGE BOULDERS IN THE FOOTPRINT OF THE COFFERDAM OR NEAR THE COFFERDAM MAY BE MOVED AS REQUIRED.

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A11
1:1	DATE	07-09-12	APPROVED BY	JDD	6/23/14		

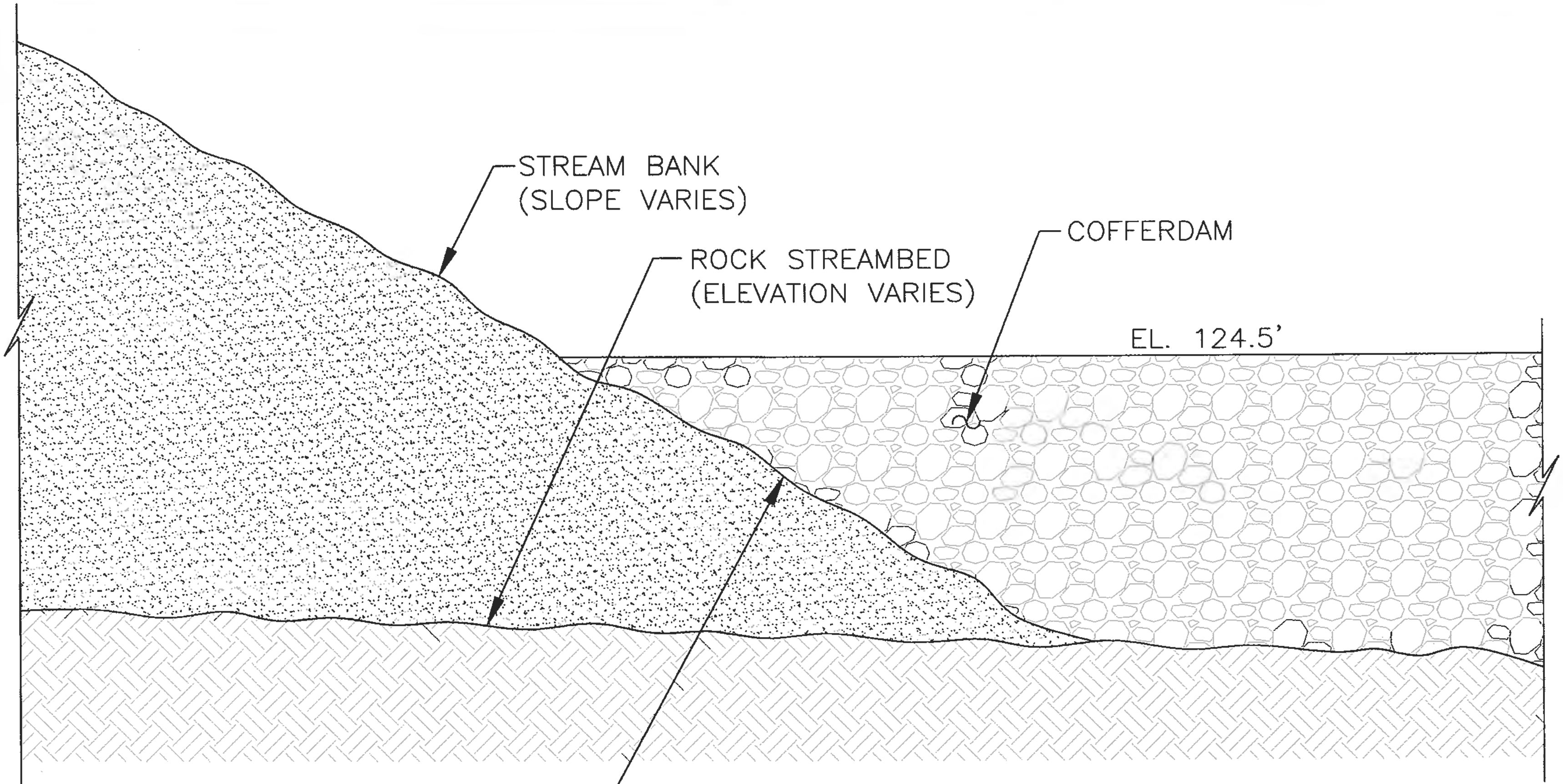
SHEET 11 OF 14

NOTES

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES



PREPARE STREAMBANK PRIOR TO COFFERDAM CONSTRUCTION. PREPARATION TO CONSIST OF REMOVAL OF ALL ORGANIC MATERIAL AND TOPSOIL AND COMPACTION OF PREPARED SURFACE AS COFFERDAM IS CONSTRUCTED

(NOT TO SCALE)

SHEET 12 OF 14

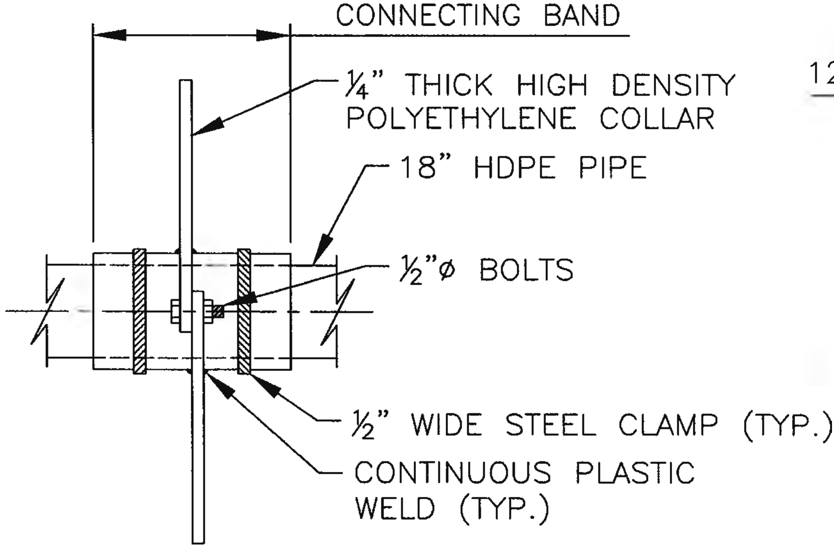
TYPICAL STREAMBED PROFILE

PREPARED FOR

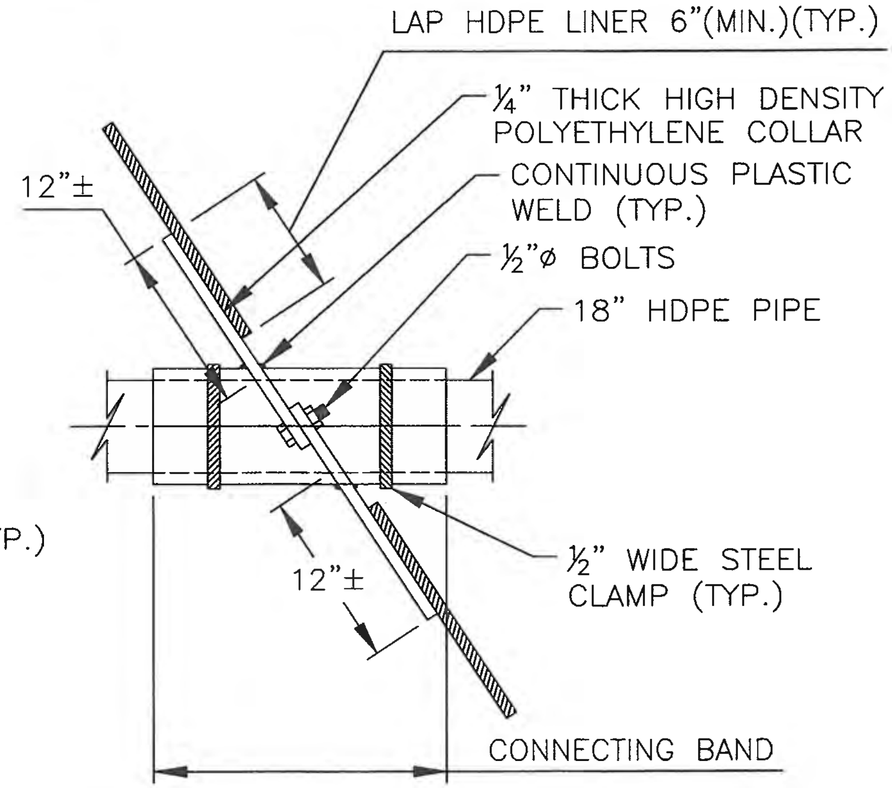
SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A12
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		



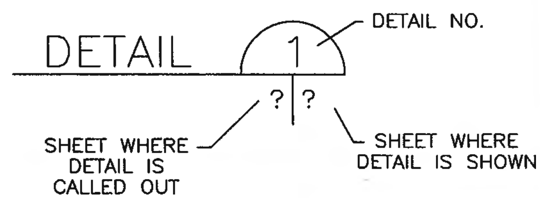
DETAIL 1
10 | 13



DETAIL 2
10 | 13

(NOT TO SCALE)

LEGEND:



SHEET 13 OF 14

HDPE COLLAR DETAILS

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A13
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		

CONSTRUCTION SEQUENCE:

1. CONSTRUCT STARTER BERM AROUND ENTIRE PHASE ONE WORK AREA.
2. STRIP STREAMBANK IN AREA WHERE COFFERDAM WILL BE CONSTRUCTED.
3. PLACE GEOTEXTILE AGAINST STARTER BERM, PLACE SHOTROCK IN LIFTS AND PLACE HDPE LINER ON STREAM BOTTOM. PLACE HDPE LINER AND STONE/FINE SAND AS SHOTROCK IS PLACED.
4. INSTALL OUTLET STRUCTURE AS SHOTROCK IS BEING PLACED.
5. PLACE CLASS D RIRRAP ON OUTBOARD FACE.
6. CONSTRUCT STARTER BERM AROUND ENTIRE PHASE TWO WORK AREA.
7. CONSTRUCT PHASE TWO COFFERDAM FOLLOWING SAME CONSTRUCTION SEQUENCE WHILE MOVING SHOTROCK AND OTHER MATERIAL FROM PHASE ONE TO PHASE TWO.
8. CONSTRUCT PHASE THREE COFFERDAM FOLLOWING SAME CONSTRUCTION SEQUENCE WHILE MOVING SHOTROCK AND OTHER MATERIAL FROM PHASE TWO TO PHASE THREE.

SHEET 14 OF 14

CONSTRUCTION SEQUENCE

PREPARED FOR

SOUTH CAROLINA ELECTRIC & GAS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

RIZZO ASSOCIATES

PLOT	DRAWN BY	CVL	CHECKED BY	JDD	6/23/14	CAD FILE NUMBER	114708A14
1:1	DATE	08-29-12	APPROVED BY	JDD	6/23/14		

ATTACHMENT B

COFFERDAM STABILITY ANALYSIS

500 Penn Center Boulevard
Pittsburgh, PA 15235, USA
Phone: (412) 856-9700
Fax: (412) 856-9749
www.rizzoassoc.com

June 23, 2014
Project No. 11-4708

Mr. William Zeli
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

TRANSMITTAL
UPDATED COFFERDAM DRAWINGS
CONGAREE RIVER REMEDIATION
COLUMBIA, SOUTH CAROLINA

Dear Mr. Zeli:

Transmitted herewith are updated drawings for the Congaree River Remediation. The drawings have been updated to include the flooding structure and to include two phases for the cofferdam instead of three.

If you have any questions or require any additional information, please contact me at 412-825-2014 or email me at jared.deible@rizzoassoc.com.

Respectfully submitted,
RIZZO Associates

Jared Deible, P.E.
Managing Principal

JDD/kam

Attachments

PCR ENGINEERS/CONSULTANTS/CM

Calculation Title:	Embankment Slope Stability Analysis	**Date:**	10 June 14
Calculation No.:	11-4708 F-5 **Revision No.:** 0	**Page:**	1 of 12

Part I – Completed by Originator

Project Name: Congaree River Remediation

1. If this is a revision, explain reason for revision: n/a
2. Have superseded versions been VOIDED or destroyed as required? ☒N/A ☐No ☐Yes
3. Has design or analysis software been used for this calculation? ☐No ☒Yes
   - 3.1. If Yes, provide the following information:
   - 3.2. Software Name: SLOPE/W Version Number: 7.21.0
   - 3.3. Computer serial number of computer used for this calculation: 000078
   - 3.4. Confirm that software is listed on Form QP-7-13. ☐No ☒Yes
   - 3.5. Confirm that Software Usage Log has been updated to include this calculation. ☐No ☒Yes
4. Has a thorough self-check of this calculation been completed and accurate? ☐No ☒Yes
5. Is this calculation nuclear safety related? ☒No ☐Yes
   - 5.1. Has In-Use Test been performed on the computer used for this calculation? ☐N/A ☐No ☐Yes
   - 5.2. If "No" or "N/A," explain:

Part II – Completed by Verifier(s) – The Independent Reviewer shall address the following:

1. Calculation inputs were correctly selected? ☐N/A ☐No ☑Yes
2. Significant assumptions are adequately identified, described, justified, reasonable? ☐N/A ☐No ☑Yes
3. Any assumptions identified for re-verification are completed? ☐N/A ☐No ☑Yes
4. Calculation inputs were correctly incorporated into the design? ☐N/A ☐No ☑Yes
5. Numerical calculations are correct and documented? ☐N/A ☐No ☑Yes
6. Calculation outputs were reasonable compared to inputs ☐N/A ☐No ☑Yes
7. Calculation input and verification requirements for interfaces are identified (e.g., specified in the Work Plan, supporting procedures, or instructions)? ☑N/A ☐No ☐Yes
8. Suitable materials, parts, processes, inspection and testing criteria were specified (e.g., may be applicable to design calculations, field activities, etc.)? ☑N/A ☐No ☐Yes
9. Hand-annotated changes are made correctly (single line strike through, initialed, and dated)? ☑N/A ☐No ☐Yes
10. All pages are legible, references identified and appropriate; document identifier and revision assigned; and acceptable with respect to grammar, spelling and punctuation? ☐N/A ☐No ☑Yes
11. Each calculation input, information and equations from external sources referenced? ☐N/A ☐No ☑Yes
12. Calculation report contains the required information? ☐N/A ☐No ☑Yes

REVIEW COMMENTS:

Part III – Approval for Calculations

Originator(s) Print Name	**Signature/Date**	
Brandon M. Laskey		Digitally signed by Brandon M. Laskey DN: cn=Brandon M. Laskey, o=Rizzo, ou=Civil Deisgn, email=brandon.laskey@rizzoassoc.com, c=US Date: 2014.06.10 16:25:51 -04'00'
Verifier(s)	**Signature/Date**	**Verification: Independent Design Review**
Vinod Pillai	Vinod	Digitally signed by Vinod Pillai DN: cn=Vinod Pillai, o=Dams and Water, ou=Paul C. Rizzo Associates, Inc., email=vinod.pillai@rizzoassoc.com, c=US Date: 2014.06.19 16:37:41 -04'00'
Project Manager	**Signature/Date**	
Jared Deible		6/20/14

Approval of the Project Manager signifies that the document and all required reviews are complete, and the document is released for use.

TABLE OF CONTENTS

PAGE

1.0 STATEMENT OF PURPOSE

This calculation has been prepared to analyze the stability of the proposed cofferdam to be constructed in the Congaree River. This analysis is required to evaluate the stability of the tallest section of the cofferdam for static conditions.

2.0 APPROACH

The slope stability of the proposed cofferdam was completed using the software SLOPE/W to evaluate the critical failure surfaces. The SLOPE/W software program is part of the GeoStudio software package and is produced by GEO-SLOPE International, Ltd. This program is a two-dimensional, limit equilibrium slope stability program which can model heterogeneous soil types, complex stratigraphic and slip surface geometries, and variable pore-water pressure conditions using a wide range of soil models.

The Spencer method was used to evaluate the slope stability of the proposed cofferdam. The Spencer method is derived from the method of slices on the basis of limit equilibrium. It requires satisfying the equilibrium of forces and moments acting on individual slices. This method has been shown to be conservative and provide relatively accurate results.

The analysis conditions for this slope stability analysis are consistent with those presented in ***Reference 1***. The analysis conditions are presented in ***Table 2-1***.

TABLE 2-1
LOAD CASES CONSIDERED IN EMBANKMENT SLOPE STABILITY ANALYSIS

Analysis Condition	Analyzed Slope	Recommended Factor of Safety
Water Level at Crest of Cofferdam (Flood Condition)	Upstream	1.5
Water Level at Crest of Cofferdam (Flood Condition)	Downstream	1.5
No Water Condition	Upstream	1.3

Two different slip surfaces were used in the slope stability analysis, "block" for the upstream side and "circular" for the downstream side. Block slip surfaces are useful when the embankment rests on a relatively thick stratum of weak material. A series of slip surfaces are developed that consist of three line segments. One line segment is a line extending from a grid point in the left block over to a point on the right block, while the other two line segments are projections to the ground surface at a range of specified angles from each block. The combination of these three line segments forms a single slip surface. As such all of the grid points on the right block then connect to the grid points on the left block, resulting in a large number of potential slip surfaces to be analyzed. SLOPE/W will select the axis of rotation that is centered on the optimized slip surface and provide a Factor of Safety based on the locations of the left and right blocks ***(Reference 2)***.

The slip surface for the downstream side was considered as a "circular" slip surface by checking the option to optimize the critical slip surface location in SLOPE/W. This type of slip surface is where the moment equilibrium is completely independent of the interslice shear forces. The interslice shear force can be assumed zero and still retain the ability for an acceptable factor of safety. (***Reference 1***).

3.0 ASSUMPTIONS AND JUSTIFICATION

1. The cohesion of the shot rock on the downstream side has been increased by 5 psf to provide more accurate results from the analysis and provide for a deeper failure surface.

2. The material properties for the four materials used in the construction of the proposed cofferdam are based on typical values used in the industry. The material properties can be found in ***Table 4-1.***

3. The phreatic surface is assumed to be from the outboard side of the cofferdam sloping downward through the riprap and the stone/fine sand to the shot rock. It becomes vertical in the shotrock and is perpendicular to the ground surface through the shot rock until it is approximately 3 feet from the rock where it transitions parallel to the ground surface sloping downward through the shotrock. The phreatic surface is shown on ***Figure 1***.

4.0 MODEL INPUT

4.1 Model Geometry

The analysis of the proposed cofferdam was performed on the cross-section shown on ***Figure 1.*** The location of the proposed cofferdam cross-section is the tallest section of the cofferdam with the water level at the crest on the outboard (upstream) side and no water on the inboard (downstream) side.

4.2 MATERIAL PROPERTIES

The unit weights, effective friction angles, and cohesion values of the various geotechnical materials are estimated based on standard properties used in the industry. The materials were assumed to be cohesionless since they are generally a mixture of gravel, sand, and non-plastic silt. However, as previously mentioned in *Assumption #2*, the cohesion for the shotrock layer on the upstream side has been increased slightly for modeling purposes to allow for more accurate results.

Four materials are designated for specific regions within the cofferdam for this analysis – Shotrock, native foundation rock, SCDOT Class D RipRap, and stone/fine sand.

Saturated unit weights are conservatively used in the model for the total unit weight. The model uses total unit weights in all locations and computes effective stresses based on stress calculations rather than unit weights.

The estimated material properties used in the analysis are presented in ***Table 4-1***.

TABLE 4-1
MATERIAL PROPERTIES USED IN SLOPE STABILITY ANALYSIS

Material	Unit Weight	Effective Friction Angle	Cohesion
	γ_{tot}	ϕ'	c
	(pcf)	(degrees)	(psf)
Shotrock	150	45	5*
SCDOT Class D Riprap	145	50	0
Stone/Fine Sand	120	35**	0
Bedrock	-	45	1,000

*Cohesion value only for modeling purposes.
**Friction angle for sand/textured HDPE Liner Interface. Detailed design and testing required.

4.3 PHREATIC SURFACE AND PORE WATER PRESSURES

The slope stability analysis for the proposed cofferdam was performed with the water surface at the crest of the cofferdam for the upstream side, which corresponds to El. 123.5'.

The phreatic surface is assumed to be from the outboard side of the cofferdam sloping downward through the riprap and the stone/fine sand to the shotrock. It becomes vertical in the shotrock and is perpendicular to the ground surface through the shotrock until it is approximately 3 feet from the rock where it transitions mostly parallel to the ground surface sloping downward until it terminates at the rock layer. The phreatic surface is shown on ***Figure 1.***

5.0 NUMERICAL CALCULATIONS

Numerical calculations are performed in SLOPE/W.

6.0 CALCULATION OUTPUT

Output from the SLOPE/W model is included in ***Appendix A***. An electronic copy of the SLOPE/W model is included on a CD in ***Appendix B***.

7.0 RESULTS

The computed factors of safety for all load cases considered are summarized in ***Table 7-1***.

TABLE 7-1
COMPARISION OF RECOMMENDED FACTORS OF SAFETY WITH COMPUTED FACTORS OF SAFETY

Analysis Condition	Slip Surface	Analyzed Slope	Recommended Factor of Safety	Computed Factor of Safety
Water Level at Crest of Cofferdam (Flood Conditions)	Block	Upstream	1.5	1.85
Water Level at Crest of Cofferdam (Flood Conditions)	Circular	Upstream	1.5	1.95
Water Level at Crest of Cofferdam (Flood Conditions)	Circular	Downstream	1.5	1.51
No Water Condition	Block	Upstream	1.3	2.63

8.0 CONCLUSION/SUMMARY

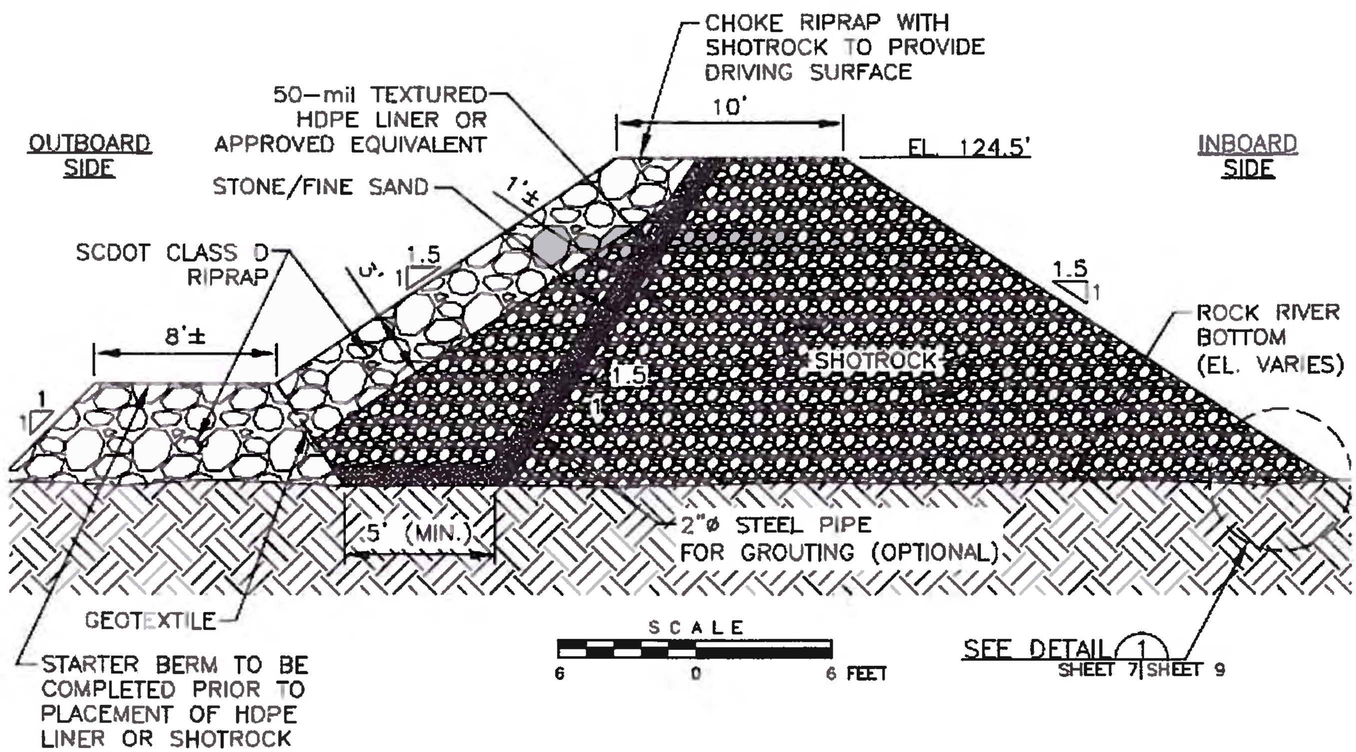
The results from the embankment slope stability analysis indicate that the upstream and downstream slopes during flooded conditions and the upstream slope during a no water condition all meet the recommended factors of safety for the analysis conditions considered.

No additional analyses are required and the design of the cofferdam is considered suitable for the conditions analyzed.

9.0 REFERENCES

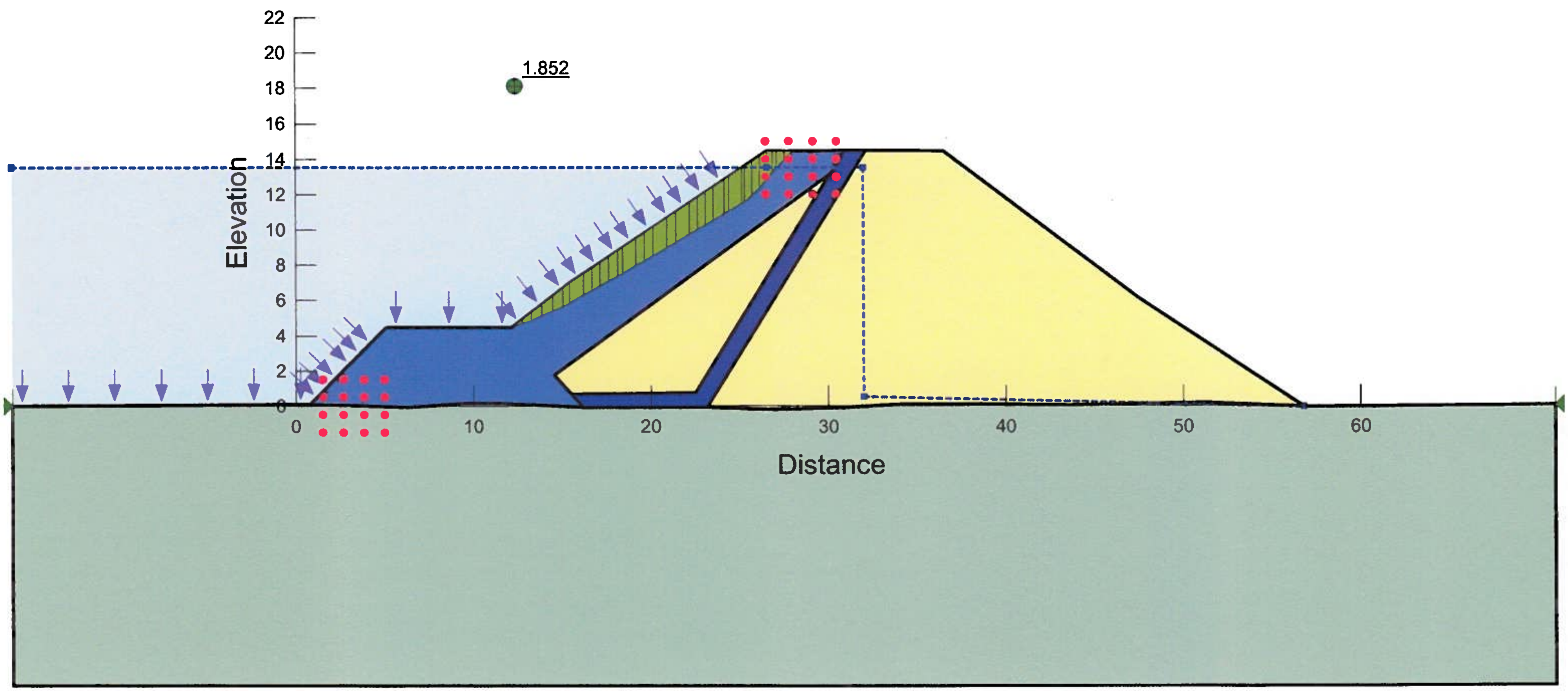
1. United States, Department of the Army, Army Corps of Engineers. *Slope Stability*. Washington, D.C.: USACE, October 2003. EM 1110-2-1902.
2. GEO-SLOPE International, Ltd. *Stability Modeling with SLOPE/W 2007 Version. An Engineering Methodology*. 4th ed. Calgary, Alberta, CA: GEO-SLOPE International, November 2008.

FIGURE 1

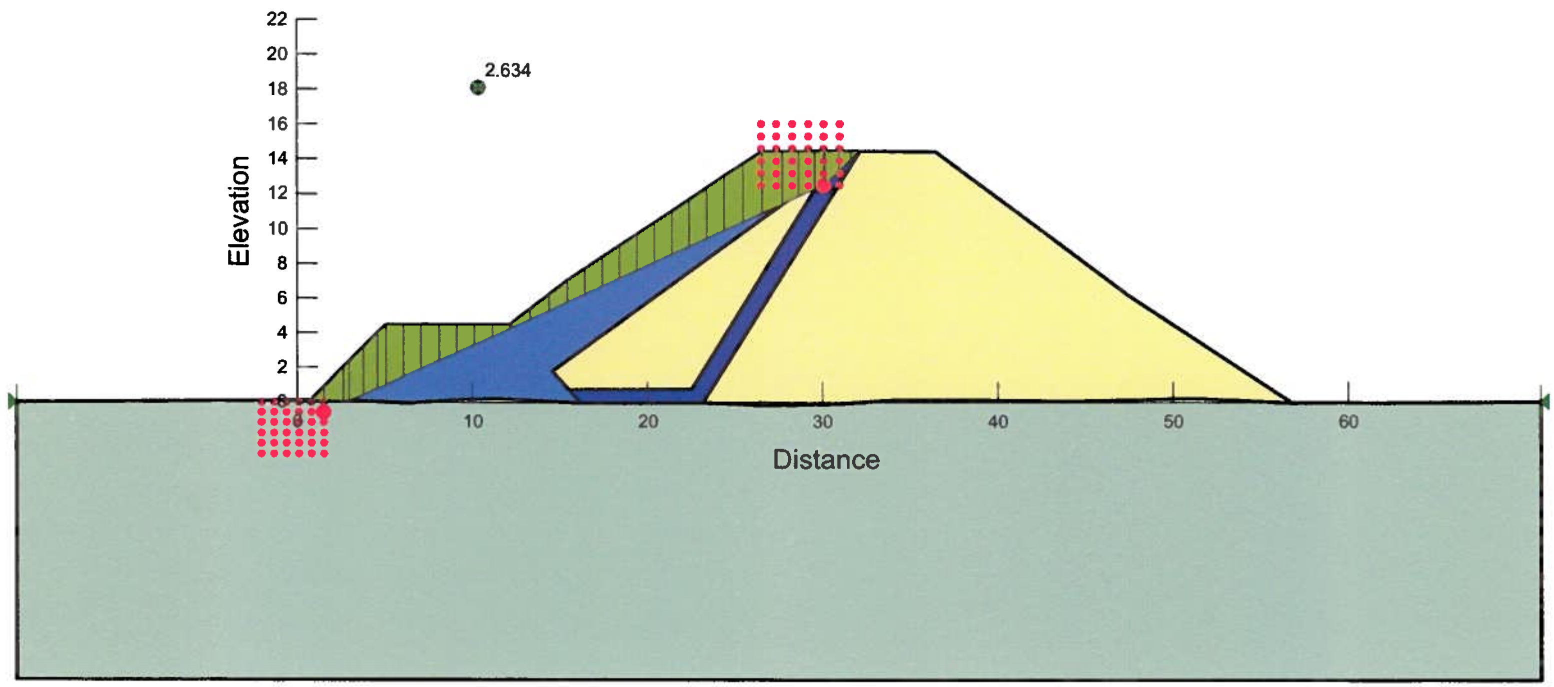

CHOKE RIPRAP WITH SHOTROCK TO PROVIDE DRIVING SURFACE
10'
EL. 124.5'
50-mil TEXTURED HDPE LINER OR APPROVED EQUIVALENT
OUTBOARD SIDE
INBOARD SIDE
STONE/FINE SAND
1'±
SCDOT CLASS D RIPRAP
3'
1.5
1
1.5
1
ROCK RIVER BOTTOM (EL. VARIES)
8'±
1
1
1.5
1
SHOTROCK
5' (MIN.)
2"ø STEEL PIPE FOR GROUTING (OPTIONAL)
GEOTEXTILE
STARTER BERM TO BE COMPLETED PRIOR TO PLACEMENT OF HDPE LINER OR SHOTROCK
SCALE
6
0
6 FEET
SEE DETAIL 1
SHEET 7 | SHEET 9

APPENDIX A:
SLOPE/W OUTPUT

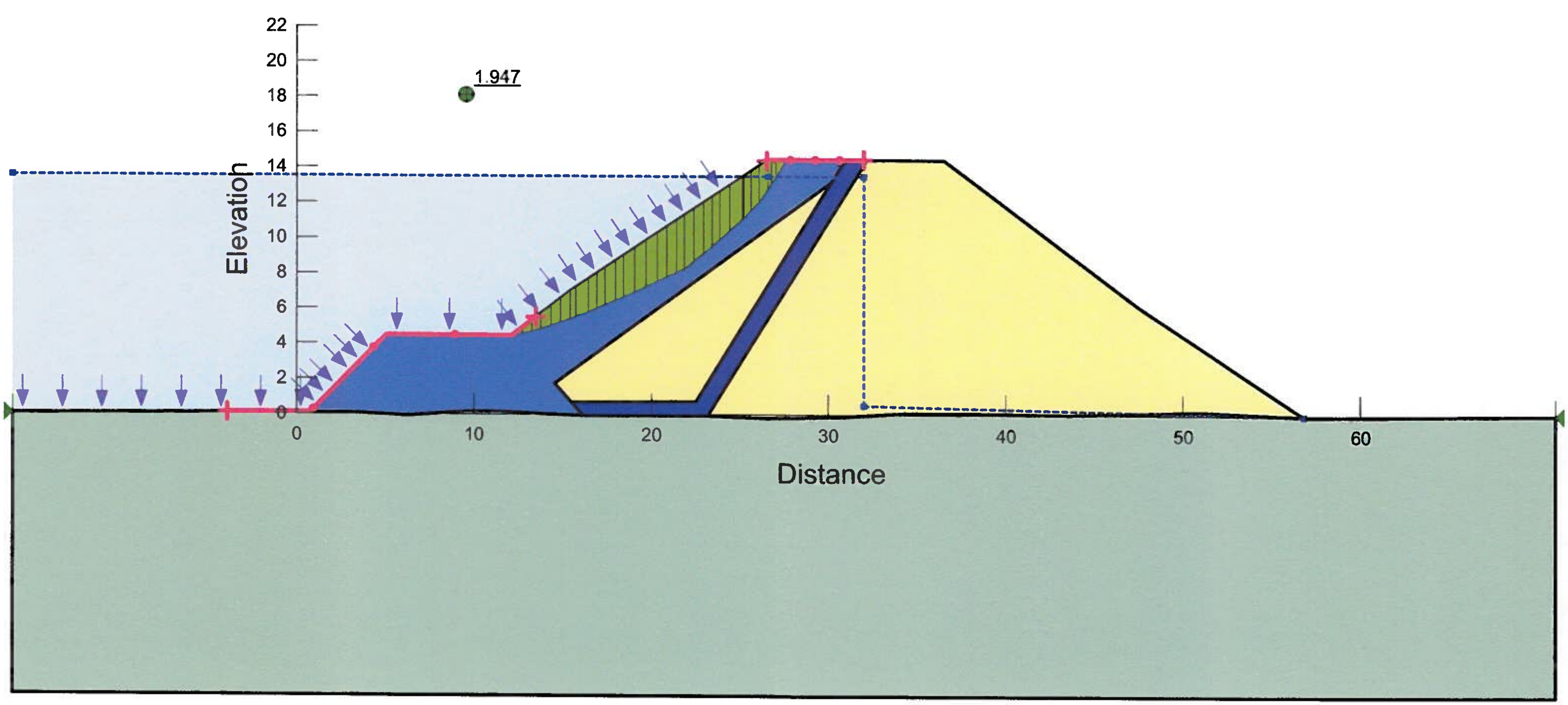
Name: Shotrock Model: Mohr-Coulomb Unit Weight: 150 pcf Cohesion: 5 psf Phi: 45 °
Name: SCDOT Class D Riprap Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion: 0 psf Phi: 50 °
Name: Stone/Fine Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35 °
Name: Foundation Model: Bedrock (Impenetrable)



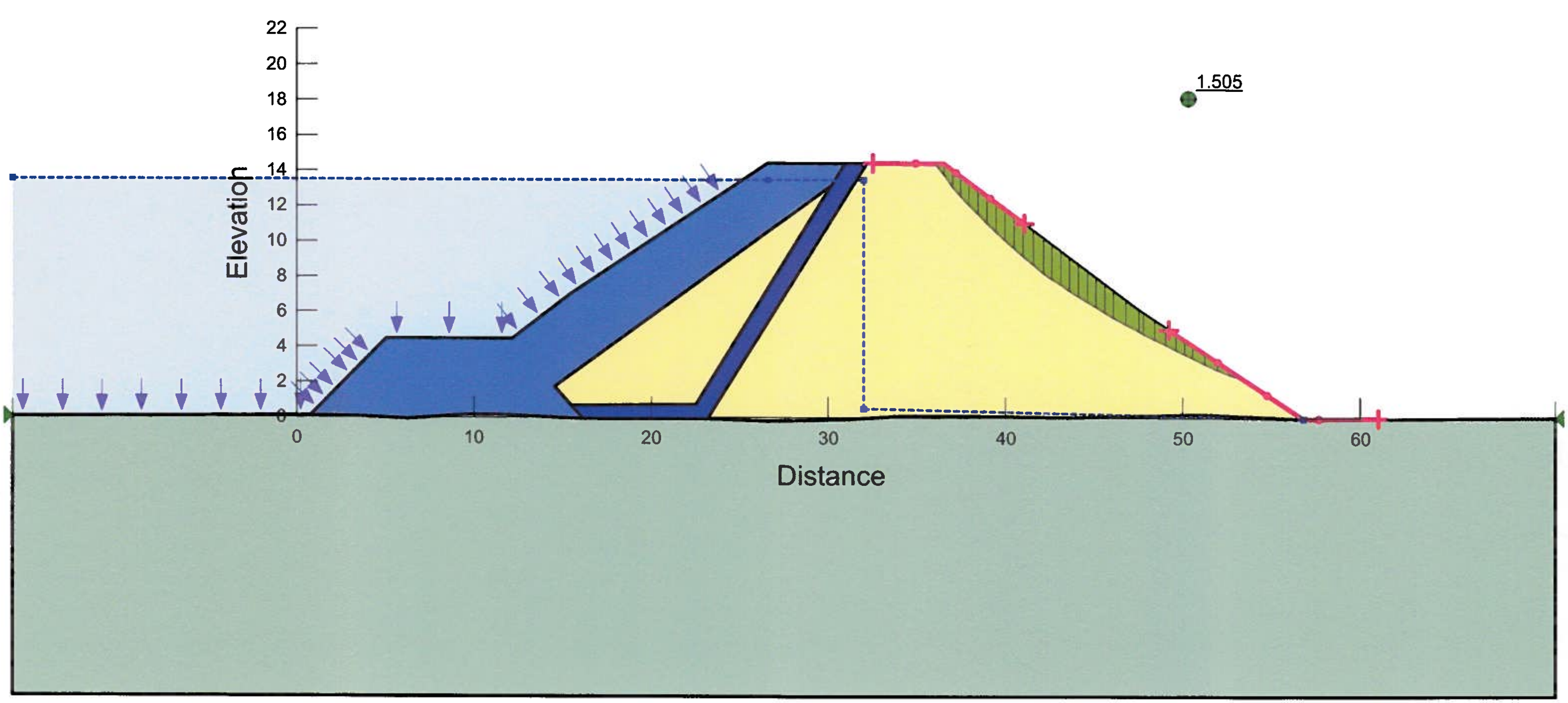
Name: Shotrock Model: Mohr-Coulomb Unit Weight: 150 pcf Cohesion: 5 psf Phi: 45 °
Name: SCDOT Class D Riprap Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion: 0 psf Phi: 50 °
Name: Stone/Fine Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35 °
Name: Foundation Model: Bedrock (Impenetrable)



Name: Shotrock Model: Mohr-Coulomb Unit Weight: 150 pcf Cohesion: 5 psf Phi: 45 °
Name: SCDOT Class D Riprap Model: Mohr-Coulomb Unit Weight: 145 pcf Cohesion: 0 psf Phi: 50 °
Name: Stone/Fine Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 35 °
Name: Foundation Model: Bedrock (Impenetrable)



Name: Shotrock   Model: Mohr-Coulomb   Unit Weight: 150 pcf   Cohesion: 5 psf   Phi: 45 °
Name: SCDOT Class D Riprap   Model: Mohr-Coulomb   Unit Weight: 145 pcf   Cohesion: 0 psf   Phi: 50 °
Name: Stone/Fine Sand   Model: Mohr-Coulomb   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Foundation   Model: Bedrock (Impenetrable)



APPENDIX B:
ELECTRONIC FILES FOR SLOPE/W MODEL

ATTACHMENT C

COFFERDAM INSPECTION FORM

DAILY COFFERDAM INSPECTION

Congaree River Sediments
Columbia, South Carolina

Date: ______________________

Excavation Area: ______________________

Cofferdam exterior (riverside) intact and free of debris: ______________________

____

____

Shoreline and tie-in locations conditions: ______________________

____

____

Warning signs/buoys intact: ______________________

____

Areas of significant leakage: ______________________

____

Is leakage water volume: increasing / decreasing / constant (circle one)

Total Suspended (TSS) measurements completed this date: Yes / No

TSS mitigation activities completed:

USGS River Gauge Reading: ______________________ (Gage "0" datum is 113.02')

NOAA river elevation prediction for next 5 days: ______________________

Planned changes in Saluda River Hydroelectric Dam release (next 5 days): ______________________

Additional notes/observations:

____

____

____

____

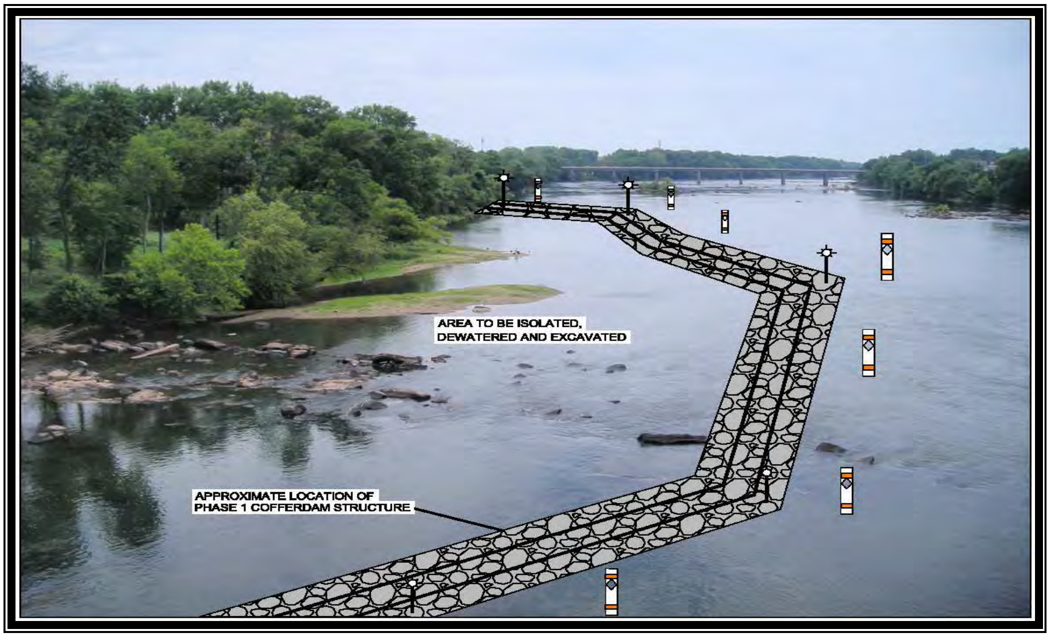
Signature of APEX Representative: ______________________

APPENDIX H

NAVIGATION PLAN

DRAFT NAVIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA



March 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

DRAFT NAVIGATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE), SCDHEC and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. Figure 2 illustrates the phased approach and the proposed cofferdam location and footprint. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities in each phase, the Navigation Plan activities for the next phase will be implemented followed by removal and movement of the cofferdam to the next phase location of the project.

SCE&G intends to complete the project with as minimal of an impact on navigation and recreational use of the Congaree River as possible. This Plan was developed based on the guidelines provided in the “U.S. Coast Guard Aids to Navigation System” publication. In addition, SCE&G is in consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office and will complete all required notifications and installation of appropriate navigational aids and safety measures as directed by the Office during implementation of the project.

NAVIGATION WITHIN THE PROJECT AREA

The USACE, Charleston District completed a navigability study of the Congaree River Basin in 1977. Excerpts from this study are provided in Attachment A. This document classifies the Congaree River as “navigable waters of the U.S. from its confluence with the Wateree River (R.M. [River Mile] 125.3) to the Gervais Street Bridge, U.S. 378 (R.M. 175.9).” As a result, the planned project area is located at the extreme upriver limit of the classified navigable waters (Figure 2). This study provides historical documentation of significant use of the Congaree River for navigation and commerce, especially during the time frame when the Columbia Canal was operational. However, the study states that use of the river for interstate commerce has not occurred since the 1950s due to the utilization of other forms of transportation.

Current conditions within the Congaree River and the project area are similar to those described in the 1977 study. The river in the vicinity of the Gervais Street Bridge is shallow and rocky with highly variable flow rates that preclude the operation of large watercraft. In fact, it was necessary to utilize multiple forms of small watercraft that ranged in size from a pontoon boat to a canoe to complete the sediment investigative activities within the project area. In some instances, areas were investigated by wading due to the shallow and rocky nature of the river bottom. In other areas, where sufficient water depth was present to allow for the small pontoon boat to operate, the flow rate of the river was too swift to permit safe operation of the watercraft.

Currently, only small personal watercraft such as inner tubes, kayaks, canoes and occasionally a small motorboat are seen operating in the vicinity of the Gervais Street Bridge and the project area. Wading for the purpose of fishing or swimming also occurs in this area.

Potential Impacts to Navigation

As seen on Figure 2, the cofferdam will be constructed in phases and will isolate a portion of the river during each phase. However, the actual project area is relatively small in comparison to the overall width of the river and at least half of the river's width will be available for continued navigation or other activities. The width of the area to be isolated by the temporary cofferdam ranges from 225 feet wide in Phase 1 to approximately 300 feet wide in Phase 3, while the entire river width ranges from approximately 600 to 775 feet in the project area.

As a result, construction of the temporary cofferdam will reduce the amount of river area available for the types of small watercraft listed above, but will not prohibit passage. For illustrative purposes, Figure 3 shows the approximate location of the cofferdam and the river at a moderately low water level. The river discharge rate, measured at the Columbia gage located directly across the river from the project area (Figure 2), on the date of the aerial photograph (October 1, 2010) was 2,540 cubic feet per second (cfs). The mean monthly discharge rate for water years 1940-2011 is 6,731 cfs. As a result, the river discharge occurring in the aerial photo is roughly one-third of the mean but well above the historical monthly minimum discharge of 1,085 cfs observed in October 2008. The discharge summary for 2010 is provided as Attachment B.

The photograph in Figure 3 shows the varying nature of the river substrate in the vicinity of the project area and clearly illustrates the characteristics that preclude the use of larger watercraft within this portion of the river. The bedrock outcrops are seen to protrude from the river's surface south and west of the project area. The shallow nature of the river in the vicinity of the Gervais Street Bridge can also be seen in the photograph. The open water area west of the proposed cofferdam is also apparent on the figure and the proposed navigation route is highlighted by the arrows. Watercraft of the type typically utilized in this area of the river will be able to continue unobstructed use of the resource during completion of the project.

Due to safety requirements, landside support zone activities and construction operations within the river, completion of the project must restrict access of the general public to the Congaree River via the Senate Street Extension (Figure 3). This area is currently utilized as a boat launch and fishing area due to the easy access provided by the asphalt and gravel access road (which is private property) and the gentle slope to the river's edge. SCDHEC has installed warning signs placing the area off limits to swimming or wading due to the presence of the impacted sediments. In addition to the boating groups that may have an access agreement with the property owner, many individuals utilizing the area for fishing and boating purposes are currently doing so by crossing private property, most likely without permission. As a result, temporary loss of this area will not affect the general public access to the river since this is private property. SCE&G plans to secure the area with a chain-link fence to establish the project support zone.

Other options for the general public to launch small watercraft and access to the river include the Three Rivers Greenway located directly across the river from the project area (Figure 3) and a public boat ramp located approximately 1.8 miles downstream of the Blossom Street Bridge.

Overall, no significant impacts to navigation of small watercraft and use of the river for recreational purposes are expected during completion of the project. At least half the river's width will be available for use by the general public at all times. The restricted access to the private property located to the east of the project area will be mitigated by the access points located directly across the river at the Three Rivers Greenway and public boat ramp located downstream. Additional safety measures that will be taken to ensure that safe navigation through the project area will be maintained are described below.

SAFETY MEASURES (PRIVATE AIDS TO NAVIGATION)

The U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office was consulted with regard to maintaining safe navigation throughout completion of the project. The U.S. Coast Guard navigation specialist from the district has been provided details associated with the project plans and proposed aids to navigation. In accordance with the regulations (after the USACE individual permit has been issued), the U.S. Coast Guard will review this Navigation Plan. If the U.S. Coast Guard concurs with the locations of the proposed private aids to navigation, they will likely issue a letter of no objection (see recent correspondence in Attachment C). The completed draft U.S. Coast Guard Private Aids to Navigation Application is provided in Attachment D and will be submitted along with the USACE individual permit, once received.

The DRAFT safety measures (private aids to navigation) and details listed below are provided to illustrate the current plan. If any revisions are made subsequent to the U.S. Coast Guard review of the Plan, the revised Plan will be submitted to the USACE for review prior to commencement of the project. The three main objectives of the safety measures are:

1. Provide boaters and other users of the river with advance notice of the construction site and the need to take appropriate measures to avoid the cofferdam structure;
2. Demarcate the area to be avoided; and

3. Alert boaters and other users of the river that the cofferdam structure, isolated area (sediment excavation area) and the landside support zone are restricted areas and off limits to non-construction related personnel.

These three objectives will be accomplished by the publication of a “Notice to Navigation Interests” (Notice) prior to initiation of each phase of the project. This Notice will provide specific details pertaining to the project area and the navigational requirements. A draft copy of the Notice is provided as Attachment E.

In addition, strategic placement of warning and restricted access signs, solar powered lights and regulatory buoys will provide real-time notification to boaters as they enter and make their way through the project area from either direction. Figures 4 through 5 provide the proposed locations for the private aids to navigation (signage and lighting placement scenario) for each phase of the project. Table 1 provides a summary of the required quantities of aids to navigation per phase as well as recommended manufacturer identification and model numbers. Proposed alternative aids to navigation that meet or exceed the criteria below will also be considered.

For Phase 1, the warning signs will be placed up and downriver of the project area in the approximate locations shown on Figure 4. The final locations of the signs will be determined in the field and will be based on existing conditions. The signs will be located in areas that are readily visible to river users. The warning signs will be relatively large (approximately 4 feet by 4 feet) and state “Warning - River Construction Zone Ahead”. The signs placed in the river will be bolted to metal posts and attached to a weighted base and secured in-place with concrete blocks or large boulders. .

The signs will be placed in the river, on the temporary cofferdam and along the shoreline and will be placed at a sufficient height (i.e., eye level - 3 to 5 feet above the water or land surface). For boaters, the elevation of the signs will be based on average river flows when most recreational boating activity is expected to occur. The average river elevation is approximately 115 feet (NGVD ‘29). This equates to an approximate sign elevation of 118 feet (NGVD ‘29). During completion of the investigative activities it was observed that river elevations above approximately 117 feet (NGVD ‘29) produced flows that were not conducive to the safe operation of small watercraft within the project area. As a result, the 118 feet elevation will place the signs above the water level at flows where most recreational boating and use of the river is expected to take place. For the cofferdam and landside sign installations, eye level, or approximately 5 feet of the surface elevation, will be used to establish the correct position of the sign.

The U.S. Coast Guard Aids to Navigation System specifies the use of an information or regulatory buoy (white with an orange band) to designate areas that should be avoided by watercraft. For this project, the buoys will also be marked with a danger symbol that specifies the presence of the dam. Example specifications of this type of buoy and markings are provided in Attachment F. For each planned phase of the project, the approximate locations for buoy moorings are shown on Figures 4 through 5. Generally, the buoys will be properly secured approximately 5 to 10 feet away from the outboard toe of the cofferdam slope and alert river users to the presence of the rock dam. The buoys will direct both downstream and upstream traffic away from the cofferdam structure. They will be relocated as necessary as the project progresses.

Marine-application lights will also be positioned slightly above the top of the cofferdam to help identify the perimeter of the structure in the unlikely event that boating traffic is in the area during nighttime or low light conditions. As part of the aids to navigation, solar powered, LED lights will be placed on each corner (or bend) and midpoint of each leg of the cofferdam. The lights will have a standard flash rate of 60 flashes per minute (FPM) and will be visible for 1 mile, under clear conditions. The lights will be positioned on the outboard side of the cofferdam with the elevation set approximately 2 feet above the crest elevation of the cofferdam, 125.5 feet (NGVD ’29). The lights will be installed on 4 inch by 4 inch treated posts secured into the rock-filled cofferdam. This height was selected to provide optimum visibility from the waterside of the cofferdam, while attempting to minimize any potential adverse impacts to the inhabitants of the residential condominiums located on Gist Street. At a minimum, ten (10) lights will be placed for each phase of construction. An example of solar powered nautical lights is provided in Attachment F.

Finally, “Restricted Area” signs will be positioned at regular intervals along the cofferdam structure to alert river users of the need to stay away from the cofferdam. No unauthorized access to or on the cofferdam structure will be permitted.

Project personnel will conduct regular inspections of the buoys, lights and signs to ensure that they are still visible, in the correct locations, securely moored in place and operating properly. The minimum inspection frequency will be once per week and as soon as possible following high water/high river flow events. Any issues identified during the inspections will be corrected as soon as possible.

TABLE 1

SUMMARY OF AIDS TO NAVIGATION

Congaree River Sediments
Columbia, South Carolina

Quantity	Description	Model No.	Manufacturer
10	Regulatory buoys ABS type 9" diameter or equivalent, with required anchors and mandatory restricted area symbol, "Danger Dam"	B1147R	Roylan
6	48" x 48" flourescent/reflective signs "Warning River Construction Zone Ahead" black message on white reflective background with orange border	B2211	Roylan
10	Solar lights (LEDs), clear, to be positioned on each "corner" of cofferdam, 60 FPM (flashes per minute) mounted on 4" x 4" treated posts or equivalent	One mile #101 Series	Roylan

Note:
Signs, buoys and lights will be deployed during each phase of the project.

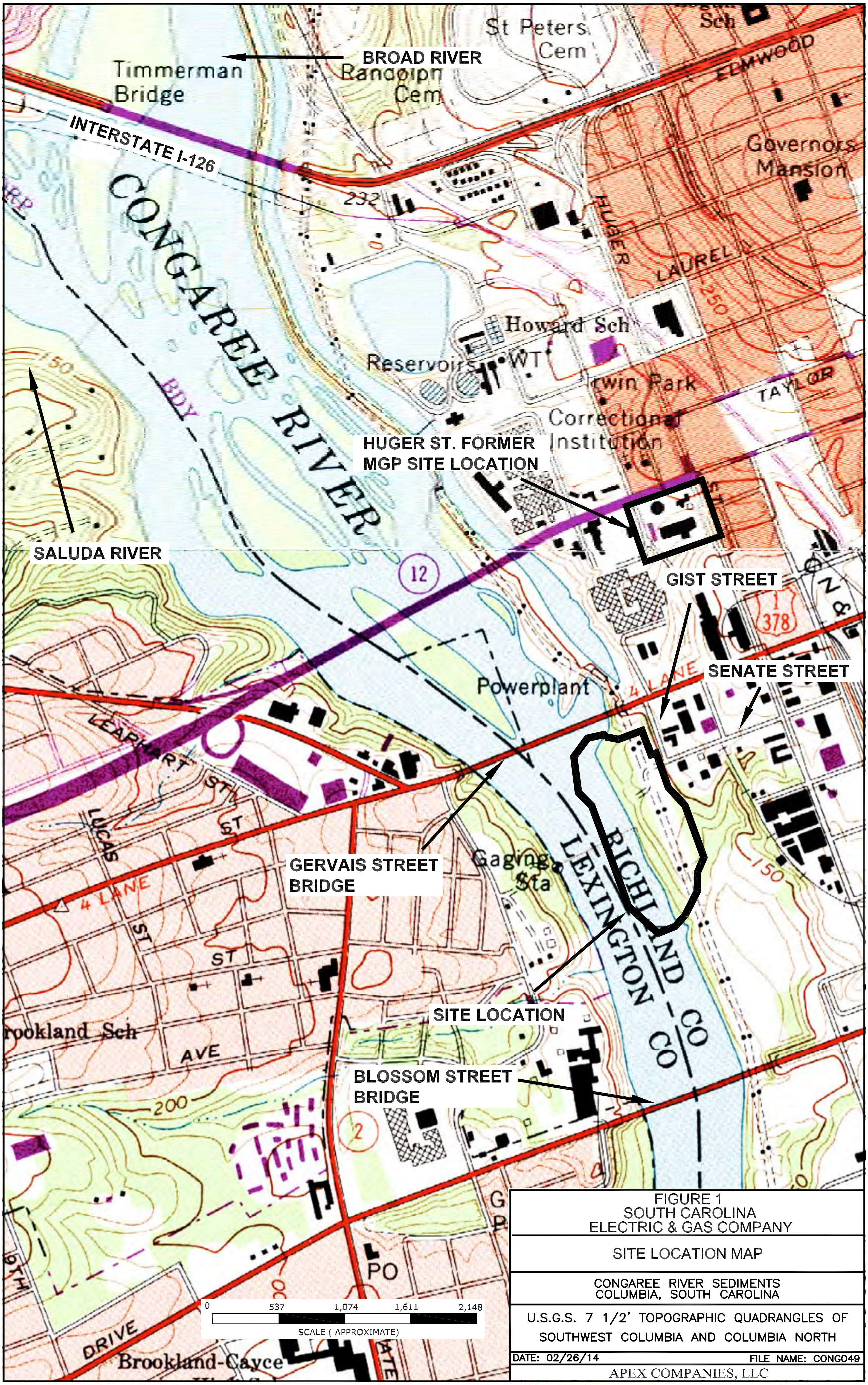


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

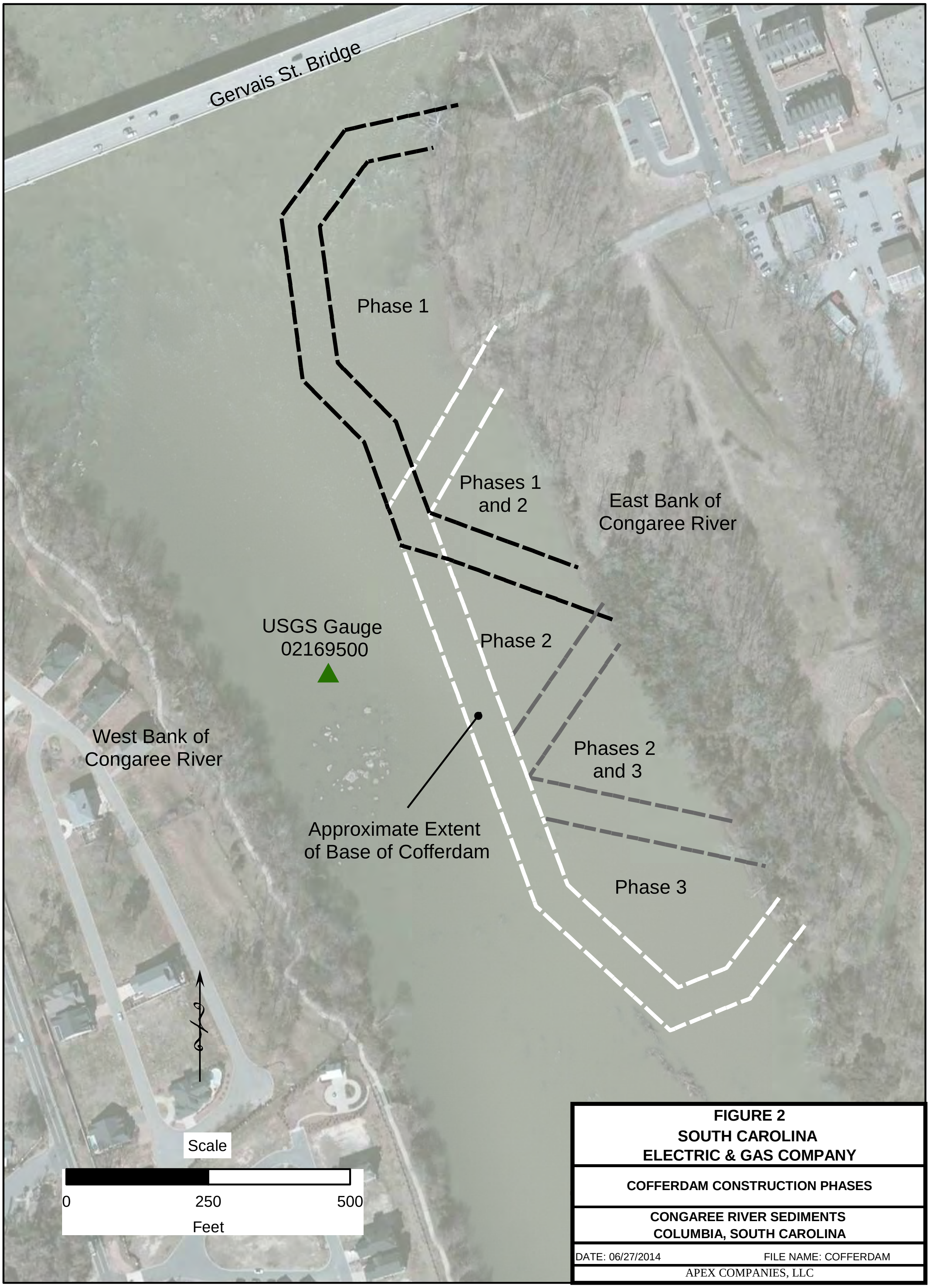


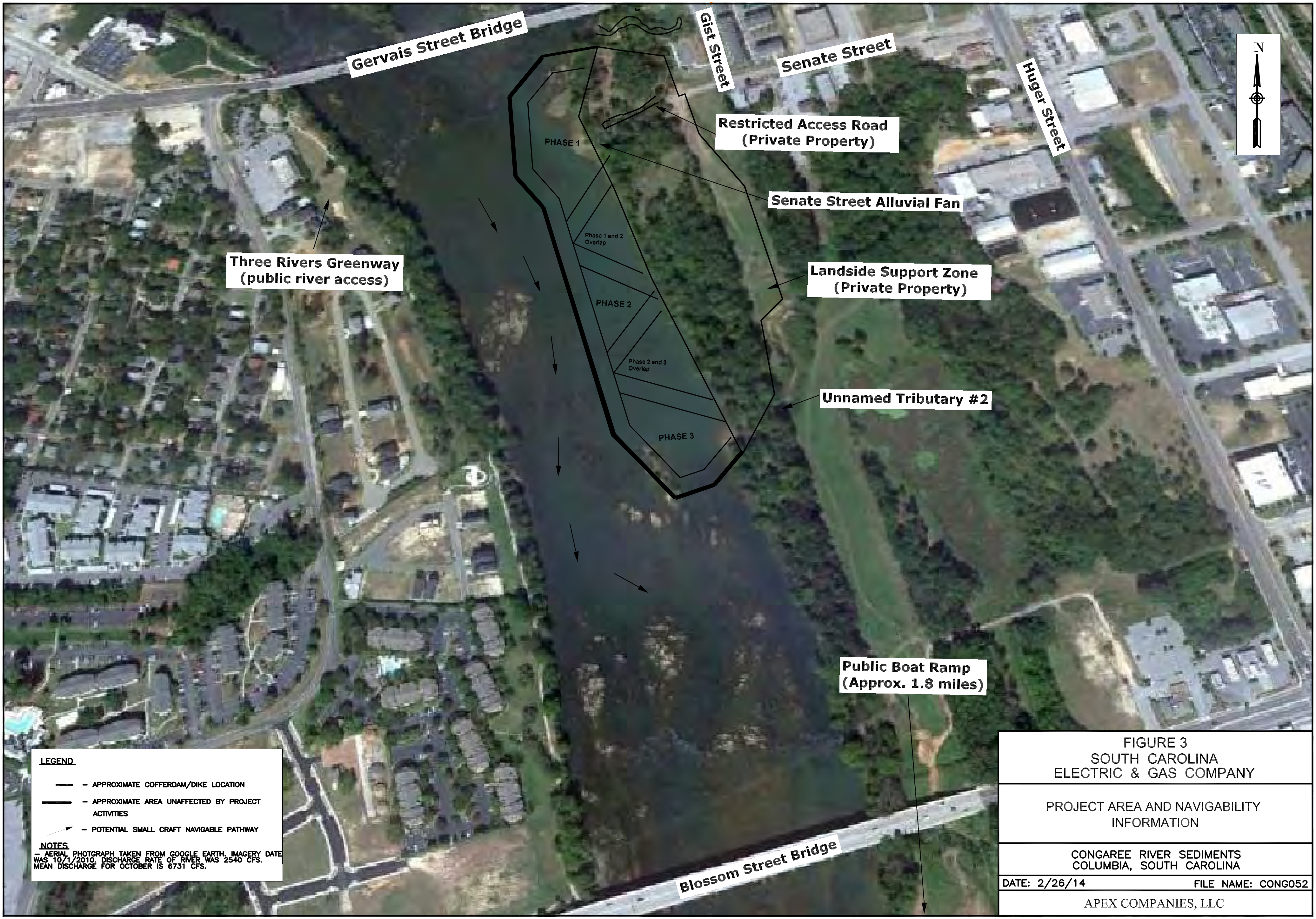
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

COFFERDAM CONSTRUCTION PHASES

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/27/2014 FILE NAME: COFFERDAM

APEX COMPANIES, LLC



Gervais Street Bridge
Gist Street
Senate Street
Huger Street
N
Restricted Access Road
(Private Property)
PHASE 1
Senate Street Alluvial Fan
Phase 1 and 2 Overlap
Three Rivers Greenway
(public river access)
Landside Support Zone
(Private Property)
PHASE 2
Phase 2 and 3 Overlap
Unnamed Tributary #2
PHASE 3
Public Boat Ramp
(Approx. 1.8 miles)
Blossom Street Bridge
LEGEND
— APPROXIMATE COFFERDAM/DIKE LOCATION
— APPROXIMATE AREA UNAFFECTED BY PROJECT ACTIVITIES
— POTENTIAL SMALL CRAFT NAVIGABLE PATHWAY
NOTES
— AERIAL PHOTOGRAPH TAKEN FROM GOOGLE EARTH. IMAGERY DATE WAS 10/1/2010. DISCHARGE RATE OF RIVER WAS 2540 CFS. MEAN DISCHARGE FOR OCTOBER IS 6731 CFS.
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
PROJECT AREA AND NAVIGABILITY
INFORMATION
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 2/26/14
FILE NAME: CONG052
APEX COMPANIES, LLC

N
Jarvis Klapman Boulevard
Gervais Street Bridge
W
W
W
PHASE 1
W
W
W
LEGEND
W – CONSTRUCTION SITE WARNING SIGNS
– CONSTRUCTION SITE WARNING LIGHTS
– REGULATORY BUOYS
NOTES:
1) FINAL PLACEMENT OF SIGNS, LIGHTS AND BUOYS WILL BE DETERMINED AT THE TIME OF INSTALLATION AND WILL DEPEND ON FIELD CONDITIONS.
2) RESTRICTED AREA SIGNS WILL BE PLACED ALONG THE COFFERDAM AND LANDSIDE AREA CHAIN LINK FENCE.
FIGURE 4
SOUTH CAROLINA ELECTRIC & GAS COMPANY
PRIVATE AIDS TO NAVIGATION - PROPOSED LOCATIONS FOR PHASE 1
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 3/25/14
FILE NAME: CONG050
APEX COMPANIES, LLC
Blossom Street Bridge

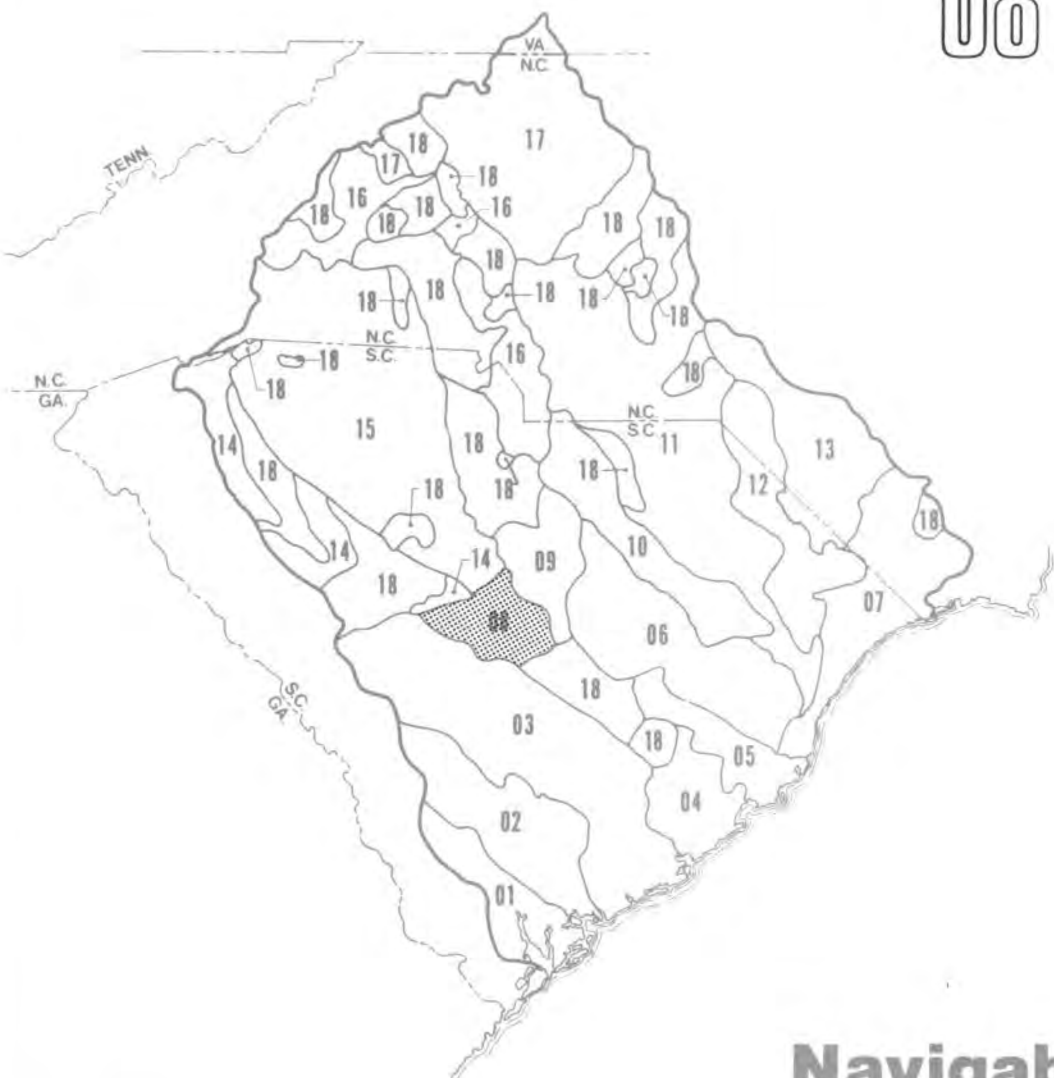
N
Jarvis Klapman Boulevard
Gervais Street Bridge
W
W
W
PHASE 2
W
W
W
Blossom Street Bridge
LEGEND
W – CONSTRUCTION SITE WARNING SIGNS
– CONSTRUCTION SITE WARNING LIGHTS
– REGULATORY BUOYS
NOTES:
1) FINAL PLACEMENT OF SIGNS, LIGHTS AND BUOYS WILL BE DETERMINED AT THE TIME OF INSTALLATION AND WILL DEPEND ON FIELD CONDITIONS.
2) RESTRICTED AREA SIGNS WILL BE PLACED ALONG THE COFFERDAM AND LANDSIDE AREA CHAIN LINK FENCE.
FIGURE 5
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
PRIVATE AIDS TO NAVIGATION -
PROPOSED LOCATIONS FOR PHASE 2
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/30/14
FILE NAME: CONG183
APEX COMPANIES, LLC

ATTACHMENT A

U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina

CONGAREE RIVER BASIN

Report No. 08



Navigability Study
1977

STANLEY CONSULTANTS

Navigation Classification Categories

This study classifies streams into several different categories, each of which is discussed subsequently:

1. Present "navigable waters of the U. S." (by regulatory procedures).
2. Historically navigable waters (based on literature review).
3. Recommended "navigable waters of the U. S." (based upon data developed as a part of this investigation).
4. Recommended waters for practical navigation (within "navigable waters of the U. S.").
5. Headwaters for all waterbodies (five cfs points).

The first four navigation classifications are displayed on the plates presented later in this report. The headwater limits are summarized in Appendix A.

Present Navigable Waters of the U. S.

Currently, the Congaree River is classified as "navigable waters of the U. S." from its confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378, (R.M. 175.9). (3)(4)(20) This classification is based on the limits of the Federally authorized project, as discussed in Section 3, as well as Federal and state court decisions, as discussed in Section 5. (See plate 08-2 for map location.)

Historically Navigable Waters

The Congaree River was extensively used for navigation throughout the earlier development of the state. After the construction of the Columbia Canal, as referred to in Section 4, navigation extended over the entire length of the Congaree River (R.M. 176.9), and continued up the Broad River (see Report 15).

Recommended and Practical Navigable Waters of the U. S.

The recommended and practical limit of "navigable waters of the U. S." is at the Gervais Street bridge (R.M. 175.9). This is the same limit as the present classification, and is based on the Federal court decisions and authorized project limits that established the present classification, as well as observations and calculations, which establish the practicality of navigation at all six bridges crossing the river. Analysis at each of the locations resulted in an approximate mean water depth of at least 7 feet, approximate channel width of at least 50 feet, and an average slope within the ranges for practical navigation. The river extends upstream for about one mile beyond R.M. 175.9; however, it becomes shallower and spotted with sandbars as it nears the confluence of the Broad and Saluda Rivers and would require extensive improvements to be navigable. In addition, entrance to the Columbia Canal, used at one time to by-pass this shallow area, is no longer operational due to installation of electric generating turbines and would also require extensive renovation to become functional.

These conclusions on the navigation limit meet the criteria established for the Federal test of navigability that the body of water is used, or is capable of being used, in conjunction with other bodies of water to form a continuous highway upon which commerce with other states or countries might be conducted.

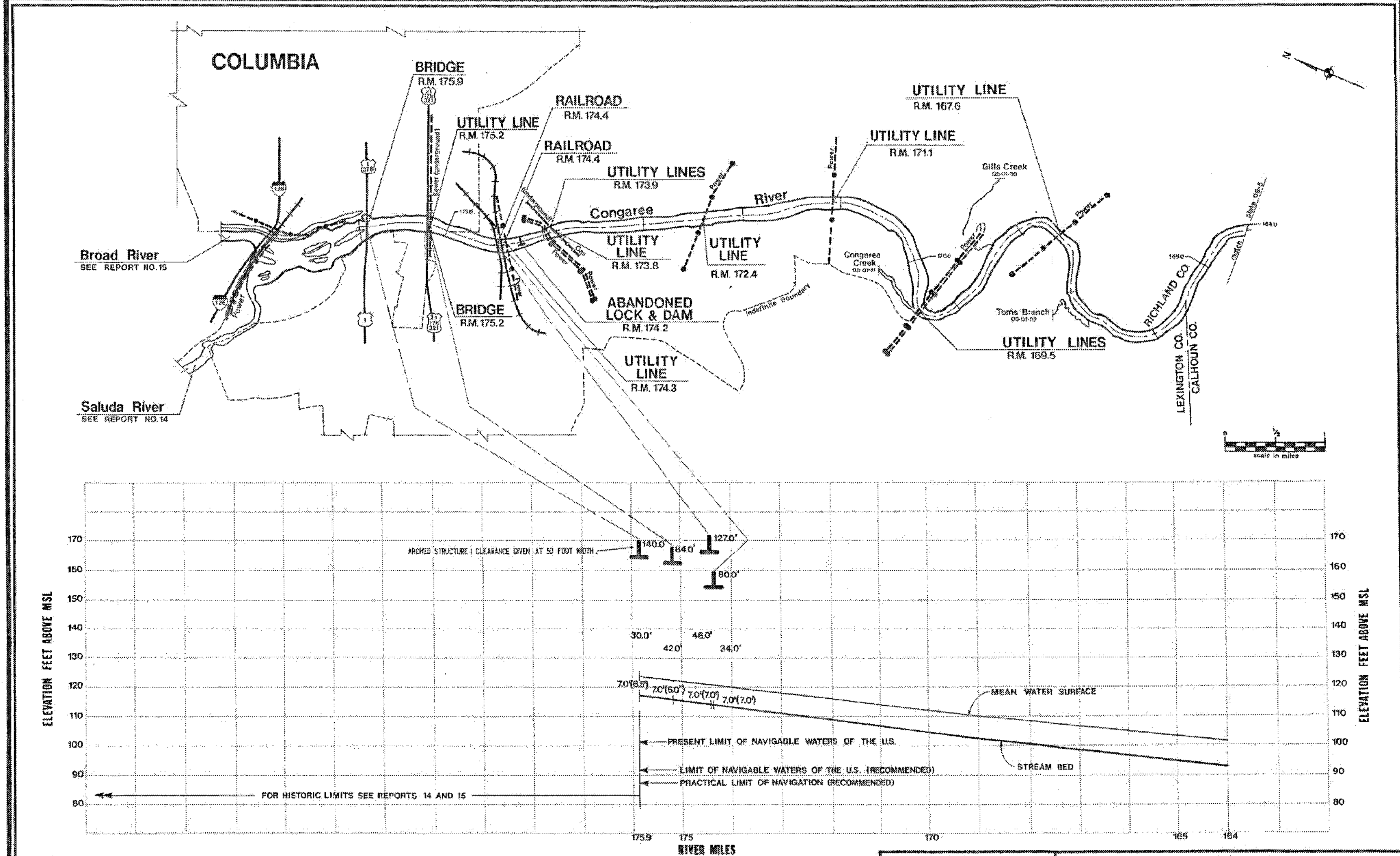
There are no significant tributaries to the Congaree River capable of supporting navigation.

Plates 08-4 through 08-6 are plan and profiles of the recommended "navigable waters of the U. S." The plan and profile plates show mean water surface as determined from USGS maps, stream bed depth, 50 feet wide navigable channel depth, pier spacing for bridges crossing the river, and vertical clearances at structures. Approximate vertical clearances for overhead utilities are shown later in this Section in Table 4. It is emphasized that all references to elevation are approximate since vertical control was established from USGS contour maps and not field instrument surveys. Water depth and structure vertical clearance measurements are also approximate due to the accuracy inherent in the field techniques. (See the Summary Report for a detailed description of field procedures and the methodology used to calculate water depth at mean flow.)

SECTION 7 - CONCLUSIONS AND RECOMMENDATIONS

Five classifications of navigation on streams in the Congaree River basin have been determined and are presented below. The first two are classifications developed from historical evidence and current Federal stream classifications. Classification 3 is based on field measurements, observations, and data analysis for the river. Classification 4 is based on review of all previously determined limits with a recommendation of the most upstream location with supporting evidence of navigability. The fifth classification accounts for all streams not otherwise classified and was determined based on the drainage area and hydrological aspects of the stream.

1. The Congaree River is presently classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge in Columbia (R.M. 175.9).
2. The historical limit of navigation on the Congaree River is, with the use of the Columbia Canal, to R.M. 177. The classification extends beyond the Congaree basin boundary to the Broad River (see Report 15).
3. The recommended practical limit of navigation is at the Gervais Street bridge (R.M. 175.9). Reasonable channel improvements will be necessary for commercial river traffic to actually use the river up to this point.
4. It is recommended that the Congaree River be classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378 (R.M. 175.9) based on the analytical procedures and tests of navigability used in this study effort.
5. All streams not recommended for classification as "navigable waters of the U. S." are recommended for classification as "waters of the U. S." throughout their entire length.



LEGEND:

OVERHEAD STRUCTURE — 75' — HORIZONTAL CLEARANCE IN MAIN CHANNEL

12' — VERTICAL CLEARANCE TO STRUCTURE

MEAN WATER SURFACE — MAXIMUM DEPTH AT MEAN FLOW

STREAM BED — 8' (6) — MAXIMUM DEPTH OF 50 FOOT WIDE CHANNEL AT MEAN FLOW

STRUCTURE RIVER MILE LOCATION

NOTES:

1. ELEVATION AND SLOPE OF MEAN WATER SURFACE ARE BASED ON USGS TOPOGRAPHIC MAPS AND ARE THEREFORE ONLY APPROXIMATIONS. VERTICAL DIMENSIONS FROM STREAM BED TO OVERHEAD STRUCTURES ARE FIELD MEASUREMENTS. RELATIVE LOCATION OF MEAN WATER SURFACE IS APPROXIMATED FROM CONTOUR MAPS, MEASURED CROSS SECTIONS AND VELOCITIES, STREAM FLOW RECORDS, THE MANNING EQUATION, AND FIELD OBSERVATIONS. SEE SUMMARY REPORT FOR COMPLETE EXPLANATION.

1977

U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina

STANLEY CONSULTANTS

PLAN AND PROFILE
CONGAREE RIVER
Congaree River Basin
CALHOUN-LEXINGTON-RICHLAND CO., S.C.
NAVIGABILITY STUDY
Miles 164.0-175.9 Plate 08-6

ATTACHMENT B

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:02169500 CONGAREE RIVER AT COLUMBIA, SC TYPE:STREAM AGENCY:USGS STATE:45 COUNTY:063
LATITUDE: 335935 LONGITUDE: 0810300 NAD27 DRAINAGE AREA:7850* CONTRIBUTING DRAINAGE AREA: DATUM:113.02 NGVD29
Date Processed: 2012-03-23 09:22 By wjstring
Lowest aging status in period is APPROVED
DD #1, FROM DCP
Discharge, cubic feet per second
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2540	2600	2680	2090	2360	3150	19600	3070	3560	1610	1280	753
2	1680	1750	8140	2330	2410	4490	11900	2520	2990	1870	1120	730
3	1400	2300	12000	2860	3400	4760	8300	3750	3000	1650	1090	747
4	1430	2510	6810	2770	7390	3970	9310	3450	3970	1430	945	749
5	1320	2100	5000	3070	6910	3000	5840	3830	2900	1830	1260	1490
6	1560	2250	4190	2920	10400	3350	7570	4270	2530	1560	1680	1820
7	1830	2290	3940	2710	11700	8490	9590	6460	2540	2090	1750	1080
8	1650	2500	2900	3590	6900	17700	7750	3000	2600	1640	1610	1250
9	1430	2190	2830	2420	5090	13200	7030	4350	2300	1400	2880	1390
10	1380	1640	2870	2740	4900	9010	8230	3560	1910	1820	1490	1190
11	1380	1830	2360	7820	4760	11600	7940	3500	1400	2250	1170	1020
12	1330	1580	2320	6640	3690	12700	6450	3200	1240	2370	1420	1080
13	1380	2370	4830	6590	2860	8400	5960	2870	1720	2340	1160	1130
14	1330	1970	10400	7300	4030	6120	8560	3040	2330	1800	1410	1300
15	1320	1840	6670	4660	2720	7410	5960	3280	2320	1300	1470	1140
16	1350	1550	2880	1730	2210	6580	4930	2720	2610	1190	1940	896
17	1370	1550	2690	2830	2460	5860	4200	3310	2960	1430	1420	856
18	1330	2610	2060	4590	3190	6260	7940	3910	2050	1980	1570	853
19	1310	2430	3460	5960	2990	5880	7890	4350	2000	1780	1010	855
20	1330	2230	2960	3410	2910	4960	7920	4860	2180	2170	1110	1300
21	1310	2200	2260	2930	3210	5470	7300	3890	2200	1510	1110	1400
22	1350	2380	2260	2890	2110	5550	3910	3810	2080	1400	1440	1400
23	1880	1460	2490	2860	2700	5400	4560	2930	1490	1370	1300	2730
24	1660	1450	3080	2470	2550	5480	4760	2090	1250	1410	1330	5530
25	1410	2130	2000	2860	2510	5380	4220	3090	2340	1370	1420	5470
26	1760	2500	2730	2160	2400	4490	5110	2870	2650	4010	1270	5120
27	1680	2280	2940	2270	2690	6770	5790	2450	2630	2300	1140	4040
28	3200	9190	2970	2950	3040	13600	5980	3390	2140	1410	1250	2250
29	4700	2570	2920	3200	---	13200	4720	4410	1470	1330	1250	2020
30	4330	2180	2910	3480	---	14400	4580	3630	1400	1180	1220	1300
31	4440	---	2910	2970	---	17200	---	2410	---	1420	960	---
TOTAL	57370	70430	121460	110070	114490	243830	213800	108270	68760	54220	42475	52889
MEAN	1851	2348	3918	3551	4089	7865	7127	3493	2292	1749	1370	1763
MAX	4700	9190	12000	7820	11700	17700	19600	6460	3970	4010	2880	5530
MIN	1310	1450	2000	1730	2110	3000	3910	2090	1240	1180	945	730
CFSM	0.24	0.30	0.50	0.45	0.52	1.00	0.91	0.44	0.29	0.22	0.17	0.22
IN.	0.27	0.33	0.58	0.52	0.54	1.16	1.01	0.51	0.33	0.26	0.20	0.25

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1940 - 2011, BY WATER YEAR (WY)

MEAN	6731	6861	8741	11410	12460	13860	11050	7608	6757	6256	6600	5966
MAX	33460	18960	24450	28430	34910	31290	27670	20460	18730	16730	18650	19250
(WY)	1965	1993	2010	1993	1960	2003	1964	2003	1973	1941	1949	1945
MIN	1085	1191	1804	2967	3211	4074	3851	2283	1427	1109	1342	1328
(WY)	2008	2008	2008	1956	2001	1955	2006	2001	2008	2008	2007	2007

SUMMARY STATISTICS FOR 2010 CALENDAR YEAR FOR 2011 WATER YEAR WATER YEARS 1940 - 2011

ATTACHMENT C

James Dunmyre

From: Timothy.R.Martin@uscg.mil on behalf of Martin, Timothy R LT [Timothy.R.Martin@uscg.mil]
Sent: Tuesday, December 31, 2013 8:27 AM
To: James Dunmyre
Cc: HQS-PF-fldr-CG-NAV; TIS-PF-NISWS
Subject: FW: ***For Action*** 2013-1153 - Inquiry Regarding Navigation

Mr. Dunmyre,

The District Seven Aids to Navigation and Waterways Management office has a private aids to navigation specialist who'll be able to work through the details with you. Depending on the situation a permit may be needed, but the process might be as simple, after some information sharing, as an email approval from this office.

Please contact Mr. Mark Engle at 305-415-6755/Andrew.M.Engle@uscg.mil to get started. Be ready to answer questions about position and construction type so we can conduct a full analysis and decide how the cofferdam should be marked.

Best Regards,

LT Timothy Martin
District Seven Aids to Navigaiton
& Waterways Management
Chief, Field Operations Section
Office: 305-415-6746
Mobile: 305-586-5592

-----Original Message-----
From: Cull, Megan L LCDR
Sent: Monday, December 30, 2013 12:45 PM
To: Martin, Timothy R LT
Subject: FW: ***For Action*** 2013-1153 - Inquiry Regarding Navigation

Greetings, Tim. I received the below query via NAVCENs website and it seems related to PATON. Can you, or someone from your office, provide a response?

Please copy HQS-PF-fldr-CG-NAV and TIS-PF-NISWS as the folks over at NAVCEN track queries for timeliness and to ensure they are closed out.

Happy New Year,

LCDR Megan Cull
CG-NAV-3

-----Original Message-----
From: JDunmyre@apexcos.com [mailto:JDunmyre@apexcos.com]
Sent: Monday, December 30, 2013 11:05 AM
To: Cull, Megan L LCDR
Subject: RE: ***For Action*** 2013-1153 - Inquiry Regarding Navigation

Yes, we are asking how the cofferdam should be marked while in place so that mariners are aware of it and act appropriately around it. The location is Columbia, South Carolina.

Thanks,

James Dunmyre
Environmental Scientist
Apex Companies, LLC
MTR is now a subsidiary of Apex Companies, LLC

O) 412-829-9650

-----Original Message-----
From: Megan.L.Cull@uscg.mil [mailto:Megan.L.Cull@uscg.mil]
Sent: Tuesday, December 24, 2013 12:28 PM
To: James Dunmyre
Cc: HQS-PF-fldr-CG-NAV; TIS-PF-NISWS
Subject: FW: ***For Action*** 2013-1153 - Inquiry Regarding Navigation

Greetings Sir -
We do not understand your question. Are you asking how the cofferdam should be marked while in place so that mariners are aware of it and act appropriately around it? What is the general location for the intended cofferdam? Coast Guard District offices oversee the aids to navigation system within their area of responsibility so they are probably the person you should discuss this with, but more information might help us discern that.

We hope this answers your inquiry and we exhort you to always navigate safely,

U.S. Coast Guard
Office of Navigation Systems
Washington, DC 20593-7851

1. Subject: Navigation
2. Name: James Dunmyre
3. Telephone number: 412-829-9650
4. Email Address: jdunmyre@apexcos.com
5. IP Address: 50.199.183.109
6. Comments or Questions:

I have a question in regards to potential temporary cofferdam construction and providing the correct information for a navigation plan while the cofferdam is constructed. I was unable to find any examples of plans online. I did although find the US aids to navigation but I was in search of an actual plan itself for example. Thanks

Mail Sent from Web Server: 12/23/2013 02:38:56

James Dunmyre

From: James Dunmyre
Sent: Friday, January 03, 2014 2:35 PM
To: 'andrew.m.engle@uscg.mil'
Subject: Columbia, South Carolina Project

Mr. Mark Engle,

Provided in this email is a link to the Army Corps Of Engineers, Public Notice for the project we discussed on Tuesday, December 31, 2013. I do believe we discussed that the Army Corps requested additional information regarding a navigation plan as a response to comments.

http://www.sac.usace.army.mil/Portals/43/docs/regulatory/publicnotices/SAC-2011-01356-6_Richland_congaree_river_remediaion.pdf

I will provide you with additional information in a separate email if required.

Thank You,

APEX
apexcos.com

James Dunmyre
Environmental Scientist
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085
O) 412-829-9650

James Dunmyre

From: James Dunmyre
Sent: Monday, January 06, 2014 12:22 PM
To: 'andrew.m.engle@uscg.mil'
Subject: Additional information - Columbia South Carolina
Attachments: Summary to the Coast Guard.pdf

Mr. Engle,

Please find attached additional information pertaining to our project located on the Congaree River, Columbia, South Carolina. Included in the attachment is a brief summary of the project details and drawings for location and phase information.

If you require anything else please let me know.

APEX
apexcos.com

James Dunmyre
Environmental Scientist
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085
O) 412-829-9650

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CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

PROJECT INFORMATION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area is located at 33° 59' 40.59" North, 81° 02' 56.80" West and is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Army Corps of Engineers (USACE).

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary rock berm cofferdam to facilitate removal of the impacted sediment. As currently envisioned, the temporary cofferdam would be constructed in three separate phases over three construction seasons beginning on May 1 and ending on October 31 of each year, with portions of the temporary cofferdam potentially left in-place (in the river) between each phase of work. Figure 2 illustrates the phased approach and the proposed cofferdam location and footprint. The width of the area to be isolated by the temporary cofferdam ranges from 225 feet in Phase 1 to approximately 300 feet wide in Phase 3. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

The USACE, Charleston District completed a navigability study of the Congaree River Basin in 1977. Excerpts from this study are provided in Attachment A. This document classifies the Congaree River as "navigable waters of the U.S. from its confluence with the Wateree River (R.M. [River Mile] 125.3) to the Gervais Street Bridge, U.S. 378 (R.M. 175.9)." As a result, the planned project area is located at the extreme upriver limit of the classified navigable waters (Figure 2). This study provides historical documentation of significant use of the Congaree River for navigation and commerce, especially during the time frame when the Columbia Canal was operational. However, the study states that use of the river for interstate commerce has not occurred since the 1950s due to the utilization of other forms of transportation.

Current conditions within the Congaree River and the project area are similar to those described in the 1977 study. The river in the vicinity of the Gervais Street Bridge is shallow and rocky with highly variable flow rates that preclude the operation of large watercraft. In fact, it was necessary to utilize multiple forms of small watercraft that ranged in size from a pontoon boat to a canoe to complete the sediment investigative activities within the project area. In some instances, areas were investigated by wading due to the shallow and rocky nature of the river bottom. In other areas, where sufficient water depth was present to allow for the small pontoon boat to operate, the flow rate of the river was too swift to permit safe operation of the watercraft.

Currently, only small personal watercraft such as inner tubes, kayaks, canoes and occasionally a small motorboat are seen operating in the vicinity of the Gervais Street Bridge and the project area. Wading for the purpose of fishing or swimming also occurs in this area.

Potential Impacts to Navigation

As seen on Figure 2, the cofferdam will be constructed in phases and will restrict a portion of the river during each phase. However, the actual project area is relatively small in comparison to the overall width of the river and at any given time throughout completion of the project at least half of the river's width will be available for continued navigation or other activities. The width of the area to be isolated by the temporary cofferdam ranges from 225 feet in Phase 1 to approximately 300 feet wide in Phase 3, while the entire river width ranges from approximately 600 to 775 feet in the project area.

As a result, construction of the temporary cofferdam will reduce the amount of river area available for the types of small watercraft listed above but will not prohibit passage. For illustrative purposes, Figure 3 shows the approximate location of the cofferdam and the river at a moderately low water level. The photograph in Figure 3 shows the varying nature of the river substrate in the vicinity of the project area and clearly illustrates the characteristics that preclude the use of larger watercraft within this portion of the river. The bedrock outcrops are seen to protrude from the river's surface south and west of the project area. The shallow nature of the river in the vicinity of the Gervais Street Bridge can also be seen in the photograph. The open area west of the project area is also apparent in the figure and the pathway through the area is visible and highlighted by the arrows. Watercraft of the type typically utilized in this area of the river will be able to continue unobstructed use of the resource during completion of the project.

SAFETY MEASURES

The three main objectives of the safety measures are:

1. Provide boaters and other users of the river with advance notice of the construction site and the need to take appropriate measures to avoid the cofferdam structure;
2. Demarcate the area to be avoided; and
3. Alert boaters and other users of the river that the cofferdam structure, isolated area (sediment excavation area) and the landside support zone are restricted areas and off limits to non-construction related personnel.

These three objectives will be accomplished by the strategic placement of warning and restricted access signs, lighting and navigational buoys, as specified by the U.S. Coast Guard. Appropriate public notices or notices to potential users will be published, as required, prior to implementation of the project.

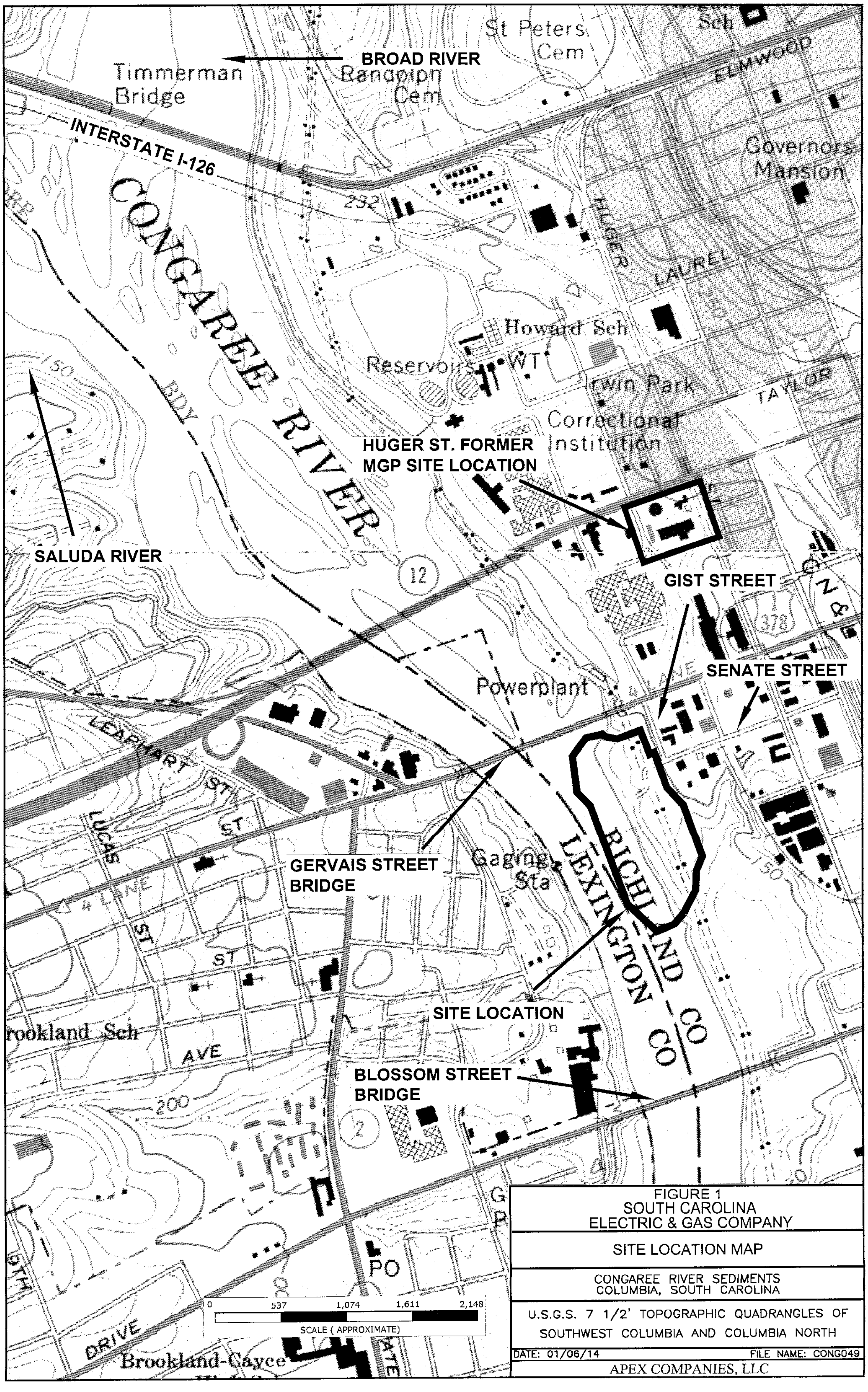


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

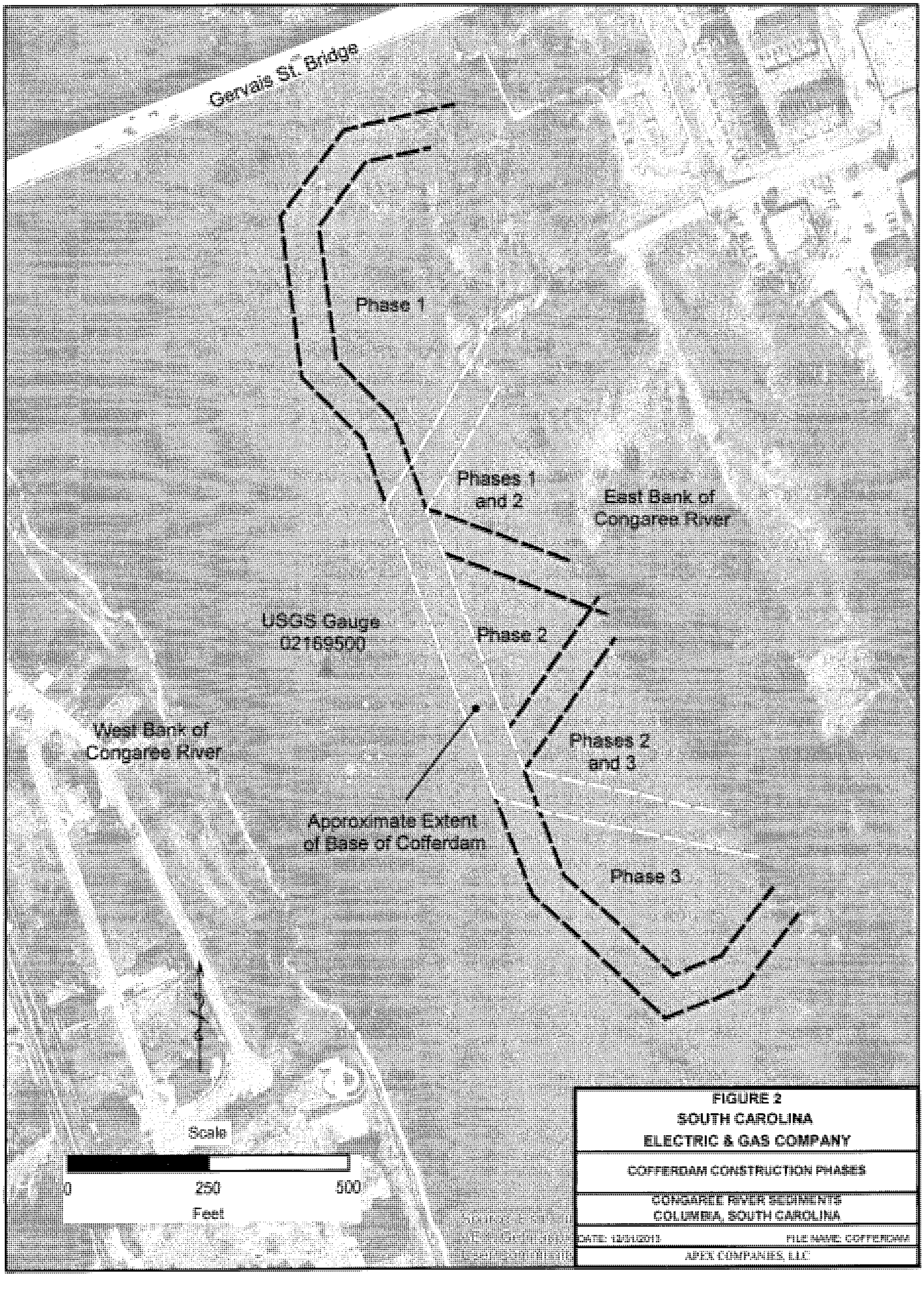
SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

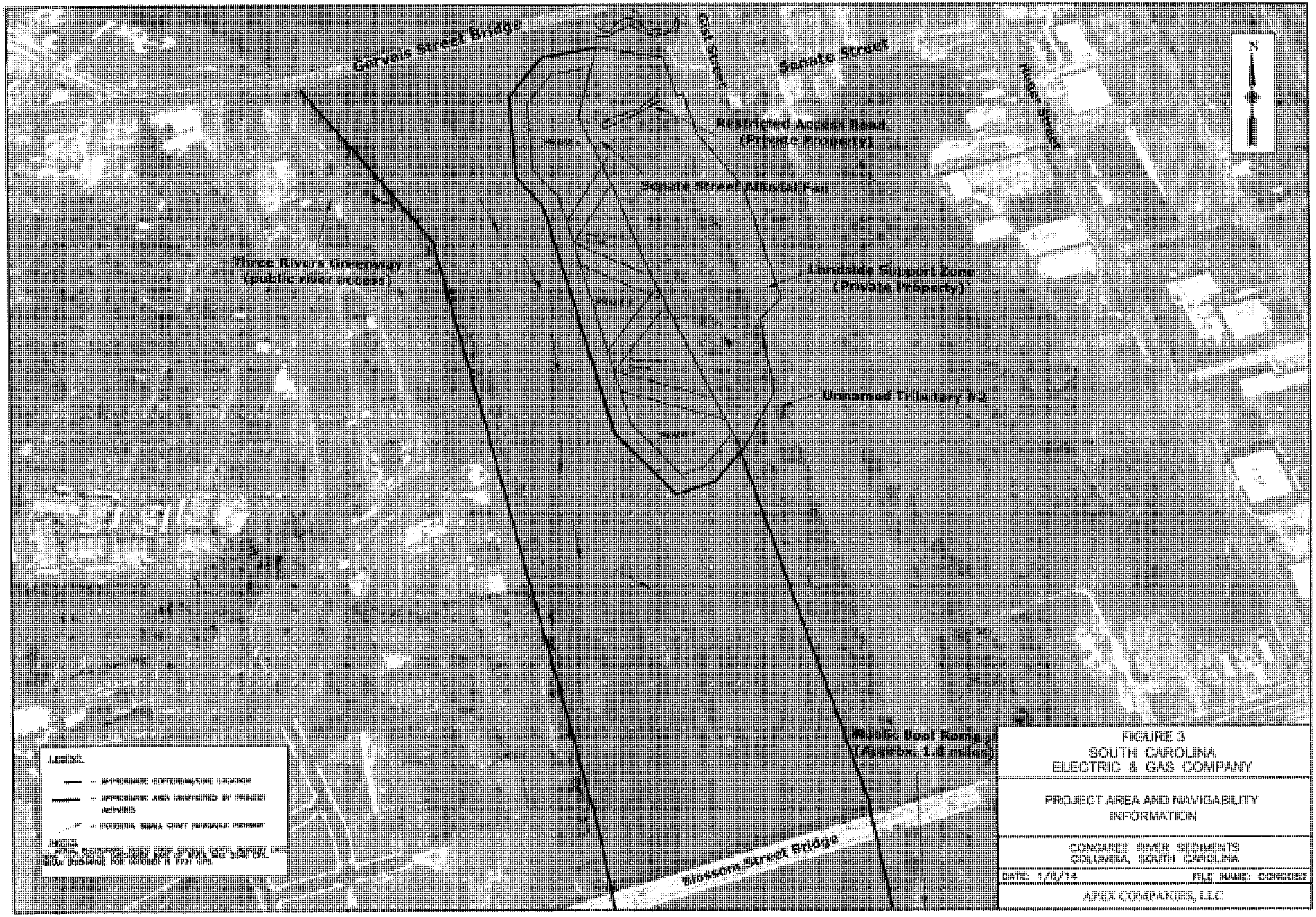
U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 01/06/14 FILE NAME: CONG049

APEX COMPANIES, LLC



Gervais St. Bridge
Phase 1
Phases 1
and 2
East Bank of
Congaree River
USGS Gauge
02169500
Phase 2
West Bank of
Congaree River
Phases 2
and 3
Approximate Extent
of Base of Cofferdam
Phase 3
Scale
0
250
500
Feet
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
COFFERDAM CONSTRUCTION PHASES
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
APEX COMPANIES, LLC


Gervais Street Bridge
Gist Street
Senate Street
Huger Street
N
Restricted Access Road
(Private Property)
Senate Street Alluvial Fan
Three Rivers Greenway
(public river access)
Landside Support Zone
(Private Property)
Unnamed Tributary #2
Public Boat Ramp
(Approx. 1.8 miles)
Blossom Street Bridge
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
PROJECT AREA AND NAVIGABILITY
INFORMATION
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 1/8/14
FILE NAME: CONG053
APEX COMPANIES, LLC

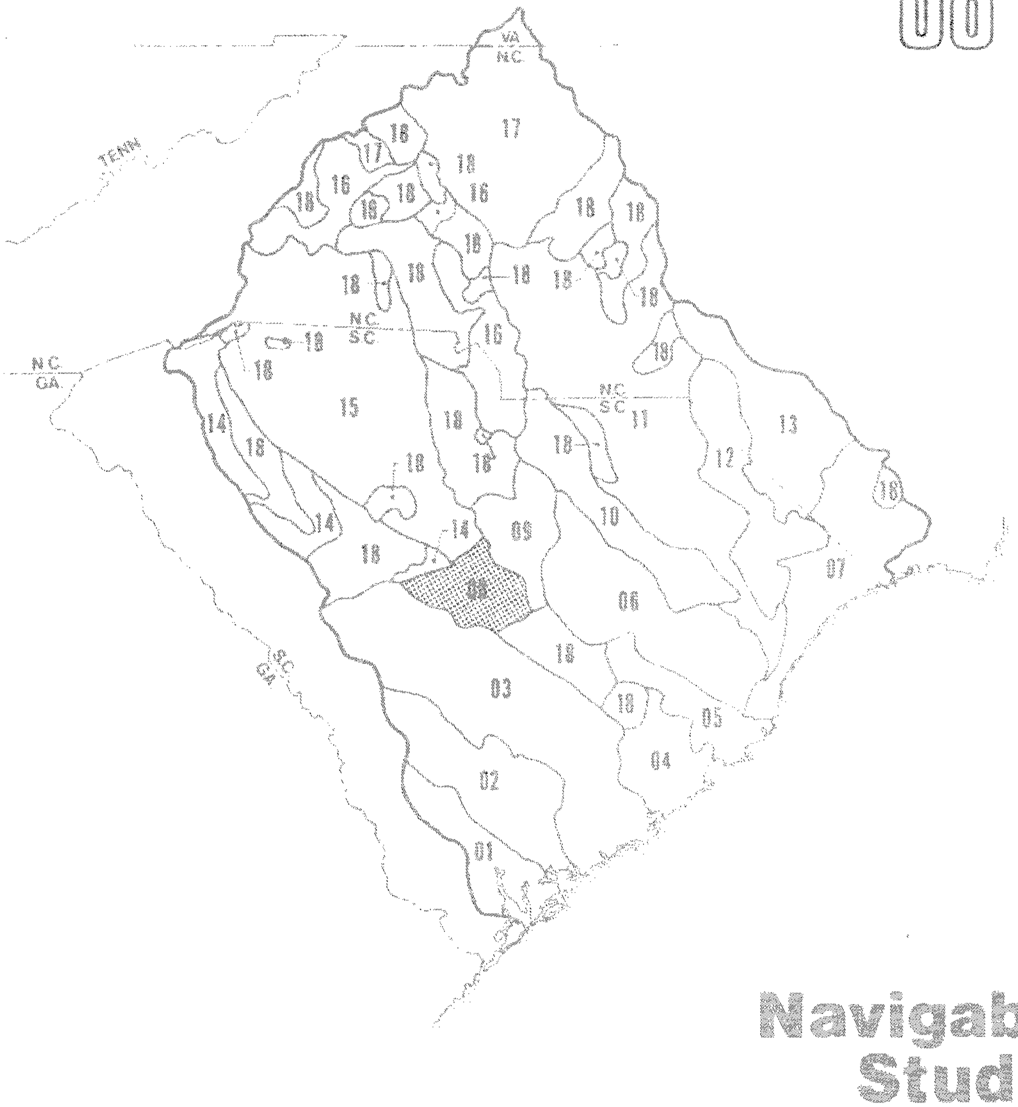
ATTACHMENT A

U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina

CONGAREE RIVER BASIN

Report No.

08



Navigability Study

1977

STANLEY CONSULTANTS

Navigation Classification Categories

This study classifies streams into several different categories, each of which is discussed subsequently:

1. Present "navigable waters of the U. S." (by regulatory procedures).
2. Historically navigable waters (based on literature review).
3. Recommended "navigable waters of the U. S." (based upon data developed as a part of this investigation).
4. Recommended waters for practical navigation (within "navigable waters of the U. S.").
5. Headwaters for all waterbodies (five cfs points).

The first four navigation classifications are displayed on the plates presented later in this report. The headwater limits are summarized in Appendix A.

Present Navigable Waters of the U. S.

Currently, the Congaree River is classified as "navigable waters of the U. S." from its confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378, (R.M. 175.9). (3)(4)(20) This classification is based on the limits of the Federally authorized project, as discussed in Section 3, as well as Federal and state court decisions, as discussed in Section 5. (See plate 08-2 for map location.)

Historically Navigable Waters

The Congaree River was extensively used for navigation throughout the earlier development of the state. After the construction of the Columbia Canal, as referred to in Section 4, navigation extended over the entire length of the Congaree River (R.M. 176.9), and continued up the Broad River (see Report 15).

Recommended and Practical Navigable Waters of the U. S.

The recommended and practical limit of "navigable waters of the U. S." is at the Gervais Street bridge (R.M. 175.9). This is the same limit as the present classification, and is based on the Federal court decisions and authorized project limits that established the present classification, as well as observations and calculations, which establish the practicality of navigation at all six bridges crossing the river. Analysis at each of the locations resulted in an approximate mean water depth of at least 7 feet, approximate channel width of at least 50 feet, and an average slope within the ranges for practical navigation. The river extends upstream for about one mile beyond R.M. 175.9; however, it becomes shallower and spotted with sandbars as it nears the confluence of the Broad and Saluda Rivers and would require extensive improvements to be navigable. In addition, entrance to the Columbia Canal, used at one time to by-pass this shallow area, is no longer operational due to installation of electric generating turbines and would also require extensive renovation to become functional.

These conclusions on the navigation limit meet the criteria established for the Federal test of navigability that the body of water is used, or is capable of being used, in conjunction with other bodies of water to form a continuous highway upon which commerce with other states or countries might be conducted.

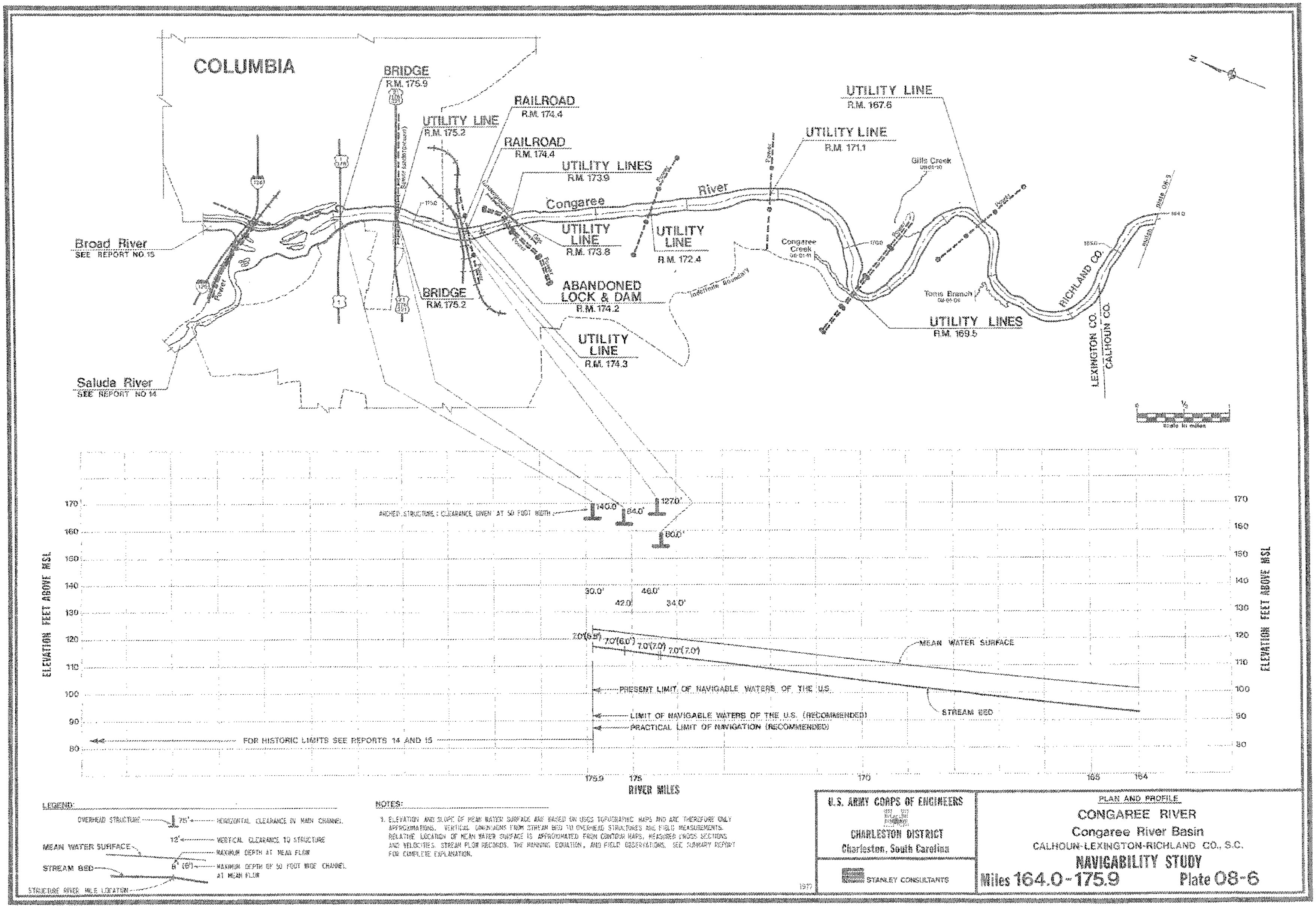
There are no significant tributaries to the Congaree River capable of supporting navigation.

Plates 08-4 through 08-6 are plan and profiles of the recommended "navigable waters of the U. S." The plan and profile plates show mean water surface as determined from USGS maps, stream bed depth, 50 feet wide navigable channel depth, pier spacing for bridges crossing the river, and vertical clearances at structures. Approximate vertical clearances for overhead utilities are shown later in this Section in Table 4. It is emphasized that all references to elevation are approximate since vertical control was established from USGS contour maps and not field instrument surveys. Water depth and structure vertical clearance measurements are also approximate due to the accuracy inherent in the field techniques. (See the Summary Report for a detailed description of field procedures and the methodology used to calculate water depth at mean flow.)

SECTION 7 - CONCLUSIONS AND RECOMMENDATIONS

Five classifications of navigation on streams in the Congaree River basin have been determined and are presented below. The first two are classifications developed from historical evidence and current Federal stream classifications. Classification 3 is based on field measurements, observations, and data analysis for the river. Classification 4 is based on review of all previously determined limits with a recommendation of the most upstream location with supporting evidence of navigability. The fifth classification accounts for all streams not otherwise classified and was determined based on the drainage area and hydrological aspects of the stream.

1. The Congaree River is presently classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge in Columbia (R.M. 175.9).
2. The historical limit of navigation on the Congaree River is, with the use of the Columbia Canal, to R.M. 177. The classification extends beyond the Congaree basin boundary to the Broad River (see Report 15).
3. The recommended practical limit of navigation is at the Gervais Street bridge (R.M. 175.9). Reasonable channel improvements will be necessary for commercial river traffic to actually use the river up to this point.
4. It is recommended that the Congaree River be classified "navigable waters of the U. S." between its mouth at the confluence with the Wateree River (R.M. 125.3) to the Gervais Street bridge, U. S. 378 (R.M. 175.9) based on the analytical procedures and tests of navigability used in this study effort.
5. All streams not recommended for classification as "navigable waters of the U. S." are recommended for classification as "waters of the U. S." throughout their entire length.



COLUMBIA
BRIDGE
R.M. 175.9
UTILITY LINE
R.M. 175.2
RAILROAD
R.M. 174.4
RAILROAD
R.M. 174.4
UTILITY LINES
R.M. 173.9
Congaree
River
UTILITY LINE
R.M. 173.8
UTILITY LINE
R.M. 172.4
UTILITY LINE
R.M. 171.1
UTILITY LINE
R.M. 167.6
Gills Creek
Congaree Creek
Toms Branch
UTILITY LINES
R.M. 169.5
RICHLAND CO.
LEXINGTON CO.
CALHOUN CO.
Broad River
SEE REPORT NO 15
Saluda River
SEE REPORT NO 14
BRIDGE
R.M. 175.2
ABANDONED LOCK & DAM
R.M. 174.2
UTILITY LINE
R.M. 174.3
Indefinite Boundary
scale in miles
ELEVATION FEET ABOVE MSL
ARCHED STRUCTURE: CLEARANCE GIVEN AT 50 FOOT WIDTH
140.0'
84.0'
127.0'
80.0'
30.0'
42.0'
46.0'
34.0'
7.0'(6.5')
7.0'(6.0')
7.0'(7.0)
7.0'(7.0')
MEAN WATER SURFACE
STREAM BED
PRESENT LIMIT OF NAVIGABLE WATERS OF THE U.S.
LIMIT OF NAVIGABLE WATERS OF THE U.S. (RECOMMENDED)
PRACTICAL LIMIT OF NAVIGATION (RECOMMENDED)
FOR HISTORIC LIMITS SEE REPORTS 14 AND 15
80
90
100
110
120
130
140
150
160
170
175.9
175
170
165
164
RIVER MILES
LEGEND:
OVERHEAD STRUCTURE
75' HORIZONTAL CLEARANCE IN MAIN CHANNEL
12' VERTICAL CLEARANCE TO STRUCTURE
MEAN WATER SURFACE
MAXIMUM DEPTH AT MEAN FLOW
STREAM BED
8' (6') MAXIMUM DEPTH OF 50 FOOT WIDE CHANNEL AT MEAN FLOW
STRUCTURE RIVER MILE LOCATION
NOTES:
1. ELEVATION AND SLOPE OF MEAN WATER SURFACE ARE BASED ON USGS TOPOGRAPHIC MAPS AND ARE THEREFORE ONLY APPROXIMATIONS. VERTICAL DIMENSIONS FROM STREAM BED TO OVERHEAD STRUCTURES ARE FIELD MEASUREMENTS. RELATIVE LOCATION OF MEAN WATER SURFACE IS APPROXIMATED FROM CONTOUR MAPS, MEASURED CROSS SECTIONS AND VELOCITIES, STREAM FLOW RECORDS, THE MANNING EQUATION, AND FIELD OBSERVATIONS. SEE SUMMARY REPORT FOR COMPLETE EXPLANATION.
1977
U.S. ARMY CORPS OF ENGINEERS
CHARLESTON DISTRICT
Charleston, South Carolina
STANLEY CONSULTANTS
PLAN AND PROFILE
CONGAREE RIVER
Congaree River Basin
CALHOUN-LEXINGTON-RICHLAND CO., S.C.
NAVIGABILITY STUDY
Miles 164.0 - 175.9
Plate 08-6

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES

STATION:02169500 CONGAREE RIVER AT COLUMBIA, SC TYPE:STREAM AGENCY:USGS STATE:45 COUNTY:063
LATITUDE: 335935 LONGITUDE: 0810300 NAD27 DRAINAGE AREA:7850* CONTRIBUTING DRAINAGE AREA: DATUM:113.02 NGVD29
Date Processed: 2012-03-23 09:22 By wjstring
Lowest aging status in period is APPROVED
DD #1, FROM DCP
Discharge, cubic feet per second
WATER YEAR OCTOBER 2010 TO SEPTEMBER 2011
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2540	2600	2680	2090	2360	3150	19600	3070	3560	1610	1280	753
2	1680	1750	8140	2330	2410	4490	11900	2520	2990	1870	1120	730
3	1400	2300	12000	2860	3400	4760	8300	3750	3000	1650	1090	747
4	1430	2510	6810	2770	7390	3970	9310	3450	3970	1430	945	749
5	1320	2100	5000	3070	6910	3000	5840	3830	2900	1830	1260	1490
6	1560	2250	4190	2920	10400	3350	7570	4270	2530	1560	1680	1820
7	1830	2290	3940	2710	11700	8490	9590	6460	2540	2090	1750	1080
8	1650	2500	2900	3590	6900	17700	7750	3000	2600	1640	1610	1250
9	1430	2190	2830	2420	5090	13200	7030	4350	2300	1400	2880	1390
10	1380	1640	2870	2740	4900	9010	8230	3560	1910	1820	1490	1190
11	1380	1830	2360	7820	4760	11600	7940	3500	1400	2250	1170	1020
12	1330	1580	2320	6640	3690	12700	6450	3200	1240	2370	1420	1080
13	1380	2370	4830	6590	2860	8400	5960	2870	1720	2340	1160	1130
14	1330	1970	10400	7300	4030	6120	8560	3040	2330	1800	1410	1300
15	1320	1840	6670	4660	2720	7410	5960	3280	2320	1300	1470	1140
16	1350	1550	2880	1730	2210	6580	4930	2720	2610	1190	1940	896
17	1370	1550	2690	2830	2460	5860	4200	3310	2960	1430	1420	856
18	1330	2610	2060	4590	3190	6260	7940	3910	2050	1980	1570	853
19	1310	2430	3460	5960	2990	5880	7890	4350	2000	1780	1010	855
20	1330	2230	2960	3410	2910	4960	7920	4860	2180	2170	1110	1300
21	1310	2200	2260	2930	3210	5470	7300	3890	2200	1510	1110	1400
22	1350	2380	2260	2890	2110	5550	3910	3810	2080	1400	1440	1400
23	1880	1460	2490	2860	2700	5400	4560	2930	1490	1370	1300	2730
24	1660	1450	3080	2470	2550	5480	4760	2090	1250	1410	1330	5530
25	1410	2130	2000	2860	2510	5380	4220	3090	2340	1370	1420	5470
26	1760	2500	2730	2160	2400	4490	5110	2870	2650	4010	1270	5120
27	1680	2280	2940	2270	2690	6770	5790	2450	2630	2300	1140	4040
28	3200	9190	2970	2950	3040	13600	5980	3390	2140	1410	1250	2250
29	4700	2570	2920	3200	---	13200	4720	4410	1470	1330	1250	2020
30	4330	2180	2910	3480	---	14400	4580	3630	1400	1180	1220	1300
31	4440	---	2910	2970	---	17200	---	2410	---	1420	960	---
TOTAL	57370	70430	121460	110070	114490	243830	213800	108270	68760	54220	42475	52889
MEAN	1851	2348	3918	3551	4089	7865	7127	3493	2292	1749	1370	1763
MAX	4700	9190	12000	7820	11700	17700	19600	6460	3970	4010	2880	5530
MIN	1310	1450	2000	1730	2110	3000	3910	2090	1240	1180	945	730
CFSM	0.24	0.30	0.50	0.45	0.52	1.00	0.91	0.44	0.29	0.22	0.17	0.22
IN.	0.27	0.33	0.58	0.52	0.54	1.16	1.01	0.51	0.33	0.26	0.20	0.25

STATISTICS OF MONTHLY MEAN DATA FOR WATER YEARS 1940 - 2011, BY WATER YEAR (WY)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
MEAN	6731	6861	8741	11410	12460	13860	11050	7608	6757	6256	6600	5966
MAX	33460	18960	24450	28430	34910	31290	27670	20460	18730	16730	18650	19250
(WY)	1965	1993	2010	1993	1960	2003	1964	2003	1973	1941	1949	1945
MIN	1085	1191	1804	2967	3211	4074	3851	2283	1427	1109	1342	1328
(WY)	2008	2008	2008	1956	2001	1955	2006	2001	2008	2008	2007	2007

SUMMARY STATISTICS FOR 2010 CALENDAR YEAR FOR 2011 WATER YEAR WATER YEARS 1940 - 2011

James Dunmyre

From: Andrew.M.Engle@uscg.mil on behalf of Engle, Andrew M CIV [Andrew.M.Engle@uscg.mil]
Sent: Tuesday, March 18, 2014 10:03 AM
To: James Dunmyre
Subject: RE: Congaree River Project, Columbia SC

Attachments: CG_2554[1].pdf

CG_2554[1].pdf
(205 KB)

Good morning James.

I am attaching a Private Aids to Navigation Application to be completed for the buoys/daybeacons you wish to install to temporarily mark the cofferdam you intend to construct. I have reached out to CG Sector Charleston to see if the Captain of the Port needs to rule on restricting navigation in the area you are working. Being these aids are only temporary we will not need to issue a permit but we will issue a letter of no objection once we review their location.

If you could send me a copy of the approve ACOE permit I would appreciate it.

Have a great day.

Mark

A. Mark Engle, BMCS (Retired)
Marine Information Specialist
U. S. Coast Guard District Seven
Waterways Management Branch
909 SE 1st Ave, ste 406
Miami, FL. 33131
305-415-6755 (w)
904-673-0999 (m)
Fax: 305-415-6757

-----Original Message-----
From: JDunmyre@apexcos.com [mailto:JDunmyre@apexcos.com]
Sent: Wednesday, January 29, 2014 10:53 AM
To: Engle, Andrew M CIV
Subject: Congaree River Project, Columbia SC

Mr. Engle,

Just a quick follow up email to a call you had returned to us a few weeks ago (you had spoken to a coworker of mine). I was wondering if any progress was made on our project, just so I can pass the information along.

Thanks,

<http://www.apexcos.com/> James Dunmyre
Environmental Scientist

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

U.S. DEPARTMENT OF HOMELAND SECURITY
U.S. COAST GUARD
CG-2554 (Rev. 09-05)

PRIVATE AIDS TO NAVIGATION APPLICATION

(See attached instructions and copy of Code of Fed. Reg., Title 33, Chap. 1, Part 66)

Form Approved
OMB-1625-0011

NO PRIVATE AID TO NAVIGATION MAY BE AUTHORIZED UNLESS A COMPLETED APPLICATON FORM HAS BEEN RECEIVED (14 U.S.C. 83; 33 C.F.R. 66.01-5)

1. ACTION REQUESTED FOR PRIVATE AIDS TO NAVIGATION: A. ☐ ESTABLISH AND MAINTAIN B. ☐ DISCONTINUE C. ☐ CHANGE D. ☐ TRANSFER OWNERSHIP

2. DATE ACTION TO START

3. AIDS WILL BE OPERATED: A. ☐ THROUGHOUT THE YEAR B. ☐ TEMPORARILY UNTIL ________ C. ☐ ANNUALLY ________ TO ________

4. NECESSITY FOR AID *(Continue in Block 8)*

5. GENERAL LOCALITY

6. CORPS OF ENGINEERS AUTHORIZED THIS STRUCTURE OR BUOY BY ☐ PERMIT OR ☐ LETTER *(file and date)*

FOR DISTRICT COMMANDERS ONLY		7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS									
			LIGHT							STRUCTURE	
LIGHT LIST NUMBER OR PAGE	NAME OF AID	NO. OR LTR. (7a)	PER. (7b)	FLASH LGTH. (7c)	COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CAN-DLE POWER (7g)	HT. ABOVE WATER (7h)	TYPE, COLOR, AND HEIGHT ABOVE GROUND (7i)	REMARKS *(See Instructions)* (7j)

8. ADDITIONAL COMMENTS

9a. NAME AND ADDRESS OF PERSON IN DIRECT CHARGE OF AID

9b. TELEPHONE NO.

10a. NAME AND ADDRESS OF PERSON OR CORPORATION AT WHOSE EXPENSE

10b. THE APPLICANT AGREES TO SAVE THE COAST GUARD HARMLESS WITH RESPECT TO ANY CLAIM OR CLAIMS THAT MAY RESULT ARISING FROM THE ALLEGED NEGLIGENCE OF THE MAINTENANCE OR OPERATION OF THE APPROVED AID(S).

10c. DATE

10d. SIGNATURE AND TITLE OF OFFICIAL SIGNING

FOR USE BY DISTRICT COMMANDER

SERIAL NO. | CLASSIFICATION OF AIDS | RECD. | CHART | L. N. M.

DATE APPROVED

SIGNATURE *(By direction)*

PREVIOUS EDITIONS ARE OBSOLETE

§ 66.01-1 Basic provisions.

(a) No person, public body or instrumentality not under the control of the Commandant, exclusive of the Armed Forces, shall establish and maintain, discontinue, change or transfer ownership of any aid to maritime navigation, without first obtaining permission to do so from the Commandant.

(b) For the purposes of this subpart, the term private aids to navigation includes all marine aids to navigation operated in the navigable waters of the United States other than those operated by the Federal Government (Part 62 of this subchapter) or those operated in State waters for private aids to navigation (Subpart 66.05).

(c) Coast Guard authorization of a private aid to navigation does not authorize any invasion of private rights, nor grant any exclusive privileges, nor does it obviate the necessity of complying with any other Federal, State or local laws or regulations.

(d) With the exception of shore based radar stations, operation of electronic aids to navigation as private aids will not be authorized.

§ 66.01-3 Delegation of authority to District Commanders.

(a) Pursuant to the authority in 49 CFR 1,4(g), the Commandant delegates to the District Commanders within the confines of their respective districts (see Part 3 of this Chapter for descriptions) the authority to grant permission to establish and maintain, discontinue, change or transfer ownership of private aids to maritime navigation, and otherwise administer the requirements of this subpart.

(b) The decisions of the District Commander may be appealed within 30 days from the date of decision. The decision of the Commandant in any case is final.

§ 66.01-5 Application procedure.

Application to establish and maintain, discontinue, change or transfer ownership of a private aid to navigation shall be made to the Commander of the Coast Guard District in which the private aid to navigation is or will be located. Application forms (CG-2554) will be provided upon request. The applicant shall complete all parts of the form applicable to the aid to navigation concerned, and shall forward the application in triplicate to the District Commander. The following information is required:

(a) The proposed position of the aid to navigation by two or more horizontal angles, or bearings and distance from charted landmarks. A section of chart or sketch showing the proposed location of the aid to navigation shall be included.

(b) The name and address of the person at whose expense the aid will be maintained.

(c) The name and address of the person who will maintain the aid to navigation.

(d) The time and dates during which it is proposed to operate the aid.

(e) The necessity for the aid.

(f) For lights: The color, characteristic, height above water, and descriptions of illuminating apparatus.

(g) For log signals: Type (whistle, horn, bell etc.) and characteristic.

(h) For buoys or daybeacons: Shape, color, number, or letter, depth of water in which located or height above water.

§ 66.01 - 10 Characteristics.

The characteristics of a private aid to navigation shall conform to the standard U.S. system to aids to navigation characteristics described in subpart 62.25 of Part 62 of this subchapter, except that only tungsten-incandescent light sources will be approved for electric lights.

§ 66.01 - 15 Action by Coast Guard.

(a) The District Commander receiving the application will review it for completeness and will assign the aid one of the following classifications:

Class I: Aids to navigation on marine structures of other works which the owners are legally obligated to establish, maintain and operate as prescribed by the Coast Guard.

Class II: Aids to navigation exclusive of Class I located in waters used by general navigation.

Class III: Aids to navigation exclusive of Class I located in waters not ordinarily used by general navigation.

(b) Upon approval by the District Commander, a signed copy of the application will be returned to the applicant.

§ 66.01 - 20 Inspection.

All classes of private aids to navigation shall be maintained in proper operating condition. They are subject to inspection by the Coast Guard at any time and without prior notice.

§ 66.01 - 25 Discontinuance and removal.

(a) No person, public body or instrumentality shall change, move or discontinue any authorized private aid to navigation required by statue or regulations (Class I § 66.01-15) without first obtaining permission to do so from the District Commander.

(b) Any authorized private aid to navigation not required by statue or regulation (Classes II and III, § 66.01-15) may be discontinued and removed by the owner after 30 days' notice to the District Commander to whom the original request for authorization for establishment of the aid was submitted.

(c) Private aids to navigation which have been authorized pursuant to this part shall be discontinued and removed without expense to the United States by the person, public body or instrumentality establishing or maintaining such aids when so directed by the District Commander.

§ 66.01-30 Corps of Engineers' approval.

(a) Before any private aid to navigation consisting of a fixed structure is placed in the navigable waters of the United States, authorization to erect such structure shall first be obtained from the District Engineer, U.S. Army Corps of Engineers in whose district the aid will be located.

(b) The application to establish any private aid to navigation consisting of a fixed structure shall show evidence of the required permit having been issued by the Corps of Engineers.

§ 66.01-35 Marking of structures and floating obstructions.

Any structure, mooring, mooring buoy, or dam, in or over the navigable waters of the United States shall display the lights and other signals for the protection of maritime navigation as may be prescribed by the Commandant. The prescribed lights and signals shall be installed, maintained and operated by and at the expense of the owner, or operator. After obtaining such approval or a statement of no objection from the Corps of Engineers as is required by law, the owner or operator shall apply in accordance with § 66.01-5 to the District Commander having jurisdiction over the waters in which the structure or floating obstruction will be located for a determination of the lights and other signals to be displayed. This requirement includes the temporary lights and signals to be displayed during the construction of a structure. If no regulation exists prescribing the lights or other signals required to mark any work or obstruction, each case shall be considered individually by the District Commander, who will prescribe such lights and signals as he considers necessary for the safety of navigation.

§ 66.01-40 Exemptions.

(a) Nothing in the preceding sections of this subpart shall be construed to interfere with or nullify the requirements of existing laws and regulations pertaining to the marking of vessels and other obstructions sunk in the navigable waters of the United States (Part 64 of this subchapter), the marking of artificial islands and structures which are erected on or over the seabed and subsoil of the outer Continental Shelf (Part 67 of this subchapter), or the lighting of bridges over navigable waters of the United States (Part 68 of this subchapter).

(b) Persons marking structures pursuant to Part 64 or Part 58 of this subchapter are exempted from the provisions of § 66.01-5 and 66.01-35.

§ 66.01-45 Penalties.

Any person, public body or instrumentality, excluding the Armed Forces, who shall establish, erect or maintain any aid to maritime navigation without first obtaining authority to do so from the Coast Guard or who shall violate the regulations relative thereto issued in this part, is subject to the provision of 14 U.S.C. 83. Any owner or operator of a fixed structure, excluding an agency of the United States, who violates any of the rules or regulations prescribed with respect to lights and other signals for fixed structures, is subject to the provision of 14 U.S.C. 85.

§ 66.01-50 Protection of private aids to navigation.

Private aids to navigation lawfully maintained under these regulations are entitled to same protection against interference or obstruction as is afforded by law to Coast Guard aids to navigation (Part 70 of this subchapter). If interference or obstruction occurs, a prompt report containing all the evidence available should be made to the Commander of the Coast Guard District in which the aids are located.

§ 66.01-55 Transfer of ownership.

(a) When any private aid to navigation authorized by the District Commander, or the essential real estate or facility with which the aid is associated, is sold or transferred, both parties to the transaction shall submit application (§ 66.01-5) to the Commander of the Coast Guard District in which the aid is located requesting authority to transfer responsibility for maintenance of the aid.

(b) The party relinquishing responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the discontinuance and the change of ownership of the aid sold or transferred.

(c) The party accepting responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the establishment and the change of ownership of the aid sold or transferred.

(d) In the event the new owner of the essential real estate or facility with which the aid is associated refuses to accept responsibility for maintenance of the aid, the former owner shall be required to remove the aid without expense to the United States. This requirement shall not apply in the case of any authorized private aid to navigation required by statute or regulation (Class I, § 66.01-15) which shall be maintained by the new owner until the conditions which made the aid necessary have been eliminated.

REMARKS

DATE	REFERENCE	ACTION AND REMARKS

	J	F	M	A	M	J	J	A	S	O	N	D

NAME OF AID	LIGHT LIST NO.	PAGE

U. S. COAST GUARD

PRIVATE AIDS TO NAVIGATION APPLICATION

INSTRUCTIONS

1. The rules, regulations, and procedures pertaining to private aids to navigation are set forth in the copy of Code of Federal Regulations; Title 33, Chapter 1, Part 66, on the back of this page.

2. Three copies of the application for private aids shall be forwarded to the Commander of the Coast Guard District in which the aids will be located 30 days in advance of the proposed action. Sections of charts or sketches showing the work proposed shall accompany each application.

3. When making application for private aids to mark structures and mooring buoys in navigable waters or to mark the excavating or depositing of material therein, evidence is required of the authorization obtained from Corps of Engineers, Department of the Army, for such work. (Code of Federal Regulations; Title 33, Part 209.120.)

4. The applicant shall complete all of Blocks 1, 2, 3, 4, 5, 9 and 10 for all new applications. When an aid is being discontinued, Block 3 need not be completed. Block 6 shall be completed whenever authorization is required to be obtained from Corps of Engineers (See Instruction No. 3). Columns of Block 7 will be completed as follows:
   a. Unlighted buoys - 7a, 7e, 7f, and 7j.
   b. Lighted buoys - 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, and 7j.
   c. Daybeacons - 7a, 7e, 7f (if applicable), 7h, 7i, and 7j.
   d. Light on a structure - 7a, 7b, 7c, 7d, 7e, 7f (if applicable), 7g, 7h, 7i, and 7j.

When an aid is being changed, Block 8 shall be used to describe the nature of the change.

5. The required information for each column includes the following:
   (7a) Proposed number or letter to be assigned to the aid.
   (7b) Period of light (time in seconds for one complete cycle).
   (7c) Flash length in seconds. For complex or multiple flashes, explain in column (7j).
   (7d) Color of light.
   (7e) Position by two or more horizontal angles, or bearing and distance from a prominent charted landmark. If a prominent charted landmark is not available, show latitude and longitude as precisely as the chart permits.
   (7f) Depth of water at buoy or structure (if marine site). All depths are measured from mean low water except on Great Lakes where depths are measured from low water datum.
   (7g) Candlepower, if known; otherwise, include the following information in column (7j); lens size, lamp voltage and amperage if electric, or details of other illuminant to be used.
   (7h) Height of light or unlighted structure above water. Height is measured from mean high water except in the Great Lakes where heights are measured from low water datum shown on U.S. Lake Survey Charts. The height of a light on a buoy is measured from the water line.
   (7i) Include details of structure (type, color).
   (7j) Used for the following specific information, plus any other useful details: a. buoys - size, shape, color, and reflective material used; b. structures - daymark shape and color; c. fog signal on a buoy or structure - type and model, audible range, and characteristic (number of strokes or blasts, period and blast length).

6. This form may be used to cover more than one aid in the same geographic area. Draw a line between each aid as indicated in example. Attach separate sheet if additional space is required.

7. Attach a section of chart showing the proposed location of the aid(s) to navigation.

8. a. After receipt of the approved form the applicant will advise the District Commander by telegram or other rapid means of communications when the work authorized is actually accomplished.
   b. If the aids have not been installed within one year of the approval date, the approved application is automatically cancelled.
   c. Any discrepancy in the operation of the aid(s) at any time shall be reported to the Disctrict Commander by telegram or other rapid means of communication in order that Notices to Mariners may be issued. A discrepancy exists whenever the aid is not as described in the approved application, i.e., lack of signal, incorrect light characteristic, or improper color, shape of position of shore structure or buoy. The correction of the discrepancy will also be reported by the same method.

9. All classes of private aids to navigation shall be maintained in proper condition. They are subject to inspection by the Coast Guard at any time and without prior notice to the maintainer.

7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS

FOR DISTRICT COMMANDERS ONLY		EXAMPLE OF USE OF APPLICATION									
			LIGHT							STRUCTURE	
LIGHT LIST NUMBER OR PAGE	NAME OF AID	NO. OR LTR. (7a)	PER. (7b)	FLASH LGTH. (7c)	COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CAN-DLE POWER (7g)	HT. ABOVE WATER (7h)	TYPE, COLOR, AND HEIGHT (7i)	REMARKS *(See Instructions)* (7j)
		1	4s	0.4s	WHITE	205°T, 3540 yds from tank, Bayview, VA.	9 Ft.	20	6 Ft.		5' Lighted buoy - black
		2				200°T, 3425 yds from tank, Bayview, VA.	7 Ft.				Nun buoy - Red White reflector
		3				210°T, 2810 yds from tank, Bayview, VA.	2 Ft.		7 Ft.	Single pile	2' square daymark - black
		5	2.5s	0.5s	WHITE	218.5°T, 330 yds from tank, Bayview, VA.	8 Ft.	20	13 Ft.	5 - pile	3' square daymark - black

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a valid OMB control number.

The Coast Guard estimates that the average burden for this report is 1hr. You may submit any comments concerning the accuracy of this burden estimate or any suggestions for reducing the burden to: Commandant (G-OPN) U.S. Coast Guard, Washington, DC 20593-0001 or office of Management and Budget, Paperwork Reduction Project (1625-0011), Washington, DC 20503

ATTACHMENT D

U.S. DEPARTMENT OF HOMELAND SECURITY
U.S. COAST GUARD
CG-2554 (Rev. 09-05)

PRIVATE AIDS TO NAVIGATION APPLICATION

(See attached instructions and copy of Code of Fed. Reg., Title 33, Chap. 1, Part 66)

Form Approved
OMB-1625-0011

NO PRIVATE AID TO NAVIGATION MAY BE AUTHORIZED UNLESS A COMPLETED APPLICATON FORM HAS BEEN RECEIVED (14 U.S.C. 83; 33 C.F.R. 66.01-5).

1. ACTION REQUESTED FOR PRIVATE AIDS TO NAVIGATION: A. [x] ESTABLISH AND MAINTAIN B. [ ] DISCONTINUE C. [ ] CHANGE D. [ ] TRANSFER OWNERSHIP

2. DATE ACTION TO START: May 2015

3. AIDS WILL BE OPERATED: A. [ ] THROUGHOUT THE YEAR B. [ ] TEMPORARILY UNTIL ______ C. [x] ANNUALLY May 2015 TO Dec 2018

4. NECESSITY FOR AID *(Continue in Block 8)*: Congaree River Sediment Remediation Project

5. GENERAL LOCALITY: Columbia, SC

6. CORPS OF ENGINEERS AUTHORIZED THIS STRUCTURE OR BUOY BY [ ] PERMIT OR [ ] LETTER *(file and date)*

FOR DISTRICT COMMANDERS ONLY		7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS									
LIGHT LIST NUMBER OR PAGE	NAME OF AID	NO. OR LTR. (7a)	LIGHT PER. (7b)	FLASH LGTH. (7c)	COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CANDLE POWER (7g)	HT. ABOVE WATER (7h)	STRUCTURE TYPE, COLOR, AND HEIGHT ABOVE GROUND (7i)	REMARKS *(See Instructions)* (7j)
		1				5'-10' from cofferdam base - Congaree River	<1'-20'				Information buoy "Danger Dam"
		2	60s	1s	W	Crest of Cofferdam - Congaree River	N/A	1mi.	10.5	Solar Power, LED Marine Application 10.5'	Visible for 1 mile during clear conditions Light Color - White
		3				Up and Down river from cofferdam - Congaree River	N/A		3'-5'	Reflective Sign - "Warning River Construction"	White/orange 4'x 4'

8. ADDITIONAL COMMENTS

The project area and cofferdam location is located at 33 59' 40.59" North, 81 02" 56.80" West.

9a. NAME AND ADDRESS OF PERSON IN DIRECT CHARGE OF AID

Bob Apple - 220 Operation Way
Cayce, South Carolina

9b. TELEPHONE NO.
(919) 819-2748

10a. NAME AND ADDRESS OF PERSON OR CORPORATION AT WHOSE EXPENSE

SCE&G - 220 Operation Way
Cayce, South Carolina
29033-3701

10b. THE APPLICANT AGREES TO SAVE THE COAST GUARD HARMLESS WITH RESPECT TO ANY CLAIM OR CLAIMS THAT MAY RESULT ARISING FROM THE ALLEGED NEGLIGENCE OF THE MAINTENANCE OR OPERATION OF THE APPROVED AID(S).

10c. DATE

10d. SIGNATURE AND TITLE OF OFFICIAL SIGNING

FOR USE BY DISTRICT COMMANDER

SERIAL NO.	CLASSIFICATION OF AIDS			
		RECD.		
		CHART		
		L. N. M.		

DATE APPROVED

SIGNATURE *(By direction)*

PREVIOUS EDITIONS ARE OBSOLETE

FEDERAL REGULATIONS CONCERNING PRIVATE AIDS TO NAVIGATION, 33 CFR 66

§ 66.01-1 Basic provisions.

(a) No person, public body or instrumentality not under the control of the Commandant, exclusive of the Armed Forces, shall establish and maintain, discontinue, change or transfer ownership of any aid to maritime navigation, without first obtaining permission to do so from the Commandant.

(b) For the purposes of this subpart, the term private aids to navigation includes all marine aids to navigation operated in the navigable waters of the United States other than those operated by the Federal Government (Part 62 of this subchapter) or those operated in State waters for private aids to navigation (Subpart 66.05).

(c) Coast Guard authorization of a private aid to navigation does not authorize any invasion of private rights, nor grant any exclusive privileges, nor does it obviate the necessity of complying with any other Federal, State or local laws or regulations.

(d) With the exception of shore based radar stations, operation of electronic aids to navigation as private aids will not be authorized.

§ 66.01-3 Delegation of authority to District Commanders.

(a) Pursuant to the authority in 49 CFR 1,4(g), the Commandant delegates to the District Commanders within the confines of their respective districts (see Part 3 of this Chapter for descriptions) the authority to grant permission to establish and maintain, discontinue, change or transfer ownership of private aids to maritime navigation, and otherwise administer the requirements of this subpart.

(b) The decisions of the District Commander may be appealed within 30 days from the date of decision. The decision of the Commandant in any case is final.

§ 66.01-5 Application procedure.

Application to establish and maintain, discontinue, change or transfer ownership of a private aid to navigation shall be made to the Commander of the Coast Guard District in which the private aid to navigation is or will be located. Application forms (CG-2554) will be provided upon request. The applicant shall complete all parts of the form applicable to the aid to navigation concerned, and shall forward the application in triplicate to the District Commander. The following information is required:

(a) The proposed position of the aid to navigation by two or more horizontal angles, or bearings and distance from charted landmarks. A section of chart or sketch showing the proposed location of the aid to navigation shall be included.

(b) The name and address of the person at whose expense the aid will be maintained.

(c) The name and address of the person who will maintain the aid to navigation.

(d) The time and dates during which it is proposed to operate the aid.

(e) The necessity for the aid.

(f) For lights: The color, characteristic, height above water, and descriptions of illuminating apparatus.

(g) For log signals: Type (whistle, horn, bell etc.) and characteristic.

(h) For buoys or daybeacons: Shape, color, number, or letter, depth of water in which located or height above water.

§ 66.01 - 10 Characteristics.

The characteristics of a private aid to navigation shall conform to the standard U.S. system to aids to navigation characteristics described in subpart 62.25 of Part 62 of this subchapter, except that only tungsten-incandescent light sources will be approved for electric lights.

§ 66.01 - 15 Action by Coast Guard.

(a) The District Commander receiving the application will review it for completeness and will assign the aid one of the following classifications:

Class I: Aids to navigation on marine structures of other works which the owners are legally obligated to establish, maintain and operate as prescribed by the Coast Guard.

Class II: Aids to navigation exclusive of Class I located in waters used by general navigation.

Class III: Aids to navigation exclusive of Class I located in waters not ordinarily used by general navigation.

(b) Upon approval by the District Commander, a signed copy of the application will be returned to the applicant.

§ 66.01 - 20 Inspection.

All classes of private aids to navigation shall be maintained in proper operating condition. They are subject to inspection by the Coast Guard at any time and without prior notice.

§ 66.01 - 25 Discontinuance and removal.

(a) No person, public body or instrumentality shall change, move or discontinue any authorized private aid to navigation required by statue or regulations (Class I § 66.01-15) without first obtaining permission to do so from the District Commander.

(b) Any authorized private aid to navigation not required by statue or regulation (Classes II and III, § 66.01-15) may be discontinued and removed by the owner after 30 days' notice to the District Commander to whom the original request for authorization for establishment of the aid was submitted.

(c) Private aids to navigation which have been authorized pursuant to this part shall be discontinued and removed without expense to the United States by the person, public body or instrumentality establishing or maintaining such aids when so directed by the District Commander.

§ 66.01-30 Corps of Engineers' approval.

(a) Before any private aid to navigation consisting of a fixed structure is placed in the navigable waters of the United States, authorization to erect such structure shall first be obtained from the District Engineer, U.S. Army Corps of Engineers in whose district the aid will be located.

(b) The application to establish any private aid to navigation consisting of a fixed structure shall show evidence of the required permit having been issued by the Corps of Engineers.

§ 66.01-35 Marking of structures and floating obstructions.

Any structure, mooring, mooring buoy, or dam, in or over the navigable waters of the United States shall display the lights and other signals for the protection of maritime navigation as may be prescribed by the Commandant. The prescribed lights and signals shall be installed, maintained and operated by and at the expense of the owner, or operator. After obtaining such approval or a statement of no objection from the Corps of Engineers as is required by law, the owner or operator shall apply in accordance with § 66.01-5 to the District Commander having jurisdiction over the waters in which the structure or floating obstruction will be located for a determination of the lights and other signals to be displayed. This requirement includes the temporary lights and signals to be displayed during the construction of a structure. If no regulation exists prescribing the lights or other signals required to mark any work or obstruction, each case shall be considered individually by the District Commander, who will prescribe such lights and signals as he considers necessary for the safety of navigation.

§ 66.01-40 Exemptions.

(a) Nothing in the preceding sections of this subpart shall be construed to interfere with or nullify the requirements of existing laws and regulations pertaining to the marking of vessels and other obstructions sunk in the navigable waters of the United States (Part 64 of this subchapter), the marking of artificial islands and structures which are erected on or over the seabed and subsoil of the outer Continental Shelf (Part 67 of this subchapter), or the lighting of bridges over navigable waters of the United States (Part 68 of this subchapter).

(b) Persons marking structures pursuant to Part 64 or Part 58 of this subchapter are exempted from the provisions of § 66.01-5 and 66.01-35.

§ 66.01-45 Penalties.

Any person, public body or instrumentality, excluding the Armed Forces, who shall establish, erect or maintain any aid to maritime navigation without first obtaining authority to do so from the Coast Guard or who shall violate the regulations relative thereto issued in this part, is subject to the provision of 14 U.S.C. 83. Any owner or operator of a fixed structure, excluding an agency of the United States, who violates any of the rules or regulations prescribed with respect to lights and other signals for fixed structures, is subject to the provision of 14 U.S.C. 85.

§ 66.01-50 Protection of private aids to navigation.

Private aids to navigation lawfully maintained under these regulations are entitled to same protection against interference or obstruction as is afforded by law to Coast Guard aids to navigation (Part 70 of this subchapter). If interference or obstruction occurs, a prompt report containing all the evidence available should be made to the Commander of the Coast Guard District in which the aids are located.

§ 66.01-55 Transfer of ownership.

(a) When any private aid to navigation authorized by the District Commander, or the essential real estate or facility with which the aid is associated, is sold or transferred, both parties to the transaction shall submit application (§ 66.01-5) to the Commander of the Coast Guard District in which the aid is located requesting authority to transfer responsibility for maintenance of the aid.

(b) The party relinquishing responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the discontinuance and the change of ownership of the aid sold or transferred.

(c) The party accepting responsibility for maintenance of the private aid to navigation shall indicate on the application form (CG-2554) both the establishment and the change of ownership of the aid sold or transferred.

(d) In the event the new owner of the essential real estate or facility with which the aid is associated refuses to accept responsibility for maintenance of the aid, the former owner shall be required to remove the aid without expense to the United States. This requirement shall not apply in the case of any authorized private aid to navigation required by statute or regulation (Class I, § 66.01-15) which shall be maintained by the new owner until the conditions which made the aid necessary have been eliminated.

REMARKS

DATE	REFERENCE	ACTION AND REMARKS

	J	F	M	A	M	J	J	A	S	O	N	D	

NAME OF AID	LIGHT LIST NO.	PAGE

U. S. COAST GUARD

PRIVATE AIDS TO NAVIGATION APPLICATION

INSTRUCTIONS

1. The rules, regulations, and procedures pertaining to private aids to navigation are set forth in the copy of Code of Federal Regulations; Title 33, Chapter 1, Part 66, on the back of this page.

2. Three copies of the application for private aids shall be forwarded to the Commander of the Coast Guard District in which the aids will be located 30 days in advance of the proposed action. Sections of charts or sketches showing the work proposed shall accompany each application.

3. When making application for private aids to mark structures and mooring buoys in navigable waters or to mark the excavating or depositing of material therein, evidence is required of the authorization obtained from Corps of Engineers, Department of the Army, for such work. (Code of Federal Regulations; Title 33, Part 209.120.)

4. The applicant shall complete all of Blocks 1, 2, 3, 4, 5, 9 and 10 for all new applications. When an aid is being discontinued, Block 3 need not be completed. Block 6 shall be completed whenever authorization is required to be obtained from Corps of Engineers (See Instruction No. 3). Columns of Block 7 will be completed as follows:

a. Unlighted buoys - 7a, 7e, 7f, and 7j.
b. Lighted buoys - 7a, 7b, 7c, 7d, 7e, 7f, 7g, 7h, and 7j.
c. Daybeacons - 7a, 7e, 7f (if applicable), 7h, 7i, and 7j.
d. Light on a structure - 7a, 7b, 7c, 7d, 7e, 7f (if applicable), 7g, 7h, 7i, and 7j.

When an aid is being changed, Block 8 shall be used to describe the nature of the change.

5. The required information for each column includes the following:

(7a) Proposed number or letter to be assigned to the aid.
(7b) Period of light (time in seconds for one complete cycle).
(7c) Flash length in seconds. For complex or multiple flashes, explain in column (7j).
(7d) Color of light.
(7e) Position by two or more horizontal angles, or bearing and distance from a prominent charted landmark. If a prominent charted landmark is not available, show latitude and longitude as precisely as the chart permits.
(7f) Depth of water at buoy or structure (if marine site). All depths are measured from mean low water except on Great Lakes where depths are measured from low water datum.
(7g) Candlepower, if known; otherwise, include the following information in column (7j); lens size, lamp voltage and amperage if electric, or details of other illuminant to be used.
(7h) Height of light or unlighted structure above water. Height is measured from mean high water except in the Great Lakes where heights are measured from low water datum shown on U.S. Lake Survey Charts. The height of a light on a buoy is measured from the water line.
(7i) Include details of structure (type, color).
(7j) Used for the following specific information, plus any other useful details: a. buoys - size, shape, color, and reflective material used; b. structures - daymark shape and color; c. fog signal on a buoy or structure - type and model, audible range, and characteristic (number of strokes or blasts, period and blast length).

6. This form may be used to cover more than one aid in the same geographic area. Draw a line between each aid as indicated in example. Attach separate sheet if additional space is required.

7. Attach a section of chart showing the proposed location of the aid(s) to navigation.

8. a. After receipt of the approved form the applicant will advise the District Commander by telegram or other rapid means of communications when the work authorized is actually accomplished.
b. If the aids have not been installed within one year of the approval date, the approved application is automatically cancelled.
c. Any discrepancy in the operation of the aid(s) at any time shall be reported to the Disctrict Commander by telegram or other rapid means of communication in order that Notices to Mariners may be issued. A discrepancy exists whenever the aid is not as described in the approved application, i.e., lack of signal, incorrect light characteristic, or improper color, shape of position of shore structure or buoy. The correction of the discrepancy will also be reported by the same method.

9. All classes of private aids to navigation shall be maintained in proper condition. They are subject to inspection by the Coast Guard at any time and without prior notice to the maintainer.

7. APPLICANT WILL FILL IN APPLICABLE REMAINING COLUMNS

FOR DISTRICT COMMANDERS ONLY		EXAMPLE OF USE OF APPLICATION									
			LIGHT							STRUCTURE	
LIGHT LIST NUMBER OR PAGE	NAME OF AID	NO. OR LTR. (7a)	PER. (7b)	FLASH LGTH. (7c)	COLOR (7d)	POSITION (7e)	DEPTH OF WATER (7f)	CAN-DLE POWER (7g)	HT. ABOVE WATER (7h)	TYPE, COLOR, AND HEIGHT (7i)	REMARKS (See Instructions) (7j)
		1	4s	0.4s	WHITE	205°T, 3540 yds from tank, Bayview, VA.	9 Ft.	20	6 Ft.		5' Lighted buoy - black
		2				200°T, 3425 yds from tank, Bayview, VA.	7 Ft.				Nun buoy - Red White reflector
		3				210°T, 2810 yds from tank, Bayview, VA.	2 Ft.		7 Ft.	Single pile	2' square daymark - black
		5	2.5s	0.5s	WHITE	218.5°T, 330 yds from tank, Bayview, VA.	8 Ft.	20	13 Ft.	5 - pile	3' square daymark - black

ATTACHMENT E

NOTICE TO NAVIGATION INTERESTS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

Overview

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area is located at 33^{o} 59' 40.59" North, 81^{o} 02' 56.80" West, as shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and subject to permits and approvals from the U.S. Army Corps of Engineers (USACE), SCDHEC and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The plan is to construct a temporary cofferdam in three phases to facilitate removal of the impacted sediment. The work will be completed in three construction seasons, with portions of the temporary cofferdam left in-place (in the river) between each phase of work. Figure 1 illustrates the phased approach and the proposed cofferdam location and footprint. The impacted sediment will be removed and transported off-site for disposal. Following completion of the impacted sediment removal activities in each phase, the Navigation Plan activities for the next phase will be implemented followed by removal and movement of the cofferdam to the next phase location of the project.

The actual project area is relatively small in comparison to the overall width of the river and at least half of the river's width will be available for continued navigation or other activities. The attached Figure 1 shows the planned restricted area and the area that will remain available for navigation during completion of project. Figures 2, 3 and 4 provide an illustration of the planned Phase 1 cofferdam and show the river portion available for continued navigation during this phase. A new Notice To Navigation Interests will be published for each phase of the project and contain phase-specific information.

Navigation Signage, Lighting and Signals

Prior to initiation of cofferdam construction activities, warning signs will be placed upriver and downriver of the project area in the approximate locations shown on Figure 2. The final locations of the signs will be determined in the field and based on existing conditions. The signs will be located in areas that are readily visible from the water. The warning signs will be approximately 4 feet by 4 feet and state "Warning - River Construction Zone Ahead". The signs will be bolted to metal posts and attached to a weighted base and secured in-place with concrete blocks or boulders.

Information buoys (white with a orange band) will be placed approximately 5-10 feet away from the outboard toe of the cofferdam as an aid to alert river users to the presence of the rock dam. The buoys will be marked with a danger symbol that specifies the presence of the dam. The buoys will direct both downstream and upstream traffic away from the cofferdam structure. They will be relocated as necessary as the project progresses. Figures 3 and 4 provide an illustration of the planned Phase 1 cofferdam and the buoy and lighting scenario.

Marine-application lights will also be positioned slightly above the top of the cofferdam to help identify the perimeter of the structure in the unlikely event that boating traffic is in the area during nighttime or low light conditions. As part of the aids to navigation, solar powered, LED lights will be placed on each corner (or bend) and midpoint of each leg of the cofferdam. The lights will have a standard flash rate of 60 flashes per minute (FPM) and will be visible for one mile, under clear conditions. The lights will be positioned on the outboard side of the cofferdam with the elevation set approximately two feet above the crest elevation of the cofferdam, 125.5 feet (NAVD '29). At a minimum, ten (10) lights will be placed for each phase of construction. The operating period for lights is between sunset and sunrise.

Finally, “Restricted Area” signs will be positioned at regular intervals along the cofferdam structure to alert river users of the need to stay away from the cofferdam. No unauthorized access to or on the cofferdam structure will be permitted.

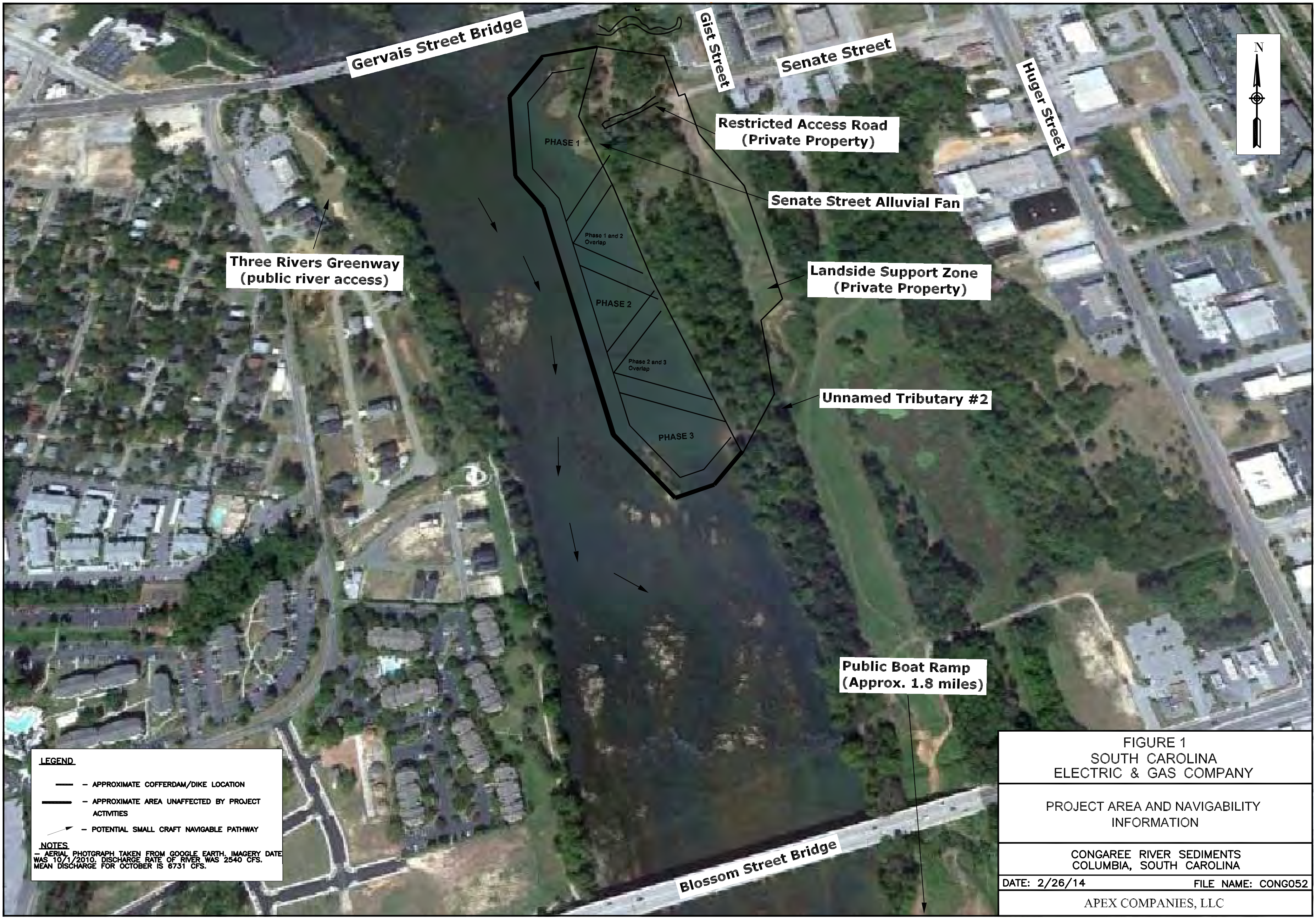


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PROJECT AREA AND NAVIGABILITY
INFORMATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 2/26/14 FILE NAME: CONG052

APEX COMPANIES, LLC

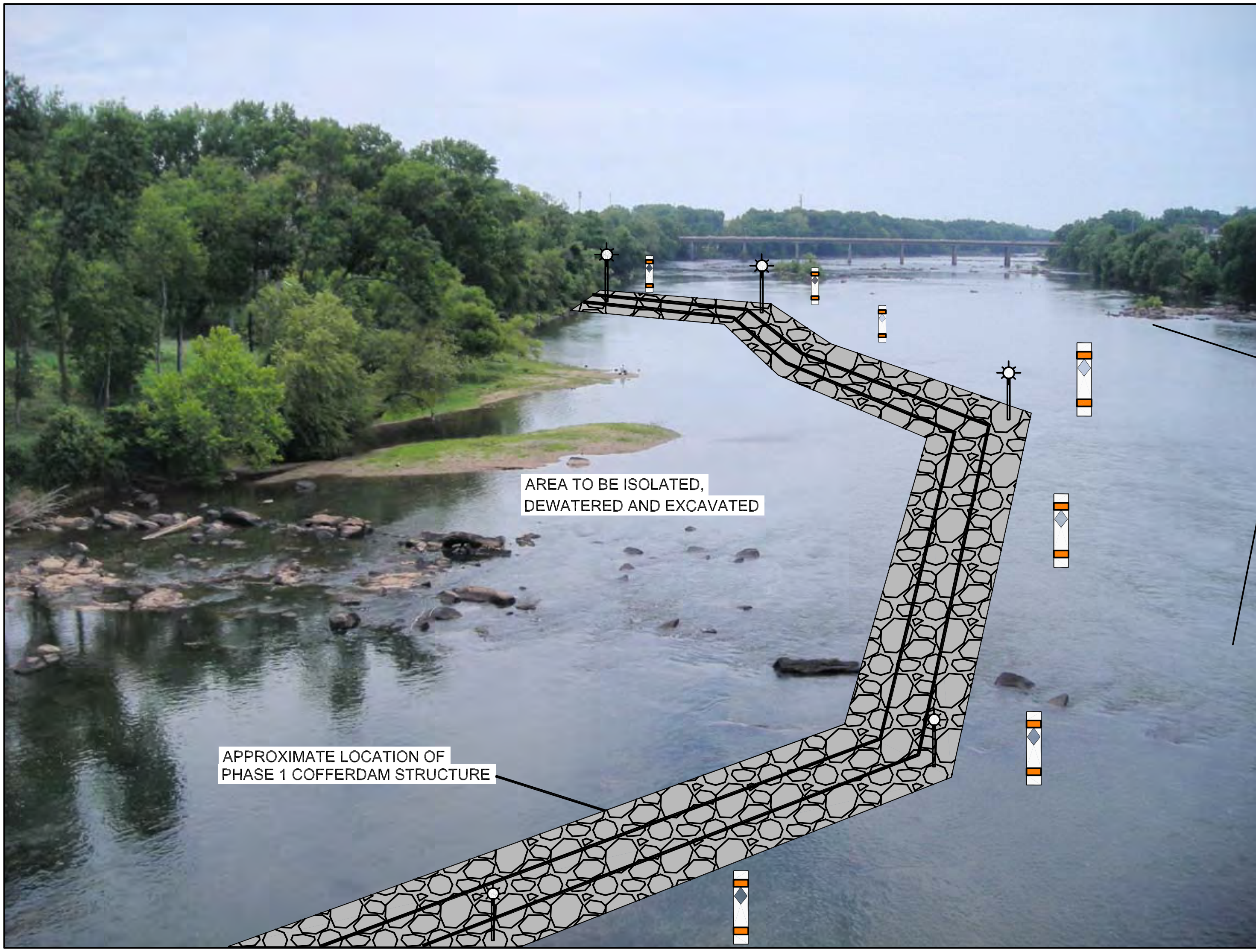
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PRIVATE AIDS TO NAVIGATION - PROPOSED LOCATIONS FOR PHASE 1

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/25/14 FILE NAME: CONG050

APEX COMPANIES, LLC

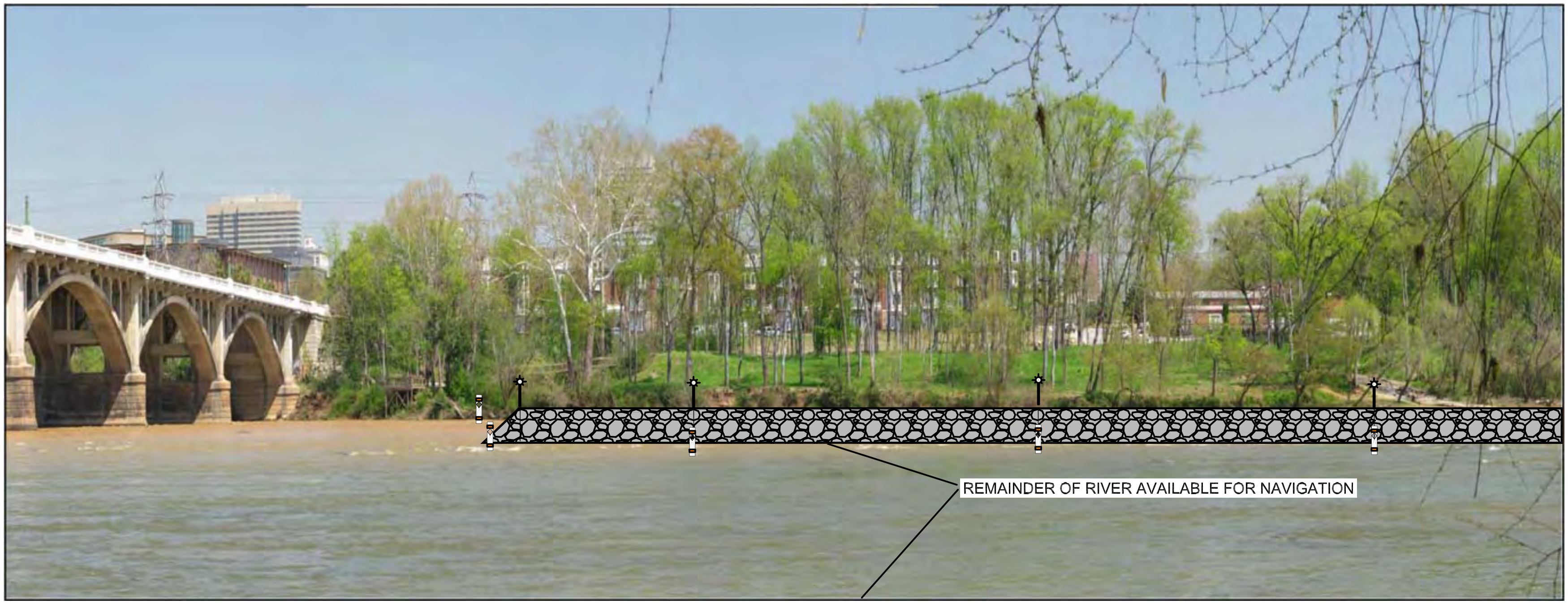


- INFORMATION BUOY WITH DANGER OR OTHER SYMBOL TO ALERT BOATERS OF COFFERDAM
- OBSTRUCTION LIGHTS WILL BE PLACED IN ACCORDANCE WITH 33 C.F.R. 67.05-1.

REMAINDER OF RIVER AVAILABLE FOR NAVIGATION

NOTES:
- DRAWING NOT TO SCALE AND IS FOR ILLUSTRATIVE PURPOSES ONLY.
- COFFERDAM STRUCTURE LOCATION AND CONFIGURATION IS APPROXIMATE.
- PHOTOGRAPH TAKEN FROM THE GERVAIS ST. BRIDGE LOOKING SOUTH.

FIGURE 3 SOUTH CAROLINA ELECTRIC & GAS COMPANY
PHASE 1 COFFERDAM ILLUSTRATION
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 3/24/14 FILE NAME: CONG108 2
APEX COMPANIES, LLC



- INFORMATION BUOY WITH DANGER OR OTHER SYMBOL TO ALERT BOATERS OF COFFERDAM

- OBSTRUCTION LIGHTS WILL BE PLACED IN ACCORDANCE WITH 33 C.F.R. 67.05-1.

NOTES:
- DRAWING NOT TO SCALE AND IS FOR ILLUSTRATIVE PURPOSES ONLY.
- COFFERDAM STRUCTURE LOCATION AND CONFIGURATION IS APPROXIMATE.
- PHOTOGRAPH TAKEN FROM THE WEST BANK OF THE RIVER LOOKING EAST.

FIGURE 4
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PHASE 1 COFFERDAM ILLUSTRATION

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/6/14 FILE NAME: CONG109

APEX COMPANIES, LLC

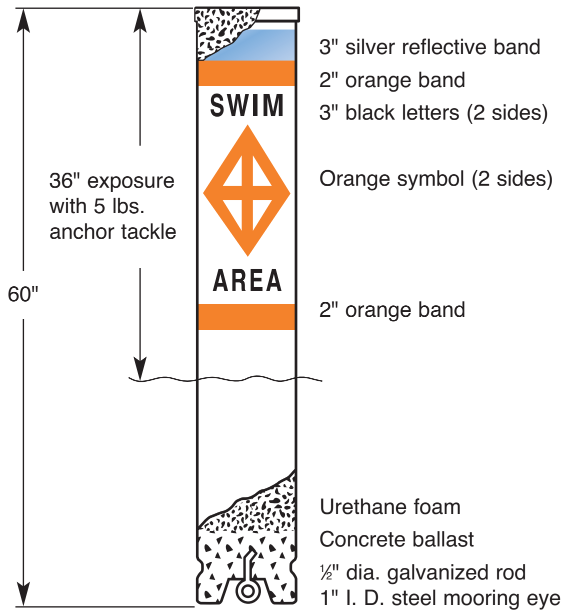
ATTACHMENT F

EXAMPLE BUOY SPECIFICATIONS AND SOLAR POWERED NAUTICAL LIGHTS

Regulatory Buoys • ABS type – 9" Dia.

Approved and universally used by local, state and federal agencies to ensure water safety. Ideal for private applications.

UNSINKABLE — filled with urethane foam



Specify desired symbols and messages when ordering.

Submerged buoyancy	84 lbs.
Net weight	49 lbs.
Shipping weight	56 lbs.

Refer to installation suggestions on page 21.
See warranty information on back cover.

Model B1147R

Features

- Easy reconditioning of weather-worn buoys with excellent adhesion of restoration materials. See page 18.
- 9" diameter, white, ABS plastic exterior. Will not rust, chip or peel. Ultraviolet inhibited.
- Completely urethane foam filled. Virtually unsinkable.
- 3"-wide reflective band at top provides excellent nighttime visibility.
- Self-righting without tackle.
- Recessed cap allows buoy to stand upright.
- Heavy steel galvanized anchoring eye cast in an internal concrete ballast.
- Includes choice of standard symbols and messages.

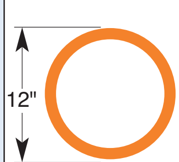
Available Options

- Pickup eye built into top.
- Stainless steel anchoring eye for salt water applications.
- Agency or name identification.
- Cone cap top.
- Special non-standard messages.
- Solar lights (see page 11).
- Available in yellow.
- Side mooring eyes for swim areas, float lines.

STANDARD INLAND WATERWAY SYMBOLS AND MESSAGES

Special messages are available. Request a quotation.

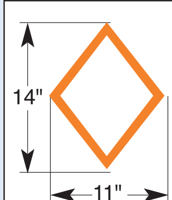
CONTROLLED AREA SYMBOL



2" band width

STANDARD MESSAGES
SLOW 5 MPH
SLOW NO WAKE
SKI AREA
NO SKI
SLOW 10 MPH
SPEED ZONE
NO WAKE IDLE SPEED

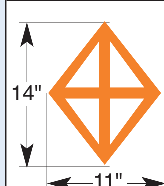
HAZARD WARNING SYMBOL



2" band width

STANDARD MESSAGES
ROCK
DANGER
RAPIDS
SHOAL
STUMP
SHALLOW AREA
HAZARD AREA
DANGER DAM

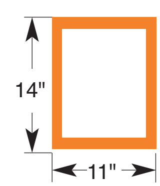
RESTRICTED AREA SYMBOL



2" band width

STANDARD MESSAGES
SWIM AREA
KEEP OUT
NO BOATS
BOATS KEEP OUT
CLOSED AREA
NO BOATING
DANGER DAM

INFORMATION SYMBOL



2" band width

STANDARD MESSAGES
REST ROOM 1 MILE
STATE PARK AHEAD
MARINA ENTRANCE
FISH ATTRACTOR

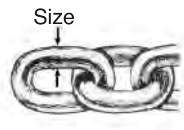
PERMAFLEX® CABLE

Lightweight
High strength
Safe to handle
Tough, durable, bright yellow, waterproof plastic covering is highly resistant to alkalis and salt

Covering O.D.	Part No.	Cable Dia.	Construction ①	Weight Lb./Ft.	Breaking Strength Lbs.	Standard Reel Size②	Reel Wt. Lbs.
5/32"	B1934	1/8"	7 x 7	.028	920	1000'	28
1/4"	B1936	3/16"	7 x 7	.065	3700	500'	37
5/16"	B1931	1/4"	7 x 7	.12	6100	500'	60
15/32"	B1933	3/8"	7 x 19	.28	14400	500'	180

Permaflex Cable – Galvanized steel wire rope coated & Impregnated with yellow polypropylene plastic.

CHAIN



	Size	Part No.	Weight Lb./Ft.	Working Load Limit Lbs.	Standard Drum Size①
Proof Coil Heavy Duty	1/4"	B1828	.42	1300	400'
Steel Chain	3/8"	B1829	1.36	2650	200'
Hot Dipped Galv.	1/2"	B18210	2.3	4500	100'

NOTES: ① Chain may also be purchased by the foot. Subject to cut charge.

GALVANIZED HARDWARE

CABLE THIMBLES

	Size	Part No.	Weight Lb./Ft.
Standard Electro Galvanized	3/16"	B2311	.03
	1/4"	B2312	.04
	5/16"	B2313	.05
	1/2"	B2316	.15
Heavy Duty Hot Dipped Galvanized	1/4"	B2324	.08
	5/16"	B2321	.11
	1/2"	B2323	.47

CABLE CLAMPS

	Size	Part No.	Weight Lb./Ft.
Standard Electro Galvanized	3/16"	B1831	.2
	1/4"	B1832	.3
	5/16"	B1833	.4
	1/2"	B1835	.5
Heavy Duty Hot Dipped Galvanized	3/16"	B2331	.11
	1/4"	B2332	.16
	5/16"	B2333	.28
	1/2"	B2335	.82

CONNECTING LINKS

Electro Galvanized

Size	Part No.	Weight Lb./Ft.
1/4"	B1891	.10
3/8"	B1892	.25
1/2"	B1893	.54

QUICK LINKS

Electro Galvanized

Size	Part No.	Weight Lb./Ft.
1/4"	B1801	.10
3/8"	B1803	.19
1/2"	B1804	.38

ANCHOR SHACKLES

Hot Dipped Galvanized

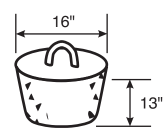
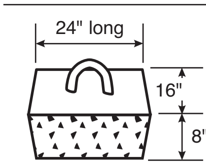
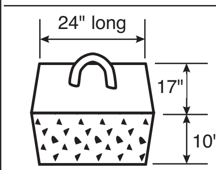
Size	Part No.	Weight Lb./Ft.
5/16"	B1900	.25
3/8"	B1901	.30
1/2"	B1902	.75

SWIVELS

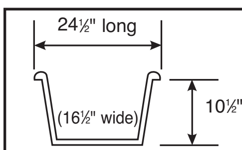
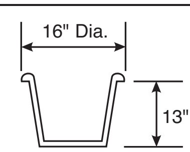
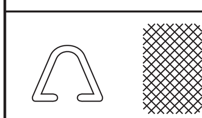
Hot Dipped Galvanized

Size	Part No.	Weight Lb./Ft.
1/4"	B1921	.21
3/8"	B1922	.61
1/2"	B1923	.93

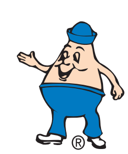
ANCHORS

ANCHORS CONCRETE		Avg. Wt. Lbs.	Under-water Wt. Lbs.
	B1842 ½" Round Steel Eye Hot Dipped Galvanized	90	54
	B21620 ½" Round Steel Eye Hot Dipped Galvanized	200	164
	B2152 ½" Round Steel Eye Hot Dipped Galvanized	300	180

ANCHOR KITS

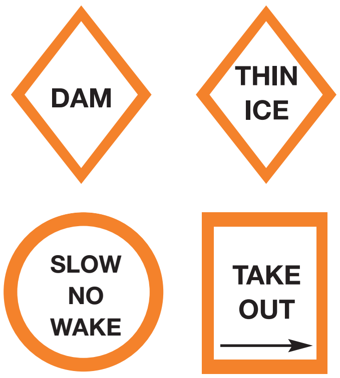
	**B2161** Tough, high-density polyethylene anchor form. Cast up to 300 lb. concrete anchors.
	**B2163** Plastic anchor form for 90 lb. concrete anchors.
	**B2162** 1/2" Steel anchor eye and steel wire mesh.

Stainless steel hardware available.
Call for pricing.



Warning and Portage Signs

Bold black message on white reflective background with orange border. .080" aluminum base material. Excellent visibility, day and night.

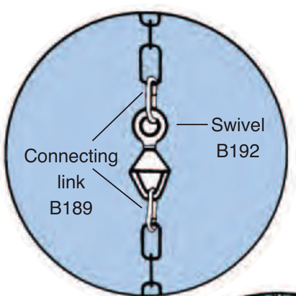


DAM	
SIZE (IN.)	PART NO.
24 x 24	B2011
30 x 30	B2021
36 x 36	B2031
48 x 48	B2211
THIN ICE	
24 x 24	B2013
30 x 30	B2023
36 x 36	B2033
48 x 48	B2213

SLOW NO WAKE	
SIZE (IN.)	PART NO.
24	B22258
30	B22259
36	B22260

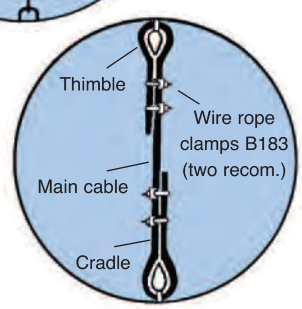
TAKE OUT		
SIZE (IN.)	PART NO.	RIGHT ARROW
24 x 24	B2012L	B2012R
30 x 30	B2022L	B2022R
36 x 36	B2032L	B2032R
48 x 48	B2212L	B2212R

Mooring Suggestions



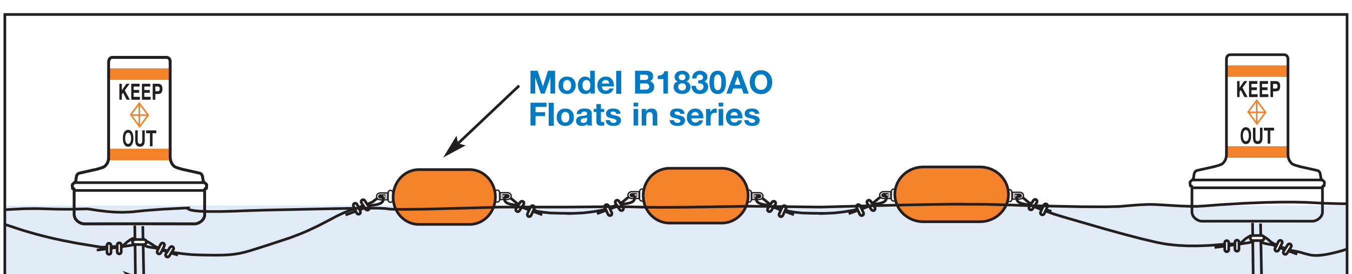
Use swivels to cut chain wear and increase buoy performance. Wind, wave, and current action causes buoys to rotate. This rotation, if severe, can cause chain or cable to twist, which will eventually submerge the buoy, increase chain wear, and increase the load on the anchor.

NOTE - The design and selection of a mooring system should be determined by a qualified professional engineer who is familiar with the specific application and local conditions. The illustrations shown are provided for informational purposes and are not intended to be suggested designs. The company assumes no responsibility for any mooring system based upon these illustrations.

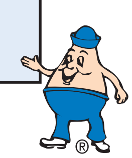


Correct cable clamp assembly. Note from the sketch that the cradle is tightened against main cable. This is the correct assembly method to insure against the clamps, slipping while in service. Be sure to tighten nuts down, alternating from side to side frequently. Thimbles should be assembled so they are firmly trapped within the cable loop.

Typical Barrier Float System



Note: The design and selection of a mooring system should be determined by a qualified professional engineer who is familiar with the specific application and local conditions. The illustrations shown are provided for informational purposes and are not intended to be suggested designs. The company assumes no responsibility for any mooring system based upon these illustrations.



APPENDIX I

WATER MANAGEMENT PLAN

WATER MANAGEMENT PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

WATER MANAGEMENT PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former manufactured gas plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. Figure 2 illustrates the phased approach and the proposed cofferdam location and footprint. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

WATER MANAGEMENT SCENARIO

Management of water will be a major component of the overall remediation project. For implementation purposes, water to be managed has been divided into two separate categories: non-contact and contact water. Non-contact water is visually unimpacted water that has not been in contact with TLM or other impacted material. Conversely, contact water has been in relatively close contact with TLM and/or impacted material or appears to be visually impacted (i.e., contains large amounts of suspended solids, exhibits a sheen, or has TLM particles suspended within the water column). The primary method for distinguishing between contact and non-contact water will be a visual evaluation by site personnel. Also, the area of origin of the water will also be considered when determining which mode of water management will be used.

Four main categories of water requiring proper management are currently anticipated:

1. Non-contact water – Stormwater (run-on, runoff), primarily associated with the landside support zone;
2. Non-contact water – River water from the initial dewatering of the excavation area following construction of the cofferdam or after an overtopping event;
3. Non-contact water – Leakage or seepage water that continuously filters through the stone cofferdam; and
4. Contact water – Potentially impacted water that contacts exposed impacted material.

These four water types and associated management details are described below.

Non-Contact Landside Stormwater

The project area includes the planned construction activities associated with the river and the landside support zone. Since the landside support zone is currently undeveloped and vegetated, no stormwater inlets or conveyances are currently present and no increase in stormwater discharges to the municipal storm sewer from current conditions are anticipated during completion of the landside construction and operation activities. Figure 2 provides the currently anticipated landside support zone scenario. The major components will be placed and constructed in such a manner as minimize clearing and grading activities. The primary planned location for the majority of site operations is the power line right-of-way, which has already been cleared of large vegetation. SCE&G has relocated the overhead wires located within the right-of-way to accommodate future site operations. This scenario will reduce disturbance of currently forested land and further preserve the riparian corridor.

The stormwater associated with the landside operations will primarily include precipitation and runoff from non-impacted areas. This stormwater will be controlled to prevent erosion following clearing activities and to prevent run-on of landside stormwater into the active sediment excavation areas. Impacted sediment conditioning will be conducted on the landside within the temporary structures, which will minimize the amount of stormwater that contacts the impacted sediment. Industrial stormwater discharges are not anticipated for this project. Newly cleared and graded areas such as site roads and material storage and lay down areas will be stabilized by the addition of geotextile material and gravel. Some minimal grading in the form of drainage swales, berms or other measures may be employed to direct stormwater runoff from the landside area away from the current active excavation. Specific details pertaining to the management of stormwater such as the grading plans and the planned sediment and erosion control measures are not covered in this Water Management Plan since they are described in detail in the Comprehensive Stormwater Pollution Prevention Plan (C-SWPPP) submitted as part of the National Pollutant Discharge Elimination System (NPDES) permit application and the City of Columbia Land Disturbance permit application. These documents will be reviewed and approved by SCDHEC and the City of Columbia and the resultant permits will be provided in the Removal Action Report (RAR) for the project. All landside stormwater management activities will be conducted in accordance with the approved C-SWPPP. The NPDES permit will also cover discharges associated with the initial dewatering, over-topping events, and leakage/seepage water.

Non-Contact Initial Excavation Water

Initial excavation area water will be the river water left inside the isolated area following completion of the cofferdam construction. This water may also be left behind following an overtopping event, where the river levels temporarily exceed the height of the cofferdam and result in a flood of the previously dewatered area. This water will be considered “non-contact” as it will not have been in direct contact with impacted sediment and will be visually unimpacted and sediment free. Currently two methods are planned for removing the initial excavation water. These include the use of an outlet structure and/or pumps. The outlet structure will consist of a pipe installed as part of the cofferdam that will permit gravity flow of river water from inside the cofferdam to the outside river, while preventing backflow into the dewatered area with a check valve. The outlet structure will be located on the downstream end of the cofferdam. The actual discharge location will not result in generating any additional sediment-laden water or cause any additional erosion or other adverse affects. Figures 3 and 4 provide water management scenarios for the planned phases of the project and show the potential locations of the outlet structure. Figure 5 provides the outlet structure details. The final outlet structure locations will be determined in the field. As shown on Figure 5, the invert of the outlet structure will be a minimum of approximately 30 inches from the river bottom. This will prevent water from near the river bottom sediment from being discharged through the structure. Please refer to the Cofferdam Inspection and Maintenance Plan for the cofferdam design outlet structure and other details.

The outlet structure is expected to be the primary method for initial dewatering. It will likely be supplemented with pumps stationed on the cofferdam or the adjacent riverbank (Figures 3 and 4) that will be utilized to further dewater the area and permit access to the sediment. These pumps will also be used to remove the additional few feet of water located below the outlet structure intake but above the water column that is in contact with the impacted sediment. The pump suction hoses will be suspended from the bottom of the river or float on the top of the water surface in order to ensure that no sediment is disturbed by the pumping activities. Project personnel will visually monitor the initial excavation water prior to and during discharge activities to ensure that it is free of sheens or excess turbidity. Downstream real-time total suspended solids (TSS) monitoring will be conducted during completion of riverside construction activities to ensure that the project does not contribute to elevated TSS levels within the river. Monitoring for a potential increase in TSS (attributable to the cofferdam construction) will be conducted according to the TSS Monitoring Plan that will be submitted for agency approval as part of the Removal Action Plan (RAP).

Non-Contact Leakage Water

Leakage or seepage water will result from the anticipated continuous movement of river water from outside of the cofferdam into the dewatered area. Water is expected to constantly move through and under the constructed cofferdam. The current design engineer’s estimate of the rate of expected leakage ranges from 0.37 to 1.42 gallons per minute per foot of the completed cofferdam. For the largest excavation area (Phase 1) this results in approximately 500-1,800 gallons per minute that will require management.

The leakage water is expected to be similar to the initial dewatering water in that it will be considered “non-contact” as it will not have been in direct contact with impacted sediment and will be visually unimpacted and sediment free. In order to collect the seepage water, a concrete berm, sandbag dike or other structure will be constructed roughly parallel to the interior toe of the cofferdam slope, as shown on Figures 3 and 4. This berm (detail provided on Figure 5) will be located in an unimpacted or a previously excavated and decontaminated area and will be used to direct the leakage water to pre-determined collection points where it will be pumped back over the structure. Management of the leakage water will be an around-the-clock activity and redundant pumps will likely be present to provide a safeguard against mechanical failures or routine maintenance. The leakage water collection points will be visually monitored by project personnel for evidence of impacts such as sheens or the presence of sediment. If impacts are observed the leakage water will be managed as contact water, which is described in detail below, until the necessary changes are made to eliminate the cause of the impacts.

The number of leakage water collection points will vary depending on the volume of water to be managed, excavation operations and the overall topography of the dewatered excavation area. Each phase of excavation will be different due to the varying nature of the river elevation, river bottom structure and the presence of the bedrock, which may preclude constructing sumped collection points.

Contact Water

Contact water is expected to include:

- Entrained water that seeps from the sediment once it is excavated or disturbed;
- Precipitation that contacts the exposed impacted sediment;
- The final layer of water from the initial dewatering activities that is located directly on top of the sediment; and
- Leakage water that potentially exhibits a sheen or excessive sediment.

All contact water will be collected and pumped to the water management system located in the landside support zone where it will be managed for disposal via discharge to the City of Columbia sanitary sewer system (POTW) under an approved industrial wastewater discharge permit. A similar permit was obtained for the previously completed Huger Street MGP removal action and SCE&G is familiar with the City of Columbia and SCDHEC permit and discharge requirements. The planned discharge location is a sanitary sewer manhole located near the eastern perimeter of the landside support zone shown on Figure 2. In some instances, as a contingency measure, the contact water may be transferred to tanker trucks and disposed of off-site at an approved treatment and disposal facility.

Following receipt of the POTW approval, the water will be managed and discharged in accordance with the specifications provided by the City of Columbia Public Works Department. As a result, filtration to remove suspended solids and other type of conditioning may be necessary prior to discharge. The water management system will be sized accordingly to minimize the potential for excavation downtime due to dewatering requirements. The system will most likely operate around-the-clock in order maintain a steady discharge rate to the POTW sewer system. The components of the water management system will most likely consist of water storage tanks (e.g., 20,000 gallon frac tanks and/or larger volume modular tanks), filtration equipment such as bag filters and/or activated carbon vessels, associated piping and hoses and a totalizing flow meter. The storage tanks will provide flow equalization and provide residence time to allow for settling of solids. Filtration equipment will also be available to achieve acceptable water quality in the discharge. The final design for the water management system will be submitted to the City of Columbia for review as part of the industrial discharge permit request. For illustrative purposes, the general water storage tank and filtration/discharge scenario is provided on Figure 3. The total gallons discharged from the site will be tracked and reported in the RAR. In addition, sampling and analysis of the discharge water will be conducted, if required by the POTW permit, and the results will be included in the RAR.

Excavation operations will likely begin at the highest point within the dewatered area and progress toward the lower lying areas. Water that has contacted impacted material will be directed to the lower lying unexcavated areas and pumped to the on-site water management system located in the landside support zone. Current excavation plans include temporarily stacking the extremely wet sediment within the confines of the open excavation and allowing the entrained water to drain out and collect in a low area where it will be pumped to the water management system. This technique will reduce the amount of material conditioning required to transport the impacted sediment to the disposal facility and the amount of water released from the sediment once it is transported to the landside support zone structures. Any contact water collected on the landside will also be pumped to the water management system. This general approach is illustrated in Figures 3 and 4.

The volume of contact water to be pumped and subsequently managed will be minimized to the extent possible by limiting the amount of open excavation area available for contact with precipitation and by proactively controlling leakage water and directing landside stormwater runoff away from the excavation area.

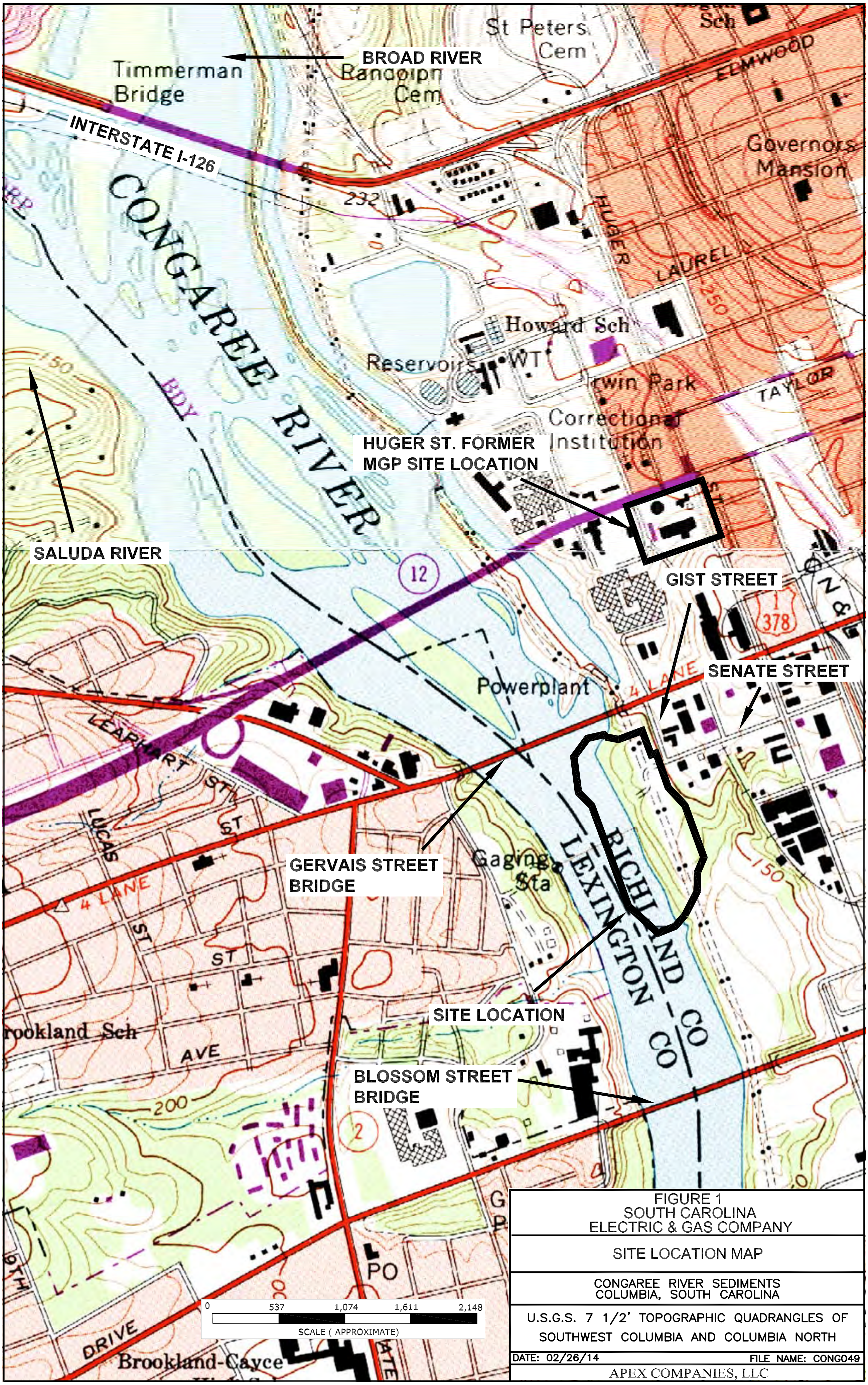


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

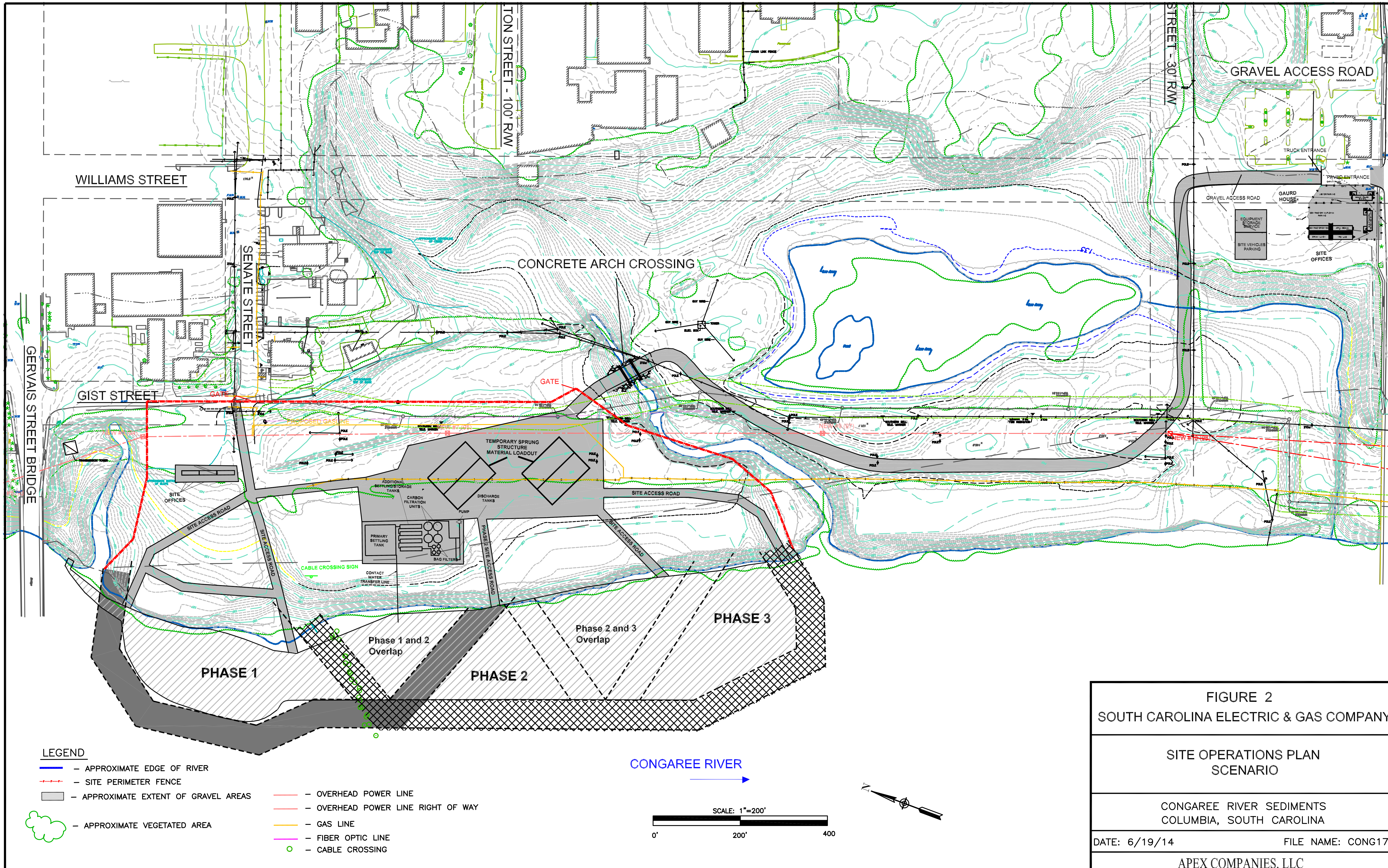
SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC


WILLIAMS STREET
GIST STREET
SENATE STREET
GERVAIS STREET BRIDGE
TON STREET - 100' R/W
STREET - 30' R/W
GRAVEL ACCESS ROAD
TRUCK ENTRANCE
PAVED ENTRANCE
GAURD HOUSE
EQUIPMENT STORAGE SERVICE
SITE VEHICLES PARKING
SITE OFFICES
CONCRETE ARCH CROSSING
GATE
TEMPORARY SPRUNG STRUCTURE MATERIAL LOADOUT
ADDITIONAL SETTLING/STORAGE TANKS
CARBON FILTRATION UNITS
DISCHARGE TANKS
PUMP
PRIMARY SETTLING TANK
BAG FILTERS
CONTACT WATER TRANSFER LINE
CABLE CROSSING SIGN
SITE ACCESS ROAD
SITE OFFICES
PHASE 1
PHASE 2
PHASE 3
Phase 1 and 2 Overlap
Phase 2 and 3 Overlap
CONGAREE RIVER
SCALE: 1"=200'
0'
200'
400'
LEGEND
– APPROXIMATE EDGE OF RIVER
– SITE PERIMETER FENCE
– APPROXIMATE EXTENT OF GRAVEL AREAS
– APPROXIMATE VEGETATED AREA
– OVERHEAD POWER LINE
– OVERHEAD POWER LINE RIGHT OF WAY
– GAS LINE
– FIBER OPTIC LINE
– CABLE CROSSING
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY
SITE OPERATIONS PLAN SCENARIO
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/19/14
FILE NAME: CONG177
APEX COMPANIES, LLC

NOTES:
1) ACTUAL LOCATIONS OF COLLECTION AND DISCHARGE POINTS WILL BE DETERMINED IN THE FIELD DURING IMPLEMENTATION.
2) SEDIMENT WILL BE REMOVED FROM THE LEAKAGE CONTROL DRAINAGE AND COLLECTION AREAS PRIOR TO CONSTRUCTION OF THE CURB.
3) LEAKAGE CONTROL WATER WILL BE VISUALLY INSPECTED PRIOR TO DISCHARGE.
4) IMPACTED WATER WILL BE TRANSFERRED TO WATER MANAGEMENT SYSTEM PRIOR TO DISCHARGE TO THE SANITARY SEWER SYSTEM.
5) OUTLET STRUCTURE WILL BE UTILIZED FOR INITIAL DISCHARGE OF WATER FOLLOWING COFFERDAM CONSTRUCTION OR OVERTOPPING EVENT.

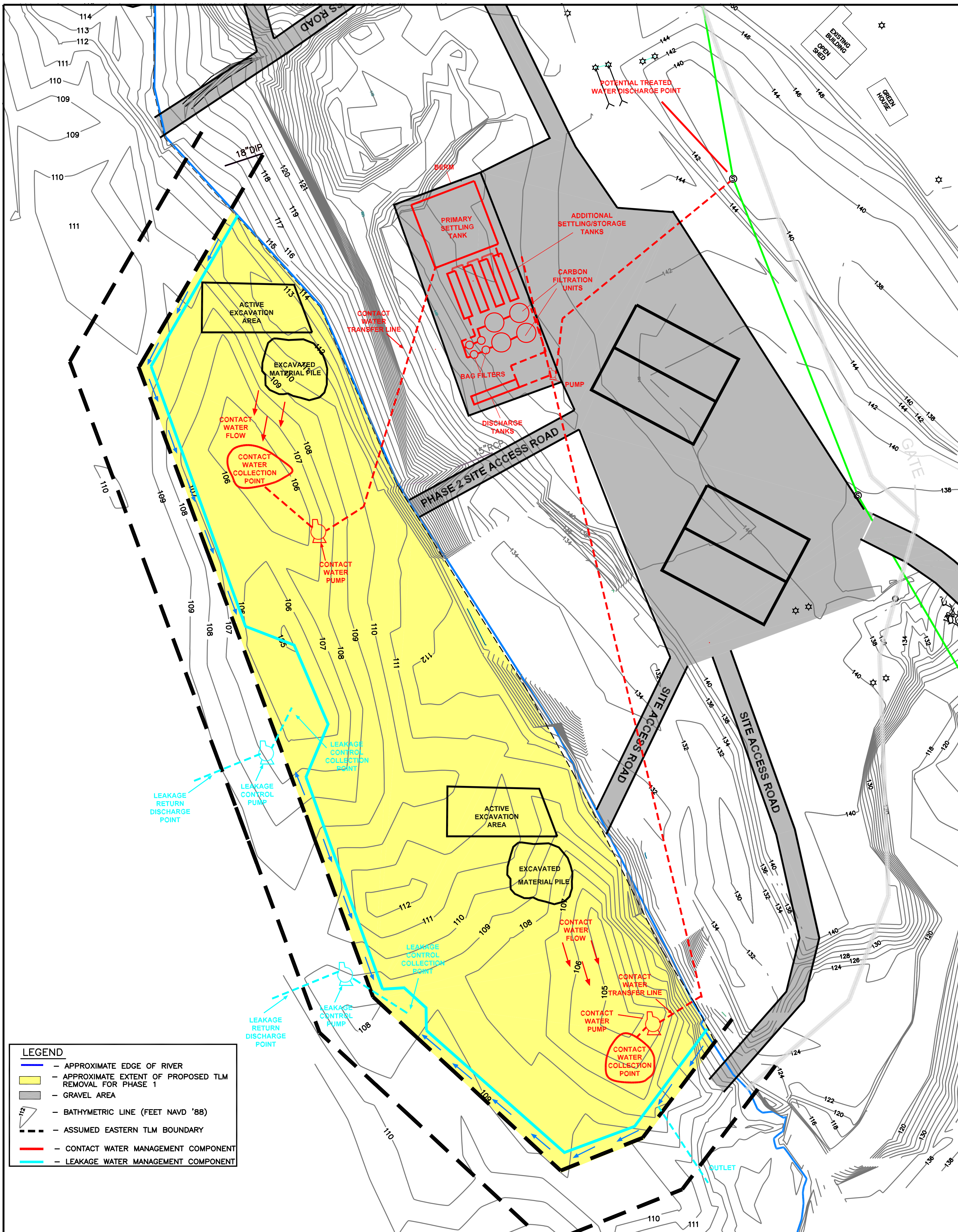
FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

WATER MANAGEMENT SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/24/14 FILE NAME: CONG178

APEX COMPANIES, LLC



LEGEND

- APPROXIMATE EDGE OF RIVER
- APPROXIMATE EXTENT OF PROPOSED TLM REMOVAL FOR PHASE 1
- GRAVEL AREA
- BATHYMETRIC LINE (FEET NAVD '88)
- ASSUMED EASTERN TLM BOUNDARY
- CONTACT WATER MANAGEMENT COMPONENT
- LEAKAGE WATER MANAGEMENT COMPONENT

NOTES:

1) ACTUAL LOCATIONS OF COLLECTION AND DISCHARGE POINTS WILL BE DETERMINED IN THE FIELD DURING IMPLEMENTATION.
2) SEDIMENT WILL BE REMOVED FROM THE LEAKAGE CONTROL DRAINAGE AND COLLECTION AREAS PRIOR TO CONSTRUCTION OF THE CURB.
3) LEAKAGE CONTROL WATER WILL BE VISUALLY INSPECTED PRIOR TO DISCHARGE.
4) IMPACTED WATER WILL BE TRANSFERRED TO WATER MANAGEMENT SYSTEM PRIOR TO DISCHARGE TO THE SANITARY SEWER SYSTEM.
5) OUTLET STRUCTURE WILL BE UTILIZED FOR INITIAL DISCHARGE OF WATER FOLLOWING COFFERDAM CONSTRUCTION OR OVERTOPPING EVENT.

FIGURE 4

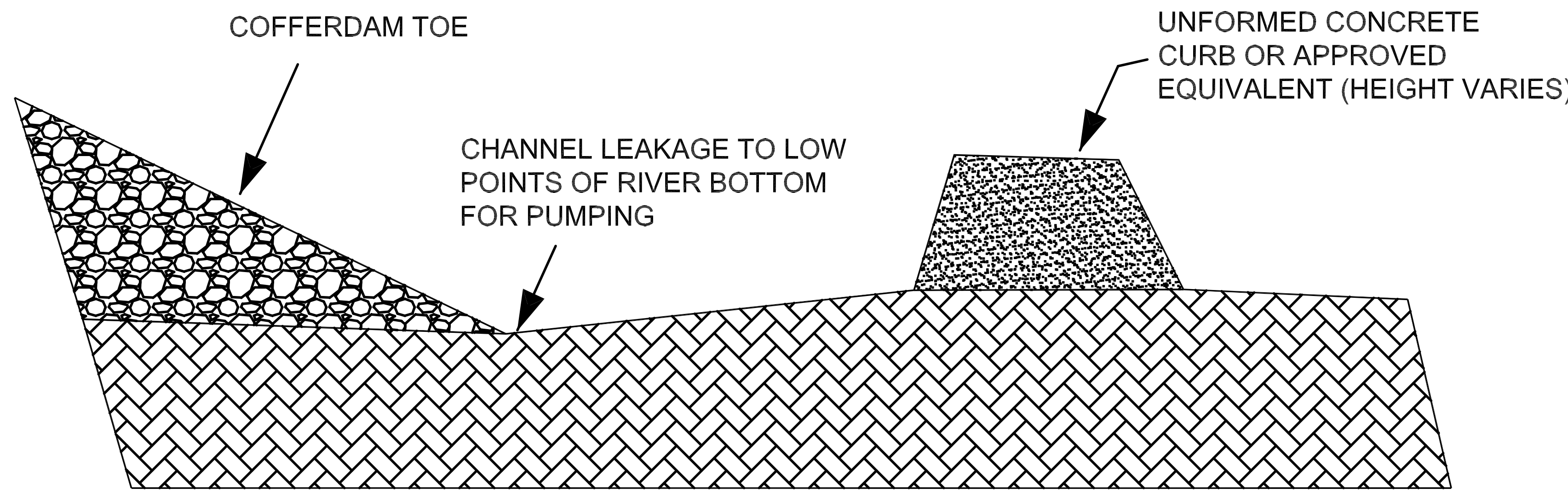
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

PHASES 2 AND 3
WATER MANAGEMENT SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

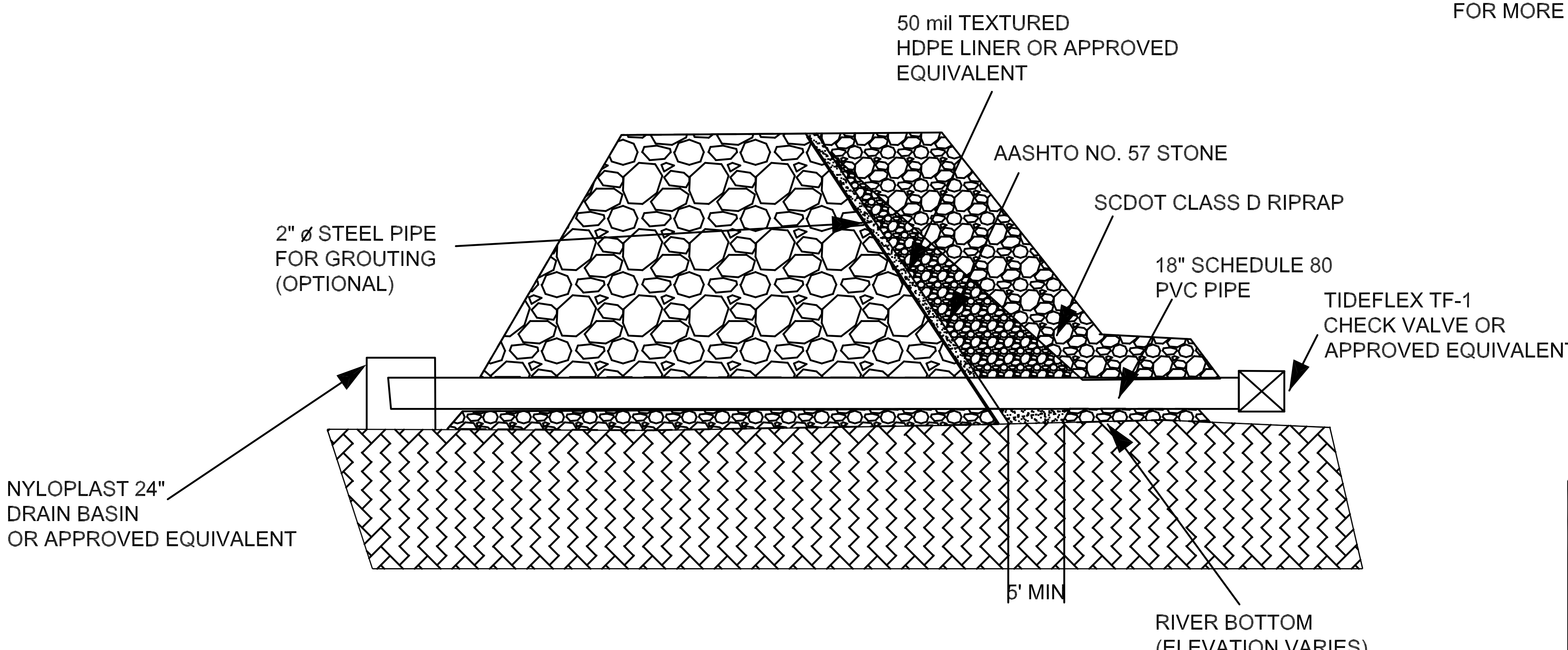
DATE: 6/24/14 FILE NAME: CONG180

APEX COMPANIES, LLC



LEAKAGE CONTROL

NOTE:
PLEASE REFER TO COFFERDAM DESIGN PROVIDED IN THE COFFERDAM INSPECTION AND MAINTENANCE PLAN FOR MORE DETAILED INFORMATION.



OUTLET STRUCTURE

FIGURE 5
SOUTH CAROLINA ELECTRIC & GAS COMPANY

CONCEPTUAL LEAKAGE CONTROL AND
OUTLET STRUCTURE DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/27/14 FILE NAME: CONG062

APEX COMPANIES, LLC

APPENDIX J

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

June 2014

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COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

To ensure the safety of on-site workers and the local community, a comprehensive environmental site air-monitoring and odor/dust control program will be implemented during the project. SCE&G has successfully completed numerous former MGP remediation projects and has developed and refined a reliable and effective system for eliminating the potential for remediation worker or community exposure to the chemicals of concern originating from the coal tar impacted material. [It should be noted that dust presents a typical concern with former MGP site remediation projects. For the Congaree River Sediment Project, dust from excavation will be a minimal concern due to the subaqueous/wet nature of the TLM and impacted sediment to be removed.] The primary components of the air monitoring program include real-time excavation area and perimeter air monitoring, dust and odor control measures, controlled and methodical excavation and contained material handling work areas.

There are two basic objectives of the air monitoring program:

- Protection of the on-site remediation worker; and

- Protection of the surrounding community.

A brief overview of the safety program developed for the on-site worker is provided in the next section as it provides the basis for the community air-monitoring program.

ON-SITE REMEDIATION WORKER HASP

Based on regulatory requirements and SCE&G's commitment to health and safety, a Health and Safety Plan (HASP) was prepared and will be implemented to protect the health and well-being of the on-site remediation workers. In summary, the HASP specifically addresses:

- The potential hazards associated with completing the work;
- The primary chemicals of concern that site workers may be exposed to; and
- The safety measures, precautions and personal protective equipment (PPE) to be used by the on-site workers.

A major concern addressed by the HASP is the air-monitoring activities that will be completed during active excavation and material handling activities. Numerous procedures and techniques have been developed and will be implemented to minimize exposure to the on-site workers at the point of excavation and subsequently while handling and screening the TLM-impacted sediment. If the exposure concentrations exceed certain standards as specified in the HASP, then on-site personnel must upgrade their PPE accordingly. It is important to note that air monitoring within the active work zones at other previously completed MGP projects has not identified sustained elevated air monitoring readings within the work areas and SCE&G does not anticipate that this project will produce sustained elevated readings in the work zone.

Therefore, it stands to reason that if the air monitoring conditions at the point of excavation are acceptable to an on-site worker (without the need for PPE as specified in the HASP), then air concentrations at the perimeter monitoring stations will be substantially less.

Work Area Air Monitoring

The work area air monitoring will be conducted to ensure that remediation workers are safely able to complete their duties. If elevated readings are identified, then the appropriate engineering controls will be implemented to quickly reduce any air impacts. Impacted material excavation and handling activities will be conducted only in the river within the cofferdam footprint and within a temporary structure(s) located well away from potential residential areas.

Figure 2 provides the currently planned site operations scenario, which includes the approximate locations of the temporary structure(s) and the planned excavation areas. These structures and excavation areas will be the primary locations for the work area air monitoring activities. Periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation worker likely to have the highest exposure. These readings will be compared to the established action levels located in the

HASP. Guidelines for specific project related activities that require air monitoring and the subsequent frequency of air monitoring are also presented in the HASP.

Volatile organic compounds (VOCs) associated with the constituents found in the TLM and dust/particulates will be the primary focus of the air monitoring program for this project. A photo-ionization detector (PID) and a particulate (dust) meter will be the instruments used to collect the periodic real-time measurements in the breathing zone in locations where impacted material is being handled. Examples of the instruments typically utilized for similar projects are provided in Attachment A. If sustained VOC readings are identified using a PID, additional air monitoring using constituent-specific detector tubes, as specified in he HASP will be conducted. Engineering controls such as the application of a foaming agent or the use of tarps or other such means to encapsulate the impacted material and limit the potential for volatilization will be implemented should conditions warrant. Water sprays will be utilized to control dust.

The remainder of this Plan describes the community air-monitoring program.

COMMUNITY AIR MONITORING & ODOR/DUST CONTROL PLAN

This Community Air Monitoring and Odor/Dust Control Plan (CAMP) was developed to specifically identify measures that will be implemented to assure minimal impacts to the local residents and the surrounding community while completing the Congaree River Sediment Project. There are two primary elements of this plan that consist of:

- Conducting perimeter air-monitoring activities in the vicinity of Senate and Gist Streets; and
- Implementing counter measures should the air monitoring activities warrant such mitigation activities.

SCE&G's objective for this plan is to measure air quality concentrations at the perimeter of the project area to be protective of human health and confirm that there are no exceedances of any applicable air quality standards. The approach to achieving this objective is rather straight forward as described below.

Perimeter Air Monitoring

SCE&G plans to implement a perimeter air monitoring program during completion of impacted material removal and handling operations. SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at other SCE&G MGP remediation sites and it successfully confirmed the absence of elevated concentrations at these locations.

Attachment B provides information on the predominant wind direction and wind speed for the Columbia Owens, SC weather station located approximately 3.5 miles southeast of the site. This weather station documents a predominant northeast to southwest wind direction. This approximate wind direction is also shown on Figure 3. With the prevailing wind direction blowing across the site from the northeast to the southwest, the downwind perimeter of the site would most often be the southeast corner, which is the Congaree River. Other than boaters utilizing this portion of the river on an infrequent basis, this perimeter location does not contain potential sensitive receptors. The primary location of potential sensitive receptors is the Senate and Gist Streets area and the Gervais Street Bridge. As a result, SCE&G has developed this perimeter air monitoring program to be protective of both the sensitive receptor areas and the downwind perimeter of the site at all times, regardless of wind direction.

SCE&G will establish a number of air monitoring stations along the northern and eastern landside perimeter, (Gervais Street Bridge and Senate and Gist Streets area), as shown on Figure 3. These stations will house VOC and particulate air monitors whenever impacted material handling operations are being conducted regardless of the predominant wind direction. Other similar stations will be established periodically around the remainder of the perimeter of the landside and riverside operations area. These stations will be utilized according to the prevalent wind direction. A windsock or another device on-site will be used to determine the direction of the wind. Wind direction, weather conditions and perimeter monitoring locations will be noted in the field logbook. Three stations in the Gist, Senate and Gervais Street areas will be supplemented with two downwind stations and one upwind (background station) that will be established on a daily basis. Implementation of this scenario will provide background data, downwind data and data directly adjacent to the Gervais Street Bridge and Senate and Gist Streets area.

The perimeter meters will conduct continuous real-time measurements of dust and organic compounds and will be set to log data at 15-minute intervals and to alarm at conservative action levels. The monitoring stations will be periodically inspected by site personnel and the data collected will be downloaded to the site computer and provided in the final report for the project. The data will also be available for review at any time.

For volatile organic vapors the PIDs will have an audible alarm set at a 15-minute average concentration of 1 ppm. This conservative action level has been successfully utilized at other SCE&G sites. If the ambient air concentration of total organic vapors at the northern and eastern landside perimeter or the downwind perimeter of the work area exceeds 1 part per million (ppm) above background for a 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level decreases (per instantaneous readings) below 1 ppm over background, work activities will resume with continued monitoring. If total organic vapor levels at the perimeter monitoring stations persist at levels in excess of 1 ppm over background work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions and monitoring continued until levels are reduced below 1 ppm and work activities can resume.

Similar to the VOC monitoring, the particulate monitoring will be performed at the perimeter locations using real-time monitoring equipment (e.g., DataRam) capable of integrating readings over a period of 15 minutes (or less) and data logging the results. The monitors will be set to alarm at the conservative action level and will be periodically inspected by oversight personnel. In addition, fugitive dust migration will be visually assessed during work activities. If the perimeter particulate level is 100 micrograms per cubic meter (μg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be immediately employed. Work may continue with dust suppression techniques provided that downwind particulate level does not exceed 150 μg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 μg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 μg/m^3 of the background level and in preventing visible dust migration.

It should be noted that all loading and off-loading activities will be conducted with care to minimize the occurrence of particulate emissions. Also, water-resistant tarps will be used on all vehicles loaded at the site to minimize the production of particulates during transportation off-site.

Air Monitor Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. A written record of all air monitoring equipment calibration and adjustment information will be maintained. Initially, the PID and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the field work. Calibration and/or zeroing will also be conducted during work hours if a potential malfunction in the instrument is detected.

Odor Control

Odor control measures will be implemented, as needed to ensure that site activities do not produce unsatisfactory odors at the site perimeter. Use of the temporary structure(s) to house impacted material management operations will be a significant component of the odor control plan. Exposed impacted material will only be handled within the river excavation areas and the temporary structures. Plastic sheeting or tarps may be applied to cover impacted material and prevent or minimize fugitive odors. Additional control measures will be available on-site as a contingency measure when impacted material handling operations are ongoing. These include the following two commercially available odor suppressant technologies, or equivalent:

- **Bio Solve® –** Bio Solve® is a biodegradable, water-based product that has the ability to encapsulate hydrocarbon VOC vapors. The product is mixed with water at a 3 to 5 percent concentration and can be applied with a variety of water application spray methods. Bio Solve® is not subject to breaches or drawdown (like some foam applications) that allow for re-volatilization, making it a preferred option in windy conditions or on sloped surfaces.
- **Odor Suppressant Foam –** Odor suppressant foam can provide immediate, localized control of odor emissions. The foam is produced by injection of air into a foam concentrate/water mixture using a pneumatic foam unit. The foam is applied via a hose to cover source areas, generally to a depth of 3 to 6 inches. Short-term foam (such as Rusmar AC-645) is recommended to control odors from active excavations and stockpiles. This foam may last between 12 to 16 hours but because it can degrade quickly in direct sunlight, frequent and liberal applications may be necessary. For longer-term odor suppression, such as over weekends, a long-term foam (such as Rusmar AC-904) should be used.

Dust Control

Excavation area and perimeter air monitoring activities will provide real-time measurements of dust levels at the point of excavation and at the site perimeter. Dust is not anticipated to be an issue with the wet sediment. However, dust from applying a drying agent such as kiln dust may result in a short, transient dust cloud. Site personnel will visually monitor for dust during equipment movement and windy conditions. Nuisance dust from truck movements (haul roads) and drying agent application may require management through the application of a water spray via a water truck. A source of clean potable water will be obtained (most likely from a fire hydrant tap permit) and a water truck will be operated on-site to periodically dampen haul roads and other site areas exhibiting visible dust.

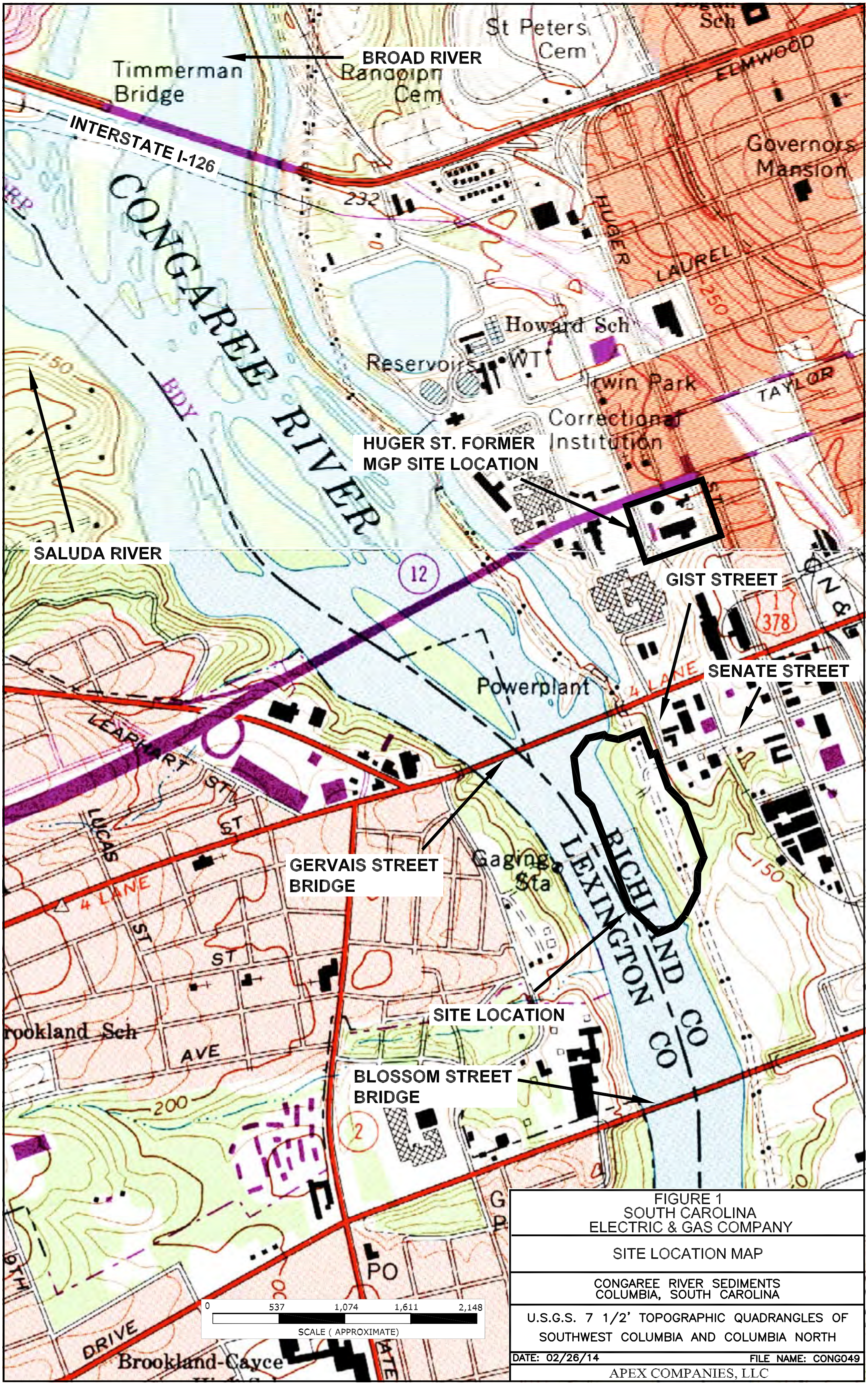


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

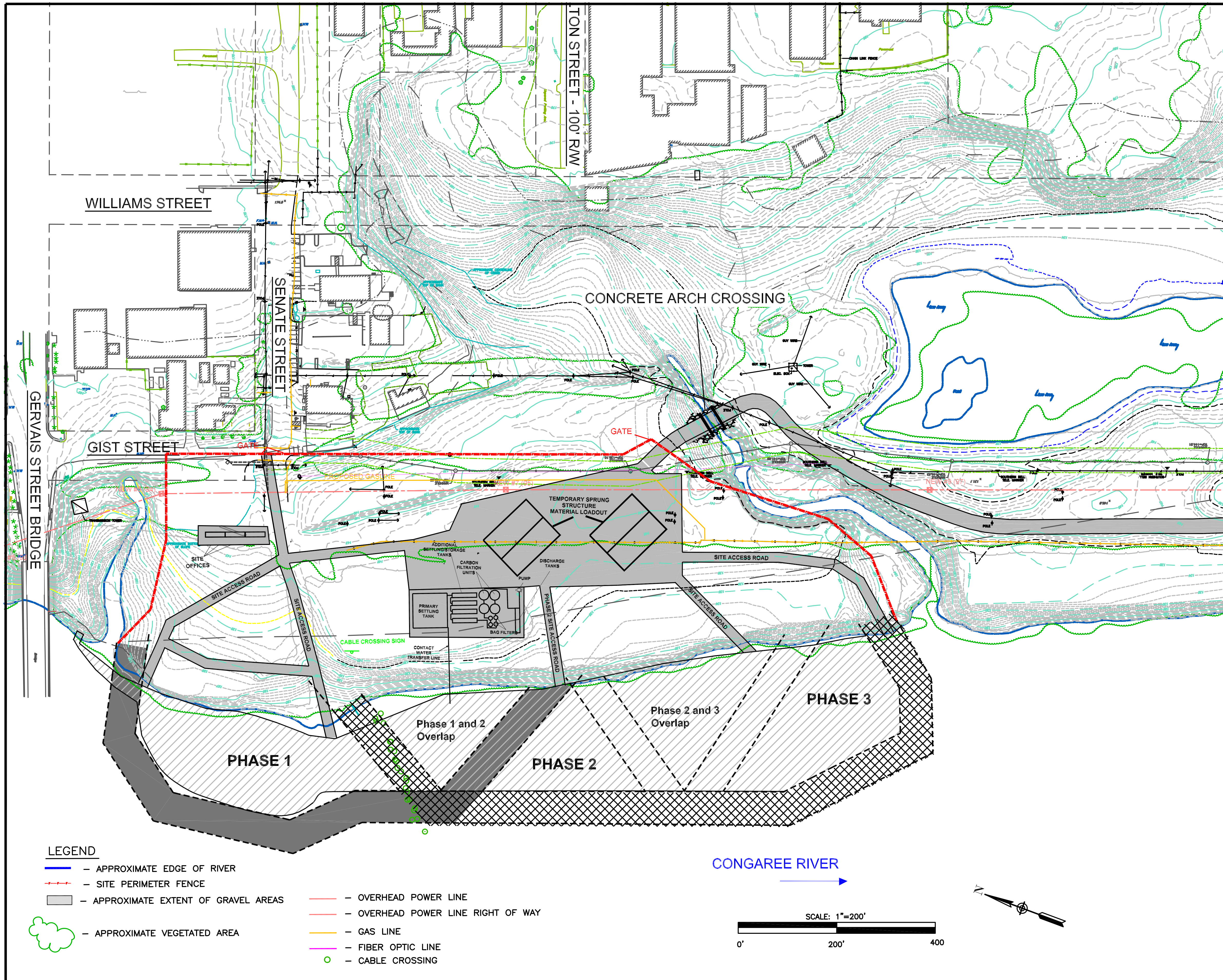


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/19/14 | FILE NAME: CONG177

APEX COMPANIES, LLC

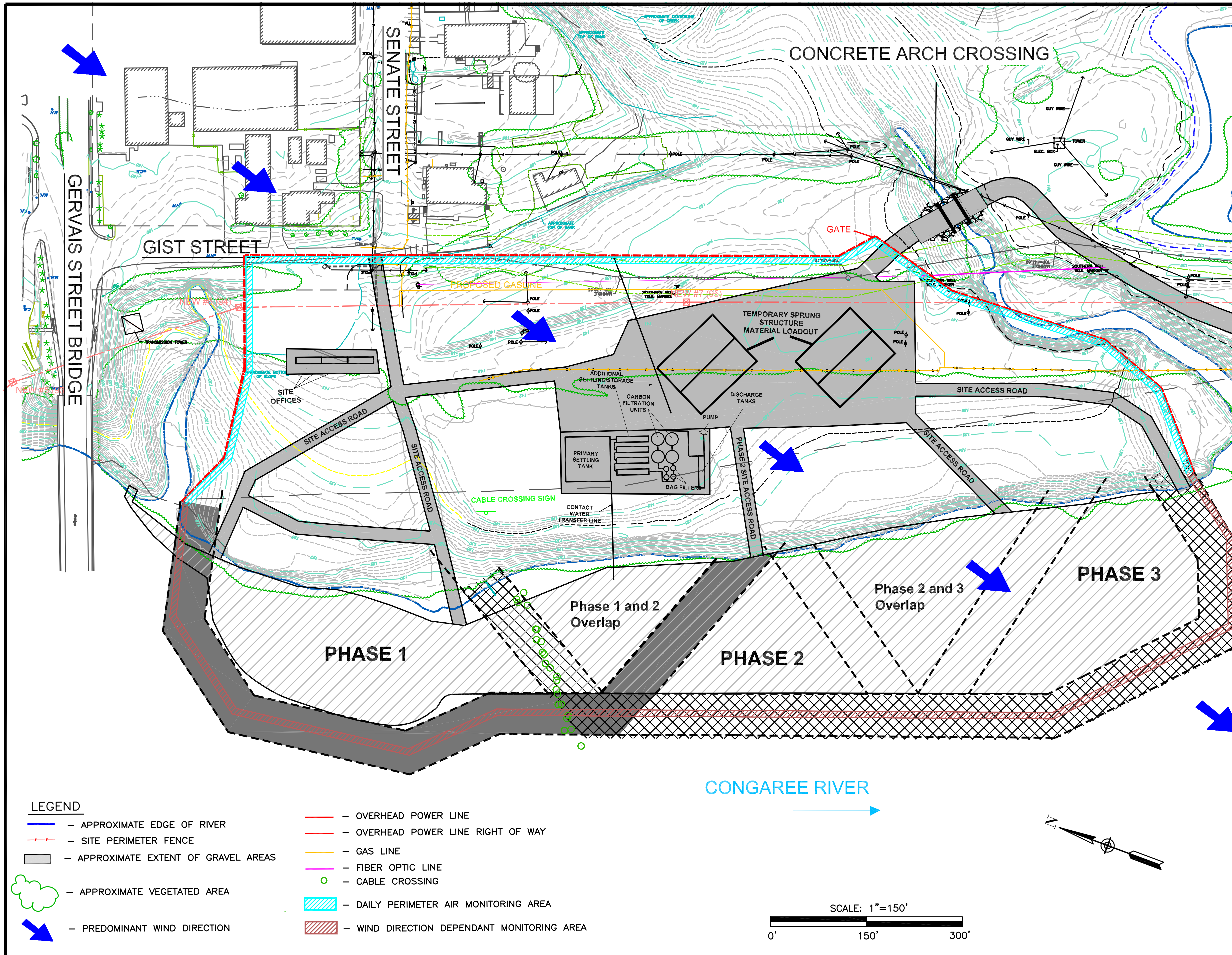


FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PERIMETER AIR MONITORING SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/25/14 FILE NAME: CONG136

APEX COMPANIES, LLC

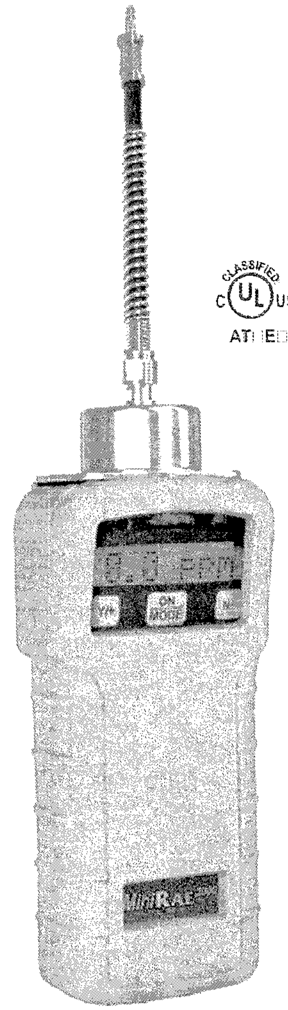
ATTACHMENT A

AIR MONITORING INSTRUMENT INFORMATION

MiniRAE 2000

Portable Handheld VOC Monitor

The rugged MiniRAE 2000 is the smallest pumped handheld Volatile Organic Compound (VOC) monitor on the market. Its Photoionization Detector's (PID) extended range of 0-10,000 ppm makes it an ideal instrument for applications from environmental site surveying to HazMat/Homeland Security.



Key Features

Proven PID technology
The patented 3D sensor provides a 3-second response up to 10,000 ppm and sets a new standard for resistance to moisture and dirt.

Self-cleaning lamp and sensor
Our patented self-cleaning lamp and sensor minimize the need for maintenance and calibration.

The MiniRAE 2000 lamp and sensor can be taken apart in seconds for easy maintenance without any tools!

Measure more chemicals than with any other PID With over 100 Correction Factors built into the MiniRAE 2000 memory and the largest printed list of Correction Factors in the world (300+), RAE Systems offers the ability to accurately measure more ionizable chemicals than any other PID. When a gas is selected from the MiniRAE 2000's library, the alarm points are automatically loaded into the meter.

User friendly screens make it easy to use for simple applications and flexible enough for sophisticated operations.

Drop-in battery When work schedules require putting in more hours than the 10 hours supplied by the standard NiMH battery, the drop-in alkaline pack supplied with every MiniRAE 2000 lets you finish the job.

Rugged Rubber Boot The standard rubber boot helps assure that the MiniRAE 2000 survives the bumps and knocks of tough field use.

Strong, built-in sample pump draws up to 100 feet (30m) horizontally or vertically.

Tough flexible inlet probe

Large keys operable with 3 layers of gloves.

Easy-to-read display with backlight.

Stores up to 267 hours of data at one minute intervals for downloading to PC (with the datalogging option).

3-year 10.6 eV lamp warranty

Applications

HazMat/Homeland Security
- Initial PPE (personal protective equipment) assessment
- Leak detection
- Perimeter establishment and maintenance
- Spill delineation
- Decontamination
- Remediation

Industrial Hygiene/Safety
- Confined Space Entry (CSE)
- Indoor Air Quality (IAQ)
- Worker exposure studies

Environmental
- Soil and water headspace analysis
- Leaking underground storage tanks
- Perimeter fence line monitoring
- Fugitive emissions (EPA Method 21)
- Vapor recovery breakthrough
- Landfill monitoring

RAE Systems Inc.
1339 Moffett Park Drive • Sunnyvale, California 94089 USA
Tel: 408.752.0723 • Fax: 408.752.0724
Email: raesales@raesystems.com • www.raesystems.com

rev10_ 04.04

ISO 9001 CERTIFIED

Specifications*

Default Sensor Settings**

Gas Monitor	Range (ppm)	Resolution (ppm)	Response Time (T90)
VOCs	0 - 999 ppm	0.1 ppm	< 3 sec
	100 - 10,000 ppm	1 ppm	< 3 sec

Detector Specifications

Size	8.2"L x 3.0"W x 2.0"H (21.8 x 7.62 x 5.0 cm)
Weight	20 oz with battery pack (553g) w/o rubber boot
Sensor	Photoionization sensor with standard 10.6 eV or optional 9.8eV or 11.7 eV UV lamp
Battery	• Rechargeable, external, field replaceable Nickel-Metal-Hydride (NiMH) battery pack • Alkaline battery holder (for 4 AA batteries)
Operating Period	10 hours continuous operation
Display	Large LCD, backlight activated manually, with alarms or darkness
Keypad	1 operation and 2 programming keys
Direct Readout	• VOCs as ppm by volume • High and low values • STEL and TWA (in hygiene mode) • Battery and shut down voltage
Alarms	90 dB buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms automatic reset or latching with manual override • Optional plug-in pen size vibration alarm • User adjustable alarm limits
Calibration	Two point field calibration of zero and standard reference gas. Calibration memory of 8 calibration gases, alarm limits, span values and calibration date
Datalogging	Optional 267 hours (at one minute intervals) with date/time. Header information includes monitor serial number, user ID, site ID, date and time
Sampling Pump	• Internal, integrated flow rate 400 cc/min • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto shut-off pump at low flow condition
Communication	Download data and upload instrument set-up from PC through RS-232 link to serial port
Temperature	14° to 104°F (-10° to 40°C)
Humidity	0% to 95% relative humidity (non-condensing)
EM/RFI	Highly resistant to EMI /RFI. Compliant with EMC Directive 89/336/EEC
IP-rating	IP-55: protected against dust, protected against low pressure jets of water from all directions
Hazardous Area Approval	• US and Canada: UL and cUL, Classified for use in Class I, Division 1, Groups A, B, C and D hazardous locations • Europe: ATEX II IG EEx ia IIC T4
Attachment	Durable bright yellow rubber boot w/belt clip & wrist strap
Warranty	Lifetime on non-consumable components (per RAE Systems Standard Warranty), 1 year for 10.6.V PID lamp, 1 year for pump and battery

ATEX

ISO 9001 CERTIFIED

DISTRIBUTED BY:

MiniRAE 2000 and Accessories

Monitor only includes:

- 10.6eV, 9.8eV or 11.7eV as specified
- RAE Systems UV lamp: 10.6eV, 9.8eV or 11.7eV as specified
- 5-inch Flex-I-Probe
- External filter
- Rubber boot with belt clip
- Alkaline battery adapter
- Tool kit
- Lamp cleaning kit
- Nickel-Metal-Hydride battery
- 120/230 V AC/DC wall adapter (if specified)
- Operation and maintenance manual

Monitor with accessories kit adds:

- Hard transport case with pre-cut foam
- 5 porous metal filters and O-rings
- Organic vapor zeroing adapter
- Gas outlet port and tubing

Optional calibration kit adds:

- 10 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

Datalogging monitor adds:

- ProRAE Suite software package for Windows 98, NT, 2000 and XP
- Computer interface cable

Optional Guaranteed Cost of Ownership Program:

- 4-year repair and replacement guarantee
- Annual maintenance service

* On going projects to enhance our products means that these specifications are subject to change

** Performance based on isobutylene calibration

MiniRAE 2000

RAE Systems Inc.
1339 Moffett Park Drive • Sunnyvale, California 94089 USA
Tel: 408.752.0723 • Fax: 408.752.0724
Email: raesales@raesystems.com • www.raesystems.com

rev10_ 04.04

RAE SYSTEMS

Product Overview

All these applications in one small unit

- Indoor air quality monitoring
- Walk-through surveys
- Personal exposure monitoring
- Time & motion studies
- Workplace & plant monitoring
- Fixed-point continuous monitoring
- Remediation personal surveillance
- Remote alarming
- Mobile monitoring in vehicles & aircraft
- Toxicology & epidemiology studies
- Emergency response
- Testing air filtration efficiency

personalDataRAM™ Series

Measures airborne particulate concentration in real time

- ***p***DR-1000AN
  For passive air sampling applications
- ***p***DR-1200
  For active air sampling applications

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

*p*DR-1000AN
Hand-held and fixed-point, real-time aerosol monitor/datalogger

Measure airborne particulate concentration in real-time

The *personal*DataRAM (*p*DR-1000AN) measures mass concentrations of dust, smoke, mists, and fumes in real time, and sounds an audible alarm whenever the user-defined level is exceeded. Conventional filter-based monitoring methods cannot indicate dangerous, real-time dust levels. In contrast, the *p*DR-1000AN alerts you to a problem within seconds, allowing you to take immediate action. With the datalogging enabled, the instrument automatically tags and time stamps the data collected, and stores it for subsequent retrieval, printing, or graphing through a computer.

Highest performance of any real-time personal particulate monitor

With a measurement range from 0.001 to 400 mg/m^3 (auto-ranging), and an optical feedback stabilized sensing system, the *p*DR-1000AN sets the standard for sensitivity, long-term stability and reliability.

The palm-sized *p*DR-1000AN weighs only 18 oz (0.5 kg) for easy portability and attachment to a belt or a shoulder strap. The absence of any moving parts, such as pumps, motors and valves, and the use of low-power semiconductors housed in a ruggedized case ensures long life and dependable operation.

High correlation with gravimetric measurement

The *p*DR-1000AN is a light-scattering photometer (i.e., nephelometer) incorporating a pulsed, high output, near-infrared light emitting diode source, a silicon detector/hybrid preamplifier, and collimating optics and a source reference feedback PIN silicon detector. The intensity of the light scattered over the forward angle of 50^o to 90^o by airborne particles passing through the sensing chamber is linearly proportional to their concentration. This optical configuration produces optimal response to particles in the size range of 0.1-10 µm, achieving high correlation with standard gravimetric measurements of the respirable and thoracic fractions.

Simple zeroing and calibration

The *p*DR-1000AN arrives practically ready to use after the easy zeroing step. The unit comes gravimetrically calibrated in mg/m^3 (NIST traceable) using standard SAE Fine test dust (ISO Fine). Zeroing with particle-free air is accomplished quickly and effectively under field conditions using the zeroing kit included with the instrument. Internal firmware controls an automatic calibration check. To maximize efficiency in the field, gravimetric calibration can be performed by comparison with a filter sampler and programming of the calibration constant.

Standard Accessories

- Universal voltage power supply
- PC communications software
- Zeroing kit
- Belt clip kit
- Instruction manual
- Carrying case
- Signal output cables

Optional Accessories

- Rechargeable battery pack (NiMH)
- Active sampling kit (converts *p*DR-1000AN to *p*DR-1200)
- Portable pump unit
- Shoulder strap
- Remote alarm interface
- Wall mounting bracket

pDR-1200
Active aerosol monitor/datalogger, plus aerodynamic sizing

Designed for active particulate monitoring applications

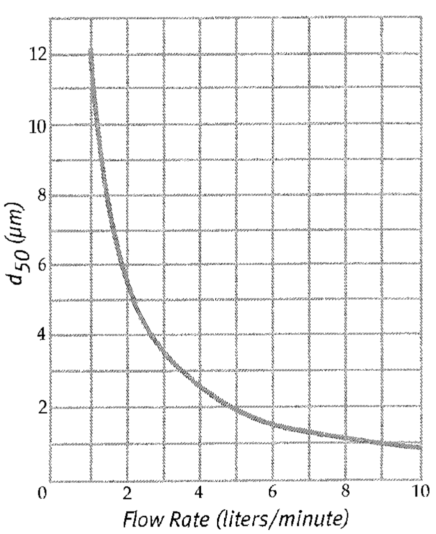
The *personal*DataRam™ (model *p*DR-1200) performs active sampling applications and aerosol sizing. The *p*DR-1200 requires a vacuum pump module to perform particle size selective measurements under field conditions. The separate pump (not included) is required for active sampling and aerosol sizing. With optional inlet accessories, the *p*DR-1200 is excellent for ambient air measurements under variable wind and high humidity conditions. It is ideal for respirable, thoracic, and PM2.5 monitoring, as well as continuous emission and test chamber monitoring. With an isokinetic sampling set, the pDR-1200 can be used for stack and duct extractive sampling monitoring. Membrane filters can be used to capture particles for particles for subsequent laboratory analysis.

Aerodynamic particle sizing

The *p*DR-1200 incorporates an optimally designed metal cyclone (BGI Model GK 2.05) or the optional low flow cyclone (BGI Model Triplex SCC1.062-CUST) especially selected for PM2.5 collection at 1.5 LPM. By operating the pump at specific sampling flow rates, the *p*DR-1200 cyclone preseparator provides precisely defined particle size cuts.

Primary calibration and particle samples by filter collection

An integral filter holder directly downstream of the photometric sensing stage accepts 37 mm filters. The calibration constant of the *p*DR-1200 is simply adjusted to coincide with the filter-determined concentration. Primary gravimetric calibration of the instrument concentration readout is easily accomplished under actual field conditions by means of this integral filter. Use membrane filters for chemical analysis or concurrent gravimetric measurements.

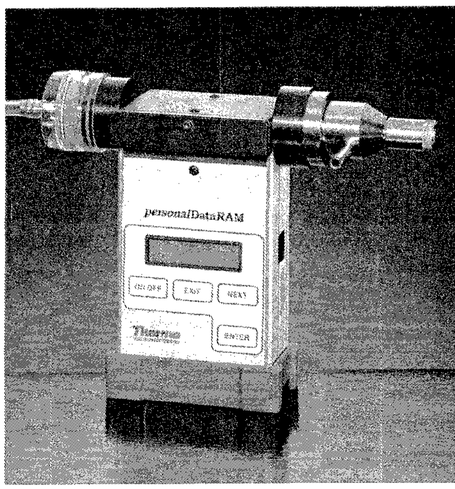


GK 2.05 Cyclone Cut Point (50%) as a Function of Flow Rate

*p*DR-PU Attachable Pump Module

This optional accessory is designed for use with the *personal*DataRAM Model *p*DR-1200. It incorporates a dual-chamber diaphragm pump, a volumetric flow sensing, and control unit. The pump module operates from either an optional, rechargeable NiMH battery pack or from AC line current using the power supply/charger supplied with the *personal*DataRAM. The *p*DR-PU is designed as a modular unit that can be used in various combinations.

- Flow rate (user adjustable): 1 to 4 liters/minute
- Maximum pressure drop: 10 in H2O (25 mbar)
- Precision of constant flow rate control: ±2%
- Power: 9 VDC, 200 mA at 4 liters/minute (approximate)
- Dimensions: 4 in (100 mm) H x 3.6 in (90 mm) W x 1.8 in (45 mm) D
- Weight: 1 lb (0.45 kg)



personal*DataRAM™ *Series

At last,
a compact,
versatile,
real-time
aerosol monitor

Specifications

Concentration Measurement Range (auto-ranging)
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm sg = 2.5, as aerosolized)
0.001 to 400 mg/m^3

Scattering Coefficient Range
1.5 x 10^{-6} to 0.6 m^{-1}(approx) @ lambda = 880 nm

Precision/Repeatability Over 30 Days (2-sigma at constant temperature and full battery voltage)
- ±2% of reading or ±0.005 mg/m^3, whichever is larger, for 1 second averaging time
- ±0.5 of reading or ±0.0015 mg/m^3, whichever is larger, for 10 second averaging time
- ±0.2% of reading or ±0.0005 mg/m^3, whichever is larger, for 60 second averaging time

Accuracy
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm, sg = 2.5, as aerosolized)
±5% of reading ±precision

Resolution
0.1% of reading or 0.001 mg/m^3, whichever is larger

Particle Size Range of Maximum Response
0.1 to 10 µm

Flow Rate Range (model *p*DR-1200)
1-10 liters/min (external pump required)

Aerodynamic Particle Sizing Range
1.0 to 10 µm (*p*DR-1200 only)

Concentration Display Updating Interval
1 second

Concentration Display Averaging Time (user selectable)
1 to 60 seconds

Alarm Level Adjustment Range (user selectable)
Selectable over entire measurement range

Alarm Averaging Time (user selectable)
Real-time (1 to 60 seconds) or STEL (15 minutes)

Datalogging Averaging Periods (user selectable)
1 second to 4 hours

Total Number of Data Points That Can Be Logged in Memory
More than 13,300

Number of Data Tags (data sets)
99 (maximum)

Logged Data
- Each data point: average concentration, time/date, and data point number
- Run summary: overall average and maximum concentrations, time/data of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration, and time/date of occurrence, averaging (logging) period, calibration factor, and tag number

Analog Signal Output
0 to 5 V and 4 to 20 mA, with selectable full scale ranges between 0.1 and 400 mg/m^3

Power
- Internal battery 9 V alkaline, 20 hour run time (typical)
- Internal battery 9 V lithium, 40 hour run time (typical)
- AC source universal voltage adapter (included) 100-250 volts, 50-60 Hz (CE marked)
- Optional battery pack rechargeable NiMH, 72 hour run time typical (*p*DR-BP)

Readout Display
LCD 16 characters (4 mm height) x 2 lines

Serial Interface
RS232, 4800 baud

Computer Requirements
PC compatible, 486 or higher, Windows 95® or higher

Storage Environment
-20°C to 70°C (-4°F to 158°F)

Operating Environment
-10°C to 50°C (14°F to 122°F), 10 to 95% RH, non-condensing

Dimensions (max external)
153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D (*p*DR-1000AN)
160 mm (6.3 in) H x 205 mm (8.1 in) W x 60 mm (2.4in) D (*p*DR-1200 including cyclone and filter holder)

Weight
0.5 kg (18 oz) (*p*DR-1000AN)
0.68 kg (24 oz) (*p*DR-1200)

Approvals
- Intrinsic safety approval by US Mine Safety & Health Administration (MSHA) coal-mining environments containing methane gas (the *p*DR-PU pump is not approved by MSHA)
- US FCC Rules (Part 15)
- CE certified

Lit_PDREID_06/05

Thermo Electron Corporation
Environmental Instruments
27 Forge Parkway
Franklin MA USA 02038
www.thermo.com/ih

1.866.282.0430
+1.508.520.0430
+1.508.520.1460 fax

ATTACHMENT B

PREDOMINANT WIND DIRECTION INFORMATION

FIGURE 1

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

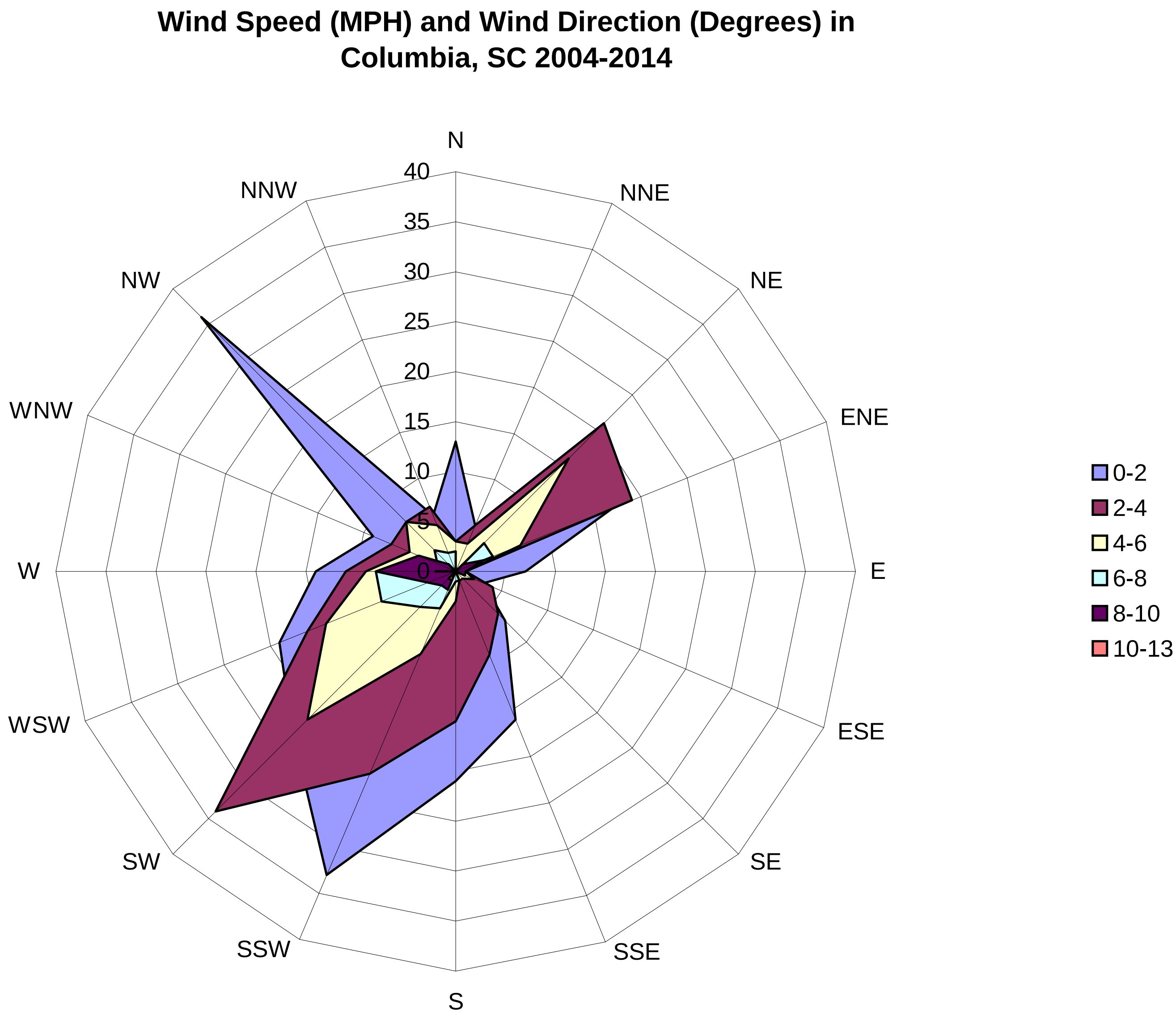
LOCATION OF THE PROJECT AREA WITH RESPECT TO THE WEATHER STATION

CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

DATE: 05/05/2014 FILE NAME: WEATHER STATION

APEX COMPANIES, LLC


Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014
N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
40
35
30
25
20
15
10
5
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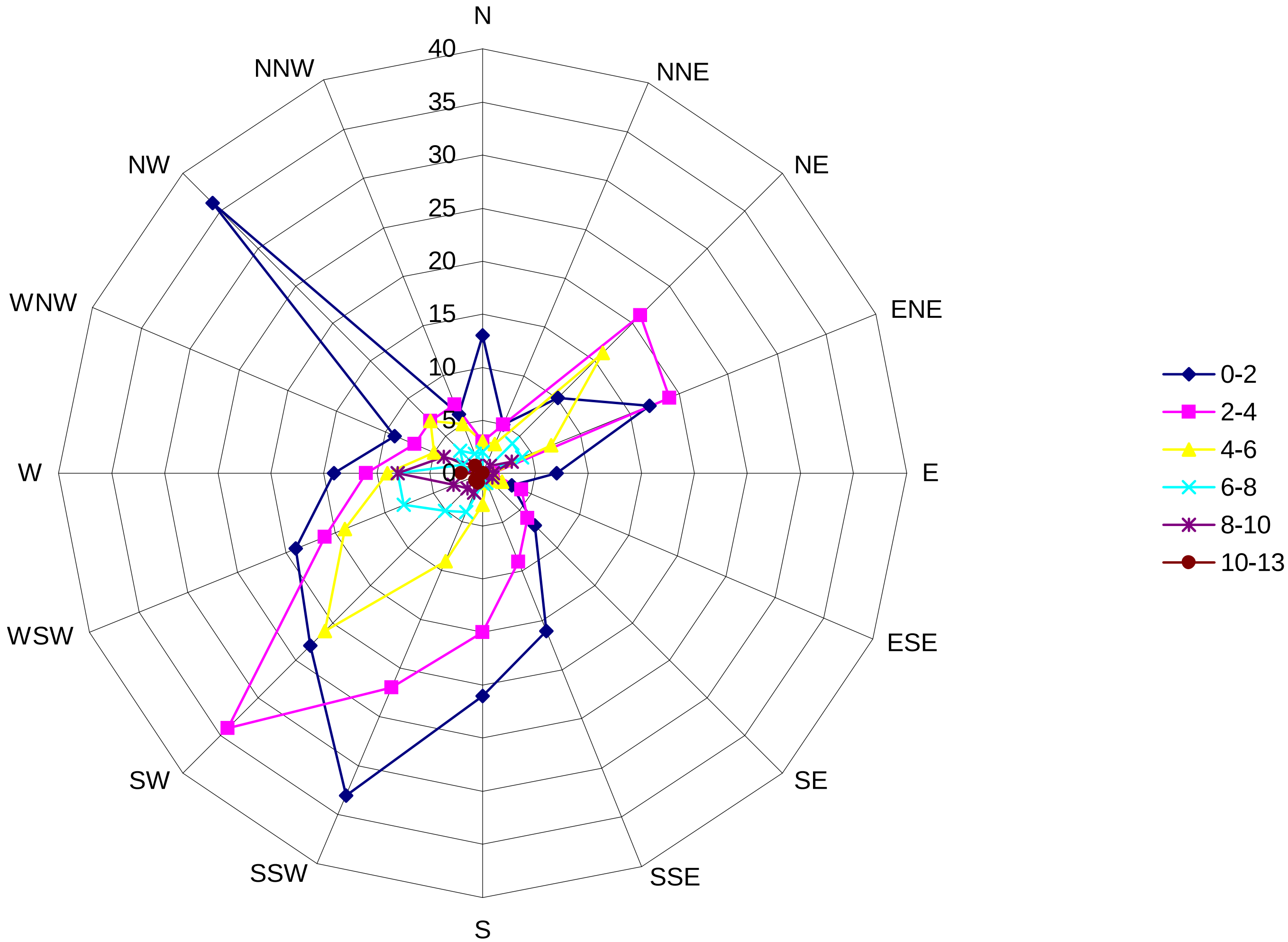
0-2
2-4
4-6
6-8
8-10
10-13

Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014

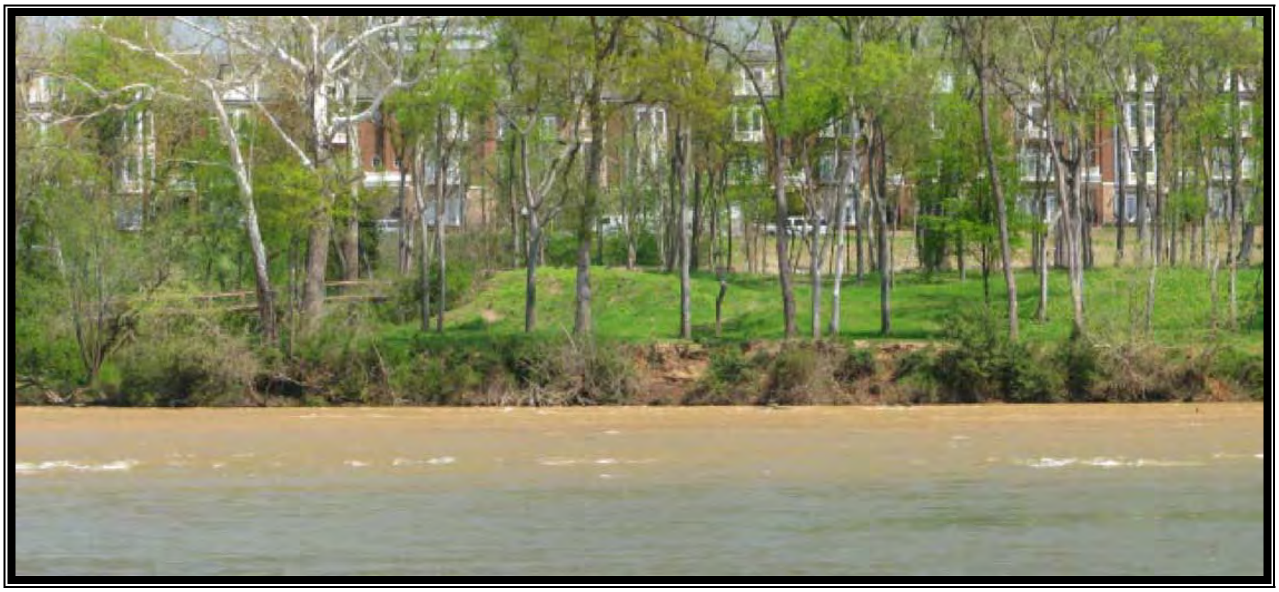


APPENDIX K

RIVERBANK AND SHORELINE RESTORATION PLAN

RIVERBANK AND SHORELINE RESTORATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA



March 2014

Prepared for:

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Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

RIVERBANK AND SHORELINE
RESTORATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment in phases. After the temporary cofferdam is constructed for each phase, each isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities in each phase, the Riverbank and Shoreline Restoration Plan will be implemented in the impacted area followed by removal and movement of the cofferdam to the next phase location of the project.

Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April.

This Plan was developed to provide additional details regarding the planned riverbank and shoreline restoration activities that will be completed during each phase of construction and at the end of the project. The Plan includes the use of bio-restoration techniques for the riverbank and riparian areas disturbed by construction activities. Due to unknown factors such as the exact extent and depth of TLM impacts immediately adjacent to the shoreline, and the resulting uncertainty of slope stability while removing the impacted sediment, the actual approach, locations and techniques for shoreline protection are assumed and may have to be modified slightly during construction. This plan will serve as a guide for the planned restoration techniques and recognizes that actual site conditions will dictate the exact extent, location, and materials of construction for the shoreline restoration.

REMOVAL ACTION ACTIVITIES

Initial project activities will consist of constructing the landside support zone and installing the cofferdam around the planned Phase 1 excavation area. Figure 2 shows the cofferdam phases, conceptual site operations layout and the landside support zone components. The landside support zone will consist of a series of gravel roads and equipment/material storage areas and multiple temporary structures.

The cofferdam will consist of a stone riprap and a 50-mil textured HDPE liner (or approved equivalent) that will be constructed to isolate the planned work area from the remainder of the river and facilitate dewatering and excavation of the impacted sediment. Once the cofferdam is in place and the area dewatered, the sediment removal activities will commence. To the extent practical, the existing riverbank will remain undisturbed. However, many areas of the existing shoreline/riverbank, where excavation is required to remove the TLM, will be impacted and will require restoration. The riverbank/shoreline restoration activities, as described herein, will also be completed prior to progressing to the next phase of work. Once the impacted sediment is removed from each dewatered area and the restoration activities are completed, the cofferdam will be relocated to the next phase and the process will be repeated. At the completion of the project, the cofferdam components will be completely removed from the river and any remaining disturbed portions of the riverbank will be restored. Landside support zone equipment and structures will be demobilized and the upland footprint of the project area will be restored to pre-removal action conditions. The following sections describe the specific site restoration activities associated with the river, shoreline and riverbank areas.

River Restoration

SCE&G plans on removing all sediment (both visually impacted with TLM and visually unimpacted material) gravel, small rocks, etc. from the project area to the extent practical. Large rocks that are visually unimpacted will be temporarily relocated within the work area to facilitate sediment removal and then returned to their approximate original locations. As an additional measure, SCE&G plans to pressure wash the exposed bedrock bottom of the river. Water generated during the pressure washing stage will be collected and removed from the excavation for treatment and final disposition via the City of Columbia Public Owned Treatment Works (POTW). The intent is to remove any residual staining or impacts due to the presence of TLM. Once the work has been completed, the cofferdam will be relocated to the next area and the process will be repeated.

The current project plan does not include replacing any sand or other backfill material. The impacted sediment will be removed down to the top of the underlying bedrock. In many areas, this will only require removal of several inches of sediment. Following completion of the removal activities, the cofferdam will be removed and over time, the natural depositional processes of the river will be allowed to restore the river substrate to the appropriate thickness and composition. This process will allow for natural re-deposition of sediment within the removal area based on current river hydraulics. Not replacing the impacted sediment with fill material will also eliminate the potential for backfill materials to be washed downstream and deposited in other areas or degrade other habitats through siltation, etc.

Riverbank and Shoreline Restoration

Figure 2 provides the site operations plan scenario and highlights the approximate areas where the eastern shoreline of the riverbank will likely be disturbed as a result of construction activities. The areas where the riparian corridor will be left intact are also shown on the Figure 2. Currently, it is estimated that approximately 44% of the project area shoreline will be unimpacted by site activities. The current plan was developed with the intention of limiting the excavation activities to only those areas where TLM is present and shoreline disturbance to only where access to the work areas are required. These access points would include access roads and cofferdam/riverbank tie-in locations. Available delineation data suggests that the TLM is not located within the riverbank soil and as a result, approximately half of the riverbank and riparian corridor will be left undisturbed.

Areas not slated for disturbance will be demarcated with flagging or fencing to ensure that they are not damaged by removal operations or heavy equipment movement. Oversight personnel will monitor these areas on a daily basis in order to prevent damage.

In areas where shoreline impacts are unavoidable, and/or the removal of TLM impacted sediment results in slope failure, SCE&G will conduct restoration activities, which will include recreating the approximate shoreline slope, stabilization of the bank via riprap and/or bioengineered solutions and restoration of vegetative cover, where practical. SCE&G's goals are to minimize riverbank disturbance whenever possible, to restore disturbed areas to natural pre-removal action conditions and to utilize bioengineering techniques and structures to the extent practical when repairing impacted shoreline. Figure 2 provides the currently envisioned shoreline restoration scenario. Figures 3 through 6 show details of riverbank restoration/stabilization alternatives and examples of potential techniques that will be utilized. The restoration approach consists of four major components:

1. Minimization of impacts and protection from damage in areas not slated for disturbance (Figure 2);
2. Use of "hardscaping" or riprap type stabilization measures in high velocity/high turbulence areas to safeguard against future bank erosion (primarily limited to Phase 1 area excavations) [refer to details on Figure 3];
3. Use of riprap to stabilize the transition area between the excavated area and the undisturbed shoreline at and below normal water level (refer to detail 4-1 on Figure 4); and
4. Use of bioengineered solutions in areas less susceptible to future erosion (refer to details on Figures 4 through 6).

As stated above, portions of the riparian corridor not slated for disturbance will be demarcated with flagging or fencing to ensure that they are not damaged by removal operations or heavy equipment movement. This preservation technique will be a key component of the overall project.

In high water velocity or turbulent areas, stabilization of the shoreline will take priority over re-establishing vegetative cover. As a result, in some areas identified in Phase 1 it will be necessary to utilize restoration techniques and material that is more resistant to erosion (i.e., hardscape) in order to ensure that the bank is capable of withstanding high velocity and turbulent flows. Currently the bank is eroding due to recent high water conditions. Typical techniques utilized in these areas include placement of geotextile and riprap, which will serve to fortify the bank and resist future erosion over time (Figure 3). As currently envisioned, the uppermost Phase 1 cofferdam riverbank tie-in location and areas north of the Senate Street alluvial fan are the two locations where these stabilization practices will likely be necessary.

Removal operations will necessitate creation of a small cut at the toe of the existing riverbank slope where excavation of material is discontinued. Geotextile and riprap will be placed in this transition zone in order to support and protect the riverbank from sloughing or collapsing. The specific detail for this technique is provided as 4-1 on Figure 4. The riprap placement will be minimized to the extent practical and should not significantly extend above the normal waterline in most areas. Over time, sediment will likely accumulate in the voids within the riprap placement area and serve to re-establish the current shoreline aesthetic characteristics.

In areas where river flow characteristics are more conducive, bioengineered solutions, such as those shown on Figures 4 through 6, will be employed. These alternatives primarily focus on incorporating vegetative restoration with stabilization. Shoreline cover recreation such as staging partially submerged trees (Figure 5) or other habitat enhancements will also be conducted, as feasible. In some areas, it may be appropriate to plant native southeastern shrubs, grasses and forbs (Figure 6) secured by a biodegradable mat. As currently envisioned, the remainder of the disturbed shoreline downstream of the Senate Street alluvial fan can be restored using these techniques (Figure 2).

This plan was developed in order to convey the current river and shoreline restoration plans. As project plans are further developed, certain details or specifications of the plan may be modified in order to reflect minor changes in the project or input from applicable experts. The USACE, SCDHEC and other agencies, as may be appropriate, will be made aware of any major modifications to planned activities prior to implementation.

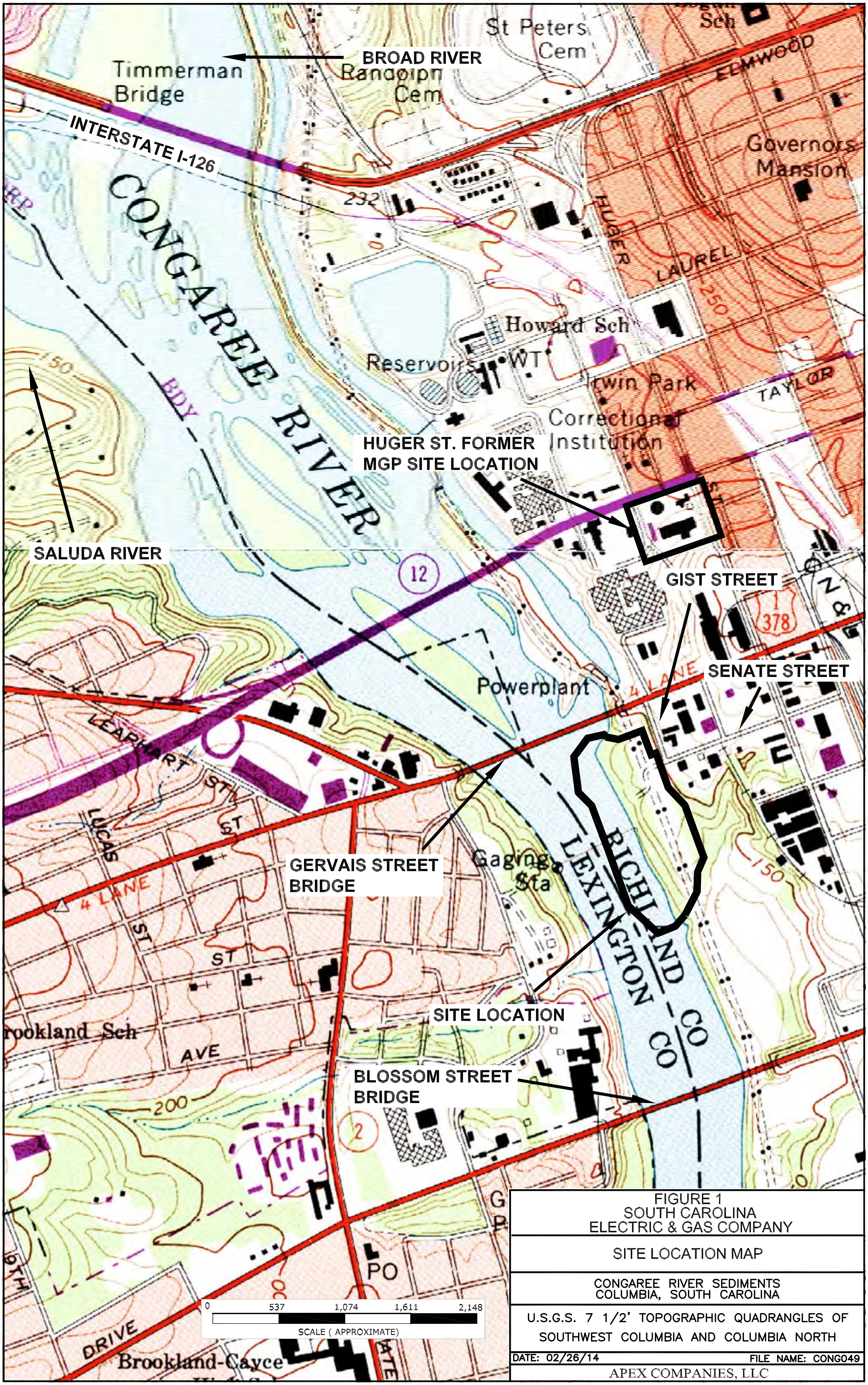


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

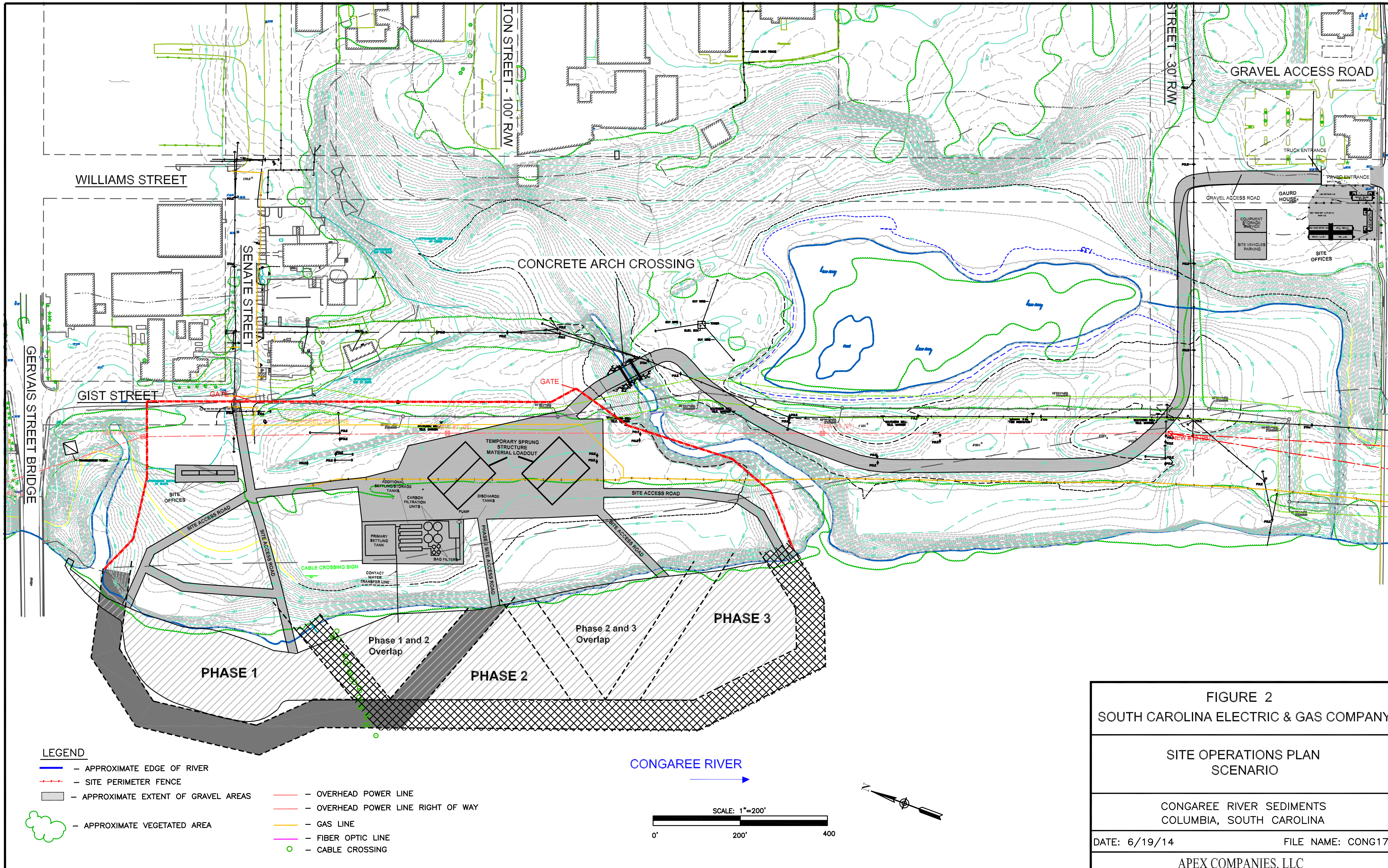
SITE LOCATION MAP

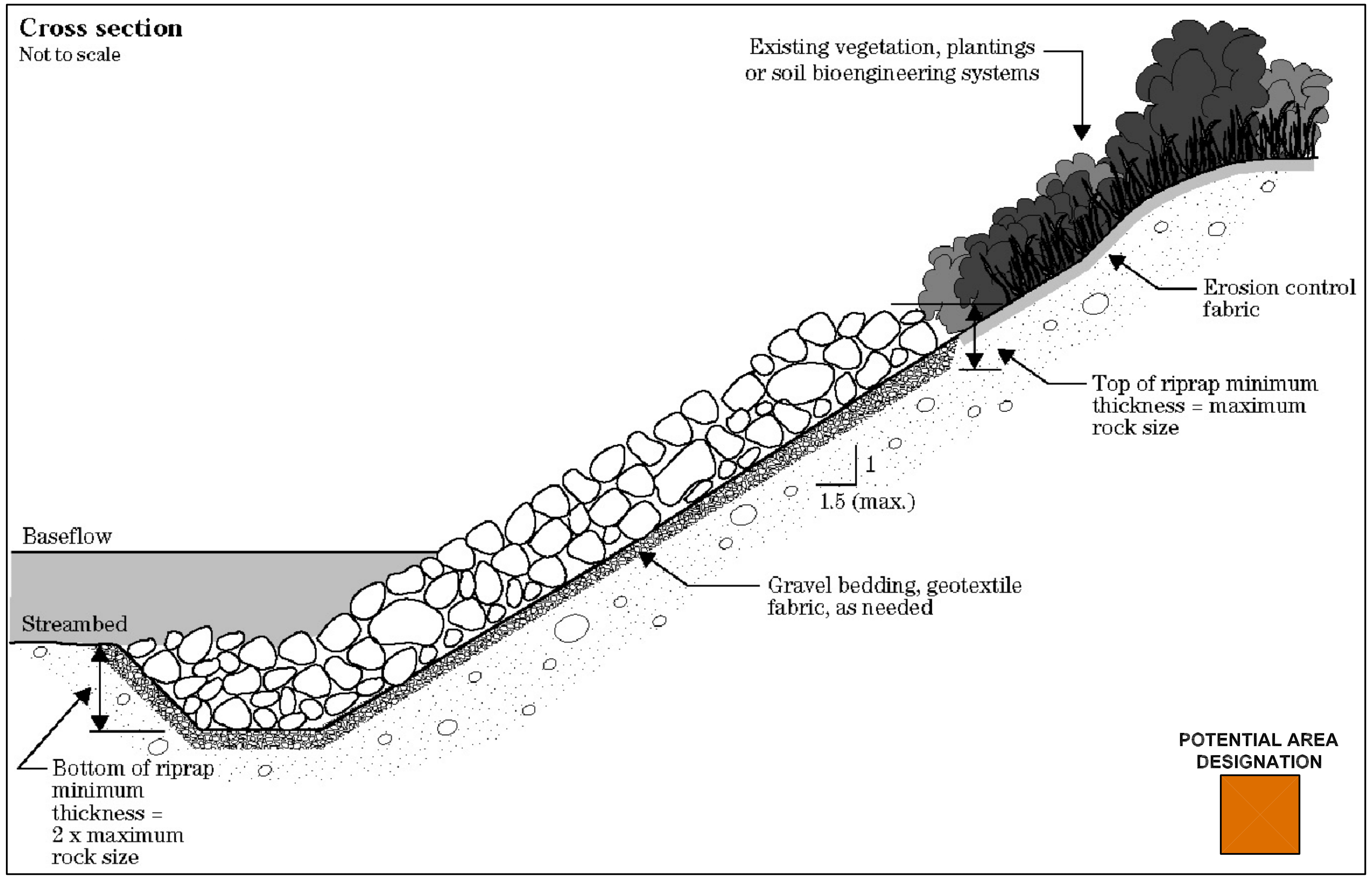
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

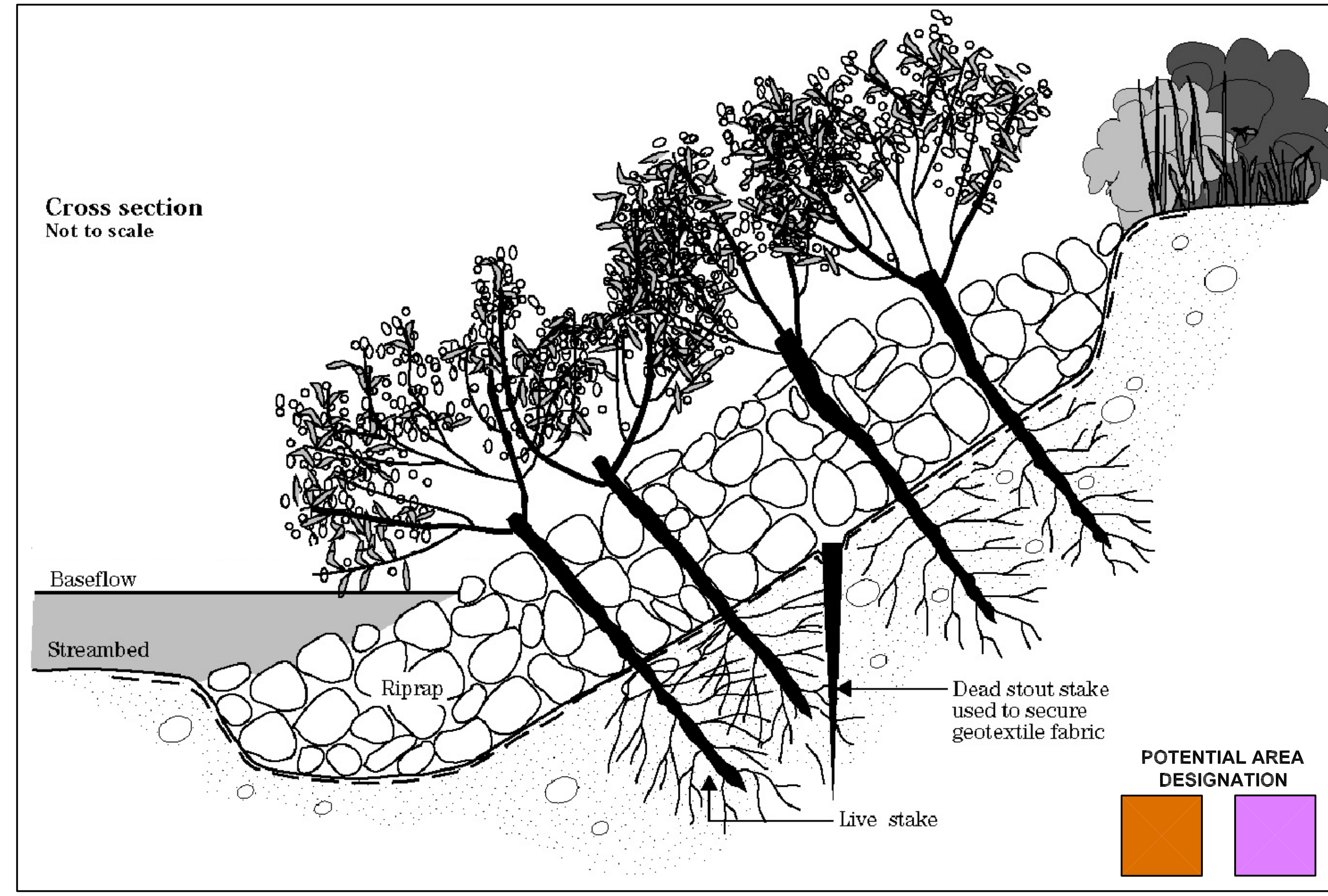
DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC


WILLIAMS STREET
GIST STREET
SENATE STREET
GERVAIS STREET BRIDGE
TON STREET - 100' R/W
STREET - 30' R/W
GRAVEL ACCESS ROAD
TRUCK ENTRANCE
PAVED ENTRANCE
GAURD HOUSE
EQUIPMENT STORAGE SERVICE
SITE VEHICLES PARKING
SITE OFFICES
CONCRETE ARCH CROSSING
GATE
TEMPORARY SPRUNG STRUCTURE MATERIAL LOADOUT
ADDITIONAL SETTLING/STORAGE TANKS
CARBON FILTRATION UNITS
DISCHARGE TANKS
PUMP
PRIMARY SETTLING TANK
BAG FILTERS
CONTACT WATER TRANSFER LINE
CABLE CROSSING SIGN
SITE ACCESS ROAD
SITE OFFICES
PHASE 1
PHASE 2
PHASE 3
Phase 1 and 2 Overlap
Phase 2 and 3 Overlap
CONGAREE RIVER
SCALE: 1"=200'
0'
200'
400'
N
LEGEND
– APPROXIMATE EDGE OF RIVER
– SITE PERIMETER FENCE
– APPROXIMATE EXTENT OF GRAVEL AREAS
– APPROXIMATE VEGETATED AREA
– OVERHEAD POWER LINE
– OVERHEAD POWER LINE RIGHT OF WAY
– GAS LINE
– FIBER OPTIC LINE
– CABLE CROSSING
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY
SITE OPERATIONS PLAN SCENARIO
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/19/14
FILE NAME: CONG177
APEX COMPANIES, LLC



3-1 TYPICAL RIPRAP RIVER BANK STABILIZATION
(OR OTHER HARDSCAPE MATERIAL)



3-2 TYPICAL RIPRAP RIVER BANK STABILIZATION WITH JOINT PLANTING
(OR OTHER HARDSCAPE MATERIAL)

NOTES:
1. RIPRAP BANK STABILIZATION WILL BE UTILIZED IN AREAS WITH HIGH VELOCITY AND OR TURBULENT RIVER FLOWS TO GUARD AGAINST FUTURE RIVERBANK EROSION.
2. JOINT PLANTING (DETAIL 3-2) WILL BE CONDUCTED, IF FEASIBLE, TO PROVIDE VEGETATIVE COVER IN RIPRAP AREAS AND TO PROVIDE A TRANSITION TO OTHER BIOENGINEERED AREAS.
3. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
4. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
5. TABLES 1, 2 AND 3 ON FIGURE 6 PROVIDE PLANT SPECIFICATIONS.

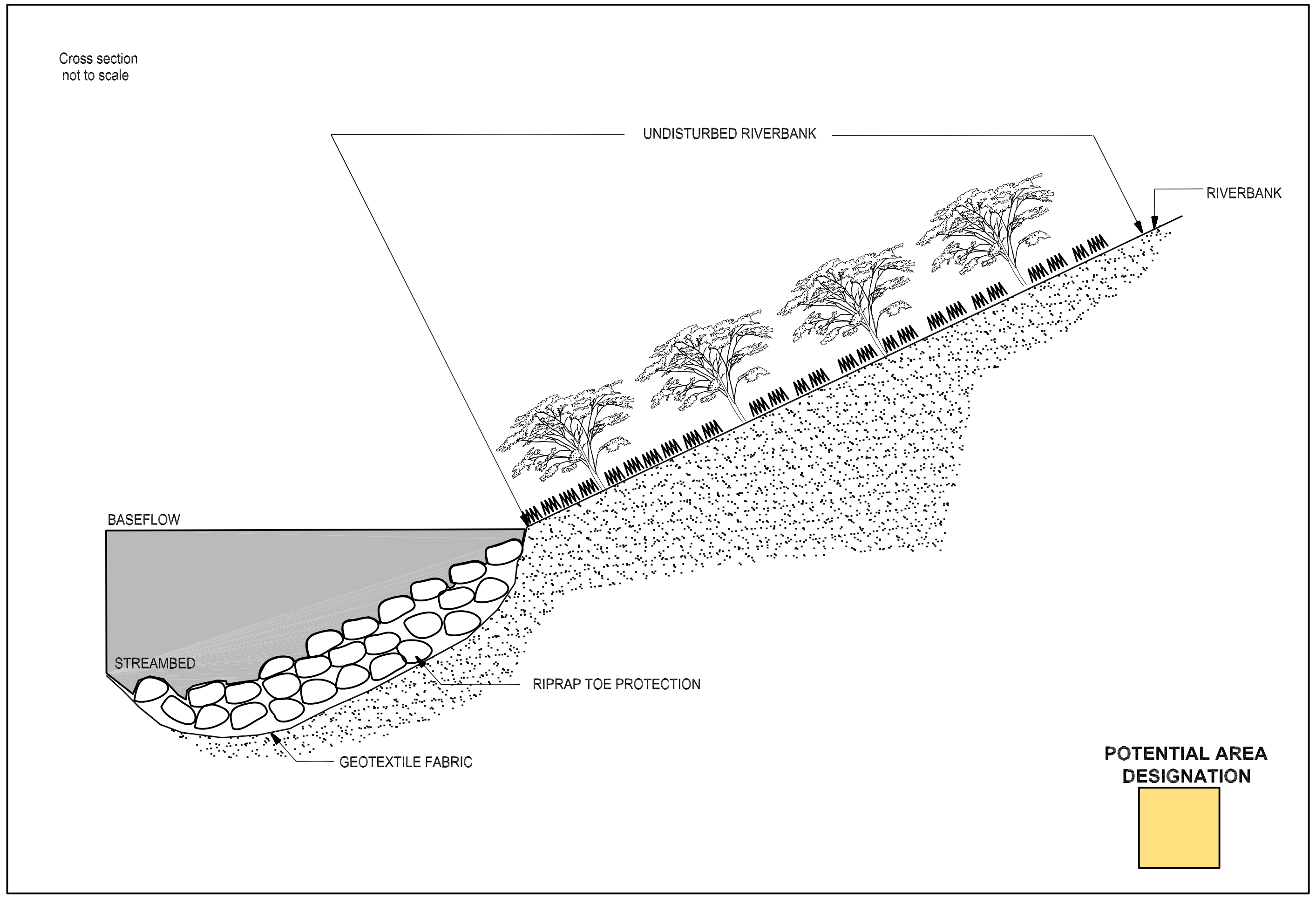
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

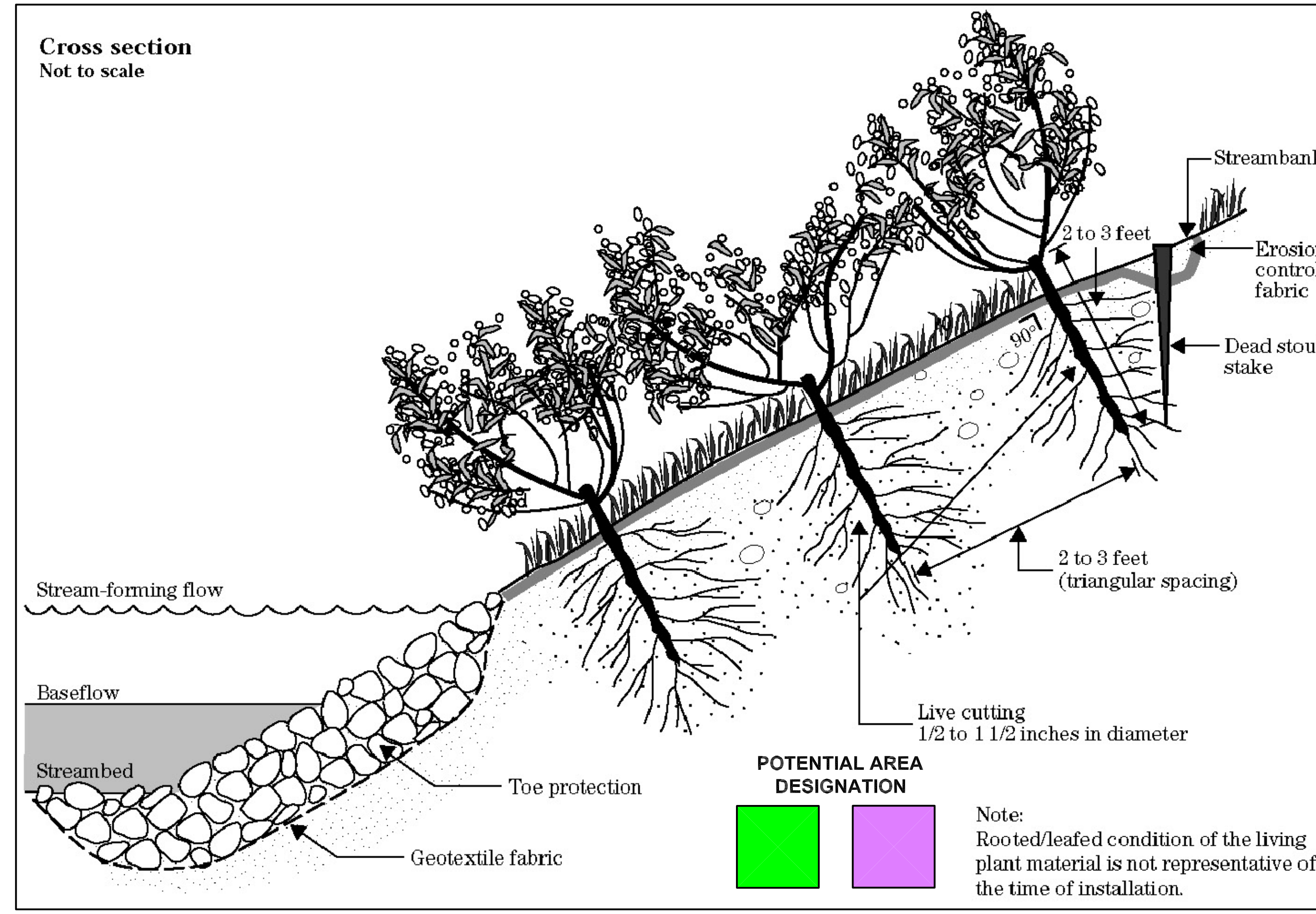
RIVERBANK STABILIZATION
DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/21/14 FILE NAME: CONG110

APEX COMPANIES, LLC





4-1 UNDISTURBED RIVER BANK TOE STABILIZATION

4-2 JOINT PLANTING BIOENGINEERED BANK STABILIZATION OPTION DETAIL

NOTES:
1. GEOTEXTILE AND RIPRAP (DETAIL 4-1) WILL BE UTILIZED TO STABILIZE EXCAVATED AREAS AT THE TOE OF RIVERBANK SLOPES TO PREVENT SLOUGHING OR COLLAPSING. RIPRAP PLACEMENT WILL TERMINATE AT OR BELOW THE APPROXIMATE NORMAL WATERLINE.
2. LIVE STAKES (DETAIL 4-2) WILL POTENTIALLY BE UTILIZED IN CONJUNCTION WITH OTHER BIOENGINEERED SOLUTIONS, AS NEEDED, IN AREAS WHERE RIVERBANK DISTURBANCE EXTENDS SIGNIFICANTLY ABOVE THE NORMAL WATERLINE AND RIVER FLOW VELOCITY AND TURBULENCE CONDITIONS DO NOT REQUIRE ADDITIONAL STABILIZATION MEASURES.
3. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
4. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
5. TABLES 1, 2 AND 3 ON FIGURE 5 PROVIDE PLANT SPECIFICATIONS.

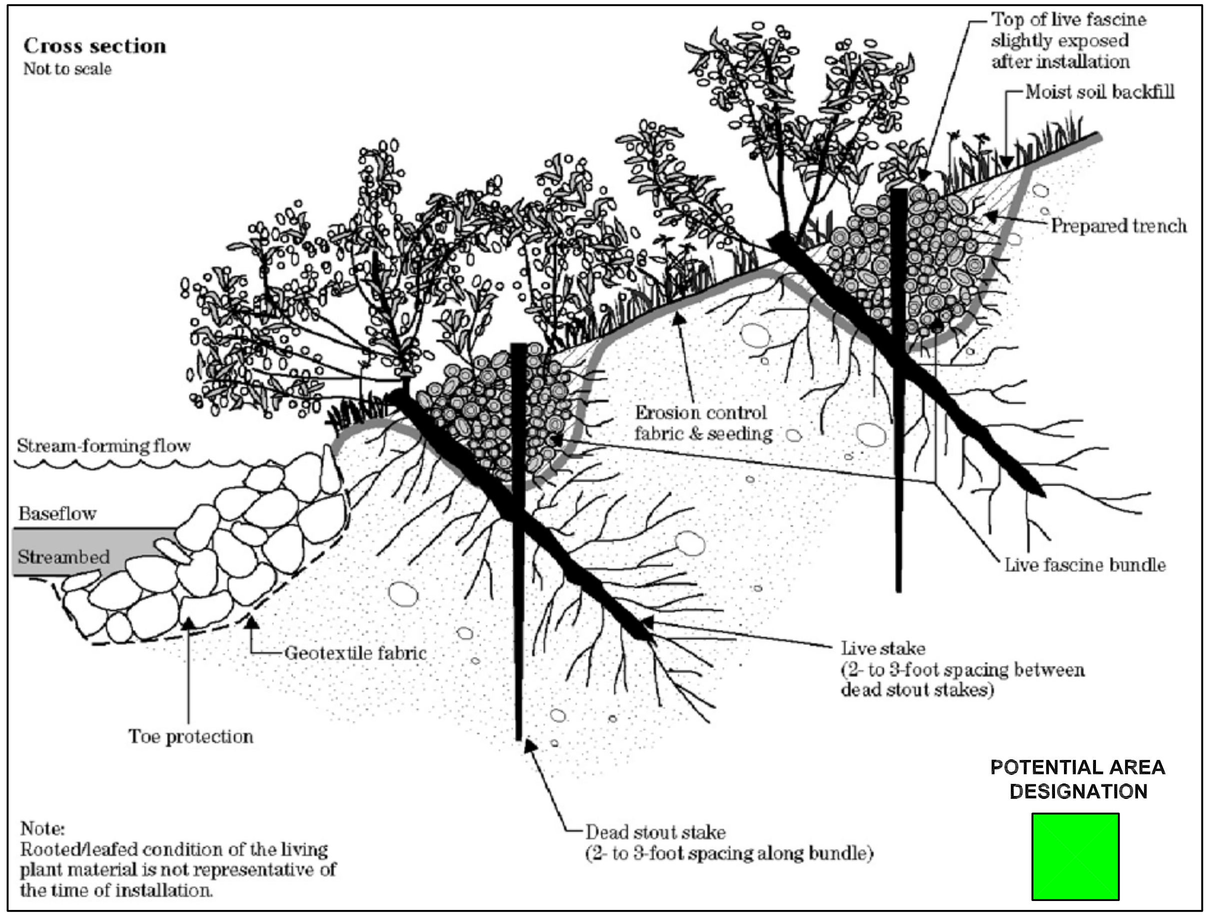
FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

RIVERBANK TOE STABILIZATION
AND BIOENGINEERING OPTION DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

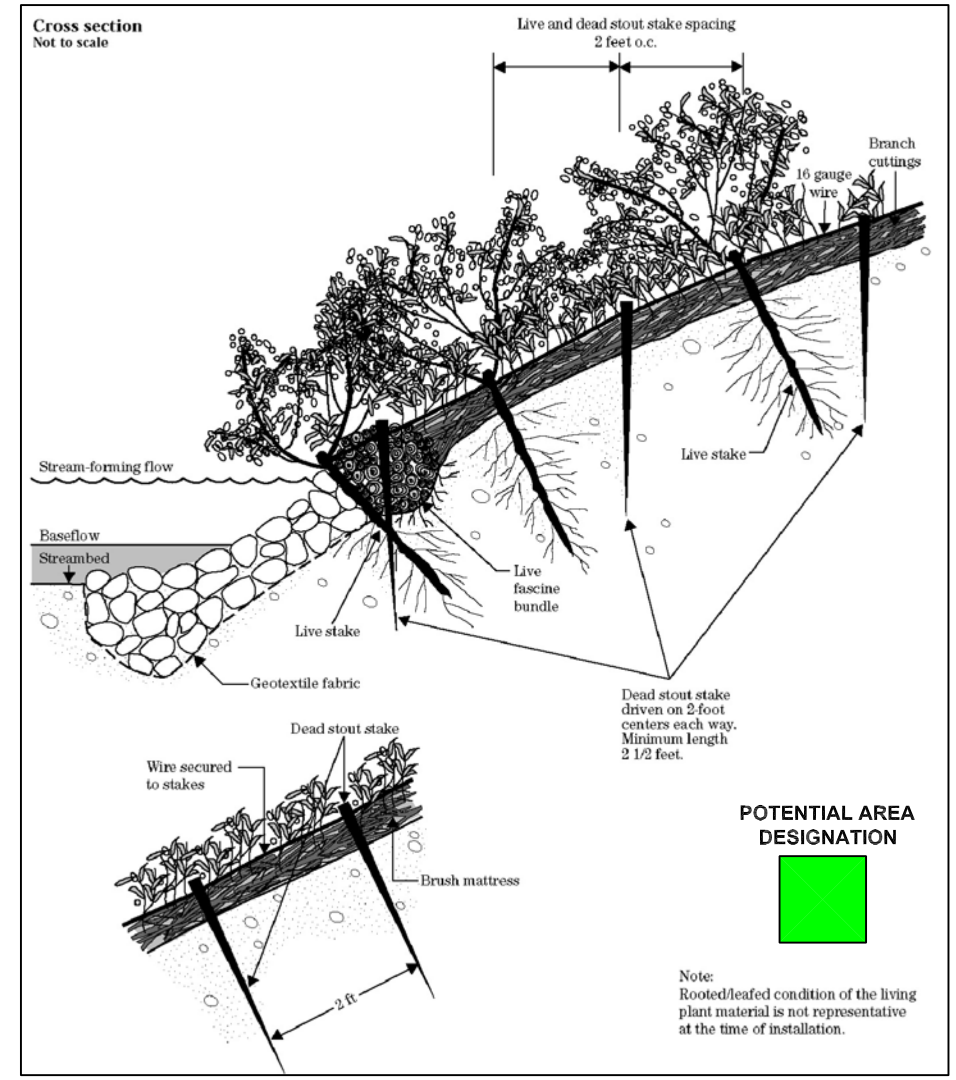
DATE: 3/21/14 FILE NAME: CONG110

APEX COMPANIES, LLC



5-1 LIVE FASCINE STABILIZATION OPTION

5-2 LIVE FASCINE DETAIL



5-3 BRUSHMATTRESS BANK STABILIZATION OPTION DETAIL

NOTES:

1. LIVE FASCINES (DETAIL 5-1) ARE AN OPTION FOR FLATTER SLOPE (3:1 OR FLATTER) STABILIZATION IN AREAS WHERE RIVER VELOCITY AND TURBULENCE CONDITIONS DO NOT REQUIRE ADDITIONAL STABILIZATION MEASURES.
2. LIVE FASCINES (DETAIL 5-2) ARE LONG BUNDLES OF BRANCH CUTTINGS THAT CONTAIN SOME LIVE BRANCHES.
3. BRUSHMATTRESS PROVIDE A COMBINATION OF LIVE STAKES, LIVE FASCINES AND BRANCH CUTTINGS AND PROVIDE MORE PROTECTION FROM EROSION OF STEEPER SLOPES OR AREAS OF HIGHER VELOCITY RIVER FLOW.
4. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
5. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
6. TABLES 1, 2 AND 3 ON FIGURE 6 PROVIDE PLANT SPECIFICATIONS.

FIGURE 5

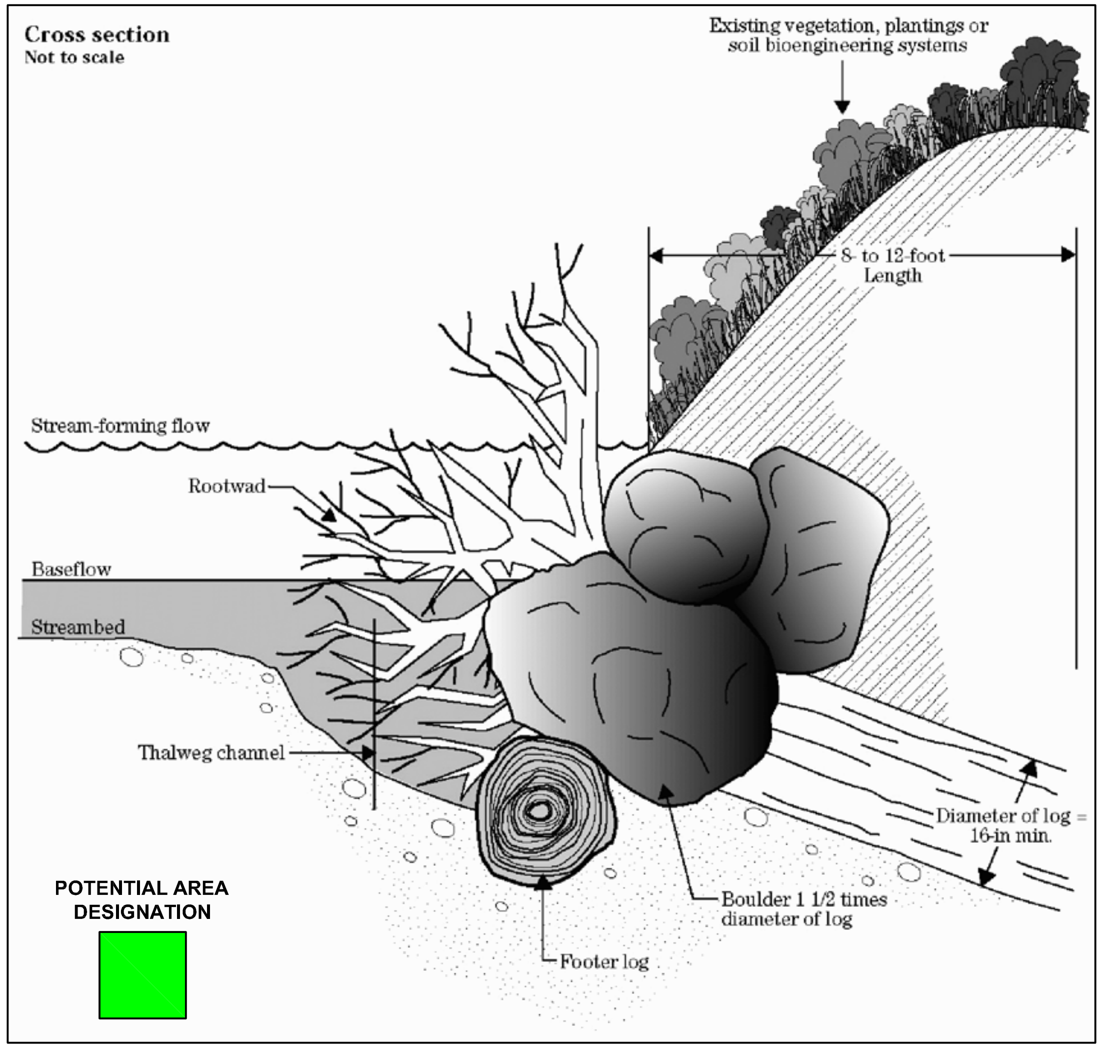
SOUTH CAROLINA ELECTRIC & GAS COMPANY

BIOENGINEERED STABILIZATION OPTION DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/21/14 FILE NAME: CONG110

APEX COMPANIES, LLC



6-1 LOG, ROOTWAD AND BOULDER REVETMENT STABILIZATION OPTION DETAIL

TABLE 1
GRASSES AND FORBES

Schientific Name	Common Name	Soil Preference	Drought Tolerance	Shade Tolerance	Flood Tolerance
Ammophila breviligulata	American beachgrass	sands	fair	poor	
Andropogon gerardii	Big bluestem	loams	good	poor	fair
Arundo donax	Giant reed	sandy	good	poor	poor
Herarthria altissima	Limpograss	sandy	poor	poor	good
Panicum amarulum	Coastal panicgrass	sands to loams	good	poor	good
Panicum virgatum	Switchgrass	loams to sands	good	poor	good
Paspalum vaginatum	Seashore paspalum	sandy		poor	good
Pennisetum purpureum	Elephant grass			poor	
Spartina pectinata	Prairie cordgrass	sands to loams	good	fair	fair
Zizaniopsis miliacea	Giant cutgrass	loam	poor	poor	good

TABLE 2
PLANTS SUITABLE FOR ROOTING

Scientific Name	Common Name	Plant Type	Rooting Ability (from cutting)
Acer negundo	Boxelder		
Asimina triloba	Pawpaw	small tree	poor to fair
Baccharis balimifolia	Groundsel bush	medium shrub	good
Cephalanthus occidentalis	Buttonbush	large shrub	fair to good
Cornus amomum	Silky dogwood	small shrub	fair
Cornus sericia	Red osier dogwood		
Gleditsia triacanthos	Honeylocust	medium tree	poor to fair
Populus deltoides	Eastern cottonwood	tall tree	very good
Robinia sp.	Black locust		
Salix discolor	Pussy willow	large shrub	very good
Salix nigra	Black willow	small to large tree	good to excel
Salix purpurea	Purpleosier willow	medium tree	excel
Sambucus canadensis	American elder	medium shrub	good
Viburnum dentatum	Arrowwood	medium to tall shrub	good
Viburnum lentago	Nannyberry	large shrub	fair to good

TABLE 3
WOODY PLANTS

Scientific Name	Common Name	Plant Type	Establishment Speed
Acer negundo	Boxelder	small to medium tree	fast
Acer rubrum	Red maple	medium tree	fast
Alnus serrulata	Smooth alder	large shrub	medium
Amorpha fruitcosa	False indigo	shrub	fast
Aronia arbutifolia	Red Chokeberry	shrub	fast
Asimina triloba	Pawpaw	small tree	
Betula nigra	River birch	medium to large tree	fast
Carpinis caroliniana	American hornbeam	small tree	slow
Carya cordiformis	Bitternut hickory	tree	
Catalpa bignonioides	Southern catalpa	tree	fair
Celtis laevigata	Sugarberry	medium tree	slow
Celtis occidentalis	Hackberry	medium tree	slow
Cephalanthus occidentalis	Buttonbush	large shrub	medium
Chionanthus virginicus	Fringe tree	small tree	
Clethera ainifolia	Sweet Pepperbush	shrub	
Cornus amomum	Silky dogwood	small shrub	medium
Cornus florida	Flowering dogwood	small tree	fair
Diospyros virginiana	Persimmon	medium tree	fair
Fraxinus pennsylvanica	Green ash	medium tree	fast
Gleditsia triacanthos	Honeylocust	medium tree	fast
Ilex decidua	Possomhaw	large shrub to small tree	
Ilex opaca	American holly	small tree	medium
Ilex verticillata	Winterberry	small to large shrub	
Juglans nigra	Balck walnut	medium tree	fair
Juniperus virginiana	Eastern redcedar	large tree	medium
Liquidambar styraciflua	Sweetgum	large tree	
Liriodendron tulipifera	Tulip poplar	large tree	fast
Magnolia virginiana	Sweetbay	small tree	
Nyssa sylcatica	Blackgum	tall tree	slow
Ostrya virginiana	Hophornbean	small tree	slow
Platanus occidentalis	Sycamore	large tree	fast
Populus deltoides	Eastern cottonwood	tall tree	fast
Quercus alba	White oak	large tree	slow
Quercus lyrata	Overcup oak	medium tree	slow
Quercus michauxii	Swamp chestnut oak	medium tree	fair
Quercus nigra	Water oak	medium tree	slow
Quercus phellos	Willow oak	medium to large tree	medium
Quercus shumardii	Shumard oak	large tree	slow
Rhododenron atlanticum	Coast azalea	small shrub	
Rhododendron viscosum	Swamp azalea	shrub	
Salix nigra	Black willow	small to large tree	fast
Viburnum nudum	Swamp haw	large shrub	

NOTES:
1. LOG, ROOTWAD AND BOULDER REVETMENTS MAY BE UTILIZED SPORADICALLY TO PROVIDE OVERHEAD COVER AND HABITAT IMPROVEMENT ALONG THE DISTURBED SHORELINE.
2. DETAILS OBTAINED FROM UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE ENGINEERING FIELD HANDBOOK (ISSUED 1996) - PART 650 - CHAPTER 16 STREAMBANK AND SHORELINE PROTECTION.
3. INSTALLATION OF SHORELINE RESTORATION COMPONENTS WILL BE CONDUCTED IN ACCORDANCE WITH ESTABLISHED STANDARDS AS OUTLINE IN THE ABOVE REFERENCE ENGINEERING FIELD HANDBOOK.
6. PLANTING OPTIONS OBTAINED FROM THE "STREAMBANK AND SHORELINE STABILIZATION TECHNIQUES TO CONTROL EROSION AND PROTECT PROPERTY" - GEORGIA DEPARTMENT OF NATURAL RESOURCES.

FIGURE 6
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

BIOENGINEERED STABILIZATION
OPTION DETAILS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 3/21/14 FILE NAME: CONG110

APEX COMPANIES, LLC

APPENDIX L

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

SOUTH CAROLINA ELECTRIC & GAS COMPANY
CONGAREE RIVER SEDIMENTS SITE
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033-3701

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

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TABLES

FIGURE

APPENDICES

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared by Apex Companies, LLC (Apex) for SCANA Services, Inc. (SCANA). The HASP addresses activities associated with remedial investigations and remedial actions at the South Carolina Electric & Gas Company (SCE&G) Congaree River Sediments site (Site) in Columbia, South Carolina.

Work conducted at the Site by Apex will comply with the Apex corporate health and safety guidelines and all applicable Occupational Safety and Health Administration (OSHA) requirements. OSHA regulations applicable to the anticipated work include:

- 29 CFR 1910 (Occupational Safety and Health Standards), specifically 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response); and
- 29 CFR 1926 (Safety and Health Regulations for Construction), specifically 29 CFR 1926, Subpart P-Excavations (29 CFR 1926.650-652).

Apex and its subcontractors will conduct site activities consistent with the requirements of this HASP. This HASP is also available as a reference to SCE&G and other contractors that may perform work at the Site. However, any work performed by others must be conducted in accordance with the requirements of the written Health and Safety Program of each contractor, as well as a site-specific HASP that each contractor deems appropriate to cover their site activities, which may vary from those addressed in this HASP. The written Health and Safety Program of each contractor must address the personal protective equipment (PPE) requirements specified in 29 CFR 1910.120(g)(5). Apex assumes no liability or responsibility for any other parties based upon the accuracy or completeness of the information contained herein.

Development of this HASP indicates that the workplace has been evaluated for the hazards as described, and the adequacy of the PPE selected is based on available information. The health and safety-related procedures and PPE specified in this HASP are based on specific work activities currently planned or anticipated in the future for the site. Any changes in the project work scope or site conditions as described herein must be addressed in an amendment to this HASP.

Site emergency information is summarized in the form provided as Appendix A. A sign-in sheet (see Example in Appendix B) will be used to maintain control of project personnel and visitors on-site. A HASP Agreement and Acknowledgement Form is provided in Appendix C. All project personnel prior to conducting field activities should sign the form. A list of acronyms used within this document or other health and safety-related reference information is provided for reference as Appendix D.

1.1 Site Location

The Site is located within Columbia, South Carolina, and is defined by the stretch of the Congaree River and adjacent eastern shoreline from the Gervais Street Bridge to a distance of approximately 3,200 feet down river to the Blossom Street Bridge. The river project area extends from the eastern shore to the approximate mid-point of the river. Figure 1 provides the location of the site. It should be noted that the actual site extent might change with time as more data becomes available and understanding of the tar-like material (TLM) evolves.

1.2 Scope of Work

This HASP addresses the safety issues associated with meeting the following tasks anticipated at the Site, which include:

- Sediment investigation;
- Construction of a cofferdam, concrete arch crossing and other associated landside support zone construction activities;
- Unexploded ordnance (UXO) management;
- Water management; and
- Excavation and off-site disposal of impacted material;

Details of the work scope (e.g., soil boring/coring investigations, removal activities, etc.) will be provided in written plans specific to each project task. As noted previously, the health and safety-related procedures specified in this HASP are based on the work activities currently planned or potentially anticipated for the Site. Any changes in the project work scope as identified above must be addressed in an amendment to this HASP.

Due to documented historical activities conducted in the vicinity of the project area, this project will include screening the planned river based construction and excavation area for potential Civil War era unexploded ordnance (UXO). Only properly trained personnel will conduct site activities relating to the location, identification and subsequent management of historical artifacts and/or unexploded ordnance (UXO). These activities will be completed in accordance with the appropriate plans. This HASP does not provide guidance with respect to UXO related work.

1.3 Level of Protection for Site Activities

For each task, the potential for employee exposure to site contaminants and/or air monitoring results will determine the level of personal protection. Initial investigation and excavation activities will be conducted in Level D. It is not anticipated that an upgrade to Level C or Level B will be required at the site. Action levels for upgrade to Modified Level D, Level C or Level B are discussed in the air monitoring section (Section 5.0).

This HASP must be amended when circumstances or conditions develop that are beyond the scope of this plan. Any changes in project work scope or site conditions as described must be addressed.

1.4 Project Personnel and Responsibilities

The following management structure must be followed by each contractor performing work at the Site pursuant to the requirements of this HASP, for the purpose of successfully and safely completing this project.

A technical advisor, site health and safety officer (SHSO), project supervisor and work team must be designated for each project task. Table 1 outlines the project personnel and responsibilities. Specific duties of the technical advisor include:

- Providing technical input into the design and implementation of the site HASP; and
- Advising on potential for worker exposure to project hazards along with appropriate methods or controls to eliminate site hazards.

A SHSO will be assigned to the site during field activities. The SHSO:

- Has the responsibility and authority to implement and enforce the HASP;
- May modify work, halt work, or remove personnel from the site if work conditions change and adversely effect health and safety matters; and
- Serves as the main contact for any on-site emergency situation.

A project supervisor will be designated for all field activities. The project supervisor has the authority to direct and control site activities. During implementation of larger projects, the project supervisor will coordinate with the SHSO regarding health and safety-related matters. During smaller project tasks, the project supervisor may also serve as the SHSO.

The project team reports to the project supervisor for on-site activities. Project teams must be comprised of at least two people for high hazard operations. Personnel on the project team work to safely fulfill the requirements of the work plan in accordance with this HASP, and notify the SHSO or project supervisor of any suspected unsafe conditions.

Apex currently has the responsibility to provide investigation and remediation management and oversight for all phases of the project. Apex personnel assignments on this project, pursuant to the above requirements, include:

Technical Advisor:	Mr. Rusty Contrael 412-829-9650
Site Health and Safety Officer:	Varies with work activities (may be same as project supervisor) 412-829-9650, or on-site cell phone when available.
Project Supervisor:	Varies with work activities (may be same as SHSO) 412-829-9650, or on-site cell phone when available.
Project Team:	Various personnel reporting to project supervisor.

The SHSO, or another qualified individual, will conduct inspections as necessary on behalf of the employer to determine the effectiveness of this HASP. The employer will correct any deficiencies in the effectiveness of this HASP.

2.0 CONSTITUENTS OF CONCERN PROFILE

The constituents of concern at the Site include VOCs primarily benzene, toluene, ethylbenzene and xylenes (BTEX) and SVOCs, primarily polynuclear aromatic hydrocarbons (PAHs). Chemical and physical properties of the constituents of concern are summarized in Table 2. Published exposure levels for the constituents of concern are provided in Table 3.

Based upon the background information, including site history and site characterization, a summary profile of the hazards and control measures to follow for the constituents of concern has been developed. Summarized in Table 4, the profile provides an overview of the hazards associated with potential exposure to the constituents of concern and the preventative measures.

For more detailed and specific information, refer to the Material Safety Data Sheet (MSDS) or equivalent information for the contaminant located in Appendix E.

3.0 TRAINING

All site workers will have completed health and safety training, in compliance with OSHA's Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120). This requirement includes an initial 40 hours of training and a minimum of three days of actual field experience under the direct supervision of an experienced supervisor, as well as eight hours of annual refresher training.

The SHSO will conduct an initial information session prior to initiation of any site activity. These pre-entry briefings are intended to ensure that field personnel are aware of the hazards at the site associated with the scheduled activities, and that the project team will perform in a manner to minimize risks to health and safety. The health and safety instructions during these briefings will generally include the following:

- A general overview of the project and site;
- An explanation of potential exposure routes and constituents identified at the site;
- Requirements for personal protective equipment and clothing, skin protection, etc.;
- Decontamination and disposal procedures;
- Personal hygiene requirements;
- Emergency response procedures (personal injury, accidents and other emergencies);
- Route to hospital and local emergency contacts;
- General site safety rules and standard operating procedures;
- Responsibility of on-site supervision and management related to health and safety issues;
- Names of personnel responsible for site safety and health;
- Work practices to minimize on-site health and safety risks;
- Use of site engineering controls;
- Contingency plans; and
- Cold and Heat stress.

The instructions will address site-specific issues, and job-specific health and safety instructions will be reviewed before beginning each new phase of work. Also, general health and safety issues will be routinely discussed in daily health and safety “tailgate” meetings. The daily meetings will be documented (see example form in Appendix F).

4.0 HAZARD IDENTIFICATION AND CONTROL

Site-specific job tasks and the associated hazards are identified in Table 5. For each anticipated task, the types of hazards that may be encountered are listed. The hazard analysis matrix (Table 5) is used as a guide for implementing specific health and safety procedures.

Based upon the hazard analysis of tasks that are anticipated at the Site, Table 6 lists the general control procedures and practices to follow to prevent injury or illness. Field personnel must complete appropriate training for specific hazards prior to initiating work activities. Precautions must be taken to prevent injuries and exposures to the potential hazards identified in Table 6.

Specific procedures that address excavation and trenching activities, drilling, and sampling are provided for reference in Appendices G, H and I, respectively.

5.0 ENVIRONMENTAL SITE AIR MONITORING

To ensure the safety of on-site workers and nearby residents, a comprehensive environmental site air-monitoring program will be implemented during all site excavation activities. Of particular interest is the monitoring of fugitive organic vapors and airborne particulate (dust) emissions during excavation activities.

5.1 Investigation and Excavation Area Air Monitoring

To ensure a safe working environment, the excavation contractor will monitor organic vapor using a photoionization detector (PID) in the active work area during intrusive excavation activities. Periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation worker likely to have the highest exposure. Continuous air monitoring will be conducted at the perimeter of the site during large-scale activities. Perimeter air monitoring is discussed further in Section 5.3. Monitoring may be conducted at lower or higher frequencies depending on site conditions or by direction of the Project Site Supervisor or SHSO. If high organic vapor levels (greater than 1 ppm) are observed near the surface of the excavation, or the operator’s workspace (i.e., excavator cab), work will be temporarily stopped.

Air monitoring measurements will be taken in the breathing zone of the worker most likely to have the highest exposure. Temporary peaks will not automatically trigger action. Action will be taken when levels are consistently exceeded in a five-minute period. Similarly, if chemical odors are detected that are a nuisance, bothersome, or irritating, an upgrade in respiratory protection can provide an extra level of comfort or protection when conducting site activities.

If organic vapors above 1 ppm are sustained for 5 minutes or longer, Colormetric Detector Tubes (e.g., Draeger) will be used to determine if the constituent being measured is benzene. The action limit for benzene is 0.5 ppm. Should this limit be reached, investigative or excavation activities will cease until engineering controls can be utilized to reduce the vapors to within acceptable levels. Any organic vapor measurements of greater than 250 ppm on the PID sustained for five minutes will require immediate evacuation of the work area.

Particulate monitoring will be conducted during excavation operations. If particulate levels exceed 0.10 mg/m^3 in the excavation area, engineering controls, such as suppressant sprays, may be used to control and minimize particulate emissions.

All organic vapor monitoring will be conducted with the use of a MiniRAE 2000 PID with a 10.6 eV lamp or equivalent. Particulate levels will be monitored with the use of a MiniRam, DataRam particulate meter, or similar. Guidelines for frequency of air monitoring are presented in Table 7. Personal protective equipment (PPE) and the type of air monitoring required are summarized in Table 8 for the various job tasks. Air monitoring action levels (Table 9) have been developed to indicate the chemical concentrations in the breathing zone that require an upgrade in level of PPE. Action levels are typically set at one-half the OSHA Permissible Exposure Limit (PEL), National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (REL), or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV). Rationale for establishing action levels based on the contaminants of concern are then set based on the compound(s) with the lowest OSHA PEL, NIOSH REL or ACGIH TLV. By adhering to the air monitoring protocols set forth, the potential for overexposure is minimized.

All workers on-site must have been properly fitted with the proper PPE (i.e., respirators) and have been trained in their use (i.e., cleaning, inspecting for defects, donning and doffing).

Exclusion zones will be installed around the work areas to prevent unauthorized personnel from entering into the area, thus minimizing exposure. Workers will be instructed to stand up-wind whenever activities occur that generate visible signs of airborne particulates and/or organic vapors and odors.

When excavating soil highly impacted with volatile organic compounds, engineering controls for vapor/odor mitigation as a means to downgrade PPE requirements (e.g., Level B to C or Level C to D) may include:

- Use of circulating fans to exhaust or dissipate vapors emanating from the excavation;
- Closing the excavator cab door;
- Minimizing the open excavation area;
- Covering the open excavation with plastic sheeting; and/or
- Applying vapor suppressant foams or spray to the active excavation area.

Some of these controls may also be used for any soil stockpiles present on the site.

5.1.2 Drilling

Air monitoring will be performed in the breathing zone of either the driller or helper on approximate 1-2 hour intervals as conditions warrant. Air monitoring will be performed to assess concentration of organic vapors in the breathing zone following criteria previously established.

5.2 Air Monitoring Equipment Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. The operator must understand the limitations and possible sources of errors for each instrument. All monitoring equipment will be calibrated and maintained periodically by the operator. It is important that the operator ensures that the instrument responds properly to the constituent it was designed to monitor. A written record of all air monitoring equipment calibration and adjustment information must be maintained. An Air Monitoring Report form is presented in Appendix J.

Initially, the PIDs and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the fieldwork. Calibration and/or zeroing will also be conducted during work hours if a potential malfunction in the instrument is detected.

5.3 Work Area Perimeter Monitoring

As a contingency measure and for documentation purposes, SCE&G plans to implement a perimeter air monitoring program during completion of impacted material removal and handling operations. SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at most other SCE&G MGP remediation sites and it successfully documented the absence of elevated concentrations at these locations. A site-specific Community Air Monitoring and Odor/Dust Control Plan was developed for the remediation portion of the project and provides the specific details pertaining to the perimeter air monitoring activities. It is included in the Removal Action Plan (RAP) for the project and in Appendix L. The associated dust/particulate action level calculation is provided in Appendix M. The conservative action level was calculated utilizing the highest concentration of total semi-volatile organic compounds (SVOCs) identified during the sediment sampling program. This calculation is provided in Appendix L. The action level is 5,300 $\mu g/m^{3.}$ Since the action levels provided in Table 7 and the Community Air Monitoring and Odor/Dust Control Plan are well below this action level, they will be utilized as the conservative action levels for this phase of the project.

The air monitoring data stored in the perimeter instruments will be periodically downloaded to the site computer and provided in the final report.

5.4 Noise Monitoring

Noise levels can be monitored in the field with either a Type I or Type II Sound Level Meter (SLM). Noise dosimeter readings can also be obtained to determine the percent of noise dose. Noise levels and percentage dose measured are then compared to limits listed in OSHA standard 29 CFR 1910.95, Hearing Conservation.

Action levels listed in Table 10 will trigger upgrade in PPE to include appropriate hearing protection (muffs or plugs) or initiate possible noise control engineering. All personnel that are operating or working near heavy equipment (e.g., front-end loaders) will wear earplugs or muffs. Apex will initiate noise monitoring activities at the site perimeter if required based on the site conditions.

Selection of hearing protection must match the employees' needs and the ability to attenuate noise below 90dB(A). Each hearing protection device (muffs or plugs) has a Noise Reduction Rating (NRR) assigned by the U.S. Environmental Protection Agency (EPA). To calculate the hearing protector's effectiveness use the following formula: Noise Reading dB (A) – (NRR – 7dB) < 90dB(A).

Most drilling methods (e.g., DPT, sonic, etc.) are inherently noisy and likely require the use of hearing protection. Given the inherent noise levels associated with drilling, all employees will use hearing protection devices and noise monitoring will not be performed.

5.5 Combustible Gas and Oxygen Monitoring

A combustible gas indicator (CGI)/oxygen (O_2) meter (MSA Model 261 or equivalent) may be used if the potential for explosive conditions exist, or as directed by the Project Site Supervisor or SHSO.

Guidelines have been established by NIOSH concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

- <10% Lower Explosive Limit (LEL) – Conduct work activities freely
- >10% LEL – Cease all activities in order to allow time for combustible gasses to vent

6.0 CONFINED SPACE ENTRY (CSE) PROCEDURES

Any site work that may require personnel to enter confined spaces must be conducted in accordance with their corporate health and safety program procedures and the site-specific requirements of this HASP. Any on-site field personnel shall not enter an area identified as a confined space without proper training on the use of CSE procedures.

The purpose of the CSE procedures is to protect employees from potentially hazardous environments and to facilitate immediate rescue in an emergency situation. During work, a CSE Permit must be posted at the entrance to each confined space.

7.0 PHYSICAL AND OUTDOOR HAZARDS

7.1 Physical Hazards

Physical hazards at sites may include conditions such as uneven terrain, holes, ditches, unstable slopes, slippery surfaces, unguarded openings, unmarked projections and ground debris that can cause employees to trip and fall. Examine site conditions upon arrival at the site and take precautions to avoid potentially hazardous situations. Appropriate precautions include:

- Identify traffic flow, and high and low traffic periods.
- Visually examine slopes for stability.
- Test one's footing.
- Mark or remove large projections.
- Make sure the walking/work area is adequately lit.
- Be aware of ground debris; remove broken glass, nails, wire, and other debris if possible, or mark off and avoid areas of heavy debris.
- During the initial on-site survey, any existing site buildings should be inspected for evidence of water damage and deteriorated walls, floors, and roofs. Stairs should be inspected for missing, loose, or warped steps. These items may need to be repaired before site operations begin.
- All personnel in the vicinity of overhead power lines must utilize extreme caution.
- Identify location of underwater utility line and ensure remedial activities are located a sufficient distance from the utility line.
- Potential for Civil War era unexploded ordnance (UXO) as discussed below

Historical research shows that the potential for Civil War era UXO may be present at the Site and buried within the sediment. A magnetic survey was performed in August 2010 to map the location of magnetic anomalies at the Site. Since the nature of the magnetic anomalies are not known, a conservative approach is used and assumed to be representative of UXOs. Prior to the initiation of drilling activities, a magnetic field detecting device will be used to clear each drilling location.

A qualified UXO contractor will be utilized to clear the planned river based work areas prior to initiation of intrusive activities during completion of the removal action. The UXO contractor’s plans for screening, identification and subsequent management of the potential UXO will be followed at all times.

7.2 Outdoor Hazards

Heat stress and cold exposure are important factors to consider during any project. Both hyperthermia (heat stress) and hypothermia (cold exposure) can lead to death or serious injury. Procedures to manage heat or cold-related stress hazards are included as Appendix K. Other outdoor hazards may include insect or animal bites and poisonous plants.

Heat Stress

In hot environments, the human body cools itself by the evaporation of perspiration. However, PPE, which provides protection from chemical exposure, also prevents perspiration from evaporating. Heat stress can occur within minutes and severe heat stress requires immediate medical attention.

- Be familiar with the signs and symptoms of heat stress and treatment:

  Heat Rash or muscle cramps (heat cramps) - The least serious condition. Provide cool non-caffeine and non-alcohol fluids. Rest in a cool place.

  Heat Exhaustion - Weakness or fatigue, nausea, headache, clammy or moist skin with a pale or flushed complexion. Rest in a cool place; provide cool, non-caffeine and non-alcohol fluids.

  Heat Stroke - The most serious condition, may be fatal, get medical help immediately. Symptoms are hot, dry skin, mental confusion or delirium, convulsions or unconsciousness, and body temperature of 105^{o}F. Call for medical help or transport to a hospital immediately. Apply cool towels over the person; apply cool towel or ice pack to back of person's neck.

- Plan the most strenuous work for the coolest times of the day, or work in the evening if possible.
- Drink plenty of cool liquids to replace body fluids lost to sweating. Drink even when not thirsty; heat stress and dehydration can happen before you feel thirsty.
- Drink only water, or occasionally, electrolyte-balanced drinks such as Gatorade. Avoid caffeine-containing beverages such as colas, tea, coffee; these can dehydrate body tissues.
- Do not use salt tablets unless recommended by a physician.
- Use the buddy system and self-monitoring to check for signs of heat stress.
- Use rest periods in the shade as necessary; at least 15 minutes in the morning and afternoon, and at least 30 minutes for lunch.
- Acclimatize (get used to) working in hot conditions gradually by working for increasing periods of time over a few days rather than jumping into daylong strenuous activities.

Cold Stress

Cold injury to the body may be influenced by temperature, wind speed, and degree of body covering. Injury may range from mild frostbite to severe hypothermia. To prevent or minimize the effects of cold stress, use the following work practices:

- Use dry, insulated and/or layered work clothing; warm gloves; hardhat liners and boots. Combine winter gear with PPE and waterproof gear to provide appropriate protection for the task.
- Take frequent rest breaks in warm areas as necessary. For operations conducted below 19 ^{o}F, follow the work/warm-up schedule recommended by American Conference of Governmental Industrial Hygienists (ACGIH).
- Drink warm fluids occasionally, but not stimulants such as coffee, tea or alcohol.
- Be aware of the signs and symptoms of various degrees of cold stress and know how to treat each accordingly:

Frostnip - Usually involves the ears, nose, chin, cheeks, fingertips, and tips of toes. It may occur during high winds and/or low temperatures. The skin suddenly turns white. Frostnip may occur without a person knowing it because it does not cause immediate pain. It can be treated by warming the affected area using warm water. Do not rub.

Superficial Frostbite - A more severe localized injury involving the skin and tissue just beneath the skin. The skin becomes white, waxy, and firm while the tissue below remains soft. Get out of the cold and warm the affected area slowly and carefully. Do not rub the area. Stinging and burning sensations will occur and occasionally small blisters may appear. Drink warm fluids but no stimulants such as coffee, tea, or alcohol, and no tobacco products.

Deep Frostbite - Involves freezing of skin, underlying tissue, and even muscle and bone. Remove wet clothes and put on dry clothes, warm up with blankets, heater or warm water. Protect frostbitten parts with a bandage. Transport patient immediately to an emergency room. The injured area will turn blue or purple and is very painful when thawing. Drink warm fluids but no stimulants such as coffee, tea, or alcohol, and no tobacco products.

Hypothermia - Occurs when the core body temperature decreases. Symptoms begin with severe shivering, apathy, loss of coordination, lethargy and coma, and possibly death. Hypothermia is life threatening, get medical help immediately. Remove wet clothes and put on dry ones, warm up the body slowly. Give warm fluids only if the victim is conscious; but no coffee, tea, alcohol, or tobacco products.

Insect or Animal Bites and Poisonous Plants

Working outdoors can result in exposure to hazards including animals, insects, snakes, ticks, poison ivy, poison oak and poison sumac.

- Avoid contact with wild animals. Do not try to capture, pet, or otherwise touch animals, even domestic animals. They may react unpredictably or they may transmit diseases.
- Be familiar with the hazards of certain insects in the area you are working. Bees, ants, spiders, wasps, and ticks may be present and cause mild to severe injury or illnesses. Check areas where these insects may live or hide before conducting work, especially if work is to be done in a precarious position of height.
- Ticks may be present on many sites in brush, grass, and weeds. Some ticks carry diseases like Lyme Disease or Rocky Mountain Spotted Fever. Wear protective clothing, boots, secure pant leg to leg/boot, and apply bug repellent to the lower legs. Check for ticks after every outing through the brush. If a tick is found, do not try to pick it off or scrape it with a credit card or other object. Use fine tip tweezers to remove the tick at the base of the skin where it is attached. Save the tick for later identification. Wash the bitten area with soap and water. See a doctor if a rash appears at the tick bite or if flu-like symptoms appear in a few days or few weeks.
- Be familiar with the appearance of poison ivy and other poisonous plants. Contact with vines, roots, leaves, or sap can cause a skin rash. Wear protective clothing and gloves as necessary to prevent contact. Consult a doctor if a severe reaction occurs.
- Avoid contact with snakes. If bitten get to a doctor quickly. Attempt to save or identify the snake for identification to assist in treatment. Use a snakebite kit only if you are an hour or more away from a doctor; always follow up with a doctor even if a kit is used. Never use a tourniquet or attempt to suck the venom out of the snakebite site.
- Some individuals may have severe allergic, and possibly fatal, reactions to animal and insect bites. Observe victims of bites carefully for shortness of breath, chest pain or tightness, or other unusual behaviors and get the victim medical attention immediately if any symptoms appear.

7.3 Water Hazards

The outdoor hazards reviewed in Section 7.2 are applicable and in some cases potentially exacerbated while working in or near water. Heat stress occurs more easily while working on or in water due to additional personal protective equipment worn (raising body temperature more quickly), and the additional exertion required to perform actions in the denser, aqueous medium. Cold stress is also a concern while working in watery conditions, because immersion in water speeds the loss of body heat, amplifying hypothermic reactions. Insect and animal bites can be more prevalent in or near water due to the common occurrence suitable habitats such as warm shallow pools of stagnant water where mosquitoes and other insects breed. Additionally, these environments are ideal habitats for snakes, amphibians, and possibly crocodiles. Extra attention to the above stated outdoor hazards should be practiced while site personnel are performing tasks in close proximity to water.

Working in and around water presents hazards different from those on dry ground. These water hazards vary based on whether work is being performed on or near shore in water that can be waded, or in deeper water requiring a boat or barge. These hazards include, but are not limited to: wet, slippery conditions (worsening slip and trip hazards), swift currents, and drowning.

Site personnel working on on-shore, or in shallow water, that is water which is no greater than waist deep, will observe the following safety precautions:

- Employ the use of the buddy system. All sampling, drilling, digging, or site related activities are performed with a minimum of two site personnel working in tandem for mutual safety and assistance.
- The donning of water specific PPE including hip or chest waders, wading belts (if chest waders are worn), type II personal floatation devices (PFD), and standard Level D PPE (hard hat, safety glasses, and rigid toed boots).
- Seek immediate first aid for cuts or abrasions that are exposed to surface water, as the likelihood of infection is greater in water.
- Be mindful of the potential for rapidly changing water conditions, submerged objects, unexpected changes in water depth, current velocity, floating debris, and entrapment hazards such as submerged logs and boulders.
- Use of a walking stick or rod is recommended for stability on uneven portions of the river bed or unknown water depths to minimize slipping and tripping hazards, and to probe the water for changing conditions.

Work performed in water greater than approximately waist deep will be performed from a boat and/or barge. Workers on a boat or barge will be required to wear PFDs and the boat or barge will be equipped with a life ring. Any site work that may require personnel to operate and or work on a boat or barge must be conducted in accordance with the laws of the state of South Carolina, the United States Coast Guard, their corporate health and safety program procedures, and the site-specific requirements of this HASP. Any on-site field personnel shall not operate or board a boat or barge without proper training. Table 11 provides a list of boating hazards and safeguards for each phase of water work.

In addition, SCE&G personnel working at Lake Murray and the Broad River Hydroelectric plant (located north of the site) will be contacted prior to the investigative and remedial activities to discuss lake and canal levels and discharge plans. Contacts for both facilities will be incorporated into the HASP or contact list for future reference.

8.0 CHEMICAL HAZARD CONTROL

8.1 Chemical Handling Procedures

Personnel must practice the chemical-specific handling procedures outlined in Table 12.

8.2 Personal Protective Equipment

Based upon the hazards that may be encountered during site activities, PPE as follows was selected. Only PPE that meets the following American National Standards Institute (ANSI) standards are to be worn.

- Eye protection - ANSI Z87.1-1989
- Head protection - ANSI Z89.1-1986
- Foot protection - ANSI Z41-1991

Field personnel must maintain the proper use and care of PPE. Initial work in the exclusion zone and during drilling will commence in Level D PPE.

Level D is the minimum acceptable level of protection for the project site. Upgrade to Modified Level D occurs when the possibility of contact to the skin or work uniform can occur from contaminated media. Upgrade to Level C will occur when results of air monitoring reveal that action levels have been exceeded. Upgrade to Level B will occur by site personnel that meet the applicable training requirements when results of air monitoring reveal that action levels have been exceeded. Hearing protection must be worn when working in areas where high noise levels are generated. Table 13 summarizes the various levels of PPE.

Should the use of a respirator be required, cartridge life will be calculated based upon information provided by the manufacturer and conservative assumptions.

8.3 Decontamination Procedures

Operations conducted at this site have the potential to contaminate field equipment and PPE. To prevent the transfer of contamination to vehicles, administrative offices and personnel, the procedures presented in Table 14 must be followed. Utilizing the equipment for that purpose will follow specific decontamination requirements. PPE must be left either on-site or in the company vehicle.

8.4 Example Decontamination Diagram

If Level C or Level B PPE is required, a contamination reduction zone (CRZ) will be constructed at an appropriate location with a travel path identified from the exclusion zone (EZ). When necessary, the decontamination procedure for this project site is a two-stage process.

Stage 1

- Gross contamination removal with a brush
- Remove outer boots and dispose in a drum
- Remove Tyvek® suit and dispose in a drum
- Remove outer gloves and dispose in a drum
- Walk to Stage 2 area

Stage 2

- Remove respirator
- Remove cartridge and dispose in a drum
- Clean respirator and insert into a bag
- Remove inner gloves and dispose in a drum

- Wipe hands with a towelette and dispose in a drum
- Walk out of decontamination area

9.0 SITE CONTROL PROGRAM

A map depicting the Congaree River Sediments site is provided as Figure 1. The site is located west of the intersection of Gist and Senate Streets in Columbia, South Carolina.

During investigative and corrective action activities, work zones will be established in order to:

- Delineate high-traffic locations;
- Identify hazardous locations; and
- Contain contamination within the smallest area possible.

Employees entering the work zone must wear the proper PPE for that area. Work and support zones will be established based on ambient air monitoring data, necessary security measures, and site-specific conditions. Work zones will be identified as either hot zone (HZ)/EZ, decontamination zone (DZ)/ CRZ; or clean zone (CZ)/support zone (SZ).

The following PPE requirements apply for the various work zones:

- HZs/EZs require Level D PPE
- DZs/CRZs require Level D PPE
- SZs/CZs require Level D PPE

Listed are general guidelines for delineation of work zones. CRZs will be developed for decontamination procedures.

1. The HZ/EZ is identified by a minimum 10-foot distance surrounding this area (on-land), and will be designated if unattended with cones, barricades or caution tape, depending on the location in relation to employees, the general public and high traffic areas.
2. The DZ/CRZ will be designated at its boundaries, as appropriate, depending on the location in relation to employees, the general public and high traffic areas. In some cases, the DZ/CRZ may include the back-end of a pick-up truck.
3. Support zones are located in clean areas.

Site security procedures that address various working areas of the site are summarized in Table 15.

10.0 CONTINGENCY PLANS

Table 16 presents contingency plans for potential emergency situations. The information in the contingency plans must be clearly communicated to all project personnel that may be affected at the site. Additional site emergency information is provided in Appendix A.

Communications at the work site can be accomplished by verbal or non-verbal means. Verbal communication can be impacted by the on-site background noise or while wearing respiratory protection. Table 17 lists the type of communication methods and equipment to use, depending on site conditions. Communication equipment must be checked daily to ensure proper operation, and all project personnel must be initially briefed on the communication methods prior to starting work and reminded as necessary during the daily safety meetings.

Absorbent booms and turbidity curtains will be incorporated as contingency elements during the investigation, and potentially remediation. During the investigation, absorbent booms may be deployed around a portion of the boat to capture material that may be spilled during accidental or inadvertent spills. Drilling will be assessed to determine if turbidity is generated. If turbidity is significant, then deployment of a turbidity curtain on a section of the boat may be considered.

11.0 MEDICAL MONITORING PROGRAM

All field personnel who may work at hazardous waste sites must undergo medical surveillance in accordance with their corporate health and safety program and the requirements of 29 CFR 1910.120(f).

This requirement applies to employees who may be exposed to hazardous substances or health hazards at or above the permissible exposure limits, without regard to the use of respirators, for 30 days or more a year; to all employees who may wear a respirator; and to all employees who are injured or develop signs or symptoms of overexposure to hazardous substances or health hazards from hazardous waste operations or an emergency response. The medical surveillance program consists of baseline pre-employment screening and periodic exams/consultations.

TABLES

TABLE 1

RESPONSIBILITIES OF PERSONNEL

Title	General Description	Responsibilities
Technical Advisor APEX - Andrew Contrael	Has authority to direct all health and safety aspects of response operations.	• Coordinates with the PM (if different from PM). • Prepares and organizes background review of the project for the HASP. • Advises on potential for worker exposure to project hazards along with appropriate control methods. • Together with the SHSO, assures that health and safety requirements are met.
Site Health and Safety Officer (SHSO)	Advises all aspects of health and safety on site. Stops work if site operations threaten worker health and safety. Informs of any changes in site conditions or project status.	• Periodically inspects protective clothing and equipment. • Sees that protective clothing and equipment are properly stored and maintained. • Controls entry and exit at the access control points. • Monitors the workers for signs of stress, including heat stress, cold exposure, and fatigue. • Implements the HASP. • Conducts periodic inspections to assess whether the HASP is being followed. • Enforces the "buddy" system. • Informed of emergency procedures, evacuation routes, and telephone number of local hospital, poison control center, fire department, and police department. • Notifies, when necessary, local public emergency officials. • Coordinates emergency medical care. • Sets up decontamination lines and decontamination solutions appropriate for the chemical contaminants encountered. • Controls the decontamination of equipment, personnel, and samples from contaminated areas. • Facilitates the proper disposal of contaminated clothing and materials. • Maintains the availability of required equipment. • Advises health services and medical personnel of potential exposures. • Notifies emergency response personnel in the event of an emergency. • Maintains and oversees operation of monitoring equipment and interpretation of data from the monitoring equipment.
Project Supervisor	Has authority to direct response operations. Assumes total control over site activities.	• Conducts Daily Safety Tailgate Meeting and documents attendance. • Conducts periodic field health and safety inspections. • Manages field operations. • Executes the work plan and schedule. • Enforces safety procedures. • Enforces site control. • Documents field activities and sample collection. • Notifies when necessary, local public emergency officials.
Work Team	Reports to project supervisor for on-site activities. Work parties must comprise of at least two people for high hazard operations.	• Safely completes on-site tasks required to fulfill the work plan. • Complies with the HASP. • Attends and participates in Daily Safety Tailgate Meetings. • Notifies SHSO or supervisor of suspected unsafe conditions.

TABLE 2

CHEMICAL AND PHYSICAL PROPERTIES OF SELECT ORGANIC CONSTITUENTS

Constituents	Molecular Weight (g/mol)	Solubility in Water (mg/L)	Soil-Water Partition Coefficient	Water-Carbon Partition Coefficient (mL/g)	Vapor Pressure (torr)	Specific Gravity	Relative Mobility Index[1]	Henry's Law Constant ($atm\text{-}m^3/mol$)
Volatile Organic Compounds (Mono-Aromatic Hydrocarbons)								
Benzene	78.1	1,780	97	83	9.52E+01	0.879	3.3	5.59E-03
Toluene	92.1	515	242	300	2.81E+01	0.871	1.7	6.37E-03
ortho-Xylene	106	170	363	240	1.00E+01	0.870	0.9	8.043-03
Ethylbenzene	106	150	622	1,100	9.35E+00	0.872	0.1	8.44E-03
Polynuclear Aromatic Hydrocarbons								
Naphthalene	128	31.7	1,300	9,400	8.70E-02	1.175	-3.5	4.26E-04
1-Methylnaphthalene	142	28				1.020		
2-Methylnaphthalene	142	25	12,882	8,511	5.10E-02	1.020	-3.8	
Acenaphthene	154	7.4	2,580	4,600	1.55E-03	1.069	-5.6	9.20E-05
Acenaphthylene	152	3.93	3,814	2,500	2.90E-02	0.899	-4.3	1.48E-03
Fluorene	166	1.98	5,835	7,300	7.10E-04		-6.7	6.42E-05
Carbazole	167	1.2 *	2,455	3,390	2.66E-04	1.10	-7.0	
Fluoranthene	202	0.275	19,000	38,000	5.00E-06		-10.4	6.46E-06
Phenanthrene	178	1.29	23,000	14,000	6.80E-04	1.025	-7.2	1.59E-04
Anthracene	178	0.073	26,000	14,000	1.95E-04	1.250	-9.0	1.02E-03
Pyrene	202	0.135	63,000	38,000	2.50E-06		-11.1	5.04E-06
Benzo(a)anthracene	228	0.014	125,179	1,380,000	2.20E-08		-15.7	1.16E-06
Benzo(a)pyrene	252	0.0038	282,285	5,500,000	5.60E-09		-17.4	1.55E-06
Chrysene	228	0.006	420,108	200,000	6.30E-09	1.274	-15.7	1.05E-06
Benzo(b)fluoranthene	252	0.0012	1,148,497	550,000	5.00E-07		-15.0	1.19E-05
Benzo(g,h,i)perylene	276	0.00026	1,488,389	1,600,000	1.03E-10		-19.8	5.34E-08
Dibenz(a,h)anthracene	278	0.00249	1,668,800	3,300,000	1.0E-10		-19.1	7.33E-08
Benzo(k)fluoranthene	252	0.00055	2,020,971	550,000	5.1E-07		-15.3	3.94E-04
Indeno(1,2,3-cd)pyrene	276	0.0002		1,600,000	1.0E-10		-19.9	6.86E-08
Arsenic	74.9	0				5.73		

[1] **- Relative Mobility Index**

Relative Mobility Index	Mobility Descriptor
> 5	Extremely Mobile
0 to 5	Very Mobile
-5 to 0	Slightly Mobile
-10 to -5	Immobile
< -10	Very Immobile

REFERENCES:

U.S. EPA, 1979. Water-Related Environmental Fate of 129 Priority Pollutants.
U.S. EPA, 1982. Aquatic Fate Process Data for Organic Priority Pollutants.
Vershueren, 1983. Handbook on Environmental Data on Organic Chemicals, 2nd Edition.
Lyman and others, 1982. Handbook of Chemical Property Estimation Methods.
Ford and Gurba, 1984. Methods of Determining Relative Contaminant Mobilities and Migration Pathways Using Physical-Chemical Data.
* - Pennsylvania Act 2 Technical Guidance Manual, Table 5A.
U.S. ACE , 1997. Riverine Emergency Management Model Chemical Properties Table.

TABLE 3

CONSTITUENTS OF CONCERN EXPOSURE LEVELS

Constituents of Concern	PEL-TWA [(1)]	PEL-STEL [(1)]	TLV-TWA[(2)]	TLV-STEL[(2)]
Benzene	1 ppm	5 ppm	0.5 ppm	2.5 ppm
Ethylbenzene	100 ppm	125 ppm	20 ppm	N/A
Toluene	200 ppm/300 ppm C[(3)]	150 ppm	20 ppm	N/A
Xylene	100 ppm	150 ppm	100 ppm	150 ppm
Arsenic	0.010 mg/m^3	N/A	0.01 mg/m^3	N/A
Creosote (Coal Tars)	0.2 mg/m^3	N/A	0.2 mg/m^3	N/A
Cyanide	5 mg/m^3	N/A	5 mg/m^3 C	N/A
Hydrogen Sulfide [(4)]	20 ppm C	15 ppm	1 ppm	5 ppm
Naphthalene	10 ppm	15 ppm	10 ppm	15 ppm
PAHs as Naphthalene	10 ppm	15 ppm	10 ppm	15 ppm
Phenol	5 ppm	N/A	5 ppm	N/A

(1) Source: 29 CFR 1910.1000 and NIOSH Pocket Guide to Chemical Hazards Online (last updated 2010).

(2) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) from OSHA Chemical Sampling Information Online. Data represented is from various years ranging from 2001-2011.

(3) C - ceiling recommended exposure limit, should not be exceeded at any time

(4) Hydrogen sulfide may be present due to a reduced geochemical environment in the subsurface.

(5) Some constituents (e.g. arsenic) are included as a conservative measure

(6) Highlighted values - refer to Appendix G: 1989 Air Contaminants Update Project - Exposure Limits NOT in Effect of the NIOSH Pocket Guide to Chemical Hazards for additional information.

TABLE 4

CONSTITUENTS OF CONCERN PROFILE

Contaminant of Concern	Profile of Hazards and Control Measures
Petroleum Hydrocarbons	1. Main concerns with petroleum hydrocarbons are preventing skin contact and inhalation of petroleum hydrocarbons. Utilize air monitoring equipment for screening of vapor concentrations and confirm specific substances, such as benzene with detector tubes. Benzene is a known carcinogen. Toluene can be absorbed through the skin. Aromatic hydrocarbons, when inhaled, cause central nervous system depression with symptoms such as headache, dizziness, tiredness, and nausea. If exposure is suspected, leave area to fresh air and seek medical attention. 2. Excessive and repeated exposure to petroleum hydrocarbons can cause reddening, drying, and cracking of the skin. If direct contact occurs, rinse for 15 minutes with water and seek medical attention. 3. Chemical protective clothing and gloves must be specified by a health and safety professional. Respiratory protection, as well as action levels for upgrade, need to be specified by a health and safety professional.
Coal Tar	1. Coal Tar can contain up to 160 aromatic compounds such as phenol, pyrol, and pyridine plus additional poly aromatic hydrocarbons (PAHs). It is listed as a carcinogenic substance by IARC, NTP, and OSHA. 2. Coal Tar is toxic by inhalation, ingestion and skin contact. The range of toxicity depends on the exposure, concentration and duration. Effects may include irritation to skin, mucous membranes and respiratory system upon exposure from direct contact short term contact to respiratory and skin diseases from repeated long term exposure. Symptoms include redness and itching to skin leading to a dermatitis from skin contact, severe eye irritation when contacted in the eye, and trouble breathing from inhalation. 3. Precautions to take to avoid exposure to Coal Tar are wearing appropriate PPE to avoid skin and eye contact when working with contaminated soil and water. Minimize breathing in contaminated soil by using wet methods to control dust or wear a cartridge respirator with HEPA filter. In the event of contact or suspected exposure, rinse the affected area with water, and seek medical attention.

TABLE 5

HAZARD ANALYSIS MATRIX

	Tasks										
Hazards	Mobilization	Decon Pad Construction	Air Monitoring	Excavation/ Trenching/ Dewatering	Material Handling Transportation	Soil/Water Sampling	DNAPL Monitoring/ Recovery	Wading	Work from Boat	Decontamination	Restoration
Unexploded Ordnance (UXO)				X	X	X		X	X		X
Constituents of Concern Exposure			X	X	X	X	X	X	X	X	
OSHA Chemicals Exposure			X	X		X	X	X	X	X	
Mechanical Equipment/ Construction	X	X	X	X	X	X	X	X	X	X	X
Lifting and Material Handling	X	X	X	X	X	X	X	X	X	X	X
Slip/Trip/Fall	X	X	X	X	X	X	X	X	X	X	X
Electrical	X	X	X	X			X				
Fire and Explosion			X	X				X	X		
Heat/Cold Stress	X	X	X	X	X	X	X	X	X	X	X
Vehicular Traffic	X	X	X	X	X	X	X			X	X
Pedestrian Traffic	X	X	X	X	X	X	X	X	X	X	X
Overhead Utilities	X			X	X						X
Underground Utilities		X		X				X	X		
Noise	X		X	X	X	X	X	X	X	X	X
Confined Space Entry (CSE)				X							
Poisonous Plants	X	X	X	X	X	X	X	X		X	X
Reptiles/Spiders/ Insects	X	X	X	X	X	X	X	X	X	X	X

TABLE 6

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Unexploded Ordnance (UXO)	1. All river work areas must be cleared by trained UXO personel prior to intrusive activities. 2. Follow all UXO Management Plan requirements
Exposure to Chemical Products (Refer to Appendix B: MSDS Definitions and MSDSs)	1. Stand up-wind of chemical products whenever possible. 2. Minimize direct contact and contact time with contaminated media to prevent exposure. 3. Avoid walking through discolored areas, puddles, leaning on drums, or contacting anything that is likely to be contaminated, unless wearing the appropriate PPE. 4. Do not eat, drink, smoke and/or apply cosmetics in the hot or warm zones. 5. Wear appropriate PPE when it is required to come in contact with contaminated media or surfaces. 6. Level D PPE must be worn as a minimum when on project site. 7. >50 parts per million (ppm) organic vapors, sustained for 5 minutes, in breathing zone requires upgrade to Level C. 8. If unknown materials are encountered, call the PM.
Exposure to OSHA Defined Hazardous Materials (Refer to Appendix B: MSDS Definitions and MSDSs)	1. All chemicals brought on-site by APEX personnel or their subcontractors, such as pipe glues, solvents, reagents, decontamination solutions, or any other OSHA defined hazardous material must be adequately labeled and the MSDSs available on-site. 2. MSDSs brought on-site can be attached in Appendix B or in the MSDS binder that is kept in the company vehicle. 3. Training on OSHA defined hazardous materials must be completed and documented. Use the Daily Safety Tailgate Meeting Form in Appendix C to record training attendance.
Exposure to Surface/Subsurface Airborne Dust	1. Stand up-wind whenever intrusive activities occur and generate visible signs of airborne dust. 2. Monitor air for airborne soil dust (surface or subsurface soil) with portable aerosol dust direct-reading instrument. 3. >0.1 mg/M^3 in breathing zone requires upgrade to Level C. 4. Utilize wet methods (spraying ground, wet drilling, etc.) when visible signs of airborne dust are generated.
Mobilization	1. Wear leather gloves in addition to Level D PPE. 2. Follow the back injury prevention techniques included in this table under “Back Injury”. 3. Be aware of traffic hazards. Follow the traffic control procedures specified in the HASP. In addition, a spotter must be used for moving and positioning equipment.
Decon Pad Construction Hand and Power Tools	1. Wear leather gloves in addition to Level D PPE 2. HAND TOOLS • Wear leather gloves. • Use tools to do the job they were intended for…don’t cut corners! • No “homemade” handles or extensions (cheaters) are permitted! • Never operate without proper training or instructions. • Tools and equipment must be maintained in good condition. Keep hand tools sharp, clean, oiled, dressed, and not abused. • Worn tools are dangerous (e.g., the “teeth” in a pipe wrench) can slip if worn smooth; and adjustable wrench will slip if the jaws are sprung; hammerheads can fly off loose handles. • Tools subject to impact (chisels, star drills and caulking irons) tend to “mushroom”. Keep them dressed to avoid flying spalls. Use tool holders. • Don’t force tools beyond their capacity. • Don’t use tools for pry bars. • Use non-sparking tools where required per client policy or when working around flammable or explosive materials.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Decon Pad Construction Hand and Power Tools (Continued)	3. POWER TOOLS • Loose clothing, long hair, rings, and other jewelry shall not be worn around rotating equipment. • Warn those around you and use proper eye protection. • Examine for damaged parts, cracked housing in insulated tools, loose fittings, and frayed or cut cords. Tag and return defective tools for repairs. • Use only 3-prong plug power tools and extension tools. • Inspect also for adequate lighting, proper lubrication, and abandoned tools or material that could “vibrate into trouble.” • Portable electrical equipment and tools shall be grounded. Ground fault circuit interrupters (GFCIs) shall be used on all extension chords and portable electrical tools. • Air must be shut off or the electric cord unplugged before making tool adjustments. Air must be “bled down” before replacement or disconnection. • Air compressors must have a relief valve and must be shut down during extended breaks, such as lunch. • Proper guards or shields must be installed on all power tools before issued. Do not sue improper tools or tools without guards in place. • Replace all guards before start-up. Remove cranks, keys, or wrenches used in service work. 4. MATERIAL HANDLING AND EQUIPMENT • Severe back and other bodily injuries can be safely prevented by using proper procedures and equipment. APEX personnel must wear a back belt when lifting more than 40 pounds, and seek assistance or use a mechanical lifting device when lifting more than 70 pounds. Subcontractors must maintain their own back prevention program.
Heavy Equipment	1. Wear leather gloves while attaching support member to protect against pinching injuries. 2. While working from elevated levels greater than 6 feet, ensure that all employees have 100% fall protection with full body harnesses and guardrails. 3. Do not stand under loads that are being raised or lowered with cranes or aerial lifts. 4. Conduct pre-operational inspection of all equipment. In addition, daily inspections will be conducted on the equipment prior to site activities. 5. Maintain a safe distance of 20 feet from unguarded overhead power lines. 6. Always stay out of the swing radius of all heavy equipment. Always use a spotter during movement of equipment. The spotter, and others as appropriate, shall maintain constant communication with the operator. 7. All operators must have adequate training and be qualified to operate the particular heavy equipment unit. 8. Conduct site evaluation to determine proper positioning for the unit. Make sure surface I level. Cordon off holes, drip-offs, bumps or weak ground surfaces. 9. When using a crane, do not use hands when the load is being lifted or lowered. Use no-conductive tag line to help direct and position the load. 10. Never climb a raised platform or stand on the min-rail or top-rail. 11. Tools should always be hung or put into a belt whenever possible. 12. Wear face shield and hearing protection in conjunction with other required PPE when hoe ram in operating. Also ensure adequate clearance around overhead power lines, other equipment and personnel.
Excavation/Trenching	1. It is APEX policy that no personnel will enter an excavation hole or trench. 2. Excavation/trenching requirements per 29 CFR 1926 shall be followed. 3. Procedures for excavation and trenching are included in Appendix D. 4. Follow all UXO Management Plan requirements .

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Inclement Weather	1. Stop outdoor work during electrical storms and other extreme weather conditions such as extreme heat or cold temperatures. 2. Take cover indoors or in vehicle. 3. Listen to local forecasts for warnings about specific weather hazards such as tornados, hurricanes, and flash floods.
Utility Lines Contact	1. Contact PUPS to have utility lines marked prior to excavation/trenching. 2. Refer to site drawings or customer interviews if on private property for utility locations. 3. Hand dig 3 to 5 feet down and 5 feet each side of utility marker to avoid breaking utility lines.
Noise	1. Wear hearing protection when equipment such as a drill rig, jackhammer, cut saw, air compressor, blower or other heavy equipment is operating on the site. 2. Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; this much noise indicates the need for protection. 3. Hearing protection is required when measured sound pressure levels (SPL) exceed 85 dB(A) where employees stand or conduct work. 4. Conduct noise monitoring of suspected high noise operations at the beginning of the workday or start up of new operations to verify noise control/hearing protection requirements. 5. Refer to Section 3.2, Noise Monitoring for guidance.
Electric Shock	1. Maintain appropriate distance from overhead utilities; **20-foot minimum clearance from power lines required;** **10-foot minimum clearance from shielded power lines.** 2. Use ground-fault circuit interrupters as required. 3. Perform LO/TO procedures. 4. Use three-pronged plugs and extension cords. 5. Contact your local underground utility-locating service. 6. Follow code requirements for electrical installations in hazardous locations.
Physical Injury (All Tasks)	1. Wear hard hats and safety glasses when on-site. 2. Maintain visual contact with the equipment operator and wear orange safety vest when heavy equipment is used on-site. 3. Avoid loose-fitting clothing (driller and driller's helper). 4. Prevent slips, trips, and falls; keep work area uncluttered. 5. Keep your hands away from moving parts (i.e., augers). 6. Test the emergency shut-off switch on the drill rig daily.
Back Injury (All Tasks)	1. Use a mechanical lifting device or a lifting aid where appropriate. 2. If you must lift, plan the lift before doing it. 3. Check your route for clearance. 4. Bend at the knees and use leg muscles when lifting. 5. Use the buddy system when lifting heavy or awkward objects. 6. Do not twist or jerk your body while lifting.
Heat Stress	1. Increase water intake while working. 2. Minimize and/or avoid alcohol intake the night before working in heat stress situations. 3. Increase number of rest breaks and/or rotate workers in shorter work shifts; take breaks in shaded areas. 4. Watch for signs and symptoms of heat exhaustion and fatigue. 5. Plan work for early morning or evening during hot months.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Heat Stress (Continued)	6. Use ice vests when necessary. 7. Rest in cool, dry areas. 8. In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. Refer to Appendix K.
Insects (All Tasks)	1. Tuck pants into socks. 2. Wear long sleeves. 3. Use insect repellent. 4. Avoid contact by always looking ahead to where walking, standing, sitting, leaning, grabbing, lifting or reaching into. 5. Check for signs of insect/spider bites, such as redness, swelling, and flu-like symptoms. 6. Use buddy system to check each other for signs of insect/spider bites. 7. Remove ticks immediately with fine tipped tweezers by grasping the tick as close to your skin as possible and gently pulling straight out. Do not squeeze the tick's body as this may inject fluids into you. Wash the bite area of skin and apply antiseptic.
Poisonous Plants (i.e., Poison Ivy, Oak or Sumac) (All Tasks)	1. Don't enter areas infested with poisonous plants. 2. Immediately wash any areas that come into contact with poisonous plants. 3. Protect exposed skin area with gloves and Tyvak® suits. 4. Be aware that the oil from the plant can be carried on boots, clothes and equipment. Always protect skin from contact. 5. If you have known or suspected allergies, carry an Epi-Pen at all times and notify co-workers that you are allergic.
Poisonous Snakes (All Tasks)	1. Avoid walking in areas where snake may nest or hide. Always look ahead to where walking for signs of snakes. 2. Use extreme caution when moving or lifting objects which could be used by snakes as cover. 3. Never reach under or behind objects or into other areas where snakes may hide. 4. Wear study leather boots.
Slip/Trip/Fall (All Tasks)	1. Inspect each work area for slip/trip/fall potential prior to each work task. 2. Slip/trip/fall hazards identified must be communicated to all personnel. Hazards identified shall be corrected or labeled with warning signs to be avoided. 3. All personnel must be aware of their surroundings and maintain constant communication with each other at all times.
Restoration	1. Follow the heavy equipment procedures specified in this table. 2. Use leather gloves in addition to Level D PPE when handling grading tools. 3. Beware of slip/trip/fall hazards. Follow the slip/trip/fall procedures outlined in this table **Follow the traffic control procedures when necessary.**
Material Handling Drums/Transportation	1. Drums will be safely transported on-site using conventional drum handling techniques including a bobcat, dump truck, front-end loader. Heavy equipment used for transporting will follow the heavy equipment procedures specified in this table. 2. Extreme care will be taken during drum handling operations to prevent release and to ensure safe working conditions. All drums will be staged and labeled in accordance with regulatory requirements. 3. Ensure that your body, material, tools and equipment are safe from such unexpected movement as falling, slipping, rolling, tripping, blowing, or any other uncontrolled motion.

TABLE 6 (Continued)

POTENTIAL HAZARDS AND CONTROL

Potential Hazard	Control
Material Handling Drums/Transportation (Continued)	4. Trucks (i.e., flat beds) hauling equipment or materials must not be moved once rigging has been released. 5. Chock all material and equipment (such as pipes, drums, tanks, reels, trailers, and wagons) as necessary to prevent rolling.
Drilling/Boring Operations (Refer to Appendix H)	1. Driller and helper must be present during all active operations. 2. Driller helper and other site personnel must know location of emergency shut off switch. 3. Unauthorized personnel must be kept clear of drilling rig. 4. Area of drilling operation must be cordoned off/barricade. 5. When hazardous conditions are deemed present, operation must be shut down.
Well Installation/Abandonment Well Development Well Gauging Well Bailing DNAPL Monitoring and Recovery Groundwater Sampling (Refer to Appendix I)	1. Wear appropriate PPE to avoid skin, eye, and inhalation contact with contaminated groundwater and/or soil. 2. Stand upwind when conducting tasks and minimize possible inhalation exposure; especially when first opening monitoring wells. 3. Conduct air monitoring to determine level of respiratory protection.
Fire Control	1. Smoke only in designated areas. 2. Keep flammable liquids in closed containers. 3. Keep site clean; avoid accumulating combustible debris such as paper. 4. Follow Hot Work Safety Procedures when welding or performing other activities requiring an open flame. 5. Isolate flammable and combustible materials from ignition sources. Ensure fire safety integrity of equipment installations.
Cleaning Equipment	1. Wear appropriate PPE to avoid skin and eye contact with isopropyl alcohol, or other cleaning materials. 2. Stand upwind to minimize any potential inhalation exposure. 3. Dispose of spent cleaning solutions and rinses accordingly.
Wading	1. Buddy system must be employed 2. Preferably wade in water where bottom can be seen 3. When bottom cannot be seen, use a probing device to check bottom 4. Inspect area for crevices, washouts, etc. 5. Visually assess current and depth. Stay clear of rapidly moving water and do not proceed above wader height 6. Do not wade during periods of storm flush, or with floating debris in water
Boat	1. Life jackets must be worn at all times on boat 2. Be aware of surroundings since the boat will contain limited space and have a fair amount of equipment 3. Respect railing and boat edge 4. Move deliberately 5. River conditions will be inspected daily to ensure safe boating conditions exist
First aid kit, blood borne pathogen kit, emergency eye wash/shower station, fire extinguisher and absorbent pads will be located on-site either in the decontamination zone, or in the company vehicle.	

TABLE 7

AIR MONITORING FREQUENCY GUIDELINES

Conduct periodic monitoring when:

1. It is possible that an immediately dangerous to life or health (IDLH) condition or a flammable atmosphere has developed; or

2. There is an indication that exposures may have risen over established action levels, permissible exposure limits or published exposure levels since the last monitoring. Look for a possible rise in exposures associated with these situations:

   - Change in site area - work begins on a different section of the site.
   - Change in contaminants - handling contaminants other than those first identified.
   - Visible signs of particulate exposure from intrusive activities such as drilling/boring and excavation.
   - Perceptible chemical odors or symptoms of exposure.
   - Change in on-site activity - one operation ends and another begins.
   - Handling leaking drums or containers.
   - Working with obvious liquid contamination (e.g., a spill or lagoon).

Conduct air monitoring when the possibility of volatilization exists (such as with a new monitoring well).

TABLE 8

PERSONAL PROTECTIVE EQUIPMENT AND AIR MONITORING SUMMARY

Job Task	Level PPE	Instrument	Frequency
Mobilization	Level D	None	None.
Decon Pad Construction	Level D	None	None.
Drilling/Well Installation	Level D	PID[1] or FID[2], O_2/LEL[3], HS/B[4], DM[5]	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Excavation/ Trenching/ Dewatering	Level D	PID or FID, O_2/LEL, HS/B, DM	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Material Handling/ Transport	Level D	PID or FID, O_2/LEL, HS/B, DM	Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Soil Sampling	Level D	PID or FID, O_2/LEL, HS/B	Surface - None, unless visible evidence of contamination is observed. Subsurface - Start up of work, then every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. O2/LEL, HS/B used based on site conditions.
Water Sampling	Level D	PID or FID, O_2/LEL, HS/B	Monitor initially at each location, and continue if necessary (potential for action level exceedance). Subsequent monitoring after initial event to be conducted if potential for action level exceedance is suspected (e.g., based on analytical results or product accumulation in well). O2/LEL, HS/B used based on site conditions.
Decontamination	Modified Level D	PID or FID, O_2/LEL, HS/B	Initial decontamination: Every 1-2 hours to continuously based on sampling results and sample location. Continuously if action level is exceeded. Based on monitoring results and site conditions, a decrease in frequency or cessation of monitoring may be warranted. O2/LEL, HS/B used based on site conditions.
Restoration	Level D	None	None.

[1] PID, Photoionization Detector
[2] FID, Flame Ionization Detector
[3] O_2LEL, Oxygen Level and Combustible Gas Meter
[4] HS/B, Hydrogen Sulfide Real-time Monitors and Benzene Detector Tubes
[5] DM, Dust, Particulate Monitor

Note: "Start up of work at each new task location" means to monitor the air quality at each new operation on the site. The breathing zone is the area inside a 1-foot radius around the head.

TABLE 9

AIR MONITORING ACTION LEVELS

Instrument*	Function	Measurement	Action
FID or PID (10.6 eV lamp) - Measures Total Organic Vapors			
Conduct air monitoring for volatile organic compounds during activities where exposure to contaminated media may occur.		>1ppm	Sustained for five minutes. Level D required. Check for benzene with detector tubes.
		> 10 ppm	Sustained in breathing zone for five minutes. Upgrade to Level C with a minimum of a half face APR with combination organic vapor/P100 cartridges
		>25 ppm	Sustained in breathing zone for five minutes. Upgrade to Level C with a minimum of a full face APR with combination organic vapor/P100 cartridges.
		>250 ppm	Sustained for five minutes. Stop work. Evacuate site. Contact PM and HSR.
Conduct perimeter air monitoring for volatile organic compounds during activities where exposure to contaminated media may occur.		>1ppm	Sustained at perimeter. Stop work. Identify source and abate emissions.
Benzene Detector Tube			
Conduct grab sampling for benzene when sustained PID/FID readings are detected in the breathing zone.		0 – 0.5 ppm	Modified Level D required.
		>0.5 – 10 ppm	Upgrade to Level C with a minimum of a half face APR with combination organic vapor/P100 cartridges required.
		>10 – 50 ppm	Upgrade to Level C with a minimum of a full face APR with combination organic vapor/P100 cartridges required.
		>50 ppm	Stop work. Evacuate site. Contact PM and HSR for guidance.
Hydrogen Sulfide Monitor			
Conduct air monitoring when intrusive activites such as drilling or excavation could release hydrogen sulfide gas. Levels of hydrogen sulfide greater than 5 ppm will require work to be temporarily suspended. Stop work, leave the area, and contact PM and HSR.			
Dust/Particulate Monitor			
Conduct dust monitoring during activities where exposures to contaminated media may occur. Engineering controls (e.g., ground spraying) will be employed as appropriate to control dust. If action levels (>0.10 mg/M^3) are exceeded, engineering controls will be utilized.		Background – 0.10 mg/M^3	Level D required
		>0.10 – 5.0 mg/M^3	Upgrade to Level C.
		>5.0 mg/M^3	Stop work. Contact PM or HSR for guidance.
Conduct perimeter dust monitoring during activities where exposures to contaminated media may occur. Engineering controls (e.g., ground spraying) will be employed as appropriate to control dust. If action levels (>0.10 mg/M^3) are exceeded or visible airbone dust observed, engineering controls will be utilized.		>0.15 mg/M^3	Sustained at perimeter. Stop work. Contact PM or HSR for guidance.
Oxygen/Combustible Gas (O_2/LEL) Monitor – Measures oxygen level (O_2) and lower explosive limit (LEL).			
Conduct air montioring for O_2/LEL when conditions exist where flamable vapors/gasses and/or oxygn deficiency or inrichment can occur.		O_2 >19.5 – 20.8%	Verify reasons for O_2 depletion with appropriate air monitoring instrumentation before work continues. Utilize appropriate engineering controls/PPE once atmospheric contaminants have been verified.
A decreased O2 reading of 0.1% (e.g., 20.9% to 20.8%) actually represents a change in the total air envelope of approximately 0.5% or 5,000 ppm. This represents little hazard if the displacing gas is inert; if the displacing gas is toxic/flamable/reactive, such a concentration represents a real hazard.		O_2 >20.8 % – 22%	Verify reasons for O_2 enrichment before entering area. Utilize appropriate engineering controls/PPE to control O_2 enriched atmosphere.
		O_2 >22%	Leave area immediately; this atmosphere is extremely flamable. Notify PM or HSR for guidance.
		O_2 <19.5%	Leave area immediately; this atmosphere is oxygen deficient. Verify reason for O_2 depletion with appropriate air monitoring instrumentation before work continues. Utilize appropriate engineering controls/PPE once atmospheric contaminants have been verified.
Verify reasons for O2 depletion by conducting air monitoring with instruments that can measure suspected contaminants (PID/FID) or that can confirm presence of contaminats (detector tubes or chemical specific real-time air monitors).		LEL <10%	Acceptable conditions. Continue normal activity.
		LEL >10%	Leave area immediately. Contact PM or HSR for guidance on venting and other safety measures.
***Note: Instruments must be calibrated according to manufacturer's recommendations.**			

TABLE 10

NOISE MONITORING

Instrument	Measurement	Action
Type I or Type II SLM Calibrate Before Use	>80 dB(A) - 85 dB(A)	Hearing protection recommended. Limit work duration to 8-hour shifts.
	>85 dB(A) - 90 dB(A)	Hearing protection required. Limit work duration to 8-hour shifts.
	>90 dB(A) - 115 dB(A)	Hearing protection required. Investigate use of engineering controls. Limit work duration to 8-hour shifts.
	>115 dB(A)	Stop work. Contact PM.

TABLE 11

BOATING HAZARDS AND SAFEGUARDS

Job Steps	Job Hazards	Safeguards and Precautions
Pre-boarding	a) Damaged Equipment b) Improper Equipment c) River conditions	1) Inspect boat; holes, dents, cracks, etc. 2) Inspect motor; leaks, damaged propeller, etc. 3) Inspect personal floatation devices (PFDs). There should be one PFD for each person on board the boat, and throwable PFDs (life rings, buoys) for emergency use 4) Do not wear hip/chest waders while on boat 5) Assess river conditions at the beginning of the day and during the day to ensure safe boating conditions
Boarding/deboarding the boat	a) Slip, trip and/or fall	1) Don appropriate safety equipment including shoes with non-slip soles and PFD
Performing tasks on boat	a) Slip, trip and/or fall b) Fall overboard c) River traffic d) Severe weather	1) Restrict non essential movement. 2) Wear PFD at all times. 3) Enforce buddy system 4) Do not lean awkwardly over boat to perform tasks 5) Implement rescue procedures should someone fall overboard 6) Remain watchful of other boats on water and other equipment, floating debris 7) Return to shore immediately at the onset of severe weather

TABLE 12

CHEMICAL HANDLING PROCEDURES

Chemical	Description	Procedures
Acids and Bases Acids: Including hydrochloric, nitric, and sulfuric acids Bases: Including sodium hydroxide	Extremely corrosive materials with a variety of uses.	• Wear gloves and eye-splash protection while using acid dispensed from a small dropper bottle during water sampling. • Wear a full-face, air-purifying respirator equipped with combination cartridges (organic vapor/ acid gas) as well as Tyvek® coveralls and nitrile and/or nitrile butyl rubber (NBR) gloves for large volume applications. • Have an eye wash bottle or portable eye wash station on-site. • Cap all drums after dispensing chemicals. • Do not add anything into a virgin chemical drum, including unused product. • Avoid mixing strong acids and bases. Consult SHSO for task-specific evaluation. If mixing is absolutely necessary, do it slowly. Avoid vapors or fumes that are generated. • When diluting acids, add the acid to water in small quantities and mix cautiously. • When diluting bases, add water to the base in small quantities and mix cautiously.
Activated Carbon	Granular adsorbent medium used to remove residual hydrocarbons from water and/or air.	• Use respiratory protection when activated carbon creates a dusty environment. • Avoid using Activated Carbon Filter Beds for Ketone Solvents - an exothermic reaction can develop over time and result in possible explosion. • Contact SHSO for task-specific evaluation.
Oxygen-Supplying Chemicals	Dry chemical used to increase subsurface oxygen levels and enhance aerobic biodegradation of organic constituents.	• Refer to product information provided in Appendix M of the HASP.

TABLE 13

PERSONAL PROTECTIVE EQUIPMENT

Level	Requirements
Level D	• Work Uniform • Steel-toed boots • Approved safety glasses or goggles • Hard hat • Fluorescent vest, when vehicular traffic is on or adjacent to the site Nitrile gloves for water sampling handling.
Modified Level D	**One or more of the following:** • Chemical resistance (acid or solvent) boot covers • Kleen Guard LP (Reduced Heat Stress) or PE-coated Tyvek® suit, Neoprene outer and PVC inner gloves. • Hearing protection (muffs and/or plugs).
Level C	• Level D and Modified Level D • NIOSH/MSHA-approved full-face respirator with organic vapor/acid gas high efficiency particulate air-purifying (HEPA) cartridges.
Level B	• Level B cannot be worn without the prior approval of the SHSO.
Level A	• Level A cannot be worn without the prior approval of the SHSO.
Prior to use, all equipment must be inspected to ensure proper working condition.	

TABLE 14

DECONTAMINATION PROCEDURES

Item	Examples	Procedure
Field equipment	Bailers, interface probes, hand tools, drill augers, and miscellaneous sampling equipment.	• Decontaminate with a solution of detergent and water; rinse with water prior to leaving the site. • Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.
Disposable PPE	Tyvek® suits, inner latex gloves, respirator cartridges	• Dispose of according to the requirements of the client, state and federal agencies. • Change-out respirator cartridges on a daily basis and dispose accordingly.
Non-disposable PPE	Respirators	• Wipe out respirator with disinfecting pad prior to donning. • Decontaminate respirator on-site at the close of each day based upon extent of contamination. This procedure could include disassembling the respirator and cleaning, rinsing, sanitizing, and drying all parts with approved powders and solutions.
	Boots and gloves	• Decontaminate outside with a solution of detergent and water; rinse with water prior to leaving the site. • Protect from exposure by covering with disposable covers such as plastic to minimize required decontamination activities.

TABLE 15

SITE SECURITY PROCEDURES

Working in Street or Roadway

- Wear traffic vest and hardhat when vehicle hazard exists.
- Use cones, flag-mounted cones, caution tape and/or barricades.
- Develop traffic patternization plan for high traffic situations:
  - use flag person;
  - use flashing arrow sign;
  - use "MEN WORKING" signs liberally;
  - obtain lane closing permits; and
  - engage police details.

Working at Excavation/Trenching Sites or Investigation Area

- "Competent person" is required per OSHA 29 CFR 1926 Subpart P.
- Safetyguard open excavations by restricting unauthorized access.
- Highlight work area and maintain zone definition along perimeter with appropriate controls (caution tape, signs, cones, barricades, etc.).
- Restrict access to work areas with fencing and gates or caution tape
- Use security on a 24-hour basis

Equipment and Excavations Left Unattended or Overnight

Use one of the following methods to address these situations:

- Restrict access to the site with fencing and locked gates.
- Surround entire perimeter of open excavation with appropriate controls (caution tape, signs, cones, barricades, etc.).
- Place barricades affixed with flashing lights end to end with construction net fence attached to barricades.
- Utilize temporary curbing or concrete "jersey" barriers affixed with flashing signal lights or other effective warning signs.
- Restrict access to work areas with fencing and gates or caution tape
- Use security on a 24-hour basis

TABLE 16

CONTINGENCY PLANS FOR SITE EMERGENCIES

Situation	Action
Evacuation	1. Immediately notify all on-site personnel of an emergency requiring evacuation. 2. Leave the dangerous area and report to a designated rally point. 3. Notify emergency medical service (EMS), as appropriate. 4. Account for all personnel. 5. Contact the PM as soon as possible. 6. Maintain site security and control measures for community safety until emergency responders arrive.
Medical Emergency	1. Survey the situation: • **Do not enter an area that may jeopardize your safety.** • Establish the patient's level of consciousness. • Call for help. • Contact EMS and inform them of patient's condition. 2. Primary assessment (patient unconscious). • Arousal • Airway • Breathing • Circulation • **Only trained personnel should perform CPR or First Aid - State that you are medically trained.** 3. Secondary assessment (patient conscious). • Check for bleeding: Control with direct pressure. • Do not move patient (unless location is not secure). • Monitor vital signs. • Provide first aid to the level of your training. • Contact the PM as soon as possible.
Fire Emergency	1. **Evacuate the area.** 2. Notify the EMS. 3. Extinguish small fires with an all-purpose extinguisher. 4. Contact the PM.
Spill/Release	Prevent problems by documenting the location of underground lines (e.g., product, sewer, telephone) before starting site work. If you drill through a line or tank or another leak occurs, document the spill/release in writing. Include dates, times, actions taken, agreements reached and names of people involved. In the event of a spill/release, follow this plan. 1. Wear appropriate PPE; stay upwind of the spill/release. 2. Turn off equipment and other sources of ignition. 3. Turn off pumps and shut valves to stop the flow/leak. 4. Plug the leak or collect drippings in a bucket, when possible. 5. Place sorbent pads to collect product, if possible. 6. Call Fire Department immediately if fire emergency develops. 7. Inform PM about the situation. 8. Determine if the client wants to repair the damage of if the client will use an emergency repair contractor. 9. Based on agreements, contact emergency spill contractor for containment of free product. 10. Advise the client of spill discharge notification requirements and determine who will complete and submit forms. Do not submit or report to agencies without the client's consent. Document each interaction with the client and regulators and note, in writing; name, title authorizations, refusals, decisions, and commitments to actions. 11. Do not transport or approve transportation of contaminated soils or product until proper manifests have been completed and approve. Be aware that soils/product may meet criteria for hazardous waste. 12. Do not sign manifests as generator of wastes; contact the regional compliance manager to discuss waste transportation.
The PM must contact the client or generator. The generator is under obligation to report to the proper government agencies. If the spill extends into waterways, the Coast Guard and the National Response Center (800-424-8802) must be notified immediately by the client or with their permission.	

TABLE 17

FIELD COMMUNICATION METHODS

Communication Device	Type of Communications	Signal
Telephone On-Site or Cellular Telephone	Emergency Notification	Initiate phone call using applicable emergency phone numbers.
Two-Way Radio	Emergency notification among site personnel.	Initiate radio communication with Code Red message.
Compressed Air Horn	Hailing site personnel for non-emergency.	One long blast, one short blast.
Compressed Air Horn	Hailing site personnel for emergency evacuation.	Three long continuous blasts.
Visual	Hailing site personnel for distress, need help.	Arms waved in circle over head.
Visual	Hailing site personnel for emergency evacuation.	Arms waved in criss-cross over head.
Visual	Contaminated air/strong odor.	Hands clutching throat.
Visual	Break, lunch, end of day.	Two hands together, break apart.

FIGURE

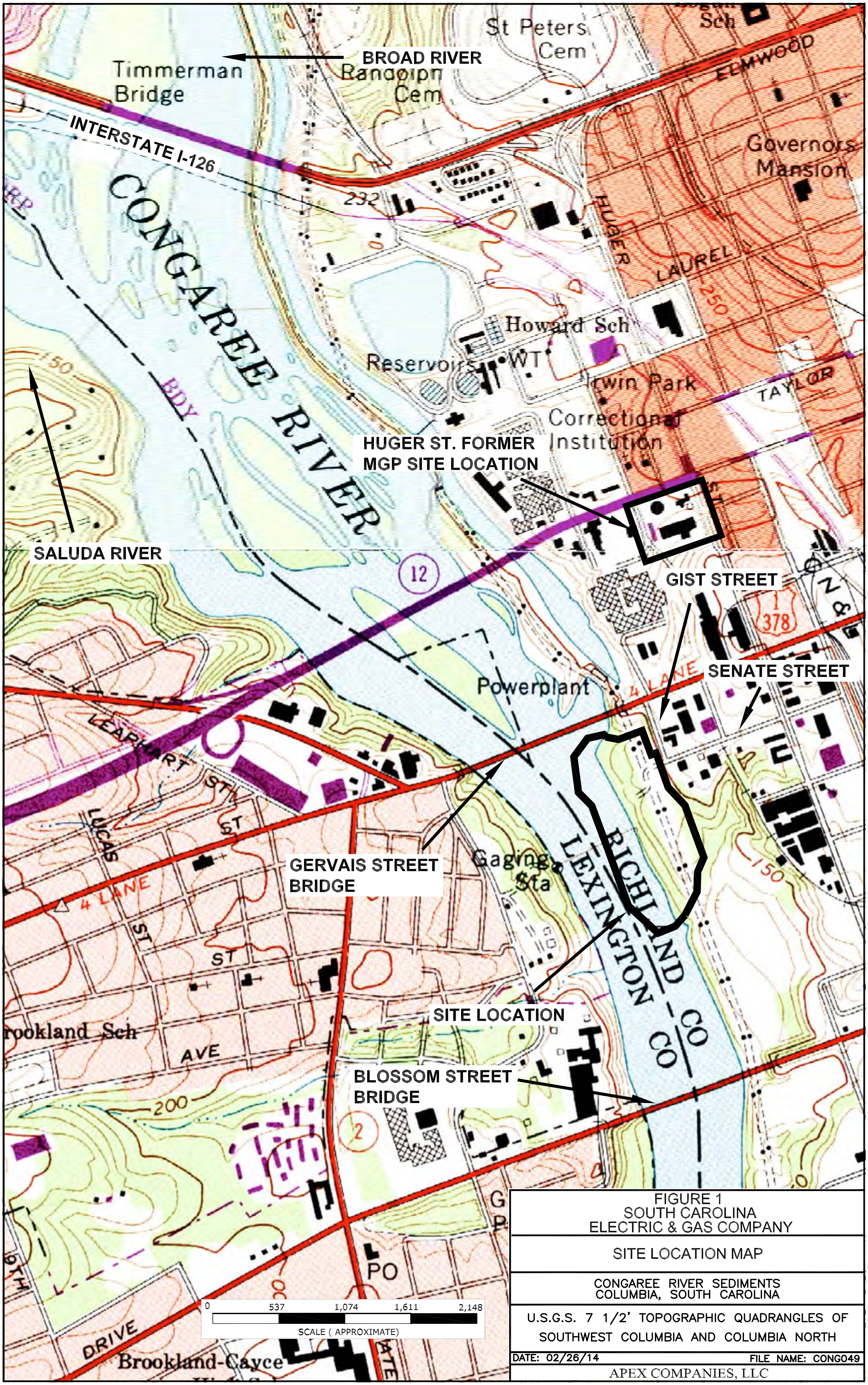


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

APPENDIX A

SITE EMERGENCY INFORMATION

SITE EMERGENCY FORM

Contaminants of Concern: PAHs, Coal Tars, BTEX, SVOCs, Arsenic
Minimum Level of Protection: Level D
Hazard Determination: Serious_____ Moderate__X___ Low_____

Do not endanger your own life. Survey the situation before taking any action.

Apex Companies, LLC Office Telephone	412-829-9650 - Trafford, Pennsylvania
Site Location Address:	West of Gist and Senate Streets, Columbia, South Carolina
Telephone Located at:	Trailer Phone: 412-818-6151

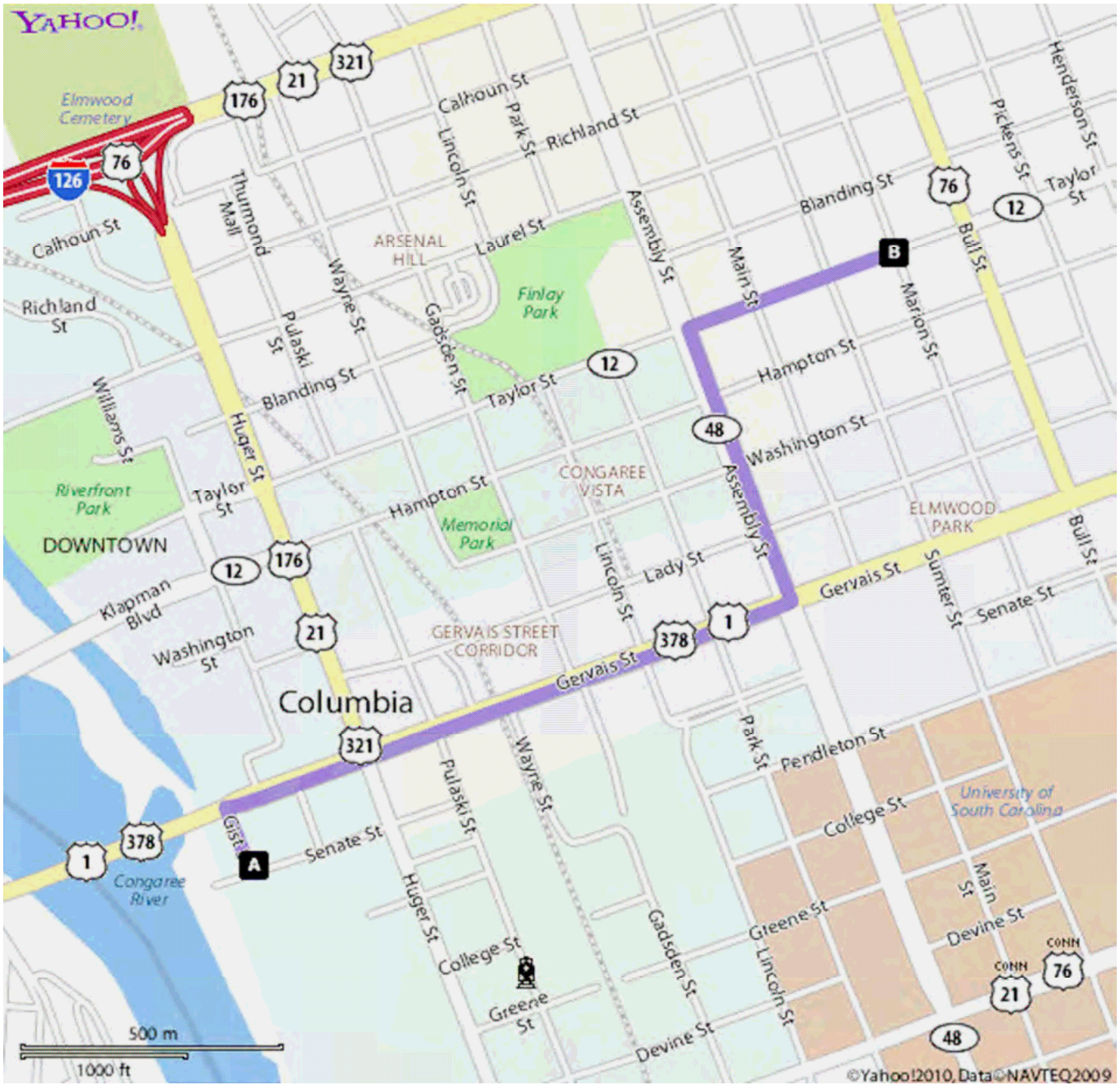
EMERGENCY PHONE NUMBERS **IN THE EVENT OF ANY EMERGENCY CONTACT PROJECT MANAGER (PM) OR HEALTH AND SAFETY REPRESENTATIVE (HSR).**

Ambulance	911
Fire	911
Police	911
Poison Control	1-800-222-1222
Hospital Name	Palmetto Health Baptist
Hospital Phone Number	911 or 803-296-5010
National Response Center (all spills)	800-424-8802
Project Manager	Andrew Contrael: 412-829-9650
Site Safety Officer	To be determined: 412-818-6151
Health and Safety Manager	Andrew Contrael: 412-829-9650
Client Contact	Bob Apple, SCANA Services, Inc.: 919-819-2748
State Agency	SCDHEC: 803-898-4258

UTILITY MARKER EMERGENCY TELEPHONE NUMBERS

Utility	Color Code	
Water Gas Electric Telephone/Cable Sewer	Blue Yellow Red Orange Green	Palmetto Utility Protection Service: 888-721-7877

HOSPITAL LOCATION MAP



HOSPITAL DIRECTIONS:

A 1.	Start at 1102 GIST ST, COLUMBIA going toward GERVAIS ST	go 453 ft
2.	Turn R on GERVAIS ST(US-1 N)	go 0.8 mi
3.	Turn L on ASSEMBLY ST(SC-48 N)	go 0.4 mi
4.	Turn R on TAYLOR ST(SC-12)	go 0.29 mi
B 5.	Arrive at TAYLOR ST & MARION ST, COLUMBIA	

HOSPITAL INFORMATION:

Name: Palmetto Health Baptist Center

Address: Taylor and Marion Streets
City, State: Columbia, SC

Phone: Emergency: 911
General: 803-296-5010

EMERGENCY FIRST AID

FIRST AID

Ingestion:	DO NOT INDUCE VOMITING. Call Poison Control - follow instructions. Administer cardiopulmonary resuscitation (CPR), if necessary. Seek medical attention.
Inhalation:	Remove person from contaminated environment. Administer CPR if necessary. Seek medical attention. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND A STANDBY PERSON IS PRESENT.
Skin Contact:	Brush off dry material, remove wet or contaminated clothing. Flush skin thoroughly with water. Seek medical attention if irritation persists.
Eye Contact:	Flush eyes with water for 15 minutes. Seek medical attention.
Exposure Symptoms:	Headache, dizziness, nausea, drowsiness, irritation of eyes, nose, throat, breathing difficulties.
Contingency Plan:	Report incident to PM after emergency procedures have been implemented.

RESPONDER MUST BE QUALIFIED TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME UNLESS PROPERLY EQUIPPED AND TRAINED. ENSURE ALL PROTOCOLS ARE FOLLOWED INCLUDING THAT A STANDBY PERSON IS PRESENT.

2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.

3. Decontaminate the victim without delaying life-saving procedures.

4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by trained Emergency Medical Services (EMS) personnel: let the doctor assume the responsibility for determining the severity of the injury. If the condition is obviously serious, EMS must transport the victim.

5. Notify the PM.

<table>
<tr><th colspan="2">EMERGENCY FIRST AID PROCEDURES</th></tr>
<tr><th>To Stop Bleeding</th><th>CPR</th></tr>
<tr><td>1. Give medical statement.

2. Assure airway, breathing, circulation.

3. Use DIRECT PRESSURE over the wound with clean dressing or your hand (use nonpermeable gloves). Direct pressure will control most bleeding.

4. Bleeding from an artery or several injury sites may require DIRECT PRESSURE on a PRESSURE POINT. Use pressure points for 30 - 60 seconds to help control severe bleeding.

5. Continue primary care and seek medical aid as needed.</td><td>1. Give medical statement.

2. Arousal: Check for consciousness.

3. Open airway with chin-lift.

4. Look, listen, and feel for breathing.

5. If breathing is absent, give 2 slow, full rescue breaths.

6. Check the pulse for 5 to 10 seconds.

7. If pulse is present, continue rescue breathing: 1 breath every 5 seconds.

8. If pulse is absent, initiate CPR; 15 compressions for each two breaths.</td></tr>
</table>

APPENDIX B

SIGN-IN SHEET

SIGN IN SHEET

South Carolina Electric & Gas Company
Congaree River Sediments Site
Columbia, South Carolina

Date	Name	Signature	Company	Time In	Time Out

APPENDIX C

AGREEMENT AND AKNOWLEDGEMENT SHEET

APEX

AGREEMENT AND ACKNOWLEDGEMENT SHEET
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

Apex Companies, LLC (APEX) personnel have the authority to stop field activities at this site if any activity is not performed in accordance with the requirements of the HASP. APEX project personnel, subcontractor personnel, and visitors are required to sign the Agreement and Acknowledgement Sheet prior to conducting field activities at this site.

APEX COMPANIES, LLC
AGREEMENT AND ACKNOWLEDGEMENT STATEMENT

1. I have read and fully understand the HASP and my responsibilities.
2. I agree to abide by the provisions of the HASP.

Name: ____________________ Signature: ____________________
Company: ____________________ Date: ____________________

Name: ____________________ Signature: ____________________
Company: ____________________ Date: ____________________

Name: ____________________ Signature: ____________________
Company: ____________________ Date: ____________________

Name: ____________________ Signature: ____________________
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Company: ____________________ Date: ____________________

Name: ____________________ Signature: ____________________
Company: ____________________ Date: ____________________

Name: ____________________ Signature: ____________________
Company: ____________________ Date: ____________________

APPENDIX D

LIST OF ACRONYMS

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
BP	Breath pipe
BT	Body temperature
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BWL	Body water loss
BWT	Body water temperature
CET	Certified Environmental Trainer
CFR	Code of Federal Regulations
CGI	Combustible gas indicator
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
COHN	Certified Occupational Health Nurse
CNS	Central nervous system
CPR	Cardio-pulmonary resuscitation
CRZ	Contaminant reduction zone
CSE	Confined space entry
CSP	Certified Safety Professional
CZ	Clean zone
DM	Dust-particulate monitor
DOT	Department of Transportation
DT	Detector tube
DZ	Decontamination zone
EKG	Electrocardiogram
EMR	Environmental Medical Resources
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EZ	Exclusion zone
FID	Flame ionization detector
FP	Flashpoint
GFCI	Ground fault circuit interrupter
GM	Geiger-Mueller
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B-virus

LIST OF ACRONYMS (Continued)

HEPA	High efficiency particulate air-purifying
HR	Heart rate
HSM	Health and Safety Manager
HSR	Health and Safety Representative
HSS	Health and Safety Specialist
HVDPE	High vacuum dual-phase extraction
HZ	Hot zone
IDLH	Immediately dangerous to life or health
ILO	International Labor Organization
IP	Ionization potential
JSA	Job safety analysis
LEL	Lower explosive limit
LO/TO	Lockout/tagout
mg/M_3	Milligrams per cubic meter
mg/L	Milligrams per liter
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
N	NIDA drug screen
NA	Not available
NBR	Nitrile butyl rubber
NEC	National Electrical Code
NIDA	National Institution on Drug Abuse
NIOSH	National Institute for Occupational Safety and Health
NFPA	National Fire Prevention Association
NL	NIDA-like drug screen
NRR	Noise reduction rating
O_2	Oxygen
O_3	Ozone
OM	Operations Manager
OJT	On the job training
OT	Oral temperature
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
PID	Photoionization detector
PIR	Preliminary incident report

LIST OF ACRONYMS (Continued)

PM	Project Manager
ppb	Parts per billion
PPE	Personal protective equipment
ppm	Parts per million
RB	Random breathalyser
RBP	Random breath pipe
RCRA	Resource Conservation and Recovery Act of 1976
REL	Recommended exposure limit
RN	Registered Nurse
RR	Relative responses
RT	Random ten panel drug screen
SHSO	Site Health and Safety Officer
SLM	Sound level meter
SOW	Scope of work
SPL	Sound pressure level
STEL	Short-term exposure limit
SZ	Support zone
TLV	Threshold limit value
TSF	Tons per square foot
TWA	8-hour time-weighted average
UEL	Upper explosive limit
ug/L	Micrograms per liter
UST	Underground storage tank
VP	Vapor pressure
WBGT	Wet bulb globe temperature

APPENDIX E

MATERIAL SAFETY DATA SHEETS (MSDS)

APPENDIX F

DAILY HEALTH AND SAFETY TAILGATE MEETING FORM

DAILY TAILGATE SAFETY MEETING FORM

Instructions:

- **Conduct a Daily Tailgate Safety Meeting with site personnel prior to commencing daily activities. Safety topics can be selected from the attached table.**
- **Address potential hazards and controls for tasks that will be conducted.**
- **Discuss air monitoring, training, PPE and other appropriate requirements.**
- **Follow-up on noted items and document the resolution of any action items.**

Date: ________________

Meeting conducted by: ____

Project/Site: ____

Safety topics/information reviewed: ____

____

____

____

____

____

Follow-up action items/comments: ____

____

____

____

____

____

Attendance:

NAME	SIGNATURE	COMPANY/AGENCY/OTHER ORG.

DAILY TAILGATE SAFETY MEETING TOPICS GUIDE

1. ACCIDENT REPORTING
2. AIR MONITORING
3. AIR MONITORING AND ACTION LEVELS
4. ALCOHOL CONSUMPTION AND WORKSITE SAFETY
5. COLD STRESS
6. CONFINE SPACE ENTRY
7. CRANE SAFETY
8. DAILY WORK TASK HAZARDS
9. DECONTAMINATION
10. DISCIPLINARY POLICY FOR NOT FOLLOWING SAFETY RULES/SAFE WORK PRACTICES
11. DRILL RIG SAFETY
12. ELECTRICAL SAFETY
13. EMERGENCY RESPONSE
14. ERGONOMICS
15. EXCAVATION/TRENCHING HAZARDS
16. EYE WASH STATION LOCATION (S)
17. FALL PROTECTION
18. FIRE SAFETY/BONDING-GROUNDING TECHNIQUES
19. FIRST AID/CPR
20. FUGITIVE DUST CONTROL
21. GENERAL SITE SAFETY RULES
22. HAND TOOL HAZARDS
23. HAZARD COMMUNICATION/LOCATION OF MSDS/REVIEW OF HAZMAT PROPERTIES
24. HEALTH AND SAFETY PLAN
25. HEARING PROTECTION
26. HEAT STRESS
27. HEAVY MACHINERY
28. HOSPITAL DIRECTIONS
29. HOUSEKEEPING
30. MATERIAL HANDLING
31. MECHANICAL HAZARDS/GUARDING/LOTO
32. OVERHEAD HAZARDS
33. PERSONAL PROTECTIVE EQUIPMENT
34. RESPIRATORY PROTECTION AND FILTER CHANGE-OUT SCHEDULE
35. ROLES AND RESPONSIBILITIES
36. SITE SECURITY
37. SMOKING AND BREAK AREAS
38. TANK REMOVAL SAFETY
39. UNDERGROUND UTILITIES
40. USE OF “BUDDY SYSTEM”
41. VAPOR CONTROL
42. WATER HAZARDS
43. WELDING SAFETY
44. WORK STOPPAGE

APPENDIX G

EXCAVATION AND TRENCHING

EXCAVATION AND TRENCHING -- SOP-02

1.0 INTRODUCTION

Excavation and trenching is one of the major hazards of construction activities; therefore a number of precautions must be taken to prevent cave-ins or other accidents. OSHA defines an excavation as any man-made cut, cavity, trench, or depression in the earth's surface as formed by earth removal. A trench refers to a narrow excavation made below the surface of the ground in which the depth is greater than the width- and the width does not exceed 15 feet. The following site conditions must be taken into account when planning excavation work:

- Traffic;
- Proximity and physical conditions of nearby structures;
- Soil type;
- Surface and ground water;
- Depth to water table;
- Overhead and underground utilities; and
- Weather.

2.0 SUMMARY OF REQUIREMENTS

All excavations must be dug according to OSHA 29 CFR 1926.650-652, "Excavation, Trenching, and Shoring." These requirements include the following:

- The sides of trenches more than five (5) feet deep must be shored, unless they are sloped to the angle of repose or unless the trench is in solid rock. Shoring must be adequate to prevent trench wall collapse in whatever soil condition is encountered. See Appendices A through E of 29 CFR 1926.652.

- Trenches or excavations 4 feet or deeper must be provided with means of access/ egress (i.e., ramps or ladders). A worker must never be more than 25 feet away from a means of egress. Ladders must extend from the bottom of the trench to at least 3 feet above the surface of the ground.

- The atmosphere of the excavation must be tested for flammable gas concentration, oxygen deficiency, and other hazardous substances which may be present before employees enter a trench or excavation greater than 4 feet deep. Employees shall not be permitted to work in hazardous or toxic atmospheres with a combustible gas concentration greater than 20% of the lower flammable limit; and oxygen less than 19.5% or more than 23.5 %.

- Daily inspections of the excavation; adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could result in possible cave-ins, failures of protective systems and equipment, hazardous atmospheres, or other hazardous conditions. Inspections are required prior to the start of work and as needed throughout the shift, also after every rainstorm or other hazard increasing occurrence. Inspections are only required when employee exposure can be reasonably anticipated.

If the competent person finds evidence of a dangerous situation, employees must be removed from the hazardous area until precautions are taken to protect employees.

- Determine the exact location of underground utilities before excavating. While the excavation is open, the underground installations must be protected, supported, or removed as necessary to safeguard excavation personnel.

- All surface encumbrances (e.g., trees and boulders) must be removed or supported if they present a hazard to employees. Surface encumbrances can collapse on employees when undermined by excavation activities and also interfere with site traffic.

- If the stability of an adjacent structure is endangered by excavation operations, support systems must be used to ensure the stability of the structure.

- Water must not be allowed to accumulate in an excavation. Water accumulation leads to cave-ins.

- Employees must not work on faces of sloped or benched excavations at levels above other employees unless the employees at the lower level are protected from the hazard of falling, rolling, or sliding material or equipment.

- Personnel are not permitted on the downgradient side of heavy equipment when operating on a grade. A safe pathway must be determined before equipment is moved from one location to another.

- Employees are not permitted under loads handled by lifting or excavation equipment. To avoid being struck with debris, employees must also stand clear of trucks being loaded or unloaded.

- If a machine operator does not have a clear and direct view of an excavation's edge, a warning system (i.e., hand signals or barricades) must be used to ensure that equipment does not fall into the excavation.

- Personnel working along roadways must use highly visible safety vests. Signs, traffic cones, barricades and a flagman, if necessary, must be used to slow down and direct traffic away from the area.

- Emergency response equipment, including PPE and retrieval harnesses with lifelines, must be available when employees may enter an excavation deeper than 5 feet.

Employees entering deep and confined footing excavations must wear harnesses and lifelines.

- During excavation or trenching activities, the excavation must be barricaded to prevent employees and others from falling into them. When an excavation must remain open for the duration of the construction work, barricades, fences, horses, and warning signs are needed. If necessary, one or more employees will direct traffic away from the excavation.

- Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails must be provided.

Employees must be protected from loose rock or soil that could fall or slide into an excavation, either from the face of the excavation or from above the excavation. Materials and equipment must be kept at least 2 feet from the edge of the excavation, or a retaining device must be used to keep materials and equipment controlled.

The next three pages provide flow diagrams for selecting proper shoring and sloping systems. These diagrams were taken Appendix F of the OSHA excavation/trenching standard.

Additional information on soil classification, slope configuration, timber shoring, aluminum hydraulic shoring, and other alternatives are found in Appendices A through E at the end of 29 CFR 1926.652.

APPENDIX H

DRILLING

DRILLING

The following work practices should be used to minimize the risk of exposure and injury to employees during drilling and soil boring activities:

- Clear away all debris from the immediate area

- Be sure that the area to be drilled is free of underground power lines, gas lines, water mains, sewers, or other utilities.

- Before erecting the derrick, be sure that there are no overhead power lines, tree branches, or other obstructions in the way.

- Because the driller is expected to have the necessary experience, it is his responsibility to take charge of the drilling operation. He should be in control of the rig at all times so that the danger of someone accidentally engaging the drive during the operation is reduced.

- When extracting cores lay the core barrel on a platform clear of the drill hole. Allow enough slack in the hoisting cable to prevent the hoisting plug from unscrewing when lifting the core barrel from the hole.

- Never hold your hand over the end of the core barrel when extracting a core, the core may drop suddenly and cut your hand.

- Stay a safe distance from the lines being used for hoisting and pulling drill rods or sheet piling. Never straddle or reach across them. Serious injuries from whiplash can occur if the cable breaks or loosens suddenly.

- Always stand clear of the cable, hoisting plug, and rods while the operator releases the tension on the cable, the bail or hoisting plug may spin rapidly when the tension is released.

- **Never** place a hand on the guide or drive head when the drive hammer is suspended or in use. Most hand injuries around drill rigs occur in this fashion.

APPENDIX I

SAMPLING ACTIVITIES

SAMPLING ACTIVITIES

Well Testing, Ground Water Monitoring

These sampling activities involve possible contact with contaminated ground water. The most common route of exposure is skin/eye contact with splashed liquid, although there is also a potential for eye irritation and inhalation of volatile organic vapors if the water is heavily contaminated. Employees involved in handling samples and sampling equipment must wear gloves, safety glasses/goggles and other PPE as necessary.

Surface Water and Waste Sampling

Personnel sampling ponds, lagoons or other surface waters must wear appropriate PPE to protect themselves from over-exposure to hazardous substances. The most common danger associated with surface water sampling is skin and/or eye exposure due to splashing. Inhalation of volatile compounds is also a potential danger when sampling surface waters that may be heavily contaminated. If necessary to characterize hazards associated with sampling at specific sites, air monitoring will be conducted with instruments such as organic vapor monitors. PPE required may include coveralls, disposable gloves, boots, chemical splash goggles or safety glasses or full-face shield, and organic respirator or SCBA.

Drowning is a real danger for personnel suited in protective equipment that may impair swimming ability. Where there is danger of drowning, necessary safety gear such as lifeboats, safety lines and flotation gear will be provided. Whenever possible, stay on shore; be aware that some solid wastes may float and give the appearance of cracked mud. Caution should be exercised when working along shorelines.

Soil Sampling, Drilling

Contact with hazardous substances may include skin exposure from handling a sample, skin and/or eye exposure from flying debris while drilling, as well as from dusts, aerosols, vapors generated in drilling or while hand auguring. When necessary due to actual or expected site conditions, monitoring shall be performed with an organic vapor meter, combustible gas meter, and/or radiation detection device.

Employees involved in soil sampling by hand auguring or split-spoon sampling must wear gloves while handling samples and sampling equipment, and goggles/safety glasses to prevent eye damage or exposure while drilling, and other PPE such as coveralls, boots, safety shoes, and respirators, if necessary.

Drum Sampling

Drum sampling can be a hazardous activity because it often involves direct contact with unidentified wastes. To minimize hazards associated with drum sampling the following procedures will be performed as appropriate to the sampling situation:

- Obtain background information about the waste.
- Determine which drums should be sampled.
- Select the appropriate sampling device and containers.
- Develop a sampling plan, which includes the number, volume, and locations of samples to be taken.
- Follow the Standard Operating Procedures below for opening drums, sampling and sample packaging and transportation.
- Sample through a free opening or bung when possible.
- Do not move drum unless necessary.
- Mark sampling areas if necessary, and keep non-essential personnel at a safe distance.

- Do not lean over other drums to reach the drum being sampled unless absolutely necessary.

- Cover drum tops with plastic sheeting, if necessary, to avoid excessive contact with the drum tops.

- Never stand on drums. Use mobile steps or platforms to achieve the height. necessary to safely sample from the drums

- Select and use the appropriate PPE when sampling drums.

The appropriate procedures for sampling and handling drums depend on the drum contents. Prior to any handling or sampling, drums will be visually inspected to gain as much information as possible about their contents. The inspection should determine:

- Any symbols, words, or other marks indicating that its contents are hazardous (e.g., toxic, corrosive, flammable, etc.)

- Any symbols, words, or other marks indicating that it contains potentially dangerous materials in small volume individual containers

- Signs of deterioration such as corrosion, rust, and leaks

- Signs that the drum is under pressure such as swelling and bulging

- Drum type and configuration of drum head.

If there are no clues as to the contents of a drum, or if it is deemed necessary by the SHSO or his designee, monitoring will be conducted around the drums using appropriate instruments, such as an organic vapor monitor, a combustible gas meter, or a radiation survey instrument. Information about drum contents may also be obtained from the site history. The results of the initial survey and drum content determination will be recorded on the sampling sheet.

The following procedures are recommended when opening drums:

- Select and use appropriate PPE when opening and sampling drums (e.g., coveralls, disposable gloves compatible with the waste, rubber boots and safety shoes, chemical splash goggles or full face shield, organic respirator, or SCBA).

If necessary, monitor continuously during drum opening to characterize potential hazards.

- Do not use picks, chisels, etc. to open drums, sample through free openings or bungs.

- If drums must be pierced to open, use remote-controlled devices for opening drums and shields as necessary.

- Keep non-essential personnel at a safe distance from the drums being opened.

- If the drum shows signs of swelling or bulging, perform all opening steps slowly. Relieve excess pressure prior to opening, use shielding if possible.

- Drums with drum covers should be opened carefully.

Drums containing individually packaged wastes such as discarded lab packs should be handled carefully as such containers may contain shock-sensitive materials, exotic toxic substances, etc. Lab packs may be opened to inspect and classify wastes but individual bottles should not be opened if they are unlabeled. To characterize unlabeled materials in individual packs, return the entire pack to the laboratory for analysis if possible.

APPENDIX J

AIR MONITORING FORM

AIR MONITORING FORM

Congaree River Sediments Site
Columbia, South Carolina

Date: ____________________

Grid Location(s) Excavated This Date: ____________________

Wind Direction: __________ Shift Start: __________ Shift End: __________

Air Monitoring:

Location / Excavation Depth	Time	PID BG / BZ	LEL BG / BZ	O_2 BG / BZ	H2S BG / BZ	Wind Direction

Safety observations for this date (Draeger Tube results):

____

____

____

____

____

Signature of APEX Representative: ____________________

APPENDIX K

HEAT AND COLD STRESS PROCEDURES

HEAT/COLD STRESS PROCEDURES

1.0 HEAT STRESS

Heat stress is a significant potential hazard associated with the work task performed and the type and degree of protective equipment used in hot weather environments. Local weather conditions may produce conditions, which will require restricted work schedules in order to protect employees. Monitoring for heat stress will follow one of two protocols depending on whether impermeable clothing (tyvek, saranex. rain gear, etc.) or permeable clothing (cotton coveralls) is worm. This section will apply to both hazardous and non-hazardous waste workers at the site. The SHSO with direction from HSR will detemtine the environmental wet bulb globe temperature (WBGT) and physiological (heart rate (HRI and oral temperature [OR]) monitoring to be conducted for both of workers.

1.1 Workers Wearing Permeable Clothing

The ACGIH have set TLVs for worker exposure to heat stress in which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs assume that workers are acclirnatized, fully clothed in permeable clothing with adequate water and salt intake, and capable of functioning effectively under the given working conditions without exceeding a deep body temperature (BT) of 100.4°Fahrenheit (F). Measurement of the WBGT has been found to be the most adequately measurable environmental factor in which to correlate with the deep BT and other physiological responses to heat. The following table the work/rest regimen to be followed by all permeably clothed workers based upon routinely measured WBGT.

Permissible Heat Exposure TLVs Applicable to Workers Wearing Permeable Clothing

Work /Rest Regimen	Workload		
	Light	Moderate	Heavy
Continuous work	86 (76)	80 (70)	77 (67)
75% work – 25% rest, each hour	87 (77)	82 (72)	78 (68)
50% work – 50% rest, each hour	89 (79)	85 (75)	82 (72)
25% work – 75% rest, each hour	90 (80)	88 (78)	86 (76)

Values are given in °F WBGT.

Rest means minimal physical activity. Rest should be accomplished in the shade. Any activity requiring only minimal activity can be performed during rest period.

() Parentheses indicate the 10 degree adjustment for working in impermeable protective clothing.

1.2 Workers Wearing Impermeable Clothing

Workers who must wear impermeable clothing are held at a higher risk of suffering heat stress. Impermeable clothing impedes sweat evaporation, one of the body's major cooling mechanisms. It is the duty of each employer to alert or notify the SHSO if symptoms of heat stress occur to their respective site personnel. Physiological and environmental monitoring of personnel wearing an impermeable protective equipment ensemble will commence when the ambient temperature rises above 70°F. Environmental monitoring will be conducted continuously for as long as the ambient temperature stays above 70°F and physiological monitoring will be conducted immediately before and after each work period. Frequency of physiological monitoring will increase as the ambient temperature increases or if slow recovery rates are indicated. The break time must be sufficient to allow workers to recover from the effects of heat stress. This will be accomplished by measuring the recovery HR and OT. The break time duration will be determined using the following methodology and criteria:

- Seat person being monitored;
- Take OT; and
- Measure pulse in the following sequence:
  - Pulse #1: 30 seconds to 1 minute after sitting
  - Pulse #2: 2½ to 3 minutes after sitting

An excessive heat stress condition exists when any of the following conditions exist:

1. Oral or ear temperature exceeds 99.5°F
2. If pulse #2 is greater than 90 beats/minute
3. Pulse #1 is greater than I 00 beats/minute

Worker cannot return to work until:

- Oral or ear temperature is below 99.5°F
- Pulse rate is below 90 beats/minute
- Recovery HR for workers with HRs over 9Obeats per minute is less than 10 beats per minute less than the original HR

Adhering to the guidelines for heat stress prevention and monitoring will greatly minimize the possibility of the occurrence of heat stress. Site personnel must also be aware of the symptoms of heat-related disorders and be prepared to administer the appropriate treatments.

1.2.1 Prevention

A. Provide plenty of fluids. A 50 percent solution of fruit juice or similar solution in water, or plain water will be available. For workers performing work inside an EZ, fluid intake may occur in the CRZ. Workers must first perform a partial decontamination process, which will include removal of gloves and washing of hands and face prior to consumption of fluids. The SHSO will monitor the partial decontamination and fluid consumption process to ensure that ingestion of site contaminants does not occur.

B. Work in pairs whenever conducting Level B activity or permit required CSE activity.

C. Provide cooling devices. Ice vests or on-site showers can be provided to reduce BT and/or cool protective clothing.

   The amount and type of undergarments worn will be left to the preference of each individual unless prone to heat stress, especially heat rash. In this case, the worker can wear "long john" cotton type underwear to keep skin off chemical resistant clothing.

D. Adjustment of the work schedule. When practicable the most labor-intensive tasks should be carried out during the coolest part of the day.

E. Shaded or cooled rest areas. Shaded or cooled rest areas will be provided when site environmental and/or workers physiological responses warrant.

1.1.3 Heat Stress Monitoring

Physiological monitoring of personnel wearing an impermeable protective ensemble will be conducted at regular intervals at the beginning and conclusion of the work period. HR must be periodically measured for all site personnel when heat stress conditions (climate or wearing impermeable clothing) Additional physiological monitoring such as BT and body water temperature (BWT) monitoring can be measured for extreme temperatures and when impermeable clothing is worn.

A. HR must be measured by the radial pulse for 30 seconds as early as possible in the resting period and repeated approximately 3 minutes into rest period.

   The HR at the beginning of the rest period should not exceed 110 beats per minute. The HR also should not exceed 90 beats per minute after approximate 3 minutes of rest. If the HR does exceed the criteria, the next work period will be shortened by 33 percent, while the length of the rest period will remain the same. If the HR still exceeds the criteria at the beginning of the next rest period, the following work period will be shortened by 33 percent.

B. BT can be measured orally with a clinical or disposable thermometer in accordance with manufacturer's instructions, as early as possible in the rest period (before drinking liquid). Oral or ear temperature at the beginning of the rest period should not exceed 99.5°F. If it does, the next work period will be shortened by 33 percent while the length of the rest period will remain the same. However, if the OT exceeds 99.5°F at the beginning of the next rest period, the following work period will be shortened by another 33 percent. A worker will not be permitted to wear a semi-permeable or impermeable protective ensemble when his or her BT exceeds 99.5°F.

C. Body water loss (B.L.) due to perspiration can be measured by having the worker weigh him or her self at the beginning and end of each workday. Similar clothing should be worn at both weighing. B.L. should not exceed 1.5 percent total body weights in a workday.

Suggested Frequency of Physiological Monitoring for Fit and Acclimated Workers [1]

Adjusted Temperature [2]	Normal Work Ensemble [3]	Impermeable Ensemble [4]
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5° -90°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5° - 87.5°F (28.1° - 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5° - 77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

1 For work levels of 250 kilocalories per hour.

2 Calculate the adjusted air temperature (T_{adj}) using the following equation:

T_{adj} (°F) = Tadj (°F) + (13 x percent sunshine)

Measure the air temperature (Tadj) using a standard mercury-in-glass thermometer with the bulb shielded from radiant heat.

3 A normal work ensemble consists of cotton overalls with long sleeves and pants.

4 An impermeable work ensemble consists of impermeable coveralls with long sleeves and pants.

1.1.4 Recognition and Treatment

Any personnel who observes any of the following forms of heat stress either in themselves or In another worker, will report this information to his or her immediate supervisor or the SSHO.

A. Heat Rash (or prickly heat)

Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.

Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.

Treatment: Remove sources of irritation and cool the skin with water or wet cloths.

B. Heat Cramps or Heat Prostration

Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

Symptoms: Sudden development of pain and/or muscle spasms in the abdominal region.

Treatment: Remove the worker to the CRZ. Remove protective clothing. Decrease BT and allow a period of rest in a cool location.

C. Heat Exhaustion - SERIOUS

Cause: Over exertion in a hot environment and profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

Symptoms: Muscular weakness, staggering gait, nausea, dizziness, shallow breathing.

Treatment: Perform the following while simultaneously making arrangements for transport to a medical facility.

Remove the worker to the CRZ. Remove protective clothing. Lie the worker down on his or her back in a cool place, and raise the feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of a salt water solution consistency of one teaspoon salt in 12 ounces water. Transport the worker to a medical facility.

D. Heat Stroke - EXTREMELY SERIOUS

Cause: Same as heat exhaustion.

Symptoms: No perspiration, dry mouth, pain in the head, dizziness, nausea.

Treatment: Perform the following while making arrangements for transport to a medical facility.

Remove the worker to the CRZ. Remove protective clothing. Lie the worker down in a cool place and raise the head and shoulders slightly. Cool without chilling. Apply ice bags or cold wet cloth to the head. Sponge bare skin with cool water or rubbing alcohol. If possible, place the worker in a tub of cool water. Do not give stimulants. Transport to a medical facility.

HEAT STRESS MONITORING FORM

Project Name: ______________________________

Project Number: ______________________________

SHSO: ______________________________

Date	Title	Ambient Temp.	WBGT	Work/ Rest Regimen	Employee/ Location	Pulse Rate	Body Temp.	Body Water Loss	Comments

2.0 COLD STRESS

If work on this project begins in the winter months thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Localized cold exposure is generally labeled frostbite.

A. Hypothermia: hypothermia is defined as a decrease in the patient core temperature below 96°F. The BT is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interferences with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

B. Frostbite: frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 2°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of cold related illness can be aided by educating workers on recognizing the symptoms of frostbite and hypothermia and by identifying and limiting known risk factors. The workers should be provided with enclosed, heated invironments on or adjacent to the site, dry changes of clothing, and warm drinks.

To monitor the worker for cold related illnesses, start (oral) temperature recording at the job site:

- At the field team leader's discretion when suspicion is based on changes in a worker's performance or mental status.
- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
- As a screening measure whenever any one worker on the site develops hypothermia.

Workers developing moderate hypothermia (a core temperature of 92°F) should not return to work for at least 48 hours.

Progressive Clinical Symptoms of Hypothermia

Core Temperature (°F)	Symptoms
99.6	Normal core body temperature
96.8	Metabolic rate increases
95.0	Maximum shivering
93.2	Victim conscious and responsive
91.4	Severe hypothermia
89.6 - 87.8	Consciousness clouded, blood pressure difficult to obtain, pupils dilated but react to light, shivering ceases
86.0 - 84.2	Progressive loss of consciousness, muscular rigidity increases, pulse and blood pressure difficult to get, respiratory rate decreases
78.8	Victim seldom conscious
64.4	Lowest accidental hypothermia victim to recover

In order to minimize the risk of the hazards of working in cold environments, workers will be trained and periodically reinforced in the recognition of the physiologic responses of the body to cold stress. In addition, the use of insulated work clothing, warm shelters and work/warming regimens may be used to minimize the potential hazards of cold stress. Also, special attention will be paid to equipment warm-up time and freeze protection for vessels, piping, equipment, tools, and walking/working surfaces. The current ACGIH TLVs for cold stress found in this appendix will be used as a guideline.

APPENDIX L

COMMUNITY AIR MONITORING AND DUST/ODOR CONTROL PLAN

COMMUNITY AIR MONITORING AND ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

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COMMUNITY AIR MONITORING AND
ODOR/DUST CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

To ensure the safety of on-site workers and the local community, a comprehensive environmental site air-monitoring and odor/dust control program will be implemented during the project. SCE&G has successfully completed numerous former MGP remediation projects and has developed and refined a reliable and effective system for eliminating the potential for remediation worker or community exposure to the chemicals of concern originating from the coal tar impacted material. [It should be noted that dust presents a typical concern with former MGP site remediation projects. For the Congaree River Sediment Project, dust from excavation will be a minimal concern due to the subaqueous/wet nature of the TLM and impacted sediment to be removed.] The primary components of the air monitoring program include real-time excavation area and perimeter air monitoring, dust and odor control measures, controlled and methodical excavation and contained material handling work areas.

There are two basic objectives of the air monitoring program:

- Protection of the on-site remediation worker; and

- Protection of the surrounding community.

A brief overview of the safety program developed for the on-site worker is provided in the next section as it provides the basis for the community air-monitoring program.

ON-SITE REMEDIATION WORKER HASP

Based on regulatory requirements and SCE&G's commitment to health and safety, a Health and Safety Plan (HASP) was prepared and will be implemented to protect the health and well-being of the on-site remediation workers. In summary, the HASP specifically addresses:

- The potential hazards associated with completing the work;
- The primary chemicals of concern that site workers may be exposed to; and
- The safety measures, precautions and personal protective equipment (PPE) to be used by the on-site workers.

A major concern addressed by the HASP is the air-monitoring activities that will be completed during active excavation and material handling activities. Numerous procedures and techniques have been developed and will be implemented to minimize exposure to the on-site workers at the point of excavation and subsequently while handling and screening the TLM-impacted sediment. If the exposure concentrations exceed certain standards as specified in the HASP, then on-site personnel must upgrade their PPE accordingly. It is important to note that air monitoring within the active work zones at other previously completed MGP projects has not identified sustained elevated air monitoring readings within the work areas and SCE&G does not anticipate that this project will produce sustained elevated readings in the work zone.

Therefore, it stands to reason that if the air monitoring conditions at the point of excavation are acceptable to an on-site worker (without the need for PPE as specified in the HASP), then air concentrations at the perimeter monitoring stations will be substantially less.

Work Area Air Monitoring

The work area air monitoring will be conducted to ensure that remediation workers are safely able to complete their duties. If elevated readings are identified, then the appropriate engineering controls will be implemented to quickly reduce any air impacts. Impacted material excavation and handling activities will be conducted only in the river within the cofferdam footprint and within a temporary structure(s) located well away from potential residential areas.

Figure 2 provides the currently planned site operations scenario, which includes the approximate locations of the temporary structure(s) and the planned excavation areas. These structures and excavation areas will be the primary locations for the work area air monitoring activities. Periodic air monitoring will be conducted in the work zone (breathing zone) for the remediation worker likely to have the highest exposure. These readings will be compared to the established action levels located in the

HASP. Guidelines for specific project related activities that require air monitoring and the subsequent frequency of air monitoring are also presented in the HASP.

Volatile organic compounds (VOCs) associated with the constituents found in the TLM and dust/particulates will be the primary focus of the air monitoring program for this project. A photo-ionization detector (PID) and a particulate (dust) meter will be the instruments used to collect the periodic real-time measurements in the breathing zone in locations where impacted material is being handled. Examples of the instruments typically utilized for similar projects are provided in Attachment A. If sustained VOC readings are identified using a PID, additional air monitoring using constituent-specific detector tubes, as specified in he HASP will be conducted. Engineering controls such as the application of a foaming agent or the use of tarps or other such means to encapsulate the impacted material and limit the potential for volatilization will be implemented should conditions warrant. Water sprays will be utilized to control dust.

The remainder of this Plan describes the community air-monitoring program.

COMMUNITY AIR MONITORING & ODOR/DUST CONTROL PLAN

This Community Air Monitoring and Odor/Dust Control Plan (CAMP) was developed to specifically identify measures that will be implemented to assure minimal impacts to the local residents and the surrounding community while completing the Congaree River Sediment Project. There are two primary elements of this plan that consist of:

- Conducting perimeter air-monitoring activities in the vicinity of Senate and Gist Streets; and
- Implementing counter measures should the air monitoring activities warrant such mitigation activities.

SCE&G's objective for this plan is to measure air quality concentrations at the perimeter of the project area to be protective of human health and confirm that there are no exceedances of any applicable air quality standards. The approach to achieving this objective is rather straight forward as described below.

Perimeter Air Monitoring

SCE&G plans to implement a perimeter air monitoring program during completion of impacted material removal and handling operations. SCE&G does not foresee any scenario where elevated concentrations will be identified at the perimeter of the landside footprint. However, perimeter air monitoring has been conducted at other SCE&G MGP remediation sites and it successfully confirmed the absence of elevated concentrations at these locations.

Attachment B provides information on the predominant wind direction and wind speed for the Columbia Owens, SC weather station located approximately 3.5 miles southeast of the site. This weather station documents a predominant northeast to southwest wind direction. This approximate wind direction is also shown on Figure 3. With the prevailing wind direction blowing across the site from the northeast to the southwest, the downwind perimeter of the site would most often be the southeast corner, which is the Congaree River. Other than boaters utilizing this portion of the river on an infrequent basis, this perimeter location does not contain potential sensitive receptors. The primary location of potential sensitive receptors is the Senate and Gist Streets area and the Gervais Street Bridge. As a result, SCE&G has developed this perimeter air monitoring program to be protective of both the sensitive receptor areas and the downwind perimeter of the site at all times, regardless of wind direction.

SCE&G will establish a number of air monitoring stations along the northern and eastern landside perimeter, (Gervais Street Bridge and Senate and Gist Streets area), as shown on Figure 3. These stations will house VOC and particulate air monitors whenever impacted material handling operations are being conducted regardless of the predominant wind direction. Other similar stations will be established periodically around the remainder of the perimeter of the landside and riverside operations area. These stations will be utilized according to the prevalent wind direction. A windsock or another device on-site will be used to determine the direction of the wind. Wind direction, weather conditions and perimeter monitoring locations will be noted in the field logbook. Three stations in the Gist, Senate and Gervais Street areas will be supplemented with two downwind stations and one upwind (background station) that will be established on a daily basis. Implementation of this scenario will provide background data, downwind data and data directly adjacent to the Gervais Street Bridge and Senate and Gist Streets area.

The perimeter meters will conduct continuous real-time measurements of dust and organic compounds and will be set to log data at 15-minute intervals and to alarm at conservative action levels. The monitoring stations will be periodically inspected by site personnel and the data collected will be downloaded to the site computer and provided in the final report for the project. The data will also be available for review at any time.

For volatile organic vapors the PIDs will have an audible alarm set at a 15-minute average concentration of 1 ppm. This conservative action level has been successfully utilized at other SCE&G sites. If the ambient air concentration of total organic vapors at the northern and eastern landside perimeter or the downwind perimeter of the work area exceeds 1 part per million (ppm) above background for a 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level decreases (per instantaneous readings) below 1 ppm over background, work activities will resume with continued monitoring. If total organic vapor levels at the perimeter monitoring stations persist at levels in excess of 1 ppm over background work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions and monitoring continued until levels are reduced below 1 ppm and work activities can resume.

Similar to the VOC monitoring, the particulate monitoring will be performed at the perimeter locations using real-time monitoring equipment (e.g., DataRam) capable of integrating readings over a period of 15 minutes (or less) and data logging the results. The monitors will be set to alarm at the conservative action level and will be periodically inspected by oversight personnel. In addition, fugitive dust migration will be visually assessed during work activities. If the perimeter particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be immediately employed. Work may continue with dust suppression techniques provided that downwind particulate level does not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 μg/m^3 of the background level and in preventing visible dust migration.

It should be noted that all loading and off-loading activities will be conducted with care to minimize the occurrence of particulate emissions. Also, water-resistant tarps will be used on all vehicles loaded at the site to minimize the production of particulates during transportation off-site.

Air Monitor Calibration and Maintenance

All air monitoring equipment will be calibrated, maintained and operated in accordance with the instrument manufacturer's instructions. A written record of all air monitoring equipment calibration and adjustment information will be maintained. Initially, the PID and the MiniRam/DataRams will be calibrated/zeroed at the beginning of each workday. If manufacturer specifications and recommendations indicate that reduced calibration frequency is acceptable, then consideration to reduce the calibration frequency will be made prior to implementing the field work. Calibration and/or zeroing will also be conducted during work hours if a potential malfunction in the instrument is detected.

Odor Control

Odor control measures will be implemented, as needed to ensure that site activities do not produce unsatisfactory odors at the site perimeter. Use of the temporary structure(s) to house impacted material management operations will be a significant component of the odor control plan. Exposed impacted material will only be handled within the river excavation areas and the temporary structures. Plastic sheeting or tarps may be applied to cover impacted material and prevent or minimize fugitive odors. Additional control measures will be available on-site as a contingency measure when impacted material handling operations are ongoing. These include the following two commercially available odor suppressant technologies, or equivalent:

- **Bio Solve® –** Bio Solve® is a biodegradable, water-based product that has the ability to encapsulate hydrocarbon VOC vapors. The product is mixed with water at a 3 to 5 percent concentration and can be applied with a variety of water application spray methods. Bio Solve® is not subject to breaches or drawdown (like some foam applications) that allow for re-volatilization, making it a preferred option in windy conditions or on sloped surfaces.
- **Odor Suppressant Foam –** Odor suppressant foam can provide immediate, localized control of odor emissions. The foam is produced by injection of air into a foam concentrate/water mixture using a pneumatic foam unit. The foam is applied via a hose to cover source areas, generally to a depth of 3 to 6 inches. Short-term foam (such as Rusmar AC-645) is recommended to control odors from active excavations and stockpiles. This foam may last between 12 to 16 hours but because it can degrade quickly in direct sunlight, frequent and liberal applications may be necessary. For longer-term odor suppression, such as over weekends, a long-term foam (such as Rusmar AC-904) should be used.

Dust Control

Excavation area and perimeter air monitoring activities will provide real-time measurements of dust levels at the point of excavation and at the site perimeter. Dust is not anticipated to be an issue with the wet sediment. However, dust from applying a drying agent such as kiln dust may result in a short, transient dust cloud. Site personnel will visually monitor for dust during equipment movement and windy conditions. Nuisance dust from truck movements (haul roads) and drying agent application may require management through the application of a water spray via a water truck. A source of clean potable water will be obtained (most likely from a fire hydrant tap permit) and a water truck will be operated on-site to periodically dampen haul roads and other site areas exhibiting visible dust.

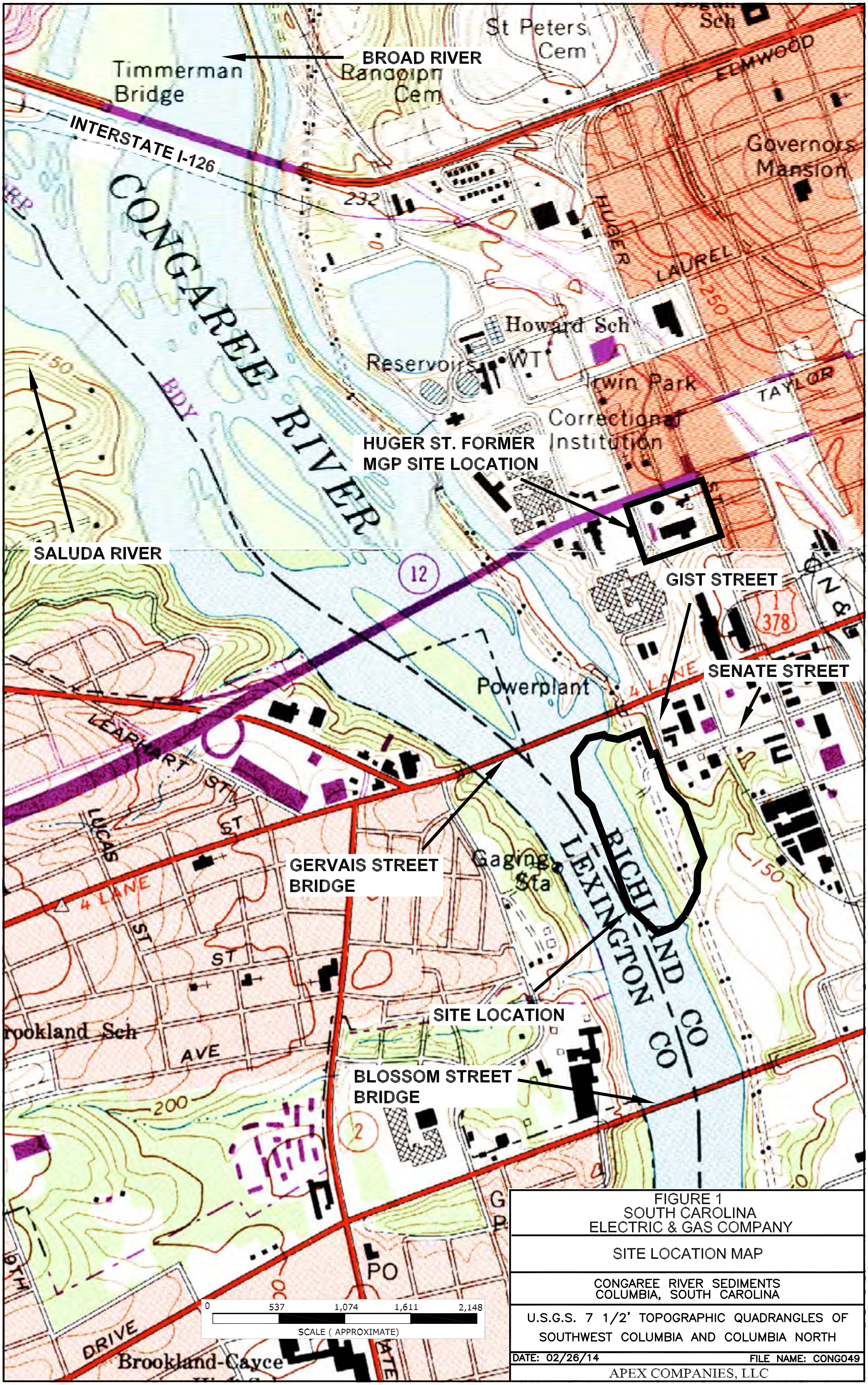


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

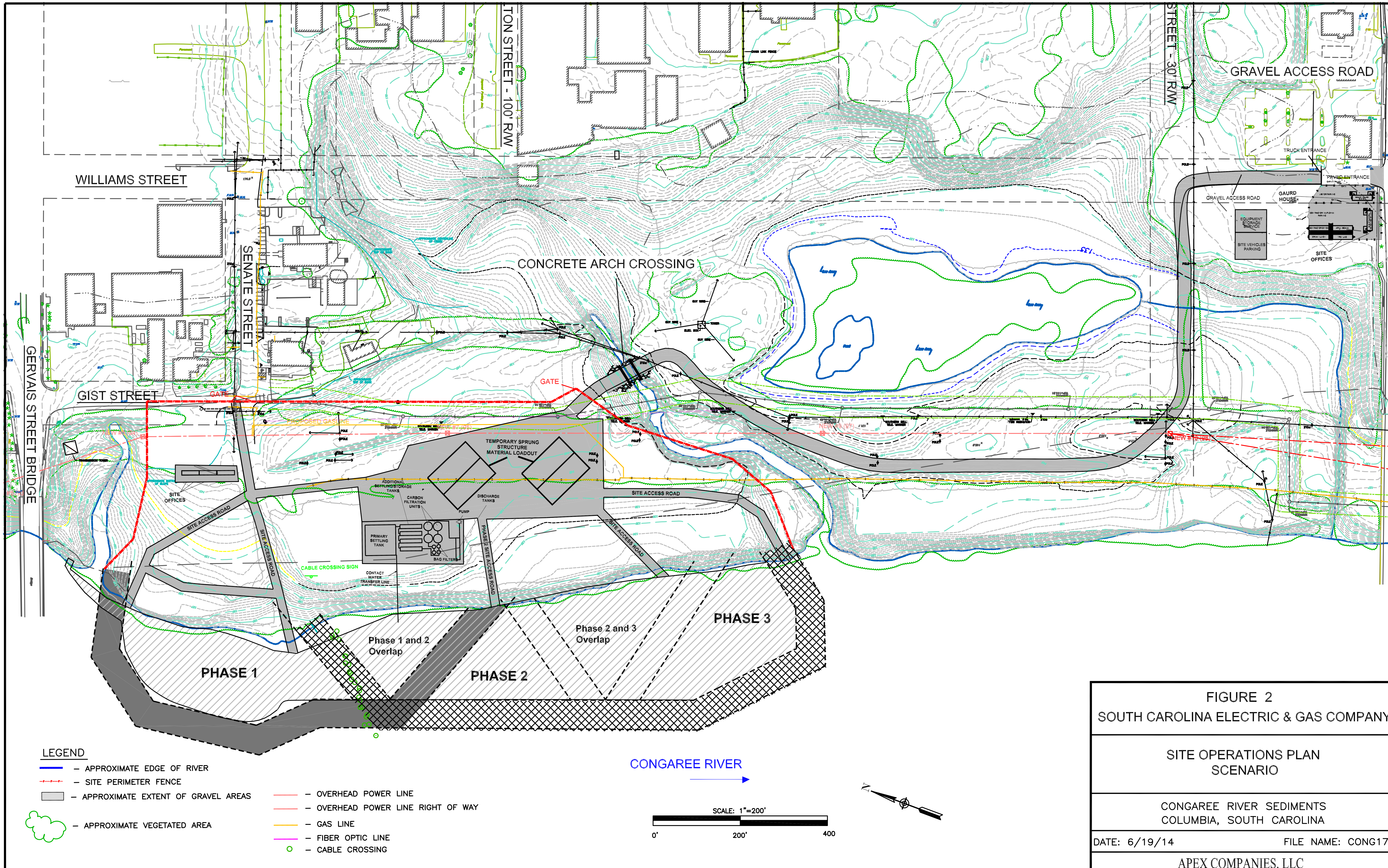
SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

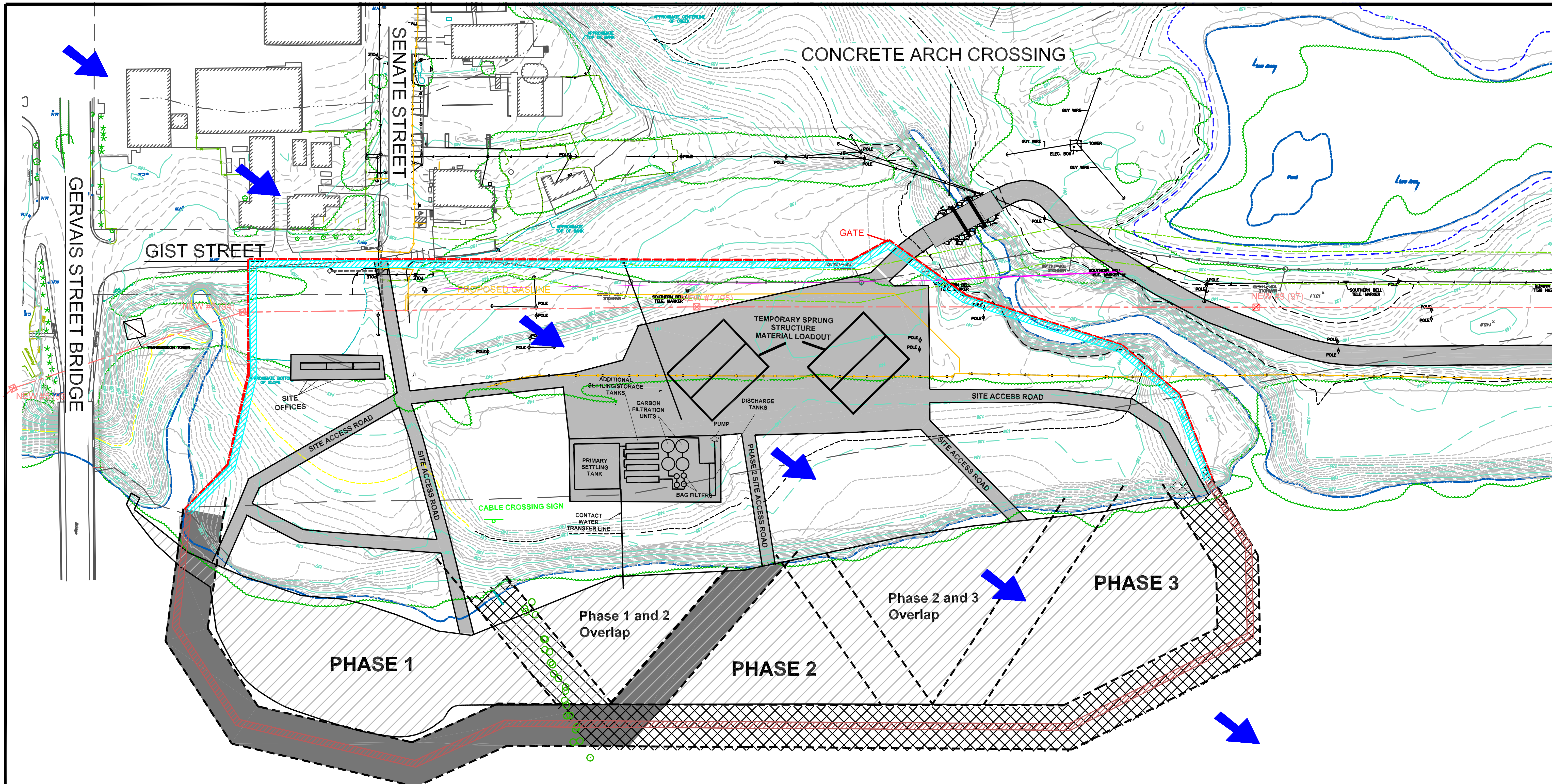
U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC



WILLIAMS STREET
SENATE STREET
GIST STREET
GERVAIS STREET BRIDGE
TON STREET - 100' R/W
STREET - 30' R/W
GRAVEL ACCESS ROAD
TRUCK ENTRANCE
PAVED ENTRANCE
GAURD HOUSE
EQUIPMENT STORAGE SERVICE
SITE VEHICLES PARKING
SITE OFFICES
CONCRETE ARCH CROSSING
GATE
TEMPORARY SPRUNG STRUCTURE MATERIAL LOADOUT
ADDITIONAL SETTLING/STORAGE TANKS
CARBON FILTRATION UNITS
DISCHARGE TANKS
PUMP
PRIMARY SETTLING TANK
BAG FILTERS
CONTACT WATER TRANSFER LINE
CABLE CROSSING SIGN
SITE ACCESS ROAD
PHASE 1
Phase 1 and 2 Overlap
PHASE 2
Phase 2 and 3 Overlap
PHASE 3
CONGAREE RIVER
SCALE: 1"=200'
0'
200'
400
N
LEGEND
– APPROXIMATE EDGE OF RIVER
– SITE PERIMETER FENCE
– APPROXIMATE EXTENT OF GRAVEL AREAS
– APPROXIMATE VEGETATED AREA
– OVERHEAD POWER LINE
– OVERHEAD POWER LINE RIGHT OF WAY
– GAS LINE
– FIBER OPTIC LINE
– CABLE CROSSING
FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY
SITE OPERATIONS PLAN SCENARIO
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/19/14
FILE NAME: CONG177
APEX COMPANIES, LLC



LEGEND

- APPROXIMATE EDGE OF RIVER
- SITE PERIMETER FENCE
- APPROXIMATE EXTENT OF GRAVEL AREAS
- APPROXIMATE VEGETATED AREA
- PREDOMINANT WIND DIRECTION
- OVERHEAD POWER LINE
- OVERHEAD POWER LINE RIGHT OF WAY
- GAS LINE
- FIBER OPTIC LINE
- CABLE CROSSING
- DAILY PERIMETER AIR MONITORING AREA
- WIND DIRECTION DEPENDANT MONITORING AREA

FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PERIMETER AIR MONITORING SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/25/14 FILE NAME: CONG136

APEX COMPANIES, LLC

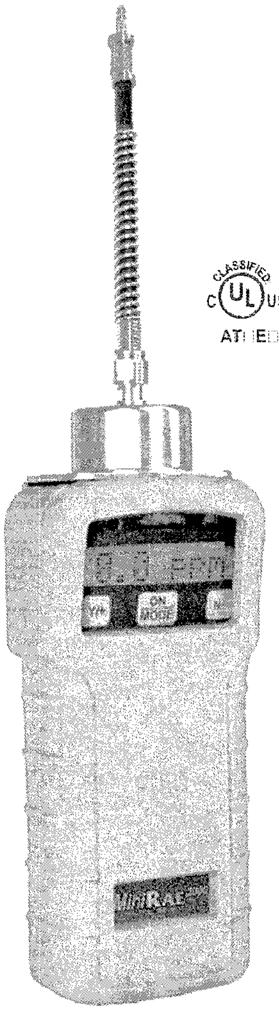
ATTACHMENT A

AIR MONITORING INSTRUMENT INFORMATION

MiniRAE 2000

Portable Handheld VOC Monitor

The rugged MiniRAE 2000 is the smallest pumped handheld Volatile Organic Compound (VOC) monitor on the market. Its Photoionization Detector's (PID) extended range of 0-10,000 ppm makes it an ideal instrument for applications from environmental site surveying to HazMat/Homeland Security.



c UL us
AT EX

Key Features

Proven PID technology
The patented 3D sensor provides a 3-second response up to 10,000 ppm and sets a new standard for resistance to moisture and dirt.

Self-cleaning lamp and sensor
Our patented self-cleaning lamp and sensor minimize the need for maintenance and calibration.

The MiniRAE 2000 lamp and sensor can be taken apart in seconds for easy maintenance without any tools!

Measure more chemicals than with any other PID With over 100 Correction Factors built into the MiniRAE 2000 memory and the largest printed list of Correction Factors in the world (300+), RAE Systems offers the ability to accurately measure more ionizable chemicals than any other PID. When a gas is selected from the MiniRAE 2000's library, the alarm points are automatically loaded into the meter.

User friendly screens make it easy to use for simple applications and flexible enough for sophisticated operations.

Drop-in battery When work schedules require putting in more hours than the 10 hours supplied by the standard NiMH battery, the drop-in alkaline pack supplied with every MiniRAE 2000 lets you finish the job.

Rugged Rubber Boot The standard rubber boot helps assure that the MiniRAE 2000 survives the bumps and knocks of tough field use.

Strong, built-in sample pump draws up to 100 feet (30m) horizontally or vertically.

Tough flexible inlet probe

Large keys operable with 3 layers of gloves.

Easy-to-read display with backlight.

Stores up to 267 hours of data at one minute intervals for downloading to PC (with the datalogging option).

3-year 10.6 eV lamp warranty

Applications

HazMat/Homeland Security

- Initial PPE (personal protective equipment) assessment
- Leak detection
- Perimeter establishment and maintenance
- Spill delineation
- Decontamination
- Remediation

Industrial Hygiene/Safety

- Confined Space Entry (CSE)
- Indoor Air Quality (IAQ)
- Worker exposure studies

Environmental

- Soil and water headspace analysis
- Leaking underground storage tanks
- Perimeter fence line monitoring
- Fugitive emissions (EPA Method 21)
- Vapor recovery breakthrough
- Landfill monitoring

RAE Systems Inc.
1339 Moffett Park Drive • Sunnyvale, California 94089 USA
Tel: 408.752.0723 • Fax: 408.752.0724
Email: raesales@raesystems.com • www.raesystems.com
rev10_ 04.04

ISO 9001 CERTIFIED

RAE SYSTEMS

Specifications*

Default Sensor Settings**

Gas Monitor	Range (ppm)	Resolution (ppm)	Response Time (T90)
VOCs	0 - 999 ppm	0.1 ppm	< 3 sec
	100 - 10,000 ppm	1 ppm	< 3 sec

Detector Specifications

Size	8.2"L x 3.0"W x 2.0"H (21.8 x 7.62 x 5.0 cm)
Weight	20 oz with battery pack (553g) w/o rubber boot
Sensor	Photoionization sensor with standard 10.6 eV or optional 9.8eV or 11.7 eV UV lamp
Battery	• Rechargeable, external, field replaceable Nickel-Metal-Hydride (NiMH) battery pack • Alkaline battery holder (for 4 AA batteries)
Operating Period	10 hours continuous operation
Display	Large LCD, backlight activated manually, with alarms or darkness
Keypad	1 operation and 2 programming keys
Direct Readout	• VOCs as ppm by volume • High and low values • STEL and TWA (in hygiene mode) • Battery and shut down voltage
Alarms	90 dB buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms automatic reset or latching with manual override • Optional plug-in pen size vibration alarm • User adjustable alarm limits
Calibration	Two point field calibration of zero and standard reference gas. Calibration memory of 8 calibration gases, alarm limits, span values and calibration date
Datalogging	Optional 267 hours (at one minute intervals) with date/time. Header information includes monitor serial number, user ID, site ID, date and time
Sampling Pump	• Internal, integrated flow rate 400 cc/min • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto shut-off pump at low flow condition
Communication	Download data and upload instrument set-up from PC through RS-232 link to serial port
Temperature	14° to 104°F (-10° to 40°C)
Humidity	0% to 95% relative humidity (non-condensing)
EM/RFI	Highly resistant to EMI /RFI. Compliant with EMC Directive 89/336/EEC
IP-rating	IP-55: protected against dust, protected against low pressure jets of water from all directions
Hazardous Area Approval	• US and Canada: UL and cUL, Classified for use in Class I, Division 1, Groups A, B, C and D hazardous locations • Europe: ATEX II IG EEx ia IIC T4
Attachment	Durable bright yellow rubber boot w/belt clip & wrist strap
Warranty	Lifetime on non-consumable components (per RAE Systems Standard Warranty), 1 year for 10.6.V PID lamp, 1 year for pump and battery

ATEX

ISO 9001 CERTIFIED

DISTRIBUTED BY:

MiniRAE 2000 and Accessories

Monitor only includes:

- 10.6eV, 9.8eV or 11.7eV as specified
- RAE Systems UV lamp: 10.6eV, 9.8eV or 11.7eV as specified
- 5-inch Flex-I-Probe
- External filter
- Rubber boot with belt clip
- Alkaline battery adapter
- Tool kit
- Lamp cleaning kit
- Nickel-Metal-Hydride battery
- 120/230 V AC/DC wall adapter (if specified)
- Operation and maintenance manual

Monitor with accessories kit adds:

- Hard transport case with pre-cut foam
- 5 porous metal filters and O-rings
- Organic vapor zeroing adapter
- Gas outlet port and tubing

Optional calibration kit adds:

- 10 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

Datalogging monitor adds:

- ProRAE Suite software package for Windows 98, NT, 2000 and XP
- Computer interface cable

Optional Guaranteed Cost of Ownership Program:

- 4-year repair and replacement guarantee
- Annual maintenance service

* On going projects to enhance our products means that these specifications are subject to change

** Performance based on isobutylene calibration

MiniRAE 2000

RAE Systems Inc.
1339 Moffett Park Drive • Sunnyvale, California 94089 USA
Tel: 408.752.0723 • Fax: 408.752.0724
Email: raesales@raesystems.com • www.raesystems.com

RAE SYSTEMS

Product Overview

All these applications in one small unit

- Indoor air quality monitoring
- Walk-through surveys
- Personal exposure monitoring
- Time & motion studies
- Workplace & plant monitoring
- Fixed-point continuous monitoring
- Remediation personal surveillance
- Remote alarming
- Mobile monitoring in vehicles & aircraft
- Toxicology & epidemiology studies
- Emergency response
- Testing air filtration efficiency

*personal*DataRAM™ Series

Measures airborne particulate concentration in real time

- *p*DR-1000AN
  For passive air sampling applications
- *p*DR-1200
  For active air sampling applications

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

*p*DR-1000AN
Hand-held and fixed-point, real-time aerosol monitor/datalogger

Measure airborne particulate concentration in real-time

The *personal*DataRAM (*p*DR-1000AN) measures mass concentrations of dust, smoke, mists, and fumes in real time, and sounds an audible alarm whenever the user-defined level is exceeded. Conventional filter-based monitoring methods cannot indicate dangerous, real-time dust levels. In contrast, the *p*DR-1000AN alerts you to a problem within seconds, allowing you to take immediate action. With the datalogging enabled, the instrument automatically tags and time stamps the data collected, and stores it for subsequent retrieval, printing, or graphing through a computer.

Highest performance of any real-time personal particulate monitor

With a measurement range from 0.001 to 400 mg/m^3 (auto-ranging), and an optical feedback stabilized sensing system, the *p*DR-1000AN sets the standard for sensitivity, long-term stability and reliability.

The palm-sized *p*DR-1000AN weighs only 18 oz (0.5 kg) for easy portability and attachment to a belt or a shoulder strap. The absence of any moving parts, such as pumps, motors and valves, and the use of low-power semiconductors housed in a ruggedized case ensures long life and dependable operation.

High correlation with gravimetric measurement

The *p*DR-1000AN is a light-scattering photometer (i.e., nephelometer) incorporating a pulsed, high output, near-infrared light emitting diode source, a silicon detector/hybrid preamplifier, and collimating optics and a source reference feedback PIN silicon detector. The intensity of the light scattered over the forward angle of 50^o to 90^o by airborne particles passing through the sensing chamber is linearly proportional to their concentration. This optical configuration produces optimal response to particles in the size range of 0.1-10 µm, achieving high correlation with standard gravimetric measurements of the respirable and thoracic fractions.

Simple zeroing and calibration

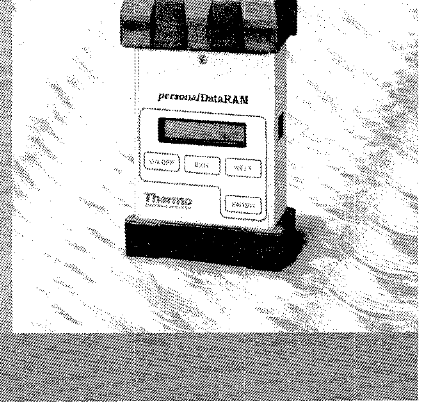
The *p*DR-1000AN arrives practically ready to use after the easy zeroing step. The unit comes gravimetrically calibrated in mg/m^3 (NIST traceable) using standard SAE Fine test dust (ISO Fine). Zeroing with particle-free air is accomplished quickly and effectively under field conditions using the zeroing kit included with the instrument. Internal firmware controls an automatic calibration check. To maximize efficiency in the field, gravimetric calibration can be performed by comparison with a filter sampler and programming of the calibration constant.

Standard Accessories

- Universal voltage power supply
- PC communications software
- Zeroing kit
- Belt clip kit
- Instruction manual
- Carrying case
- Signal output cables

Optional Accessories

- Rechargeable battery pack (NiMH)
- Active sampling kit (converts *p*DR-1000AN to *p*DR-1200)
- Portable pump unit
- Shoulder strap
- Remote alarm interface
- Wall mounting bracket



pDR-1200
Active aerosol monitor/datalogger, plus aerodynamic sizing

Designed for active particulate monitoring applications

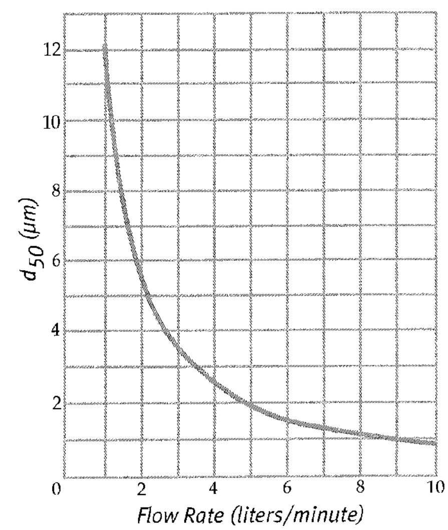
The *personal*DataRam™ (model *p*DR-1200) performs active sampling applications and aerosol sizing. The *p*DR-1200 requires a vacuum pump module to perform particle size selective measurements under field conditions. The separate pump (not included) is required for active sampling and aerosol sizing. With optional inlet accessories, the *p*DR-1200 is excellent for ambient air measurements under variable wind and high humidity conditions. It is ideal for respirable, thoracic, and PM2.5 monitoring, as well as continuous emission and test chamber monitoring. With an isokinetic sampling set, the pDR-1200 can be used for stack and duct extractive sampling monitoring. Membrane filters can be used to capture particles for particles for subsequent laboratory analysis.

Aerodynamic particle sizing

The *p*DR-1200 incorporates an optimally designed metal cyclone (BGI Model GK 2.05) or the optional low flow cyclone (BGI Model Triplex SCC1.062-CUST) especially selected for PM2.5 collection at 1.5 LPM. By operating the pump at specific sampling flow rates, the *p*DR-1200 cyclone preseparator provides precisely defined particle size cuts.

Primary calibration and particle samples by filter collection

An integral filter holder directly downstream of the photometric sensing stage accepts 37 mm filters. The calibration constant of the *p*DR-1200 is simply adjusted to coincide with the filter-determined concentration. Primary gravimetric calibration of the instrument concentration readout is easily accomplished under actual field conditions by means of this integral filter. Use membrane filters for chemical analysis or concurrent gravimetric measurements.

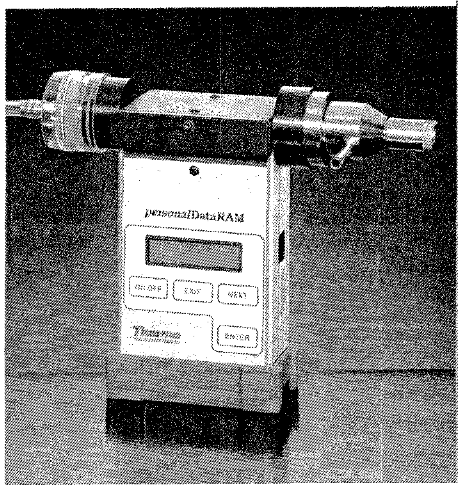


GK 2.05 Cyclone Cut Point (50%) as a Function of Flow Rate

*p*DR-PU Attachable Pump Module

This optional accessory is designed for use with the *personal*DataRAM Model *p*DR-1200. It incorporates a dual-chamber diaphragm pump, a volumetric flow sensing, and control unit. The pump module operates from either an optional, rechargeable NiMH battery pack or from AC line current using the power supply/charger supplied with the *personal*DataRAM. The *p*DR-PU is designed as a modular unit that can be used in various combinations.

- Flow rate (user adjustable): 1 to 4 liters/minute
- Maximum pressure drop: 10 in H2O (25 mbar)
- Precision of constant flow rate control: ±2%
- Power: 9 VDC, 200 mA at 4 liters/minute (approximate)
- Dimensions: 4 in (100 mm) H x 3.6 in (90 mm) W x 1.8 in (45 mm) D
- Weight: 1 lb (0.45 kg)



personal*DataRAM™ *Series

At last,
a compact,
versatile,
real-time
aerosol monitor

Specifications

Concentration Measurement Range (auto-ranging)
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm sg = 2.5, as aerosolized)
0.001 to 400 mg/m^3

Scattering Coefficient Range
1.5 x 10^{-6} to 0.6 m^{-1}(approx) @ lambda = 880 nm

Precision/Repeatability Over 30 Days (2-sigma at constant temperature and full battery voltage)
- $\pm$2% of reading or $\pm$0.005 mg/m^3, whichever is larger, for 1 second averaging time
- $\pm$0.5 of reading or $\pm$0.0015 mg/m^3, whichever is larger, for 10 second averaging time
- $\pm$0.2% of reading or $\pm$0.0005 mg/m^3, whichever is larger, for 60 second averaging time

Accuracy
Referred to gravimetric calibration with SAE Fine test dust (mmd = 2 to 3 mm, sg = 2.5, as aerosolized)
$\pm$5% of reading $\pm$precision

Resolution
0.1% of reading or 0.001 mg/m^3, whichever is larger

Particle Size Range of Maximum Response
0.1 to 10 µm

Flow Rate Range (model *p*DR-1200)
1-10 liters/min (external pump required)

Aerodynamic Particle Sizing Range
1.0 to 10 µm (*p*DR-1200 only)

Concentration Display Updating Interval
1 second

Concentration Display Averaging Time (user selectable)
1 to 60 seconds

Alarm Level Adjustment Range (user selectable)
Selectable over entire measurement range

Alarm Averaging Time (user selectable)
Real-time (1 to 60 seconds) or STEL (15 minutes)

Datalogging Averaging Periods (user selectable)
1 second to 4 hours

Total Number of Data Points That Can Be Logged in Memory
More than 13,300

Number of Data Tags (data sets)
99 (maximum)

Logged Data
- Each data point: average concentration, time/date, and data point number
- Run summary: overall average and maximum concentrations, time/data of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration, and time/date of occurrence, averaging (logging) period, calibration factor, and tag number

Analog Signal Output
0 to 5 V and 4 to 20 mA, with selectable full scale ranges between 0.1 and 400 mg/m^3

Power
- Internal battery 9 V alkaline, 20 hour run time (typical)
- Internal battery 9 V lithium, 40 hour run time (typical)
- AC source universal voltage adapter (included) 100-250 volts, 50-60 Hz (CE marked)
- Optional battery pack rechargeable NiMH, 72 hour run time typical (*p*DR-BP)

Readout Display
LCD 16 characters (4 mm height) x 2 lines

Serial Interface
RS232, 4800 baud

Computer Requirements
PC compatible, 486 or higher, Windows 95® or higher

Storage Environment
-20°C to 70°C (-4°F to 158°F)

Operating Environment
-10°C to 50°C (14°F to 122°F), 10 to 95% RH, non-condensing

Dimensions (max external)
153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D (*p*DR-1000AN)
160 mm (6.3 in) H x 205 mm (8.1 in) W x 60 mm (2.4in) D (*p*DR-1200 including cyclone and filter holder)

Weight
0.5 kg (18 oz) (*p*DR-1000AN)
0.68 kg (24 oz) (*p*DR-1200)

Approvals
- Intrinsic safety approval by US Mine Safety & Health Administration (MSHA) coal-mining environments containing methane gas (the *p*DR-PU pump is not approved by MSHA)
- US FCC Rules (Part 15)
- CE certified

Lit_PDREID_06/05

Thermo Electron Corporation
Environmental Instruments
27 Forge Parkway
Franklin MA USA 02038
www.thermo.com/ih

1.866.282.0430
+1.508.520.0430
+1.508.520.1460 fax

ATTACHMENT B

PREDOMINANT WIND DIRECTION INFORMATION

FIGURE 1

SOUTH CAROLINA

ELECTRIC & GAS COMPANY

LOCATION OF THE PROJECT AREA WITH RESPECT TO THE WEATHER STATION

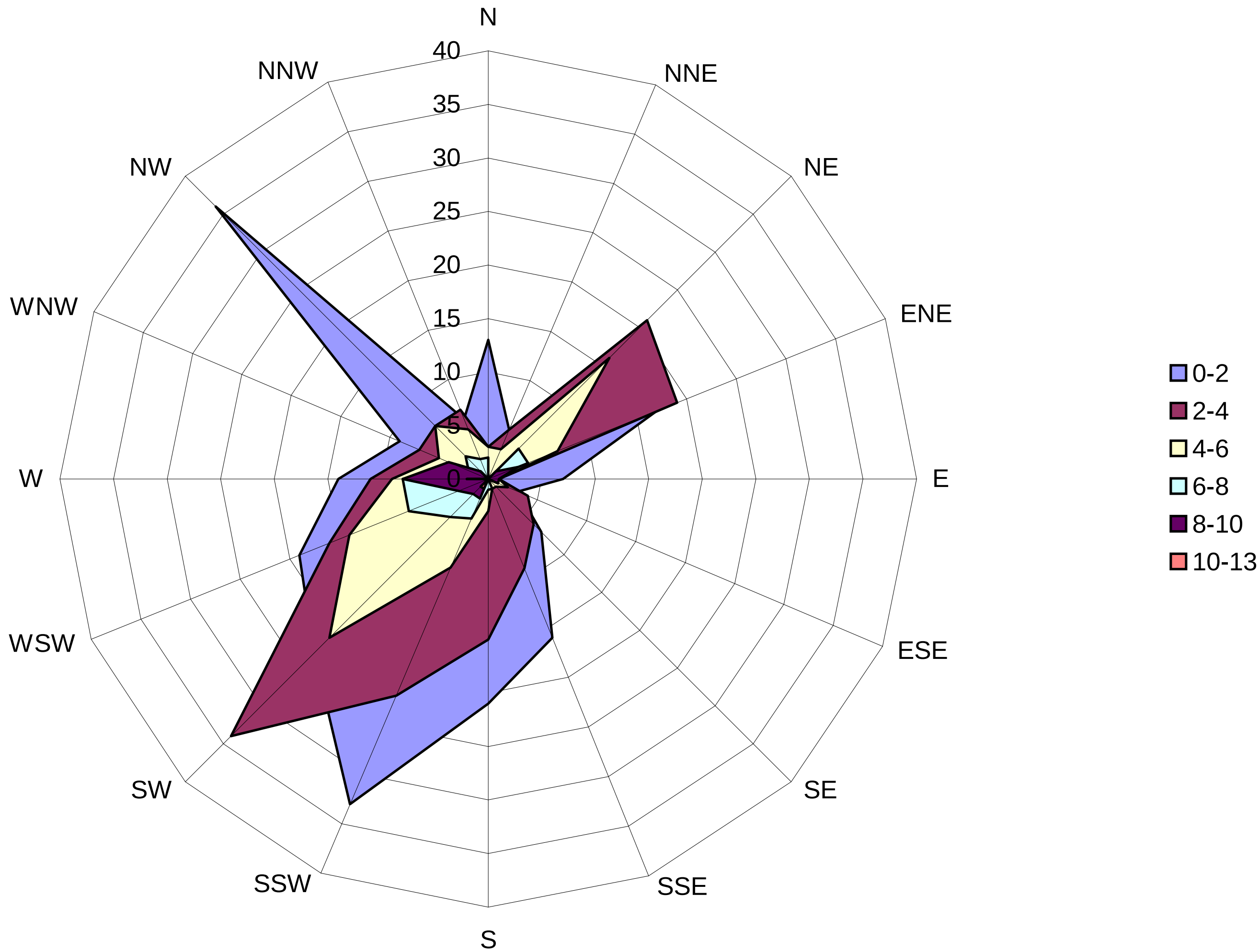
CONGAREE RIVER SEDIMENTS

COLUMBIA, SOUTH CAROLINA

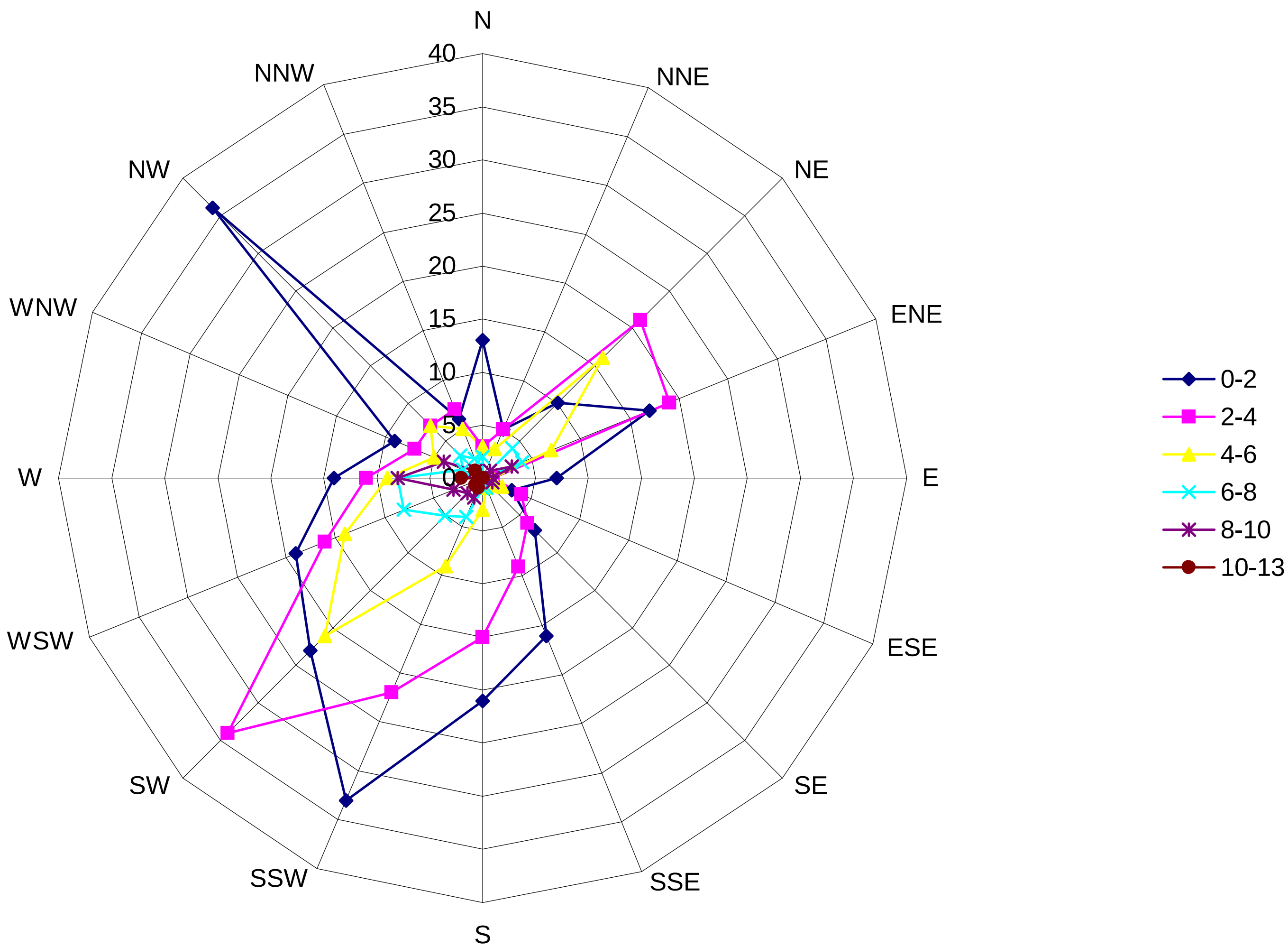
DATE: 05/05/2014 FILE NAME: WEATHER STATION

APEX COMPANIES, LLC

Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



Wind Speed (MPH) and Wind Direction (Degrees) in Columbia, SC 2004-2014



APPENDIX M

AIRBORNE DUST/PARTICULATE ACTION LEVEL CALCULATION

Calculation of a Site-specific airborne dust action level for PAHs:

EQUATION USED IN THIS CALCULATION

$$\text{Dust action level} = \frac{(10^6)(\text{Exposure Limit mg/m}^3)}{(\text{Soil/Waste Concentration mg/kg})(\text{Safety Factor})}$$

Constituent	OSHA Permissible Exposure Limit[(1)] (mg/m^3)	Total PAH Max Soil Concentration[(2)] (mg/Kg)	Safety Factor	Site-specific Dust Exposure Limit (mg/m^3)
Total PAHs	0.2	9429	4	5.30

Conversion to ug/m^3 $5.30\ mg/m^3 \times 1000\ ug/m^3$= 5300 ug/m3

Notes:

(1) OSHA Permissible Exposure Limit is for Coal Tar Pitch Volatiles which, by OSHA definition, include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter.

(2) The highest concentration of Total PAHs detected was collected from SCE&G S-1 on 6/28/2010.

APPENDIX M

NOTIFICATION PLAN

NOTIFICATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

NOTIFICATION PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to safely and appropriately remove the impacted sediment from the Congaree River and to restore the aquatic resource to its natural functions. Numerous project plans exist that describe the operational activities that will be utilized to remove the TLM from the river. This plan is intended to identify key third parties, local governmental officials, and State and Federal Agencies that would be notified if conditions occur that could result in significant disturbances or disruptions to project activities.

This document contains a contact list of Third Party Project Stakeholders, Adjacent Property Owners, Local Governmental Officials, and State and Federal Regulatory Agencies that may be contacted in the event of project conditions that result in significant interruptions or disturbances while the project is underway.

Conditions that require notification of Stakeholders, adjacent property owners, local governmental officials and State and Federal Regulatory Agencies include:

- **Type A** - Unpermitted discharges into the Congaree River, land or air;
- **Type B** - Any violation of project permits and approvals;
- **Type C** - Catastrophic failure of cofferdam, water management system, sprung structures, or other critical operational assets;
- **Type D** - Reportable injuries to project personnel;
- **Type E** - Significant traffic incidents (including loss of TLM material);
- **Type F** - Security breach (beyond that managed by on-site security); and
- **Type G** - Any other activities that result in a suspension of processing activities and/or off-site movement of TLM (for periods exceeding two operational months).

The following notification list is provided by category type:

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
Congaree Riverkeeper Bill Stangler PO Box 5294 Columbia, SC 29250	Ph: 803-760-3357 crk@congareeriverkeeper.org	A, G
River Alliance Michael Dawson, Director 420-C Rivermont Road Columbia, SC 29210	Ph: 803-446-1300 info@riveralliance.com	A, G
Granby Crossing (apartment complex located near the river) 100 Granby Crossing Cayce, SC 29033	Ph: 803-739-4857	G
City Club and Congaree Park residential communities (located along both sides of the river) Congaree Park Development Co. 831 Meeting Street West Columbia, SC 29169	Ph: 803-451-5234	G
Vista Guild Sarah Luadzers, Executive Dir. 701 Gervais Street Suite 150-118 Columbia, SC 29201	Ph: 803-269-5946 Sarah@vistacolumbia.com	G
Keep the Midlands Beautiful Jacqueline Buck, Executive Dir. PO Box 1360 Columbia, SC 29202	Ph: 803-733-1139	G
Greater Columbia Chamber of Commerce Ike McLeese, President and CEO 930 Richland Street Columbia, SC 29201	Ph: 803-733-1111 imcleese@columbiachamber.com	G
Friends of the Congaree Swamp John Grego	Ph: 803-331-3366	G
Adventure Carolina Jane Scott and David Mikell	Ph: 803-796-4505	G
Adjacent Property Owners:		
Guignard and Associates Charlie Thompson	Ph: 803-254-2125	C, G
Dupre Catering and Events Bobby Percival	Ph: 803-748-4144	C, G
City Club Condos Homeowners Association C. Dixon Lee (contact)	Ph: 803-343-3300	C, G
MJS Inc. Property Management City Club Condominiums 4910 Trenholm Rd. Columbia, SC 29206 Contact: Patricia Dawkins	Ph: 803-743-0600 ext 114	G

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
City of Columbia:		
Asst. City Manager Missy Gentry	Ph: 803-545-3026	C, E, G
Columbia Police Department	Ph: 803-545-3500	E, F
Columbia Fire Department	Ph: 803-545-3700	(as appropriate)
Columbia Traffic Engineering David Brewer	Ph: 803-545-3850 ddbrewer@columbiasc.net	E, G
Columbia Waste Water Dept.	Ph: 803-545-3400 CustomerCare@ColumbiaSC.Net	B, C, G
The Development Center (Land Disturbance Permit) -or- Tracy Mitchell, Stormwater Engineer	Ph: 803-545-3483 Stormwater@ColumbiaSC.Net Ph: 803-545-3304	B
City of Cayce:		
Cayce City Manager Rebecca Vance	Ph: 803-550-9557 rrhodes@cityofcayce-sc.gov	E, G
Cayce Traffic Engineering	Ph: 803-794-0456	E, G
Cayce Fire Department	Ph: 803-794-0456	E
Cayce Police Department	Ph: 803-794-0456	E
City of West Columbia:		
West Columbia City Administrator Jennifer T. Cunningham	Ph: 803-791-1880 ext. 600	G
Richland County:		
Richland County EMS	Ph: 803-576-3400	D (as appropriate)
Region IV FEMA	Ph: 770-220-5200	G (flood related issues)
SC Regulatory Agencies:		
SCDHEC Bureau of Land Management Lucas Berresford	Ph: 803-231-9031	A, B, C
SCDHEC Bureau of Water Mark Giffin	Ph: 803-898-4179	A, B, C (applicable to water related issues)

Third Party Stakeholders	Contact Information	Type of Event Requiring Notification
SCDHEC Bureau of Water Water Quality Certification and Wetlands Section Chuck Hightower, Manager	Ph: 803-898-0369	A, B, C (applicable to water related issues)
SCDNR Wildlife and Freshwater Fisheries Vivianne Vejandi	Ph: 803-734-4199	A, B, C (applicable to water related issues)
SCDHEC Air Quality	Ph: 803-898-4123	A, B, C (applicable to air quality issues)
South Carolina State Historic Preservation Office Emily K. Dale	Ph: 803-896-6181	B (applicable to historical preservation issues)
South Carolina Institute of Archeology and Anthropology Jim Spirek	Ph: 803-576-6566	B, C (applicable to historical preservation issues)
South Carolina DOT	Ph: 855-467-2368 -or- 803-737-2314	B (applicable to DOT related incidents)
Federal Regulatory Agencies:		
USACE Columbia Office Chip Ridgeway Brice McKoy	Ph: CR - 803-253-3906 Ph: BM - 834-1079	A, B, C, G
USACE Huntsville Office Chris Cochrane Project Manager	Ph: 256-895-1696	B, C, G
US National Marine Fisheries NOAA Charleston Jaclyn Daly-Fuchs (Pace Wilber, Virginia M. Fay)	Ph: 843-762-8610	A, C, G
US National Marine Fisheries Southeast Regional Office St. Petersburg, Fla Kelly Shotts	Ph: 727-551-5773	A, C, G
US Fish and Wildlife M. A. Caldwell Jay Herrington Dr. Thomas Rainwater (ext. 218)	Ph: 803-727-4707	A, C, G

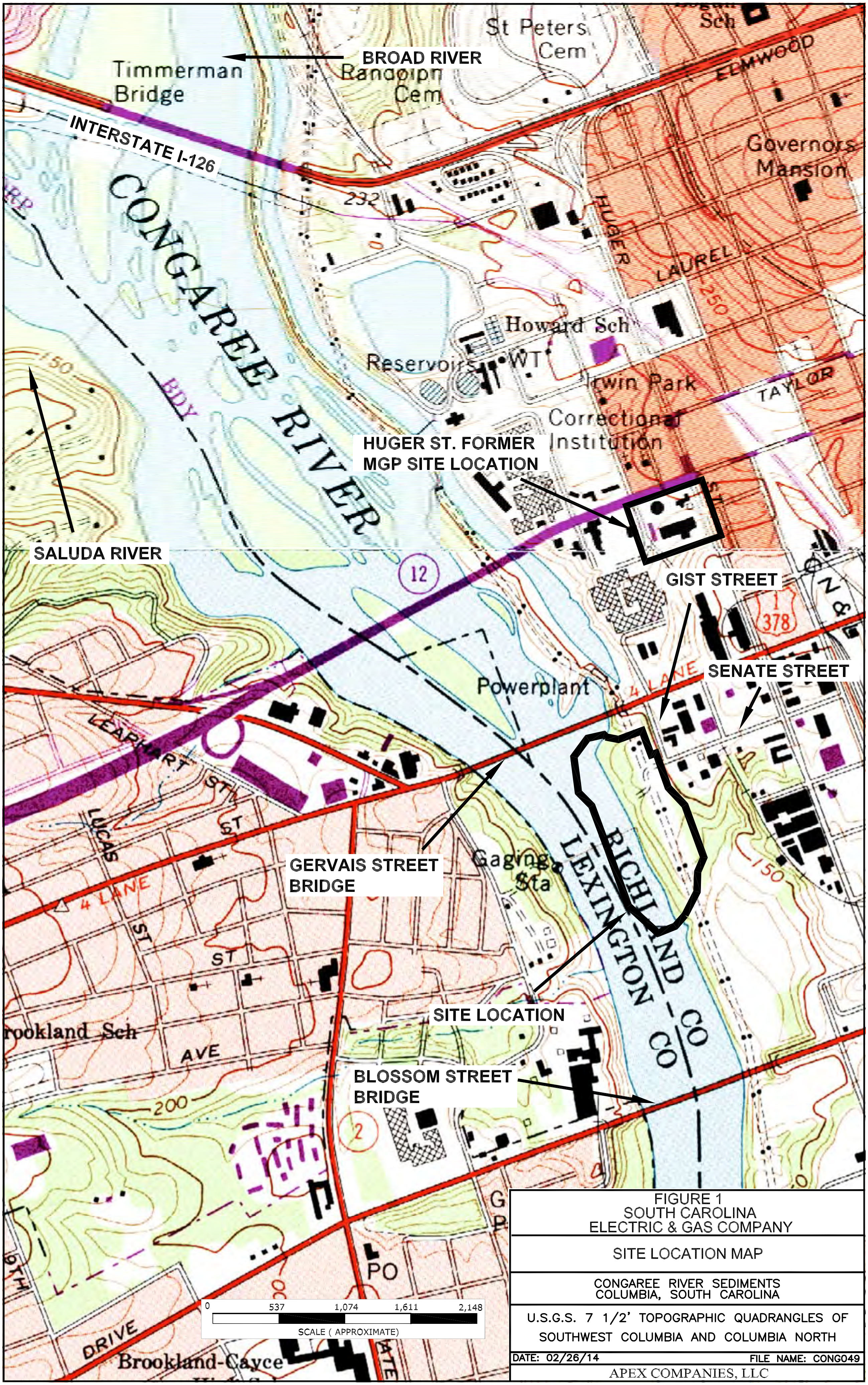


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

APPENDIX N

ARTIFACT RECOVERY AND ARTIFACT CONSERVATION PLAN

State Historic Preservation Office/ South Carolina Institute of Archeology and Anthropology (6/26/14)

The purpose of this document is to explain the relationship between the South Carolina State Historic Preservation Office (SHPO) and the South Carolina Institute of Archeology and Anthropology (SCIAA) in matters involving the recovery of historic artifacts located in the waters of the State of South Carolina and more specifically the SCE&G Congaree River Project located in downtown Columbia, South Carolina.

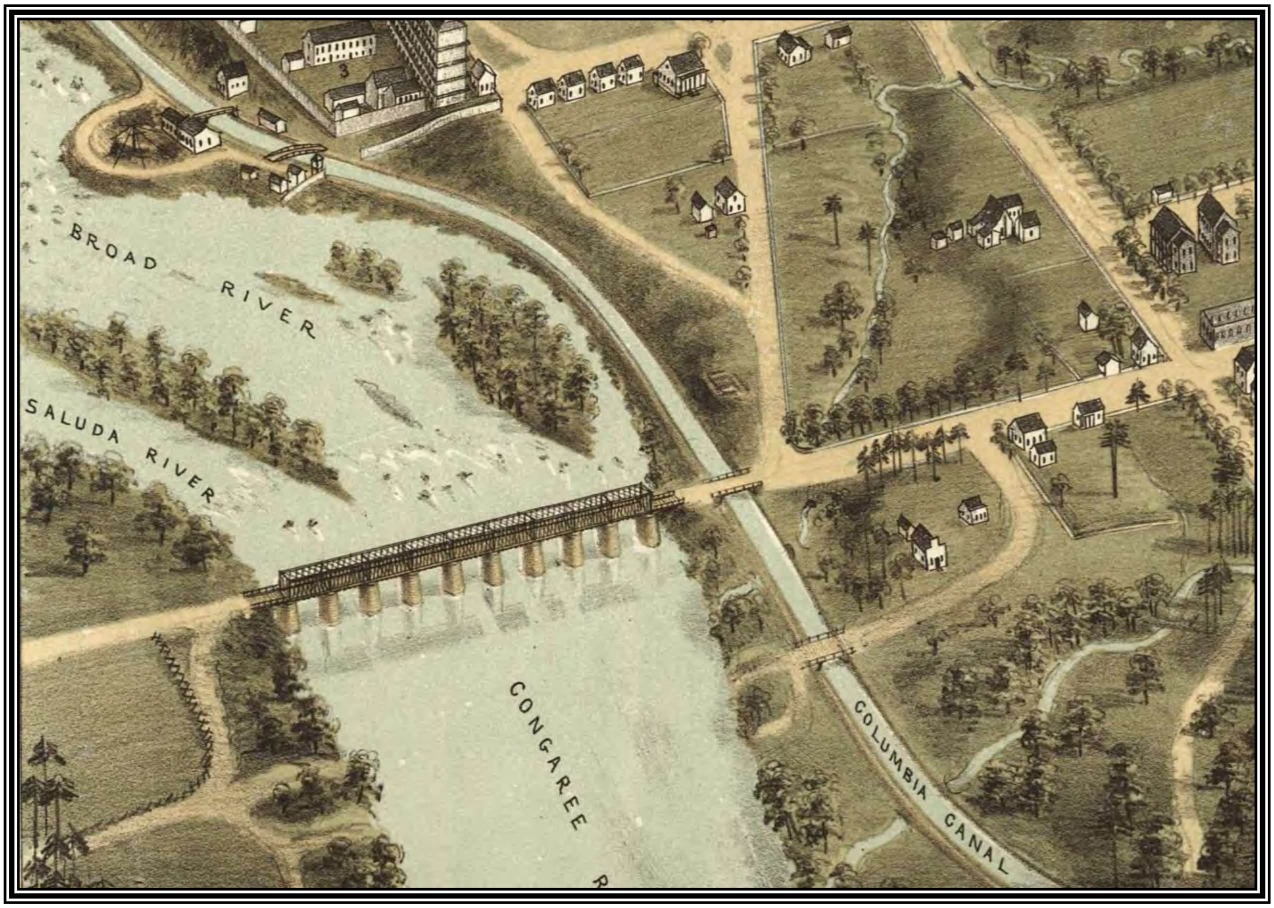
The recovery of artifacts located beneath the waters of the State of South Carolina is regulated pursuant to the South Carolina Underwater Antiquities Act (UAA). The UAA requires the recovering party to obtain a Commercial Data Recovery Salvage License pursuant to the Underwater Antiquities Act of 1991 (Article 5, Chapter 7, Title 54, Code of Laws of South Carolina, 1976) prior to disturbing any potential artifacts. The UAA requires the applicant to submit a plan that defines recovery techniques, and to submit an Artifact Analysis and Conservation Plan (AACP). The AACP must address initial documentation, storage prior to conservation, encrustation removal, analysis of artifacts and curation of artifacts.

Authority to regulate the recovery and conservation of artifacts from the Congaree River was delegated to SCIAA by the SCSHPO. Meetings were held by SCE&G in 2010 with SHPO staff (Dr. Jodi Barnes) to ensure that the company understood the appropriate process for managing objects of potential historic value. At SHPO direction the company began meeting regularly with SCIAA staff in 2010 and since that time many meetings with SCIAA have occurred as SCE&G began the process of preparing appropriate plans to recover potential artifacts and ensure compliance with the UAA.

In order to update the record a meeting with Emily Dale (State Archeologist) has been scheduled for July 1, 2014. During that meeting SCE&G will seek to obtain a letter addressed to USACE that documents the SHPO/SCIAA relationship for the project files and to discuss any potential historic structures/sites within the vicinity of the project site. Currently two identified sites (Gervais Street Bridge and Columbia Canal) are in immediate proximity to the project location.

Attached to this correspondence is a copy of the SCE&G Application of March 2014 to SCIAA for an exclusive Commercial Data Recovery License for the Congaree River Project.

APPLICATION FOR A COMMERCIAL DATA RECOVERY LICENSE RELATING TO WORK CONDUCTED FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT, COLUMBIA, SOUTH CAROLINA



Birdseye View of the city of Columbia showing the Gervais Street Bridge (C. Drie, 1872).

March 2014

APPLICATION FOR A COMMERCIAL DATA RECOVERY LICENSE RELATING TO WORK CONDUCTED FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT, COLUMBIA, SOUTH CAROLINA

Submitted to:

SOUTH CAROLINA INSTITUTE OF ARCHAEOLOGY AND ANTHROPOLOGY
MARITIME RESEARCH DIVISION
1321 Pendleton Street
Columbia, SC 29208

By:

TRC ENVIRONMENTAL CORPORATION
621 Chatham Avenue
Columbia, South Carolina 29205

On Behalf of:

SCANA SERVICES, INC.
200 Operation Way
Cayce, South Carolina 29033

Sean Norris, Program Manager Archaeology

March 2014

INTRODUCTION

TRC Environmental Corporation (TRC), on behalf of SCANA, is pleased to provide the following information for Artifact Recovery and Artifact Conservation related to the Congaree River Sediment Removal Project. This plan is being submitted as part of the application for an Exclusive Commercial Data Recovery Salvage License as pursuant to the Underwater Antiquities Act of 1991 (Article 5, Chapter 7, Title 54, Code of Laws of South Carolina, 1976). Due to the extensive nature of the undertaking a one year license is being requested with the expectation that up to three additional year-long extensions will be requested. Mr. Robert Apple, SCANA Project Manager, will be the license holder.

The excavation and recovery of submerged artifacts will be conducted in support of and concurrently with a large scale environmental remediation project. The project involves the removal of contaminated sediments in the Congaree River. In June 2010, tarlike material (TLM) was reported near the eastern shoreline of the Congaree River directly downstream of the Gervais Street Bridge. The South Carolina Department of Health and Environmental Control (SCDHEC) began sampling material from the river and concluded that the source of the TLM was a manufactured gas plant (MGP) that operated on Huger Street in downtown Columbia from 1906 to the mid-1950s. During its period of operation the MGP had allowed coat tar runoff to empty into the Congaree River.

This MGP, after a series of mergers and acquisitions, became one of South Carolina Electric and Gas's (SCE&G) predecessor companies. As a result SCE&G owned the land the former MGP occupied. In 2002 SCE&G had entered into a Voluntary Cleanup Contract with SCDHEC to mitigate the former MGP site. Beginning in 2008 SCE&G removed over 125,000 tons of MGP impacted soil and debris from the Huger Street location. Since the discovery of tar in the river SCE&G has worked with SCDHEC in order to define the extent of the TLM contamination, and has conducted a series of surveys to establish the vertical and horizontal distribution of the TLM. The project area begins directly south of the Gervais Street Bridge and extends downstream for approximately 2,000 feet; it extends approximately 300 feet into the river from the eastern bank (Figure 1).

In 2013 SCDHEC approved the Project Delineation Report and tasked SCE&G to develop an appropriate plan for the removal and mitigation of the contaminated soil. In 2013 a report detailing four "removal action" options was submitted to SCDHEC. The four options were:

1. No Action – Leave the TLM in place.

2. Monitoring and Institutional Controls – Leave the TLM in place, restrict access to the area, and conduct annual monitoring.

3. Sediment Capping and Institutional Controls – Place a physical barrier on top of the contaminated sediment effectively burying the TLM and conduct annual monitoring.

4. Removal – Physically remove the TLM and contaminated sediment.

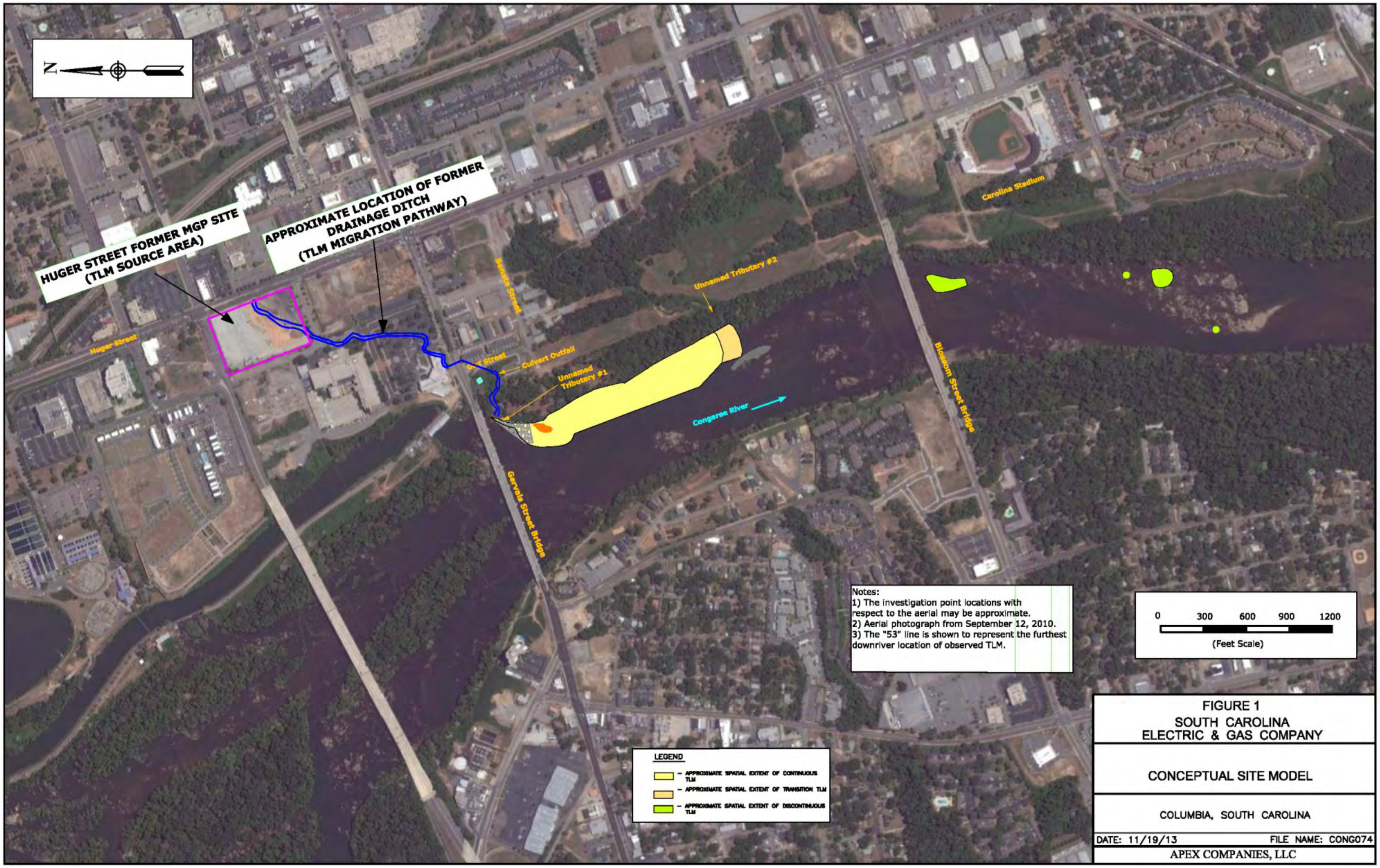


Figure 1. Project location map.

SCDHEC approved option four as the preferred method of dealing with the TLM. This method was deemed to the most protective of human health and the environment because it would permanently remove the contaminated sediment.

PROJECT DESCRIPTION

The recovery of archaeologically significant artifacts will take place concurrently with the proposed environmental remediation project. The remediation and removal of the TLM and contaminated sediments will involve the following activities:

- Conducting landside clearing, grading and site setup activities;
- Installing a cofferdam of sufficient height to restrict river flow;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment and debris using conventional equipment;
- Conditioning the sediment material for transportation to the landfill;
- Backfill as necessary; and
- Off-site disposal.

An average of two feet of sediment will need to be removed over the entire project area. This is equal to approximately 40,000 tons of sediment requiring removal and off-site treatment or disposal. Prior to activities in the river, construction on the eastern shoreline to improve access to the project area for personnel, equipment and material transportation trucks will be conducted. These construction activities would include clearing and grading operations in the area of the Senate Street alluvial fan and along the eastern shoreline as well as improving and/or creating access roads. A project compound with office trailers, support structures and associated electrical power and utilities would be required. Protective fencing would also be installed to restrict access to the work areas by unauthorized personnel.

The first component of the sediment removal will be the construction of a cofferdam around the planned removal areas. Figure 2 provides a potential sediment removal scenario with an assumed cofferdam configuration. The purpose of the coffer dam is to isolate and dewater the areas prior to initiating the removal operations. Due to the varying thickness of sediment, the uneven nature of the riverbed and changing conditions within the project area a number of different methodologies and equipment will be employed to complete the project. Generally speaking, heavy equipment/machine excavators coupled with vacuum removal or other techniques will be employed to remove the sediment to bedrock. The sediment will be removed in 50 × 50 foot grid squares.

Once removed, the sediment would likely require drying or solidification prior to transporting. Depending on the amount of TLM in the sediment the material will either be sent to an on-site sorting facility for screening or to an off-site facility for visual examination prior to disposal in a landfill. In order to minimize potential impacts on spawning migrations for threatened and/or endangered species a construction phase (for actual work in the river) would begin no earlier

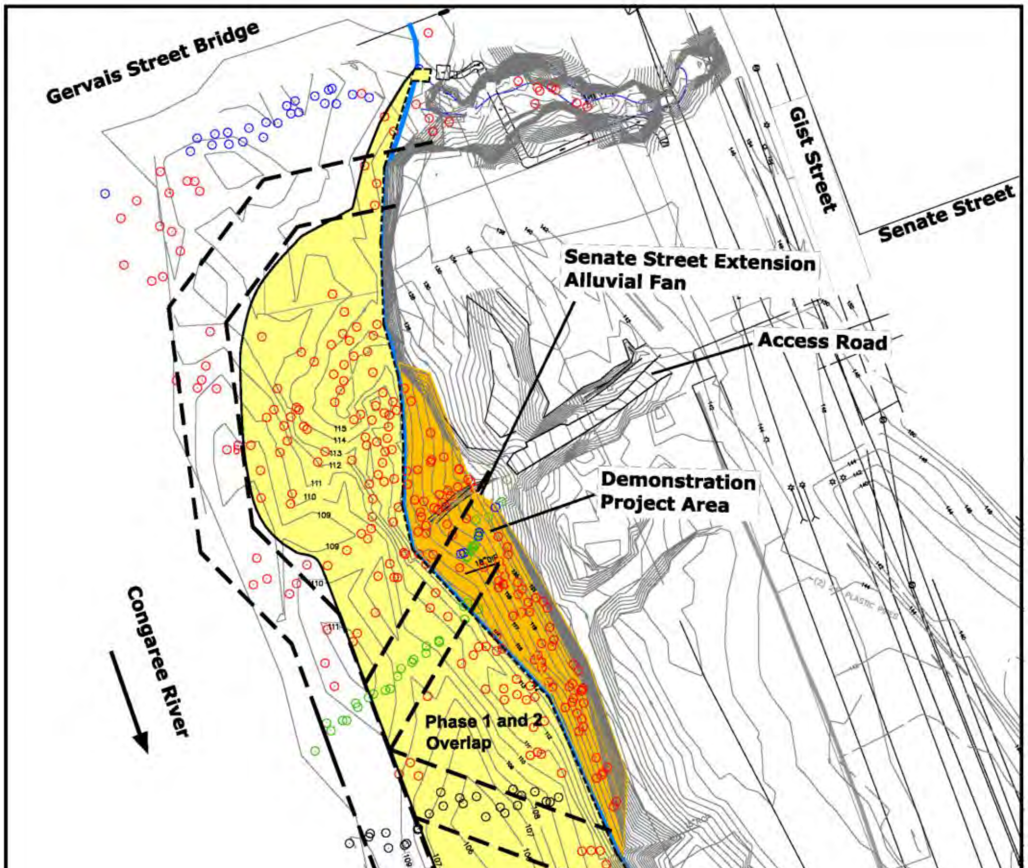


Figure 2. Recovery phase plan map.

than May and need to end by October of each year. Because of this, and the amount of material to be removed, it is projected that multiple construction seasons or phases will be required. Once each construction phase is completed the river bottom would be restored to its approximate original conditions by the placement of imported fill sand or rock as may be required and the cofferdam would be removed, potentially to be reused as fill or erosion protection.

ARCHAEOLOGICAL SIGNIFICANCE

On February 17, 1865 General Sherman's troops captured Columbia. During the two day occupation, live munitions and other weapons of war housed at the Palmetto Armory were dumped into the Congaree River near the Gervais Street Bridge. According to Civil War Records:

> *A detail of 500 men each from the First and Second Brigades, properly officered for fatigue duty, together with the pioneer corps and fifty wagons, reported to Captain Buel, chief ordnance officer, to destroy public works, machinery, ordnance, ordnance stores, and ammunition, of which there were large quantities.*
>
> *General John. E. Smith*

According to General Smith it took 1200 men and 50 wagons from 1 P.M. February 18 to 6 P.M. February 19 to destroy the machinery, ordnance, ordnance stores and ammunition. Figure 3 provides a list of the ordnance captured.

Soon after Union troops departed Columbia ordnance recovery began. The accounts of J. F. Williams indicated that industrious citizens of Columbia were quick to salvage powder from the boxes of paper cartridges that had been left on the bank and for years after the war people would dive into the river and recover cannon balls and shells (Williams 1929).

Newspaper articles dating to the 1930s and more formal recovery attempts conducted in the 1970s and 1980s provide supporting evidence that Civil War ordnance is still present in the river. In June 1930, *The State* reported that two fishermen recovered ammunition from the area of a small tributary near the base of the Gervais Street Bridge. The discovery motivated New Brookland Mayor L. Hall and Councilman D. A. Spigner to organize a project to recover the artifacts. Their recovery was extensive and labor intensive. A coffer dam was erected approximately where Senate Street terminates at the river. After digging through the mud and silt the project collected six 10-inch cannonballs, 1,010 round rifle balls, 767 pointed rifle balls, a number of cast-iron copper fused explosive cannon shells; and cast iron lead butt explosive shells; three cast-iron cannon balls; one brass cap explosive, 11 3½-inch round cannon balls, 51 2-inch cannon balls; 2 6-inch cannon balls; 3 3½-inch time fuse explosive bombs; and an artillery axe (*The State* 1930). According to the article Hall and Spigner believed they had recovered practically all the ammunition that was deposited in the river. Based on the inventory presented in Figure 3, however, the 1930s recovery accounts for only a fraction of what may be present.

Eight years after the Hall and Spigner conducted their recovery, the *Spartanburg Herald* reported that two New Brookland high school boys found an artillery projectile in the Congaree River. The boys, Luther J. Morris and Knowiton Jeffcoat, apparently attempted to melt lead out of the round causing a minor explosion that brought the find to the attention of New Brookland authorities (*The Spartanburg Herald* 1938).

Beginning in the 1970s a number of formal recovery and salvage projects have been conducted at the sites. A majority of these projects have been conducted with licenses provided by the South Carolina Institute of Archaeology and Anthropology (SCIAA) under the Underwater Antiquities Act, providing a precedent for conducting the currently proposed project under a similar Salvage License. In the winter of 1976 an acoustic survey in the Congaree River below the Gervais Street Bridge was conducted to identify concentrations of ordnance and artifacts. Although conditions were not ideally suited for an acoustic survey the project identified a concentration of ferrous material below the Gervais Street Bridge (Finkelstein 1976).

Inventory of ordnance and ordnance stores captured in Columbia, S. C., February 17, 1865.

Ball cartridges (no caps)		1,200,000
Percussion caps		100,000
Powder	pounds	26,150
12-pounder gun ammunition, fixed	rounds	1,007
6-pounder gun ammunition, fixed	do	3,852
24-pounder gun ammunition, fixed	do	546
8-inch shot and shell	do	2,364
10-inch shot and shell	do	1,320
Stands of arms		10,410
Unfinished arms		6,000
6-pounder guns		14
James guns		2
12-pounder mountain howitzers		5
Blakely guns		4
18-pounder rifled guns		3
Wiard gun		1
3-inch rifle		1
10-pounder guns		2
4-inch gun		1
4-inch mortars		2
6-inch Coehorn		1
Bronze guns, caliber 1½ and 2 inches		4
4-inch gun, smooth-bore		1
10-pounder Parrotts		2
Repeating battery		1
Gun carriages		9
Gun caissons		14
Gun (mountain howitzer) caissons		3
Forges		2
Anvils		4
Blacksmiths' vises		20
Sponges and rammers		1,125
Sabers, cavalry, artillery, and naval		3,100
Saber knots		700
Pairs cavalry pistol holsters		300
Saber belts		800
Bayonet scabbards		4,000
Cartridge-boxes (infantry)		5,150
Cartridge-box plates		3,500
Cartridge-box belts and plates		2,500
Waist-belts		2,900
Waist-belt plates		3,600
Ball screws		2,000
Pistol cartridge-boxes		550
Gunners' shot-pouches		600
Knapsacks		1,100
Haversacks		900
Slow match	yards	500
10-inch fuses		900
Tents		58

PHILIP MACCAHILL,
Lieut. and Actg. Ordnance Officer, First Div., Fifteenth Army Corps.

Figure 3. Inventory of ordnance caputured during the occupation of of Columbia.

Under a salvage license issued in 1980, diver Gerald Mahle discovered a cache of 10-inch cannon balls at the site. Mahle and his team estimated that 50 to 100 additional shot lay in the river. However, by the time they were able to return to the river divers associated with the Savannah River Dive Club in Hampton, South Carolina had removed the ordnance (Salvage License No. 26 file SCIAA).

Mahle continued work under the SCIAA permit from February through September 1981. Using a dragline, a backhoe and a gold dredge, Mahle and his team removed and screened sediment from

the river bed and apparently the alluvial fan near the foot of Senate Street. Fieldwork resumed in August 1981 using the backhoe for excavation. The project recovered numerous Civil War artifacts including a 3.5-inch shell, a 24-pound cannonball, two 10-inch shells and a post-Civil War projectile. Apparently the work did not produce sufficient material to justify continuation of the project (Salvage License No. 26 file SCIAA).

In 1983 a SCIAA Salvage License was issued for a metal detecting survey in the Congaree immediately south of the Gervais Street Bridge. Recovered artifacts associated with the Armory consist of 12 explosive shot for a 6-pounder cannon and one explosive shot for a 4-pounder (Salvage License No. 30 file SCIAA).Since the 1980s there are anecdotal reports of Civil War related artifacts being discovered in the river and on the alluvial fan at the terminus of Senate Street but there have been no additional formal recoveries.

Based on this information, there is sufficient documentary and formal survey evidence to establish the continuing presence of ordnance in this section of the river. With this in mind a series of magnetometer and side scan sonar surveys were conducted in advance of the Congaree River Sediment Clean-up project to determine the possible extent of ordnance within the contaminated area.

Over a period of 18 months, from 2010 to 2012, Tidewater Atlantic Research, Inc. conducted remote sensing surveys within the course of the river and on the eastern bank (Tidewater Atlantic Research 2010, 2011a, 2011b, 2012). The first phase of this work focused on the area from the Gervais Street to approximately 1500 feet downstream. The magnetometer survey identified 218 anomalies that were consistent with unexploded ordnance (UXO). Phase II of the survey began where Phase I ended and extended another 400 feet downstream. Ten anomalies that could be could represent UXO were identified in this phase. Phase III of the survey focused on the area from Unnamed Tributary 2 (as seen in figure 1) to just south of the Blossom Street Bridge. One hundred and twenty-two hits consistent with potential ordnance were recorded in this phase. Phase IV was the continuation of a terrestrial metal detector survey along the river bank and alluvial fan at the end of Senate Street. An additional 67 potential instances of UXO were recorded along the shoreline. Attachment A provides a summary of magnetic anomaly survey along with a map detailing the precise locations of the possible UXO.

SCOPE OF WORK

The following Scope of Work outlines our approach to artifact recovery and conservation at the Congaree River Project. The design will outline the goals of the salvage project followed by a detailed methodology for three stages of artifact recovery. Laboratory and artifact conservation methods will be outlined and initial plans for project deliverables, public outreach and the final disposition of the artifacts will be discussed.

PROJECT GOALS

Historic documents, previous salvage projects and intensive remote sensing surveys have confirmed the presence of artifacts related to the burning of Columbia and destruction of the stores at the State Armory in 1865. This previous work has also established that ordnance in the river possesses no locational or depositional integrity. In other words, the location of the artifacts will not provide any pertinent or useful information as allowing interpretation of intra and intersite feature patterns or depositional positioning. Consequently the main goal and value of this project is the recovery of the artifacts and their final inventory and analysis. The Congaree River Sediment Removal Project is designed in such a way as to remove the sediment down to bed rock. That material will then be deposited in a landfill. Recognizing the presence of artifacts invaluable to the history of South Carolina and the nation, recovering them has become a priority to SCANA. Because of the lack of depositional integrity and the nature of the remediation project, the recovery of artifacts will focus on salvage and collection of as many artifacts as possible rather than the collection of traditional archaeological data.

In addition to satisfying salvage objectives and essential rescue of artifacts that would otherwise be confined to a landfill, it is expected that the cataloging of the ordnance will provide substantive contributions to the archaeology of the Civil War. Archaeological inquiry applied to this collection will not only corroborate or refute the historical record but ideally also provide what Smith (1994) describes as the relevant facts upon which to build the discipline of Civil War archaeology. This is vital in defining history because historical records are often confusing, disorganized, contradictory, incomplete, and biased (Smith 1994). For example in Sherman's memoirs he mentions that the ordnance from the Columbia Armory:

> *…were hauled in wagons to the Saluda River, under the supervision of Colonel Baylor, chief of ordnance, and emptied into deep water, causing a very serious accident by the bursting of a percussion-shell, as it struck another on the margin of the water. The flame followed back a train of powder which had sifted out, reached the wagons, still partially loaded, and exploded them, killing sixteen men and destroying several wagons and teams of mules.* (Sherman 2006: 443)

We know from other historic documents that it was the Congaree River and that one commissioned officer (Captain William Davis, whose tombstone stands in Florence National Cemetery, Florence, SC) and three enlisted men (Jesse Johnson, James Kilpatrick and Coleman Wright) were killed by the explosion. By drawing on both the historical record and archaeological evidence a more informed account of the past will established. Consequently, the data gathered during each phase of this project will be used as far as possible to address research questions specific to this site as well as pertinent to Civil War archaeology in general. These include the following topics:

- A comparison of the reported inventories and the collected material;
    - The 1930 salvage inventory lists an "artillery axe", which is presumably a pick axe or axe carried by a caisson. No axes are listed in the official Civil War inventories. Are there items in the river that were not identified in the historic inventories?
- Identification of different styles and types of ordnance and ammunition;
    - During the Civil War more varieties of artillery were used than in another conflict in history. Can it be determined if the ammunition present was created at the Columbia Armory?
    - Are there shells and munitions present that were shipped to Columbia during this latter stage of the war from other armories?
    - Can an evolution or time line of ordnance types be identified?
    - Are there shells from the beginning of the war as well as well as more technologically advanced material from later in the war?

- Identification of military rank or distinction between the quality of side arms, personal weaponry and miscellaneous items that may be deposited in the river;
    - At the start of the war high quality French and British arms and armaments were purchased and utilized by officers. Are examples of these weapons present?
    - Were higher quality items appropriated and distributed to Union troops during the initial destruction of the State Armory or were all items deposited in the river?
    - Reports indicate that muskets and sabers were destroyed at the site of the Armory itself. Might any of these destroyed weapons have made it to the wagons that were depositing material in the river?
    - A number of side arms and weapons were present at the Citadel Arsenal Academy and listed on some inventories of the captured and destroyed items from Columbia. Did any of these items make it into the river and can it be determined if they were cadet issued items?

FIELD METHODS

Based on previous archaeological work conducted at manufactured gas plants (e.g., Cherau and Bannister 2006; Stratton et al. 2004; Warren et al. 2002) and consultation with SCANA on the nature of the project the following recovery plan for this unique project is proposed. Artifact recovery will take place in three different locations pending the disposition of the material: *in situ*, within enclosed structures, and in an off-site location. The flow chart presented in Figure 4 provides a guide to how artifacts will be identified and recovered at various locations during the course of the project. Generally speaking 100% of the project area will be assessed by pedestrian survey and remote sensing equipment including, but not necessarily limited to, metal detectors and magnetometers during the *in situ* ordnance removal phase. All sediment removed from the project area will be evaluated as to its level of TLM contamination. Sediment determined to be lightly impacted or "clean" will be sent to a screening facility for sorting and artifact recovery. Sediment determined to be too viscous to effectively screen will be sent to an off-site location where it will be spread out in thin layers and subject to visual inspection and/or metal detecting to facilitate artifact recovery. It is expected that reviewers and monitors from SCIAA and SHPO will periodically visit the recovery operations and provide feedback on the recovery methods.

Details for artifact recovery for each of these stages follow.

***In Situ* Ordnance Removal/Geophysical Survey**

During each phase of the sediment removal project the area to be removed will be divided into 50 foot by 50 foot grid squares. Removing the soil in units of this size accomplishes three goals. It provides an organized system that expedites the removal of contaminated soil. It also provides a system to easily identify the boundaries for UXO clearance, and provides additional provenience for use in assessing the distribution of the artifacts.

The overarching goal of the project is the timely removal of the contaminated soil rather than the recovery of the artifacts themselves. As stated earlier the material in the river possesses no depositional context. Locational information for the artifacts will not result in the identification

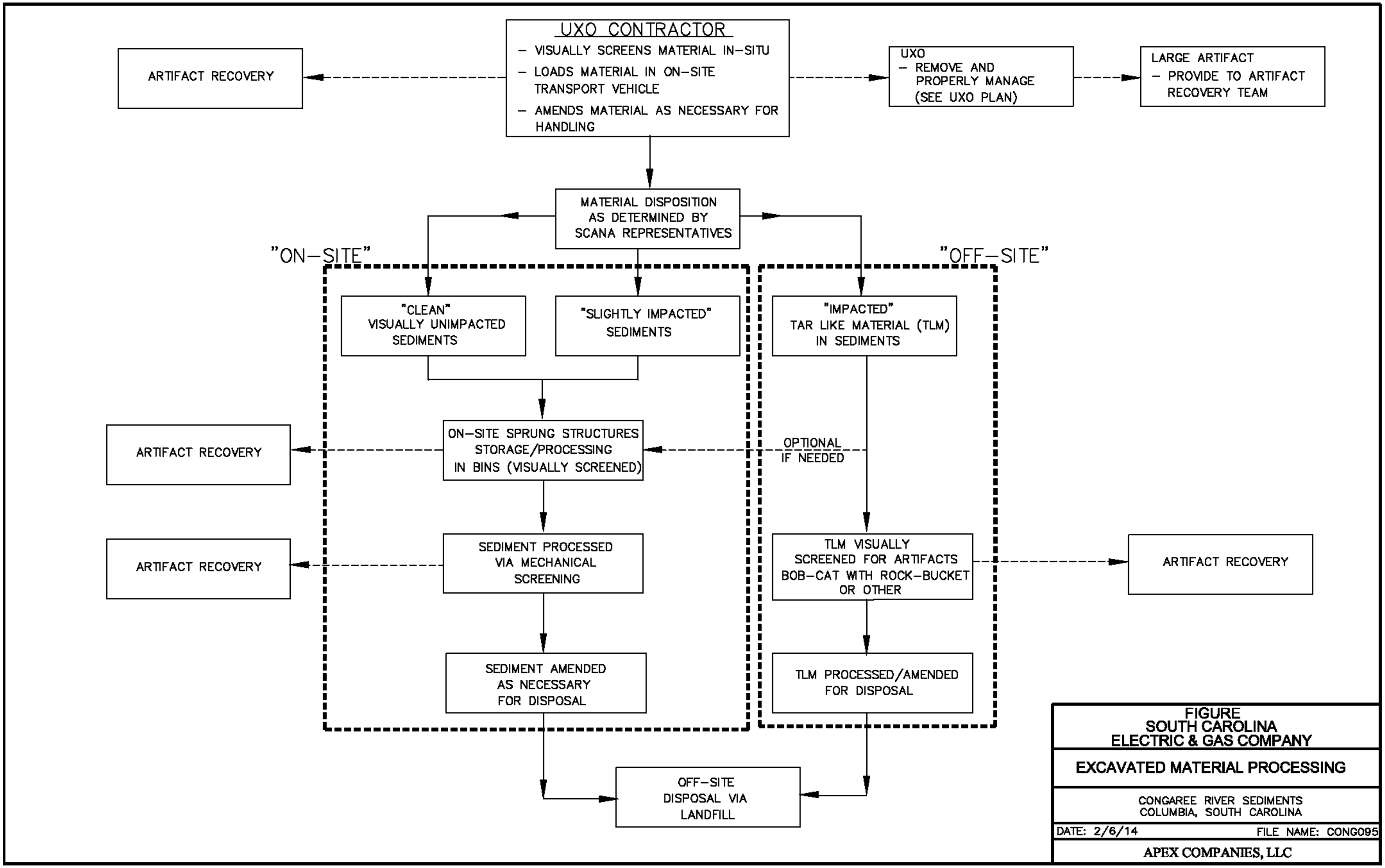


Figure 4. Process for recovering artifacts during sediment removal.

of any patterns or organizational system that can be applied to any other Civil War site or archaeological context. Given these facts, the 50 foot by 50 foot system constitutes a practical grid size that will facilitate recovery and processing of the materials and artifacts, and is believed to be the minimum grid size possible for the time constraints required by the sediment removal. The grid size along with the locational data attained during the magnetometer survey will provide acceptable locational information of larger artifacts. Smaller artifacts will have been displaced by river currents, the actual disposal into the river and modern day activities.

The final plan for removal of UXO will be determined by the UXO contractor, in consultation with TRC and TRC's subcontractor James Legg. It is believed the plan will generally follow the guidelines and procedures outlined in *Handbook on the Management of Munitions Response Actions* (EPA 2005) and *EPA Munitions Response Guidelines OWSER Directive 9200.1-101* (EPA 2010) for UXO recovery in areas other than operational ranges. Site specific modifications to these guidelines will be generated due to the historic nature of the potential UXO and the conditions of the project area.

In the first step of the *in situ* recovery nonintrusive geophysical detection technologies will be deployed to locate surface and subsurface anomalies that may be UXO. Distinguishing the ordnance from modern material and other non-ordnance materials based solely on the geophysical signature will be a challenge and will likely require continual adjustments in equipment and procedures throughout the recovery. It is presumed that each 50 foot by 50 foot grid square will be subdivided into lanes in order to facilitate and coordinate the geophysical survey. It is likely that a combination of technologies will then be utilized to evaluate each lane. Magnetometers will be used to detect subsurface ferrous anomalies. The amount of river rock containing ferrous inclusions may cause false positives with this type of sensor. Electromagnetic Induction (EMI) sensors will use electric currents to identify both ferrous and non-ferrous ordnance. Ground Penetrating Radar (GPR) does not appear to be a viable option based on an initial evaluation of the conditions at the site, however, the option is available should the UXO contractor deem it appropriate.

A positioning system will likely be employed to map the location of anomalies based on the geophysical readings. This map will provide data on the anomalies that can be processed by the UXO contractor. They UXO contractor will determine if an anomaly meets the minimum threshold for potential ordnance. The map produced during this phase can be compared to and combined with the results of the underwater magnetometer survey to provide additional locational information of artifacts.

Once identified, the potential UXO will be recovered. A combination of mechanized, manual, and possibly remote control recovery techniques will be employed in order to recover the items. Excavators or front end loaders will be used to remove the surrounding soil matrix from large or deeply buried UXO. Shovels and other hand tools will be utilized for the final clearing of deeply buried UXO once a sufficient level is reached, and for surface or near surface finds. Once an item is uncovered it will be visually assessed to determine they type of ordnance, whether it is inert and can safely be removed for on-site processing, whether it is live (fused or unfused) and if so whether it can be safely removed for off-site detonation or whether on-site demolition will be required. Proper safety measures and protocols will be strictly adhered to for any blow-in-place situation or removal of live ordnance.

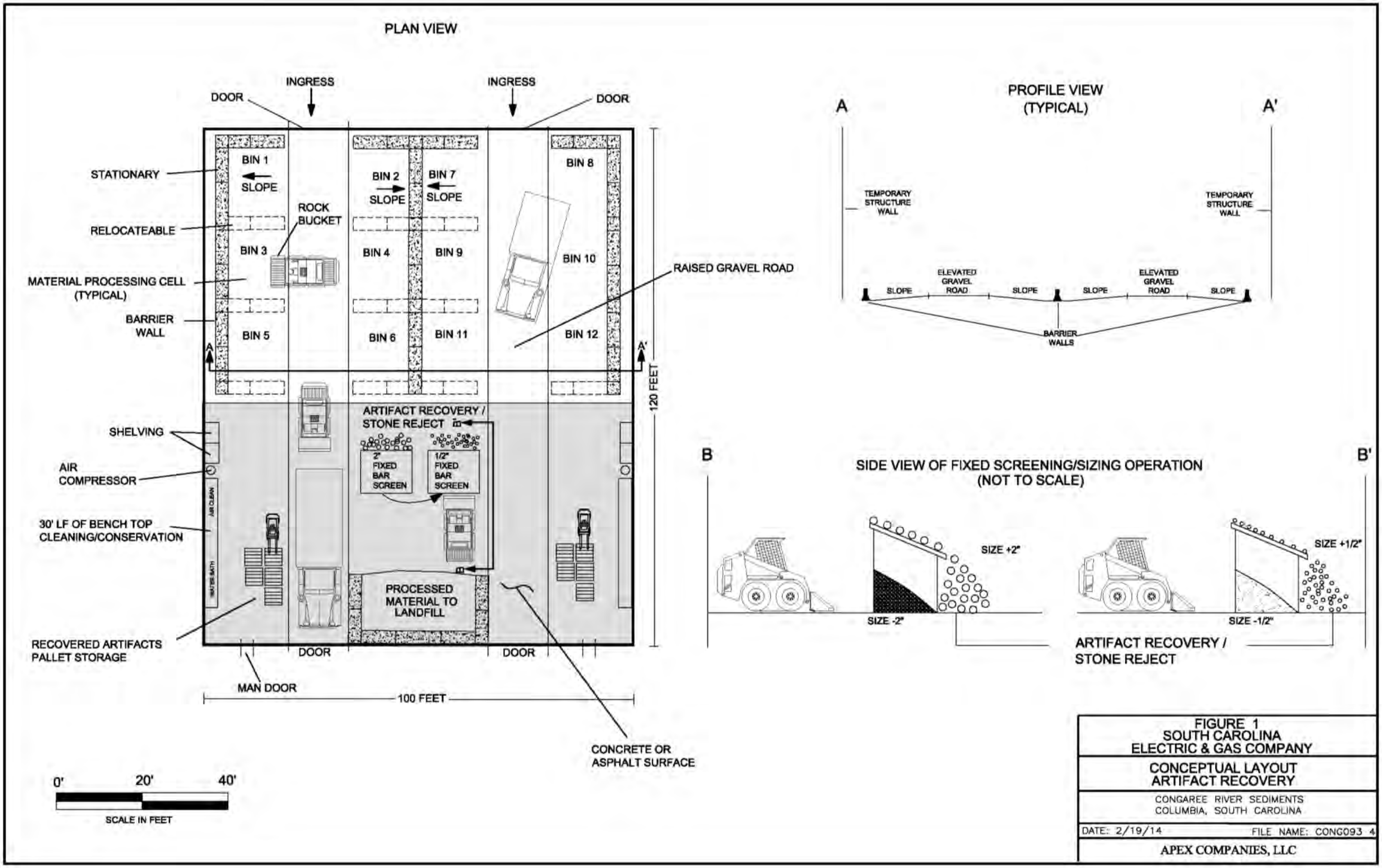


Figure 5. Artifact processing facility.

Ordnance that is found to be inert will be excavated and removed by the UXO contractor with the possible assistance of the on-site archaeologist. The item will be delivered to the archaeologist who will bag it and label the item with provenience information including the grid square from which it was removed and any identifiers assigned to the item by the UXO contractor (Survey lane number, anomaly number etc...). The item will then be temporarily stored at the on-site artifact sorting facility before being taken to the TRC office for cleaning, analysis and conservation.

On-Site Recovery

Once a grid square has been cleared by the UXO contractor heavy equipment will be utilized to remove the sediment. If saturated the soil will be either be placed in roll off containers or in discrete piles. It will then be allowed to dry (or processed with a drying agent such as cement dust) in preparation for transport. At the time of the removal a project manager familiar with the excavation and characteristics of TLM will assess the soil and make a determination whether the soil is too contaminated to pass through a screen. If the soil is “clean” it will be transported to an enclosed facility (Figure 5) and screened for artifacts

Once in the processing facility soil will be stored in discrete piles based on grid square. The soil from each grid square will then undergo a three stage screening process. The first sort of the material will be by a Bobcat outfitted with a skid steer rock bucket attachment that has finger tines spaced 4 inches apart (Figure 6). The rock bucket will be used to remove items, including modern debris (tires, bottles, etc…), over four inches in diameter. It is assumed that any potential ordnance over four inches will be detected during the *in situ* removal phase. However all material that does not fall through the tines will be visually inspected before being loaded into a roll off container for removal to the landfill. Any larger artifacts identified during this phase will be set aside for processing. If an artillery shell or potential UXO is identified safety protocols will be implemented and the UXO contractor will be immediately notified.

Figure 6. Example of a rock bucket to sort larger artifacts and sort rocks and debris.

Material that falls through the tines of the rock bucket will be subject to a second sort through a narrower gauge 2-inch bar sorter (Figure 7) similar to those used to sort rock and gravel. Material that does not fall through the bars will be visually examined. This sort is designed to recover items smaller ordnance and items or fragments of items that may have been broken up prior to disposal in the river (sabers, rifles, side arms, tools, buckles). The castoff material will be place in roll-off containers for disposal.

Figure 7. Example of a bar sorter

The remaining material will be taken to a screening and sorting station. This final stage of on-site recovery will be designed to recover the smaller artifacts. The soil will be sifted through various methods depending on the nature of the material and amount of time available for recovery. Options include ½-inch or ¼-inch mesh screens set up on sawhorses where the sediment can be manually screened. Water screening stations over shop sinks and standard archaeological shaker screens are also options. Artifacts recovered at the on-site processing facility will be bagged and labeled according to grid square and any other pertinent provenience.

With this final station up to 100% of the soil capable of falling through a screen will be screened. Due to time constraints and the throughput requirements of the project, however, circumstances may arise where it may not be feasible to screen all the "clean" sediment from a particular grid square. Therefore it is proposed that a minimum of 50% of the "clean" sediment removed from each grid square will be screened. Every effort will be made to screen 100% of this material, but if that fails, it is believed that recovery from 50% of this soil along with the *in situ* recovery will provide a viable study sample.

Off-Site Recovery

The viscous nature of the TLM in the river requires a creative solution to artifact recovery. Above a certain threshold of TLM in the sediment screening will result in clogged mesh, soil consolidating into large tar balls and ineffectual artifact recovery. For this reason, sediment that is determined to contain too much TLM will be sent to an off-site location, tentatively identified as the landfill where the contaminated material will be disposed of, and examined. Examination will take place visually and through geophysical methods.

When it arrives at the off-site facility the soil will once again be stored according to grid location. An area measuring up to 50 feet by 50 feet (final dimensions will depend on the amount of open land available) will be covered with heavy, industrial plastic sheeting. A backhoe will be used to spread the sediment from a selected grid square in a thin layer, up to 2 inches thick, on the sheeting. Five foot wide lanes will be established across the examination area. A crew of archaeological field technicians will then walk the lanes and make a visual survey of the sediment collecting artifacts as they are encountered.

In the early stages of the recovery process a metal detector will be employed on every other lane. A comparison will be made of the amount and type of artifacts recovered from the metal detected lanes and the visually inspected lanes. If there is a large discrepancy the method found to recover the most artifacts will be employed throughout the remainder of the project. If there is no discernable difference the method found to be the most effective use of time and personnel will be the procedure of choice for the project.

Artifacts recovered from this facility will be more contaminated. They will be safely bagged, labeled and stored until they can be effectively cleaned and conserved.

Recovery Conclusions

The complex nature of this project must be recognized. Not only will conditions change during each proposed field session, but they have the potential to change on a weekly and daily basis. The characteristics of the coal-tar plume vary along the 2,000-foot length of the project area. The amount of TLM will vary from little to nearly 100% tar. It is because of this that different recovery strategies were developed.

The plan is designed to maximize the amount of sediment examined and minimize the time in which that examination takes place. If reported inventories are correct nearly 1.5 million items were potentially discarded into the river over a two day period. Official recovery projects account for around 2000 of those artifacts. Unofficial recoveries dating back to the Civil War have likely accounted for thousands if not tens of thousands more. That only accounts for a fraction of the potential material that may be present. The proposed recovery plan is focused heavily on recovering the larger artifacts that may be present. The Minié balls, round shot and percussion caps that account for much of the inventory will be collected to the extent possible. It is felt that if they are still present a fairly large representative sample of these smaller items will be recovered from ½-inch screening and visual examination. Similarly, artifacts not related to the Civil War and of a smaller size, including prehistoric tools and projectiles, prehistoric ceramics, and historic artifacts dating from the populating of Columbia to the early twentieth century, will be collected with the proposed strategy. While these artifacts are not the primary focus of the salvage every effort will be made to recover significant diagnostic material.

ARTIFACT ANALYSIS AND CONSERVATION

Civil War documents indicate that artifacts recovered during this project may include lead ammunition, rifle barrels and wood stocks, percussion caps, sabers and cutlasses, artillery shells, cannons, scabbards, and munitions containers. Other artifacts may be present in addition to the military artifacts. There are a number of sites adjacent to the project area, including a 19th century saw mill and a possible ferry crossing (Figure 8). Likewise, prehistoric Native American artifacts have been recorded as being present on the shoreline adjacent to the project area. Artifacts from these sites may have eroded or been deposited into the river and may be present in the project area as well; the condition of potential artifacts from these sites is unknown.

The Artifact Analysis and Conservation Plan has been designed to accommodate this broad range of materials. The laboratory operations from the time a specimen is delivered to its ultimate place of storage or exhibition can be separated into five basic stages:

1. Initial documentation.
2. Storage prior to conservation process.
3. Encrustation removal.
4. Analysis.
5. Curation.

Initial Documentation

As an artifact is recovered, it will be bagged, labeled and recorded on the site log sheet documenting its associated unique provenience number (grid square). In this manner the recovered material can be roughly tracked and artifact density information by proveniences can be monitored. Inert and defused materials recovered during the in situ/ordnance removal phase will be similarly bagged and labeled according to grid square and UXO identifiers. Blow-in-place ordnance and live ordnance transported off-site for detonation will be photographed and measured in place (as safety allows) and assigned a specific inventory number.

At this stage artifacts may be lightly washed or dry brushed to remove excess sediment and TLM. Based on information provided by SCANA, some artifacts may be entirely encased in TLM. The time and effort needed to clean and conserve these artifacts may be cost prohibitive. Depending on the information collected as the project goes on, it may be appropriate to propose sorting criteria based on the amount of tar affecting an artifact and the type of artifact as part of the conservation plan. For example if thousands of rounds of ammunition are recovered and found to be entirely encased in TLM an initial cleaning might remove as much material as possible, the lab crew would add the artifact type, quantities, and description to the field excavation forms and the items (or a percentage of the items) would be discarded. The details of a triage procedure such as this will be determined through consultation with SCANA and SCIAA personnel.

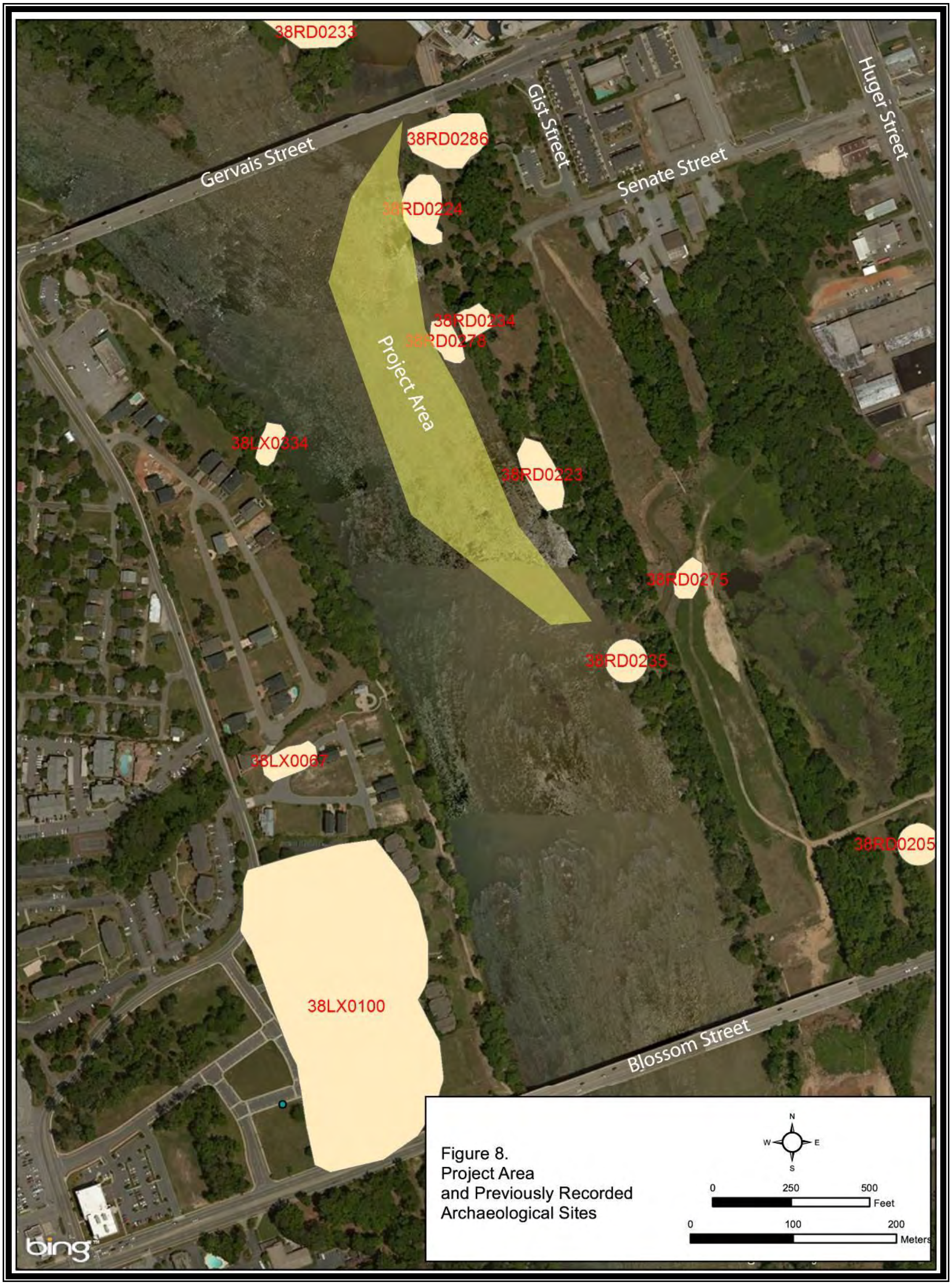


Figure 8.
Project Area
and Previously Recorded
Archaeological Sites

Storage Prior to Treatment

Removal of TLM will take place at this stage. In order to remove potentially hazardous contaminants artifacts will be lightly brushed and bathed in a solution of BioSolve. This is a water-based, biodegradable formulation of surfactants and performance additives. It is used in soil remediation projects and been found to be effective in cleaning oily residue and TLM from heavy equipment used in MGP remediation projects. This process will likely take place in TRC's Treatability Lab in Greenville, SC or in a designated area at the on-site processing facility where contaminants can be disposed of with the overburden.

Once the TLM has been removed the artifacts will be stored and conserved according to methods outlined in *Methods of Conserving Archaeological Material from Underwater Sites* (Hamilton 1999). Due to the potential volume of artifacts it is anticipated that some materials may need to be stored for a time before they can be properly cleaned and conserved. As part of this storage stage any adhering encrustation or corrosion layers will largely be left intact until the objects are treated, since they form a protective coating which retards further corrosion. Therefore all metal objects determined to be suitable for analysis will initially be kept in tap water with an inhibitor added to prevent further corrosion. For long-term storage, an oxidizing solution of potassium dichromate and sodium hydroxide or an alkaline inhibitive solution may be used (Hamilton 1999).

Encrustation Removal/Conservation

For most metal items, this will consist of thorough reduction in electrolysis, alternating with manual cleaning. After the rust has been removed, the artifact will be boiled in distilled water to remove salts, and then dried. The artifacts will finally be sealed with microcrystalline wax. Non-ferrous or fragile items may be treated by boiling in distilled water, drying, and sealing. Below are more details of possible cleaning and conservation methods based on expected material types.

<u>IRON/FERROUS OBJECTS</u>
Iron artifacts will be stored in an aqueous solution until they are subject to electrolysis. Electrolysis will take place in tanks specially equipped with a battery charger and a copper pipe; alligator clips are used to suspend the artifacts in a solution of tap water and sodium bicarbonate. A low voltage electric current is passed through the tank, removing the rust from the artifacts. Electrolysis is continued in the tap water electrolyte until the chloride level of the electrolyte approximates the level found in the tap water. The artifacts will remain in the tanks for as long as it takes to remove all rust.

The artifact is then rinsed thoroughly in several changes of alternate boiling and cold de-ionized water to remove any residuum. The artifact will be submerged in the last vat of rinse water for a minimum of 24 hours. After rinsing, the moisture absorbed by the artifact must be removed before any sealant is applied. The artifact may be baked or if exposure to air is found to cause too much oxidation the object may be submerged in water-free isopropanol to dehydrate for a minimum of 24 hours. It may also be expedient to eliminate the drying process altogether and simply towel off the artifacts before dipping them in microcrystalline wax (Hamilton 1999). If larger object such as cannons are recovered a wax sealant may not be feasible. In such a case coats of polyurethane or Rustoleum may be appropriate.

LEAD

A majority of the artifacts recovered will presumably be made of lead. Lead will initially be stored in a tap water and sodium sesquicarbonate solution. In the case of lead artifacts, use of electrolysis is minimal. The lead will be immersed in 10 percent hydrochloric acid, which will remove any adhering marine encrustation, along with lead carbonates, lead monoxide, lead sulfide, calcium carbonate, and ferric oxide. This will be followed by a rinsing and gentle removal of adhering materials. Lead objects will be allowed to dry and finally sealed with microcrystalline wax.

COPPER, BRONZE AND BRASS

Artifacts made of copper and its alloys will be subject to the same electrolysis procedures as described for iron. The main variations in treatment involve the fact that the duration of electrolysis for cupreous objects is significantly shorter than that for comparable iron objects. Small cupreous artifacts, such as coins, require only a couple of hours in electrolysis (Hamilton 1999). Following electrolytic cleaning, the artifacts will be put through a series of hot rinses in de-ionized water until the pH of the last rinse bath is neutral. Because copper tarnishes in water, a wet paste of sodium bicarbonate may be used as polish. After polishing, a coat of benzotriazole (BTA), commercially known as KrylonClear Acrylic Spray will be applied.

WOOD

Waterlogged wood artifacts in the form of gun stocks, pistol butts or wagon/caisson wheels or parts may be recovered. Wood artifacts will be assessed as to their preservation potential and either discarded after being documented or submerged to await conservation. If wood is to be conserved it will be done with the Polyethylene glycol (PEG) method. This process simultaneously removes water from the object while also strengthening and consolidating the wood. The procedure is simple but time consuming. The wood artifact is placed in a solution of PEG and water or alcohol where it is allowed to sit. Over a period of months or years (depending on the size of the artifact) the PEG level is gradually raised until the solution consists of at least 70% PEG. At this level wood will remain stable and no further treatment of the wood should be necessary.

CERAMICS, STONE AND GLASS

Ceramic artifacts, stone tools or projectiles and glass objects that have been submerged in water do not typically require special treatment. Glazed and hard fired historic ceramics such as stoneware and porcelain are impervious to water. Low fired earthenware and prehistoric ceramics may encounter some erosion but will remain structurally solid. Glass and lithic material may become discolored be will largely remain unaffected. Rinsing with tap water and light brushing to remove excess sediment is typically all that will be required. A mild detergent may be used in an attempt to remove deep stains. Care will be taken not to remove paint or surface treatments. The artifacts will then be allowed to air dry on rack. Reconstruction or re-fitting of vessel or container fragments may be attempted using proper fixatives. No sealant is required.

LEATHER

Leather conservation will follow the same procedures as detailed for ceramic items. Rinsing with tap water and light brushing to remove ingrained soil is typically all that will be required. If leather is waterlogged it can be subject to the same PEG treatment as wood. Treating leather with PEG will generally take less time than wood.

Analysis

Artifacts will be separated into functional groups that are then subdivided by use category and object type. The artifact pattern model, as devised by South (1977) and revised by Garrow (1982) is the basic formatting procedure for all artifacts. This model offers a rational approach for the organization of artifacts on a provenience to provenience level, or all the way up to total site contents. This system also allows for analytical modifications when collections of a specialized nature are recovered and was used to generate the functional categories outlined above for the Civil War artifacts.

This system will consolidate large quantities of like artifacts under descriptive headings and facilitate interpretation. A final and compelling reason to use the artifact pattern model is that it provides a good format within which to present the contents of the site, and can lead to cross-comparisons with other sites formatted in that manner. Functional groups, categories and sub-categories will consist of:

- Arms
    - Artillery
        - Cannons
        - Howitzer/Mortar
        - Ordnance - Fixed
            - Shot (24-pounder, 12-pounder, 6-pounder)
            - Case (24-pounder, 12-pounder, 6-pounder)
            - Fuse (24-pounder, 12-pounder, 6-pounder)
            - Grape (24-pounder, 12-pounder, 6-pounder)
            - Canister (24-pounder, 12-pounder, 6-pounder)
        - Ordnance – Not Fixed
            - Shot (10 inch, 8 inch)
            - Shell (10 inch, 8 inch)
        - Artillery Accoutrements
            - Carriages and parts
            - Caissons and parts
            - Tools
            - Fuses
    - Firearms
        - Small Arms (pistols, pistol parts)
            - Small Arms Ammunition (shot)
            - Small Arms Accoutrements (holsters, belts, cartridge boxes, tools)
        - Long Arms (muskets, rifles, parts)
            - Long Arms Ammunition (shot, Minié balls)
            - Long Arms Accoutrements
    - Edged Weapons
        - Sabers
            - Cavalry
            - Artillery
            - Naval
        - Bayonets

                - Cavalry
            - Edged Weapon Accoutrements
                - Saber knots
                - Saber scabbards
                - Bayonet scabbards
- Clothing
    - Button
    - Buckles
    - Insignias/Pins
    - Knapsacks
    - Haversacks
    - Other

- Tools
    - Anvil
    - Forge
    - Vise
    - Other

- Personal – Civil War
    - Jewelry
    - Writing
    - Food storage, preparation and consumption
    - Indulgence (alcohol and tobacco related items)
    - Medicine

Information recorded during the analysis of the Civil War related artifacts will vary depending on what objects are recovered. It is anticipated that a majority of artifacts recovered will be lead shot. These will be and measured, perpendicular to the ball's mold seam, for diameter (*not caliber*) to 1000ths of an inch. The catalog description will include a conclusion regarding each shot's function based on its diameter or former diameter as implied by weight. Shot and shell will similarly be measured and weighed. Distinguishing characteristics that denote armory or metalworks of origin, and when possible range of manufacture, will be noted and photographed. Guns and fire arm parts as well as saber parts will be identified, photographed and cataloged.

Clothing items will be weighed and measured. Photographs will be taken. Detailed photographs of insignias or devises apparent on the durable clothing items will be documented and attempts will be made to identify insignias by military unit. Since their presence in the river is not necessarily documented and their recovery is not anticipated we are collapsing some material culture categories outlined by Legg and Smith (1989) into the single category of Personal Items. These items are items that would be in the possession of an individual soldier.

Historic artifacts will be analyzed by functional groups according to the procedures outlined in South (1977). Historic ceramic artifacts will be classified according to recognized types (e.g., pearlware, ironstone), and by decorative technique (e.g., hand-painted, transfer print, decal) and vessel form. Bottles are described by type, color, size, and closure type. Where possible, standard references such as Miller (2000), Noel Hume (1970), Jones and Sullivan (1985) and South (1977), as well as more specific published and on-line references for particular artifact types will be used to obtain date ranges for historic ceramics and glass.

The prehistoric artifact analysis will focus on identifying assemblages and/or technological attributes diagnostic of particular temporal and geographical cultural trends. The artifacts will be identified according to established regional types or styles. In the case of projectile points, morphological attributes will be used as typological markers. Ceramics will be typed according to paste, temper, and surface decoration.

The following descriptions define the categories in the lithic artifact typology to be used in the lithic analysis. Lithics refer to stone tools and debris from producing stone tools. The following categories are derived in part from those developed by Blanton et al. (1986) and Garrow (1982), which have been used with excellent success on many projects in South Carolina.

The two major groups of lithics are debitage and functional artifacts. Debitage can be divided into the following categories:

> *Biface Thinning Flakes.* Biface thinning flakes are relatively thin and flat to slightly curved in cross section. Secondary flake scars are frequently present on the dorsal surface. The platform may be faceted and may exhibit a distinct lip, and the bulb of percussion is usually diffuse. These features are characteristic of soft hammer percussion, and the flakes of this type are most often the result of late stage biface reduction and maintenance.
>
> *Blades and Bladelike Flakes.* These flakes approach or exceed a length-to-width ratio of 2:1. Blades and bladelike flakes frequently have a ridge oriented along the dorsal surface. They are typically manufactured for a specific purpose, such as replacing edges in cutting or grating implements.
>
> *Bipolar Flakes.* Bipolar flakes exhibit a bulb of percussion on the ventral surface of both the distal and proximal ends. They are often curved in cross section. These flakes are manufactured by placing the raw material on a hard surface, such as an anvil stone, and striking its superior surface with a hard implement.
>
> *Unspecialized Flakes.* These flakes are relatively thick and wide with little or no indication of having a particular function or representing a specific stage of manufacture.
>
> *Flake Fragment*. This category includes those flakes that have only nondiagnostic medial or distal portions. Any flake lacking a proximal end will be placed in this category.
>
> *Shatter.* Shatter is debitage that is angular and blocky. Specimens in this category cannot be oriented in relation to their proximal or distal end.
>
> Chipping debris also will be subdivided based on the amount of cortex present on the dorsal surface. Classifications are assigned based on whether more than half (>50%), less than half (<50%), or no cortex was present on the dorsal surface. This measure should give an approximate indication of the stage of reduction represented in the assemblage. All lithic artifacts will be identified as to debitage class and raw material.

The second major lithic group is functional artifacts. The categories in this group are defined as follows:

> *Bifaces.* This category comprises artifacts that are bifacially flaked and do not have haft elements. They can be finished tools, projectile points, knives, scrapers, or preforms. Bifaces usually cannot be given an established type name.
>
> *Hafted Bifaces.* Hafted bifaces are bifacially worked artifacts that have a hafting element (i.e., stem and notches). They are often described as projectile points or knives and may conform to established type names.

Cobble Tools. Cobble tools are altered or unaltered cobbles used as hammerstones, nutting stones, anvils, and other similar tools.

Cores. Cores consist of parent raw material and are the remnants of flake manufacture. They can be blocky or discoidal in appearance and exhibit one or more flake scars.

Ground Stone. Artifacts in this category are manufactured by polishing or grinding stone into a desired shape—celts, axes, and manos, for example. These tools are often used in woodworking and food processing.

Manuports. Manuports are unaltered pieces of stone that are not indigenous to the area and obviously have been transported to the site by humans.

Retouched, Used, or Modified (RUM) Flakes. The category of RUM flakes includes all flakes that have been retouched into a unifacial tool, exhibit use wear, or have been modified by undetermined means. This category includes scrapers and utilized flakes.

Soapstone. Soapstone is a very soft stone that is easily worked. Artifacts frequently constructed of soapstone include bowls, pipes, and beads.

Fire-Cracked Rock. Although fire-cracked rock is not a tool per se, these are rocks that exhibit evidence of having been in or near a fire due to human activity. Alteration in color and/or luster, angular fractures, and potlidded surfaces are diagnostic of fire-cracked rock.

The analysis of prehistoric sherds will begin with a basic characterization of the entire assemblage. Sherds smaller than 2×2 cm will be counted, weighed, and examined to determine the presence of surface treatments or vessel forms that could prove useful in the analysis. If not, they will receive no further analysis. All larger sherds will be classified by surface decoration and aplastic content. The aplastic content will be documented as the type (or raw material) and size of the major aplastics. Size will be determined through comparison with the Wentworth scale, used by most archaeologists to standardize aplastic descriptions. Aplastic size will be recorded as no apparent temper, fine, medium, coarse, and very coarse. Surface decoration will be recorded by type (e.g., incised), and major decorative mode characteristics will be recorded.

The preliminary analysis will allow a characterization of the sherd assemblage. During this initial analysis, sherds will be labeled and pulled for cross-mending, so the subsequent analyses can focus on the vessel assemblage. The surface decoration–aplastic content classes from the preliminary analysis will be compared to published type descriptions; type names will be applied where possible.

Surface decoration, aplastic content, thickness, and interior surface treatment will be considered in cross-mending the sherds. The analysis will seek to reconstruct as many vessels as possible to help determine vessel form and function. The following attributes will be recorded for each vessel to provide a detailed technological description of the wares. They will be examined to determine technological patterns within and between types.

- Type, size, shape, and density of major aplastics
- Type and size of minority aplastics
- Degree of carbon core retention
- Sherd core cross-section configuration
- Thickness 3 cm below rim
- Rim form
- Presence of coil breaks

- Dominant paste color
- Interior surface treatment

Curation

SCANA realizes a disposition agreement with SCIAA regarding the percentage of artifacts to be received is required as part of the application process. SCANA is committed to displaying and making the artifacts recovered from this site available to the public. At the conclusion of the analysis the artifacts will be prepared for curation following accepted guidelines. Copies of all records, including, but not limited to, field notes, maps, catalog sheets, and representative photographs shall be submitted for curation with the artifacts. After project clearance has been obtained, artifacts and relevant notes will be curated in accordance with the selected repository. It has not yet been determined where the material will be curated. It is possible that due to the volume of material expected multiple curation facilities may be needed. .

DOCUMENTATION

Daily logs and records will be kept at each artifact processing area during the recovery phase. These logs will be available for review by SCIAA personnel during monitoring visits. Interim reports/management summaries will be provided documenting each phase of the remediation project. These management summaries will minimally include maps depicting the area cleared during the related field season, a description of the work completed to date, a preliminary inventory of the artifacts recovered and a status update that will provide detail of the next field season.

At the conclusion of the remediation project a draft technical report will be produced and delivered to the SCIAA for review. The report will follow the format and content specified in the *South Carolina Standards and Guidelines for Archaeological Investigations*, including a description of past archaeological research in the project vicinity, a discussion of local history, an explanation of the research design, the field methods employed, evaluation methods, findings, conclusions, and recommendations. TRC will promptly address all comments and revisions provided in writing by SCIAA in a final technical report.

All maps and drawings will be high quality and produced in a professional manner. Project maps will be produced in color using ArcGIS software, CAD or other appropriate mapping programs. These maps will depict each phase of the project and include grid square boundaries. Individual maps of grid squares may be used to identify the locations of ordnance removed during the UXO recovery stages of the project. Overlays of historic maps and plats may be used where appropriate. High quality color photographs or measured drawings, as appropriate, will be provided that show details of representative diagnostic or other interesting artifacts. The report will be bound in a durable cover (minimum 80 lbs cover stock), and contain an identifying label. The paper will be high quality laser printed paper, minimum 24 lbs stock, and will be acid free. Pages will be printed on both sides and project maps and photographs will be produced in color. Electronic copies of the final report in Adobe Portable Document File (PDF) format will be provided to SCIAA and outside reviews as appropriate. In addition a CD or DVD with photographs of the artifacts will be provided if desired.

At the discretion of SCANA a popular report suitable for public distribution may be produced. This report may also be reviewed and commented on by SCIAA prior to publication. This report, if produced, will be part of the public outreach program that SCANA is committed to in order to inform and educate the public on this significant find.

PUBLIC INFORMATION

Salvage of the Civil War material deposited in the Congaree River offers an amazing opportunity to educate and involve the public about a historically significant site. The recovery of tangible evidence of the capture of Columbia will take place almost exactly 150 years from when it occurred. There will be multiple opportunities for the general public to benefit from this project. Initial plans call for an on-site structure dedicated to exhibiting the history of the site, the on-going work and the interpretation of the artifacts. This structure will be open to the public and will tentatively be staffed by SCANA personnel and an archaeological docent.

An electronic presentation or social media site suitable for hosting by SCANA or other appropriate website may be created to present the on-going recovery process. Museum quality artifact displays and/or traveling artifact shows at museums throughout the state can be generated. A book/booklet depicting the artifacts and history of the site suitable for presentation to the general public can be authored. Additional public outreach may involve professional papers and presentations at national and regional archaeological conferences, tours and talks for school age children as well as avocational groups is also an option. Some or all of these potential public outreach approaches will be completed as a result of this project.

QUALIFICATIONS

Company Profile

A pioneer in groundbreaking scientific and engineering developments since the 1960s, TRC is a national engineering and consulting firm providing integrated services to the energy, environmental, and infrastructure markets. We serve a broad range of clients in government and industry, implementing complex projects from initial concept to operations. TRC employs over 2,600 technical professionals and support personnel at more than 70 offices throughout the U.S.

TRC's cultural resource group in the Southeast originated as Garrow and Associates, an Atlanta-based small business that was founded in 1983 and acquired by TRC in 1997. We offer a complete range of cultural resource services in the Southeast from our offices in Atlanta, Georgia; Chapel Hill, North Carolina; Columbia, South Carolina; and Nashville, Tennessee; including archaeological investigations, historic structure surveys and evaluations, and cemetery studies. Our local office in Columbia is within a ten-minute drive of the Congaree River Project site. With the Principal Project Manager and Key Project Team members being local to Columbia, we will be able to respond quickly to all SCANA's needs. Our office provides us rapid access to SCIAA, SHPO, the South Carolina Department of Archives and History (SCDAH), the University of South Carolina at Columbia, and other regulatory offices and research facilities. Our organizational depth will allow us to draw on resources from our nearby offices to support this project as needed.

TRC's core cultural resources staff in the Southeast consists of approximately 55 professional archaeologists, crew chiefs, preservation planners, historians, and support personnel. Our archaeologists possess M.A. or Ph.D. degrees in Anthropology, meet the Secretary of the Interior's standards, and are Register of Professional Archaeologists (RPA) certified or eligible.

Our Columbia office contains 2,400 square feet of laboratory, office, and storage space. It possesses wet lab and dry lab capabilities and has ample room to conduct electrolysis and metal conservation operations. TRC's Atlanta facility includes 2,500 square feet of fully equipped laboratory space that includes tanks capable of conserving metal objects up to four feet in length, and the Chapel Hill office has similar lab and storage capabilities. Our Greenville office contains a wet lab and research/treatability laboratories complete with ventilation hoods and resources for preparing and storing solvents for use in cleaning coal tar from artifacts.

Key Personnel

TRC's proposed key staff for the Congaree River Sediment Removal Project includes highly experienced researchers with extensive experience managing and directing large scale projects that require consultation with multi-disciplinary teams as well as state and Federal agencies. Our team also has experience with both complex projects that involve creative approaches to archaeological issues and with Civil War era projects that involve recovery and conservation of artifacts similar to those anticipated for the Congaree River Project.

TRC Columbia Program Manager Sean Norris, M.A., RPA, will serve as Principal Project Manager for the project. Ms. Ramona Grunden, Senior Archaeologist in our Columbia office will serve as the Assistant Project Manager. Both Mr. Norris and Ms. Grunden will be available for rapid deployment to any meetings or consultations required by SCIAA.

Principal Project Manager

Mr. Sean Norris is the Program Manager for Archaeology at the Columbia Office of TRC. He handles administrative duties and manages all projects and contracts that originate in that office. Mr. Norris will serve as Principal Project Manager and will attend meetings with SCANA and other team members, lead the development of the Artifact Recovery/Salvage and Artifact Conservation and Stabilization plans, and act as TRC's point of contact for this project. Mr. Norris has over 15 years of experience in the eastern U.S. and is RPA certified. Mr. Norris has served as Principal Investigator on numerous projects in South Carolina and has experience in project planning, the development and implementation of research designs and field and laboratory methodologies, and technical and popular reporting. Mr. Norris is President of the Council of South Carolina Professional Archaeologists and routinely interacts and sits on committees with employees of SCIAA and the South Carolina SHPO. He has authored Memorandums of Agreement (MOAs) and Memorandums of Understanding (MOUs) as well as Protective Covenants for significant archaeological sites that have included the SHPO, SCDHEC, and the COE as signatories.

Assistant Project Manager

Ms. Ramona Grunden is a Senior Archaeologist and Laboratory Director in TRC's Columbia Office. She will serve as the Assistant Project Manager. Her duties for this phase of the project will include providing input on artifact recovery strategies related to Civil War sites, she will also be present to attend meetings should Mr. Norris be unavailable. Ms. Grunden has over 30 years of experience in South Carolina archaeology including seven years as an archaeologist at SCIAA. Ms. Grunden has conducted and managed numerous large-scale projects in the Southeast. She has extensive experience in all phases of historic sites investigations, and has worked on numerous Civil War projects and others involving military instillations and military components.

Senior Technical Advisor

Mr. Paul Webb is TRC's Cultural Resource Program Leader, and is stationed in the Chapel Hill office. He has over 25 years of experience in cultural resource management, including planning, implementing, and reporting all aspects of cultural resource studies. His qualifications include extensive experience with large and technically complex archaeological projects, and in assisting multidisciplinary teams in developing creative approaches to cultural resource issues. Mr. Webb will assist in the development of the artifact recovery/salvage and conservation and stabilization plans, and will also assist in agency negotiations as appropriate. Mr. Webb's background includes service to public, tribal, and private-sector clients, including the North Carolina Department of Transportation; Federal Highway Administration Eastern Federal Lands Highway Division (FHWA EFLHD); National Park Service (NPS); National Forests in North Carolina; Eastern Band of Cherokee Indians; U.S. Army Corps of Engineers; U.S. Army Construction Engineering Research Laboratory (USACERL); U.S. Army Environmental Center; Maryland State Highway Administration; Iroquois Gas Transmission System; Duke Energy; Piedmont Natural Gas; North Carolina Natural Gas; Spectra Energy; and Progress Energy; along with numerous engineering and environmental firms.

Safety Advisor/Technical Advisor

Dr. Larry McKee has over 25 years of experience and progressive responsibility in archaeological research and cultural resource management. His qualifications include extensive field investigation, artifact analysis, consultation at the tribal, state, and federal level, and large-scale project management. Mr. McKee came to TRC in 1999 following twenty years of academic and museum based archaeological research. He currently serves as a Senior Program Manager with the southeastern cultural resources division of TRC, with responsibility for the business functions and technical performance of the Nashville, TN office.

Laboratory Director

Mr. Thomas Garrow is the Laboratory Manager for TRC's Atlanta office, a position he has held since 1993. Mr. Garrow is responsible for artifact processing, analysis, conservation, and cataloging, as well as specialized recovery techniques such as flotation. Mr. Garrow has nearly 30 years of experience in cultural resource management, including field and laboratory work across the eastern United States. Mr. Garrow has participated in numerous archaeological investigations covering a wide range of site types, including those dating to the Civil War. Mr. Garrow has received training in artifact conservation techniques and curation standards, and few cultural resource practitioners in the region can match his depth of experience in metal conservation. Mr. Garrow will assist in development of the Artifact Recovery/Salvage and Conservation and Stabilization plans.

Senior Scientific Advisor

Dr. Karen Saucier has over 25 years of experience, and has worked extensively in the areas of CERCLA- and RCRA-mandated investigations, risk evaluations and remediations. Dr. Saucier will act as TRC's in-house technical advisor with experience on Manufactured Gas Plant sites. Her expertise includes providing strategic technical services, and assessing regulatory and business implications of environmental remediations and historic liabilities. Dr. Saucier supports client/agency negotiations with respect to risk-based decision making, sediment, soil and groundwater remediation approaches, and liability portfolio life-cycle costing and management. She routinely serves as Project Manager with responsibility for coordination and integration of multidisciplinary technical resources through the various stages of liability project life cycles. She advises on and leads project communications to corporate, regulatory and community stakeholders.

Additional Consultants/Staff

TRC will retain the services of Mr. James Legg as an archaeologist and consultant to assist in the General Consulting and planning tasks requested in this RFP. Mr. Legg currently works as a project archaeologist for SCIAA and has more than 40 years of experience in archaeological research involving battlefields and other military sites. He has worked with Ms. Grunden on a number of those sites. He has a particular interest in 18th and 19th century ordnance, including both small arms and artillery ammunition. He is a recognized expert who has handled all of the major types of Civil War ammunition and has disarmed and conserved many examples.

Mr. Legg has 32 years of experience in archaeological metal detecting, and has a regional reputation as an authority on the subject. Mr. Legg is also highly experienced in metal conservation. Over the last 35 years he has conserved several thousand metal artifacts from private collections as well as significant archaeological collections including those from 16th century Santa Elena, the Camden Battlefield, and a number of other projects conducted by SCIAA and other research entities.

REFERENCES CITED

Blanton, Dennis B., Christopher T. Espenshade, and Paul E. Brockington Jr.
1986 *An Archaeological Study of 38SU83: A Yadkin Phase Site in the Upper Coastal Plain of South Carolina*. Garrow & Associates, Inc., Atlanta. Submitted to South Carolina Department of Transportation, Columbia.

Cherau, Suzanne and Jennifer Bonner Bannister
2006 *Archaeological Investigations Chadwick Lead Mill Site, Salem and Marblehead, Massachusetts*. Public Archaeology Laboratory, Pawtucket, Rhode Island.

Finkelstein, Charles
1976 *Sonar Survey of the Congaree River, Columbia, South Carolina*. Conservation Research Laboratory Center for Maritime Archaeology and Conservation. Texas A&M University. College Station, Texas.

Garrow, Patrick H.
1982 *Archaeological Investigations of the Washington, D.C. Civic Center Site*. Soil Systems, Inc., Marietta, Georgia. Submitted to the Department of Housing and Community Development, Government of the District of Columbia, Washington, D.C.

Hamilton, Donny
1999 *Methods of Conserving Archaeological Material from Underwater Sites*. Report to Bruce Hoverman, Columbia, South Carolina, from Massachusetts Institute of Technology, Cambridge, MA.

Jones, Olive and Catherine Sullivan
1985 *The Parks Canada Glass Glossary.* National Parks and Sites, Ottawa.

Legg, James B. and Steven D. Smith
1989 *The Best Ever Occupied…Archaeological Investigations of a Civil War Encampment on Folly Island, South Carolina*. Research Manuscript Series 209. South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Miller, George L.
2000 Telling Time for Archaeologists. *Northeast Historical Archaeology* 29:1–22.

Noel Hume, Ivor
1970 *A Guide to Colonial Artifacts of America*. Alfred A. Knopf, New York.

Sherman, William Tecumseh
2006 *Memoirs of General W. T. Sherman*. Reprint of the 1889 revised and corrected second edition. Echo Library, Teddington, Middlesex, England.

South, Stanley
1977 *Method and Theory in Historical Archaeology*. Academic Press, New York.

Smith, Steven D.
1994 Archeological Perspectives on the Civil War: The Challenge to Achieve Relevance. In Geier, Clarence R. and Susan E. Winter, editors. *Look to the Earth: Historical Archaeology and the American Civil War*. Knoxville, Tennessee: The University of Tennessee Press. pp. 3-20.

The Spartanburg Herald
1938 YOUNGSTERS TRY TO MELT LEAD FROM OLD WAR SHELLS: EXPLOSION ALMOST REOPENS CONFEDERATE CONFLICT. *The Spartanburg Herald* 5 January:1.
Spartanburg, SC.

The State
1930 Confederate Ammunition, Dug From River, To Go on Display in Columbia This Week. *The State* 3 June 1930:1. Columbia, SC.

Stratton, Susan K., Barry A. Price, and M. Colleen Hamilton
2004 Hazardous Site Archaeology: A Case Study of a Manufactures Gas Plant. *Proceeding of the Society for California Archaeology*, Volume 14 (pp 21-24)

Tidewater Atlantic Research, Inc
2010 *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011a *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase II Addition.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011b *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase III Report.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2012 *A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

Warren, Keith, Wendy Nettles, and Colleen Hamilton
2002 *Test Excavations and Evaluation of Historic Archaeological Resources at the Santa Barbara I Manufactured Gas Plant*. Applied Earthworks, Inc., Hemet, California.

Williams, J.F.
1929 *Old and New Columbia.* Epworth Orphanage Press, Columbia, SC.

ATTACHMENT A – SUMMARY OF UNDERWATER ANOMALIES

APPENDIX O

TRAFFIC CONTROL PLAN

TRAFFIC CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, Carolina 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

TRAFFIC CONTROL PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and subject to approvals from the U.S. Army Corps of Engineers (USACE).

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment. As currently envisioned, the temporary cofferdam would be constructed in two or three separate phases over two or three construction seasons. The construction seasons will range from approximately May through December of each year. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

In order to complete this project an estimated 5,700 tractor-trailer or tri-axle dump truck movements into and away from the project area are anticipated. The majority of the truck movements will be associated with importation of stone for cofferdam construction and for the installation of site access roads as well as for the transportation of the excavated material to a local landfill.

SCE&G intends to ensure that the necessary truck movements are completed with as minimal of an impact to the surrounding area as practicable. Completion of the project in phases will spread the activity out over a larger time frame, and controlled use of established truck routes will minimize potential impacts to local traffic patterns. This Traffic Control Plan presents the proposed methodology for development of the truck routes and for monitoring of driver compliance during completion of the project.

A site entrance at the corner of Senate Street and Gist Street was initially planned but has since changed in response to safety concerns associated with traffic constraints at the intersection of Senate and Gist Street (Figure 2). The proposed entry/exit plan consists of constructing a southern access road that will extend from the landside support zone to Blossom Street, as shown on Figure 2. This entry and exit point will require construction of a concrete arch crossing over unnamed tributary #2 and modification/improvement of the gravel road currently in place. Utilization of the southern access road and the entry/exit point will eliminate the potential for safety related and other issues that could result from the project related traffic operating in the Senate and Gist Street area.

SITE OPERATIONS AND TRAFFIC PATTERNS

Figure 2 shows the current site operations scenario, which includes establishing the landside support zone directly adjacent to the project area within the river. The landside support zone will consist of a series of gravel roads and equipment/material lay down areas and two temporary structures. A chain link perimeter fence will be installed around the landside area and the main site entrance/exit will be at the gate east of the Blossom Street Bridge (Figure 2). All project related heavy truck traffic will be routed through this gate. Smaller personnel vehicles will use this Blossom Street entry/exit as well, but may on occasion use the gate at the corner of Senate and Gist Streets. No tractor-trailer or triaxle trucks will be permitted to enter or exit the site at any other location than the Blossom Street entrance. Throughout completion of the project only authorized remediation personnel will be allowed access to the work areas during the source removal activities and on-site traffic patterns will be restricted to the site roads.

Initial project activities will consist of constructing the culvert/bridge, southern access route and the landside support zone. Initial river construction will entail installing the cofferdam around the planned Phase 1 excavation area. Truck traffic associated with these activities will be primarily incoming deliveries of various types and sizes of stone. SCE&G currently anticipates using the Martin Marietta Cayce Quarry located to the southwest of the project site at 2125 State Street in Cayce, SC to obtain the stone for the support zone and cofferdam construction.

Once the cofferdam is constructed and the isolated area dewatered, the sediment removal activities will commence. The excavated sediment will be transported from the river to the temporary structures via the site access roads. Initial dewatering and stabilization of the wet material will be completed within the isolated area in the river and additional conditioning will be completed in the temporary structures in order to render the material suitable for offsite transport and disposal. The stabilized material will be loaded into offsite transport trucks inside the temporary structures. All trucks carrying impacted material either from the river to the structures or from the structures offsite to the landfill will be inspected for the presence of residual or loose material outside of the beds in order to prevent the tracking of impacted material outside of the designated loading areas. Clean, plastic lined loading areas will be utilized for truck loading operations in both the river excavation and the temporary structures in order to keep the truck tires from contacting impacted material. Prior to leaving the site, each truck will be properly manifested in accordance with applicable state and federal regulations. Currently, SCE&G anticipates using Waste Management's Richland County landfill located at 1047 Highway Church Road in Elgin, SC for disposal. This landfill is located approximately 20 miles from the site.

All site vehicles will maintain safe-operating speeds at all times. The site roads are anticipated to be wide enough to accommodate trucks passing each other in opposite directions. Spotters and/or flagmen will be utilized as required to maintain safe traffic flow onsite.

TRAFFIC CONTROL PLAN

As previously stated, the use of the southern access road and the Blossom Street entry/exit point for heavy truck traffic will greatly reduce the potential for safety related issues in the Senate and Gist Street areas. However, it will still be critical to adequately control the flow of tractor-trailer and tri-axle trucks into and out of the general site vicinity in order to minimize the impact on the surrounding community. The following specific routes were developed through consultation with local officials (police, fire department, public works, government personnel, etc.). All routes will be verified prior to commencement of the project and will be modified, if necessary, to account for changing traffic patterns or input from local residents/officials, etc. Each truck driver will be informed of the prescribed routes for site entry and exit and an effort will be made to utilize regular drivers who are familiar with these routes. All site related vehicles will follow the specific routes and project oversight personnel will conduct periodic monitoring of truck movements to ensure compliance with the Traffic Control Plan. Any identified deviation from the prescribed route will be immediately corrected.

Incoming Traffic

General incoming and outgoing traffic patterns are presented on Figure 3. All incoming traffic will enter the site by turning right onto Blossom Street from the southbound lanes of Huger Street and making a right turn onto the access road at the entrance of the site. Outgoing traffic will exit the site entrance and turn right onto Blossom Street.

The bulk of the project related heavy truck traffic will result from shipments of impacted material to the landfill and likely importation of stone from the Martin Marietta Cayce Quarry.

Figure 4 illustrates the route for empty material transport trucks traveling from the landfill to the project site. Trucks will exit the landfill entrance by turning right onto Highway Church Road and then turning right onto Screaming Eagle Road. Trucks will then turn left onto Percival Road, right on Spears Creek Church Road and merge onto I-20 W toward Columbia. Once on I-20 W, trucks will travel for 17.3 miles until they reach Exit 64A where they will exit onto I-26 E towards Charleston. Trucks will then continue onto I-126 E for 3.2 miles and take the exit for Huger Street. Once on Huger Street, the trucks will follow the incoming route shown on Figure 3.

The traffic route of trucks carrying stone from the quarry is shown on Figure 5. Trucks will exit the quarry entrance by staying straight and continuing onto Frink Street. Trucks will then make a left turn onto 12th Street. After traveling 3.0 miles, trucks will merge onto I-77 S via the ramp to Charleston/Spartanburg and immediately merge onto I-26 W towards Spartanburg and travel for 7.3 miles. Trucks will then take Exit 108B for I-126 towards Columbia and merge onto I-126 E. Trucks will continue on I-126 E for 3.2 miles and take the exit for Huger Street. Once on Huger Street, the trucks will follow the incoming route shown on Figure 3.

Outgoing Traffic

Trucks carrying material to dispose of at the landfill will exit the site by turning right onto Blossom Street and continuing west until 12th Street, where a left turn will be made at a stoplight. These trucks will follow 12th Street until they reach I-77 where they will merge using the ramp on the left toward Charlotte. Once on I-77, the trucks will follow the route specified on Figure 6, which is designed to keep the trucks on four lane highways until they reach the landfill exit. This truck route was developed through consultation with the City of Cayce Officials.

Empty trucks traveling to the quarry will also exit the site by turning right onto Blossom Street and continuing west until 12th Street, where a left turn will be made at a stoplight. The trucks will follow 12th Street and make a right turn on to Frink Street and continue into the quarry entrance.

Figure 3 through 7 will be supplied to the truck drivers in order to inform them of the required routes for the project.

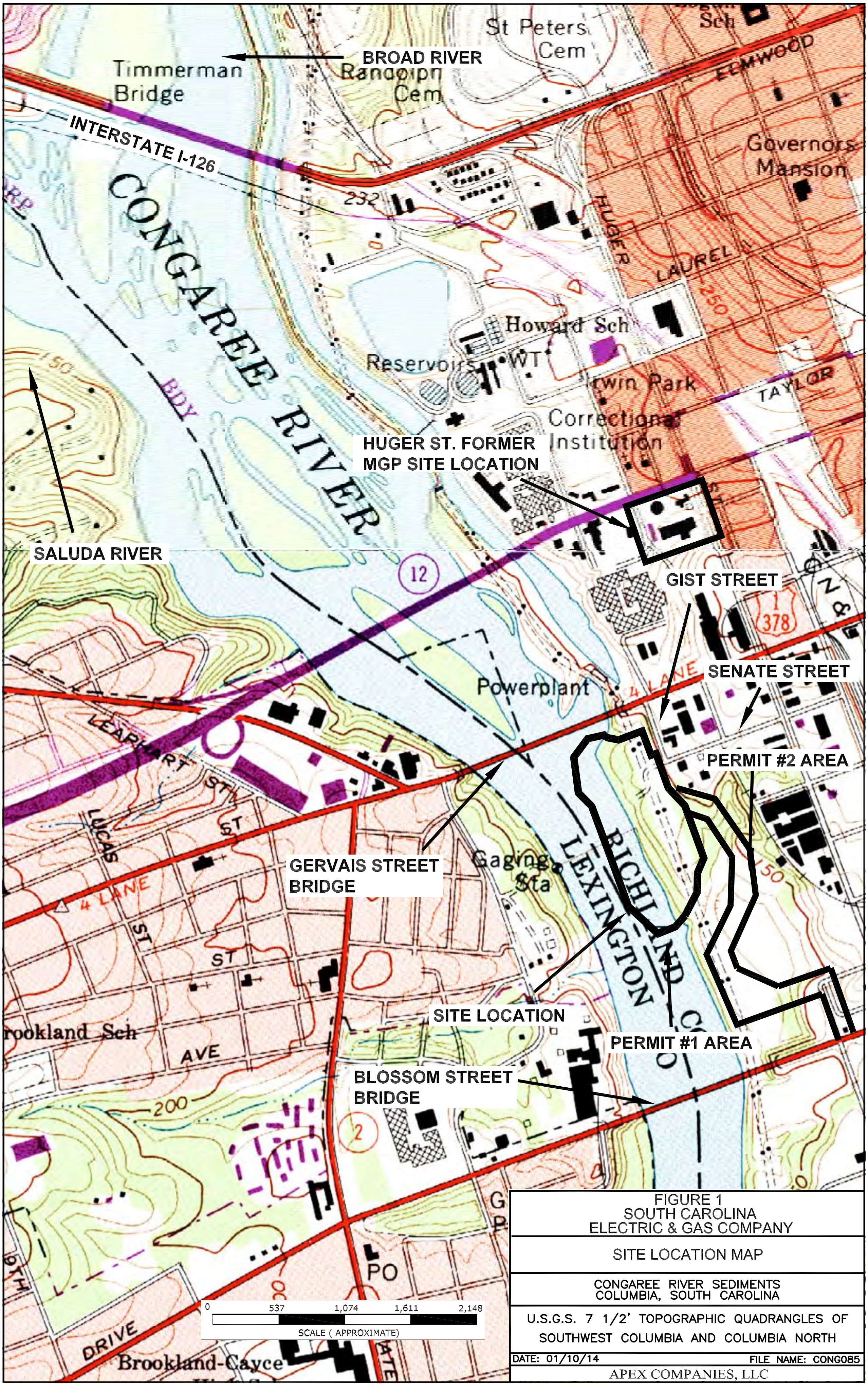


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 01/10/14 | FILE NAME: CONG085

APEX COMPANIES, LLC

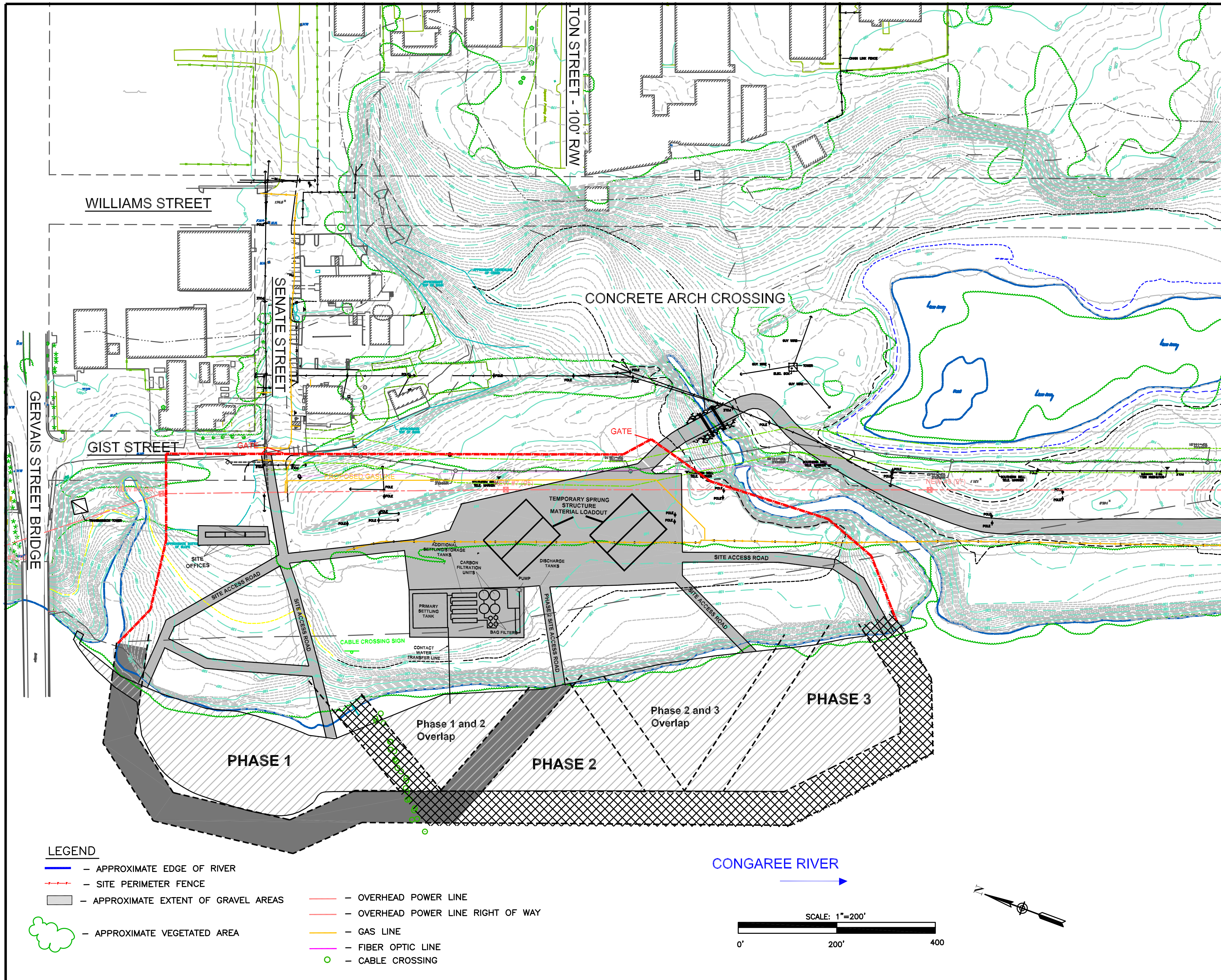


FIGURE 2
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN
SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/19/14 FILE NAME: CONG177

APEX COMPANIES, LLC

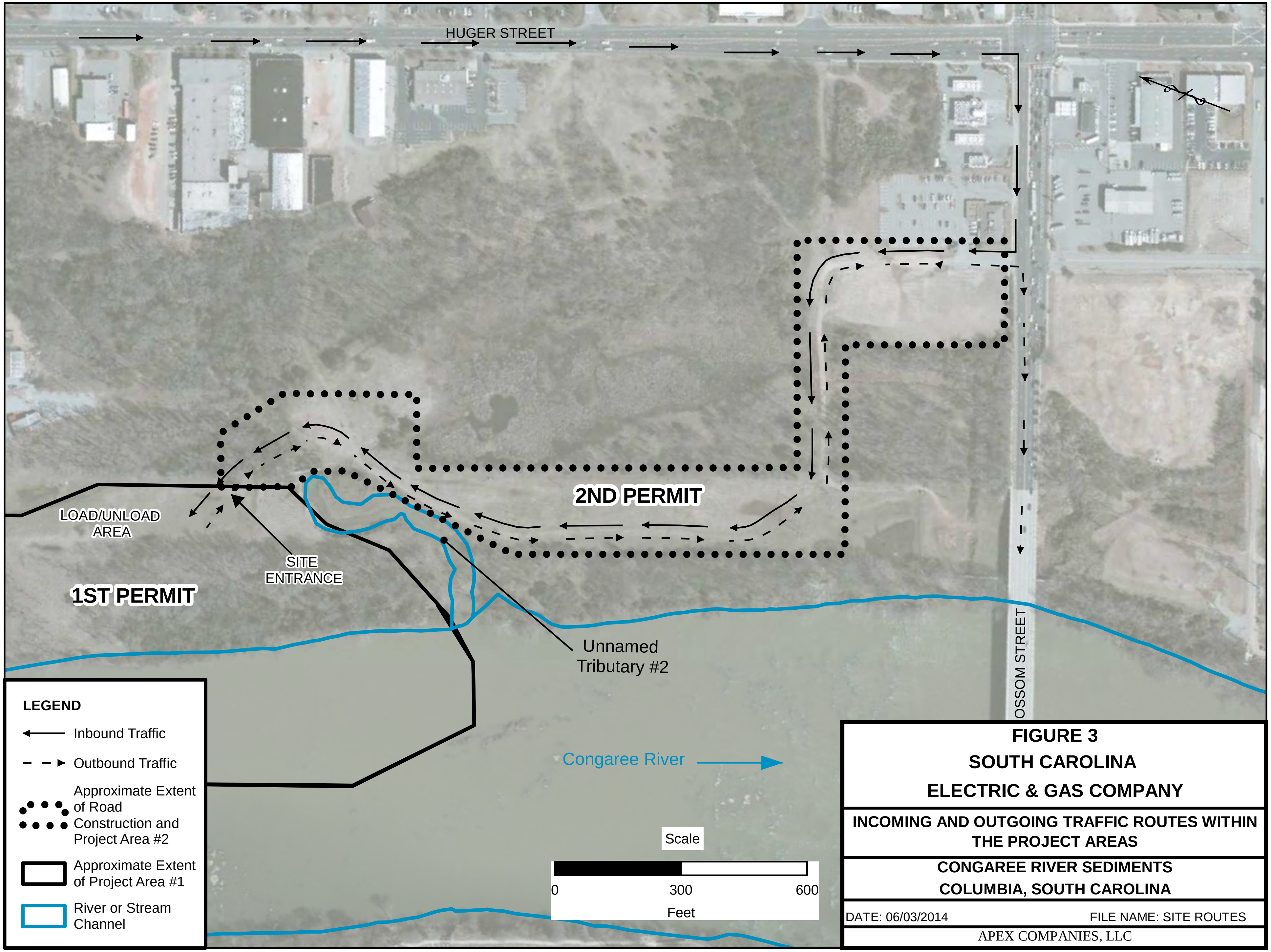


FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

INCOMING AND OUTGOING TRAFFIC ROUTES WITHIN THE PROJECT AREAS

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/03/2014 FILE NAME: SITE ROUTES

APEX COMPANIES, LLC

TRUCK ROUTE FROM LANDFILL

1. Exit the landfill entrance and turn right onto Highway Church Road.
2. Turn right onto Screaming Eagle Road.
3. Turn left onto Percival Road/SC-12.
4. Turn right onto Spear Creek Church Road and turn left to merge onto I-20 W toward Columbia.
5. Take Exit 64A to merge onto I-26 E towards Charleston.
6. Continue onto I-126 E. Travel for 3.2 miles.
7. Take the Exit for Huger Street.
8. Merge onto US-21 S/US-321 S/Huger Street.
9. Stay on Huger Street until Blossom Street.
10. Turn right onto Blossom Street and turn right onto the temporary access road to enter the site.

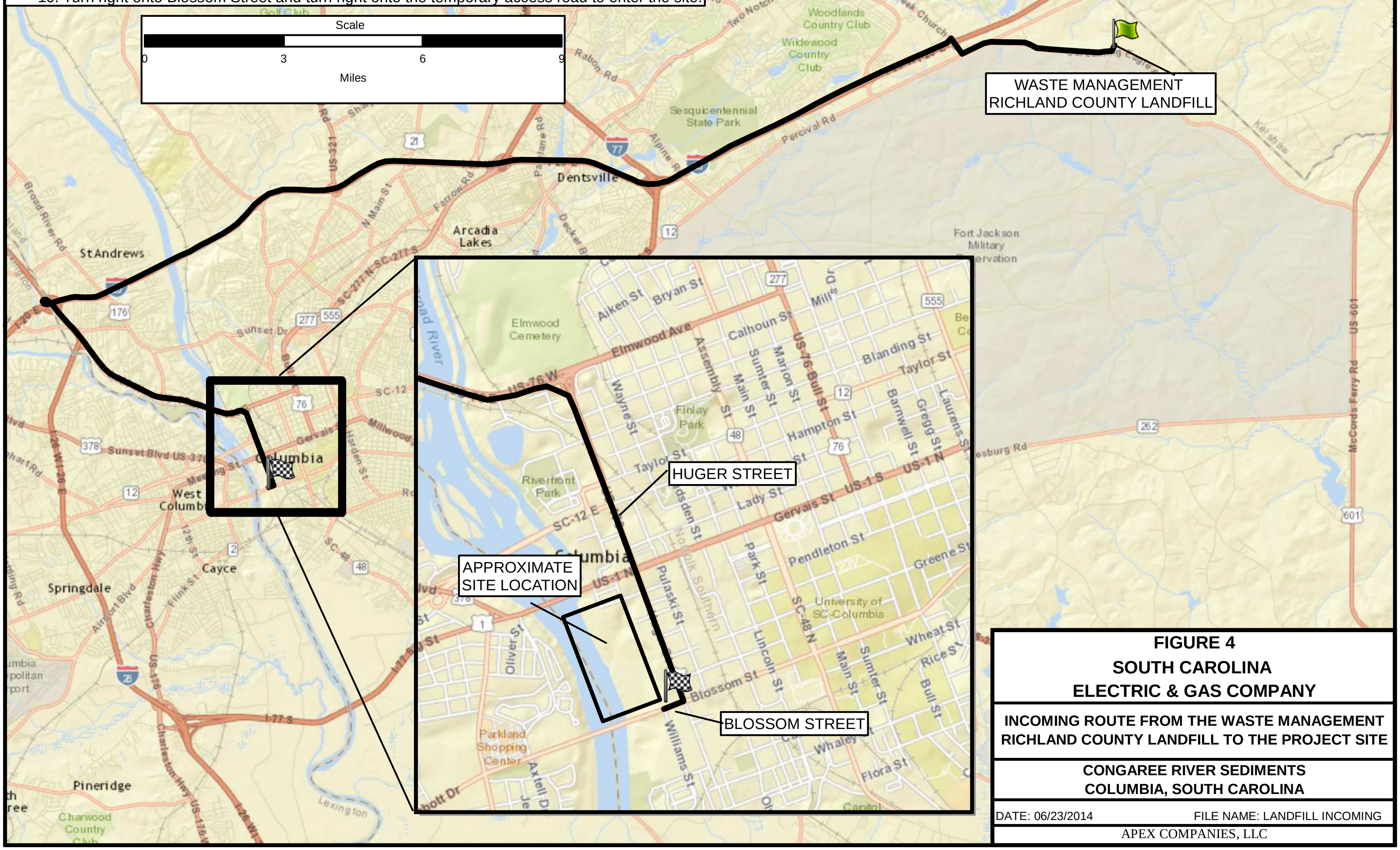


FIGURE 4

SOUTH CAROLINA ELECTRIC & GAS COMPANY

INCOMING ROUTE FROM THE WASTE MANAGEMENT RICHLAND COUNTY LANDFILL TO THE PROJECT SITE

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

DATE: 06/23/2014 FILE NAME: LANDFILL INCOMING

APEX COMPANIES, LLC

TRUCK ROUTE TO QUARRY

1. Exit the Martin Marietta Cayce Quarry entrance and stay straight onto Frink Street.
2. Turn left onto 12th Street and travel for 3.0 miles.
3. Merge onto I-77 S via the ramp to Charleston/Spartanburg.
4. Keep right at the fork and follow signs for I-26 W/Spartanburg.
5. Merge onto I-26 W and travel for 7.3 miles.
6. Take Exit 108B for I-126 toward Columbia.
7. Merge onto I-126 E and travel for 3.2 miles.
8. Take the Exit for Huger Street.
9. Merge onto US-21 S/US-321 S/Huger Street.
10. Stay on Huger Street until Blossom Street.
11. Turn right onto Blossom Street and turn right onto the temporary access road to enter the site.

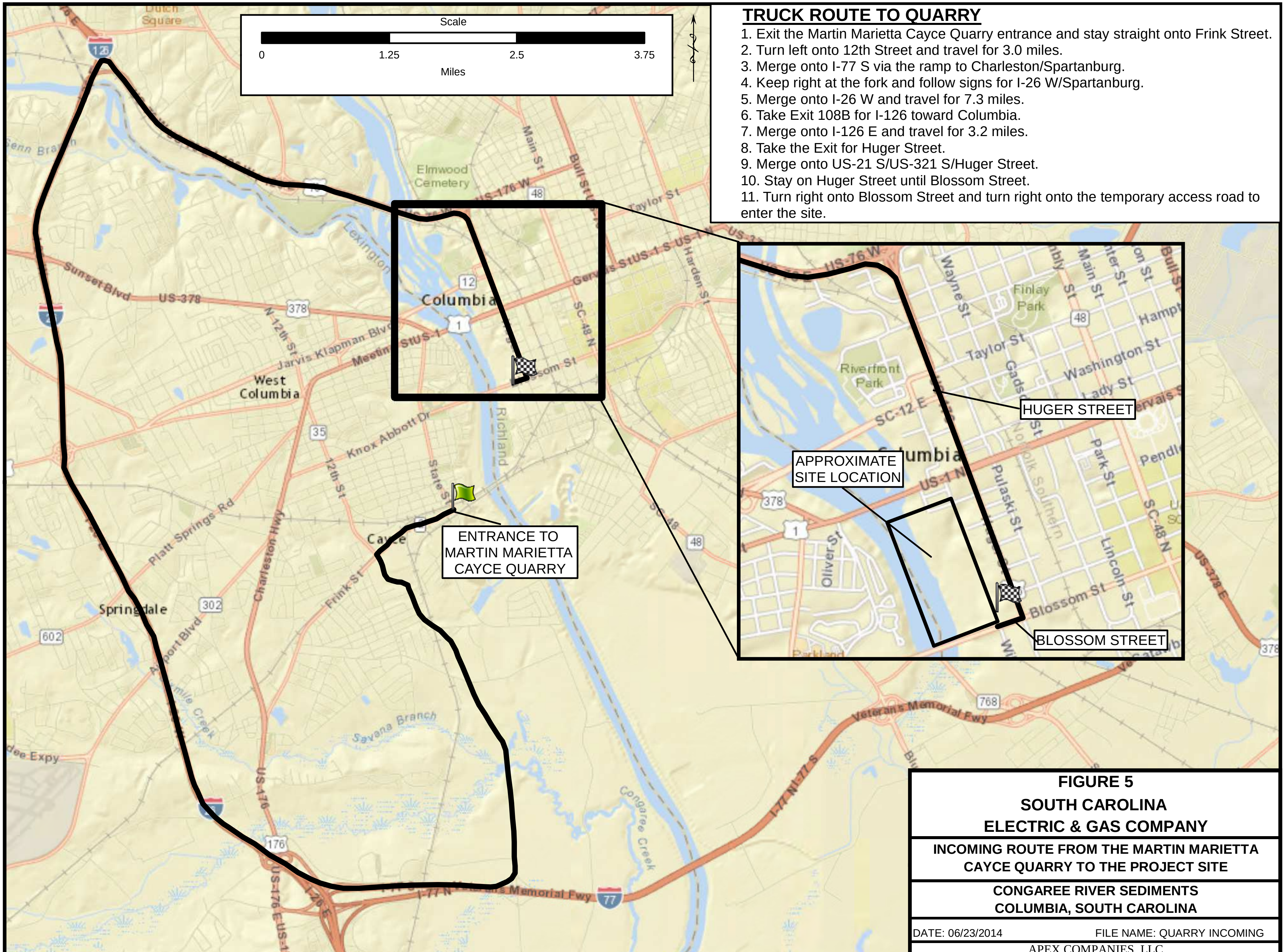


FIGURE 5

SOUTH CAROLINA ELECTRIC & GAS COMPANY

INCOMING ROUTE FROM THE MARTIN MARIETTA CAYCE QUARRY TO THE PROJECT SITE

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

DATE: 06/23/2014 FILE NAME: QUARRY INCOMING

APEX COMPANIES, LLC

TRUCK ROUTE FROM LANDFILL

1. Exit site from temporary access road and turn right (west) onto Blossom Street.
2. Turn left onto 12th Street.
3. 12th Street becomes 12th Street Extension.
4. Merge onto I-77 N via the ramp on the left toward Charlotte. Travel for 13.6 miles.
5. Take Exit 16 to merge onto I-20 E toward Florence and travel for 5.9 miles.
6. Take Exit 82 for Spear Creek Church Road toward Pontiac.
7. Turn right onto Spear Creek Church Road and turn left onto Percival Road.
8. Turn slight right onto Screaming Eagle Road.
9. Turn left onto Highway Church Road.
10. Turn left into landfill entrance.

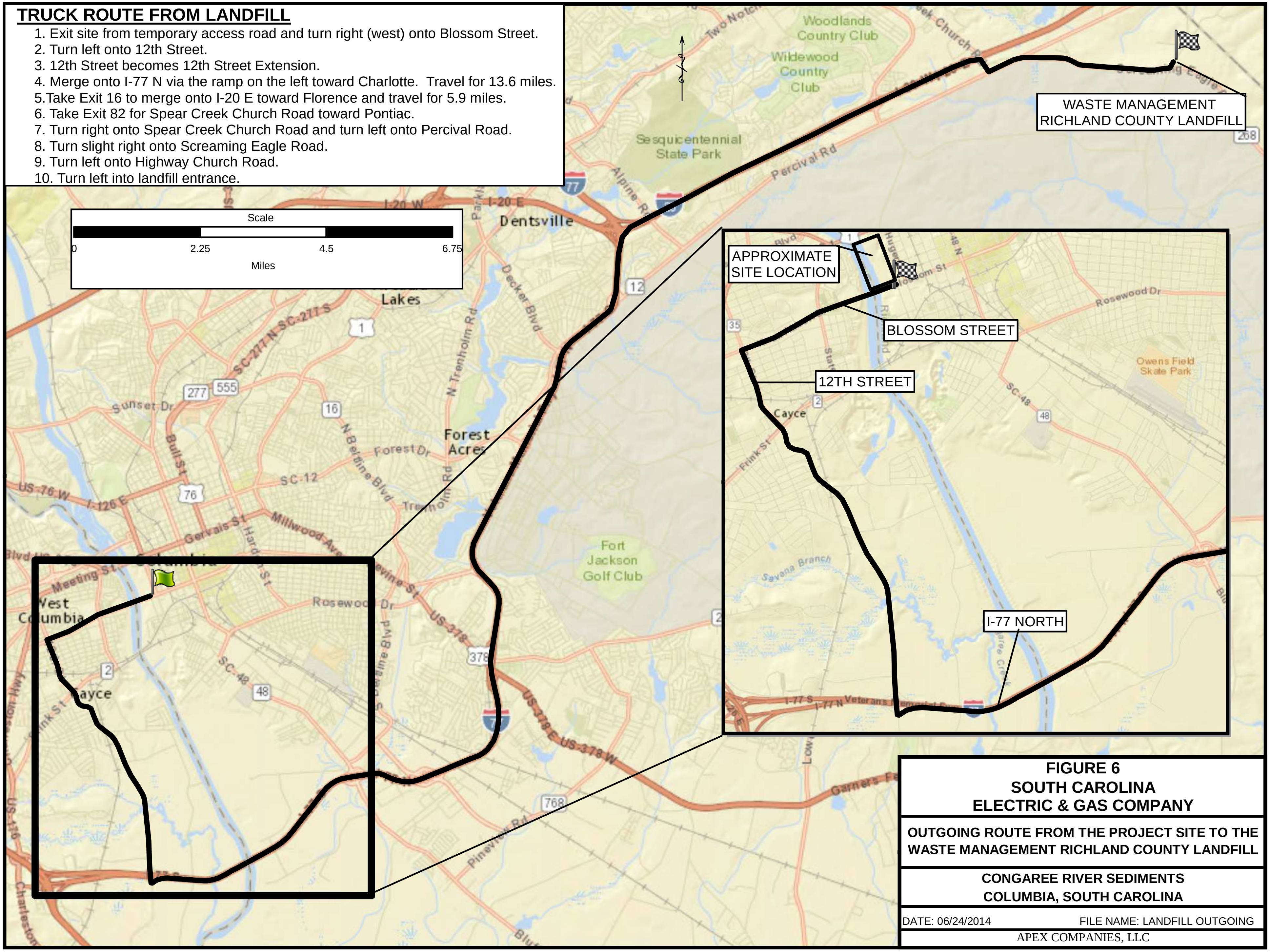


FIGURE 6
SOUTH CAROLINA ELECTRIC & GAS COMPANY

OUTGOING ROUTE FROM THE PROJECT SITE TO THE WASTE MANAGEMENT RICHLAND COUNTY LANDFILL

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/24/2014 FILE NAME: LANDFILL OUTGOING

APEX COMPANIES, LLC

TRUCK ROUTE TO QUARRY

1. Exit site from temporary access road and turn right (west) onto Blossom Street.
2. Continue west until 12th street.
3. Turn left onto 12th Street.
4. Continue on 12th Street until making a right onto Frink Street.
5. The quarry entrance is at the end of Frink Street.

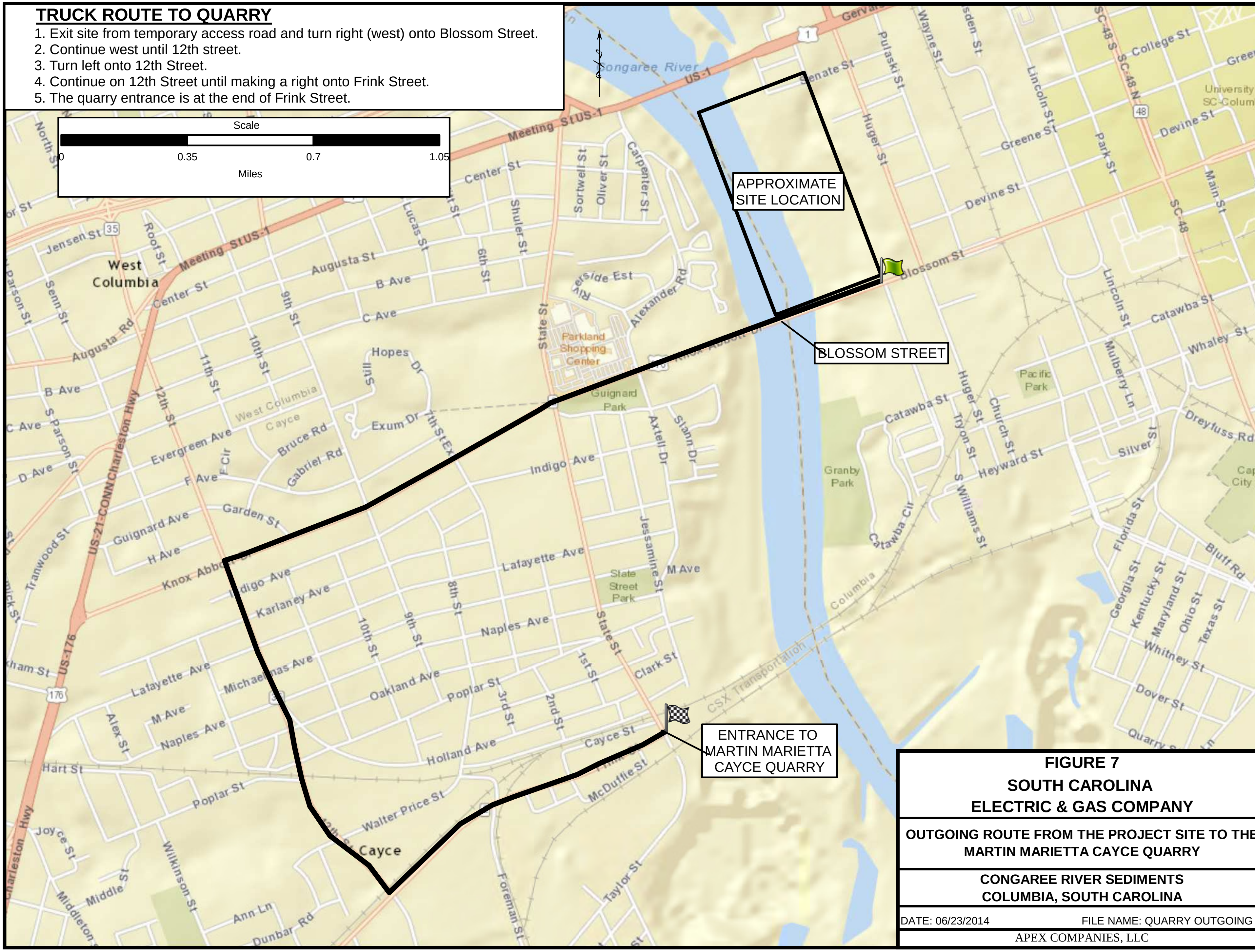


FIGURE 7

SOUTH CAROLINA ELECTRIC & GAS COMPANY

OUTGOING ROUTE FROM THE PROJECT SITE TO THE MARTIN MARIETTA CAYCE QUARRY

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

DATE: 06/23/2014 FILE NAME: QUARRY OUTGOING

APEX COMPANIES, LLC

APPENDIX P

PUBLIC SAFETY PLAN

PUBLIC SAFETY PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2014

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
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Trafford, PA 15085

PUBLIC SAFETY PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

INTRODUCTION

South Carolina Electric and Gas Company (SCE&G) plans to complete a response action to address the occurrence of a tar-like material (TLM) that is commingled with sediment along the eastern shoreline of the Congaree River, just south of the Gervais Street Bridge in Columbia, South Carolina. The project area location is shown on Figure 1. The TLM is believed to be a coal tar material that originated from the Huger Street former Manufactured Gas Plant (MGP) site, located approximately 1,000 feet to the northeast of the project area. The proposed work is being performed by SCE&G at the direction of South Carolina Department of Health and Environmental Control (SCDHEC) and is subject to permits and approvals from the U.S. Army Corps of Engineers (USACE) and other agencies.

The overall objective of this project is to remove the impacted sediment from the Congaree River and restore the aquatic resource to its natural functions. The current plan is to construct a temporary cofferdam to facilitate removal of the impacted sediment in phases. Initially, the work was to be completed in three phases over three separate construction seasons. As currently envisioned, the cofferdam construction and sediment removal work will be completed over two construction seasons with Phase 2 and Phase 3 being combined, weather permitting. The active, or in-the-river construction season for building or relocating the cofferdam, will be from May through December of each year (pending approval). SCE&G has also requested permission to work behind the cofferdam year round, with minimal site activity projected during the months of December through April. After the temporary cofferdam is constructed for each phase, the isolated area will be dewatered and the impacted sediment removed and transported off-site for disposal. Following completion of the impacted sediment removal activities, the cofferdam will be completely removed from the river.

GENERAL PROJECT DETAILS

Initial project activities will consist of constructing the landside support zone and installing the cofferdam around the planned Phase 1 excavation area. Figure 2 shows the cofferdam phases, current site operations plan scenario and the landside support zone components. The landside support zone will consist of a series of gravel roads and equipment/material lay down areas, office trailers and at least one temporary structure.

The cofferdam will consist of a stone riprap and a HDPE liner that will be constructed around the planned work area to isolate it from the remainder of the river and permit dewatering and excavation of the impacted sediment. Once the cofferdam is in place and the area dewatered, the sediment removal activities will commence. Due to documented historical activities conducted in the vicinity of the project area, this project will include screening the planned construction and excavation areas for potential Civil War era unexploded ordnance (UXO). Once the area is cleared by the UXO management personnel, remediation personnel will begin excavating and preparing the TLM impacted sediment for off-site transport to the disposal facility. Following completion of the sediment excavation in each area, the cofferdam will be relocated to the next phase area and the process repeated until the project is complete.

SCE&G intends to ensure that public safety and habitat conservation control measures are completed within the project area at each phase of implementation. Additionally SCE&G plans to protect the public during any landside construction activities, excavation activities and UXO identification, management and disposal activities. The following sections describe procedures to ensure the safety of remediation personnel and the public during completion of the project.

GENERAL PUBLIC SAFETY CONCERNS

Throughout completion of the planning and permitting tasks associated with this project, SCE&G has identified the major potential public safety related concerns and has developed the appropriate plans to manage these concerns. The primary concerns identified by SCE&G, regulatory officials and other interested parties include:

1. Potential traffic related issues in the general project vicinity;
2. Safe identification, handling and disposal of potential UXO;
3. Airborne constituents of concern, dust and odors from the TLM and site operation activities;
4. Construction and operation of the cofferdam structures; and
5. Continued safe navigation through the project area and use of the Congaree River resources.

In addition to the Removal Action Plan (RAP), a number of separate plans were developed to adequately address the above-mentioned concerns. These plans are briefly described below and can be reviewed in detail under separate covers and have been provided as appendices to the RAP.

PROJECT SAFETY RELATED PLANS AND COMPONENTS

A number of project plans and components have been developed to provide guidance and specific details pertaining to project personnel and public safety during completion of the project. The plans are provided under separate covers and in the RAP for the project and include:

- **Health and Safety Plan (HASP)** – The HASP is the primary source of safety related information for the project and includes a project specific evaluation of the potential hazards and the corresponding control and mitigation activities. Task specific hazard matrices are included as are air monitoring frequencies and action levels, personnel responsibilities, training requirements and emergency procedures. All personnel and visitors entering the site will be given a HASP briefing and will review the HASP prior to conducting work on the site.
- **Traffic Control Plan** – This Plan provides specific routes into and away from the site, the landfill and the anticipated stone (cofferdam construction material) quarry to ensure that all site-related traffic movements are conducted as safely and with as minimal of an impact on the surrounding community as practical. Local government officials and emergency response agencies were

contacted and their input was utilized in development of the Traffic Control Plan. The Plan will be implemented during completion of the project and project oversight personnel will monitor trucking operations to ensure continued compliance with the plan.

- **Public Notification Plan** – This document provides the planned steps that SCE&G, USACE and SCDHEC will undergo to notify the general public in the vicinity of the project area, local officials and emergency response agencies of anticipated major project milestones or changes, etc. It will ensure timely notification of important project details, as required throughout completion of the project.
- **Navigation Plan** – Developed based on and in accordance with the guidelines located in the "U.S. Coast Guard Aids to Navigation System" publication and through consultation with the U.S. Coast Guard District Seven Aids to Navigation and Waterways Management Office. The plan provides specific methods for notifying boaters and other users of the river in advance of the construction site (upriver and downriver) and the need to take appropriate measures to avoid the cofferdam structure. It provides the specific methods for demarcating the area to be avoided and the buoy/signage/lighting scenario for the project.
- **Community Air Monitoring and Odor/Dust Control Plan** – This Plan provides work area and site perimeter air monitoring procedures to ensure that site related constituents of concern, dust and odors are monitored and throughout completion of the project.
- **UXO Management Plans** – These Plans will provide the specific guidelines for completion of the potential UXO screening, identification and subsequent management and disposal activities. The specific plans include the Draft Work Plan for Munitions Response, Explosive Safety Submission Munitions and Explosives of Concern, Draft Diving Operations Plan and Diving Safe Practices Manual. These plans were developed in accordance with industry standards and will be reviewed and approved by the USACE prior to implementation.
- **Site Operations Plan** – This Plan will provide details pertaining to the actual remediation work including excavation, water management, material conditioning, site traffic flow and other components. The various tasks outlined in the Site Operations Plan were developed with the intent to complete the project as safely, efficiently and with as minimal of an impact as possible on the surrounding community, river ecosystem and the landside support zone.
- **Cofferdam Inspection and Maintenance Plan** – This Plan provides a detailed daily cofferdam structure inspection plan that will be implemented by project oversight personnel. Areas of inspection include the cofferdam structural integrity, exterior conditions (such as debris buildup), riverbank tie-in locations, overall performance and leakage volumes, navigational signage and notification components, expected future river levels, etc. An inspection form/checklist will be completed daily and any potential areas in need of repairs will be documented and addressed as soon as practical. Implementation of this plan will ensure that cofferdam structural issues are identified and rectified in a timely manner and that project personnel are aware of changing river conditions and can plan accordingly to protect project assets.

Finally, an important component of the overall project will be site security. Site security measures are explained in detail in the Site Operations Plan and the RAP, but since they are likely the most integral public safety component, they are further described below. Maintaining site security will ensure that only properly trained personnel have access to the various work areas associated with the site.

The primary method for securing the site will be the installation of a temporary chain-link fence around the perimeter of the landside support zone. "Restricted Area" signs will be posted at regular intervals along the fence and also posted on the cofferdam structure, as noted in the Navigation Plan. The approximate fence location is shown on Figure 2. Two locking gates, one at the corner of Senate and Gist Streets and one at the entrance to the landside support zone just north of the bridge over unnamed Tributary #2, will restrict vehicular traffic into and away from the project area. The Senate and Gist Streets gate will only be utilized by project personnel in small personal vehicles to gain access to the site office complex. No project related heavy truck traffic will access the site through this gate.

To prevent the unauthorized or unknowing entry of third parties onto the site, access gates will remain closed during site activities to the extent practical. The gates will remain locked during non-working hours while removal activities are occurring and/or remediation equipment and material are present.

Once site construction operations are initiated, SCE&G will also post security guards on-site during non-working hours. SCE&G has previously successfully utilized off-duty City of Columbia police officers as security guards at other local sites. These guards will conduct regular patrols of the property during non-working hours and at times of low site activity when a minimal number of site personnel are present. The guards and fence will serve to keep unauthorized and untrained personnel out of the active project area.

Implementation of the above plans and security measures will result in the following public safety related project attributes:

1. Restrict access to the site area to only authorized and properly trained personnel;
2. Ensure that work within the project area is conducted in accordance with industry standards for safety;
3. Control odor, dust and other potential emissions within the work area and the site perimeter, which will protect the site workers and the surrounding community;
4. Control traffic patterns on-site and into and away from the project area, landfill and stone quarry locations in order to significantly reduce the potential for traffic related incidents in the surrounding community;
5. Inform boaters and other river users of the cofferdam structure and the appropriate measures to avoid the structure and safely pass through the project area;
6. Conduct UXO screening, identification and management activities in accordance with industry standards for safety and the approved site specific work plans;
7. Inspect and rectify potential issues with the cofferdam structure; and
8. Generally complete all site related activities in a safe and efficient manner.

SCE&G believes that the successful implementation of the above plans and security measures will result in the safe completion of the project with as minimal of an impact on the surrounding community, as practical.

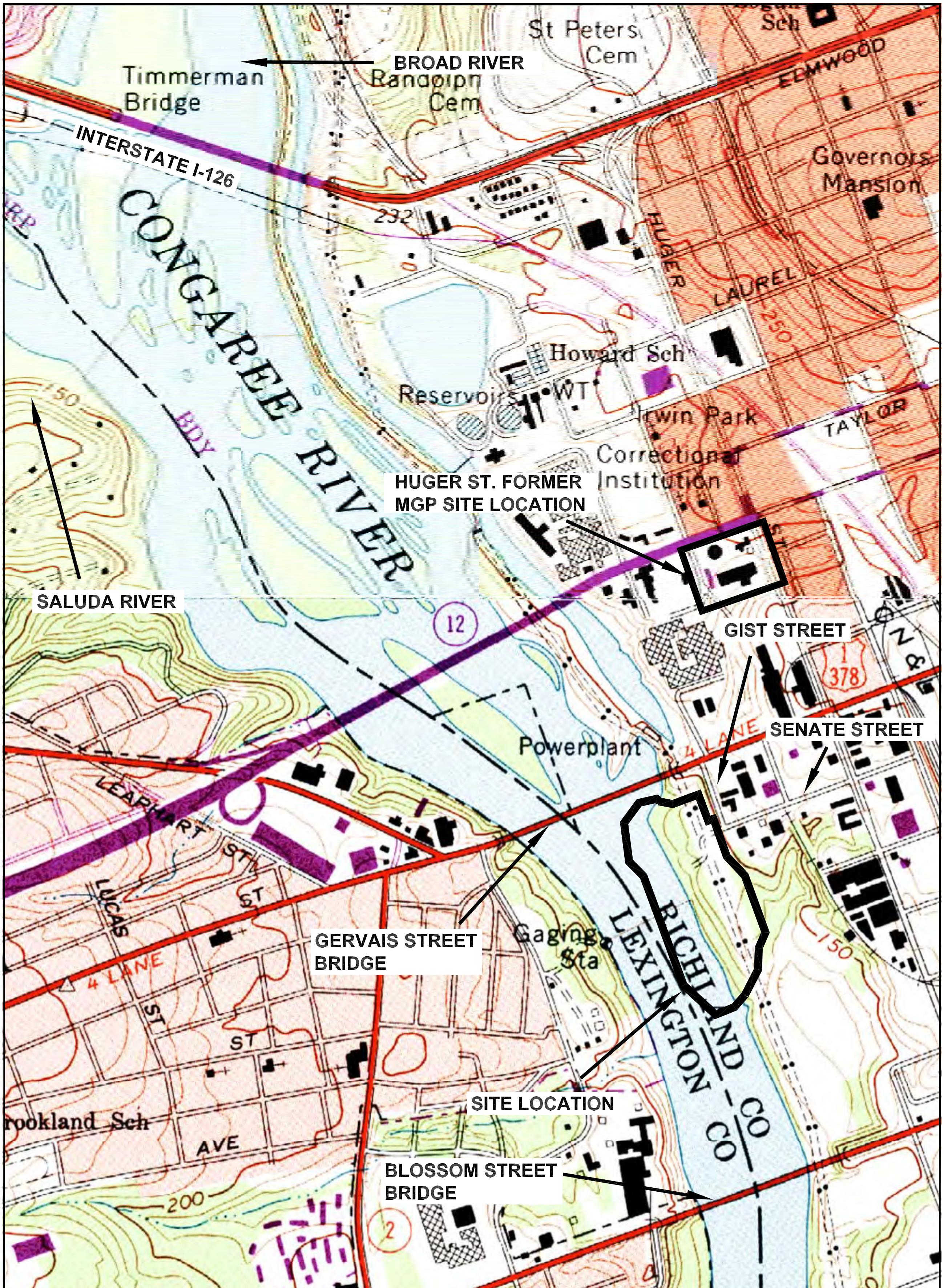


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 02/26/14 FILE NAME: CONG049

APEX COMPANIES, LLC

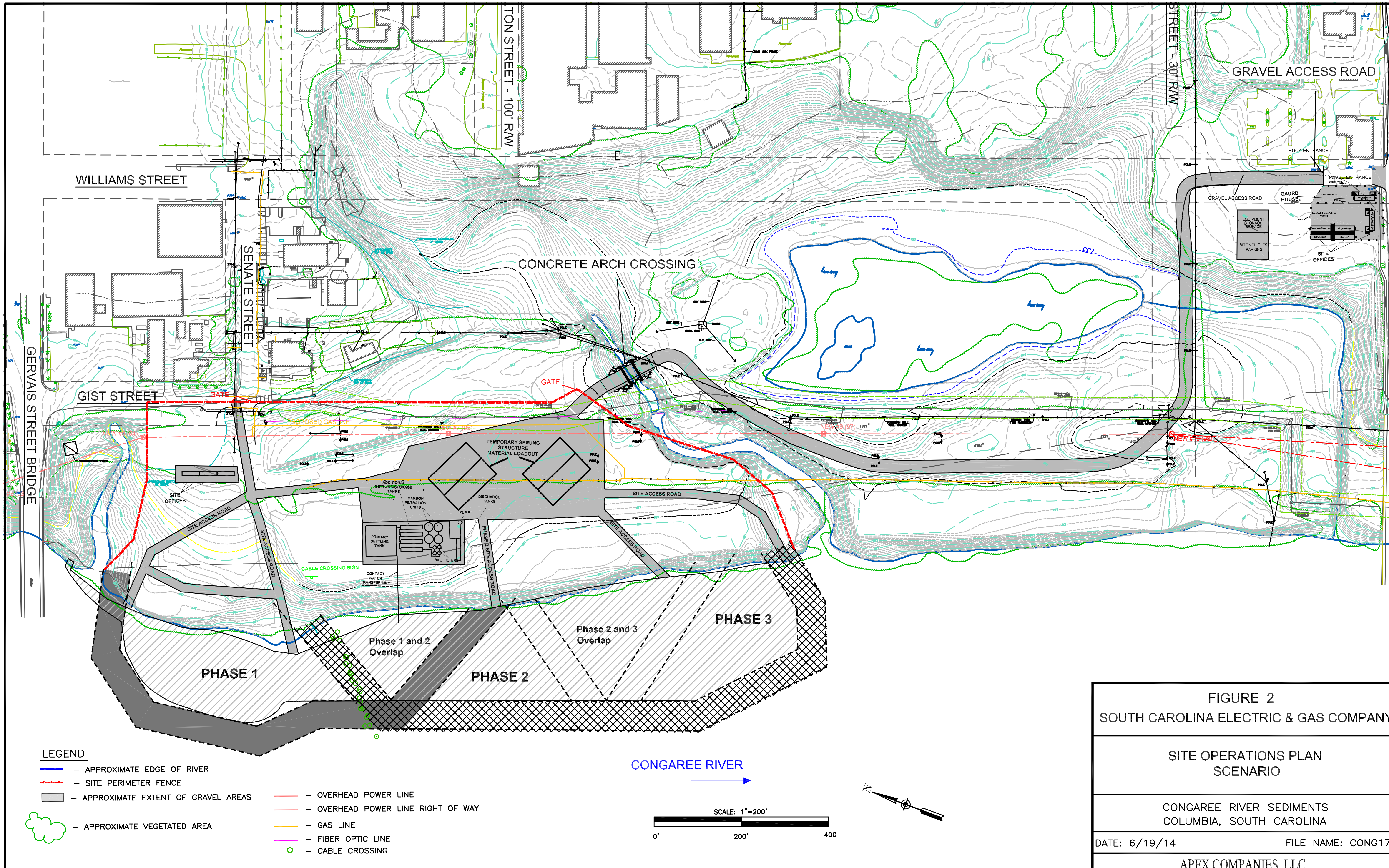


FIGURE 2

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SITE OPERATIONS PLAN SCENARIO

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/19/14 FILE NAME: CONG177

APEX COMPANIES, LLC

APPENDIX Q

USACE APPLICATION FOR FIELD DEMONSTRATION PROJECT (CD)

JOINT FEDERAL AND STATE APPLICATION

Joint Federal and State Application Form **For Activities Affecting Waters of the United States** **Or Critical Areas of the State of South Carolina**	**This Space for Official Use Only** Application No.__________ Date Received__________ Project Manager__________ Watershed #

Authorities: 33 USC 401, 33 USC 403, 33 USC 407, 33 USC 408, 33 USC 1341, 33 USC 1344, 33 USC 1413 and Section 48-39-10 et. Seq of the South Carolina Code of Laws. These laws require permits for activities in, or affecting, navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters. The Corps of Engineers and the State of South Carolina have established a joint application process for activities requiring both Federal and State review or approval. Under this joint process, you may use this form, together with the required drawings and supporting information, to apply for both the Federal and/or State permit(s).

Drawings and Supplemental Information Requirements: In addition to the information on this form, you must submit a set of drawings and, in some cases, additional information. A completed application form together with all required drawings and supplemental information is required before an application can be considered complete. See the attached instruction sheets for details regarding these requirements. You may attach additional sheets if necessary to provide complete information.

1. Applicant Last Name: Apple		11. Agent Last Name (agent is not required): Contrael	
2. Applicant First Name: Robert		12. Agent First Name: Andrew	
3. Applicant Company Name: South Carolina Electric & Gas Co. (SCE&G)		13. Agent Company Name: Apex Companies, LLC	
4. Applicant Mailing Address: 220 Operation Way		14. Agent Mailing Address: 1600 Commerce Circle	
5. Applicant City: Cayce		15. Agent City: Trafford	
6. Applicant State: SC	7. Applicant Zip: 29033	16. Agent State: PA	17. Agent Zip: 15085
8. Applicant Area Code and Phone No.: 919-819-2748		18. Agent Area Code and Phone No.: 412-829-9650	
9. Applicant Fax No.: 803-933-8004		19. Agent Fax No.: 412-349-0350	
10. Applicant E-mail: rapple@scana.com		20. Agent E-mail: rcontrael@apexcos.com	
21. Project Name: Congaree River - Field Demonstration Project		22. Project Street Address: N/A - Alluvial fan located at the terminus of the Senate St. Ext. and directly adjacent to the Congaree River	
23. Project City: Columbia	24. Project County: Richland	25. Project Zip Code: 29201	26. Nearest Waterbody: Congaree River
27. Tax Parcel ID: R08911-01-14		28. Property Size (acres): Approximately 33 acres (Landside)	
29. Latitude: 33 59 40.59N		30. Longitude: 81 02 56.80W	

31. Directions to Project Site (Include Street Numbers, Street Names, and Landmarks and attach additional sheet if necessary):

Travel east on the Gervais Street Bridge, turn right onto Gist Street, and turn right onto the Senate St. Ext. Project site located at the terminus of Senate St. Ext. and adjacent to the Congaree River.

32. Description of the Overall Project and of Each Activity in or Affecting U.S. Waters or State Critical Areas (attach additional sheets if needed)

The Field Demonstration Project (FDP) basically entails screening the approximate alluvial fan area for metallic anomalies, which could be potentially historically significant items, UXO or other metallic debris. The soil, stone, debris and other materials that constitute the alluvial fan will be carefully removed and replaced down to the underlying bedrock. The end of the access road that leads to the alluvial fan will be improved. Sand bags will be placed at the western, riverside extent of the FDP area to provide a buffer against minor river level fluctuations during completion of the project. Additional information is provided in the attachments.

33. Overall Project Purpose and the Basic Purpose of Each Activity In or Affecting U.S. Waters (attach additional sheets if needed):

The overall purpose of this project is to screen and properly manage potential UXO in the alluvial fan area, which will provide access to the future removal area within the Congaree River. Completion of the FDP will provide the project team with valuable insight into coordination of the future TLM removal action and UXO management activities and also safety clear the alluvial fan of potentially hazardous UXO. Additional information provided in the attachments.

34. Type and quantity of Materials to Be Discharged

Dirt or Topsoil:	_____	☐cubic yards
Clean Sand:	_____	☐cubic yards
Mud:	_____	☐cubic yards
Clay:	_____	☐cubic yards
Gravel, Rock, or Stone:	_____	☐cubic yards
Concrete:	_____	☐cubic yards
Other (describe):	_____	☐cubic yards
TOTAL:	0	cubic yards

35. Type and Quantity of Impacts to U.S. Waters (including wetlands).

Filling:		☐acres	☐ sq.ft.		☐cubic yards
Backfill & Bedding:		☐acres	☐ sq.ft		☐cubic yards
Landclearing:		☐acres	☐ sq.ft		☐cubic yards
Dredging:		☐ acres	☐ sq.ft.		☐cubic yards
Flooding:		☐acres	☐ sq.ft.		☐cubic yards
Draining/Excavation:	<5,000	☐acres	☒ sq.ft.		☐cubic yards
Shading:		☐acres	☐ sq.ft.		☐cubic yards
TOTALS:		acres	<5,000 sq.ft.		cubic yards

36. Individually list wetland impacts including mechanized clearing, fill, excavation, flooding, draining, shading, etc. and attach a site map with location of each impact (attach additional sheets if needed).

Impact No.	Wetland Type	Distance to Receiving Water body (LF)	Purpose of Impact (road crossing, impoundment, flooding, etc)	Impact Size (acres)
N/A				
			Total Wetland Impacts (acres)	N/A

37. Individually list all seasonal and perennial stream impacts and attach a site map with location of each impact (attach additional sheets)

Impact No.	Seasonal or Perennial Flow	Average Stream Width (LF)	Impact Type (road crossing, impoundment, flooding, etc)	Impact Length (LF)
Congaree River	Perennial	~600	Remove and replace portions of alluvial fan	500-600
			Total Stream Impacts (Linear Feet)	500-600

38. Have you commenced work on the project site? ■ YES ☐ NO If yes, describe all work that has occurred and provide dates.

Completed the TLM delineation work from June 2010 through February 2011. See previous project submittals.

39. Describe measures taken to avoid and minimize impacts to Waters of the United States:

It is the intent of SCE&G to complete the FDP in a relatively dry environment, with the river at lower elevations. Large sandbags will be placed at the water's edge to isolate the work area from minor river flow fluctuations and reduce the potential for downstream migration of sediment. Implementation of BMPs will also help avoid and minimize impacts to the river. Limiting the FDP work to outside of the normal low river elevation will minimize any minor impacts to the river that may arise from completion of the FDP. Disturbed areas will be back-filled prior to moving to the next location and at the end of every workday. Also, the weather forecast and the river gauge predictor will be closely monitored for impending high water so that the FDP area can be quickly secured. Higher river flows will not be impacted by completion of the FDP. Additional information is provided in the Attachments.

40. Provide a brief description of the proposed mitigation plan to compensate for impacts to aquatic resources or provide justification as to why mitigation should not be required (Attach a copy of the proposed mitigation plan for review).

No mitigation plan is required since the proposed intrusive activities associated with this portion of the project are temporary and removing the physical hazards associated with potential UXO will improve safety for those accessing the river. Removing debris from the project area will result in a permanent improvement to the environment.

41. See the attached sheet to list the names and addresses of adjacent property owners.
See Attachment

42. List all Corps Permit Authorizations and other Federal , State, or Local Certifications, Approvals, Denials received for work described in this application.

Although not specifically required for this Joint Application, a NWP-14 permit for linear construction projects was approved to construct the "Southern Access Route". The Souther Access Route will permit Phase 2 project traffic to be directed to the south to Blossom Street. This work is now expected to be initiated after the Phase 1 - FDP is completed and prior to implementation of the Phase 2 – MRA.

43. Authorization of Agent. I hereby authorize the agent whose name is given on page one of this application to act in my behalf in the processing of this application and to furnish supplemental information in support of this application. [1]

June 12, 2015

Applicant's Signature — Date

44. Certification. Application is hereby made for a permit or permits to authorize the work and uses of the work as described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent for the applicant. [1]

June 12, 2015 — June 12, 2015

Applicant's Signature — Date — Agent's Signature — Date

[1]The application must be signed by the person who desires to undertake the proposed activity or it may be signed by a duly authorized agent if the authorization statement in blocks 11 and 43 have been completed and signed. 18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

JOINT FEDERAL AND STATE APPLICATION FORM FOR ACTIVITIES AFFECTING WATERS OF THE UNITED STATES OR CRITICAL AREAS OF THE STATE OF SOUTH CAROLINA (JOINT APPLICATION)

PHASE 1 – FIELD DEMONSTRATION PROJECT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2015

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

LIST OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
BMP	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (commonly known as Superfund)
CSM	Conceptual Site Model
EE/CA	Engineering Evaluation/Cost Analyses
EOD	Explosive and Ordnance Demolition
FDP	Field Demonstration Project
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
MGP	Manufactured Gas Plant
MRA	Modified Removal Action
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permit
PAHs	Polynuclear Aromatic Hydrocarbons
PCN	Pre-Construction Notification
PDR	Project Delineation Report
RAWP	Remedial Action Work Plan
RD	Remedial Design
RSLs	Regional Screening Levels
RSSL	Rocky Shoal’s Spider Lily
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company (primary subsidiary of SCANA Services, Inc.)
SCIAA	South Carolina Institute of Archeology and Anthropology
SHPO	South Carolina State Historic Preservation Office
SF	Square Feet
TLM	Tar-Like Material
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UXO	Unexploded Ordnance
VCC	Voluntary Cleanup Contract

TABLES

FIGURES

ATTACHMENTS

INTRODUCTION

This Joint Federal and State Application Form For Activities Affecting Waters Of The United States Or Critical Areas Of The State Of South Carolina (Joint Application) is being submitted on behalf of South Carolina Electric & Gas Company (SCE&G) to provide information pertaining to the first phase of a proposed sediment removal project located in a portion of the Congaree River in Columbia, South Carolina.

SCE&G is the respondent required to complete a removal action for a tar-like material (TLM) that is commingled with sediment within the Congaree River. The actual project area is located along the eastern shoreline of the river, just south of the Gervais Street Bridge as shown on Figure 1.

Information regarding this project has been previously submitted under USACE Permit Number P/N 2011-01356-6NO. In correspondence dated March 2, 2015 (Attachment A), the South Carolina Department of Health and Environmental Control (SCDHEC) directed SCE&G to proceed with revising all previously submitted plans to implement a “targeted” or Modified Removal Action (MRA) to address impacted sediment within the Congaree River.

From a permitting approach and to achieve the directive stated above, SCE&G is currently proposing two phases of work with separate permit submittals/approvals for each phase. The proposed phases consist of:

- Phase 1 - Field Demonstration Project (Phase 1 – FDP); and
- Phase 2 - Modified Removal Action (Phase 2 – MRA) [To be submitted at a later date].

Based on the previously submitted delineation work, the extent of the TLM in the river has been defined. Additionally, based on prior work, a significant number of metallic anomalies have been identified within the river and near the terminal end of the Senate Street Extension (the primary access point to the river in the general area). These metal anomalies (or any portion thereof) may potentially be Civil War era unexploded ordinance (UXO). Their identification and safe removal utilizing the USACE approved UXO management plans provided in Attachment B are the primary objectives of the FDP and the purpose of this submittal.

Specific details pertaining to the investigation activities, the nature and extent of TLM locations, potential remedial alternatives and other site-related issues have been provided in previous submittals and reports. For efficiency, these previously submitted documents are incorporated into this PCN by reference only.

JOINT FEDERAL AND STATE APPLICATION FORM FOR ACTIVITIES AFFECTING WATERS OF THE UNITED STATES OR CRITICAL AREAS OF THE STATE OF SOUTH CAROLINA (JOINT APPLICATION)

DRAWINGS AND SUPPLEMENTAL INFORMATION

Applicant and Project Information

Please refer to item numbers 1 thru 30 of the Joint Application form, which have been completed.

Item #31 - Directions to the Project Site

The FDP area is located on an alluvial fan that protrudes from the eastern bank of the Congaree River and extends from approximately 400 feet south of the Gervais Street Bridge downriver (generally south) for approximately 500 feet. The nearest street intersection is Gist and Senate Streets. Figure 1 is a USGS 7½ minute quadrangle map that shows directions from Interstate I-126. Take interstate I-126 south and exit onto Huger Street. Stay on Huger Street for about one mile. Turn right onto Senate Street, which is located about 500 feet south of the Huger Street and Gervais Street intersection. Once on Senate Street, proceed about 1,000 feet west, where a steel gate exists across the access road and represents the entrance to the project site. The access road leads directly to the Congaree River and the Senate Street “alluvial fan”, which is a term used to describe a prominent site feature where sediment has accumulated near the end of the deteriorated access road (i.e., tow of slope). See Figure 2 for specific site details. After completion of the FDP the alluvial fans area will be the primary access point for the removal phase of the project (Phase 2).

Item #32 - Description of the Overall Project

<u>Overview</u>
As currently proposed, the Phase 1 – FDP project will be conducted only on “dryland” in the location referred to as “the alluvial fan area”, situated at the end of the Senate Street Extension, as shown on Figure 2. The alluvial fan appears to be an area where sediment accumulation occurs as a result of erosion from urban landside activities and from depositional forces within the fluctuating river environment (during higher water level events). “Dryland” also referred to as the “landside” is defined as the alluvial fan area that extends from the edge of the low water level eastward to the normal high-water mark. The proposed FDP area is exposed and accessible during normal (lower) river levels, as seen on Figure 2.

The FDP basically entails “screening”, or evaluating, the entire alluvial fan area (Figures 2 and 3) for metal anomalies, locating and identifying the source of the metallic signal and then safely and carefully exposing and removing the item. Excavation of surrounding sand/soil/sediment will be completed only to the extent necessary to expose and retrieve the item generating the magnetic anomaly signal. No sand/soil/sediment will be removed from the site during implementation of the FDP, unless, in the unlikely event, the excavated material is determined to be impacted by TLM. Any large boulders, logs or fallen trees encountered within the FDP area will be pushed aside to facilitate access and then returned to the “as-found” position, to the extent possible. The entire scope of work related to excavation within the alluvial fan will be governed by the approved UXO plans. Retrieved objects (i.e., UXOs, historical artifacts and/or debris) will be managed as described below.

FDP Process

The FDP Work Plan is provided in Attachment C. It includes a more detailed description of the activities outlined below. The general process will include re-establishing the locations of previously identified metal anomalies in the field. Next, the locations and surrounding areas will be re-screened using metal detectors or other devices as set forth in the UXO plans. Once a metal anomaly has been identified, the material surrounding the object generating the signal will be carefully removed. The excavated material will be temporarily set aside (i.e., no material will be removed from the site unless it appears to be impacted). Once the metallic item has been exposed by trained UXO personnel, it will be managed in accordance with the approved UXO plans. If there is sediment/soil below a removed object, careful excavation of existing material in controlled lifts will be completed, if necessary, to determine if additional or currently unknown metal anomalies are present (i.e., the “mag and dig” approach). Once the underlying bedrock surface has been encountered, the screening activities will have been completed and the excavated material will be replaced and the process will start again in an adjacent location.

During completion of the FDP, the sand, soil, stone, sediment, debris and other materials that constitute the alluvial fan will be evaluated down to the underlying bedrock surface. The approximate extent of the FDP area is shown on Figure 3 and is approximately 23,000 Square Feet (SF). It extends from the water’s edge during normal river flow elevations (approximately 116 feet MSL) to the approximate toe of the main river bank (approximately 122 feet MSL). The sediment thickness within the alluvial fan ranges from approximately 2 to 10 feet, depending on the location. Figure 4 provides a cross-section of the alluvial fan area and illustrates the anticipated thickness of the material to be evaluated. It is anticipated the majority of material evaluated from the alluvial fan area will be un-impacted (i.e., no TLM has been documented in this material). However, since the potential exists that TLM could be encountered, albeit unlikely, provisions will be in place to manage the material for proper disposal in accordance with SCDHEC-approved procedures.

In summary, the entire FDP area will be evaluated by the screening process briefly described above and detailed in the UXO plans. Metal anomalies that are deemed “safe-to-move” will be removed and managed appropriately as summarized in the next section. For the FDP, the unearthed metallic anomalies will likely fall into one of the three following categories (and will be handled accordingly):

- Potentially hazardous unexploded ordinance (UXO);
- Historically significant items or artifacts; or
- Other, inert metallic debris.

UXO Management

Based on previously conducted work, approximately 74 metallic anomalies were identified in the FDP area that have “*electro-magnetic signature characteristics that could potentially be associated with ordnance*”. Therefore, a qualified UXO contractor will be employed to conduct the screening and UXO management activities in accordance with USACE-approved plans and procedures (Attachment B) with USACE providing oversight while the field work is being completed. “Screening”, defined in simple terms, consists of evaluating an area using approved equipment such as a metal detector, etc. to determine the presence of a metal anomaly and carefully exposing the anomaly to ascertain its hazard potential and determining/rendering the object safe to move (i.e., the “mag and dig” approach). The attached plans contain much more detail than this simplified summary. By design, SCE&G's approach to addressing the potential UXO issue is identical to how experts in the UXO field and at the USACE would conduct the work.

Historical Artifact Management

Potential, metallic, non-UXO related items or artifacts of historical value that may be recovered will be evaluated by an archeologist and eventually transferred to the South Carolina Institute of Archeology and Anthropology (SCIAA) or State Historic Preservation Office (SHPO), as applicable. **AFTER THE UXO PERSONNEL HAVE DETERMINED THE RECOVERED OBJECT IS SAFE TO MOVE**. The location of any recovered objects will be carefully documented. Approved plans for addressing artifact recovery and conservation are provided in Attachment D. A Memorandum of Agreement (MOA) has been developed among and between the appropriate agencies, the USACE and SCE&G and is also included in Attachment D.

It should be noted that the Archaeological Data Recovery Plan contains significant details that were envisioned at the time when it was submitted and approved and was based on the original scope of work for the Congaree River project. Since the approval date, the scope of the project has been greatly reduced to the currently envisioned Phase 2 – MRA. Although the intent and objectives of the plan will be fulfilled during execution of the FDP, the magnitude of the originally planned artifact recovery support infrastructure will not be installed on-site for the FDP. However, the recovery and conservation work will be conducted in TRC's conservation laboratory in Columbia, SC.

Other Metallic Debris

Other metallic debris (i.e., discarded trash, cans, hubcaps, and the like) encountered during implementation of the FDP, will be collected and either recycled or disposed of properly by SCE&G. Metallic debris will not be returned to the area in which it was found.

Logistical Issues

Improvement (removing fallen trees and debris) of the access road that leads to the alluvial fan area will be required. Stone fill will also be placed at the end of the asphalt road extension to address previous erosion issues and facilitate access to the project area. Some minor clearing and grading to establish a temporary support zone adjacent to the FDP removal area will also be completed. Sand bags and/or large filter socks will likely be placed at the western, riverside extent of the FDP project area to provide a buffer against minor river level fluctuations during completion of the project. Best Management Practices (BMPs) for Erosion and Sedimentation (E&S) controls will also be installed prior to starting intrusive work within the project area, if needed.

The FDP will only be completed during favorable, lower water level elevations. The total FDP evaluation area is approximately 23,000 SF. For the 74 known metal anomalies in the evaluation area, it is assumed that a typical test pit excavation of 6 foot by 10 foot will be completed. Therefore, the estimated total surface area to be disturbed (removed and replaced) is estimated to be 4,440 SF. This calculation neglects any overlap for known metal anomalies. Assuming a 10% contingency for additional (presently unknown) metallic anomalies, the total anticipated surface area to be physically disturbed is less than 5,000 SF. The FDP evaluation area and the known 74 metallic anomalies are shown on the attached Figure 3.

The FDP is expected to entail completion of the following specific activities:

1. Mobilization of a UXO contractor, sediment excavation personnel and oversight personnel (USACE UXO, SCE&G, archeologist);
2. Establish security measures (fencing and security personnel);
3. Completion of access road improvement activities that will include grading to remove damage caused by ongoing erosion of the paved/gravel road, near the alluvial fan (Figure 2);
4. Establishing landside support zone areas (near the river and within the electrical right-of-way near Senate and Gist Streets);
5. Establishing a water management system, described in the Water Management Plan provided in Appendix A of the attached FDP Plan;
6. Placement of large sandbags at the western, riverside extent of the FDP project area to provide a buffer against minor river level fluctuations during completion of the project;
7. UXO screening and management activities with oversight provided by USACE UXO experts;
8. Historical artifact management with oversight provided by an archaeologist;
9. Excavation of test pits to uncover and identify the metallic anomalies;
10. Proper disposal of any TLM impacted material or recovered debris, as may be required;
11. Excavation water management, as required; and
12. Removal of the large sandbags and any temporary E&S controls installed during the FDP.

Some of these planned activities may be completed in a different sequence than listed above or in advance of the mobilization to perform the actual FDP.

Item #33 - Overall Project Purpose and the Basic Purpose of Each Activity

The primary purpose of the FDP is to implement, evaluate and improve (if necessary) the UXO management plans on “dryland”, before expanding the work into the river area. This section presents a justification for completing the FDP as the initial phase of the overall sediment removal project. After completing the Phase 1 – FDP, a determination to proceed with implementation of the Phase 2 – Modified Removal Action (MRA) will be made by the regulatory agencies, assuming all other permit and design requirements for the Phase 2 – MRA have been adequately addressed.

The locations of the known metal anomalies in the alluvial fan area are shown on Figure 3. The potential for encountering metal anomalies that are in fact UXOs, presents a significant physical hazard to removing the TLM from the river. Also, there is a very real possibility that there could exist more metal anomalies/UXOs than currently identified. Therefore, SCE&G believes that the “readily” accessible metal anomalies that currently exist within the alluvial fan area must be properly addressed prior to initiating any impacted sediment removal work within the river. The information obtained during the FDP will increase the safety and efficiency of the Phase 2 removal effort.

Completion of the FDP will provide the project team and the regulatory agencies with valuable insight into the actual risks associated with the UXO management activities. Completion of the FDP will also result in “clearing” the alluvial fan area of potentially hazardous UXO, which will facilitate the primary access way into the river for the full-scale sediment MRA. Therefore, for permitting purposes, the NWP-38 is applicable for both phases of the overall project since screening for and removal of the potential UXOs is “hazardous” from a physical exposure standpoint, and the TLM is considered “toxic” from a chemical constituent perspective (i.e., benzene).

Detailed plans relating to the safe management procedures for handling the potential UXOs are discussed below. The USACE UXO review team also concurs with SCE&G and its consultants that it is prudent to conduct the FDP in order to test (and perhaps refine) the specific detailed procedures for management of the UXOs, prior to full scale implementation. The USACE UXO team will also provide oversight personnel during implementation of the FDP.

Item #34 - Type and Quantity of Materials to be Discharged

The FDP will only be completed during favorable, lower water level elevations and excavation operations will be conducted on the alluvial fan, which is composed of depositional material including sand, silt clay and some larger diameter cobbles. No new materials will be placed onto the alluvial fan and the excavations will be backfilled by the removed material. The total FDP evaluation area is approximately 23,000 SF. For the 74 known metal anomalies in the evaluation area, it is assumed that a typical test pit excavation of 6 foot by 10 foot will be completed. Therefore, the estimated total surface area to be disturbed (removed and replaced) is estimated to be 4,440 SF. This calculation neglects any overlap for known metal anomalies. Assuming a 10% contingency for additional (presently unknown) metallic anomalies, the total anticipated surface area to be physically disturbed is less than 5,000 SF. The FDP evaluation area and the known 74 metallic anomalies are shown on the attached Figure 3.

Item #35 - Type and Quantity of Impacts to U.S. Waterways (including wetlands)

Although located on “dryland” during normal low river flows, the alluvial fan area is within the high water mark boundary of the Congaree River. Removal and replacement of the alluvial fan materials down to the underlying bedrock will not significantly impact the river and will have minimal impact on aquatic habitat since it will be conducted on “dryland”.

Item #36 - Individually List Wetland Impacts

Figure 6 shows the approximate extent of the FDP area and the location of wetlands. As can be noted, the Congaree River and adjacent shoreline represents the dominant wetland. Two unnamed tributaries (#1 and #2) lie to the north and south of the project area. No activities are proposed that will impact these tributaries. A relatively large palustrine wetland is also located to the south of Unnamed Tributary #2 and will not be disturbed or impacted by the Phase 1 – FDP.

Other than temporarily disturbing the alluvial fan adjacent to the Congaree River, no other wetland impacts are anticipated for the FDP portion of the project. This impact will be relatively short in duration (the actual UXO work is currently anticipated to be completed within one week) and only the areas with metal anomalies will be removed and replaced. The FDP project area does not exhibit characteristics of special aquatic sites or designated critical resource waters and it is not specified as a wild and scenic river system.

Item #37 - Individually List Seasonal and Perennial Stream Impacts

The Congaree River is the main perennial water body located within the project area. Work on the alluvial fan, as previously described, will be the only impact to the river during this Phase of the project. There are two perennial streams located adjacent to the project area as shown on Figure 6. These streams are referred to as Unnamed Tributary #1 (UT-#1) located to the north of the project area and Unnamed Tributary #2 (UT-#2) located to the south of the project area. The planned construction/removal activities covered under this permit request will have no impact on these streams.

As stated previously, construction of the temporary culvert/bridge over Unnamed Tributary #2 was approved under NWP-14.

Item #38 - Have You Completed Work on the Project Site?

Yes, the TLM delineation activities were completed from June 2010 through February 2011. The sampling methods and findings of the sediment investigation activities were provided in the Project Delineation Report (PDR) [MTR, March 2012], which was submitted to SCDHEC for review and approval. The PDR was approved by SCDHEC on April 23, 2012. A brief summary of the PDR and a copy of the approval letter were provided in previous submittals.

Item #39 - Describe Measures Taken to Avoid and Minimize Impacts to Waters of the United States

As stated above, the area to be impacted by the planned FDP activities extends from the approximate water's edge during normal river flow elevations (approximately 116 feet MSL) to the approximate toe of the main river bank (approximately 122 feet MSL). It is the intent of SCE&G to complete the FDP in a relatively dry environment. Large sandbags will be placed at the water's edge to isolate the work area from minor river flow fluctuations and reduce the potential for downstream migration of sediment. Completing the work outside of the river flow area will minimize any minor impacts to the river that may arise from completion of the FDP. Normal river flows or the normal footprint will not be impacted by completion of the FDP.

Item #40 - Justification as to Why Mitigation Should not be Required

For the activities conducted within the Congaree River, no mitigation plan is required since the proposed intrusive activities associated with this project are temporary and the improvement to the environment and aquatic resources will be permanent. The restoration and rehabilitation of the Congaree River in the project area will result in a gain in aquatic resource quality due to the removal of the TLM and the potential threat associated with the UXO. For the landside support zone, restoration of the area to original or improved conditions will negate the need for any additional mitigation measures.

Item #41 - Adjacent Property Owners

Tax Map Number: R08911-01-01
Owner: City of Columbia, 1737 Main St., Columbia, SC 29201
Property Location: 1105 Gist St.

Tax Map Number: R08911-01-17
Owner: The Guignard Partnership, PO Box 8509, Columbia, SC 29202
Property Location: Senate St.

Tax Map Number: R08911-01-14
Owner: The Guignard Partnership, PO Box 8509, Columbia, SC 29202
Property Location: Senate St.

Attachment E provides a map depicting the locations of these properties.

Item #42 - List All Corps Permit Authorizations … and Other State … Approvals

The previously approved NWP-14 permit for linear construction projects will be utilized to construct the southern access road that will connect the FDP area to the primary site entry and exit point at Blossom Street, as shown on Figure 5. The PCN for this permit request was submitted in June 2014 and it was approved on October 20, 2014. It entails improvement of the current gravel road that extends from Blossom Street to the Unnamed Tributary #2 located to the south of the alluvial fan and construction of a concrete arch crossing that will span the Unnamed Tributary #2 (Figure 5). This work is expected to be completed prior to the initiation of the FDP activities in order to provide a safe site entry and exit point for the MRA.

An additional request will be made to conduct the Phase 2 MRA once the FDP is completed. This will allow the information obtained during completion of the FDP to be incorporated into the planning for the actual removal action.

The SCDHEC and SCE&G have executed a Voluntary Cleanup Contract (VCC) for the former Huger Street MGP site. SCE&G and SCDHEC worked proactively and cooperatively to complete the delineation activities within the Congaree River under the existing VCC. The primary objective of the investigative work was to determine the vertical and horizontal extent of TLM within the Congaree River.

Additional Permit and Approval Requirements

In addition to the requested USACE permit the following permits and/or approvals will be obtained prior to implementation:

- SCDHEC 401 Water Quality Certification;
- SCDHEC approval of the Field Demonstration Project Work Plan;
- SCIAA/SHPO - Data Recovery License;
- SCIAA/SHPO Intensive Survey License; and
- City of Columbia approvals.

These licenses and approvals will be obtained in accordance with their applicable requirements and included in the Final Report for the project, which will be submitted to the USACE. A number of additional regulatory agencies as well as various stakeholder groups will have input into the project as details to address the TLM are developed.

This completes the additional responses and attachments for the Joint Application.

REFERENCES

Kleinschmidt, 2007. Status of the Shortnose Sturgeon in the Lower Saluda and Upper Congaree Rivers, 2007 Final Summary Report.

Kleinschmidt, 2008. Rare, Threatened and Endangered Species Assessment.

MTR, March 2012. Project Delineation Report – Congaree River Sediments Investigation.

MTR, January 2013. Draft Engineering Evaluation/Cost Analyses (EE/CA) – Congaree River Sediments.

South Carolina Department of Natural Resources, Inc. (SCDNR). Rare, Threatened and Endangered Species Inventory.

U.S. EPA, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.

U.S. Fish and Wildlife Service (USFWS), Endangered Species Program; Species Reports.

CHECKLIST – PCN CONTENTS

Required Preconstruction Notification Contents

SAC #:
NWP:_______
Date Application Complete:

Determination of completeness must be made within 30 days of the date of receipt. If all required information is not provided, the prospective permittee will be notified that the preconstruction notification (PCN) is still incomplete and the review will not commence until all requested information has been received. If the applicant has not received written notice from the DE within ***45 days*** of the date of receipt of a complete PCN, ***the verification is issued by default.*** However, if the permittee was required to notify the Corps pursuant to GC #17 (the activity may have an effect on listed species or critical habitat) or GC #18 (the activity may have the potential to cause effect to historic properties), then the activity cannot proceed until written notification from the Corps. Also, for NWPs 21, 49, or 50, work cannot proceed until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, work cannot begin until the district engineer issues the waiver.

All PCNs must be in writing, clearly indicate the document is a PCN, and include the following information:

ITEM#

#1 ☐ Name, address and telephone numbers of prospective permittee.

#2 ☐ Location of proposed project. This should include the following:
- ☐ Latitude and Longitude (use center of project site)
- ☐ County and nearest municipality
- ☐ Street address, if available and directions to the site

#3 ☐ Brief description of the proposed action to include:
- 3A ☐ Project purpose
- 3B ☐ Direct and indirect adverse environmental effects the project would cause.
- 3C ☐ List any other Corps of Engineers (Corps) permits or verifications used or intended to be used to authorize any part of the proposed project or any related activity. Sketches of the proposed activities should be provided when necessary to show that the activity complies with the terms of the NWP.

#4 ☐ Description of the aquatic resources that will be adversely impacted by the activity

#5 ☐ Location of each proposed impact See attached Figures

#6 ☐ For activities involving discharges of dredged or fill material into waters of the United States, the application must include a statement describing how impacts to waters of the United States are to be avoided and minimized.

#7 ☐ The application must also include either a statement describing how impacts to waters of the United States are to be compensated for or a statement explaining why compensatory mitigation should not be required for the proposed impacts.

#8 ☐ For non-Federal applicants, if listed species or critical habitat might be affected or is in the vicinity of the project, the PCN must include the names(s) of those listed species that might be affected or utilize critical habitat. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act.

#9 ☐ For non-Federal applicants, if any activity may affect a historic property, the PCN must state the name of the historic property. Federal applicants are required to provide documentation demonstrating compliance with Section 106.

☐ A delineation of affected special aquatic sites and other waters of the United States is **required** if the project requires notification under General Condition 27. **NOTE**: *The 45-day default time clock does not start until the wetland delineation has been completed and submitted to the Corps.*

☐ For **NWP 3,** where maintenance dredging is proposed, the pre-construction notification must include information regarding the original design capacities and configurations of the outfalls, intakes, small impoundments, and canals.

☐ For **NWP 3,** paragraph a activities. The permittee must notify the DE in accordance with GC 27, if the discharge of dredged or fill material causes the loss of greater than 1/10 acre of waters of the U.S or there is a discharge in a special aquatic site, including wetlands and riffle pool complexes.

☐ For **NWP 12**, where the proposed utility line is constructed or installed in navigable waters of the United States (i.e. section 10 waters), copies of the pre-construction notification and NWP verification will be sent by the Corps to the National Oceanic and atmospheric Administration (NOAA), National Ocean service (NOS), for charting the utility line to protect navigation.

☐ **For NWP 12**, construction techniques to prevent draining, such as anti-seep collars, will be required for utility lines buried in wetlands, when necessary. If no construction techniques to prevent draining are proposed, the applicant must provide appropriate documentation that such techniques are not required to prevent wetland drainage.

☐ **For NWP 12**, all notifications must include:

- ☐ Specifications of how pre-construction contours will be re-established and verified after construction;
- ☐ A justification for the required width of all maintained utility crossings impacting waters of the U.S.;
- ☐ A justification for the loss of waters of the U.S. impacted by utility line sub-stations.
- ☐ The acreage of impacts to waters of the U.S indefinitely converted from a forested wetland to a herbaceous wetland and a compensatory mitigation proposal.

☐ **For NWP's 14, 29, 39 and 46**, all notifications must include appropriately sized and located culverts for crossings of waters of the U.S. that meet the requirements of General Conditions 2, 9 and 10.

☐ **For NWP 27**, notifications for aquatic habitat *restoration,* establishment, and enhancement activities will require coordination with appropriate Federal, State, and local agencies. The coordination activity will be conducted by the Corps of Engineers. Agencies will generally be granted 15 days to review and provide comments unless the District Engineer determines that an extension of the coordination period is reasonable and prudent.

☐ **For NWP 31**:

- ☐ Prospective permittee must notify the District Engineer with a PCN prior to conducting any maintenance activity. The PCN may be for activity-specific maintenance or for maintenance of the entire flood control facility by submitting a five-year (or less) maintenance plan.
- ☐ The PCN must include sufficient baseline information to identify the approved channel depths and configuration of existing facilities.
- ☐ The PCN must specify the location of the dredged material disposal site.

☐ **For NWP 33**, the preconstruction notification must include a restoration plan showing how all temporary fills and structures will be removed and the area restored to pre-project conditions.

☐ **For NWP 38**, notifications require the following information:

- ☐ Documentation that the specific activities are required to effect the containment, stabilization, or removal of hazardous or toxic waste materials as performed, ordered, or sponsored by a government agency with established legal or regulatory authority; See Attachment
- ☐ A narrative description indicating the size and location of the areas to be restored, the work involved and a description of the anticipated results from the restoration; See attached text

☐ A plan for the monitoring, operation, or maintenance of the restored area. See attached PCN text

☐ **For NWP 41**, notification must be submitted for projects that require mechanized land clearing in waters of the U.S., including wetlands, in order to access or perform reshaping activities.

☐ **For NWP 44**, if reclamation is required by other statutes, then a copy of the reclamation plan must be submitted with the pre-construction notification.

☐ **For NWP 45**, the permittee must submit a pre-construction notification within 12 months of the date of damage to uplands. The PCN should include documentation, such as a recent topographic survey or photographs, to justify the extent of the proposed restoration.

PRE-CONSTRUCTION NOTIFICATION (PCN)
PHASE 1 – FIELD DEMONSTRATION PROJECT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

June 2015

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, SC 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

LIST OF ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
BMP	Best Management Practices
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (commonly known as Superfund)
CSM	Conceptual Site Model
EE/CA	Engineering Evaluation/Cost Analyses
EOD	Explosive and Ordnance Demolition
FDP	Field Demonstration Project
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
MGP	Manufactured Gas Plant
MRA	Modified Removal Action
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NWP	Nationwide Permit
PAHs	Polynuclear Aromatic Hydrocarbons
PCN	Pre-Construction Notification
PDR	Project Delineation Report
RAWP	Remedial Action Work Plan
RD	Remedial Design
RSLs	Regional Screening Levels
RSSL	Rocky Shoal’s Spider Lily
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SCE&G	South Carolina Electric & Gas Company (primary subsidiary of SCANA Services, Inc.)
SCIAA	South Carolina Institute of Archeology and Anthropology
SHPO	South Carolina State Historic Preservation Office
SF	Square Feet
TLM	Tar-Like Material
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UXO	Unexploded Ordnance
VCC	Voluntary Cleanup Contract

TABLES

FIGURES

ATTACHMENTS

INTRODUCTION

South Carolina Electric & Gas Company (SCE&G) is the respondent required to complete a removal action for a tar-like material (TLM) that is commingled with sediment within the Congaree River in Columbia, South Carolina. This Pre-Construction Notification (PCN) is intended to provide sufficient information to the United States Army Corps of Engineers (USACE) to permit the project to proceed as described herein. Additional information regarding this project has also been previously submitted under USACE Permit Number P/N 2011-01356-6NO.

The actual project area is located along the eastern shoreline of the river, just south of the Gervais Street Bridge as shown on Figure 1. In correspondence dated March 2, 2015 (Attachment A), the South Carolina Department of Health and Environmental Control (SCDHEC) directed SCE&G to proceed with revising all previously submitted plans to implement a “targeted” or Modified Removal Action (MRA) to address impacted sediment within the Congaree River.

From a permitting approach and to achieve the directive stated above, SCE&G is currently proposing two phases of work with separate permit submittals/approvals for each phase. The proposed phases consist of:

- Phase 1 - Field Demonstration Project (Phase 1 – FDP); and
- Phase 2 - Modified Removal Action (Phase 2 – MRA) [To be submitted at a later date].

It is anticipated that both phases can be completed under the Nation Wide Permit - 38 – Cleanup of Hazardous and Toxic Waste (NWP-38) protocols. Based on the previously submitted delineation work, the extent of the TLM in the river has been defined. Additionally, based on prior work, a significant number of metallic anomalies have been identified within the river and near the terminal end of the Senate Street Extension (the primary access point to the river in the general area). These metal anomalies (or any portion thereof) may potentially be Civil War era unexploded ordinance (UXO).

As currently proposed, the Phase 1 – FDP project will be conducted only on “dryland” in the location referred to as “the alluvial fan area”, situated at the end of the Senate Street Extension, as shown on Figure 2. The alluvial fan appears to be an area where sediment accumulation occurs as a result of erosion from urban landside activities and from depositional forces within the fluctuating river environment (during higher water level events). “Dryland” also referred to as the “landside” is defined as the alluvial fan area that extends from the edge of the low water level eastward to the normal high-water mark. The proposed FDP area is exposed and accessible during normal (lower) river levels, as seen on Figure 2.

Specific details pertaining to the investigation activities, the nature and extent of TLM locations, potential remedial alternatives and other site-related issues have been provided in previous submittals and reports. For efficiency, these previously submitted documents are incorporated into this PCN by reference only.

JUSTIFICATION

The primary purpose of the FDP is to implement, evaluate and improve (if necessary) the UXO management plans on “dryland”, before expanding the work into the river area. This section presents a justification for completing the FDP as the initial phase of the overall sediment removal project. After completing the Phase 1 – FDP, a determination to proceed with implementation of the Phase 2 – Modified Removal Action (MRA) will be made by the regulatory agencies, assuming all other permit and design requirements for the Phase 2 – MRA have been adequately addressed.

The locations of the known metal anomalies in the alluvial fan area are shown on Figure 3. The potential for encountering metal anomalies that are, in fact UXOs, presents a significant physical hazard to removing the TLM from the river. Also, there is a very real possibility that there could exist more metal anomalies/UXOs than currently identified. Therefore, SCE&G believes that the “readily” accessible metal anomalies that currently exist within the alluvial fan area must be properly addressed prior to initiating any impacted sediment removal work within the river. The information obtained during the FDP will increase the safety and efficiency of the Phase 2 removal effort.

Completion of the FDP will provide the project team and the regulatory agencies with valuable insight into the actual risks associated with the UXO management activities. Completion of the FDP will also result in “clearing” the alluvial fan area of potentially hazardous UXO, which will facilitate the primary access way into the river for the full-scale sediment MRA. Therefore, for permitting purposes, the NWP-38 is applicable for both phases of the overall project since screening for and removal of the potential UXOs is “hazardous” from a physical exposure standpoint, and the TLM is considered “toxic” from a chemical constituent perspective (i.e., benzene).

Detailed plans relating to the safe management procedures for handling the potential UXOs are discussed below. The USACE UXO review team also concurs with SCE&G and its consultants that it is prudent to conduct the FDP in order to test (and perhaps refine) the specific detailed procedures for management of the UXOs, prior to full scale implementation. The USACE UXO team will also provide oversight personnel during implementation of the FDP.

Phase 1 – FDP Summary

This Pre-Construction Notification (PCN) is being submitted on behalf of South Carolina Electric & Gas Company (SCE&G) to provide information pertaining to the first phase of a proposed Field Demonstration Project (Phase 1 – FDP). The primary focus of the FDP is described above and consists of screening and properly managing potential UXO in the alluvial fan area, which is the "landside" portion of the project. The actual FDP area is located at the end of the Senate Street Extension access road (also referred to as "the boat ramp"), as shown on Figure 2. The alluvial fan area is integral to completion of the overall project because it provides the primary access point to the planned removal area. It is also the location of a significant number of metallic anomalies that may be potential UXO (Figure 3).

This Phase 1 – FDP is primarily intended to address the hazards associated with potential UXO. To that end, SCE&G and its consultants have been working with various offices of the USACE – (Huntsville, Alabama, Charleston, SC, etc.) to develop the appropriate plans and procedures to address the UXO issues. In summary, the following plans have been developed to be consistent with the same level of expertise and scrutiny as a typical military operation to address UXOs. These plans have been reviewed and approved by the appropriate USACE UXO personnel and are included herein (Attachment B). The approved UXO plans address metal anomalies in both the FDP and MRA areas and include:

- Draft Final Work Plan for Munitions Response Removal Action and Construction Support
- Explosives Safety Submission Munitions and Explosives of Concern Removal Action and Construction Support
- Diving Operations Plan
- Diving Safe Practices Manual

REQUIRED PRE-CONSTRUCTION NOTIFICATION (PCN) CONTENTS

The following information is provided as supplemental information based on the “Required Pre-Construction Notification (PCN) Contents” checklist. For convenience, “Item Numbers” were assigned to each box on the PCN Application.

Item #1 - Name, Permittee

The name, contact information and general location of the project are provided on Page 1 of the Joint Application and are included herein.

- Permittee: South Carolina Electric & Gas Company (SCE&G)
- Permittee Contact: Mr. Robert Apple
- Permittee Contact Phone Number: 919-819-2748
- Permittee Address: 220 Operation Way; Cayce, South Carolina 29033

Item #2 - Location of Proposed Project

The project site is located along the shoreline of the Congaree River in Columbia, South Carolina. The location is shown on Figure 1.

- Latitude: 33º 59’ 40.59” North;
- Longitude: 81º 02’ 56.80” West;
- County: Richland, South Carolina; and
- Street Address: None, “the alluvial fan area” is located at the terminus of the Senate Street Extension and directly adjacent to the Congaree River. Phase 1 - FDP activities associated with this PCN will be limited to the “landside” area only which is defined by the edge of the river at the alluvial fan at low or normal river elevation to the general elevation of the normal high-water mark. See Figures 2 and 3.

Item #3 - Brief Description of Proposed Action

Overview

The FDP basically entails “screening”, or evaluating, the entire alluvial fan area (Figure 2) for metal anomalies, locating and identifying the source of the metallic signal and then safely and carefully exposing and removing the item. Excavation of surrounding sand/soil/sediment will be completed only to the extent necessary to expose and retrieve the item generating the magnetic anomaly signal. No sand/soil/sediment will be removed from the site during implementation of the FDP unless, in the unlikely event, the excavated material is determined to be impacted by TLM. Any large boulders, logs or fallen trees encountered within the FDP area will be pushed aside to facilitate access and then returned to the “as-found” position, to the extent possible. The entire scope of work related to excavation within the alluvial fan will be governed by the approved UXO plans. Retrieved objects (i.e., UXOs, historical artifacts and/or debris) will be managed as described below.

FDP Process

The FDP Work Plan is provided in Attachment C. It includes a more detailed description of the activities outlined below. The process will include re-establishing the locations of previously identified metal anomalies in the field. Next, the locations and surrounding areas will be re-screened using metal detectors or other devices as set forth in the UXO plans. Once a metal anomaly has been identified, the material surrounding the object generating the signal will be carefully removed. The excavated material will be temporarily set aside (i.e., no material will be removed from the site unless it appears to be impacted). Once the metallic item has been exposed by trained UXO personnel, it will be managed in accordance with the approved UXO plans. If there is sediment/soil below a removed object, careful excavation of existing material in controlled lifts will be completed, if necessary, to determine if additional or currently unknown metal anomalies are present (i.e., the "mag and dig" approach). Once the underlying bedrock surface has been encountered, the screening activities will have been completed and the excavated material will be replaced and the process will start again in an adjacent location.

During completion of the FDP, the sand, soil, stone, sediment, debris and other materials that constitute the alluvial fan will be evaluated down to the underlying bedrock surface. The approximate extent of the FDP area is shown on Figure 3 and is approximately 23,000 square feet (SF). It extends from the water's edge during normal river flow elevations (approximately 116 feet MSL) to the approximate toe of the main river bank (approximately 122 feet MSL). The sediment thickness within the alluvial fan ranges from approximately 2 to 10 feet, depending on the location. Figure 4 provides a cross-section of the alluvial fan area and illustrates the anticipated thickness of the material to be evaluated. It is anticipated the majority of material evaluated from the alluvial fan area will be un-impacted (i.e., no TLM has been documented in this material). However, since the potential exists that TLM could be encountered, albeit unlikely, provisions will be in place to manage the material for proper disposal in accordance with SCDHEC-approved procedures.

In summary, the entire FDP area will be evaluated by the screening process briefly described above and detailed in the UXO plans. Metal anomalies that are deemed "safe-to-move" will be removed and managed appropriately as summarized in the next section. For the FDP, the unearthed metallic anomalies will likely fall into one of the three following categories (and will be handled accordingly):

- Potentially hazardous unexploded ordinance (UXO);
- Historically significant items or artifacts; or
- Other, inert metallic debris.

UXO Management

Based on previously conducted work, approximately 74 metallic anomalies were identified in the FDP area that have "*electro-magnetic signature characteristics that could potentially be associated with ordnance*". Therefore, a qualified UXO contractor will be employed to conduct the screening and UXO management activities in accordance with USACE-approved plans and procedures with USACE providing oversight while the field work is being completed. "Screening", defined in simple terms, consists of evaluating an area using approved equipment such as a metal detector, etc. to determine the presence of a metal anomaly and carefully exposing the anomaly to ascertain its hazard potential and determining/rendering the object safe to move (i.e., the "mag and dig" approach). The attached plans contain much more detail than this simplified summary. By design, SCE&G's approach to addressing the potential UXO issue is identical to how experts in the UXO field and at the USACE would conduct the work.

Historical Artifact Management

Potential, metallic, non-UXO related items or artifacts of historical value that may be recovered will be evaluated by an archeologist and eventually transferred to the South Carolina Institute of Archeology and Anthropology (SCIAA) or State Historic Preservation Office (SHPO), as applicable. **AFTER THE UXO PERSONNEL HAVE DETERMINED THE RECOVERED OBJECT IS SAFE TO MOVE**. The location of any recovered objects will be carefully documented. Approved plans for addressing artifact recovery and conservation are provided in Attachment D. A Memorandum of Agreement (MOA) has been developed among and between the appropriate agencies, the USACE and SCE&G and is included in Attachment D.

It should be noted that the Archaeological Data Recovery Plan contains significant details that were envisioned at the time when it was submitted and approved and was based on the original scope of work for the Congaree River project. Since the approval date, the scope of the project has been greatly reduced to the currently envisioned Phase 2 – MRA. Although the intent and objectives of the plan will be fulfilled during execution of the FDP, the magnitude of the originally planned artifact-recovery support infrastructure will not be installed on-site for the FDP. However, the recovery and conservation work will be conducted in TRC's conservation laboratory in Columbia, SC.

Other Metallic Debris

Other metallic debris (i.e., discarded trash, cans, hubcaps, etc.) encountered during implementation of the FDP, will be collected and either recycled or disposed of properly by SCE&G. Metallic debris will not be returned to the area in which it was found.

Logistical Issues

Improvement (removing fallen trees and debris) of the access road that leads to the alluvial fan area will be required. Stone fill will also be placed at the end of the asphalt road extension to address previous erosion issues and facilitate access to the project area. Some minor clearing and grading to establish a temporary support zone adjacent to the FDP removal area will also be completed. Sand bags and/or large filter socks will likely be placed at the western, riverside extent of the FDP project area to provide a buffer against minor river level fluctuations during completion of the project. Best Management Practices (BMPs) for Erosion and Sedimentation (E&S) controls will also be installed prior to starting intrusive work within the project area, if needed.

The FDP will only be completed during favorable, lower water level elevations. The total FDP evaluation area is approximately 23,000 SF. For the 74 known metal anomalies in the evaluation area, it is assumed that a typical test pit excavation of 6 foot by 10 foot will be completed. Therefore, the estimated total surface area to be disturbed (removed and replaced) is estimated to be 4,440 SF. This calculation neglects any overlap for known metal anomalies. Assuming a 10% contingency for additional (presently unknown) metallic anomalies, the total anticipated surface area to be physically disturbed is less than 5,000 SF. The FDP evaluation area and the known 74 metallic anomalies are shown on the attached Figure 3.

The FDP is expected to entail completion of the following specific activities:

1. Mobilization of a UXO contractor, sediment excavation personnel and oversight personnel (USACE UXO, SCE&G, archeologist);
2. Completion of access road improvement activities that will include grading to remove damage caused by ongoing erosion of the paved/gravel road, near the alluvial fan (Figure 2);
3. Establishing landside support zone areas (near the river and within the electrical right-of-way near Senate and Gist Streets);
4. Establishing a water management system, described in the Water Management Plan provided in Appendix A of the attached FDP Work Plan;
5. Placement of large sandbags at the western, riverside extent of the FDP project area to provide a buffer against minor river level fluctuations during completion of the project;
6. UXO screening and management activities with oversight provided by USACE UXO experts;
7. Historical artifact management with oversight provided by an archaeologist;
8. Excavation of test pits to uncover and identify the metallic anomalies;
9. Proper disposal of any TLM impacted material or recovered debris, as may be required;
10. Excavation water management, as required; and
11. Removal of the large sandbags and any temporary E&S controls installed during the FDP.

Some of these planned activities may be completed in a different sequence than listed above or in advance of the mobilization to perform the actual FDP.

Item #3A - Project Purpose

Completion of the FDP will serve a number of important functions that include:

- Confirming that the metallic anomaly (potential UXO) screening procedures are sufficient and practical and will provide the level of safety required during completion of Phase 2;
- Defining the roles and responsibilities for all project personnel including UXO and/or remediation contractors, oversight personnel (USACE, SCE&G), historical artifact management archeologist, etc.);
- Clearing the alluvial fan of potential hazards relating to the UXOs;
- Improving the access road between the Senate and Gist Street intersection and the alluvial fan in preparation for Phase 2;
- Confirming documentation procedures for final disposition of recovered items;
- Evaluating the large sand bag deployment/removal procedures and their effectiveness with respect to limiting water infiltration;
- Gaining insight into future water management requirements; and
- Providing SCE&G, SCDHEC, USACE and other project stakeholders with insight into the basic logistics and practicality of implementing Phase 2 of the project.

Item #3B - Direct and Indirect Adverse Environmental Effects

Direct and indirect adverse environmental effects resulting from the completion of the FDP are expected to be extremely minimal. The clearing, grading and access road improvements are limited in scope to the end of the asphalt/gravel roadway and will be completed with permission from the current landowner.

Disturbed landside areas will be returned to their approximate original conditions following completion of Phase 2 of the project. The alluvial fan consists of depositional material that is mostly the result of erosion from the adjacent landside area and sediment material carried by the river flow. This depositional material will be temporarily and sequentially removed, and then be replaced, so it is not expected to adversely affect or impact the river environment.

Erosion and sediment control measures and BMPs will be employed and the large sand bags will isolate the evaluation area. Silt fence and/or filter socks will prevent downstream migration of disturbed sediment during completion of the FDP.

Item #3C - List Any Other Corps Permits to Be Used

This Phase 1 – FDP is proposed under a NWP-38 protocol. Phase 2 – MRA is also anticipated to be completed under a NWP-38 approach. This will allow the information obtained during completion of the FDP to be incorporated into the planning for the actual Phase 2 – MRA.

Previously, the USACE approved an NWP-14 permit for linear construction projects to construct the “Southern Access Route” to allow major truck traffic to enter and exit on Blossom Street, as shown on Figure 5. The PCN for this permit request was submitted on July 8, 2014 and was approved on October 20, 2014 (SAC-2014-728-6NO). This NWP-14 consists primarily of constructing a concrete arch crossing that will span the Unnamed Tributary #2 (Figure 5). The work also entails improving the existing gravel road that extends from Blossom Street to the Unnamed Tributary #2 located to the south of the FDP area. This work is now expected to be initiated after the Phase 1 – FDP is completed and prior to implementation of the Phase 2 – MRA.

Item #4 - Description of the Aquatic Resources that will be Adversely Impacted by the Activity

Although located on dryland during normal low river flows, the alluvial fan area is within the high water mark boundary of the Congaree River. Removal and replacement of the alluvial fan materials down to the underlying bedrock will not significantly impact the river and will have minimal impact on aquatic habitat since it will be conducted on “dryland”.

Wetlands - Figure 6 shows the approximate extent of the FDP area and the location of wetlands. As can be noted, the Congaree River and adjacent shoreline represents the dominant wetland. Two unnamed tributaries (#1 and #2) lie to the north and south of the project area. No activities are proposed that will impact these tributaries. A relatively large palustrine wetland is also located to the south of Unnamed Tributary #2 and will not be disturbed or impacted by the Phase 1 – FDP.

Other than temporarily disturbing the alluvial fan adjacent to the Congaree River, no other wetland impacts are anticipated for the FDP portion of the project. This impact will be relatively short in duration (the actual UXO work is currently anticipated to be completed within one week) and only the areas with metal anomalies will be removed and replaced. The FDP project area does not exhibit characteristics of special aquatic sites or designated critical resource waters and it is not specified as a wild and scenic river system.

Item #5 - Location of Each Proposed Impact

The location of the known 74 metal anomalies are shown on Figure 3. The impact is assumed to be a 6 foot by 10 foot surface area excavation at each location with the removed material temporarily set aside. The metal anomaly will then be addressed as described above and the removed material will be returned to the excavation, prior to moving to the next location.

Item #6 - How Impacts to Waters of the United States are to be Avoided and Minimized

As stated above, the area to be impacted by the planned FDP activities extends from the approximate water's edge during normal river flow elevations (approximately 116 feet MSL) to the approximate toe of the main river bank (approximately 122 feet MSL). It is the intent of SCE&G to complete the FDP in a relatively dry environment, with the river at lower elevations. Large sandbags will be placed at the water's edge to isolate the work area from minor river flow fluctuations and reduce the potential for downstream migration of sediment. Implementation of BMPs will also help avoid and minimize impacts to the river. Limiting the Phase 1 – FDP work to outside of the normal low river elevation will minimize any minor impacts to the river that may arise from completion of the FDP. Disturbed areas will be back-filled prior to moving to the next location and at the end of every workday. Also, the weather forecast and the river gage predictor will be closely monitored for impending high water so that the FDP area can be quickly secured. Higher river flows will not be impacted by completion of the FDP.

Item #7 - Compensatory Mitigation Not Required

No mitigation plan is required since the proposed intrusive activities associated with this portion of the project are temporary and removing the physical hazards associated with potential UXO will improve safety for those accessing the river. Removing debris from the project area will result in a permanent improvement to the environment.

Item #8 - Endangered Species Act - Animals

A number of sources were used to assess the potential presence of endangered or threatened species in the project area and include:

- U.S. Fish and Wildlife Service (FWS);
- U.S. National Marine Fisheries Service (NMFS);
- South Carolina Department of Natural Resources (SCDNR); and
- The Rare, Threatened and Endangered Species Assessment developed by Kleinschmidt (March, 2008) prepared for the Saluda Hydroelectric Relicensing Project (FERC project no. 516).

The Kleinschmidt report was primarily focused on Lake Murray and the Lower Saluda River and the downriver extent was generally terminated at the confluence with the Broad River or the headwaters of the Congaree River (Figure 1). However, the shortnose sturgeon study and the freshwater mussels study conducted as part of the assessment activities extended into the upper Congaree River including the area adjacent to the FDP area. Review of these assessments and the available information from the FWS and

SCDNR identified a number of federal and state threatened and endangered species, federal candidate species and federal species of concern. Table 1 provides a summary of these species.

Of specific interest to this general project area, are the Rafinesque's big-eared bat, shortnose sturgeon and several species of freshwater mussels. The Rafinesque's big-eared bat and shortnose sturgeon are listed as state endangered species and state and federal endangered species, respectively. The five species of freshwater mussels are listed as federal species of concern. Since the FDP is limited to "dry land" adjacent to the river the potential presence of the shortnose sturgeon and the freshwater mussels is not a concern for this portion of the project. Based on prior submittals and correspondence with the USFW and others, the planned FDP, if completed between months of June through December, will have no impact on potential sturgeon migration.

The Rafinesque's big-eared bat's range includes the sandhills region and it is known to roost under I-beam and T-beam bridges. The Gervais Street Bridge may provide a roosting site for this bat. However, project activities will occur downstream of the bridge and should not impact potential roosting sites within the structure.

Item #8 - Endangered Species Act - Plants

Potential habitat exists within the FDP area for the occurrence of one endangered species (smooth coneflower), one candidate species (Georgia Aster) and one federal species of concern (Rocky Shoal's Spider Lily [RSSL]). However, none of these species or their habitat are anticipated to be present in the FDP project area shown on Figures 2 and 3. The potential habitat for the smooth coneflower and Georgia Aster would be along the power line corridor located directly east of the planned FDP area. A work trailer, vehicle parking and staging of equipment will be conducted in the vicinity of the power line corridor, but will be located in the previously graded and mowed areas that do not present habitat for these plants (Figure 2). As a result, these plants would not be a concern for FDP portion of the project.

The RSSL is a perennial plant that inhabits rocky shoals or bedrock outcrops in large streams or rivers at or above the fall line (Kleinschmidt, 2008). The RSSL is found in relatively large numbers directly upstream of the project area at the confluence of the Saluda and Broad Rivers. The alluvial fan area does not exhibit favorable conditions for the RSSL since it does not contain large surface rocks or boulders.

Item #9 - Historic Property

A Cultural Resources Identification Survey (CRIS) was conducted by TRC (Attachment D) that covered the overall planned project area and the general vicinity. In addition, potential historical sites were researched using ArchSite, which is a geographic information system (GIS) maintained by SHPO and SCIAA.

Two separate sites are located in the general vicinity of the project area that were designated as historically significant. The sites consist of the Gervais Street Bridge and the Columbia Canal. Both properties are listed in the National Register of Historic Places and are shown on Figure 7 and listed on Table 2. The Gervais Street Bridge is located directly upstream of the project area. Implementation of the FDP is not expected to adversely impact the Gervais Street Bridge. Figure 7 shows that the approximate extent of the Columbia Canal area (as defined by the National Historic Register. Although the activities described in this PCN are located within the historical designation area as defined by the National Register (Figure 7), project related activities are not expected to adversely impact this historic property. The minor excavations planned on the alluvial fan and the road reconstruction work will not impact the canal area.

The cultural resources survey identified a number of archeological sites located in the vicinity of the planned FDP area. These areas are shown on Figure 7 with their applicable descriptions and site ID numbers. Possible ruins from a saw mill (site ID: 38RD224) a former structure foundation (site ID: 38RD234) are located directly adjacent to the FDP area. The archeologist will locate these sites in the field and they will be avoided during completion of the FDP. An underwater deposit of historic items (site ID: 38RD278) is located within the planned FDP area. This area will be impacted by FDP operations and an archeologist will be on-site to properly document and secure any potential historical items. The items will be transferred to SCIAA/SHPO, as needed.

The Civil War era dump site (site ID: 38RD286) located in the river is of primary concern for the FDP and the overall sediment removal project. SCE&G has been working closely the SCIAA/SHPO to develop an appropriate approach to complete the removal action, and completion of the FDP will allow for refinement of the process prior to future implementation in the river. SCE&G plans to coordinate with SCIAA/SHPO during the FDP implementation. SCIAA/SHPO will require two licenses that will be obtained prior to implementing the removal action. The licenses include an Intensive Survey License and a Data Recovery License.

REFERENCES

Kleinschmidt, 2007. Status of the Shortnose Sturgeon in the Lower Saluda and Upper Congaree Rivers, 2007 Final Summary Report.

Kleinschmidt, 2008. Rare, Threatened and Endangered Species Assessment.

MTR, March 2012. Project Delineation Report – Congaree River Sediments Investigation.

MTR, May 2012. Draft Engineering Evaluation/Cost Analyses (EE/CA) – Congaree River Sediments.

South Carolina Department of Natural Resources, Inc. (SCDNR) Rare, Threatened and Endangered Species Inventory.

U.S. EPA, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.

U.S. Fish and Wildlife Service (USFWS), Endangered Species Program; Species Reports.

CHECKLIST – NWP-38

U.S. Army Corps of Engineers - Charleston District
Checklist for 2007 Nationwide Permit Review
Nationwide Permit 38

Cleanup of Hazardous and Toxic Waste
(10/404)

SAC #:____

Applicant Name:____

Waterway/Location:_____________________________________

Project Name:____

1. Is the discharge in association with specific activities required to effect the containment, stabilization, or removal of hazardous or toxic waste materials?

☐ Yes* __ No

2. Are the activities performed, ordered, or sponsored by a governmental agency with established legal or regulatory authority?

☐ Yes* __ No

3. Are the activities the result of a court ordered remedial action plan or related settlement?

☐ Yes* __ No

4. Are the activities proposed in designated critical resource waters or their adjacent wetlands?

☐ Yes* ☐ No

5. Are the activities proposed for the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste?

__ Yes ☐ No

6. Are the activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA as approved or required by EPA?

__ Yes[1] ☐ No

7. Are all of the applicable NWP General and Regional Conditions satisfied, including, endangered species, and cultural resources, and if any Federally listed species and/or designated critical habitat occurs in the action area, have you made an effect determination and properly documented it in the administrative record?

☐ Yes __ No

8. Does the discharge cause the loss of greater than 300 linear feet of streambed?

__ Yes ☐ No

TO QUALIFY FOR THE NWP, UNLESS OTHERWISE NOTED, EVERY NUMBERED ITEM MUST HAVE A CHECKED BOX.

* - REQUIRES A PRE-CONSTRUCTION NOTIFICATION (PCN) TO THE DISTRICT ENGINEER. **SEE THE SEPARATE PCN CHECKLIST TO ENSURE THE PROSPECTIVE PERMITTEE SUBMITS THE REQUISITE INFORMATION.**

NOTE: THE PCN MUST INCLUDE A DELINEATION OF SPECIAL AQUATIC SITES AND OTHER WATERS OF THE UNITED STATES. WETLAND DELINEATIONS MUST BE PREPARED IN ACCORDANCE WITH THE CURRENT METHOD REQUIRED BY THE CORPS.

Remember, determination of completeness must be made within 30 days of the date of receipt. If all required information is not provided, the prospective permittee will be notified that the preconstruction notification (PCN) is still incomplete and the review will not commence until all requested information has been received. If the applicant has not received any written notice from the DE within ***45 days*** of the date of receipt of the PCN, ***the verification is issued by default.***

IN ADDITION, The PCN MUST INCLUDE THE FOLLOWING:

- **Documentation that the specific activities are required to effect the containment, stabilization, or removal of hazardous or toxic waste materials as performed, ordered, or sponsored by a government agency with established legal or regulatory authority;**
- **A narrative description indicating the size and location of the areas to be restored, the work involved and a description of the anticipated results from the restoration;**
- **A plan for the monitoring, operation, or maintenance of the restored area.**

[1] - Activities undertaken entirely on a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site by authority of CERCLA as approved or required by EPA, do not require permits under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act.

Reviewed by:
Date:

TABLES

TABLE 1

SUMMARY OF FEDERAL AND STATE THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

Congaree River Sediments
Columbia, South Carolina

Common Name	Scientific Name	Federal Listed and Status	State Protection and Status	Potential Occurrence
Mammals				
Rafinesque's Big-Eared Bat	*Corynorhinus Rafinesquii*	No	Yes - Endangered	Potential for occurrence in project vicinity under the Gervais and Blossom Street bridges.
Red-Cockaded Woodpecker	*Picoides Borealis*	Yes - Endangered	Yes - Endangered	No - habitat not suitable.
Wood stork	*Mycteria Americana*	Yes - Endangered	No	No - habitat not suitable, extremely rare and if present likely from dispersion or migration.
Bald Eagle	*Haliaeetus Leucocephalus*	No	Yes - Threatened	No - habitat not suitable.
Carolina Darter	*Etheostoma Collis*	No	Yes - Threatened	No - found only in the Catawba River basin.
Carolina Heelsplitter	*Lasmigona Decorata*	Yes - Endangered	No	No - found in rivers and tributaries other than the Congaree River.
Fish/Amphibians				
Pine Barrens Treefrog	*Hyla Andersonii*	Yes - Endangered	Yes - Threatened	No - found in the sandhills region located northeast of the project area.
Shortnose Sturgeon	*Acipenser Brevirostrum*	Yes - Endangered	No	Yes - though FDP work to be completed on 'dry land" and will have no impact.
Robust Redhorse Sucker	*Moxostoma Robustum*	SOC	N/A	Yes - stocked by SCDNR below Parr Shoals dam.
Freshwater Mussels				
Roanoke Slabshell	*Elliptio Roanokensis*	SOC	N/A	Yes - potential for occurrence in project vicinity but FDP work on "dry land" will have no impact.
Yellow Lampmussel	*Lampsilis Cariosa*	SOC	N/A	Yes - potential for occurrence in project vicinity but FDP work on "dry land" will have no impact.
Carolina Slabshell	*Elliptio Congaraea*	SOC	N/A	Yes - potential for occurrence in project vicinity but FDP work on "dry land" will have no impact.
Carolina Lance	*Elliptio Angustata*	SOC	N/A	Yes - potential for occurrence in project vicinity but FDP work on "dry land" will have no impact.
Fatmucket	*Lampsilis Splendida*	SOC	N/A	Yes - potential for occurrence in project vicinity but FDP work on "dry land" will have no impact.
Plants				
Canby's Dropwort	*Oxypolis Canbyi*	Yes - Endangered	No	No - habitat not suitable
Georgia Aster	*Symphyotrichum Georgianum*	Yes - Candidate	No	Yes - but only if area near power line is used for general support activities.
Rough-Leaved Loosestrife	*Lysimachia Asperulaefolia*	Yes - Endangered	No	No - habitat is not suitable.
Rocky Shoal's Spider-Lily	*Hymenocallis Coronaria*	SOC	N/A	Yes - but alluvial fan habitat is not conducive.
Smooth Coneflower	*Echnincea Laevigata*	Yes - Endangered	No	Yes - but only if area near power line is used for general support activities.

Notes:
(1) Kleinschmidt, March 2008.

TABLE 2

LISTING OF NATIONAL REGISTER OF HISTORIC PLACES

Congaree River Sediments
Columbia, South Carolina

Historic Place	Location	Level of Significance	Area of Significance
Gervais Street Bridge	Spans Congaree River in West Columbia, SC	State	Architecture
Columbia Canal	East bank of the Broad and Congaree Rivers from the diversion dam to the southern railroad bridge in Columbia, SC	National	Industry

Notes:

1. Table includes properties near to or coinciding with the Congaree River removal actions and included on the National Register of Historic Properties.
2. Source: South Carolina Institute of Archeology and Anthropology & South Carolina Department of Archives and History.

FIGURES

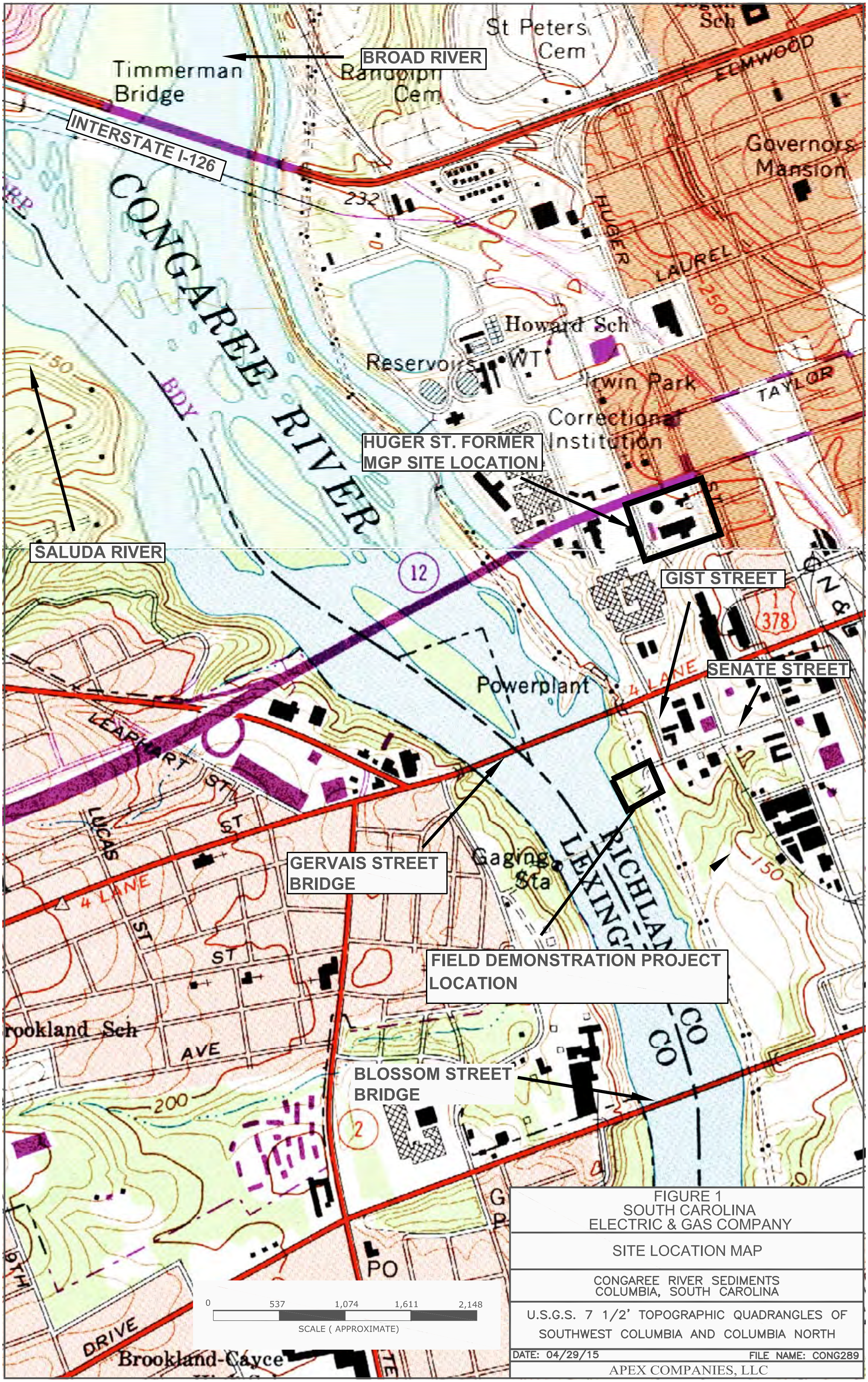


FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SITE LOCATION MAP

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF SOUTHWEST COLUMBIA AND COLUMBIA NORTH

DATE: 04/29/15 FILE NAME: CONG289

APEX COMPANIES, LLC

FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

FIELD DEMONSTRATION
PROJECT AREA

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/11/15 FILE NAME: CONG305

APEX COMPANIES, LLC

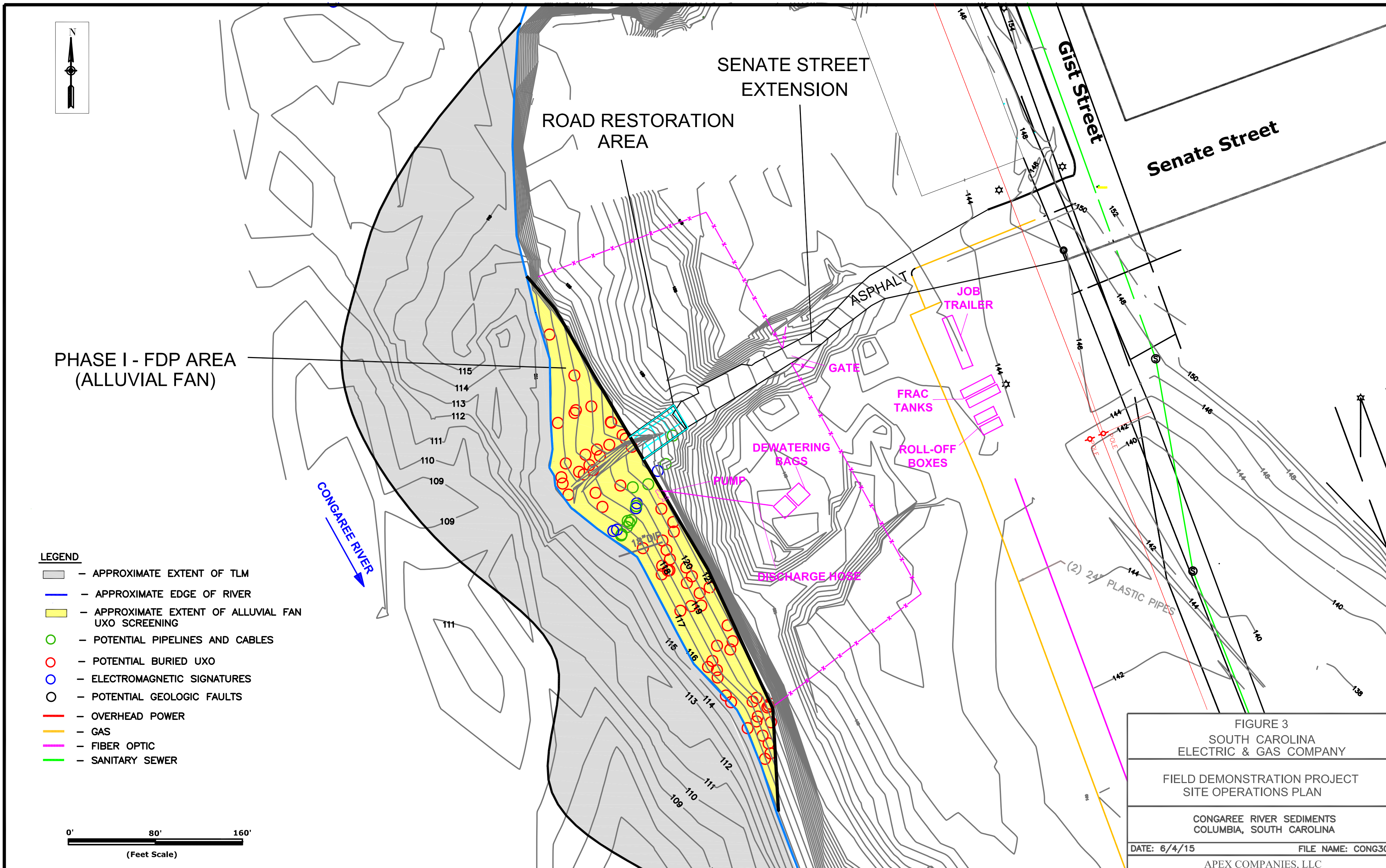


FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

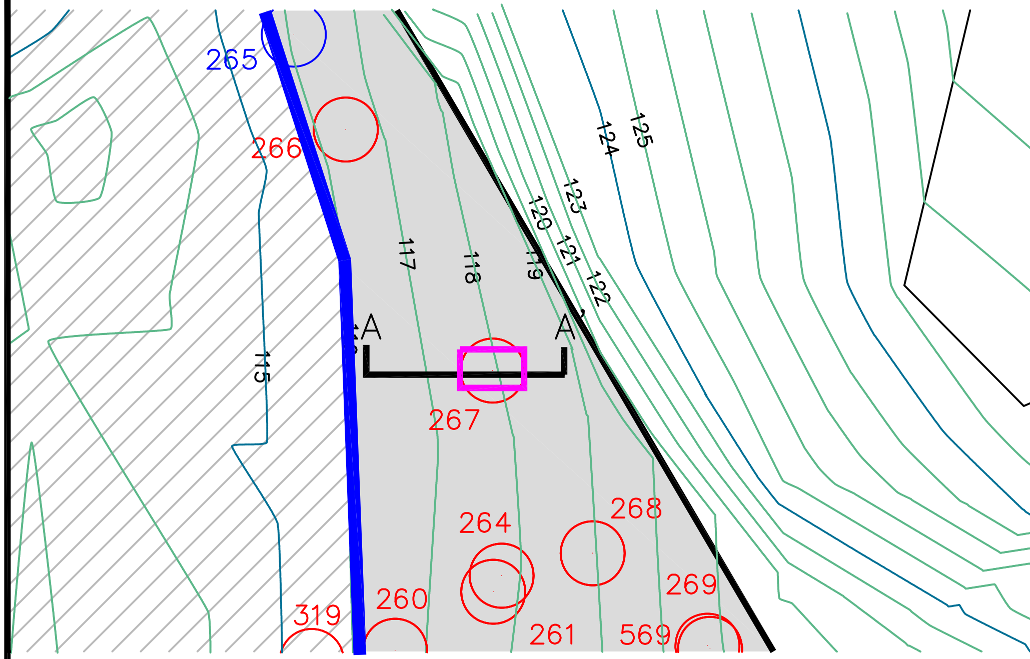
FIELD DEMONSTRATION PROJECT
SITE OPERATIONS PLAN

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/4/15 FILE NAME: CONG303

APEX COMPANIES, LLC

PLAN VIEW



SEDIMENT DEPTH METALLIC ANOMALY 267 – 5.0 – 6.0'

N

LEGEND

– APPROXIMATE EXTENT OF TLM

– APPROXIMATE EXTENT OF FIELD DEMONSTRATION PROJECT AREA (FDP)

– APPROXIMATE EDGE OF RIVER

10' 6' – PROPOSED TYPICAL EXCAVATION AREA TO FIND METAL ANOMALY

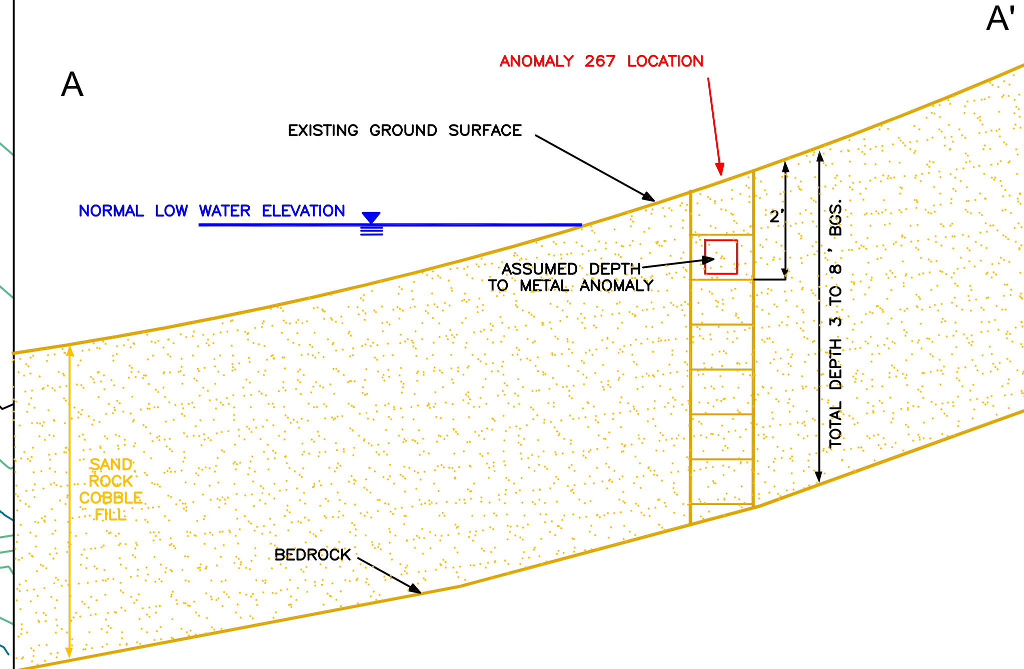
– TYPICAL METAL ANOMALY – ASSUMED 10 FOOT DIAMETER AREA (I.E. METAL ANOMALY CAN BE FOUND ANYWHERE WITHIN THE 10' CIRCLE)

BGS. – BELOW GROUND SURFACE

0' 20' 40'

SCALE IN FEET

CROSS SECTIONAL VIEW A-A'



SEQUENCE:

1) RECONFIRM METAL ANOMALY LOCATION VIA SURVEYING AND RE–SCREENING ACTIVITIES PER UXO PLANS.

2) HAND DIG IN APPROXIMATE ONE FOOT LIFTS OVER CENTER TO CONFIRM METAL ANOMALY.

3) IF METAL ANOMALY IS NOT CONFIRMED WITH RE–SCREENING ACTIVITIES – USE SMALL EXCAVATOR TO DIG 6 FOOT WIDE X 10 FOOT LONG RECTANGLE.

4) AFTER METAL ANOMALY(S) IS REMOVED THE AREA WILL BE RESTORED TO THE ORIGINAL GRADE AND CONTOURS.

NOTE:

CROSS SECTIONAL VIEW NOT TO SCALE

FOR ILLUSTRATIVE PURPOSES ONLY.

FIGURE 3A

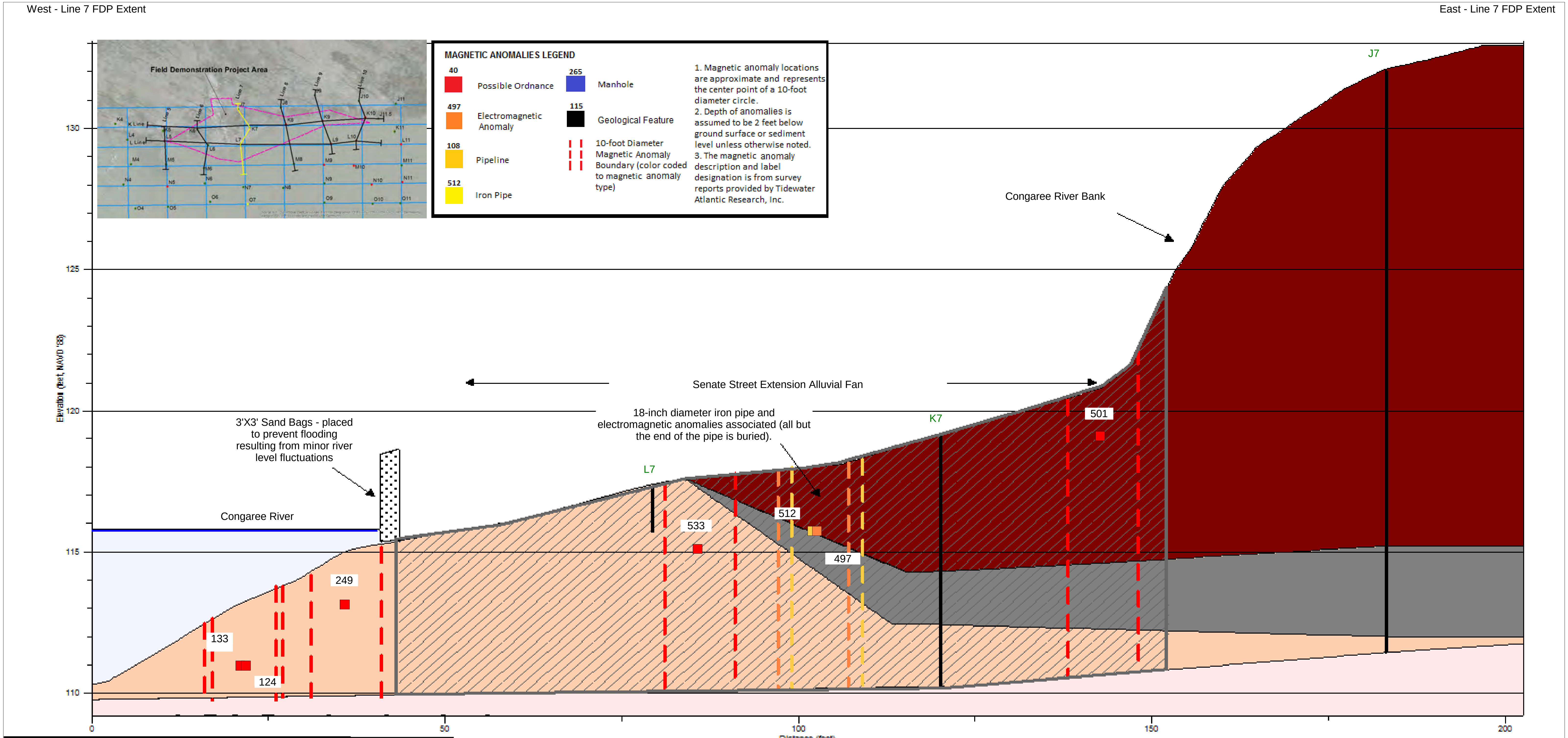
SOUTH CAROLINA ELECTRIC & GAS COMPANY

KNOWN METALLIC ANOMALY LOCATIONS TYPICAL LOCATIONS AND EXCAVATION

CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA

DATE: 7/2/15 FILE NAME: CONG313

APEX COMPANIES, LLC.



PRELIMINARY DRAFT

LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. Total depth of coring L7 was only 1.2 feet and the aluminum tube used for vibra-coring may have been impeded by a large cobble and therefore depth to granite bedrock at this location is inferred.
4.The cross section developed is based on a fence line approximately corresponding to the "7" line and topography, bathymetry, and lithologies are approximately from and between locations L7 through J7.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 4

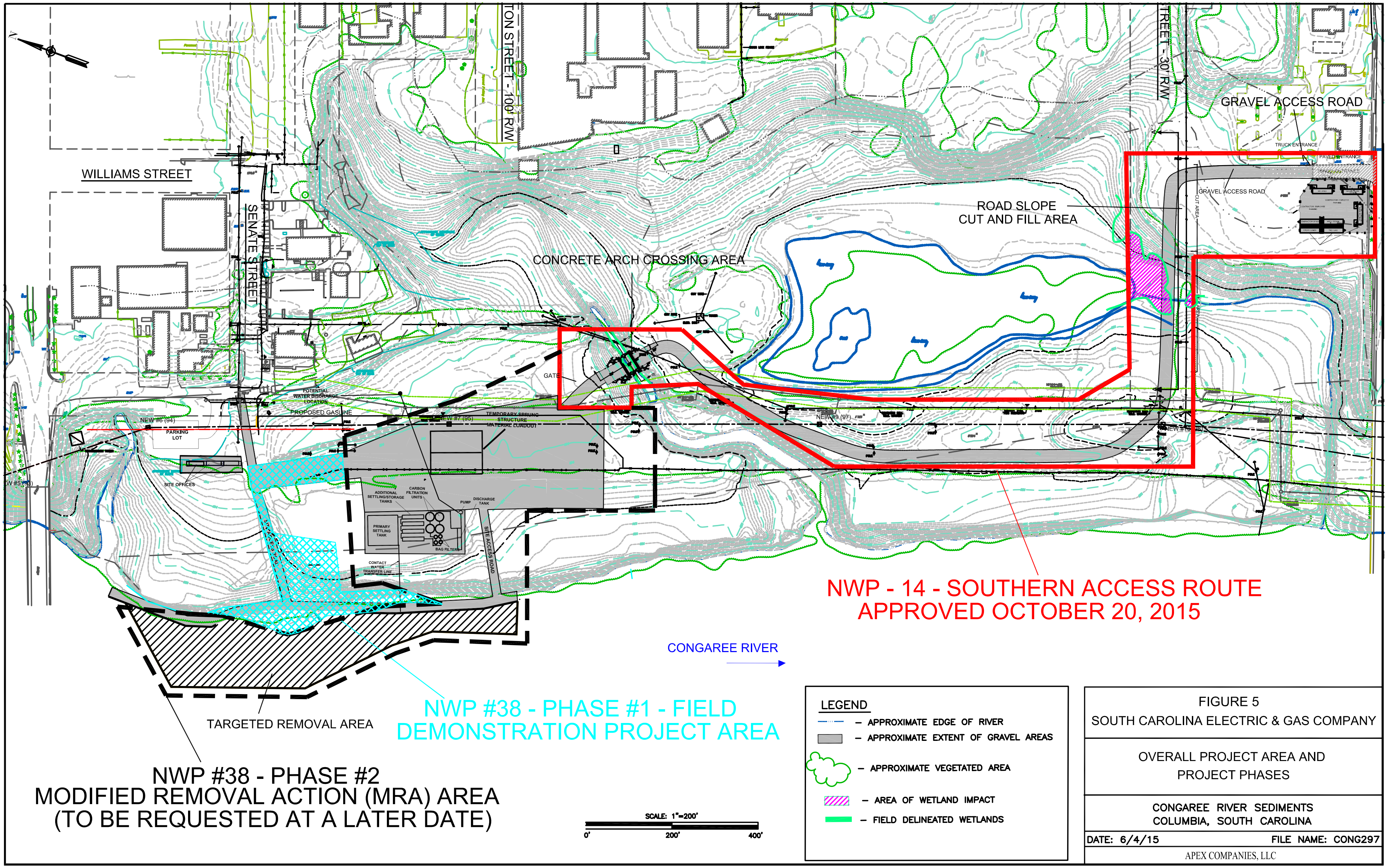
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG THE 7 LINE

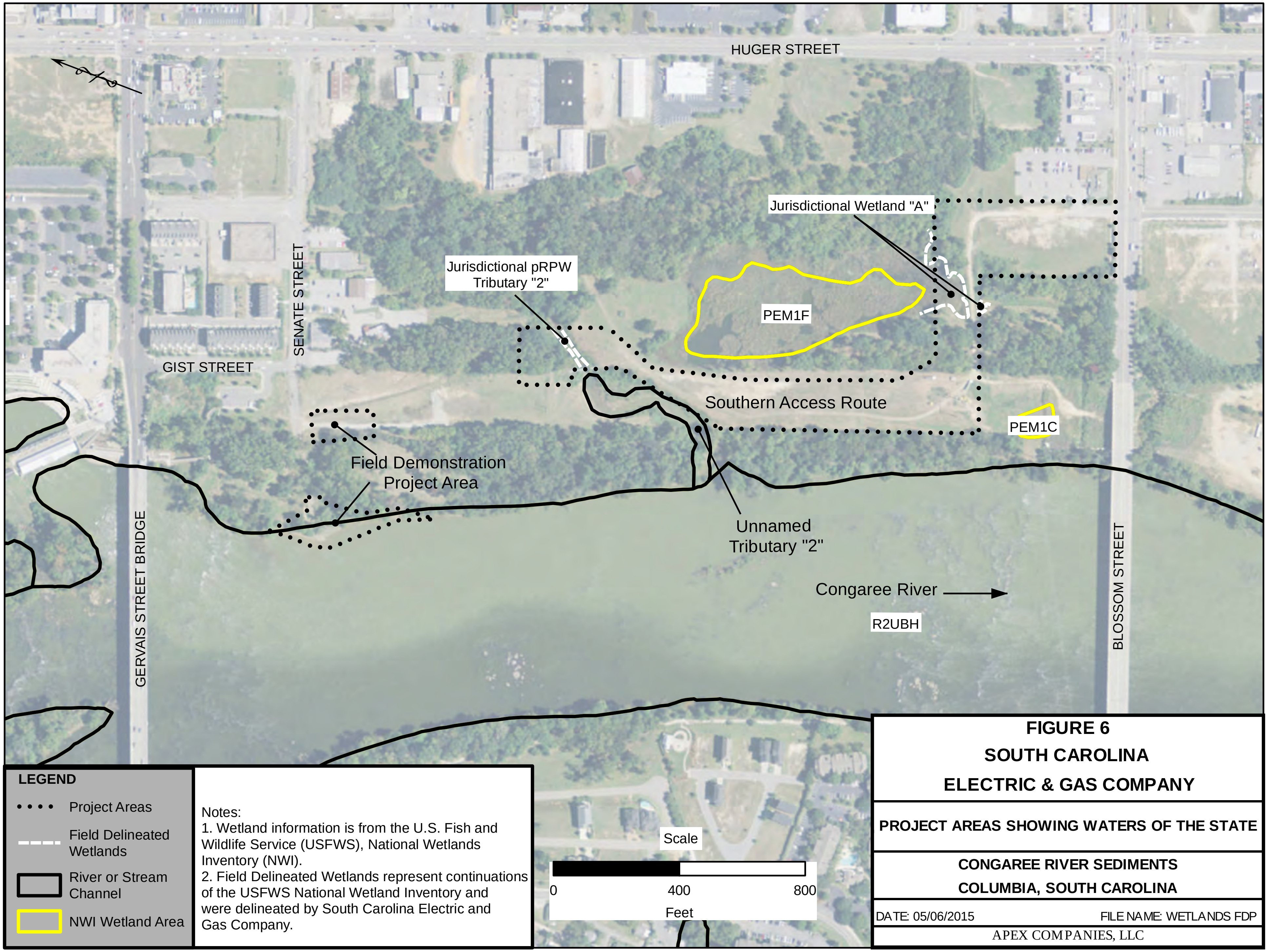
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 05/04/2012 FILE NAME: LINE 7

APEX COMPANIES, LLC



WILLIAMS STREET
SENATE STREET
GRAVEL ACCESS ROAD
ROAD SLOPE
CUT AND FILL AREA
CONCRETE ARCH CROSSING AREA
NWP - 14 - SOUTHERN ACCESS ROUTE
APPROVED OCTOBER 20, 2015
CONGAREE RIVER
TARGETED REMOVAL AREA
NWP #38 - PHASE #1 - FIELD
DEMONSTRATION PROJECT AREA
NWP #38 - PHASE #2
MODIFIED REMOVAL ACTION (MRA) AREA
(TO BE REQUESTED AT A LATER DATE)
SCALE: 1"=200'
0' 200' 400'
LEGEND
— APPROXIMATE EDGE OF RIVER
— APPROXIMATE EXTENT OF GRAVEL AREAS
— APPROXIMATE VEGETATED AREA
— AREA OF WETLAND IMPACT
— FIELD DELINEATED WETLANDS
FIGURE 5
SOUTH CAROLINA ELECTRIC & GAS COMPANY
OVERALL PROJECT AREA AND
PROJECT PHASES
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/4/15
FILE NAME: CONG297
APEX COMPANIES, LLC



LEGEND

- Project Areas
- Field Delineated Wetlands
- River or Stream Channel
- NWI Wetland Area

Notes:
1. Wetland information is from the U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory (NWI).
2. Field Delineated Wetlands represent continuations of the USFWS National Wetland Inventory and were delineated by South Carolina Electric and Gas Company.

FIGURE 6
SOUTH CAROLINA ELECTRIC & GAS COMPANY

PROJECT AREAS SHOWING WATERS OF THE STATE

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 05/06/2015 FILE NAME: WETLANDS FDP

APEX COMPANIES, LLC

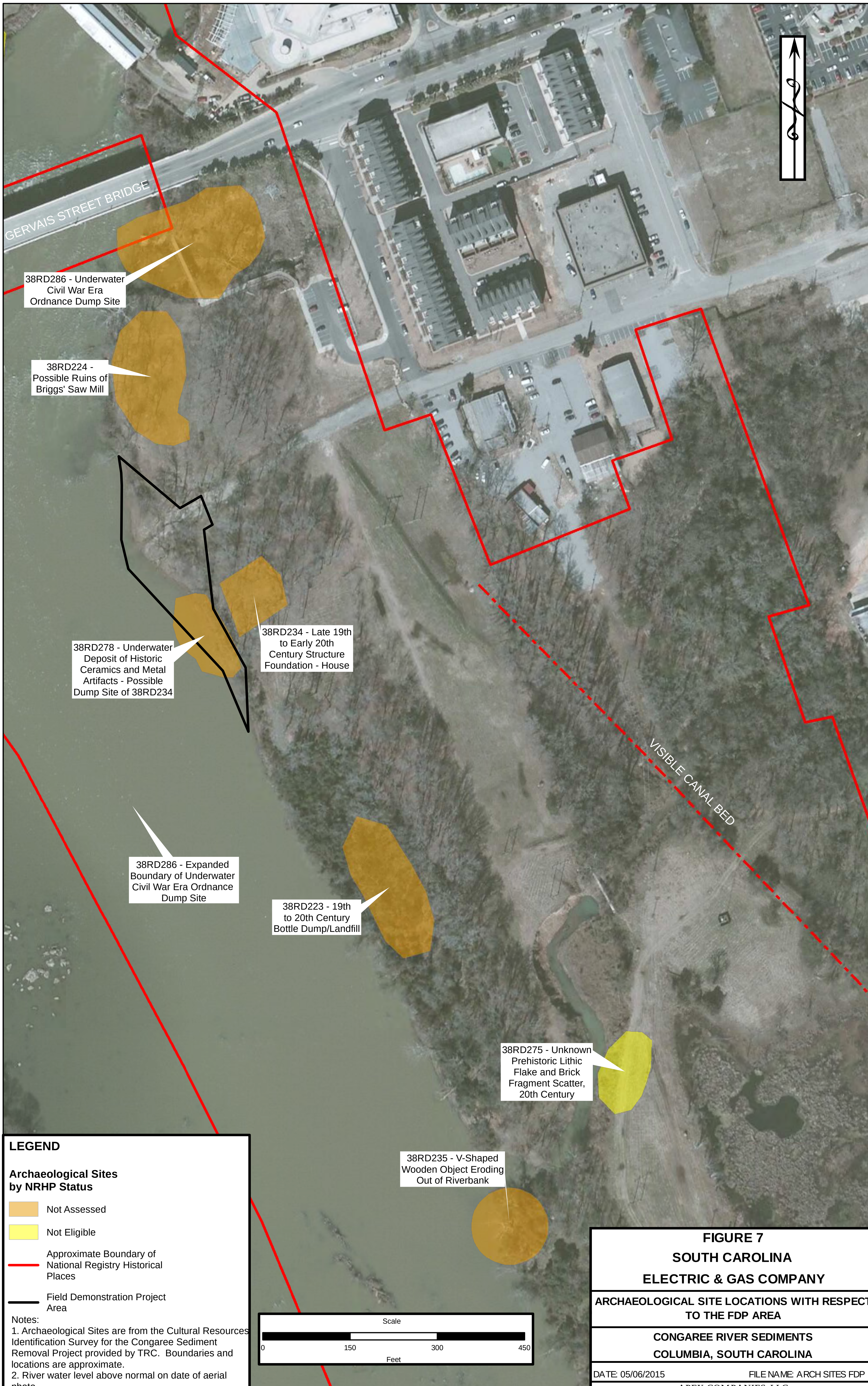

GERVAIS STREET BRIDGE
38RD286 - Underwater Civil War Era Ordnance Dump Site
38RD224 - Possible Ruins of Briggs' Saw Mill
38RD278 - Underwater Deposit of Historic Ceramics and Metal Artifacts - Possible Dump Site of 38RD234
38RD234 - Late 19th to Early 20th Century Structure Foundation - House
VISIBLE CANAL BED
38RD286 - Expanded Boundary of Underwater Civil War Era Ordnance Dump Site
38RD223 - 19th to 20th Century Bottle Dump/Landfill
38RD275 - Unknown Prehistoric Lithic Flake and Brick Fragment Scatter, 20th Century
38RD235 - V-Shaped Wooden Object Eroding Out of Riverbank
LEGEND
Archaeological Sites by NRHP Status
Not Assessed
Not Eligible
Approximate Boundary of National Registry Historical Places
Field Demonstration Project Area
Notes:
1. Archaeological Sites are from the Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC. Boundaries and locations are approximate.
2. River water level above normal on date of aerial photo.
Scale
0
150
300
450
Feet
FIGURE 7
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
ARCHAEOLOGICAL SITE LOCATIONS WITH RESPECT TO THE FDP AREA
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 05/06/2015
FILE NAME: ARCH SITES FDP
APEX COMPANIES, LLC

FIGURE 8

1872 BIRD'S EYE VIEW OF THE CITY OF COLUMBIA

ATTACHMENT A

LETTER FROM L. BERRESFORD (SCDHEC) TO R. APPLE (SCANA) DATED MARCH 2, 2015 DIRECTING SCANA TO COMPLETE A "MODIFIED REMOVAL ACTION"

March 2, 2015

Mr. Robert Apple
Environmental Division
South Carolina Electric and Gas Company
4077 Haywood Road
Mills River NC 28759

RE: Response to SCANA's February 18, 2015 Status Update - Removal Action Decision
Congaree River Sediments
SCE&G Huger Street Former MGP
Columbia SC
File # 52561, VCC # 02-4295-RP

Dear Mr. Apple:

The Department of Health and Environmental Control (Department) has reviewed SCANA's Modified Removal Action approach which proposes the removal of sediments impacted by the Tar-like Material (TLM) from "targeted" area of the Congaree River. Based on meetings and discussions with the Army Corps of Engineers (ACOE) and SCANA, the Department agrees that construction of a stone cofferdam, as originally envisioned, presents difficulties and risks not previously recognized and, more significantly, the potential for negative impacts to the opposing shore area. These negative factors outweigh the potential benefits of this original approach. Therefore, the Department approves SCANA's request to move forward with design and permitting of the Modified Removal Action approach as described/proposed in your February 18, 2015 letter. Please proceed with revising all previously submitted plans to incorporate the modifications needed to implement the modified removal action.

If you have any questions or comments please contact me at (803)898-0747 or by email at berrresjl@dhec.sc.gov.

Sincerely

Lucas Berresford
State Remediation Section
Bureau of Land and Waste Management

CC: Harry L. Mathis, P.G., Midlands Region EQC Director, via email
R. Gary Stewart, P.E., Manager, State Remediation Section, via email
Mark Giffen, BOW
File 52561

ATTACHMENT B

UXO PLANS, REVIEW AND APPROVALS

DRAFT FINAL WORK PLAN FOR
MUNITIONS RESPONSE
REMOVAL ACTION AND CONSTRUCTION SUPPORT
CONGAREE RIVER PROJECT

Prepared for:

apexcos.com

Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

Prepared by:

Explosive Ordnance Technologies, Inc. (EOTI)
9050 Executive Park Drive Suite 106-A
Knoxville, TN 37923

May 2015

I have reviewed the attached Work Plan for the referenced site.

Approved by:
Date: May 2015

David A. Farmer
Corporate Quality Manager
Explosive Ordnance Technologies, Inc.
(865) 200-8081

Table of Contents

Figures

Tables

ACRONYMS

°C	Degrees Centigrade
°F	Degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
Apex	Apex Companies, LLC
APP	Accident Prevention Plan
AR	Army Regulation
ATF	Alcohol Tobacco and Firearms
BATF	Bureau of Alcohol Tobacco and Firearms
BIP	Blow in Place
bpm	beats per minute
CAR	Corrective Action Request
CFR	Code of Federal Regulations
CHEMTREC	Chemical Transportation Emergency Center
COR	Contracting Officer's Representative
CPR	Cardio-Pulmonary Resuscitation
CPFF	Cost Plus Fixed Fee
CQDM	Quality Control Data Management
CRP	Congaree River Project
CRZ	Contamination Reduction Zone
CSHP	Corporate Safety and Health Plan
CWM	Chemical Warfare Material
DID	Data Item Description
DDESB	Department of Defense Explosive Safety Board
DMM	Discarded Military Munition
DoD/DOD	Department of Defense
DOP	Dive Operations Plan
DOT	Department of Transportation
DQO	Data Quality Objective
EE/CA	Engineering Evaluation/Cost Assessment
EED	Electro-Explosive Device
EM	Engineer Manual
EMR	Electro-Magnetic Radiation
EMT	Emergency Medical Technician
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Incorporated
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
ERCP	Emergency Response Contingency Plan
ESS	Explosives Safety Submission
EZ	Exclusion Zone
FAR	Federal Acquisition Regulation

FFP	Firm Fixed Price
FGDC	Federal Geographic Data Committee
FUP	Fixed Unit Price
GFE	Government Furnished Equipment
GIS	Geospatial Information System
GPS	Global Positioning System
HAZMAT	Hazardous Material
HAZWOPER	Hazardous Waste Operations and Emergency Response
HE	High Explosive
HEPA	High Efficiency Particulate Air
HF	High Frequency
HPS	Hantavirus Pulmonary Syndrome
HTRW	Hazardous, Toxic, or Radiological Waste
IAW	In Accordance With
ID	Identification
LB	Pound
MD	Munitions Debris
MDAS	Material Documented As Safe
MEC	Munitions and Explosives of Concern
MF	Modulated Frequency
MGFD	Munition with the Greatest Fragmentation Distance
MGP	Manufactured Gas Plant
MHZ	Megahertz
MM	Millimeter
MPPEH	Material Potentially Presenting Explosive Hazard
MR	Munitions Response
MRS	Munitions Response Site
MSD	Minimum Separation distance
MSDS	Material Safety Data Sheets
NEW	Net Explosive Weight
OE	Ordnance and Explosives
OESS	Ordnance and Explosives Safety Specialist (USACE)
OJT	On the Job Training
OSHA	Occupational Safety and Health Administration
PDS	Personnel Decontamination Station
PEL	Permissible Exposure Limit
PM	Project Manager
PPE	Personal Protective Equipment
PR	Pulse Rate
PWS	Performance Work Statement
QA	Quality Assurance
QC	Quality Control
QCI	Quality Control Inspection
QCIR	Quality Control Inspection Record
QCS	Quality Control Specialist

Q-D	Quantity-Distance
RCWM	Recovered Chemical Warfare Material
RDX	Cyclotrimethylenetrinitramine
RF	Radio Frequency
RFD	Remote Firing Device
RI	Remedial Investigation
RMSF	Rocky Mountain Spotted Fever
RRD	Range Related Debris
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric & Gas Company
SDSFIE	Spatial Data Standard for Facilities, Infrastructure, and Environment
SE QCI	Search Effectiveness Quality Control Inspection
SF	Square Feet
SOP	Standard Operating Procedure
SOW	Scope of Work
SSFR	Site Specific Final Report
STD	Standard
SUXOS	Senior Unexploded Ordnance Supervisor
SZ	Support Zone
TECH	Technician
TEU	Technical Escort Unit
TBD	To Be Determined
TLM	Tar Like Material
TM	Technical Manual
T&M	Time and Materials
TNT	Tri-Nitro Toluene
TP	Technical Publication
TPP	Technical Planning Process
TLV	Threshold Limit Value
UHF	Ultra High Frequency
USACE	United States Army Corps of Engineers
USAESCH	U. S. Army Engineering and Support Center- Huntsville
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
UXOSO/QCS	Unexploded Ordnance Safety Officer and Quality Control Specialist (Dual Hat Position)
VCC	Voluntary Clean-Up Contract
VHF	Very High Frequency
WBGT	Wet Bulb Globe Temperature
WP	Work Plan

1.0 CHAPTER 1 – INTRODUCTION

1.1 General Background Information

Apex Companies, LLC (Apex) has contracted Explosive Ordnance Technologies, Inc (EOTI) to perform clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC) for the South Carolina Electric and Gas Company (SCE&G). This work plan provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of removal of MEC from land and sediments from the project site. This work plan was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014.

The purpose Removal Action and Construction Support of the CRP is to remove MEC in order to reduce hazards from Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area being excavated by Apex. EOTI will be performing dive operations to remove MEC from a coffer dam footprint prior to installation by Apex. The dive activities are covered under a separate Dive Operations Plan (DOP), while this work plan covers the land and dewatered sediment Removal Action and Construction Support. The removal activities will be completed IAW the U. S. Army Corps of Engineers (USACE) approved Explosives Safety Submission (ESS).

1.2 Site Location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure B-1-Site Location**.

1.3 Site History

In 1865, during the Civil War, DMM and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some DMM from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of DMM within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. **Figure B-2-Previous Investigation Results** shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The purpose of this MEC removal/construction support is to protect worker safety by removing MEC prior to TLM excavation by APEX. The removal area is shown on **Figure B-3-Clearance Area** and described in Chapter 3 MEC Clearance Plan**.**

1.4 Topography

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977).The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations. These bottom elevations fluctuate from an approximate high of 116 feet to approximately 105 feet. All elevations are referenced to NAVD '88. Average river flow elevation is approximately 116 feet with an extreme variance of approximately 110 to 152 feet in elevation. Figure 2 provides the bathymetric contours for the river bottom and the topographic contours of the eastern shoreline.

The project area abuts the eastern shoreline, which rises sharply from the water's edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately 500 feet. Gist Street is the first paved land surface encountered to the east of the project area. The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway and is much thicker and overgrown further south.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river. The Senate Street alluvial fan, a key land feature in this area, is located at the end of the access road. The alluvial fan is a relatively flat portion of the project area that extends out into the river and appears to have developed over time. It will be the main access point during completion of future field activities unless another access point is constructed.

1.5 Climate

The climate in the vicinity of the project site is characterized on the following charts presented below the **Figure 1-Average Monthly Temperatures, Figure 2-Average Monthly Precipitation, Figure 3-Monthly Inclimate Weather Percentage and Figure 4-Average Wind Speed**.

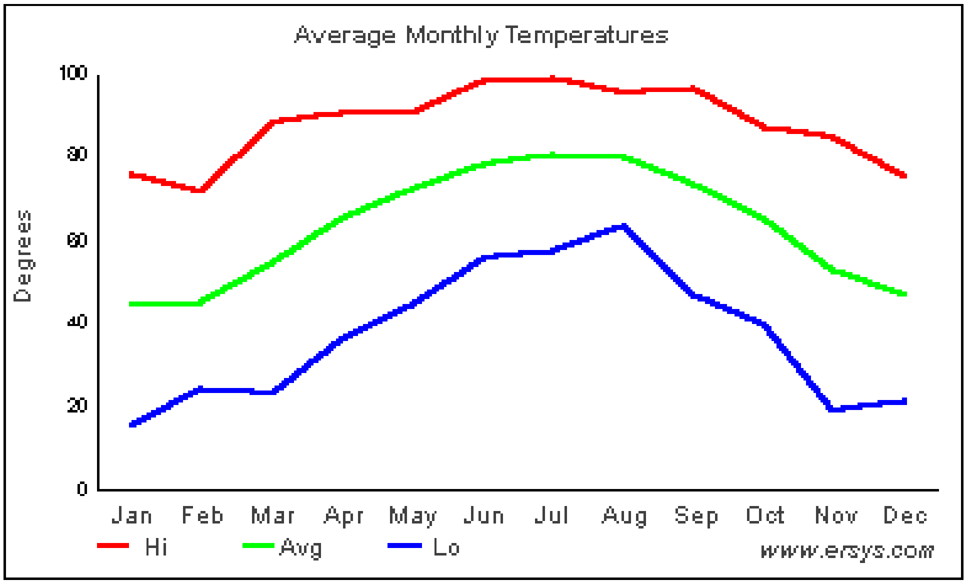


Figure 1 Average Monthly Temperatures

The two charts below show information relevant to precipitation. The first chart is the typical precipitation for the month indicated. The second chart shows the percentage of the month that inclimate weather (rain, snow, etc.) occurs. Combined the two charts give the reader a better understanding of precipitation in the area.

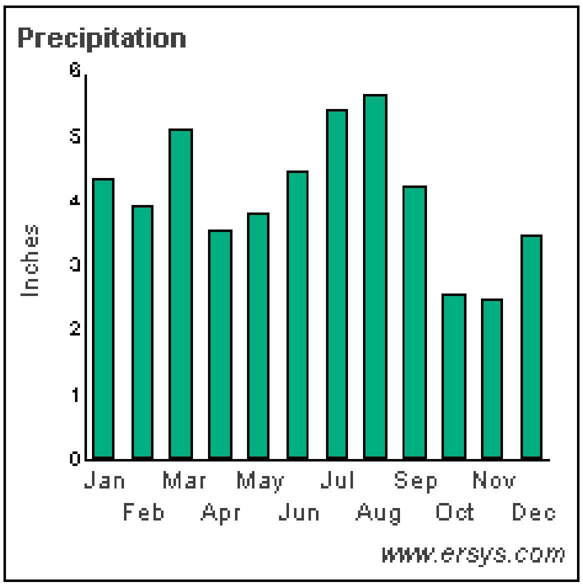


Figure 2 Average Monthly Precipitation

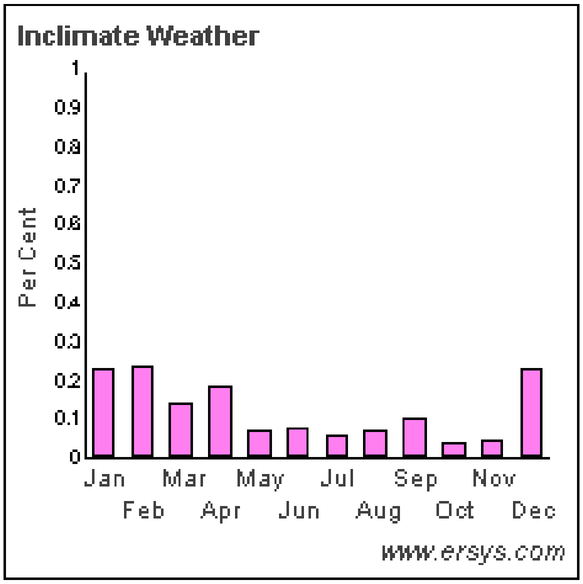


Figure 3 Monthly Inclimate Weather Percentage

The chart below illustrates typical wind speeds for the Columbia, SC area.

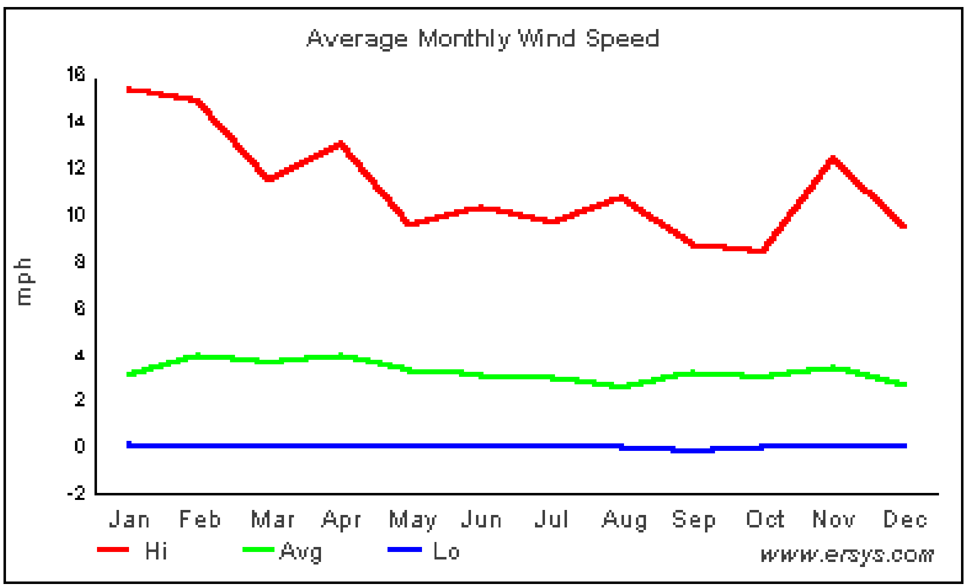


Figure 4 Average Monthly Wind Speed

1.6 Discovery of Recovered Chemical Warfare Material (RCWM)

1.6.1 The Congaree River Project site is not suspected of containing RCWM. If however, during planned MEC removal operations, EOTI identifies or suspects RCWM all personnel will immediately withdraw upwind from the work area and contact the USACE Project Manager. EOTI will secure the area and provide two personnel located upwind of the suspect RCWM to secure the site until relieved by the Department of the Army emergency response personnel.

1.6.2 If suspect RCWM is encountered, the following procedures will be followed:

- All work will immediately cease;
- Project personnel will withdraw along cleared paths upwind from the discovery;
- A team consisting of a minimum of two EOTI UXO personnel will secure the area to prevent unauthorized access;
- The supervisors will position personnel as far upwind as possible while still maintaining security of the area; and
- The USACE Ordnance and Explosives Safety Specialist (OESS) will immediately be notified.

1.7 Procedures for Change in Site Conditions

Unforeseen circumstances, such as severe weather events, may create a change in site conditions that could affect the performance of this project. Regardless of the reason for the change in site conditions, EOTI will immediately notify Apex Project Manager of the condition change and the action taken.

2.0 CHAPTER 2 – TECHNICAL MANAGEMENT PLAN

2.1 Objectives

EOTI's objective in this task order is to provide all munitions response services necessary to remove MEC from approximately 13 acres (12.65) of shoreline and within dewatered coffer dams at the Congaree River Project Site in Colombia, SC. The sediment removal will be performed in two phases over a period of two years.

"This interim response action is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and is part of the overall Remedial Action Process. Additional removal responses may be dictated in the future during the remainder of the remedial response process, as determined by subsequent action memoranda or other decision documents. If subsequent removal responses are determined to be necessary in the full remedial process, this ESS will be reviewed and amended in accordance with DoD 6055.09-M as necessary to support that response."

This Technical Management Plan describes the approach, methods, and operational procedures to be employed by EOTI to perform MEC operations at the CRP site. USACE DID WERS-001.01 and Chapter 4 of EM 1110-1-4009 were used in addressing technical management for this MEC project. No single workday will exceed ten (10) hours.

2.2 Organization

EOTI's project organization is designed to effectively control the removal action. EOTI's Project Manager, Mr. Brian Woods, PG, PMP will be the primary point of contact with the Apex Project Manager, Mr. Rusty Contrael and will have overall responsibility for ensuring that work is completed in accordance with the Work Plan. He will prepare submittals and reports in accordance with the PWS. The project organization is presented on **Figure 5-Organization Diagram**.

The Senior UXO Supervisor (SUXOS) will be the primary point of contact in the field. He will plan and supervise work completed on the site and ensure compliance with the Work Plan and other applicable requirements. He will directly coordinate with local officials, USACE onsite safety representative, and stakeholders as necessary to minimize conflicts with scheduled activities. He will prepare and submit daily reports through the EOTI Project Manager.

- The UXO Safety Officer (UXOSO) and the UXO Quality Control Specialist (UXOQCS) will be on-site when work is performed. For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS). He will be responsible to ensure that work is completed safely and to standard IAW but not limited to USACE and DoD guidance (EM 385-1-97, DoD 6055.9 and Std TM 60A 1-1-31) as well as other guidance as directed throughout this work plan. He will evaluate work daily and report any safety or quality concern to the SUXOS, Project Manager and / or Corporate Safety Manager. The UXOSO/QCS will work closely with the USACE on-site Safety Representative to immediately address any issues or concerns. He always has a direct line of communication with the EOTI Corporate Safety Manager.

All UXO Technicians and team members will meet, or exceed the requirements in DDESB TP 18 for the positions they hold. The organizational chart below shows the key project positions and personnel and the relationships between them and other team members. The SUXOS, in coordination with the Project Manager, may adjust the project organization and reallocate resource as required to most effectively complete the entire scope of the project.

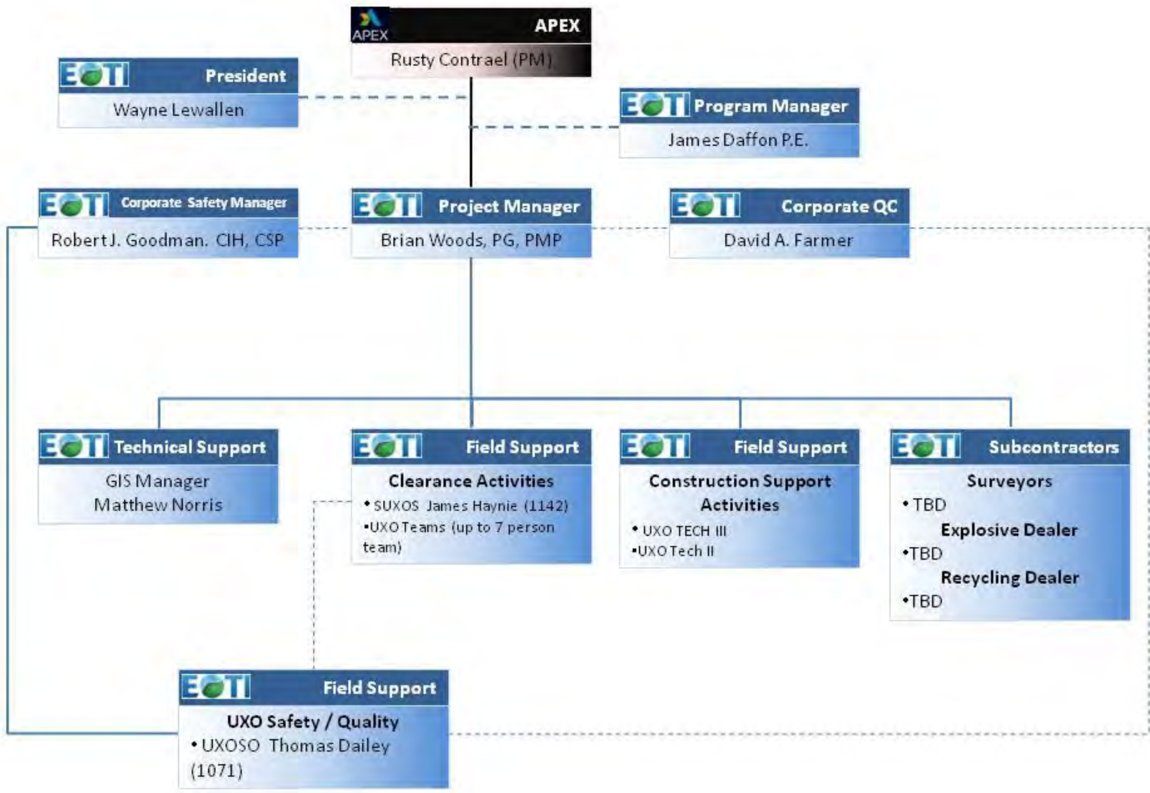


Figure 5 Organization Diagram

EOTI intends to perform this Removal Action with one UXO Team. The Team Leader will be responsible for a team of two or more personnel depending on assigned tasks and project needs. During removal operations the standard teams will consist of a UXO Tech III and up to 6 UXO Tech II/I. Team size may be reduced, at the discretion of the SUXOS. The SUXOS will make team assignments daily according to the specific needs of the project. Resumes of key personnel are included in Appendix H of this Work Plan.

2.3 Personnel

Personnel and Qualifications - Personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH. The following paragraphs describe the specific responsibilities of UXO personnel assigned to the project team.

2.3.1 Project Manager

2.3.1.1 The Project Manager is responsible for communicating with APEX Project Manager and USACE Project Manager or the USACE Safety Specialist. He will execute all directions received from the APEX Project Manager, managing all aspects of the project, overseeing the overall performance of all individuals on the project team, coordinating all contract and subcontract work, and resolving project problems. The Project Manager is also responsible for controlling cost and schedule milestones. The Project Manager will also coordinate the preparation of the Work Plan and the implementation of on-site field activities.

2.3.1.2 The Project Manager will interface directly with subcontractors to keep them advised of the PWS, schedule, and budgets. The Project Manager is also responsible for ensuring that the subcontractor costs are maintained within budget and that schedule commitments are achieved.

2.3.1.3 The Project Manager performs overall project management and is responsible for the following:

- Preparing and submitting purchase orders;
- Approving and forwarding accounts payable;
- Approving Daily Activity Report;
- Procuring necessary equipment and supplies;
- Establishing, maintaining and tracking petty cash expenditures;
- Reviewing and approving Time Sheets, Expense Reports, and Travel Order Request;
- Submitting Equipment Expense Report; and
- Supervising the Project SUXOS and, UXOSO/QCS.
- Prepare and conduct coordination meeting

2.3.2 Senior UXO Supervisor (SUXOS)

The SUXOS has more than 10 years of military/civilian EOD/UXO experience. The SUXOS will manage all on-site field activities. The SUXOS will keep the Project Manager informed of activities requiring his notification. The SUXOS is responsible for all daily work activities. He will brief the Project Manager daily on all project activities to include production, quality of work, safety, equipment status and personnel status. The SUXOS will directly coordinate any evacuation requirements with the USACE Safety Specialist. The responsibilities of the SUXOS include:

- Identification of personnel and equipment requirements;
- Supervision of all daily field team activities;
- Early detection and identification of potential problem areas and institution of corrective measures;
- Assisting with the preparation of all project reports;
- Preparation of a daily report, which will include man-hours expended, areas cleared, explosives expended, and any other information required by the Project Manager;
- Providing on-the-job training for selected UXO Supervisor(s) who may be called upon to temporarily perform SUXOS duties during his absence from the site;
- Supervision of UXO Technicians; and

- Scheduling and executing a daily safety meeting, scheduling and coordinating subcontractor field team activities, and oversight of all field activities.

2.3.3 UXO Safety Officer (UXOSO)

The UXOSO has more than eight years of military/civilian EOD/UXO experience. He is responsible for implementing all site SSHP requirements, on-site training requirements and recommending changes to level of personal protection equipment (PPE) to the SUXOS as site conditions warrant. He has Stop Work Authority for safety conditions. He will report all safety work stoppages immediately to the USACE Safety Specialist. The UXOSO evaluates and analyzes any potential safety problems, implements safety related corrective actions, and maintains a Daily Safety Log. The UXOSO reports to the Safety Manager. The UXOSO will:

- Perform on-the-job training for selected UXO Technicians who may be called upon to temporarily perform the duties of UXOSO during his absence from the site, upon approval of the USACE Safety Specialist; and
- Maintain daily liaison with the USACE Safety Specialist.

2.3.4 UXO Quality Control Specialist (UXOQCS)

The UXOQCS has more than eight years of military/civilian EOD/UXO experience. The UXOQCS reports to the Quality Manager. The UXOQCS will perform quality inspections/review all project operations, including explosives inventories, daily reports, time sheets and other documentation, and will inspect and approve each completed area prior to turnover to the USACE Safety Specialist.

For this project, the UXOSO and UXOQCS functions will be combined and performed by one dual-hatted person (UXOSO/QCS).

2.3.5 UXO Technician III

This individual, who supervises a project team, will have experience in MEC removal operations and supervising personnel, and shall have at least eight years combined active duty military EOD and contractor UXO experience. This individual must be able to fully perform all functions enumerated for UXO Tech I and II. Specific duties of the UXO Tech IIIs include:

- Reconnaissance and classification of UXO;
- Identifying fuzes and determining fuze conditions of all munitions including U.S. and foreign
    - Guided missiles,
    - Bombs and bomb fuzes,
    - Projectiles and projectile fuzes,
    - Grenades and grenade fuzes,
    - Rockets and rocket fuzes,
    - Land mines and associated components,
    - Pyrotechnic items,
    - Military explosives and demolition materials,
    - Submunitions;
- Supervising the conduct of all on-site activities directly related to MEC operations;
- Supervising the location of subsurface UXO using military and/or civilian magnetometers and related equipment;

- Supervises
  - Excavation and recovery of subsurface UXO by manual means or mechanical
  - Construction of UXO-related protective works,
  - Location of surface UXO by visual means,
  - Transporting and storing UXO/MEC assuring compliance with Federal, state, and local laws,
  - Disposal of UXO by detonation,
  - Preparation of a UXO disposal site,
  - Preparation of an on-site safe holding area for UXO,
  - Donning and doffing of personal protective equipment,
  - Operation of a personnel decontamination station,
  - Maintenance and operator checks on all team equipment,
  - Segregation of Munitions Debris (MD) and Range Related Debris (RRD) from clutter ,
  - Safe handling procedures,
  - Team preventive medicine and field sanitation procedures;

- Determine UXO-related storage compatibility;
- Preparing explosives storage plans in accordance with all applicable guidance;
- Supervise;
- Preparing required administrative reports;
- Preparing SOPs for on-site MEC operations;
- Conducting daily site safety briefings; and
- Perform Risk hazard analysis,

2.3.6 UXO Technician II

This individual will be able to fully perform all functions enumerated for UXO Tech I. In addition, the ability to perform the following functions is a requirement of the UXO Tech II:

- Identifying fuzes and determining fuze condition of all U.S. and foreign munitions, including:
  - Guided missiles,
  - Bombs and bomb fuzes,
  - Projectiles and projectile fuzes,
  - Grenades and grenades fuzes,
  - Rockets and rocket fuzes,
  - Land mines and associated components,
  - Pyrotechnics,
  - Military explosives and demolition materials, and
  - Submunitions;
- Locate subsurface UXO using military and/or civilian magnetometers and related equipment;
- Perform excavation procedures on buried UXO by
  - Manual means, and
  - Mechanical means;
- Perform operator maintenance of military and/or civilian magnetometers;
- Locate surface UXO using visual means;

- Operate motor vehicle transporting MEC material, when appropriate;
- Preparing an on-site holding area for MEC material;
- Perform storage of MEC material and demolition materials in accordance with applicable guidance;
- Prepare an MEC disposal site;
- Prepare
  - Non-electric firing system for an MEC disposal operation,
  - Electric firing system for an MEC disposal operation,
  - Detonating cord firing system;
  - Dispose of MEC/MPPEH by Detonation;
- Operate a personnel decontamination station;
- Don and doff appropriate personal protective equipment in contaminated areas;
- Construct MEC-related protective works;
- Determining a magnetic azimuth using current navigational/locating equipment; and
- Performing field expedient identification procedures to identify explosives contaminated soil.

2.3.7 UXO Technician I

The UXO Tech I's specific duties (under the supervision of a UXO Tech III or a UXO-qualified individual of higher rank than the UXO Tech III) for this project will include:

- Conducting classification of MEC materials;
- Identifying all munitions including
  - Bombs and bomb fuzes,
  - Guided missiles,
  - Projectiles and projectiles fuzes,
  - Rockets and rocket fuzes,
  - Land mines and associated components,
  - Pyrotechnics items,
  - Military explosives and demolition materials,
  - Grenades and grenade fuzes,
  - Submunitions;
- Locating subsurface MEC using military and/or civilian magnetometers and related equipment;
- Performing excavation procedures on subsurface MEC by;
  - Manual means,
  - Mechanical means;
- Locate surface MEC using visual means;
- Transporting and storing MEC and demolition materials;
- Preparing firing systems, both electric and non-electric, for destruction operations disposing of ammunition/ explosives by detonation;
- Operating Personnel Decontamination Stations (PDS);
- Donning and doffing personnel protective equipment in contaminated areas;
- Erection of MEC related protective works;
- Assist in performing operator maintenance of military and/or civilian magnetometers and related equipment;
- Operate motor vehicle transporting MEC material, when appropriate; and
- Prepare an MEC disposal site.

2.4 Communication and Reporting

2.4.1 The EOTI Project Manager and SUXOS are primarily responsible for the management of work, data and cost. The Project Manager will develop the initial schedule. The SUXOS will maintain the schedule and make adjustments as required throughout the project. The SUXOS will coordinate closely with local officials to minimize conflicts with other planned activities. He may adjust work hours / days or the order that work is completed in order to minimize conflicts and maximize productivity. The project manager will provide updated schedules throughout the project, as required.

2.4.2 The SUXOS will submit data to the Project Manager daily, as required. Data will include a daily report that will describe the activities completed and issues that arose during the workday. The project manager will post the daily reports on the project collaboration website, along with photographs and other data relating to the project. The website will incorporate GIS to better display the data and project status.

2.4.3 All task included in this project are FFP or FUP. The Project Manager will control cost by completing the project on or ahead of schedule and negotiating with vendors to ensure the best prices for equipment and material.

2.4.4 Work will be completed in accordance with the requirements of the contract. Quality Management and Quality Control requirements described in Chapter 4 will be applied to all phases of the project. EOTI will ensure strict compliance with the Accident Prevention Plan in Appendix D.

2.5 Deliverables

In addition to the Periodic Reporting requirements discussed in Section 2.7, EOTI will prepare a Site Specific Final Report.

2.6 Schedule

EOTI has prepared a Project Schedule and will be updated as necessary throughout the project. The initial schedule is based on the fixed unit price tasks and other tasks will be scheduled as they are defined. EOTI will follow the same scheduled work hours as APEX but anticipatesworking five, 10-hour days per week. The schedule is generally Monday through Friday. The schedule working days may be adjusted to better suit project needs. The SUXOS will coordinate with the Project Manager prior to adjusting the schedule.

2.7 Periodic Reporting

2.7.1 The SUXOS will prepare and submit daily reports to the EOTI Project Manager.

2.8 Costing and Billing

2.8.1 The Project Manager and SUXOS will control and manage costs through the use of Purchase Orders and Travel Orders. A record of expenditures will be maintained by the SUXOS and monitored by the Project Manager.

2.9 Public Relations Support

EOTI personnel will refer all requests for information concerning site conditions to the APEX PM.

2.10 Subcontractor Management Procedures

2.10.1 Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a South Carolina-licensed professional land surveyor to provide survey and mapping support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included Accident Prevention Plan. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO/QCS prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone while intrusive operations are ongoing.

2.10.2 Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and Accident Prevention Plan. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Suppliers will not be permitted to enter the Exclusion Zone (EZ) of the project site unless escorted by an EOTI UXO-qualified employee. Non-essential persons, including suppliers, will not be allowed in any active EZ.

2.10.3 Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site will receive a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any exclusion zone area without a UXO-qualified escort. Non-essential persons, including suppliers, will not be allowed in any active EZ. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS or UXOSO for investigation.

2.11 Field Operation Management Procedures

EOTI's Project Manager has overall responsibility for the management of the project. He will coordinate directly with the APEX Project Manager and subcontractors on project related issues, such as schedule, submittals/reports, etc. The Project Manager reports directly to the EOTI Vice President and MEC Program Manager. The Project Manager communicates frequently with the SUXOS and UXOSO/QCS. The SUXOS will coordinate all field activities. He will coordinate with the on-site USACE representatives and local officials. He will prepare and submit daily project status reports to the Project Manager. Project related reports, documents, and information will be placed on a secure project collaboration website to allow team members easy access to up-to-date project status information.

2.12 Technical Procedures to Execute Project Tasks

Detailed procedures for the execution of project tasks are contained in Chapter 3.

2.13 Data Management

2.13.1 A detailed accounting of all MEC items encountered during the investigation / removal activities will be maintained. As MPPEH / MEC is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all suspected MPPEH / MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuse Description;
- Fuse Condition; and
- Additional comments, if required.

2.13.2 Each suspect MEC item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first suspect item (0001) encountered in the Removal grid A-3).

2.13.3 The Team Leader will provide validated data to the SUXOS at the close of each working day.

2.13.4 The SUXOS will:

- Collect and review the raw field data for accuracy.
- Provide the verified data to the Knoxville office for posting to EOTI's project collaboration website for use in the final report.
- For documentation purposes, photographs will be taken of encountered MEC. If MEC is determined to be acceptable to move, multiple items may be included in the same photograph. The photograph will be taken to show detail and will be annotated with the location or area discovered.
- Photographic records will be used to supplement information recorded as needed.

2.13.5 Removal Report - EOTI will prepare a Removal Report IAW the contract.

2.14 DQOs

Data Quality Objectives (DQOs) are qualitative and quantitative statements developed, usually in the Technical Planning Process (TPP), to clarify study objectives, define the type of data needed, and specify the tolerable levels of potential decision errors. A DQO is used as the basis for establishing the type, quality, and quantity of data needed to support the decisions that will be made. For this project, quality objectives are discussed in Chapter 4. Specific quality objectives for Geospatial Information Systems (GIS) are discussed in Section 3.6 of this WP. In order to safely remove the TLM, a MEC clearance of the potentially co-located MEC is to be performed prior to TLM excavation. A list of the type of MEC believed to be present is presented in Section 3.2 but consists of civil war era cannonballs (6 lbs and 10 inch cannonballs). While a cannonball of unknown size and depth was reported in the past the depth of MEC is unknown. Anomalies will be manually investigated and resolved to a depth of 4 feet or to bedrock whichever is encountered first since the sediment thickness varies from no sediment (exposed bedrock) to approximately 4. feetThe tolerable limits for this are presented in Chapter 4. While presented in Chapter 3 below the methodology to be used is a “mag and dig” where magnetometers are used to identify anomalies and dug by hand shovel.

3.0 CHAPTER 3 MEC CLEARANCE PLAN

3.1 Overall Approach to Munitions Response Activities

This section describes EOTI's approach to completing the requirements of the PWS. Specific quality management standards and procedures used to control the work completed under the PWS are described in detail in Chapter 4 of this Work Plan.

All UXO/MPPEH disposal operations will be conducted in accordance with the procedures described in this plan and the approved ESS. DDESB 6055.09-M and EM 1110-1-4009 will also be followed during munitions response activities. If unidentifiable UXO is found, the default separation distance specified in DDESB TP16 will be used to establish the appropriate exclusion zones. Unidentified UXO will not be disposed of until the munitions filler can be determined. EP 385-1-97, dated September 2008 and EP 75-1-3 provide guidance in helping to determine unknown explosive fillers. Final disposition/disposal procedures will be determined in coordination with the USACE on-site safety representative. Demolition operations will be conducted to destroy or vent UXO / MPPEH, as required for safe disposal. Detailed discussion of MEC reporting requirements and disposition methods and techniques are provided in in the ESS, submitted separately of the work plan.

3.1.1 Personnel deemed non-essential to the demolition operation will be evacuated or assigned duties outside of the fragmentation zone. Electrical or nonelectrical systems (Non-EL) will be used to initiate BIP to insure maximum control and safety. The UXOSO is responsible for ensuring all personnel are accounted for during disposal operations and that the demolition operation is conducted in strict accordance with required procedures. The EOTI SUXOS and/or UXOSO will visually inspect the demolition site with the Demo Team Leader and announce all clear upon completion of demolition operations.

3.2 Identification of Areas of Concern

3.2.1 The clearance area for this project is as shown on **Figure B-3-Clearance Areas**.

The cofferdam area consists of an area within the boundaries of CRP that is approximately 3.75 acres (3.75) of land surface, 5.64 acres of Phase I sediment area and 6.12 acres of Phase II sediment area. Total acreage is 12.65 acres as identified on **Table 1-Areas of Clearance**.

Table 1 Areas of Clearance

Area	Acreage	Type	Anticipated Clearance
Cofferdam	3.75	Sediment	Spring 2015
Phase I Area	5.64	Sediment (dewatered)	Spring 2015
Phase II Area	6.12	Sediment (dewatered)	Spring 2016
Total	12.65	NA	2 Years

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DOD Fragmentation data base of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun
- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in "cannonball" shell has been selected as the munition with the greatest fragmentation distance (MGFD) for the project.

3.3 Geophysical Prove-out Plan and Report

Digital Geophysical Mapping (DGM) is not planned for this project. Construction and use of Test Strips to document effectiveness and proficiency with analog instruments is discussed in Chapter 4.

3.4 Geophysical Investigation

Digital Geophysical Mapping (DGM) is not planned for this project. Use of analog instruments (Schonstedt GA 52-Cx or all-metals detector) to accomplish project objectives is discussed in Section 3.7.

3.5 Location Surveys and Mapping Plan

EOTI will be supported by surveyors provided by APEX to to conduct boundary surveys of the designated clearance areas as shown in **Figure B-3**.

The surveyor will install stakes that clearly show the boundaries of the cleared area and label each stake with the proper UTM coordinate system. Flagging will be placed at the top of each stake. No stakes will be installed without approval from the UXO Tech II escort, who will check for anomalies in the location that each stake will be emplaced. The UXO Tech II will scan all stake emplacement locations with a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White's Metal Detector), or equivalent. The surveying subcontractor will maintain a field logbook detailing all field activities, including daily entries of the personnel on-site, time of day all work started and ended, weather conditions, delays, all relevant survey data, equipment used, and field sketches.

Survey data will be submitted by hard copy and digital media. The site grid data will include a map of the entire site with grids shown and other pertinent features. The surveyor will produce maps that accurately convey the clearance areas and data.
MEC location data will also be submitted in Microsoft Excel. Data will include grid number where found, item number assigned, type of item, depth, and location in appropriate UTM coordinates.

3.6 Geographic Information System (GIS) Plan

3.6.1 GENERAL

The foundation of the GIS will be derived from existing CRP data developed during previous site efforts. EOTI has acquired the existing GIS provided by APEX, and will expand it to meet the needs of the project. The GIS will be maintained through the project's life cycle and accumulate all associated geospatial data along with base map layer and analysis data.

3.6.2 ACCURACY

During removal activities, results will be collected and documented by the UXO Teams. All MEC coordinate locations will be documented using hand-held GPS such as the Trimble GeoXH or by taping in from two known points in order to determine the location of the item within plus or minus one foot.

3.6.3 GEOSPATIAL INFORMATION SYSTEMS (GIS) INCORPORATION

The foundation of the GIS will be derived from base layers collected from USACE, state GIS clearinghouses, and previous UXO related investigation/reconnaissance conducted on the site. All data will be converted or digitized into ArcGIS shapefiles and or Geodatabase formats to streamline data and avoid multiple data formats.

All data collected during field activities will be submitted to the GIS Manager. The GIS Manager will perform QC measures on all Geophysical and OE field data to elevate formatting or incorporation issues. Collected data will be incorporated into the GIS and conform to the Universal Transverse Mercator (UTM) projection, a datum of GCS North America 1983 (NAD83), and with linear unit of measure in Meters. All Geospatial data delivered to USACE will conform to Universal Transverse Mercator projection and a datum of GCS North America 1983 (NAD83) with linear units of measure stated as specified in DID WERS-007.01.

EOTI will maintain GIS QC data for the project. QC procedures will be performed periodically on the GIS datasets for inaccuracies that may jeopardize the stability of the GIS and spatial data it contains. Any inaccuracies that arise will be reviewed to determine if the error rests in the GIS incorporation methods or if the actual field data is inaccurate. After the error assessment has been completed, the EOTI Project Manager will be made aware of the inaccuracies and a formal error assessment report will be submitted by the GIS Manager. The GIS Manager will take proper action to resolve the error and retain stability over the GIS database.

Additional data entered or modifications to the existing GIS will be noted with revision dates. This will also be captured in the geospatial dataset's Federal Geographic Data Committee (FGDC) metadata.

All Spatial data incorporated into the project specific GIS will conform to the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE) standards to give all spatial datasets more compatibility with other government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for spatial layers that have been created by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigation, imagery, etc., will contain previously developed metadata created by the originator. All GIS data will be developed and incorporated in to ESRI's Shapefile or Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All Spatial Imagery during the life of the project will transferred in to geo TIFF format to help in reducing image file size.

3.6.4 PLOTTING

EOTI anticipates hard copy printouts will be utilized on the project. Hard copy map graphic scales will be based on standard mapping scales. Maps will be developed showing results of MEC found during project activities. Detailed site maps will be produced. Maps will be available in digital PDF format to the APEX.

3.6.5 MAPPING

All survey boundary points related to designated work areas will be incorporated into the project specific GIS. Maps will include true north and magnetic north arrows with the difference between them in degree and minutes shown. Tic marks at standard interval with UTM coordinate designators for the specified area that the map covers will be shown on the edge of the map. A map legend with standard mapping symbols and map index showing area covered on map in relationship to project boundary will be displayed on the map.

3.6.6 COMPUTER FILES & DIGITAL DATA SETS

EOTI utilizes ESRI's ArcGIS version 10.x in development of comprehensive and accurate geospatial data. EOTI will submit the most current GIS as part of any report submitted to APEX. This will include ArcGIS project files and metadata for the geospatial data that is referenced in the project files.
The GIS will be updated throughout the project's life.

All GIS data and ArcGIS projects will be developed and incorporated into the ESRI's Geodatabase format. All GIS project and layout files will be in the (ArcGIS.mxd) file format and submitted with the SSFR. All spatial imagery during the life of the project will be transferred into Geo TIFF/Geo JEPG format to help in reducing image file size unless stated otherwise by the Government.

All MEC items that are discovered during the removal that are determined or suspected of containing energetic material will be documented within the GIS. Coordinates for the individual items will be collected using the Geo XH GPS unit prior to BIP, consolidation, or removal operations beginning.

External tabular data that is not integrated within the Geodatabase will be provided to APEX in ANSI SQL format as well as Microsoft Access at the completion of the project. All supporting databases will be complete and single entities, with no relations or joined connections to others.

All geospatial data developed by EOTI will be incorporated into the project specific GIS and will conform to the SDSFIE standards and the USACE data standards to give all spatial datasets more compatibility with other Government GIS programs. Federal Geographic Data Committee (FGDC) metadata will be developed for core SDSFIE data layers that are developed by EOTI. It is assumed that spatial data retrieved from other sources such as GIS clearinghouses, previous site investigations, etc., will contain previously developed metadata created by the originator.

3.7 Intrusive Investigation

3.7.1 Intrusive Investigation Methodology

3.7.1.1 Mobilization

Immediately after receiving a notice to proceed for each phase, EOTI will begin the mobilization process. It is anticipated that two phases of mobilization will occur over two field seasons to accomplish the clearance task. The Project Manager will identify the personnel and equipment required, schedule a sequenced mobilization, and make the necessary travel and shipping arrangements. Personnel qualifications and certification are in Appendix H of this Work Plan.

Personnel

Personnel will be mobilized from their home to Columbia, SC as required to complete the work associated with the project in accordance with the project schedule. It is anticipated that two phases of mobilization will occur over ttwo field seasons to accomplish the clearance task. The Project Manager and SUXOS will mobilize ahead of the main team body to help set up the project site. They will also arrange to receive equipment, coordinate with survey personnel, and insure that all signed copies of required permits are in place. After this initial mobilization of the management staff has coordinated with local personnel and set up the site, the mobilization body of the remaining field team required to complete all planned activities will occur.

Equipment

EOTI will deliver equipment to the site as required by the project schedule. Mechanical excavation and/or brush cutting equipment are not anticipated but (if required) will be rented and delivered to the site by a local vendor. Other equipment will be delivered to the site by EOTI personnel or shipped to the site by commercial carrier.

3.7.1.2 Site Setup

Immediately upon arrival on the first field day at the site, EOTI will begin site setup activities.

3.7.1.3 Office / Facilities

Due to the expected short duration of field activities and the small work force, EOTI will not establish a formal project office at the project location. Office functions and communication will be established and operated out of site management vehicles and/or from site management personnel's motel rooms. EOTI intends to utilize portable toilets to be delivered during site set-up.

3.7.1.4 Work Site

Immediately upon arrival for the first field work day, EOTI will setup the work site. EOTI will establish and survey the boundary of the designated clearance area using a subcontracted South Carolina-licensed surveyor. One week prior the start of intrusive operations EOTI's PM will notify "call before you dig" number 811 or SCE&G 1-800-251-7234 of the intent to start subsurface clearance. SCE&G will perform marking of any utilities within the clearance foot print and any required digging in those areas will be carefully conducted by hand to avoid damaging any utilities.

3.7.1.5 Survey / Site Layout

The SUXOS will coordinate with the surveyor responsible for marking the work areas to ensure that the site layout is complete and documents the clearance area. To date, the boundary information presented on **Figure B-3** has been provided for this effort.

3.7.1.6 Equipment Testing

Hand held magnetometers / metal detectors will be checked on a test plot. Daily checks will be conducted by each instrument operator using his assigned instrument on the test strip. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The UXO Team leader and UXOQCS will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test strip. If the operator displays improper techniques or is unable to accurately and consistently locate seed item, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test strip before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation. The test strip simulates site conditions. It will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made.
As boundaries of the areas are being marked, EOTI will establish internal grids or clearance areas. The SUXOS will determine the most effective way to divide the removal area into internal grids or clearance areas. The internal areas will be established based on size and shape of the area, terrain, etc. but will generally not exceed one acre in size.

3.7.1.7 Vegetation Removal

Only minimal vegetation clearance, if any, will be required to effectively clear MEC, as described in Section 3.7.9. Only vegetation required to effectively complete the removal action will be cut. Vegetation may be cut using any combination of hand or mechanized clearance methods.

3.7.1.8 Surface Removal

Removal of surface MEC will be completed in accordance with procedures described in Section 3.7.9. The removal will include all MEC, MPPEH and magnetic anomalies on the surface that could mask items in the subsurface and no munitions debris equivalent to, or greater than 3.55 inch diameter or thickness of 3.55 inch or greater from the surface. The method used for surface clearance will be performed using magnetometers to assist in the location of items on the surface. Sections below describe the establishment of search lanes to ensure effective removal of the entire clearance area. Although MD and RRD are not expected on this site as it is not a range, any MD removed during the surface and subsurface removal will be collected and processed as described in section 3.7.13. The surface removal will be completed in conjunction with the subsurface removal. A grid or designated clearance area will not be considered complete and will not be turned over for QC/QA checks until both surface and subsurface removal is complete.

3.7.1.9 Subsurface MEC / MPPEH Removal

The two phase sediment removal areas identified in **Figure B-3.** The parameters for subsurface clearance are to remove MEC, MPPEH, and any ferrous metal items equivalent to 3.55 inch diameter or thickness (length) of 3.55 inch to depths up to 11 times the width or diameter. The area may be subdivided by placing grid stakes throughout the clearance area in order to better control the removal action and facilitate reporting and quality control. The internal grids corners will be located with a sub-foot GPS unit or with measuring tapes and corners will be marked with stakes.

3.7.1.9.1 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed, the search lane width will be no wider than five feet. The map in **Figure B-3** shows the areas that require surface and sub-surface removal. The precise location of these areas will be marked on the ground by the state licensed surveyor. EOTI will then layout grids/divisions and search lanes in each area that allow for the most efficient removal based on the size and shape of the area.

3.7.1.9.2 Anomaly Identification and Investigation

After establishing lanes (as described above), the areas will be cleared by a team consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).

Each UXO Technician will use a hand held magnetometer (such as a Schonstedt GA-52Cx), or an all-metals detector (such as a White's Metal Detector), or equivalent to identify potential subsurface MEC. If a geophysical anomaly is detected it will be investigated by the dig team using mechanical and / or manual digging methods (see ESS for explosives safety information).

3.7.2 MEC Accountability and Records

3.7.2.1 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all suspected UXO/MPPEH items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #);
- Location;
- Nomenclature;
- Fuze Description;
- Fuze Condition; and
- Additional comments, if required.

Each suspect UXO item encountered will be identified using a unique numerical identifier, such as A-3-0001 (for first suspect item (0001) encountered in the Removal Area/Grid A-3).

3.7.2.2 Photographs of or suspect UXO/MPPEH items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the final report; thus, a focused, well thought out photograph is necessary.

3.7.3 UXO Personnel Qualifications

UXO personnel required for this project will include UXO supervisors and technicians, all of whom possess the relevant personal training and experience requirements set forth in DDESB TP 18. Personnel for this project have been selected from a pool of available UXO technicians. Detailed personnel qualification requirements are in Section 2.3. Resumes of key personnel are included in Appendix H if not listed in the UXO database maintained by USAESCH.

3.7.4 MC Sampling Locations

MC Sampling is not a part of this project.

3.7.5 MC Sampling Procedures

MC Sampling is not a part of this project.

3.7.6 Munition with the Greatest Fragmentation Distance (MGFD)

3.7.7 The Munition with the Greatest Fragmentation Distance (MGFD) and minimum separation distances are presented in the Explosives Safety Submission (ESS).

3.7.8 MEC Identification

The SUXOS and UXOSO must be in agreement on the condition of a MEC item before any removal action is attempted. All available data sources will be consulted, as required to make this determination.

3.7.9 MEC Removal

3.7.9.1 Surface and Subsurface Removal

A surface removal will be conducted in conjunction with the subsurface removal in the designated clearance areas as shown in Figure B-3, in accordance with the SOW (Appendix A). UXO Technicians will visually search and use magnetometers such as Schonstedt GA52Cx, White's Metal detector, or similar equipment to locate MEC/MD. The SUXOS will assign grids/clearance areas to the team and the Team Leader (UXO Tech III) will organize his team to effectively conduct a systematic surface and subsurface clearance. If any area has heavy surface contamination the SUXOS may opt to conduct the surface clearance prior to completing the subsurface clearance.

3.7.9.2 Brush Clearance

3.7.9.2.1 Some minor brush cutting may be required EOTI will ensure effective removal in portions of the designated areas. It is anticipated that little, if any, brush cutting will be required. Brush clearance will be conducted by UXO qualified personnel. The purpose of the brush clearance is to allow an effective removal of MPPEH as required in the SOW.

3.7.9.2.2 EOTI will conduct brush-cutting operations only as necessary to allow for MPPEH detection and removal efforts to take place unrestricted from vegetation undergrowth. EOTI will perform minimum brush removal required to clear the surface and subsurface of MPPEH/MD required by the PWS. Underbrush, tall grass, shrubs, small trees, and limbs may be cut in order to allow efficient MPPEH detection and /or removal. Cut brush will be removed from the area identified for clearance, if necessary to prevent interference with site operations. EOTI's brush cutting team will use a variety of clearing techniques depending on the ground conditions and type of vegetation. Various hand and mechanical methods may be applied to complete this task. EOTI does not anticipate heavy vegetation in the project area. However, the use of mechanical brush cutting equipment, such as chainsaws and heavy-duty steel bladed weed eaters may be required in the open, lightly vegetated areas. If self-propelled brush cutting equipment is used, the cutting height will be adjusted to ensure that the blades do not strike potential MEC. UXO personnel will perform a visual sweep ahead of the mechanical equipment to identify any potential hazards on the surface of the ground. In areas with soft ground, EOTI will use a combination of mechanical and hand clearing techniques, possibly including the use of equipment such as a Bobcat Brush Cat or similar equipment and weed eaters. Chain saws and chippers may also be used to cut and reduce brush and low hanging limbs that would interfere with detection and removal operations. The EOTI brush cutting team will consist of UXO Technicians. In any case, any brush cutting team will include at least two persons, a minimum of one of whom will meet at least the requirements to be a UXO Tech II.

3.7.9.2.3 The brush clearance team(s) will be structured to safely and efficiently clear each of the designated areas. The SUXOS will designate team personnel and equipment, based on the size of the area, type of brush, terrain, MPPEH, etc. Brush cutting teams will consist of no less than two personnel.

3.7.9.3 Removal of Surface and Subsurface MEC/MPPEH

The map in Figure B-3 shows the area that requires sub-surface removal. The precise location of the area will be marked on the ground by the state licensed surveyor. EOTI will layout grids and search lanes in each area that allow for the most efficient removal based on the size and shape of the area as shown in Figure B-3.

3.7.9.3.1 After clearing brush sufficiently to allow safe, effective removal, EOTI will clear the designated areas. EOTI's removal team will consist of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members). The SUXOS will organize and make team assignments to ensure that the project is completed in an efficient and safe manner. Any team assigned to complete removal or other MEC operation will have a minimum of two UXO qualified personnel, including at least one that meets the qualification of a UXO Tech III.

3.7.9.3.2 EOTI's UXOSO/QCS will observe removal operations to ensure that safe, quality work is conducted in compliance with the requirements of the Work Plan. The UXO/QCS will conduct at least a 10% Search Effectiveness Quality Control Inspection (SE QCI) check of the area that was cleared using the same type of equipment and techniques used during the removal process. If an area fails the inspection the team will re-sweep the area and it will then be re-inspected. UXOQCS will conduct blind seeding within the clearance area to insure that Complete QC procedures are contained in Chapter 4.

3.7.9.3.3 All magnetometers will be calibrated and working properly. All equipment will be tested prior to each use. At a minimum, equipment will be tested in the morning prior to beginning work and after lunch prior to resuming work. Magnetometers will be tested on a test strip in accordance with Section 4.7.3.

3.7.9.3.4 Search Lanes

Those areas requiring a systematic subsurface removal will be divided into lanes to ensure effective removal of the entire area. Tape measures, cones, or small lines will mark search lanes. Unless otherwise directed the search lane width will be no wider than five feet.

3.7.9.3.5 Anomaly Identification and Investigation

3.7.9.3.5.1 After establishing lanes (as described above), the areas will be cleared by teams consisting of a UXO Tech III (Team Leader) and up to six UXO Tech II/I (team members).

3.7.9.3.5.2 Each lane will be cleared by qualified UXO Technicians under the supervision of the Team Leader. Each UXO Technician will use a hand held magnetometer (Schonstedt GA-52Cx, White's Metal Detector, or equivalent) to identify potential subsurface MEC. If a geophysical anomaly is detected that could be caused by MEC it will be investigated by the dig team using mechanical and / or manual digging methods. If mechanical methods are used, the team will excavate to within one foot of the anomaly and then hand methods will be used to carefully expose the source of the anomaly. All material suspected as MPPEH, including UXO, DMM, MD, and Range Related Debris, will be inspected by the SUXOS and UXOSO to determine if it is acceptable to move. If, after inspection, it remains MPPEH and can be safely moved, it will be consolidated and destroyed by detonation as described in Section 3.7.11. If it is not acceptable to move, it will be blown in place as described in Section 3.7.11 All MD and RRD will be handled and processed IAW Section 3.7.13.

3.7.10 MEC Holding Areas

EOTI does not plan to establish holding areas for MEC in this project. MEC/MPPEH items will be marked and will be destroyed as soon as possible in scheduled demolition operations in accordance with the approved ESS. All demolition operations will be conducted in coordination with the local law enforcement and approved ESS. Demolition operations will be performed daily per approved ESS as required or items will be properly guarded until operations can be conducted.

3.7.11 MEC Disposal

Personnel Responsibilities

3.7.11.1SUXOS – The SUXOS has overall responsibility for reporting and disposition of MEC. He will:

- Schedule and coordinate all demolition operations;
- Ensure a MEC log is maintained;

- Assure that MD generated from demolition operations is inspected prior to placement in the holding bins; and
- Inspect all recovered MD, RRD and CD.

3.7.11.2 UXOSO and the UXOQCS – The UXOSO and the UXOQCS are responsible for insuring all MEC operations meet safety and quality requirements. They will:

- Observe and inspect all demolition operations; and
- Insure all requirements of this section are complied with.

3.7.11.3 UXO Tech III – The UXO Tech III is responsible for the supervision of the MEC disposal operation. He will:

- Post individuals at entry points (if required);
- Construct appropriate engineering controls IAW "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions," HNC-ED-CS-S-98-7, August 1998 if required;
- Assign team members to specific demolition duties;
- Assure the area is clear prior to capping in for demolition operations; and
- Check the area following each shot or series of shots.

3.7.11.4 UXO Tech II – The UXO Tech II will perform demolition duties as assigned.

3.7.11.5 UXO Tech I/Sweeper – The UXO Tech I/Sweeper will perform demolition duties as assigned.

Safety Precautions

3.7.11.6 A minimum of two personnel (buddy system) will be present during all MEC operations so that one UXO person will always act as a safety observer. Only UXO-qualified personnel will perform MEC procedures. As an exception, a UXO technician I may assist in the performance of MEC procedures when under the supervision of a UXO Technician III or higher.

3.7.11.7 During all MEC operations, only the minimum number of personnel required to safely perform the task will be allowed on-site. All non-essential personnel will remain out of the exclusion zone.

3.7.11.8 If an unidentifiable MEC is found, or toxic chemical ordnance is found, EOTI will will coordinate for EOD support through APEX and local law enforcement.

3.7.11.9 UXO personnel required for this project will include qualified UXO supervisors and technicians that possess the relevant qualifications and experience. Personnel assigned to this project have been selected from a pool of available qualified UXO Technicians. All UXO personnel will meet the applicable personnel training and experience requirements.

3.7.11.10 EOTI UXO personnel will not attempt to remove any fuze(s) from the UXO. Personnel will not dismantle or strip components from any UXO. Personnel are not authorized to inert any UXO items found on-site. MEC/UXO items will not be taken from the site as souvenirs.

Off-Site Transportation

EOTI does not anticipate transporting any MEC / MPPEH items off-site for disposal.

Collection Points

Collection points will be performed in accordance with the approved ESS..

Demolition and Post Demolition Operations

- Demolition and Post Demolition Operations will be performed in accordance with the approved ESS.

General Demolition Practices

Personnel will adhere to the following standard safe practices and procedures when conducting demolition operations:

- Review electromagnetic radiation (EMR) hazards and precautions and electrical grounding procedures;
- Carry blasting caps in approved containers and keep them out of the direct rays of the sun;
- Do not handle, use, or remain near explosives during the approach or progress of an electrical storm. All persons will retire to a place of safety;
- Do not use explosives or accessory equipment that are deteriorated or damaged. They may detonate prematurely or fail completely;
- Do not abandon any explosives. Fatal or serious accidents can result from such careless practice;
- Do not use unexploded dud ordnance items for demolition purposes. They may be in an extremely sensitive and hazardous condition;
- Disposal operations will not be initiated until at least one-half hour after sunrise and will be concluded by at least one-half hour prior to sunset;
- Restrict and control access to the disposal site to a minimum of authorized personnel necessary for safe conduct of the disposal operations;
- Do not carry fire- or spark-producing devices into a disposal site except as specifically authorized;
- Do not smoke except in areas specifically designated. After smoking, assure that all burning tobacco is extinguished; and
- Avoid inhaling, and skin contact with explosives, the smoke, fumes, vapors of explosives, and related hazardous materials.

Handling Demolition Materials

When handling demolition materials, EOTI UXO Technicians will observe the following rules and safe practices:

- Do not strike, tamper with, or attempt to remove or investigate the contents of a blasting cap (electric or non-electric), detonator, or other explosive initiating device. A detonation may occur.
- Do not pull on the electrical lead wires of electric blasting caps, detonators or other electro-explosive devices. A detonation may occur.
- Do not attempt to remove an unfired or misfired primer or blasting cap from a coupling base. There is a high risk of an explosion.
- Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling. This will minimize injury should the item explode.
- Shaped charges - be certain there is no obstruction in the conical cavity or between the charge and the target, as any obstruction will materially reduce the penetration effect.
-

Preparation for Electric Firing

When preparing firing systems, EOTI will:

- Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.
- If using electric blasting caps, all caps will be of the same manufacture, for each demolition shot involving more than one cap.
- Keep blasting caps in approved containers, located at least 7.62 meters (25 feet) from other explosives, until needed for priming.
- Do not bury blasting caps. Use detonating cord to position blasting caps above the ground. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.

Electric Priming

- EOTI plans to use an RFD. EOTI plans to prime with electric detonators attached to the receiver unit(s). Depending upon availability, Non-El (shock tube) detonators may be used in place of electric detonators. Non-electric procedures are included at paragraph 3.7.11.33.

EOTI will prepare electric priming systems using the following techniques and procedures:

- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.
- Unroll the lead wires so that the cap is as far as possible from the operator and pointing away from him/her. Place the blasting cap under a sandbag or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.
- Use only the special silver-chloride dry cell battery in the testing galvanometer. Other types of dry cells may produce sufficient voltage to detonate blasting caps.
- Do not connect the power source to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charges.
- Do not hold the blasting cap directly in the hand when uncoiling the leads. Hold the wires approximately 152 millimeter (6 inches) from the cap. This will minimize injury should the cap

explode. The lead wires will be straightened by hand and not thrown, waved, or snapped to loosen the coils.

- Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts will ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the circuit firing unless the power ends of the circuit firing leads are shorted.
- Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- The UXO person in-charge will order the final priming of the shot.

Firing Demolition Charges

3.7.11.11 Keep the power end of the firing wire shunted until ready to connect the power source.

3.7.11.12 The signal for detonation will be given by the UXO person in-charge only after all personnel in the area have reached cover or a safe distance from the charge.

3.7.11.13 Prior to making connections to the power source, test the firing circuit for electrical continuity.

3.7.11.14 The UXO person in-charge will order the firing wires to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.

3.7.11.15 When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.

3.7.11.16 Do not complete the circuit at the power source (panel) or give the signal for detonation until directed to do so by the UXO person in-charge.

3.7.11.17 Do not attempt to fire a single electric blasting cap or a combination of electric blasting caps in a circuit with less than the minimum current required by the total circuit. Misfires can be expected where this occurs.

3.7.11.18 The UXO person in charge and a safety observer shall check the shot following the detonation.

3.7.11.19 The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting “blow-in-place” operations. Always check the “blow-hole” for secondary items and remove all MD.

3.7.11.20 Electro-Magnetic Radiation (EMR) Hazards. Prior to the application of detonation-in-place procedures, an EMR survey shall be conducted to determine if there are any transmitting antennas of radio, radar, or other electro-magnetic-generating devices located in the vicinity.

3.7.11.21 Radio Frequency (RF) EMR. RF EMR consists of waves of electrical energy. These waves are radiated in a line-of-site from the antennas of electronic devices that transmit radio, radar, television, or other communication, to include cellular telephones, or other communication or navigation radio frequency signals. Table 2-1 states the minimum safe distance from electro-explosive devices (EEDs) and the transmitting antenna of all RF emitters. Table 2-2 states the minimum safe distances, which will be maintained between Mobile RF transmitters and electric blasting operations. The factors to be considered when evaluating the degree of hazard that the EMR (RF) energy represents are:

- The strength of the field (its power);
- The frequencies transmitted;
- The distance from the transmitter antenna to the ordnance; and
- The amount or type of protection available.

Table 2 Minimum Safe Distance from Electro-explosive Devices (EEDs) and RF Transmitter Antenna Emitters

AVERAGE OR PEAK TRANSMITTER POWER IN WATTS	MINIMUM DISTANCE TO TRANSMITTER IN METERS/FEET
0 – 30	30 / 98.4
31 – 50	50 / 164.1
51 – 100	110 / 360
101 – 250	160 / 525
251 – 500	230 / 755
501 - 1,000	305 / 1,000
1,001 - 3,000	480 / 1,575
3,001 - 5,000	610 / 2,001
5,001 - 20,000	915 / 3.002
20,001 - 50,000	1,530 / 5,020
50,001 – 100,000	3.050 / 10,007
100,001 - 400,000	6,100 / 20,014
400,001 - 1,600,000	12,200 / 40,028
1,600,000 - 6,400,000	24,400 / 80,056

* When the transmission is a pulsed or pulsed continuous wave type and its pulse width is less than 10 microseconds, the power column indicates average power. For all other transmissions, including those with pulse widths greater than 10 microseconds, the power column indicates peak power.

Table 3 Minimum Safe Distances in Feet Between Mobile RF Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	MF to 3.4 MHz Industrial	HF 28 to 29.7 MHz Amateur	VHF 35 to 36 MHz 42 to 44 MHz 50 to 64 MHz	VHF 144 to 148 MHz 150.8 to 161.6 MHz	UHF 450 to 460 MHz Cellular Car Phones above 800 MHz
5[1]	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40

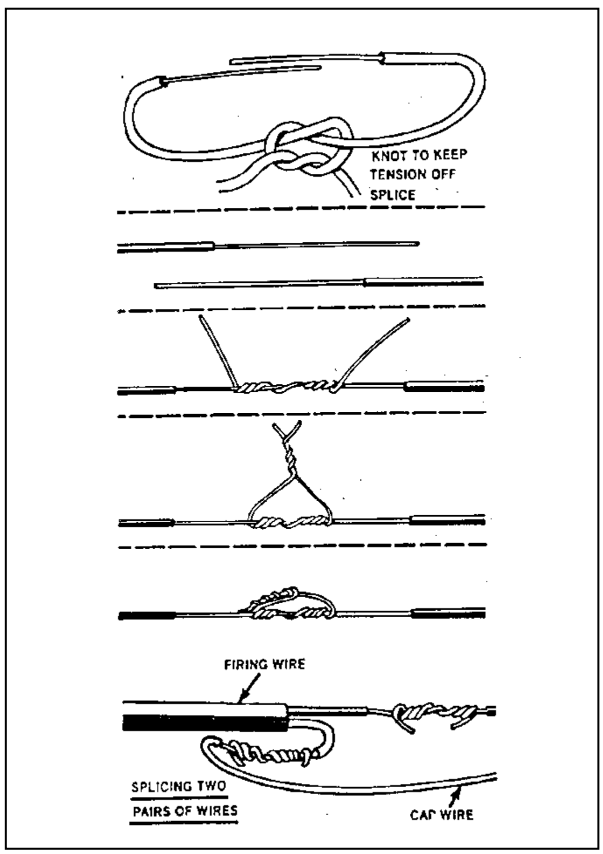
100	120	320	260	100	60
180[2]	170	430	350	130	80

[1] Citizens band radio (walkie-talkie) (26.96 to 27.41 MHz) - minimum safe distance -five feet. Double sideband - 4 watts maximum transmitter power - hand-held, 5 feet; vehicle mounted, 65 feet. Single sideband - 12 watts peak envelope power - handheld, 20 feet; vehicle mounted, 110 feet.
[2] Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed station units in UHF (450 to 460 MHz range).

3.7.11.22 Lightning, Electric Power Lines, and Static Electricity. Lightning is a hazard to both electric and non-electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap or other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during electrical storms and when one is impending. All blasting activities will be suspended when lightning-thunder storms are within ten miles of the project site.

3.7.11.23 Electrical firing will not be performed within 510 feet of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 510 feet to electric power lines, non-electric firing systems will be used or the power lines de-energized.

3.7.11.24 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by a great variety of causes; among them, dust storms, which have caused a large number of detonations; snow storms, less dangerous, but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.



Preparation of Demolition Shots

After determining and locating a safe location away from the charges, lay out the firing wire and prepare and place all explosive charges.

Test Firing Wire

3.7.11.25 If using the blasting galvanometer/M51 test set - check the galvanometer by holding a piece of metal across its terminals. If the battery is good, there should be a wide deflection of the needle. Check the M51 test set by holding a piece of wire across its terminals and depress handle - lamp should glow.

3.7.11.26 When using a Model "D" Blaster's Ohmmeter with the Lawrence Silver Chloride Dry Cell, a full needle indication is required. Frequently cells, which have been stored for long periods of time, will require re-activation. To obtain full-scale deflection of the meter needle, the meter contact posts should be shorted with a metal instrument such as a screwdriver or knife blade. Place the metal blade in full contact with both terminals simultaneously for a period of twenty seconds to one minute. This should activate the cell to full-scale deflection. If it does not, do not use the ohmmeter.

3.7.11.27 Separate firing wire connectors at both ends, and touch those at one end to galvanometer/test set posts. The needle should not move nor lamp glow. If either occurs, the firing wire has a short circuit.

3.7.11.28 Twist wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections. Note: Firing wire can be tested on the reel, but unnoticed broken wires could produce false readings. Firing wire must be tested after unreeling. Caution: Do not drag a firing cable over sand or other insulated surfaces as this can generate a static charge that will electrically fire blasting caps.

3.7.11.29 Twist free ends of firing wire together to prevent an electric charge from building up in the firing wire.

Test Blasting Caps

Complete the following steps in order to test the electric blasting caps:

- Test galvanometer/M51 test set as outlined above.
- Test electric-blasting caps for continuity at least 50 feet downwind from any explosives prior to connecting them to the firing circuit.
- Place the cap under a sandbag or other protective device in the event that the cap accidentally functions.
- Individual conducting this test will ground himself prior to removing the shunt.
- Remove short circuit shunt.
- Touch one cap lead wire to one post and the other cap lead wire to the other post. If the galvanometer's needle deflects slightly less than it did when instrument was tested, or the lamp glows, the blasting cap is satisfactory; if not the cap is defective. Destroy it on the detonation.

Note: If the battery is fresh, the galvanometer should read at least half scale when the instrument is tested and when a good blasting cap is tested.

Connecting the circuit.

Complete the following steps when connecting an electrical firing circuit:

- At the firing position, keep the free ends of the firing wire twisted together until ready to connect the blasting machine.
- Individual will ground himself prior to performing next step.
- Splice free cap lead wires to firing wire.
- Insert cap into charge.

Firing Procedures

Complete the following steps in order when firing the shot:

- Test the entire circuit. Move to the firing position and test the entire firing circuit with the galvanometer or test set as outlined above. If the firing circuit is defective, shunt wires; go down-range and recheck circuit. If the splice is found defective, re-splice wires. If cap is found defective, replace it.
- Twist free ends of firing wire together.
- Exercise the blasting machine. Test blasting machine by actuating it several times with nothing attached to the terminals.
- Connect blasting machine.
- Sound a warning (siren, horn, etc.) and loudly call out “Fire in the hole”! three times. (Specific procedures for warnings and notifications will conform to SOP for demolition operations at CRP)
- Activate blasting machine.

Electric Misfire

3.7.11.30 Prevention of electric misfires: In order to prevent misfires, insure that:

- All blasting caps are included in the firing circuit;
- All connections between blasting cap wires, connecting wires, and firing wires are properly made;
- Short circuits are avoided;
- Grounds are avoided; and
- Number of blasting caps in any circuit does not exceed rated capacity of power source on hand.

3.7.11.31 Causes of electric misfires. Common specific causes of electric misfires include:

- Inoperative or weak blasting machines or power source;
- Improperly operated blasting machine or power source;
- Defective and damaged connections, causing either a short circuit, a break in the circuit, or high resistance with resulting low current;
- Faulty blasting caps;
- The use in the same circuit of blasting caps made by different manufacturers or different design; and

- The use of more blasting caps than power source rating permits.

3.7.11.32 Clearing electric misfires. If charge is primed electrically, proceed as follows:

- Make three successive attempts to fire;
- If unsuccessful, remove firing wires from blasting machine and check continuity of firing circuit.
- If continuity is good, reattach firing wires to blasting machine and make 3 more attempts to fire charge;
- Check firing wire connections to terminals of the blasting machine and make 3 more attempts to fire charge;
- Change blasting machine after third unsuccessful attempt with original blasting machine.
- If still unsuccessful, disconnect blasting machine from firing wire ends and shunt firing wire by twisting firing wire ends together;
- Allow a minimum of 30 minutes to elapse from the last attempt to fire, before starting to investigate;
- Remove and disconnect old blasting caps and shunt wires; Connect wires of new blasting cap(s) to firing circuit and re-prime charge; and
- Reconnect firing wire ends to blasting machine and fire charge.

Non-electric Procedures

3.7.11.33 A nonelectric (shock tube) detonator firing system is designed to initiate demolition charges when a lightweight, low-initiating explosive weight, nonelectric, nonfragmenting, and waterproof initiating system is desired. These systems are made up of nonelectric detonators with pyrotechnic leads, pyrotechnic lead initiators, firing devices, and connectors. These systems provide control similar to electric initiating systems. The nonelectric detonators are not hazards of electromagnetic radiation to ordnance (HERO) or electrostatic sensitive. Unlike standard nonelectric blasting caps, no crimping or water sealing of the detonator or pyrotechnic lead is necessary and time fuze is not required in most applications. All handling procedures for donor explosives will be done as with electric firing systems.

- After determining and locating a safe location away from the charges prepare and place all explosive charges.
- The UXO person in charge will order the final priming of the shot.
- Make sure detonator is not pointed toward personnel or explosives.
- Unspool nonelectric detonator (with pyrotechnic lead) from demolition charge to required standoff.
- Insert or attach detonator to demolition charge.
- The UXO person in-charge will order the lead to be connected to the power source. He will maintain control over the activating device, while verifying that the area is clear of personnel, animals, and equipment, including aircraft.
- Attach lead to firing device (initiator or receiver) IAW the manufacturer’s instructions.
- When using a firing panel, lock the switch in the open position until ready to fire. The single key will be in the possession of the UXO person in-charge.
- Fire the shot using the initiating device IAW the manufacturer’s instructions.
- The UXO person in charge and a safety observer shall check the shot following the detonation.

- The team will search the area after each firing for any remaining explosive components and loose explosives. Scattered explosive material should be carefully gathered and destroyed by detonation with the next shot. If left in place, these items can create an additional explosive hazard. This search includes verifying that a secondary item is not present in the area after conducting "blow-in-place" operations. Always check the "blow-hole" for secondary items and remove all MD.
- In the event of a misfire, follow the RFD manufacturer's procedures in order:
  - Do not approach the shot until 30 minutes has elapsed.
  - Igniter tip may be worn or damaged. Try a new tip.
  - There may be water on the tip. Blow out the tip and test fire the tip without any tube installed.
  - Shock tube may be damaged or defective. Cut a one-foot section beginning approximately six inches from the igniter. Hold one end of the one-foot section over the palm of your hand and gently blow through the other end. If a fine powder is blown out of the tube, reattach the pyrotechnic lead to the igniter tip.
  - Replace the detonator assembly and shock tube and attempt the detonation again.

3.7.12 Material Potentially Presenting an Explosive Hazard (MPPEH)

3.7.12.1 A UXO Tech I can tentatively identify a located item as MPPEH, followed by a required confirmation by a UXO Tech II or Tech III.

3.7.12.2 A UXO Tech II will conduct a 100% inspection of each item as it is recovered and determine the following:

- Is the item a UXO, a DMM, munitions debris, or range related debris?
- Does the item contain explosive hazards or other dangerous fillers?
- Does the item require detonation?
- Does the item require demilitarization (demil) or venting to expose dangerous fillers?
- Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic, or radiological waste (HTRW) materials?

3.7.12.3 All munitions debris and range related debris will be picked up by UXO removal team during surface sweep and subsurface removal operations.

3.7.12.4 The munitions debris and range related debris will be placed into containers for collection while sweeping. When the containers are approaching full, they are transported to a predetermined location on the site.

3.7.12.5 All munitions debris and range related debris will be re-inspected by the UXO removal Team Leader (UXO Tech III) prior to transportation to the secured containers.

3.7.12.6 Items requiring demilitarization and/or venting will be segregated and processed in a timely manner and placed in securable containers.

3.7.12.7 The UXOSO/QCS will conduct daily audits of procedures for processing MPPEH and will conduct and document random checks of specific pieces.

3.7.12.8 SUXOS and UXOSO/QCS will ensure that Work Plan procedures, based on and in compliance with Chapter 14 of EM 1110-1-4009, are being followed and performed safely.

3.7.12.9 All final processed material will be placed in lockable containers, for security, before turning in for recycling. In accordance with Chapter 14 of EM 1110 dated 15 June 2007, and Errata Sheet No. 2, EOTI will dispose of all material determined by inspection not to contain an explosive hazard (munitions debris and range related debris) through an offsite recycling facility. EOTI will destroy material remaining as MPPEH after inspection.

3.7.12.10 Items that require demilitarization will be demilitarized in accordance with DoD 4160.21-M-1, Defense Demilitarization Manual. All MEC items will be investigated to insure that there are no explosives remaining in the items and that only inert filled or empty items are removed from the grid. Redundancy is built into the investigation process to assure no MEC items are removed from the site.

3.7.12.11 SUXOS will be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing MPPEH for final disposition as UXO, DMM, munitions debris or range-related debris.

3.7.13 Munitions Debris (MD) & Range Related Debris (RRD)

3.7.13.1 SUXOS will:

- Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all munitions debris and range-related debris to be transferred for final disposition.

- Perform random checks to satisfy that the munitions debris and range -related debris are free from explosive hazards necessary to complete the Form, DD 1348-1A.

- Certify all munitions debris and range-related debris as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials. No range related debris is expected on the CRP project.

- Be responsible for ensuring that inspected debris is secured in a closed, labeled, and sealed in a container and documented as follows;

    - The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification number that will start with USACE/Installation Name/Contractor's Name/0001/Seal's unique identification and continue sequentially.
    - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification information if it differs from the number on the container.
    - A documented description of the container will be provided by EOTI with the following information for each container: contents, weight of container, location

where munitions or range-related debris was obtained, name of contractor, names of certifying and verifying individuals, unique container identification, and seal identification. EOTI will also provide these documents within the Final Report.

3.7.14 Disposal Alternatives

If MPPEH is discovered that cannot be destroyed on-site, the SUXOS will coordinate with the USACE on-site Safety Specialist to determine an appropriate method of off-site disposal. The SUXOS will present possible courses of action and a recommendation to the EOTI Project Manager. The final method of off-site disposal will be approved by USACE.

3.8 Geospatial Information and Electronic Submittal

The GIS Plan is described in Section 3.6 of this WP.

3.9 Investigative Derived Waste Plan

Investigative Derived Waste is not applicable to this project.

3.10 Risk Characterization and Analysis

Risk Characterization and Analysis is not a part of this project per the PWS.

3.11 Analysis of Land Use Controls

Land Use Controls are not associated with this project.

3.12 Preparation of the Five-Year Review Plan

A Five-Year Review is not a part of this project.

4.0 CHAPTER 4 – QUALITY CONTROL PLAN

4.1 QUALITY CONTROL OBJECTIVES

This section presents the project QC Plan as required by the PWS. The QC procedures described in this section will be used for all work performed during this MEC Removal Project. This site-specific QC plan is designed to manage, control, and document performance of work efforts and to ensure quality throughout the execution of all tasks. This QC Plan will achieve the following objectives:

- Identify QC procedures and responsibilities.
- Document the quality of work efforts via audits and independent staff reviews of deliverables.
- Ensure data integrity through implementation of data management QC procedures.
- Ensure the development of an appropriate accountability and appropriate data collection.

4.2 QUALITY POLICIES

4.2.1 All services provided will be consistent with and will meet the requirements of all applicable laws and regulations.

4.2.2 Quality Management will be applied throughout all phases of the project – from the time of the task order award, until the SSFR is accepted.

4.2.3 Emphasis will be placed on preventive actions that minimize quality failures or defects.

4.2.4 All EOTI employees and team members are empowered to identify and evaluate potential quality problem areas and are encouraged to recommend solutions or corrective actions.

4.2.5 EOTI will staff all project sites with the best qualified, trained, available personnel, based upon their knowledge and prior experience with the type of operations and hazards expected to be encountered. The minimum qualifications will meet or exceed the customer's requirements.

4.2.6 All EOTI personnel will be provided with all of the information necessary to accomplish their assigned tasks in a safe, responsible, cost-efficient manner and they will be held accountable for the quality of their work.

4.2.7 The project team will be provided with a copy of the final approved Work Plan / SSHP prior to the performance of any MEC-related activities on a project site.

4.2.8 EOTI will take corrective actions on any complaint, quality defect, or negative result from an audit of operations.

4.3 DEFINITIONS

- Removal Standard - a specified size of MEC to a specified depth. The removal standard for this project is: No findings on the surface of the munitions response site of MEC or MPPEH regardless of size excluding small arms ammunition, and no munitions debris equivalent to, or greater than 3.55 in (6 lbs shell) in diameter or width with a thickness (length) of 3.55 in or greater; and finding within the subsurface of the munitions response site no ferrous metal items (including, but not limited to MEC and MPPEH) equivalent to, or greater than 3.55 in in diameter or width with a thickness (length) of 3.55 in (6 lbs shell) or greater to a depth the lesser of 11 times the item diameter (or width).

- Customer/Client - refer to the term "Purchaser" for the contract.
- Nonconformance:
  - A minor nonconformance is not likely to materially reduce the usability of the services. It is generally a departure from the approved procedures that have little bearing on the end product.
  - A major nonconformance is likely to result in failure of the services or to materially reduce the usability of the end product.
  - A critical nonconformance is likely to result in hazardous or unsafe conditions for individuals using or depending upon the services.
- Purchaser: The term purchaser shall refer to the non-government body administering the particular contract involved, or the authorized representative of that body.
- Quality Conformance Inspection (QCI): Normal inspections/audits conducted by authorized EOTI personnel during the accomplishment of the organization's mission to determine conformance to contract requirements.
- QC: The process by which EOTI manages, controls, and documents its activities in the accomplishment of the mission.
- Quality Defect: A nonconformance issue with published policy and/or a contractual requirement that requires corrective action(s).
- Quality Management: All those control and assurance activities instituted to safely and effectively accomplish the assigned mission.
- Root Cause: The basic reason for an undesirable condition or problem if eliminated or corrected, would have prevented it from existing or occurring.
- Stop-Work-Authority: The right and obligation to stop all work when serious quality or safety concerns arise.
- Surface Removal: Locating and removing UXO items that are visible on the surface, or partially visible. This includes items that are partially exposed, which will require only minimal hand excavation to determine identification.
- Characterize: Locating, identifying, and characterizing metallic objects that caused a geophysical response.

4.4 QC RESPONSIBILITY

EOTI is solely responsible for the control of product quality. Only those products/services that conform to contractual requirements will be offered to Apex for acceptance.

4.5 CONTRACT SUBMITTALS

All contract submittals will be prepared by qualified personnel in accordance with the PWS and contract requirements. All documents undergo a peer review in which they will be reviewed by an equally qualified person familiar with the project and submittal requirements.

4.6 QUALITY MANAGEMENT

4.6.1 The Project Manager has the responsibility of ensuring that QC procedures are implemented in accordance with the work plan and applicable documents identified within it.

4.6.2 The QA/QC Manager will provide the Quality Management oversight for the project. The QA/QC Manager is a part of the project team, but is authorized to elevate any quality problems that cannot be resolved by the project team. The QA/QC Manager interacts with the Project Manager, SUXOS, UXOQCS, subcontractor QC staff, as appropriate, and Project Manager to prevent and/or correct problem situations, as necessary. Vendors and subcontractors will be monitored to assure that they supply items and services, which meet quality requirements. Periodic audits will be performed to verify that the quality system and the UXOQCS are performing as required. He also ensures that:

- Required site training is conducted prior to the start of field activities.
- The UXOQC Specialist is qualified and trained.
- QC is built into the Project Work Plan to support the MEC removal action.
- The requirements of the QC Plan are adhered to.

4.6.3 Effective day-to-day field QC management is delegated to the on-site EOTI UXOQCS. He will interact daily with the project team to ensure that all QC procedures presented in the Project Work Plan are followed in the accomplishment of all project tasks. The UXOQCS reports directly to the QA/QC Manager. Scheduled activities are coordinated with the Project Manager, SUXOS, UXOSO, and all other project team members as needed. He has the authority to:

- Initiate action to prevent the occurrence of nonconformance’s relating to the provided services.
- Identify and record any problems relating to the services.
- Initiate, recommend or provide solutions through the on-site management channel.
- Verify the implementation of solutions.
- Control further actions of any nonconforming services until the unsatisfactory conditions have been corrected.
- Elevate Quality concerns, which cannot be resolved on-site to the Quality Manager.

4.6.4 All project team members are responsible for and will be held accountable for the quality of their work. Every team member has Stop-Work-Authority when an immediate safety situation is observed which could cause personal injury or damage to property and equipment. All project team members are encouraged to identify potential quality problems and are encouraged to suggest solutions or corrective actions to ensure all work conforms to the approved Work Plan and QA requirements. During site-specific training, personnel will be briefed by the QA/QC Manager or the UXOQCS, on the importance of quality work and the above stated requirements. This briefing is aimed at insuring that all site personnel understand EOTI’s dedication to quality.

4.7 QC PLAN PROCESSES

This section documents the processes affecting quality. These are essential steps to ensure a quality product is delivered to the Government.

4.7.1 *Specific Procedures*

Described below are the specific procedure that will be used to assure quality in this PWS regarding; Audits, Corrective/Preventive Action, Data Management, Field Operations, Equipment Calibration and Maintenance, and Personnel Protective Equipment.

4.7.2 *Scheduled Audits*

Periodic audits will be performed by the QA/QC Manager to ensure that the requirements of this Quality Plan are being followed. This may include on-site visits as well as frequent document review activities. Training records, periodic reports, and adherence to all aspects of this QC Plan will be monitored to assure compliance.

4.7.3 *Daily QC Audits*

All instruments, vehicles/machinery, and equipment will be checked prior to the start of each workday and periodically throughout the day batteries will be replaced as needed, and instruments requiring calibration will be checked against a known source. Hand held magnetometers / metal detectors will be checked on a test plot. Daily checks will be conducted by each instrument operator using his assigned instrument on the test plot. The instruments will be tested against a known source to verify that it responds appropriately. Once the instrument is determined to functioning properly, the operator will conduct a sweep of the test strip, using the methods and techniques applied in the field. The UXO Team leader and UXOQCS will observe each team member to ensure that he uses proper techniques and can properly locate seed items in the test plot. If the operator displays improper techniques or is unable to accurately and consistently locate seed items, the team leader will conduct refresher training and the instrument operator will then demonstrate his proficiency on the test plot before moving to the designated clearance area. If it is determined that the operator's technique is proper but that the instrument is the cause of his failure to locate seed items, he will be given a different instrument and will repeat the test. Equipment determined to be defective will be tagged and removed from operation. The test strip simulates site conditions. It will be placed in a location free of geophysical anomalies that may interfere with the tests or affect the results. Figure 6 shows the conceptual layout of the test strip and Table 4 includes seed item placement details. The UXOQCS is responsible for ensuring that personnel accomplish all QC checks and that the appropriate logbook entries are made. The UXOQCS performs random, unscheduled QCI to ensure that personnel accomplish all work specified in the Project Work Plan. The QCI Schedule will adhere to the following Table 5. The UXOQCS has the latitude to modify this schedule based on the quality of work being performed and the frequency of noted activities.

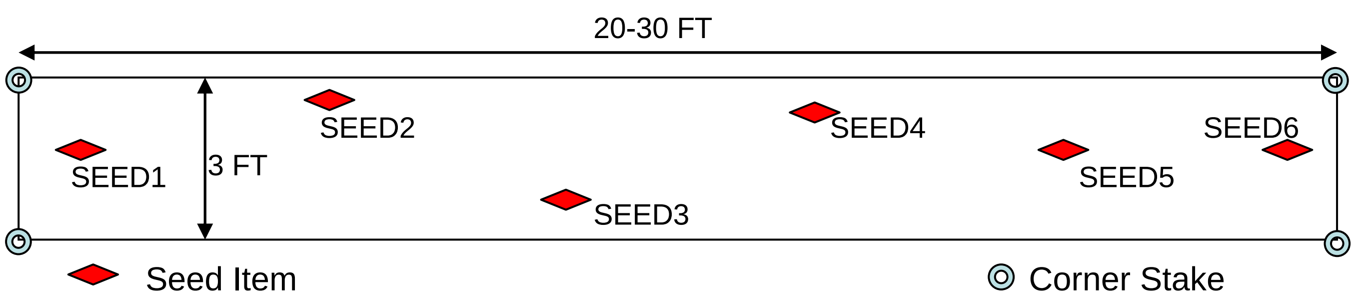


Figure 6 Test Strip Conceptual Layout

Table 4 Test Strip Seed Item Description

Test Strip Seed Item Description			
Seed Item ID	Description	Depth [in]	Notes
SEED1	10 lb Shell	34	Oriented approximately 45° from horizontal and parallel to the major axis of the test strip

SEED2	6 lb Shell	28	Oriented approximately 90^{o} from horizontal and parallel to the major axis of the test strip
SEED3	10 lb Shell	46	Oriented approximately horizontal and approximately perpendicular to the major axis of the test strip
SEED4	6 lb Shell	39	Oriented approximately 45^{o} from horizontal and parallel to the major axis of the test strip
SEED5	8 lb Shell	31	Oriented approximately 45^{o} from horizontal and perpendicular to the major axis of the test strip
SEED6	8 lb Shell	43	Oriented approximately 45^{o} from horizontal and perpendicular to the major axis of the test strip

Note: Seed items may be inert items or simulants with similar dimensions. At least two items will be blind seed items that are periodically moved by the UXOQCS.

Table 5 Frequency of QC/QA Inspections and Checks

TASK	100%	DAILY	WEEKLY	BI-WEEKLY	AS NEEDED
Personnel Qualifications	✓				
Test Plot Proficiency		✓			✓
Accident/Incident Reporting	✓				
Search Effectiveness					✓
Turn-in of Recovered Munitions Debris	✓				
Preventive Maintenance		✓			
Communications Equipment Inspection		✓			
Safety Inspections		✓	✓		
Medical Support		✓			
Communications Effectiveness		✓			
Explosives Accountability					✓
Excavation Activities	✓				
MEC Final Disposal			✓		
MEC Accountability			✓		
Fire Protection – Prevention			✓		
Project Administration			✓		
Safety and Health Programs				✓	
Visitor Briefing					✓
Site – Specific Training					✓
Hazard Assessment – Risk Analysis					✓

4.8 QUALITY ASSURANCE / QUALITY CONTROL STANDARDS

4.8.1 *Surface Removal*

Every area designated for surface removal will undergo a Search Effectiveness Quality Control Inspection (SE QCI) involving approximately 10% of the square footage. The exact location of this square footage is at the discretion of the UXOQCS. The UXOQCS will also verify that the anomalies removed from the surface are accounted for separately, properly, and weighed accurately. The UXOQCS will place seed items, as described in this Section, to verify the effectiveness of the removal.

4.8.2 *Subsurface Removal*

The UXOQCS will perform a UXO QCI on at least 10% of each area excavated by the removal team. Additionally, seed items will be used, as described in Section 4.8.3, to ensure the removal effectiveness. The UXO QCI will be performed using one of the following two methods, or a combination of the two methods.

- As available, a UXOQCS will monitor UXO Removal Teams while they acquire and excavate anomalies. He will observe the team's procedures to ensure quality standards are met.
- Following excavation, the UXOQCS will check the location using the same detection technology to ensure the team has removed all anomalies.

4.8.3 *QC Performance Requirements*

The Quality Control requirements of this project are provided in Table 4. The surface of all indicated removal areas will be cleared, in accordance with DID WERS-004.01.

Table 6 Performance Requirements Matrix

Performance Requirements Matrix				
Requirement	**Applicability**	**Performance Standard**	**Frequency**	**Consequence of Failure**
Repeatability	All operators with assigned equipment	All items in the test strip detected (trains ear to items of interest).	At least daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks for the day and will be re-tested again the next working day.
Coverage	Site	100% of the area swept and anomalies removed / No MEC of any size and no RD/MD items ≥ 3.55 in (6lb shell) diameter or width. All seed items are recovered.	At least 1-2 blind seed items per operator per lot	Redo lot
Detection and Recovery	Each Sector	All MEC/MPPEH and MD/RD greater than 3.55 (6 lb) in or width removed from the surface/subsurface. All seed items are located and recovered.	At least 1-2 blind seed items per operator per lot. 10% of the area checked by UXOQCS	Redo lot
Geodetic Equipment Functionality	All	Geodetic Repeatability-Check against a known position set by a surveyor / position located within 1 foot	At least Daily	Replace defective equipment / remedial training. Operators that fail the retest will be assigned to other tasks and will not operate geodetic equipment, until proficiency is demonstrated.
Recheck of Excavations	All	After excavation the UXOQCS will recheck the voids to determine that no magnetic signature exists.	All excavated voids will be rechecked by UXOQCS	Failure to verify that the void is free of magnetic signatures will result in further excavation and repeat of this operation after source of magnetic signature is indentified.

The UXOQCS will use blind seed items in the test plots and in the removal areas to ensure the effectiveness and completeness of the removal action. The UXOQCS will place two or three (2-3) inert MD items or surrogates (similar to those used to seed the test strip) in area to verify detection proficiency. The UXOQCS will record the location and depth of the seed items using GPS (location) and tape measure (depth) and will document the failure of any operator to accurately locate them. The location, depth, and number of items will be varied each week, when conducting intrusive operations. Additionally, the UXOQCS will place seed items on the surface and in the subsurface of the removal area. The detection seeds will also serve as coverage seeds for QC purposes. The seed items may be metallic covers for electrical junction boxes or other suitable surrogate item, painted and identified with a unique number. A lot is defined as the portion of the area assigned to the team to clear. The lots may be irregular shaped and may vary in size, depending on the shape of the removal area, but will generally be approximately one acre. The UXOQCS will record the location (grid/clearance area) of each seed item and will verify that all are located prior to the final clearance of area. Failure to recover the seed items will result in a QC failure condition that will require re-clearing of the lot. All QC logs, reports, and other QC related documentation will be maintained in MS word and MS Excel formats and available to the client PM, EOTI PM, and SUXOS.

4.9 QC FILES

4.9.1 The following two files will be established and maintained by the UXOQCS.

- QCI Record File
- Corrective Action Request (CAR) File

4.9.2 The QCI Record File will be a two-part file, containing Active and Inactive Sub-files.

4.9.3 The Inactive Sub-file will contain the Quality Conformance Inspection Record (QCIR) for tasks that were found to be in compliance with the Work Plan and those that were not in compliance, but have been re-inspected and are subsequently corrected.

4.9.4 The Active Sub-file will contain those QCIR for tasks that were found to be not in compliance with the Work Plan and have not yet been corrected.

4.9.5 The CAR File will be a two-part file containing an Active Sub-file and an Inactive Sub-file. A CAR will be maintained in the Active File until follow-up has been conducted and deemed satisfactory. Once the follow-up is completed, the CAR will be placed in the Inactive File.

4.10 CORRECTIVE/PREVENTATIVE ACTION

4.10.1 Nonconformance will be documented on a QCIR. The QCIR will document the reason for the nonconformance and describe the corrective actions taken to resolve the problem and the actions taken to prevent reoccurrence. QCI are generally intended to be preventative, rather than corrective in nature. Through preventative QCI, continuous improvement of site operations will occur.

4.10.2 The QCIR may be handwritten in ink when computer access is limited, but when practical they will be prepared electronically in Microsoft Word format.

4.10.3 A QCIR may be completed for tasks when they are in conformance with the Work Plan. QCIRs for conforming tasks will not generally be distributed off the project site.

4.10.4 A QCIR will be completed for tasks when they do not conform to the Work Plan. Nonconformance QCIRs will be forwarded by facsimile or email to the Project Manager and the QA/QC Manager.

4.10.5 A QCIR will be completed for re-inspection of nonconformance. If the re-inspection indicates that the nonconformance has been corrected, both QCIRs will be filed in the Inactive Sub-file and a copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager. If the re-inspection indicates the nonconformance has NOT been corrected, both QCIRs will be filed in the Active Sub-file. A copy of the re-inspection QCIR will be forwarded to the Project Manager and the QA/QC Manager.

4.10.6 Nonconformance will be evaluated and corrective action implemented by on-site management whenever possible. The Project Manager and QA/QC Manager will track all non-conformances to assure that they have been resolved, actions to prevent re-occurrence have been implemented and that lessons learned are communicated effectively.

4.11 CUSTOMER COMPLAINTS

4.11.1 Customer complaints will be addressed immediately. The complaint may come in the form of a verbal comment or written correspondence. Whatever the vehicle, the Project Manager will conduct an investigation to analyze the complaint and assure corrective action has been initiated. The corrective action will address not only the root cause but also the application of controls to assure its effectiveness.

4.11.2 The Project Manager will document the complaint or nonconformance and the investigation. He will look for the root cause.

4.11.3 Lessons Learned will be documented on the CAR and communicated to Project personnel and the QA/QC Manager.

4.11.4 The action on the CAR is not complete until the UXOQCS and/or SUXOS have completed follow-up. The corrective/preventative actions have to be adequate to prevent reoccurrence and the customer must be satisfied with these actions.

4.11.5 The issue addressed in the CAR will be an item for a future QCI to ensure that the corrective/preventive actions have in fact addressed the issue and the solution was effective.

4.12 DOCUMENT CONTROL AND DATA MANAGEMENT

Rigid control must be maintained over the production of QC documents. The following guidelines will apply to all documentation generated by QC staff.

4.12.1 *Document Completion*

4.12.1.1 All sections of forms will be completed. Any unused spaces will be marked not applicable (N/A). In long columns of empty lines, N/A may be written in the first and last lines of that column with a single line connecting the entries. Large areas of unused spaces may be designated N/A by drawing a single line through the unused areas with the letters N and A on either side of that line.

4.12.1.2 Time and date formats: To eliminate misunderstanding, the following formats will be used on all official reports and correspondence:

- Time: 24-hour (Examples: 0730H, 1930H)
- Date: MM/DD/YY (Examples: 10/05/12, 11/15/12)

4.12.1.3 All signatures will be accompanied by the date the signature was made, either in a date block or with the date written following the signature.

4.12.1.4 White opaque correction fluids/tape may not be applied to records to correct mistakes.

4.12.1.5 Incorrect entries shall be drawn through with a single line with the initials of the author and the date of the correction immediately adjacent. Corrected entries will be placed above or immediately following the line through or otherwise entered on the document in a legible, understandable means.

4.12.1.6 Any entries or corrections to a document, other than in document control blocks, made after its date of inception, shall be considered a "late entry". Late entries will be clearly designated with the capital letters "LE", the initials of the person making the late entry, and the date the late entry is made.

4.12.1.7 Official original documents will be distinctly marked, as such.

4.13 DATA MANAGEMENT

4.13.1 Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically and data will not be stored only on one single media. Floppy disks, Zip disks, CDs or other means of storage will be used in addition to standard computer hard drives to assure data is not lost by the failure of any one device. Since conventional Document Control Practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records.

4.13.2 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and shall appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that documents registration number.

4.13.3 Changes, additions, late entries and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

4.13.4 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

4.13.5 Any document that is revised after any required distribution either off-site or to any electronic or hard copy file will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

4.13.6 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words "signature on file" shall be entered on the electronic copy, in the signature space, of all documents requiring signatures. The signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed and filed.

4.13.7 Logs maintained electronically may be updated as required for daily activities without going through the above revision process. Each day's log, however; will be saved electronically with the date included in the file name. Previous day's logs will not be deleted from the database and will serve as additional back up should the current days log be damaged or lost.

4.14 PHOTOGRAPHIC RECORDS

Photographs will be generated to document significant site activities, MPPEH, andMEC. Photographic records will be used to supplement information recorded in the daily logs, to include photographs of equipment prior to use, and the condition of the site prior to any activity. Photographs will clearly show the task being accomplished and provide for a visual record of the operations. Operations will not be staged. Selected representative photographs will be included in the SSFR and all photos will be provided on digital media accompanying the SSFR.

4.15 LOGS AND REPORTS

Field activity logbooks will be maintained in ink. All personnel will use bound and numbered field logbooks with consecutively numbered pages. These logbooks are QA records and will be completed in accordance with this section of this QC Plan. These activity logbooks will become part of the SSFR; thus, it is imperative that they be completed clearly and legibly. Appropriate documentation will be maintained regarding the location and disposition of all MEC and munitions, range-related and clutter. Locations will be documented on a site map and entered in the Ordnance Accountability Log. Daily and Weekly Summary Reports will be prepared by the UXOQCS and forwarded via facsimile or email to the Project Manager on a timely basis.

4.16 DAILY ACTIVITY LOG

Daily Activity Logs will be maintained and will include the following:

- Date and recorder of field information.
- Start and end time of work activities including lunch and down time.
- Visitors.
- Weather conditions.
- Important telephone calls.
- Any deviations from planned activities.
- Equipment checks and calibrations.
- Equipment monitoring results, if applicable.
- QCI Performed.
- Nonconforming conditions.
- Lessons Learned.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.17 SAFETY LOG

Safety Logs will include the following:
- Date and recorder of log.
- Significant site events relating to safety.
- Accidents.
- Stop Work due to safety concerns.
- Lessons Learned.
- Safety Audits.
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.18 TRAINING LOG

Training will be documented in the Training Log as follows:
- Date and recorder of log.
- Nature of training.
- Tailgate safety briefings (including time conducted, person conducting the briefing and attendees).
- Visitor Training (including names of visitors, description of training, and person performing training).
- Signatures of the SUXOS and UXOQCS indicating concurrence.

4.19 MEC IDENTIFICATION AND REPORTING

4.19.1 At least two UXO qualified personnel must be in agreement on the condition of a suspected MEC item before any removal action is attempted. All available data sources will be consulted prior to this determination.

4.19.2 As UXO/MPPEH is located it will be documented on the MEC Accountability Log (Appendix F). A detailed accounting of all MEC items encountered during the removal action will be maintained. This accounting will include:

- Identification Number (a unique ID #).
- Location.
- Nomenclature.
- Fuse Description.
- Fuse Condition.
- Additional comments, if required.

4.19.3 Each suspect UXO/MPPEH item encountered will be identified using a unique numerical identifier, such as A5–0001 (for first suspect item (0001) encountered in grid/area A5).

4.19.4 Photographs of suspect MEC items will be taken for documentation purposes. A ruler or some similar item, to show scale, will be placed adjacent to the item. The photographer needs to remember these photographs will be utilized in the SSFR; thus, a focused, well thought out photograph is necessary.

4.19.5 MEC identification data will be entered into an electronic MEC Accountability Log daily. Terminology and definitions used when completing the MEC Accountability Log will be consistent with those given in the 21 April 2005 Memorandum from the Office of the assistant

Secretary, Installation and Environment; Subject: Munitions Response Terminology. The UXOQCS will review this data to ensure accuracy and consistency in reporting. This review will include a comparison of photographs with recorded data. Any conflict or discrepancy will be discussed and resolved with the Team Leader. Signatures of the SUXOS and UXOQCS on the MEC Accountability Log indicate concurrence of the reported data.

4.20 LESSONS LEARNED

Lessons learned from day to day activities are an important part of the continuous improvement process. They can prove vital to prevent similar problems from occurring at other sites. Lessons learned from daily activities and from the occurrence of nonconforming conditions will be documented by the UXOQCS and UXOSO, as appropriate. Lessons learned as a result of nonconforming conditions are captured and documented on the QCIR as a result of its investigation and disposition. Other Lessons learned, from both positive and negative events will be documented in the Daily Activity Log and/or Safety Log. These items will be included in the SSFR. The QA/QC Manager will maintain a database of lessons learned for communication to other sites and for incorporation into training requirements.

4.21 TRAINING

4.21.1 The Project Manager will verify that all project personnel have completed the following training prior to their assignment:

- U.S. Naval Explosive Ordnance Disposal (EOD), Indian Head, Maryland / Eglin AFB, FL or EOD Assistance Course, Redstone Arsenal, AL / Eglin AFB, FL or other formal course of instruction meeting the requirements in DDESB TP 18 appropriate to the level of employment.
- OSHA 40 Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) in accordance with 29CFR1910.120 and 8 hour refreshers as need.
- UXOSO will have OSHA 30-hour Safety Course.
- Site Specific Training on this Work Plan and additional training, as needed, will be performed and documented on a QCIR, which will be forwarded to the Project Manager for review.
- Safety Meetings will also be documented.
- The UXOQCS will ensure that all personnel using geophysical detection equipment are properly trained to use that piece of equipment. This may include verification of past experience as well as on-site training on using specific equipment in site-specific conditions, which will be documented on a QCIR and forwarded to the Project Manager.
- If sweep personnel are employed they will receive site specific training related to the task that they will perform.

4.21.2 The UXOQCS will conduct, as necessary, site-specific training and/or review of known MEC to ensure that all site personnel are thoroughly familiar with the hazards and the general safety precautions and procedures required. All personnel and site visitors will also receive site-specific training and safety briefings, as required, to ensure safety on the project. Visitors must be briefed on all of the known or anticipated hazards of the site, required PPE to be worn while on the site, and site emergency procedures. Visitors will be escorted by a UXO qualified person whenever they enter the exclusion zone and all UXO operations will cease whenever a visitor is within the exclusion zone.

4.22 CHEMICAL QUALITY DATA MANAGEMENT (CQDM)

No Hazardous, Toxic and Radiological Waste (HTRW) or CWM is expected at this site per the PWS, therefore a CQDM sub-plan is not applicable.

4.23 QC DOCUMENTATION SUBMITTAL

All QC documentation required by this Work Plan will be submitted as part of or as supporting documentation for the SSFR.

4.24 QC RECORD RETENTION

All original QC Records and documentation will be maintained on-site and made available for government inspection upon request

5.0 CHAPTER 5 EXPLOSIVE MANAGEMENT PLAN

5.1 General

This plan details the management of explosives that may be required for the destruction or venting of MEC, suspected MEC, or inert UXO/MPPEH items at CRP. This plan was developed utilizing the guidelines specified in Federal Acquisition Regulation (FAR) 45.5, local and state laws and regulations, Alcohol Tobacco and Firearms Publication (ATFP) 5400.7, DA Pamphlet 385-64 and DOT regulations. Explosives used in the performance of this Task Order will be obtained by EOTI from commercial sources. These materials will be obtained and used for the specific purpose of disposal of MEC and explosive venting of inert MEC items, if required, located during the MPPEH Removal activities at the CRP site. An RFD will be used with an electrical detonator system. A shock tube (pyrotechnic lead) initiator may be substituted for the electrical detonator depending upon availability from the supplier. Explosives will be delivered to the site in the quantities required on the day of planned demolition operations. All explosives delivered to the site will be consumed in the demolition operations on the same day they are delivered.

5.2 Licenses/permits

EOTI will maintain on site and, upon request, make available to any local, state, or federal authority a copy of all licenses/permits required authorizing EOTI to purchase, store, transport, or use explosives. If no other licenses or permits are required by the state, EOTI will maintain a copy of its Federal ATF license on-site.

5.3 Description and Quantities

Explosive materials used during the performance of the work on this project will be obtained from commercial sources. These explosive materials will be for the specific purpose of disposal of suspect UXO/MPPEH and explosive venting of inert items, if required, located during the removal action. A remote firing device with an electrical or nonelectrical (shock tube) firing system will be utilized. If a remote firing device is not available, a hard-wired electrical firing system may be used. Donor explosive materials will be delivered to the site and will be consumed in the demolition operations on the same day they are delivered.

Materials to be delivered to the site will include:

- 10 each Electric Blasting Caps (1.4B) or
- 10 each Nonelectric initiators (1.4B)
- 100 each Shaped Charge perforators, 32 gram (1.1.D)
- 1000 feet Detonation Cord, (1.1D) 50 each Cast Booster 1/2 lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed. Quantities may also vary due to minimum order quantities requirements (generally case lots).

Quantities of explosive materials required to conduct the day's operation will be ordered from the vendor, as required, and delivered to the site on the day they are required. MEC will be marked and guarded, if necessary (e.g. accessible to the public), until disposal is accomplished. EOTI estimates 2 ea. electric blasting caps (1.4B); and 2 ea. 32-gram perforators (1.1D) and/or 2 ea ½- pound cast booster

(1.1D) will be used during disposal or venting operations for a single item and detonation cord (1.1D) will be used to link perforators and/or cast boosters if multiple items are disposed of in a single demolition shot. Depending upon availability, shock tube (Non El) detonators may be used in place of electric detonators.

5.4 Acquisition Source

EOTI will obtain donor explosives from regional explosives vender or other licensed supplier, who agrees to supply and deliver the necessary quantities of demolition explosives.

5.5 List of Explosive Materials

As stated above, explosives that are expected to be used are:

- Electric Blasting Caps (1.4B) or
- Nonelectric initiators (1.4B)
- Shaped Charge perforators, 32 gram (1.1.D)
- Detonation Cord, (1.1D)
- Cast Booster ¾ lb. (1.1D)

Depending upon availability from the suppliers, other sizes of boosters and/or perforators may be used. In any case, material to be used for donor explosives will be suitable for the items to be destroyed.

5.6 Initial Receipt Procedures

5.6.1 Upon receipt of donor materials from licensed explosive suppliers, an inventory will be conducted to ascertain:

- correct type
- serviceable condition
- correct quantity

5.6.2 A copy of the invoice(s) for the incoming donor materials will be kept in the on-site donor materials accountability file.

5.6.3 Upon receipt, a separate EOTI Memorandum will be prepared, with the following information, and retained on-site:

- Date of acquisition
- Name or brand name of manufacturer
- Manufacturer's marks of identification
- Quantity
- Description
- Name, address, and license number of the persons from whom the explosive materials are received

5.7 Procedures for Variances between quantities shipped and quantities received.

If any discrepancies of any kind should be found during the initial receipt inventory and inspection, the following procedures will be followed:

- If during the initial receipt inventory a discrepancy is found between the quantity listed on the invoice and the quantity being delivered, the quantity received will be annotated on the invoice and on the memorandum.
- The SUXOS will notify the supplier of the discrepancy before the explosives are accepted from the supplier's representative.
- The Project Manager will be notified telephonically, with a copy of the memorandum and a copy of the invoice being faxed as soon as possible.

5.8 Establishment of explosive storage facility

~~5.8.1~~ Donor explosives will be stored in a on-site type 2 ATF&E explosives magazine. Should a magazine not be used, explosives will be provided by a local vendor on an as-needed basis. MEC will be marked and guarded until disposal is accomplished.~~EOTI will not establish a storage facility for donor explosives at CRP. Donor explosive materials required for destruction or venting of MPPEH will be ordered from commercial suppliers and delivered to the site when needed for demolition operations. All donor explosive materials received will be used the same day or returned to the supplier.~~

~~5.8.2~~5.8.1 MPPEH will not be stored. When discovered it will be inspected to determine if it is acceptable to move. If possible it will be consolidated for onsite detonation. If it is determined to be unacceptable to move, it will be blown in place. MPPEH will be guarded, as necessary to ensure the protection of the public (e.g. accessible to the public), until demolition operations are completed.

5.9 Physical security of explosive storage facility

5.9.1 Donor explosives will be stored in a on-site type 2 ATF&E explosives magazine. Should a magazine not be used, explosives will be provided by a local vendor on an as-needed basis. MEC will be marked and guarded until disposal is accomplished.~~EOTI does not plan to establish an explosives storage facility for this project. Explosives for disposal of MEC will be provided and delivered by a local vendor and delivered on an as-needed basis. While donor explosives are on site, EOTI will comply with all applicable regulations and requirements of ATF regulations, and USAESCH requirements for security of explosives.~~

5.10 Transportation

When transporting donor explosives within the project site to the disposal location:

- Vehicles carrying explosives should be inspected and have a Motor Vehicle Inspection DD Form 626 completed.
- Vehicles used for transportation of explosive materials will not be loaded beyond their rated capacity and the explosive materials will be secured to prevent shifting of load or dislodgment from the vehicle; when explosive materials are transported by a vehicle with an open body, a magazine or closed container shall be securely mounted on the bed to contain the cargo.
- All vehicles transporting explosive materials shall display all placards, lettering, and/or numbering required by DOT and will have two each 10BC fire extinguishers on board.
- Explosive materials and blasting supplies shall not be transported with other materials or cargos. Blasting caps (including electric) shall not be transported in the vehicle or conveyance with other

explosives unless the conditions of 49 CFR 177.835(g) are met (i.e., an IME-22 Container is used to transport the blasting caps).

- All vehicles used for transportation of explosive materials will be in the charge of and operated by a person who is physically fit, careful, reliable, able to read and understand safety instructions, and not under the influence of intoxicants or narcotics.
- Only the authorized driver and his or her helper will be permitted to ride on any conveyance transporting explosive materials or detonators.
- Explosives will not be exposed to sparking metal during transportation of materials and all electric wiring will be completely protected and securely fastened to prevent short circuits.
- Vehicles used to haul explosives will be properly inspected and an “Explosives Motor Vehicle Inspection Checklist” completed and kept on file.
- Vehicles transporting explosive materials will be operated with extreme care; full stops will be made at approaches to all railroad crossings and main highways and the vehicles shall not proceed until it is known that the way is clear.
- No vehicle will be refueled while explosive materials are on the motor vehicle except in an emergency.
- Persons employed in the transportation, handling, or other use of explosive materials will not smoke or carry on their persons or in the vehicle, matches, firearms, ammunition, or flame-producing devices.
- Vehicles transporting explosive materials will not be left unattended.

5.11 Requirements for vehicles transporting explosives to the removal site

All applicable requirements of DOT and ATF regulations that apply to transportation of explosives on the removal site will be enforced.

5.12 Receipt Procedures

5.12.1 Accountability

5.12.1.1 Upon receipt from the vendor, accountability will be established for each type of explosive material in accordance with Paragraph 5.6 above. Copies of vendor invoices will be kept with the receipt memoranda in the donor materials accountability file in the on-site project office.

5.12.1.2 Any transactions, which include receipt, issue, and/or turn-in of donor materials, will be conducted by two persons, at least one of whom will be a UXO Tech III or higher. Discrepancies will be resolved immediately. If it is determined that a theft or loss has occurred, the procedures in Section 5.14 will be followed.

5.12.1.3 All documents associated with receipt, transfer, issue, or turn –in of donor explosives will be maintained in the Donor Materials Accountability file in the on-site project office.

5.12.2 Designated Individuals

5.12.2.1 The following individuals are authorized to order and receive explosives from the supplier:

- Senior UXO Supervisor
- Site Safety and Health Officer

5.12.2.2 The following individuals are authorized to transport and use donor explosives:

- Senior UXO Supervisor
- Site Safety and Health Officer
- UXO Tech III
- UXO Tech II

5.12.3 Explosive Use Certification

5.12.3.1 At the conclusion of the intrusive activities at the CRP, the SUXOS will complete an EOTI Memorandum stating all donor explosives expended during MEC removal operations were used for their intended purpose. Any explosives remaining after a disposal operation will be disposed of in accordance with Section 5.16.

5.13 Inventory

EOTI will not store explosives on the site and therefore only the initial inventory, as described Section 5.6, will be required.

5.14 Procedures upon Discovery of Lost, Stolen, or Unauthorized Use of Explosives

Lost, stolen or unauthorized use of explosive materials will be reported as follows:

- The SUXOS will give an immediate telephonic notification to the Contracting Officer, followed up by a written report within 24 hours
- Notify the Bureau of Alcohol, Tobacco, and Firearms (ATF) at 800-800-3855, within 24 hours of discovery (complete ATF Form 5400.5, Report of Theft or Loss - Explosive Materials and mail to nearest ATF office. Instructions for completion of the form are on the reverse side.);
- Notify the local law enforcement agency.

5.15 Returning Explosives to the Explosive Storage Area

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16 Disposal of Unused Explosive Materials

Explosives will be delivered in the quantity required for the planned demolition operation and all delivered commercial explosives will be consumed in the demolition operation.

5.16.1 Perform an economic analysis for different alternatives

Since this is a firm fixed price (FFP) task, this requirement does not apply.

6.0 CHAPTER 6 ENVIRONMENTAL PROTECTION PLAN

This chapter of the Work Plan describes environmental concerns and describes methods used during site activities designed to minimize pollution, protect and preserve natural resources, restore damage, and control noise and dust within reasonable limits.

6.1 Identification of Environmental Concerns

6.1.1 Endangered / Threatened Species within the Project Site

There are no known endangered species within the project boundaries and planned activities are not expected to have any potential negative impact on protected species or their environment. There are one endangered animal species and three threatened plant species known to occur in Richland County, South Carolina. The Shortnose Sturgeon and Red-cockaded Woodpecker is the endangered species listed in Richland County. The Smooth Coneflower, Rough-leaved Loosestrife, and Canby's Dropwort are known to occur in Richland County. The Red cockaded wood pecker and the three plans species are not found within the project area. A description of each species is provided below.

6.1.1.1 Shortnose Sturgeon Sturgeons are fish of an ancient lineage easily recognized by five rows of scutes (bony plates) along their bodies: one row along the mid-back, one along the middle, and one along the lower body on each side. Sturgeons have heterocercal tails; that is, the top lobe of the caudal fin is larger than the bottom one. Coloration varies from yellowish pink to yellowish brown on the fish's back and creamy white below. Sturgeons, the largest of the bony fishes, are bottom dwellers that use chin barbels to locate food on the substrate. The barbels on the shortnose sturgeon are rather small, less than one half the width of the mouth. Sturgeons have protrusible, inferior mouths used to suck in benthic insects, crustaceans, and other food items. The shortnose sturgeon is smaller than the common Atlantic sturgeon, *Acipenser oxyrinchus,* and has a shorter, uncurved snout. It is also known as the blunt-nosed, round-nosed and small sturgeon, and it may grow up to 143 cm (56 in).


Shortnose sturgeon ***(Acipenser brevirostrum)***

http://www.dnr.sc.gov/marine/mrri/acechar/specgal/sturgeon.htm

6.1.1.2 Red-cockaded Woodpecker (*Picoides borealis*)

Red-cockaded woodpeckers are relatively small; adults measure 20 to 23 cm (7.8 to 9 inches) and weigh 40 to 55 g (1.4 to 1.9 ounces). Red-cockaded woodpeckers are relatively slender, long-tailed and small-billed woodpeckers. They are black and white with a coarsely barred back, white cheek patch and black crown. Their breasts and bellies are white to grayish-white with spots on the sides changing to bars on the flanks. Outer tail feathers are white with black barring and central tail feathers are black. Adult plumage is extremely similar between sexes and generally indistinguishable in the field. The only difference between adult males and females is the presence of the red cockade at the upper edge of the white auriculars, which is virtually invisible in field situations.


http://www.fws.gov/rcwrecovery/ - Photo by Michael McCloy

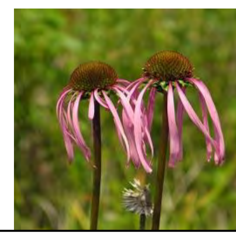
Juveniles appear similar to adults but may be distinguished in the field by duller plumage, white flecks often present just above the bill on the forehead and diffuse black shading in the white cheek patch. Juvenile males have a distinctive red patch on the crown and may be distinguished from juvenile females in this way.

6.1.1.3 Rough-leaved Loosestrife (*Lysimachia asperulifolia*)

http://upload.wikimedia.org/wikipedia/commons/thumb/1/1b/Lysimachia_asperulifolia.jpg/431px-

The Rough-leaved Loosestrife is a rhizomatous perennial herb growing erect to a maximum height around 60 to 70 centimeters. The lower stem is pinkish in color and ribbed, and the upper stem is yellowish and lacks ribs. The stem in the inflorescence is covered in reddish glands. The leaves are green, lance-shaped, and up to 5 centimeters long by 2 wide. They are borne in whorls of three or four around the stem, or sometimes in opposite pairs. The leaves are not rough in texture as the common name would suggest. Smaller, tougher, brown-colored leaves are opposite or borne in whorls of up to 7 near the stem base. The top of the stem is occupied by the inflorescence, which is a raceme of star-shaped yellow flowers interspersed with leaf-like green bracts. Each flower has 4 to 7, but usually five, yellow petals with wide bases and pointed, ragged tips. The petals and green sepals are dotted with red glands and streaked with reddish resin canals. The fruit is a red-mottled straw-colored capsule a few millimeters in length.

6.1.1.4 Smooth Coneflower (*Echinacea laevigata)*



http://www.carolinanature.com/plants/echinacealaevigata.html *-Photo By Will Cook*

The Smooth Coneflower, is an Endangered Species Act federally listed endangered species of plant found in the piedmont of the southeastern United States. Most populations are found on roadsides and other open areas with plenty of sunlight, often on calcium- and magnesium-rich soils. The Smooth Coneflower grows up to about 1.5 meters in height with a mostly naked, smooth, leafless stem. Any leaves are roughly lance-shaped. On top of the stem is a flower head containing narrow pink or purplish ray florets up to 8 centimeters long. The florets droop away from the center of the head. The small, tubular disc florets in the center are dark purple in color. Blooming occurs in May through July.

6.1.1.5 Canby's Dropwort (*Oxypolis canbyi*)

http://www.fws.gov/raleigh/media/tn_canbys_dropwort.jpg - *Photo By Dale Suiter*

Canby's dropwort belongs to the mint family (Apiaceae). It is a perennial herb which grows from 80 to 120 cm (30 to 50 in) tall. The "quill-like" hollow leaves and the thick, corky wings that extend out from the margins of the fruit are the most distinctive features of the plant. The stems are erect or ascending, round, and slender with arching/ascending or forking branches above the mid-stem. The flowers are monoecious or dioecious (flowers have either male or female parts or both) and small and white, sometimes tinged with red or pink. The flowers are borne on compound umbrella-like structures that extend from the base of the leaves, and the fruit is a schizocarp (fruit splits into one-seeded segments) about 4-6 mm long. The plant inhabits a variety of coastal plain communities, including pond cypress savannahs, the shallows and edges of cypress/pond pine ponds, sloughs, and wet pine savannas.

6.1.2 Wetlands within the Project Site

There are no known wetlands within the project site.

6.1.3 Cultural, Archaeological, and Water Resources within the Project Site

There are no known cultural, archaeological, or water resources within the project site that will be impacted by planned activities.

6.1.4 Coastal Zones within the Project Site

The project site is located on the Congaree River but not within a coastal zone and no impacts from UXO clearance activities will impact the project area.

6.1.5 Trees and Shrubs that will be removed within the Project Site

The vegetation clearance requirements for this project are minimal and generally limited clearance of small shrubs. Planned activities will have minimal impact on vegetation. EOTI will not cut trees that are six inches or more in diameter at a distance of 1 foot above ground level.

6.2 Mitigation Procedures

6.2.1 Manifesting, transportation, and Disposal of Waste

EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

6.2.2 Burning Activities

EOTI will not conduct burning activities during the performance of work required in the PWS.

6.2.3 Dust and Emission Control

6.2.3.1 None of the planned activities are expected to generate significant dust. Excavation operations using mechanical equipment may generate small quantities of nuisance dust. The SUXOS, UXOSO/QCS, and Team Leader will closely monitor dust emissions resulting from soil excavation operation. Dust masks will be available to workers in areas of high dust concentrations.

6.2.3.2 Other emissions will primarily result from operation of diesel engines associated with excavation equipment. These emissions will be limited by limiting the time that equipment idles when not in use. Team leaders will ensure that equipment is turned off when not in use. If excessive emissions are generated due to engine maintenance, equipment will be shut down until inspected by a mechanic.

6.2.4 Spill Control and Prevention

6.2.4.1 EOTI will inspect vehicles and heavy equipment before, during and after operation to identify any leaks of petroleum, oil and lubricants (POL). If leaks are detected, the equipment will not be used until the leak is controlled. Drip pans will be used to catch dripping POL.

6.2.4.2 POL will be stored on-site in approved containers, in approved areas with required containment. If a spill occurs it will be reported immediately. Immediate steps will be taken to contain the spill and limit contamination. Contaminated soil will be excavated and packaged for treatment or disposal.

6.2.5 Storage Areas and Temporary Facilities

6.2.5.1 EOTI may place chemical toilets on the site. These toilets will be delivered, setup and serviced by a subcontractor.

6.2.6 Access Routes

EOTI will primarily use existing roads and trails to access the work areas. These routes will allow access by foot or light vehicle to areas requiring MEC clearance. Any additional temporary access routes required to access portion of the clearance areas will be cleared of MEC / MPPEH, but will otherwise be unimproved.

6.2.7 Trees and Shrubs Protection and Restoration

EOTI will not cut trees larger than six inches in diameter measured at a distance of one foot from the ground surface and anticipates only minimal clearance of shrubs.

6.2.8 Control of Water Run-on and Run-off

EOTI does not anticipate extensive excavations that would require run-on or run-off controls.

6.2.9 Decontamination and Disposal of Equipment

Soil will be thoroughly cleaned from equipment and tools at the end of the project. Tools and equipment will be cleaned by brushing, sweeping and/or wiping dirt from them. Equipment may be further cleaned at established wash facilities.

6.2.10 Minimizing Areas of Disturbance

EOTI will minimize the areas of disturbance by working only in the areas designated in the PWS and marked by the surveyor. EOTI will limit vegetation removal and excavation to what is necessary to complete the work.

6.3 Post-activity Clean-up

After completing the project, EOTI will cleanup and restore the site to a condition as close to its original condition as possible. All equipment, tools and material will be removed from the site. EOTI will police the site to remove all trash, debris and other waste from the work site. The SUXOS will inspect the area to ensure that area is clean prior to demobilization.

6.4 Air-monitoring Plan

There is no RCWM expected at this site and no anticipated, significant exposure to other chemicals, and therefore air monitoring will be limited. The only significant air contaminant anticipated to be associated with this project is minimal dust generated as a result of excavation operations. If dust levels become a nuisance or hazard to workers, water may be used as an engineering control to lower the dust levels. Dust masks will be worn, as required to further reduce exposure to dust.

7.0 CHAPTER 7 PROPERTY MANAGEMENT PLAN

This Chapter does not apply to the work planned by EOTI.
No Government Furnished Equipment is to be used on this project.

8.0 CHAPTER 8 INERIM HOLDING FACILITY SITING PLAN FOR RCWM PROJECTS

This Chapter does not apply to the work planned by EOTI.

RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Interim Holding Facility for RCWM is required in the PWS.

9.0 CHAPTER 9 PHYSICAL SECURITY PLAN FOR RCWM PROJECT SITES

This Chapter does not apply to this Task Order.

RCWM is not expected to be encountered at the site were activities described in this Work Plan will take place. No Physical Security Plan for RCWM is required in the PWS.

10.0 CHAPTER 10 -- REFERENCES

Alcohol Tobacco Firearms (ATF), Publication 5400.7, Federal Explosives Laws
Department of Defense Explosives Safety Board (DDESB), TP-16, Methods for Calculating Primary Fragment Characteristic
DDESB TP-18, Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel
Department of Defense (DOD), 4160.21-M-1, Defense Demilitarization Manual
EOTI Corporate Quality Plan
EOTI Corporate Safety Plan
ERsys.com, http://www.ersys.com/usa/45/4516000/wtr_norm.htm ; Climate Weather Norm Charts for Columbia, SC
National Fire Protection Association, NFPA 780, Standard for the Installation of Lightning Protection Systems
U.S. Army Corps of Engineers (USACE), Congaree River Basin Navigability Study, 1977.
U.S. Army Engineering Support Center Huntsville (USAESCH) OE-CX Interim Guidance 02-03
U.S. Army, AR 385-64 Explosives Safety Program
U.S. Army, TM 60-Series Training Manuals
USACE, EM 1110-1-4009, Ordnance and Explosives Response
USACE, EM 385-1-1, USACE Safety and Health Requirements Manual
USACE, EM 385-1-97, Explosive Safety and Health Requirements Manual
USACE, EP 1110-1-18, Ordnance and Explosives Response
USACE, EP 75-1-2, MEC Support During Hazardous, Toxic, and Radioactive Waste (HTRW) and Construction Activities
USACE, ER 1110-1-12, Quality Management
USACE, Worldwide Environmental Remediation Services (WERS), Data Item Descriptions (DIDs)
USAESCH, OE-CX Interim Guidance 08-01

APPENDIX A
TASK ORDER SCOPE OF WORK

(EOTI has only been contracted to prepare plans and no formal SOW was prepared. EOTIs proposal for currently scoped work is presented below)

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

MUNITIONS AND ENVIRONMENTAL SERVICES
9050 Executive Park Drive, Suite 106 A • Knoxville, TN 37923
Tel: (865) 200-8081 • Fax: (865) 766-5971

March 11, 2014

Apex Companies, LLC Attn: Rusty Contrael
1600 Commerce Circle
Trafford, PA 15085

RE: Proposal for Completing Project Planning and Document Preparation for UXO Support of the Congaree River Remediation Project in Columbia, SC

1. EOTI is very pleased to be invited to participate in the South Carolina Electric and Gas Company removal project along the Congaree River in Columbia, SC. Key to success for this very complex project is thorough, integrated team planning. EOTI is prepared to support and participate in teleconference and face-to-face meetings with APEX, other subcontractors, regulators and stakeholders, in order to determine the safest most effective manner to accomplish project goals. EOTI will provide managers, engineers, UXO Safety Specialists, and other technical experts, as required to complete the project planning. EOTI anticipates project planning to be conducted through a series of calls and meetings, including up to three meetings in the vicinity of the project location in Columbia, SC, at the APEX offices in Trafford, PA or at Regulator or Corps of Engineer offices in the southeast United States. It is anticipated that each meeting will take place in one day and will be attended by two personnel. EOTI will provide technical advice for the execution of Munitions and Explosives of Concern (MEC) removal in support of remediation activities.

2. After completing project planning, EOTI will prepare required planning and work documents associated with the UXO support for the remediation activities. It is anticipated that draft and final versions of each plan may be required. Draft plans will be submitted for review electronically and hard copies of final plans will be provided if requested. Required plans may include the following:

a. ***MEC Work Plan (WP)***. The WP will be prepared in accordance with Data Item Description (DID) WERS-001.01, EM 385-1-97, and EP 75-1-2 will address UXO support at the remediation site. The WP will describe specific work proposed in order to meet the project objectives and requirements. The WP will contain, at a minimum, a Technical Management Plan, an Explosive Management Plan, an Accident Prevention Plan (APP) (DID WERS-005.01), which includes a Site Safety and Health Plan (SSHP), and a Quality Control Plan (QCP). The QCP shall be a detailed and comprehensive plan covering all aspects of the UXO support.

b. ***Explosives Safety Submission (ESS)***. EOTI will prepare an ESS in accordance with requirements of the Department of Defense (DoD) Manual 6055.09-M (DoD, 2008a). If the ESS is prepared by the Corps of Engineers or other party, EOTI will provide required information related to planned MEC operations.

c. ***Dive Safe Practices Manual.*** EOTI will provide a updated Dive Safe Practices Manual prepared in accordance with the requirements in EM 385-1-1 Section 30.

d. ***Diving Operations Plan.*** EOTI will produce a site and project specific Diving Operations Plan which will include a dive operations-specific Emergency Management Plan and Activity Hazard Analysis (AHA) as attachments.

3. EOTI has developed and enclosed detailed cost proposal for the project planning and document preparation described above. We understand that the next phase of the project is likely a demonstration project on the shore. We will provide cost estimates for this work as well as the underwater work once the initial planning is complete.

4. Please contact me at 865-200-8081 is you have any questions or comments or if you need any additional information.

Sincerely,

Explosive Ordnance Technologies, Inc.

James Y. Daffron, PE
Project Manager

Encl: as

APPENDIX B
MAPS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

Legend

Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 175 350 700

0 60 120 240
Meters

Site Location

FIGURE B-1
SITE LOCATION

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 11/05/2014	FILE Map1.mxd	
PAGE # B-1	SCALE 1 inch = 350 feet	

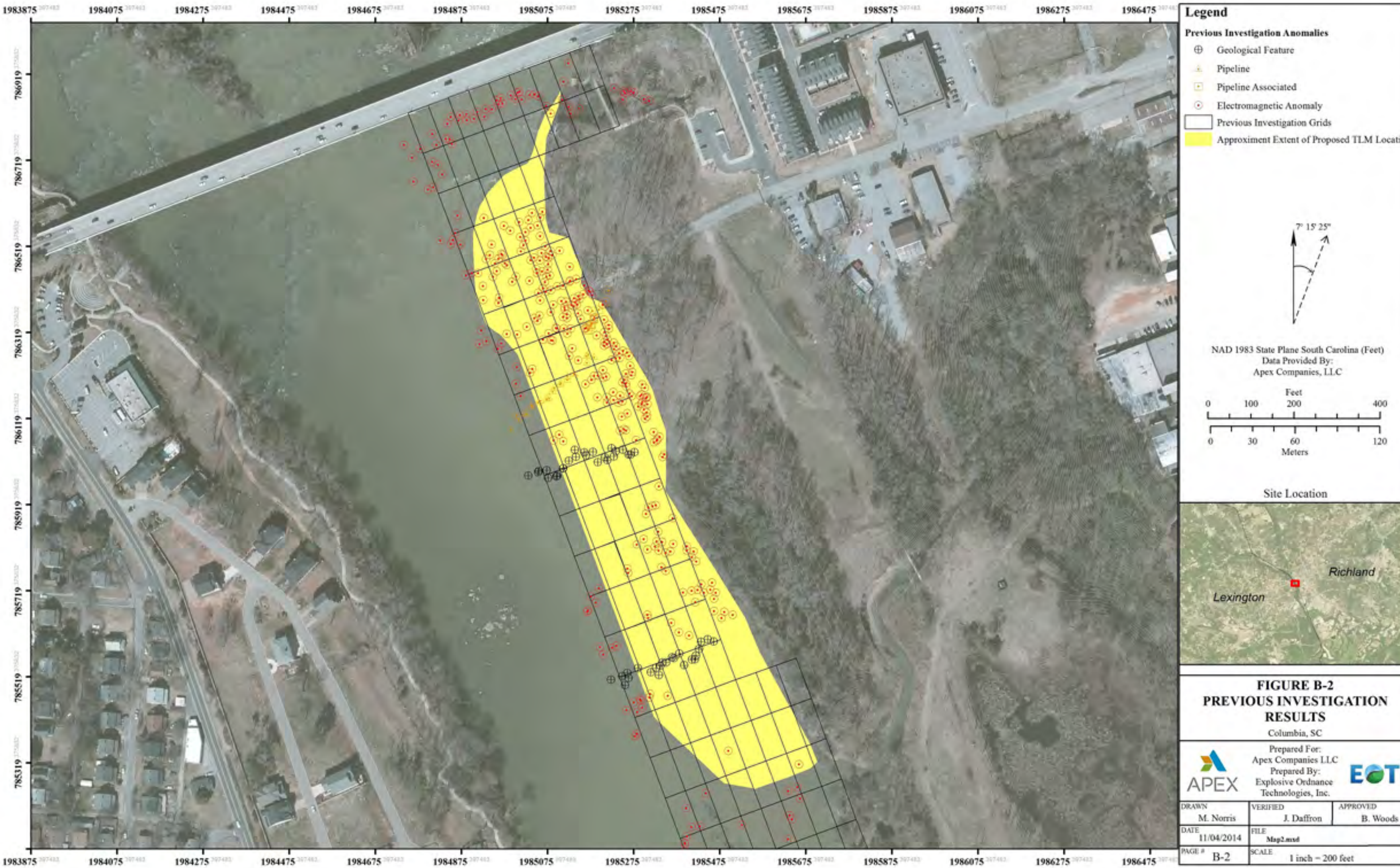


FIGURE B-2
PREVIOUS INVESTIGATION RESULTS

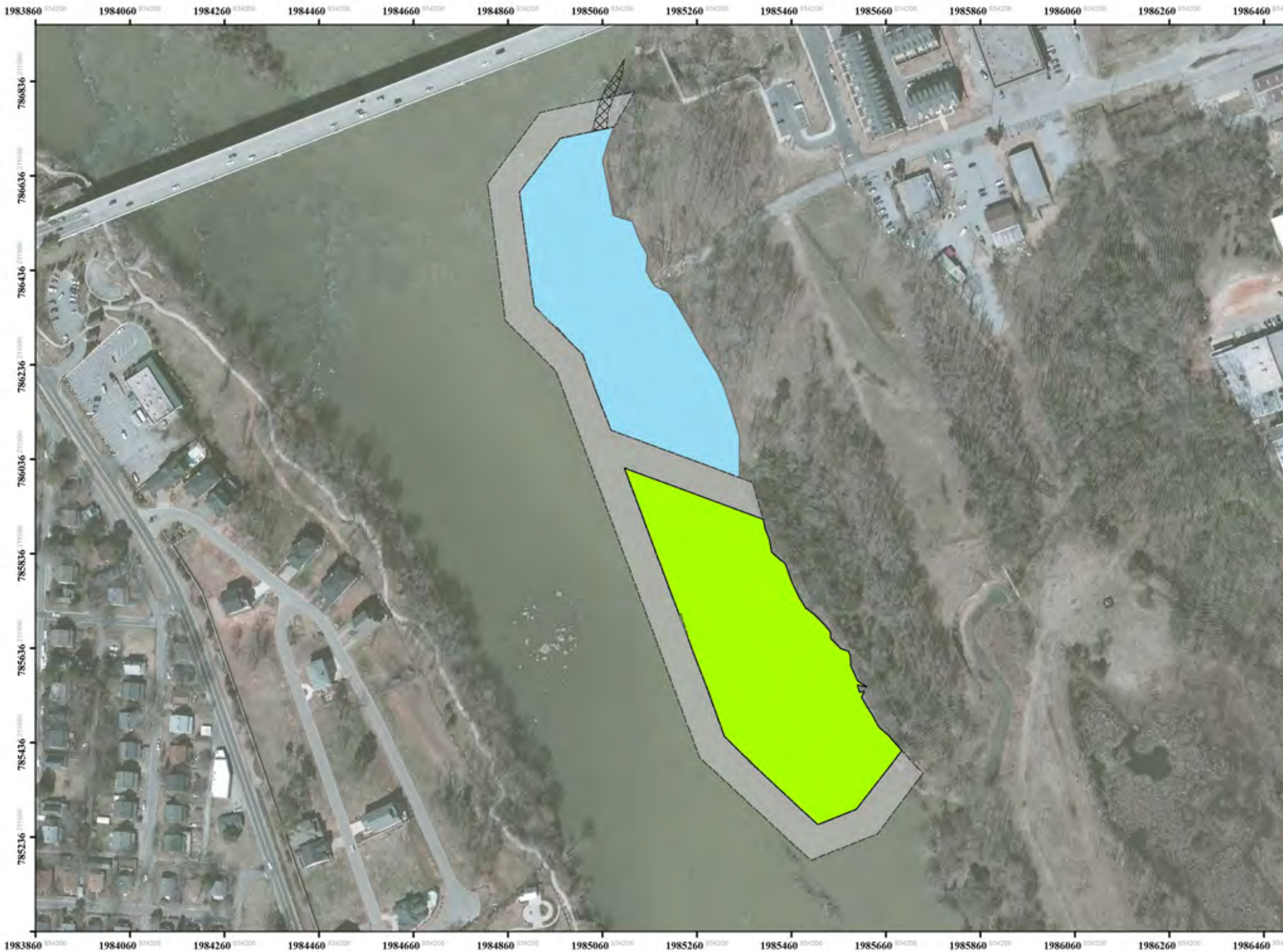
Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 11/04/2014	FILE Map2.mxd	
PAGE # B-2	SCALE 1 inch = 200 feet	



Legend

Approximate Cofferdam Location

Clearance Phase

Phase 1 - Year 1

Phase 2 - Year 2

TLM area to be addressed under a seperate effort

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 100, 200, 400

Meters: 0, 30, 60, 120

Site Location

FIGURE B-3
CLEARANCE AREAS
Columbia, SC

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

APEX

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 11/05/2014	FILE B-3.mxd	
PAGE # B-3	SCALE 1 inch = 200 feet	

APPENDIX C
POINTS OF CONTACT

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

Emergency Response / Services			
Ambulance Service			911
Emergency Medical Response			911
Police*			911
Police Department – Non emergency			803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203			803-434-7000 * For Emergency Dial 911
Fire Department*			911
Fire Department – Non Emergency			803-545-3700
National Poison Control Center			800-222-1222
CHEMTREC (hazardous materials response)			800-424-9300
National Response Team (hazardous materials response)			800-424-8802
Centers for Disease Control (CDC) **http://www.cdc.gov/health/diseases**			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Brian Woods, P.G., PMP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	TBD	TBD	TBD

APPENDIX D
ACCIDENT PREVENTION PLAN

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

TABLE OF CONTENTS

Section **Page #**

APP APPROVAL

Project: Surface/Subsurface Clearance   Site: Congaree River Project

Contract Number: 875001   Site Location: Columbia, SC

We have reviewed the attached Accident Prevention Plan (APP) for the referenced site. We recognize that when this form is completed, the attached APP is approved for field activities on the referenced site. Changes to this APP will be documented in writing.

Robert J. Goodman   December 18, 2014

Prepared by: Date

Robert J. Goodman, CIH, CSP
Certified Industrial Hygiene Consultant
EnSafe, Inc.
(513)-621-7233

Wayne Lewallen   December 18, 2014

Reviewed by: Date

Wayne Lewallen
Program Manager
Explosive Ordnance Technologies, Inc.
(865) 220-8668

____________________   ____________

Reviewed by: Date

____________________   ____________

Reviewed by: Date

____________________   ____________

Reviewed by: Date

1.0 BACKGROUND INFORMATION

Contractor: Explosive Ordnance Technologies, Inc.

Contract Number: 875001

Project Name: MEC Clearance and Support
Congaree River Project
Columbia, South Carolina

2.0 PROJECT DESCRIPTION AND HISTORY

Explosive Ordnance Technologies, Inc. (EOTI) is to provide all Munitions Response (MR) services necessary to remove Material Potentially Presenting an Explosive Hazard (MPPEH), to include munitions debris and range related debris from approximately 13 acres of at Congaree River Project (CRP), Columbia, SC.

Site Location: The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure B-1-Site Location**.

Site history: In 1865, during the Civil War, munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some MEC from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with UXO potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. **Figure B-2-Previous Investigation Results** shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former MGP located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking, and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream, which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with SC DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of TLM and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of Munitions and Explosives of Concern (MEC) from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment. The MEC clearance area is shown on **Figure B-3-Clearance Area.**

2.1 Chemical Warfare Material

The site is not suspected of containing Chemical Warfare Material (CWM). However, if a suspected Recovered Chemical Warfare Material (RCWM) is encountered during removal and / or support activities, the procedures listed below will be followed:

Upon an unexpected discovery of RCWM, all work will immediately cease. Project personnel will withdraw along a cleared path upwind from the discovery. A team, consisting of a minimum of two personnel, will secure the area to prevent unauthorized access. Personnel must position themselves as far upwind as possible while still maintaining visual security of the area. Upon evacuation, the Senior Unexploded Ordnance Supervisor/Unexploded Ordnance Safety Officer (SUXOS)/(UXOSO) will account for all work site personnel and immediately notify the United States Army Corps of Engineers (USACE) Ordnance and Explosive Safety Specialist (OESS) with detailed information regarding the suspected RCWM and assist, if requested, in making notifications in accordance with (IAW) CEMP-CE Memorandum, Notification Procedures for Discovery of RCWM during USACE Projects. At a minimum, the SUXOS will notify the EOTI project manager (PM) who will, in turn, notify the responsible Contracting Officer. Security will be maintained on the item until relieved by a military EOD unit or Technical Escort Unit.

Once RCWM item has been removed and site plans updated according to the additional site hazards encountered, work may continue.

2.2 Hazardous Chemical Contamination

By definition, hazardous substances are those materials that can threaten human health and/or environmental well being if released into the environment. This describes those hazardous substances or chemical contaminants present in soil or air that pose a threat to the environment, and as such may pose a threat to site personnel and the public during removal actions. From what is currently known about the site and its past, chemical contamination is not expected to be a problem at this site. However, it is prudent to be particularly aware of unusual smells, soils stains, or the presence of drums/containers that might indicate hazardous materials may be present. If there is reason to believe that a chemical hazard exists, the SUXOS/UXOSO will stop work and report to the Corporate Health and Safety Staff as much information as is known (i.e., names of chemicals if containers have labels, condition of containers, extent of problem, etc.) and plans will be updated to accommodate these additional site hazards prior to resuming work on the site.

2.3 Improved Conventional Munitions.

The site is not suspected to contain Improved Conventional Munitions (ICM). If suspect ICM munitions that are not determined to be practice munitions are encountered during any phase of site activities, EOTI will immediately withdraw from the work area, secure the site, and contact the USACE Safety Office for assistance and guidance.

3.0 ACCIDENT EXPERIENCE

EOTI has an excellent safety record. Since its inception in 1997, EOTI has never had a lost time accident / injury. EOTI's current Experience Modification Rate is 0.969. EOTI's lost time injury rate is 0.

4.0 PHASES OF WORK REQUIRING HAZARD ANALYSIS

The following phases of work on this project require an Activity Hazard Analysis:

- Site-Setup/Layout
- Surface Preparation / Vegetation Removal
- Subsurface Clearance using "Mag & Dig" Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Activity Hazard Analyses can be found in this Accident Prevention Plan (APP) at Section 14.0 of this Appendix.

5.0 STATEMENT OF SAFETY AND HEALTH POLICY

The EOTI Safety Policy is the first page in the Corporate Health and Safety Program, and sets the tone for all safety efforts. It is signed by Maureen McIntyre, President EOTI.

EOTI strongly believes that our people are our most important and valuable asset. It is the actions of our personnel, working together as a team, which ultimately determines the success of our endeavors as a company.

Accidental injuries and illnesses can cause needless pain and suffering of employees and their families, as well as increasing costs and decreasing productivity and morale among employees. EOTI is committed to providing a safe and healthful work environment for all of our employees in all locations. The company's goal is an accident-free work environment. The management of EOTI is committed to doing all in our power to make this a reality.

The management staff alone cannot accomplish a goal of this magnitude. It is only with the entire organization working together as a team that we can hope to achieve this level of performance. It is up to each of us to follow applicable safety requirements and procedures while performing our job functions.

A truly successful safety program involves more than simply following procedures. It involves active participation by all employees constantly striving to make improvements. No person knows any job better than the person doing that job. No person knows the condition of the equipment, potential problems with the procedures, and the work environment of a job better than the person doing that job. It is up to all of us to be constantly observant of changes in our own work environment, and to bring any potentially harmful conditions to the attention of management as soon as possible. It is the responsibility of the management staff to promptly and effectively respond to employee concerns for their safety and health.

In addressing potential safety and health problems as soon as they are observed, we prevent these situations from developing into accidents. Keeping open lines of communication at all levels within EOTI will foster an increased understanding of the safety and health issues that face us all.

6.0 RESPONSIBILITIES AND LINES OF AUTHORITY

6.1 Identification and Accountability

The following personnel and their safety related responsibilities for this project work are listed.

President (Wayne Lewallen) is responsible for enforcement of the Corporate Safety and Health Program at all worksites within his area of responsibility. He must assure that personnel receive the required training, medical surveillance, and personal protective equipment necessary in order to perform their jobs in a safe and effective manner. The enforcement of the Corporate Safety and Health Program on the worksites will be a critical rating element for site personnel and managers.

Corporate Safety and Health Management Consultant (Robert J. Goodman) is a CIH and CSP. He assists in the development, implementation, and maintenance of the Safety Program and individual Site Safety and Health Plans (SSHPs). He visits projects as requested to ensure the effectiveness of the Health and Safety Program. He remains available for project emergencies. He develops or reviews modifications to SSHPs as needed. He evaluates occupational exposure monitoring / air sampling data and adjusts SSHP requirements as necessary. He serves as a QC staff member and approves the APP/SSHP by signature.

Corporate MEC Health and Safety Coordinator (Dave Farmer) meets all the requirements of a UXOSO, Unexploded Quality Control Specialist (UXOQCS), and SUXOS and is responsible for creating, updating, and managing the Corporate Safety and Health Program, as well as APP/SSHP for individual worksites under the direction of the Corporate Safety and Health Manager. He coordinates directly with the PM and the SUXOS/UXOSO routinely to answer technical questions and to provide assistance to the worksites. He also provides safety training, as needed, and performs safety and health program inspections with the Safety and Health Manager to assure compliance with EOTI safety and health policy.

Project Manager (Brian Woods) directly impacts the safety of the site by setting the tone for the job and encouraging safe performance among all team members. Any areas of concern or questions regarding safety and health issues are coordinated with the Corporate Health and Safety Staff, Corporate MEC Safety and Health Coordinator, and the UXOSO. In instances of noncompliance with safety requirements, the PM issues warnings and/or provides disciplinary action up to and including removal of the employee from site operations, should this action be warranted. The PM assures that every accident on the work site is investigated in order to determine the root cause(s), the accident report is filled out, and takes steps necessary to prevent recurrences.

Senior UXO Supervisor (SUXOS) is responsible for the successful accomplishment of the work on the project site. He directly supervises all site work and personnel and assures they are operating in a safe manner. He assures that all personnel, including visitors, are properly trained, qualified, equipped, and protected from the hazards associated with the worksite and site operations. The SUXOS reports directly to the Project Staff on all project issues. The SUXOS has stop work authority. The SUXOS has numerous onsite responsibilities including, but not limited to:

- Coordinating with all applicable emergency response agencies to ensure appropriate response should an emergency develop on site;
- Establish medical evacuation routes and emergency telephone number listing;
- Inventory first aid equipment, personal protective equipment (PPE), fire extinguishers and purchase replacements, as required, with concurrence from the PM;
- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;

- Designate site control zones;
- Provide visitor briefing and training; and

UXO Safety Officer (UXOSO)
He is granted the authority to administer the safety and health program on the worksite. The UXOSO reports directly to the Vice President of MEC Operations on all project safety and health issues. He coordinates with the Corporate MEC Safety and Health Coordinator for technical assistance on safety and health issues at the worksite, for assistance in ordering safety equipment, medical surveillance program issues, etc. The UXOSO has stop work authority whenever an imminent danger situation is observed. The UXOSO has numerous onsite responsibilities to support the SUXOS in maintaining a safe work environment. These responsibilities may include, but are not limited to:

- Inventory first aid equipment, PPE, fire extinguishers and purchase replacements, as required, with concurrence from the SUXOS and PM;
- Survey the site for hazards;
- Provide daily safety briefings;
- Provide required safety training;
- Provide visitor briefing and training;
- Perform onsite monitoring, if required;
- Perform daily safety inspections of site activities to verify compliance with all safety and health requirements in this project APP/SSHP, as well as the Corporate Safety and Health Program and recording any deficiencies in the Safety Log; and
- Coordination of corrective actions for any deficiencies noted during safety inspections.
- Perform onsite monitoring, if required;

Team Members are responsible for performing their assigned tasks in a safe and effective manner. Questions must be immediately brought to the attention of their supervisor. Team members must not attempt to perform an assigned task for which they have not been properly trained. All personnel must attend required safety training and be aware of the operations going on around them at the work site. Any situations or conditions, which may affect the safety and health of any team member, must be immediately reported to their supervisor. Before, during, and after use, personnel must inspect each piece of personal protective equipment, as well as other tools and equipment, to assure it is in a safe operating condition. Any equipment that is deemed unsafe for use must be immediately turned in for repair or replacement. Personnel must know how to properly use all equipment assigned to them and must use required personal protective equipment at all times.

The minimum qualifications for on-site UXO personnel are as follows:

The SUXOS, UXOSO, UXOQCS**,** UXO Supervisors and UXO Technicians must be graduates of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, the U.S. Naval School, Explosive Ordnance Disposal (EOD), or approved UXO School. All personnel will meet or exceed the standards established by the Department of Defense Explosives Safety Board (DDESB) in DDESB TP 18.

The SUXOS must have at least 10 years combined MEC/ military EOD experience, which shall include 5 years in supervisory positions, which may be a combination of active duty military EOD functions and/or civilian MEC time. A SUXOS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III.

All UXO Supervisors (Tech III) shall have at least 8 years combined MEC/ military EOD experience. The UXO Technician III must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, and II.

The UXOSO and UXOQCS will have at least 8 years combined active duty military EOD and contractor UXO experience and documented Safety or Quality Control training. The UXOSO must have successfully completed an approved Occupational Safety and Health Administration (OSHA) 30-Hour Safety Training program.

The UXOSO and the UXOQCS must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III. These individuals must have documented experience supervising UXO removal operations and personnel.

A UXO Technician II be a graduate of military EOD school of the United States or other approved nation and must have prior military EOD experience or be a graduate of an approved course of instruction as defined in TP 18 and have a minimum of 3 years experience in the UXO field. All UXO Technician II's must be fully able to perform all the functions enumerated for UXO Sweep Personnel and UXO Technicians I.

Any other team member(s) must be at least OSHA 40-Hour Hazardous Waste Site Trained, have received Site Specific Hazard and Ordnance Recognition Training. UXO Technician I's must also be graduates of an appropriate recognized training course and meet all requirements in DDESB TP 18. Copies of training records, including training required by 29 Code of Federal Regulations (CFR) 1910.120, will be available at the project site office.

6.2 Lines of Authority

The ultimate authority for enforcing health and safety requirements is the Vice President/UXO Program Manager. He reports directly to the President of EOTI, and he makes all decisions regarding UXO operations. The Project Manager and the Corporate Health and Safety Staff report directly to the Vice President/UXO Program Manager.

The Project Manager is responsible for all aspects of running the project, including the safety and health of employees and the general public. The SUXOS reports directly to him on all project and safety and health issues. If there are questions, he consults with the Corporate Health and Safety Staff for resolution of areas of concern. He reports directly to the Vice President/UXO Program Manager.

The Corporate Health and Safety Manager provides consultation and advice on health and safety issues to the UXOSO, MEC Safety and Health Coordinator, the Project Manager, and the Vice President/UXO Program Manager. He reports directly to the President/UXO Program Manager.

The UXOSO directly manages the health and safety issues on the site. He coordinates with client site personnel and visitors to the site regarding health and safety issues. If there are questions on safety and health policy or procedures, he consults with the Corporate Health and Safety Staff. He reports directly to the Project Manager.

6.3 SUBCONTRACTORS AND SUPPLIERS

Identification of Subcontractors and Suppliers

EOTI anticipates awarding a subcontract to a local surveying company to provide survey support for the project. EOTI does not intend to subcontract any other portion of the scope of work. However, suppliers may deliver equipment and materials to the project site. All subcontractor personnel will be trained to the approved work plan and the included AAP. All visitors, including suppliers supporting the project, will receive a safety brief from the SUXOS or the UXOSO prior to entering any area where work is ongoing. They will sign in and will be escorted as required to perform their functions on the site. Only essential personnel will be allowed in the exclusion zone (EZ) while intrusive operations are ongoing.

Means for Controlling and Coordinating Subcontractors / Suppliers

All subcontracted personnel working on the site will receive the same thorough site-specific training provided to all EOTI site personnel. This training will include detailed training on procedures in the Work Plan and AAP. All suppliers making deliveries on site will receive a safety briefing, which will include recognition and awareness of potential site hazards. Supplies will not be permitted to enter the EZ of the project site unless escorted by an EOTI UXO-qualified employee.

Safety Responsibilities of Subcontractors / Suppliers

All subcontractor personnel and suppliers making deliveries on site are responsible for receiving a safety briefing. They are responsible for following all site safety and health procedures. They will not enter any EZ area without a UXO-qualified escort. They will wear all required personal protective equipment while on the site in areas where it is required. They will report any accidents of their personnel to the SUXOS/UXOSO for investigation.

7.0 TRAINING

Prior to commencement of site activities, the UXOSO will ensure that all employees engaged in hazardous waste operations are informed of the nature and degree of exposure to chemical and physical hazards that are likely to result from participation in site operations. EOTI will accomplish this by ensuring that all personnel entering the site have received the appropriate OSHA and site-specific training, prior to participation in site activities. The other employees working on the site in other capacities not involving hazardous waste operations will receive training on the hazards of the MEC operations on site and on MEC recognition and avoidance procedures, as well as emergency procedures. This training will be held at the time of site mobilization and will be reinforced during the daily safety briefings, to which all site workers (including subcontractor personnel) will be required to attend.

Safety Indoctrination Subjects

Safety indoctrination training will be presented by the UXOSO to all EOTI employees, as well as to subcontractor personnel who will be working on this project site. This is part of on the job training (OJT), which includes classroom type instruction on the topics specified for site-specific training and on site participation in the following:

- Details of the APP/SSHP;
- Employee rights and responsibilities;

- Safe work practices;
- Nature and extent of anticipated chemical, biological and physical hazards;
- Measures and procedures implemented for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Safe operation of heavy excavation equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

If personnel who are not UXO-qualified come on the site, a UXO recognition and awareness training will also be presented. While there is a UXO hazard on the site, personnel will have a UXO-qualified employee escorting them. Once an area is cleared of surface UXO, these employees will be permitted to enter the area without escort as long as no intrusive operations are performed. The UXO recognition and awareness training provides an additional level of protection to these workers so that if they see something that could be ordnance related, they will know enough not to touch it and to immediately get a UXO-qualified employee to examine the item.

7.1 Initial Training

Initial site-specific training will include proper procedures to evacuate the work site. It will also provide a description of the basic characteristics, deployment and functioning of the following ordnance:

- Rockets/missiles
- Projectiles
- Bombs
- Grenades
- Small Arms

All EOTI and subcontractor employees who are involved in hazardous waste site activities receive 40 hours of OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120 (General Industry) and 29 CFR 1926.65 (Construction). If it has been more than a year since any worker has received the 40 Hour OSHA HAZWOPER training, he or she must also have a current HAZWOPER 8-Hour Refresher Training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 prior to working on the site. All production workers will also receive site-specific OJT under the direct supervision of a trained/experienced supervisor when they mobilize at the site.

7.2 Mandatory Training and Certifications Applicable to This Project

The following training and certifications are required for work on this project:

- EOD School Certificates (UXO-qualified personnel only)
- OSHA HAZWOPER 40 Hour Training
- OSHA HAZWOPER 8 Hour Refresher Training (as applicable)
- OSHA HAZWOPER Supervisor Training (Supervisors only)
- OSHA 30 Hour Safety Course (UXOSO)
- Valid vehicle operator license (All vehicle operators)

- Heavy Equipment Operator Training (Heavy Equipment Operators only)

7.3 Supervisory Training

On-site managers and supervisors, who are responsible for directing others, will receive the same training as the general site workers for whom they are responsible. They will also receive an additional 8 hours of OSHA required supervisory training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 to enhance their ability to provide guidance and make informed decisions. This additional training includes the following:

- Review of the EOTI Corporate Safety and Health Program;
- Regulatory requirements;
- Management of hazardous waste site cleanup operations;
- Management of site work zones;
- How to communicate with the media and the public;
- PPE selection and limitations;
- Spill containment; and
- Monitoring site hazards.

The UXOSO, with specific responsibilities for safety and health guidance on site, will receive the training provided to general site workers and their supervisors. He also will receive advanced training in safety and health issues, policies and techniques. The UXOSO will have completed an OSHA-approved 30-hour Construction Safety Class.

7.4 Project-Specific Training

The SUXOS and UXOSO will conduct OJT. This training will include classroom type instruction covering the topics specified for site-specific training, and on site participation in the following:

- Details of the Site Specific Health and Safety Plan;
- Employee rights and responsibilities;
- Safe work practices;
- Nature and extent of anticipated chemical and physical hazards;
- Measures and procedures for controlling site hazards;
- Emergency Response and Contingency Plan;
- Rules and regulations for vehicle use;
- Safe use of field equipment;
- Handling, storage, and transportation of hazardous materials;
- Use, care, and limitations of PPE;
- Hazard communication per OSHA 29 CFR 1910.1200.

7.5 MEC Training

All employees performing work involving the handling and destruction of MEC must be graduates of the Naval Explosive Ordnance Disposal School or other appropriate recognized training per DDESB TP 18. A copy of their certificate of graduation will be kept on file at corporate headquarters. UXO qualified personnel must have knowledge and experience in military ordnance, ordnance components, and explosives location, identification, render safe, recovery/removal, transportation, and disposal safety precautions. UXO personnel must have the knowledge and experience to effect safe handling and transportation of found ordnance items.

7.6 Hazard Communication Training

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product and work environment hazards, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request a Safety Data Sheet (SDS) for any hazardous material on the site at any time. The location of the SDSs for this site will be in an SDS binder in the site office, and all personnel will be made aware of that fact. This training will occur as part of the initial mobilization training at the site.

7.7 Tailgate Safety Briefing

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day and will include such items as:

- Expected weather conditions;
- General site hazards;
- Biological hazards on site;
- MEC hazards;
- PPE required at each site;
- Emergency evacuation procedures;
- Heat or cold stress precautions;
- Buddy system procedures;
- A review of any safety violations from the previous day; and
- Any other significant events involving safety.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner.

7.8 Daily Debriefing

At the conclusion of each workday, debriefing for all employees will be held if appropriate, and the day’s work will be discussed to determine if changes are warranted before commencing the next day’s activities.

7.9 Periodic Site Training

On the first workday of each workweek / period or more frequently if needed, a pertinent topic will be selected and elaborated upon by the SUXOS/UXOSO during the Tailgate Safety Briefing. These safety meetings will help ensure the safety and health of site personnel in the performance of regular work activities and in emergency situations. Safety meetings will be documented in the appropriate log and the EOTI Documentation of Training Form will be completed.

7.10 Visitors

All visitors to the site, even if escorted, must receive as a minimum, a briefing on site conditions, hazards and emergency response procedures. The UXOSO will generally be the one providing the visitor briefing. All visitors to the EZ will be escorted at all times. When visitors who are not UXO qualified enter the EZ, all MEC operations will cease, and will resume again after the visitor has left the area. Visitors will not be permitted in the restricted work areas unless they have the appropriate level of OSHA training and are medically approved. Visitors not complying with the above requirements will not enter the restricted work areas; however, they may observe site conditions from a safe distance. All visitors will make appropriate entries in the Visitor’s Log.

7.11 Emergency Response Training Requirements

All personnel will receive training in the Emergency Response and Contingency Procedures as part of their mobilization training. In addition to this training, First Responders will receive the following training in addition to being offered the Hepatitis B vaccine, if they have not already received it:

- First Aid/Cardiopulmonary resuscitation (CPR) Training,
- Bloodborne Pathogens Training.

7.12 Other Training Requirements

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The EOTI Documentation of Training Form doubles as the Tailgate Safety Brief Log/Form. The Tailgate Safety Briefing will be given prior to commencing work each day.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner. Subcontractor personnel will also attend the daily tailgate safety briefings each morning.

At the conclusion of each workday, debriefings for all employees will be held if appropriate, and the day’s work will be discussed to determine if changes are warranted before commencing the next day’s activities.

7.13 Training Documentation

A training record will be kept in each employee’s individual file to confirm that adequate training for assigned tasks is provided and that training is current. In addition, Documentation of Training Forms will be completed and kept on file at the work site for the duration of site activities, and made available for inspection upon request.

8.0 SAFETY AND HEALTH INSPECTIONS

Internal Safety and Health Inspections

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined below. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed. The following table lists the scheduled areas and frequency of inspection. More frequent inspections can be held at the discretion of the SUXOS/UXOSO.

AREA	FREQUENCY
Sanitation	Daily
Medical and First Aid	Daily
Temporary Facilities	Weekly
Personal Protective and Safety Equipment	Daily
Hazardous Substances, Agents, and Environments	Weekly
Lighting	Monthly
Accident Prevention Signs, Tags, Labels, and Signals and Piping System Identification	Monthly
Fire Prevention and Protection	Weekly
Hand and Power Tools	Daily, if applicable
Material Handling, Storage and Disposal	Weekly
Machinery and Mechanized Equipment	Daily, if applicable
Motor Vehicles	Weekly
Safe Access and Fall Protection	Weekly, if applicable
Hazardous, Toxic and Radioactive Waste (HTRW)	Daily, if applicable

External Inspections

Due to the location and type of work being performed on this site, it is anticipated that the only external inspections required would be an inspection by the USACE to confirm compliance with Work Plan and COE requirements. EOTI will also be prepared in the event that Local and State safety and health officials or other enforcement agencies may conduct inspections to ensure compliance with Local and State or Federal requirements.

9.0 SAFETY AND HEALTH EXPECTATIONS, INCENTIVES & COMPLIANCE

The goal for EOTI on this project is zero accidents. All managers and supervisors are responsible for implementing the provisions of this APP/SSHP and for answering team member questions about accident prevention. Management is responsible for ensuring that all safety and health policies and procedures are clearly communicated and understood by all team members. Managers and supervisors are expected to enforce the rules fairly and uniformly. This will be accomplished by:

- Informing team members of the provisions of the Safety and Health Program;
- Evaluating the safety performance of all team members;
- Recognizing team members who perform safe and healthful work practices;
- Providing training to team members whose safety performance is deficient; and
- Disciplining team members for failure to comply with safe and healthful work practices.

All team members are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment. EOTI recognizes that open, two-way communication between management and all team members on health and safety issues is essential to an injury-free, productive workplace. To facilitate a continuous flow of safety and health information between all team members that is readily understandable, the following will be accomplished:

- Training all new team members, during the site-specific training, on the site safety and health policies and procedures, which will include this APP/SSHP;
- Training all new team members on the hazards associated with the job site;
- Conducting daily tailgate safety meeting for all team members;
- Conducting quarterly refresher type training;
- Posting and, if applicable, distributing safety information; and
- Encouraging open communications.

9.1 Incentive Program

Safety Performance is a critical element in all performance evaluations. Managers are evaluated on the safety of all operations on their project sites. Other workers are evaluated on their own participation in the safety program and compliance with safety procedures. EOTI takes a team approach to safety and expects all personnel to participate actively in continuously looking for ways to improve safety performance.

9.2 Policy and Procedures Regarding Noncompliance with Safety Requirements

Disregard for safety and health requirements will not be tolerated. If the SUXOS, UXOSO and Project Manager determine that a team member is not sufficiently committed to conforming to established safety standards, the team member’s employment agreement will be terminated.

Safety rules and practices are established for the safety of all employees and to promote the welfare of the company. If the occasion arises whereby safety rules and practices established by the APP are violated, appropriate penalties will be imposed.

Infractions are divided into two categories: "Major" and "Minor". An example of a minor violation is reporting for work without the prescribed Level D PPE. Any violation of the APP that could have or did result in an accident involving personal injury or property damage is considered a major violation. The following guidelines are imposed for penalties:

Minor Violations

First Offense: Verbal warning to individual; offense to be noted in individual and supervisor's project file; discussion with individual's supervisor.

Second Offense: Written reprimand by the SUXOS will be entered in individual's file; discussion with individual and individual's supervisor.

Third Offense: Termination of employment recommended by the SUXOS to the Project Manager, who makes the final decision after discussion with the Corporate Health and Safety Manager and SUXOS.

Major Violations

Any Offense: Minimum penalty will consist of a written reprimand to be entered in individual's file and a discussion with individual and the SUXOS will be conducted. Depending upon severity of the violation, the SUXOS may temporarily dismiss the individual from the job site. If this occurs, the UXOSO or SUXOS will immediately report the incident to the Corporate Health and Safety Staff. Upon completion of a full investigation, the individual's employment may be terminated, if deemed appropriate, through a joint decision of the Program Manager, Project Manager, Corporate Health and Safety Staff, and SUXOS.

When a violation occurs:

- An investigation of the incident will be carried out by the UXOSO to determine if a violation has in fact occurred.
- If the UXOSO determines that a violation has occurred, the following actions will be accomplished:
  - Report of the violation will be submitted to the SUXOS and Corporate Health and Safety Staff by the UXOSO.
  - The UXOSO, in conjunction with the Corporate Health and Safety Manager and SUXOS, will determine if the violation is "major" or "minor".
  - The SUXOS, in conjunction with the Corporate Health and Safety Manager and the Project Manager, will determine the appropriate disciplinary action.

9.3 Procedures for Holding Managers Accountable for Safety

In all cases, supervisors are evaluated on the safety of project sites under their control. If investigation into project site accidents/incidents indicates negligence on the part of a supervisor, the investigation results will be discussed between the President/UXO Program Manager, the Project Manager and the Corporate Health and Safety Staff. If there is concurrence, and depending on the severity of the situation, the supervisor could be given a written reprimand or could be removed from duty in the case of serious negligence.

10.0 ACCIDENT REPORTING

10.1 Exposure Data

Exposure data on man-hours worked on a project, will be collected by the Project Manager. The Corporate Health and Safety Staff will be provided this information from the Project Manager in order to prepare accident statistics for the company and exposure reports for individual projects as required.

10.2 Accident Investigations, Reports, Logs

Investigation and documentation of emergency responses shall be initiated by the SUXOS/UXOSO. This is important in all cases, but especially so when the incident has resulted in personal injury, property damage, or environmental impact. The documentation will be a written report and will be inclusive of the following:

- Accurate, concise and objectively recorded information;
- Authentic Information: Each person making an entry must sign and date that entry. Nothing is to be removed or erased. If details are changed or revised, the person making the change should strike out the old material with a single line and initial and date the change;
- Titles and names of personnel involved;
- Actions taken, decisions made, orders given, to whom, by whom, when, what, where, and how, as appropriate;
- Summary of data available;
- Possible exposure of personnel; and
- Copies of the Employer's Report of Occupational Injury or Illness (OSHA Form 300) or the EOTI Accident Report, as appropriate will be completed and forwarded to the Corporate Health and Safety Manager.

Reportable injury and occupational illnesses fall into one of the following categories:

- Fatality, including missing and presumed dead;
- Permanent total disability;
- Lost workday case involving days away from work;
- Recordable case without lost workdays;
- Recordable first-aid case; and
- Non-recordable injury/illness.

The following unplanned events will also be investigated and reported:

- Damage to military property;
- Damage to contractor property; and
- Unplanned functioning of UXO.

All recordable and reportable accidents will be recorded on the OSHA Form 300, Log of Federal Occupational Injuries and Illnesses, which will be maintained at the EOTI Safety Office. [29 CFR 1904.2]

All accidents will be investigated and immediate steps will be taken to prevent recurrence. The APEX Project Manager and USACE Project Manager will be notified of any accidents occurring on this project site.

Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in EOTI's Oak Ridge, TN Office.

10.3 Immediate Notification of Major Accidents [29 CFR 1904.8]

Within 8 hours after the death of any employee from a work-related incident or the in-patient hospitalization of three or more employees as a result of a work-related incident, the employer shall orally report the fatality/multiple hospitalization by telephone or in person to the nearest Area Office of OSHA. This will be accomplished by the Health and Safety Staff. In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations.

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the response and coordination with responding off-site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Health and Safety Staff as soon as the situation is under control.

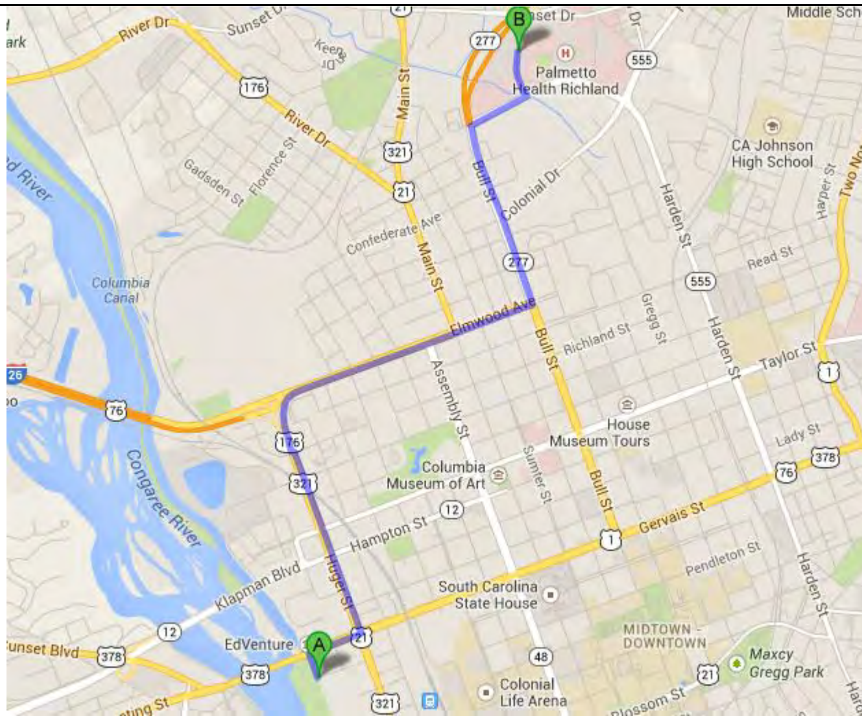
If the emergency involves employee injury, the UXOSO will complete the ENG Form 3394 Accident Report. The Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies where required. Once the emergency has been resolved, the UXOSO, Project Manager and Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

11.0 MEDICAL SUPPORT

A first aid kit will be placed in the site vehicles and the project office. A CPR mask and a bloodborne pathogen kit will also be kept with each first aid kit. The SUXOS will have final authority on the decision to require additional professional medical services (i.e., paramedics, hospital visit, etc.) for any illness or injury. Two site employees will be certified in First Aid and CPR. They will be the first responders to any site emergency and will render first aid/CPR as needed until medical assistance arrives on the scene. A Trauma First Aid Kit will be kept in the UXOSO vehicle.

All supervisory personnel shall maintain a phone listing of the nearest available medical assistance in the event of an accident. This telephone listing will be kept beside each telephone. The SUXOS will ensure that an Emergency Medical Assistance list is updated and provided to all supervisors. Directions to the nearest medical facility will be kept in each vehicle.

The nearest medical facility address is: **Palmetto Health Richland**
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 ** For Emergency Dial 911*



Driving directions to Palmetto Health Hospital

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N

0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E

1.1 mi

5. Turn left onto **Bull St** 0.7 mi

6. Turn right onto **Harden Street Extension**(signs for **Harden St**) 0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right

0.2 mi

12.0 PLANS, PROGRAMS AND PROCEDURES

12.1 PERSONAL PROTECTIVE EQUIPMENT PLAN

Whenever feasible, engineering controls as a priority and work practices, or a combination thereof, will be utilized to protect site workers from safety and health hazards and maintain personal exposures to hazardous substances below established exposure limits. The exposure limits used by EOTI will be the lower of the OSHA Permissible Exposure Limits (PELs) found in 29 CFR 1910 Subpart G and 29 CFR 1910.1000, or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Other recognized published exposure levels, such as those found on SDSs, will be used if the substance is not listed by OSHA or the ACGIH. EOTI will not utilize a system of employee rotation as a means of complying with the PEL, TLV, or other published limits.

Due to the expected hazards at this site during most operations, modified Level D PPE will be the requirement. Level D PPE is a work uniform affording minimal protection, used for nuisance contamination only. The following modified Level D equipment will be required on this site:

- Leather gloves.
- Face shields – when working around chain saws, weed whackers and vegetation removal equipment.
- Tinted or clear safety glasses with side shields or goggles.
- Hearing protection, where required by high noise levels, in the vicinity of heavy equipment operations, and vegetation clearance operations involving gas-powered equipment.
- Leather work boots with ankle support and non-slip soles (no steel toes that interfere with magnetometers).
- Cotton work clothes.
- Leg chaps – when working around vegetation removal equipment or snakes.
- Hard hat – when working around heavy equipment, and in the vicinity of chain saws, weed whackers and powered vegetation removal equipment.

Selection of PPE

Each task outlined in the Statement of Work will be assessed prior to its initiation to determine the potential of personnel exposure to safety and health hazards, which may be encountered during its conduct. The hazard assessment will be based on available information pertaining to the historical use of the site, site contaminant characterization data and the anticipated operational hazards. This information will be provided to, or collected by EOTI site personnel. The PPE assigned as a result of the hazard assessment represents the minimum PPE to be used during initial site activities. Since hazard/risk assessment is a continuing process, changes in the initial types and levels of PPE will be made in accordance with information obtained from the actual implementation of site operations and data derived from the site monitoring. As a general rule, the levels of PPE will need to be reassessed if any of the following occur:

- Commencement of a new work phase, or work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.
- Change in work scope, which affects the degree of contact with contaminants.

During the selection of PPE the Health and Safety Staff and UXOSO will also take into consideration the following factors:

- Limitations of the equipment.
- Work mission duration.
- Temperature extremes.
- Material flexibility.
- Durability/Integrity of the equipment.

12.1.1 Eye and Face Protection

All personnel will use appropriate eye or face protection when exposed to eye or face hazards from flying particles, liquid chemicals, or other eye hazards. All personnel will use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on or slide-on side shields) or goggles meeting the pertinent requirements of this section are acceptable. If there is a likelihood for glare, tinted safety glasses are recommended.

All personnel who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.

Eye and face PPE shall be distinctly marked to facilitate identification of the manufacturer. Protective eye and face devices will comply with ANSI Z87.1-1989, "American National Standard Practice for Occupational and Educational Eye and Face Protection," which is incorporated by reference as specified in Sec. 1910.6.

12.1.2 Head Protection

When working in the vicinity of heavy equipment, as well as vegetation clearance equipment, hard hats will be worn. While there is not expected to be a danger of impact to the head due to falling or flying objects during other operations, it is recommended that personnel wear caps or some type of head covering for protection from the sun.

12.1.3 Foot Protection

Due to the uneven working surfaces and potential for tripping hazards common to a UXO site, all EOTI personnel shall wear sturdy leather, work boots with ankle support and non-slip soles. Personnel using magnetometers for the detection of buried MEC will not wear steel-toe safety shoes, as they will affect the readings of the equipment. While working around heavy equipment, UXO personnel will wear steel or composite toe boots or slip on toe caps.

12.1.4 Hand Protection

EOTI selects and requires employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; thermal burns; and harmful temperature extremes. For most operations on this site, leather gloves will provide adequate protection against minor cuts, which are a hazard in most site operations.

12.1.5 Hearing Protection

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels (OSHA Action Level) or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

12.1.6 Emergency Equipment

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, and bloodborne pathogen kit, will be kept in each site vehicle. Portable eyewashes will be located in the work area and in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. A Trauma First Aid Kit will be maintained in the UXOSO vehicle.

12.1.7 Upgrading/Downgrading PPE

If work tasks are added or amended after completion and approval of the APP, the SUXOS/UXOSO will conduct the task hazard assessment and consult with the Corporate Health and Safety Manager. The level and type of PPE to be used will be identified. The Corporate Health and Safety Staff will allow any changes in PPE, which involve downgrading of the level of PPE, only after review of documentation demonstrating that the conditions and/or potential for hazardous exposure are reduced enough to justify the downgrade.

12.1.8 Purchasing PPE

The MEC Safety and Health Coordinator will maintain a list of sources for purchasing PPE and will assist the Project Manager in ordering the correct type and amounts of the PPE to accomplish the project objectives.

12.1.9 General Requirements

All personal protective equipment will be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary. PPE is required due to hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact. All PPE will be used in the manner for which it was designed. The assignment of PPE will be based upon hazard analysis, and the equipment will be selected based on its protection factor against site hazards.

12.1.10 Inspection

Each piece of PPE will be inspected daily prior to use. Defective or damaged personal protective equipment will not be used. It will be removed from service and turned in for repair, or removed from the site for disposal and replaced with new PPE.

12.1.11 Training

EOTI will provide training to each employee who is required by this section to use PPE. Each affected employee will demonstrate an understanding of the training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE. Each such employee will be trained to know at least the following:

- The decisions and justifications used to select each piece of PPE.
- The nature of the hazards and the consequences of not using PPE.
- What PPE will be required to conduct each task.
- When PPE will be required during the performance of each task.
- How to properly don, doff, adjust and wear each piece of PPE.
- The proper inspection, cleaning, decontaminating, maintenance and storage of each PPE item used.
- The limitations of the PPE.

All personnel receiving PPE training will be required to demonstrate an understanding of the training topics and the ability to correctly use the PPE. This will be accomplished through the UXOSO supervising and visually inspecting each individual's ability to properly don and use the PPE during initial use of the PPE.

When the SUXOS or UXOSO has reason to believe any affected employee who has already been trained does not have the understanding and skill required he should retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete; or
- Changes in the types of PPE to be used render previous training obsolete; or
- Inadequacies in an affected employee’s knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

Upon completion of the training and after each employee has successfully demonstrated the requisite understanding, the SUXOS or UXOSO will complete the Documentation of Training form. This identifies: the employees who attended the training course and successfully demonstrated the required knowledge; the date(s) of the training and demonstration session(s); and the PPE covered by the training session.

12.1.12 Cleaning and Decontamination

The UXOSO will be responsible for ensuring that PPE is in good, clean, working order prior to issuing the PPE the first time. Once issued, site personnel will ensure that re-usable articles of PPE are maintained in a clean and sanitary fashion. For items used inside an EZ, site personnel will ensure that the PPE is properly decontaminated as appropriate before removing the item from the EZ or Contamination reduction Zone (CRZ).

12.1.13 Maintenance

Maintenance of PPE can vary greatly, based upon the complexity of the PPE and the intricacy of the repair involved. The UXOSO will become familiar with the manufacturer's recommended maintenance and when possible repair defective PPE. If unable or unauthorized to conduct the repair, the UXOSO will return the item to the manufacturer for repair, or procure a replacement.

12.1.14 Storage

PPE will be stored in a location, which is protected from the harmful effects of sunlight, damaging chemicals, moisture, extreme temperatures, impact or crushing. If needed, the SUXOS will designate a specified area for the storage of PPE.

12.2 LAYOUT PLANS

Layout plans are not applicable for this project, as temporary structures are not being constructed.

12.3 EMERGENCY RESPONSE PLANS

12.3.1 Procedures and Tests

The SUXOS and UXOSO will coordinate to perform the following pre-emergency tasks before starting field activities and during the mobilization and site specific training phase of the project, and will coordinate emergency response with emergency medical technician (EMT)/police/fire/adjacent industry personnel or other emergency response personnel when appropriate:

- Locate telephone stations;
- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the Emergency Response Contingency Plans (ERCP); and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

Before normal activities are resumed, onsite personnel must be prepared and equipped to handle another emergency. These follow-up activities should be completed:

- The Corporate Health and Safety Staff will notify appropriate government agencies as required (Reminder: OSHA must be notified if there have been any fatalities or three or more hospitalizations).
- All equipment and supplies restocked, serviced and inspected; and
- Review and revise all aspects of the Health and Safety Plan as necessary to address and prevent future emergencies of this type.

12.3.2 Spill Plans

In the event of a spill or leak of any potentially harmful material (regardless of quantity) on site personnel will:

- Notify the SUXOS immediately;

- The SUXOS shall notify the Project Manager of the spill/leak with relative information (location, time, chemical identity, quantity, hazards listed on the SDS), and any corrective actions/measures taken;
- Locate the source and stop the leak/spill if it can be done safely (as dictated by the SUXOS);
- Begin containment and recovery of spilled material (as directed by the SUXOS), using appropriate PPE and spill clean-up equipment and materials; and
- Once notified, the EOTI Project Manager will in turn notify the APEX Project Manager and USACE Project Manager.

12.3.3 Firefighting Plans

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SUXOS and UXOSO and based on whether the fire is small, large or involves explosives.

12.3.4 Small Fires

A small fire is defined as a fire that can most likely be extinguished by site personnel using portable extinguishers. A small fire must also be free and clear of explosive materials, especially MEC. If a small fire occurs, the SUXOS or UXOSO will direct site personnel to perform the following, if safe to do so:

- Evacuate unnecessary personnel to an upwind position;
- Attempt to extinguish the fire using portable fire extinguishers or by smothering;
- Remove any essential or flammable items from the path of the fire; and
- Notify emergency response services (fire, police, ambulance, hospital, etc.) as needed.

If a fire extinguisher is used, this must be immediately reported to the SUXOS. The fire extinguisher must be immediately removed from service until it can be recharged. Another fire extinguisher must be made available to the operating area. The area around where the fire occurred must be watched for a minimum of 30 minutes after the fire has been extinguished to assure re-ignition does not occur. If personnel are not working in the area, the SUXOS should check the area of the fire periodically to assure re-ignition does not occur.

12.3.5 Large Fires

A large fire is defined as a fire, which due to its size, cannot be extinguished using portable fire extinguishers. In the event that a large fire occurs and the fire does not involve explosive materials, the SUXOS/UXOSO will direct personnel to conduct the following, if safe to do so:

- Evacuate all non-essential personnel from the site to an upwind location;
- Notify the Fire Department and other emergency response services (police, ambulance, hospital, etc.) as needed;
- Notify adjacent industries and neighbors;
- Order the appropriate level of protective equipment to be worn by personnel responding to the fire;
- Attempt to control the fire to the extent possible; and
- Remove any essential or flammable items from the path of the fire.

12.3.6 Fires Involving Explosive Materials

If a fire occurs which involves explosive materials such as chemicals, fuels or MEC, the SUXOS will order the immediate evacuation of all site personnel to an upwind assembly point at least maximum fragmentation distance from the fire site. The SUXOS will then notify the Fire Department, adjacent industries and any other emergency services (police, ambulance, hospital, etc.) as needed. At no time will EOTI personnel fight a fire involving explosive materials, nor will they allow outside emergency personnel to do so. The Fire Department personnel may not enter any closer than maximum fragmentation distance from the fire and they may spray water to surrounding buildings, structures, etc. in order to prevent the spread of fire.

After the fire has burned itself out, the site must be barricaded and entry prohibited until adequate cooling time has passed (at least 24 hours for a large fire). Explosive materials that may not have discharged during the fire may still be liable to function in the presence of extreme heat. After the site has cooled down, the SUXOS and UXOSO will inspect the site and conditions of any MEC involved in the fire, and make a determination as to whether or not the site is safe for others to enter.

If non-UXO qualified personnel must enter the site for purposes of fire investigation, etc. they must receive a briefing on the potential hazards of MEC on the site. They must be accompanied at all times by a UXO-qualified employee of EOTI. NO OUTSIDE PERSONNEL WILL BE PERMITTED ONTO THE SITE WHILE THERE IS A KNOWN MEC HAZARD PRESENT. If, during the course of the investigation, MEC is observed, the site will be evacuated of all non-UXO qualified personnel until the site can be rendered safe for re-entry.

12.3.7 Explosions

In the event of an accidental explosion, the SUXOS will order the evacuation of all site personnel to a safe, upwind assembly point at least fragmentation distance away. The SUXOS will then notify all necessary emergency response services. After an explosion has occurred the site will remain barricaded a minimum of 30 minutes before entry is permitted if no smoke/burning is observed.. If smoke or burning is observed wait 60 minutes after smoke/burning has stopped. The SUXOS/UXOSO will enter the site with a team member and inspect for presence and condition of MEC. Non-UXO qualified personnel may not enter the area until all known MEC has been removed or destroyed. If non-UXO qualified personnel need to enter the site, they must first be briefed on the potential hazards of the site. They must be accompanied at all times by an UXO-qualified employee. If MEC is discovered during the course of their visit, they must immediately leave the site until it can be rendered safe for re-entry.

12.3.8 Posting of Emergency Telephone Numbers

Emergency Response / Services	
Ambulance Service	911
Emergency Medical Response	911
Police*	911
Police Department – Non emergency	803-545-3500
Hospital-Palmetto Health Richland 5 Richland Medical Park Dr Columbia, SC 29203	803-434-7000 * For Emergency Dial 911
Fire Department*	911
Fire Department – Non Emergency	803-545-3700
National Poison Control Center	800-222-1222
CHEMTREC (hazardous materials response)	800-424-9300
National Response Team (hazardous materials response)	800-424-8802

Centers for Disease Control (CDC) http://www.cdc.gov/health/diseases			800-311-3435
Project Management / Coordination			
EOTI			
	Program Manager	Wayne Lewallen	732-673-6017
	Project Manager	Brian Woods, P.G., PMP	865-200-8081
	Safety Manager	David Farmer	865-200-8081
APEX			
	Project Manager	Rusty Contrael	412-829-9650
USACE			
	TBD	TBD	TBD
Explosives Supplier			
	TBD	TBD	TBD

12.3.9 Wild Land Fire Prevention Plan

A Wild Land Fire Prevention Plan is not expected to be needed on this site. It is anticipated that heavy vegetation will be cut prior to beginning work that could result in an accidental fire and therefore excess vegetation that could contribute to a fire is not expected. However, fire extinguishers will be present at the job site and would be used to immediately put out any small fire that would start in the area, thereby preventing large fires from developing.

12.4 Man Overboard/Abandon Ship

As work covered under this project will be conducted on dry land, a Man Overboard/Abandon Ship plan is not required.

12.5 Hazard Communication Program

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations, and all site personnel will be made aware of that fact. This SDS binder will be available on request to all site personnel during all working hours. If site workers have further questions about any of the hazardous materials they encounter, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

All employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product, proper labeling of secondary containers, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request an SDS for any hazardous material on the site at any time. This training will occur as part of the initial mobilization training at the site and will be documented on the EOTI Documentation of Training Form.

12.6 Respiratory Protection Plan

Due to the type of work taking place, respirators are not expected to be required on this site. Should unforeseen hazards develop, which would require a respirator, the EOTI Respiratory Protection Program would be followed per Chapter 16 of the EOTI Corporate Health and Safety Program.

12.7 Health Hazard Control Program

Due to the type of work that will be taking place on this project site, toxic, high hazard environments are not anticipated.

12.8 Lead Abatement Plan

As lead is not expected to be a contaminant on this site, a Lead Abatement Plan will not be required. However, if lead should be encountered, a Lead Abatement Plan will be prepared in accordance with the requirements of Chapter 38 of the EOTI Corporate Health and Safety Program.

12.9 Asbestos Abatement Plan

As asbestos is not expected to be encountered on this site and therefore, an Asbestos Abatement Plan is not required.

12.10 Abrasive Blasting Plan

Abrasive blasting is not required on this project.

12.11 Confined Space Plan

Work in confined spaces is not expected to occur on this project, as the depth of excavation is not expected to exceed 48 inches. If deeper excavations are required, sides of the excavations will be sloped at a ratio of at least 2 horizontal feet for every 1 vertical foot of excavation to protect workers from cave-ins and allow easy in and out of the excavated areas. However, if confined space work becomes necessary, it will be accomplished in accordance with the EOTI Confined Space Program.

12.12 Power Tool and Equipment Hazardous Energy Control Plan

The work on this project may require the use of power tools and excavation equipment that would require a Tool and Equipment Hazardous Energy Control Plan.

By their very nature, power tools and heavy equipment have the capability of inflicting serious injury upon site personnel if they are not used and maintained properly. To control the hazards associated with power tool and equipment operation, the requirements outlined in USACE EM 385-1-1, Section 12 and the safe work practices listed below shall be observed when using power tools and equipment:

- Operation will be conducted by authorized personnel familiar with the tool or equipment, its operation, and safety precautions.
- Power tools and equipment will be inspected prior to use, and defective equipment will be removed from service until repaired or replaced.

- Power tools and equipment designed to accommodate guards will have such guards properly in place prior to use.
- Loose fitting clothing or unrestrained long hair will not be permitted around moving parts of power tools or equipment.
- Hands, feet, etc. will be kept away from all moving parts.
- Maintenance and/or adjustments to equipment will not be conducted while it is in operation; the power will be locked out according to the Lock Out/Tag Out protocol in OSHA 29 CFR 1910.147 prior to maintenance activities.
- All maintenance activities will be performed by personnel experienced and authorized to make the repairs, or it will be sent to the manufacturer for repair.
- An adequate operating area will be provided, allowing sufficient clearance and access for operation.
- Good housekeeping practices will be followed at all times.
- Safety glasses with side shields, goggles, or face shields shall be worn at all times while operating power tools and equipment or when working in the vicinity of operating power tools and equipment.

12.13 Critical Lift Procedures

EOTI will not be performing any crane operations on this project, so critical lift procedures will not be required. Should the scope of work change, EOTI will prepare critical lift procedures in accordance with the EOTI Heavy Equipment Program found in the EOTI Corporate Health and Safety Program.

12.14 Contingency Plan for Severe Weather

Rain, dust storms, electrical storms, and tornadoes in this geographic area can constitute a safety hazard to field operations at the project site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so windy, wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS and UXOSO determine it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

12.15 Access and Haul Road Plan

There are no plans to create access and haul roads for this project, so the Access and Haul Road Plan is not required.

12.16 Demolition Plan (Engineering and Asbestos Surveys)

As work on this plan does not involve demolition of buildings containing asbestos containing material, the Demolition Plan is not required.

12.17 Emergency Rescue (Tunneling)

As work on this project does not involve tunneling operations, this Emergency Rescue plan is not required.

12.18 Underground Construction Fire Prevention and Protection Plan

As underground construction is not required on this project, the Underground Construction Fire Prevention and Protection Plan is not required.

12.19 Compressed Air Plan

As there are no plans to use compressed air on this project, a Compressed Air Plan is not required.

12.20 Formwork and Shoring Erection and Removal Plans

As this project will not involve formwork and shoring erection and removal, this plan is not required.

12.21 Jacking Plan (Lift) Slab Plans

As there will be no Lift Slab work on this project, this plan is not required.

12.22 Blasting Plan

EOTI will destroy MPPEH and potentially hazardous MEC by detonation in either consolidated shots or by Blow-In-Place (BIP) (if items are unacceptable to move). EOTI will also use explosive or mechanical means to vent MEC scrap prior to disposal. A detailed description of EOTI's Blasting plan and procedures is given in Section 3.7 of the Work Plan.

12.23 Diving Plan

Diving portions under this project are covered under a Diving Plan with accident prevention that has been submitted separately and is under a separate approval process.

12.24 Plan for Prevention of Alcohol and Drug Abuse

The use, sale, dispensing, possession, or manufacture of illegal drugs, alcohol, and narcotics on EOTI premises or work sites is prohibited. Employees will be subject to disciplinary action, up to and including termination, for bringing illegal, non-prescribed drugs and narcotics or alcoholic beverages to the workplace; being under the influence of such substances while working; using such substances while at work; or dispensing, distributing, or illegally manufacturing or selling these substances on EOTI premises and work sites.

EOTI does not regulate the conduct of employees during personal time off. However, misconduct due to the abuse of drugs, narcotics, or alcohol may bring discredit to EOTI its subcontractors and its clients. If, in the judgment of EOTI management, an employee's abuse of drugs, narcotics, or alcohol adversely affects his/her ability to perform the duties intended, that employee may be terminated for cause.

Any employee who notices another employee demonstrating unusual behavioral patterns that appear to be drug, narcotic, or alcohol related must report the observed behavior to management.

Employees may be required to submit to a test, whenever reasonable cause exists, to determine the presence of drugs, narcotics, or alcohol unless law prohibits such tests. Refusal to submit to testing constitutes grounds for termination of employment for cause. An employee judged to be under the influence of drugs, narcotics, or alcohol will be required to leave the premises. The Employee's Supervisor will arrange to have the employee escorted home.

Drug screening will occur as part of the annual physical. If the drug screen is positive for illegal drugs, the employee will not be permitted to work on the EOTI project site.

An employee who is diagnosed as an alcohol or drug abuser may be terminated or required to take a leave of absence without pay to undergo rehabilitation. The employee will not be permitted to return to work until medical certification is presented as evidence that the employee is drug-free and capable of performing his/her duties. Failure to cooperate with an agreed-upon treatment plan may result in disciplinary action, up to and including termination.

The status of an employee on drug/alcohol rehabilitation leave-of-absence will be reviewed by management on a case-by-case basis. Absences extending beyond six months will require medical recertification. Employees on leave for more than one year will be considered for termination without prejudice.

If an employee is taking prescription drugs for a medical condition while under a doctor's care, the SUXOS should be made aware of the situation. The side effects of some medications can reduce alertness and judgment, and may cause a potential safety hazard to the employee and/or others working in the vicinity, such as a heavy equipment operator becoming drowsy while operating equipment. In cases such as this, the SUXOS has the discretion to re-assign the individual to a less hazardous position on the site until the condition is cleared and medication is no longer required. If there are no other positions available on the site, which would be safe for the individual to perform, he may be placed on sick leave or leave without pay until the condition clears up and he is medically approved to resume work.

12.25 Fall Protection Plan

As work will be occurring at ground level and below, a Fall Protection Plan is not required. Excavations will be well marked with tape and/or barricades and personnel will be advised to stay away from the perimeter, as will the operators of the heavy equipment. Work will not occur during hours of darkness, when personnel might be less likely to see the excavation.

12.26 Steel Erection Plan

As no steel erection will be taking place on this project, this plan is not required.

12.27 Night Operations Lighting Plan

As there are no plans to operate during hours of darkness, there is no requirement for a Night Operations Lighting Plan.

12.28 Site Sanitation Plan

Adequate sanitation facilities will be provided at the work site to ensure proper personal hygiene. Site sanitation will be established and maintained in accordance with OSHA 29 CFR 1910.120(n).

An adequate supply of potable (drinkable) water shall be provided on site at all times, and will be supplied in accordance with the following provisions:

- Containers used for potable water shall be capable of being tightly closed, equipped with a tap and maintained in a clean and sanitary condition.
- A container used for distribution of drinking water shall be clearly labeled as to its contents and not used for any other purpose.
- Water shall not be dipped from the container and use of a common cup will not be allowed.
- Where single service cups are provided, separate sanitary containers will be provided for the storage of the unused cups and for the disposal of the used cups.

Outlets and storage containers for nonpotable water, such as water for firefighting or decontamination will be clearly labeled to indicate that the water is not suitable for drinking, washing or cooking. There will at no time be a cross connection or open potential between a system furnishing potable water and a system furnishing nonpotable water.

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the support zone (SZ), as required to support field personnel. Toilets will be appropriately maintained, vented and will be capable of being locked from the inside. There will be at least one toilet for every 15 site personnel.

Hand and face washing facilities will be set up in the SZ of the work area. These will be utilized by all personnel exiting the EZ prior to eating, drinking, using tobacco or other hand to face activities. Portable eyewash will be available in site vehicles and the office trailer.

12.29 Fire Prevention Plan

Fire Protection: Portable fire extinguishers are rated and classified with NUMERAL and LETTER designations, based on fire tests conducted by the Underwriters Laboratories, Inc. (UL) or other nationally recognized testing laboratories. The numeral rating indicates the relative extinguishing effectiveness of extinguishers classified for Class A and B fires only. The Letter classified coincides with the class of fire. Extinguishers found to be effective on more than one class of fire have multiple letter classifications. Example: B:C

The rating of hand-portable fire extinguishers is based on the following:

- Class A fire extinguisher is used for ordinary combustible materials.
- Class B fire extinguisher is for flammable liquids.
- Class C fire extinguisher is for electrical fires.
- Class D fire extinguisher is for combustible metal fires.

Many fires are small at origin and may be extinguished by the use of proper hand-portable fire extinguishers. The fire department will be notified as soon as fire is discovered. This alarm should not be delayed awaiting result of application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

- The extinguisher is properly located and in working order.

- The extinguisher is of proper type for a fire, which may occur.
- The fire is discovered while still small enough for the extinguisher to be effective.
- The fire is discovered by a person ready, willing, and able to use the extinguisher.
- Class A fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Those extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.
- Water or water-mixture type extinguishing agent must not be used under any circumstances on energized electrical equipment (Class C) fires. Whenever possible, electrical equipment and circuits should be de-energized before attacking a Class C fire. Due to its corrosive nature, dry chemical is not recommended for use on computerized, electronic or other equipment with extensive circuitry.

Fire Prevention: In order to prevent fire from occurring in the first place, every step will be taken to keep the site neat and clean. All equipment and materials not in use will be put away in designated locations. There will be trash cans with lids at the site, which will be emptied on a daily basis to keep trash from accumulating. All flammable liquids will be stored in approved flammable liquid cans in order to prevent spillage and ignition of the material. Bonding and grounding procedures will be in place whenever transferring flammable liquids from their designated containers and into equipment. Equipment will never be fueled in the back of a pick-up truck with a bed liner in it. Personnel handling explosive and/or flammable materials will wear cotton under and outer garments to prevent build-up and transfer of static electricity.

13.0 CONTRACTOR INFORMATION

EOTI is the prime contractor on this project. This APP has been prepared by EOTI based on EOTI procedures. In addition, subcontract site personnel will be familiar with and will comply with Project procedures and safety requirements.

14.0 HAZARD ANALYSIS

An activity hazard analysis (AHA) has been conducted and documented as outlined below for each activity warranted by the hazards associated with the activity. For this project, the following AHA have been prepared for all anticipated field operations:

- Site-Setup/Layout
- Surface Preparation/ Vegetation Removal
- Subsurface Clearance using “Mag & Dig” Methods
- Transportation of Explosives
- Disposal of MEC
- Mechanical Excavation

Should conditions, equipment, or types of operations change during the course of the project work, the Corporate Health and Safety Staff will review an updated existing AHA for continuing work, or prepare a new one for new types of operations.

Risk management is and will continue to be integrated into the planning, preparation, and execution of work at the site. Risk management is a dynamic process, and is continuously improved upon, as personnel become more familiar with the site operations, equipment, environment, etc. Personnel are urged to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the SUXOS/UXOSO. Control measures will be developed and coordinated. All personnel are responsible to continuously assess variable hazards and implement risk controls.

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td>ACTIVITY: Site Setup/ Lay-out</td><td colspan="2">ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• UXO personnel will accompany subcontracted survey personnel responsible for marking the work areas.
• UXO personnel will lead the team into area and will clear the path of entry into the site. If MEC is encountered, path will be routed around it.
• If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.
• Where intrusive operations, such as driving stakes, are required UXO personnel, using geophysical equipment, will determine if there are potential MEC beneath the ground surface.
• If potential MEC is located below the ground surface, the area for the intrusive operations will be moved.
• Magnetometers will be used for each two feet of depth for intrusive operations to assure accuracy of readings.</td><td>• MEC hazards
• Experience Modification Rate (EMR) for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Muscle strain carrying instruments
• Heat/Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Sunburn
• Glare of sun</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy, leather, work boots with ankle support and non-slip soles.
• Follow appropriate lifting/ carrying procedures. (Corporate Safety and Health Plan) CSHP Chp21)
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold.
• Training in biological hazards avoidance. (CSHP Chp 21)
• Long sleeved shirts, long pants, cap, and use sun screen.
• Tinted glasses.
• SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with of the Work Plan.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Appropriate geophysical equipment / magnetometer.
• Footwear with ankle support and non-slip soles.
• Back braces (optional).
• Communications to determine Wet Bulb Globe Temperature (WBGT) Index, drinking water.
• Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves and leg chaps).</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.
• Equipment inspected daily prior to use.
• PPE inspected daily prior to use</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific MEC training will be presented to all site personnel.
• Site specific training, slip/fall hazards.
• Site-specific training/lifting techniques.
• Heat Stress / Cold Stress symptoms/first aid.
• Site-specific flora/fauna to include first aid.
• PPE training.
• Current HAZWOPER Training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><th colspan="2">ACTIVITY: Surface Preparation / Vegetation Removal (if required)</th><th>ANALYZED BY/DATE: D. Farmer June 2014</th></tr>
<tr><th>PRINCIPLE STEPS</th><th>POTENTIAL SAFETY/HEALTH HAZARDS</th><th>RECOMMENDED CONTROLS</th></tr>
<tr><td>• UXO personnel will visually examine the surface for MEC.
• If there are areas where dense vegetation prevents a visual surface clearance, geophysical equipment (hand held magnetometers) may be used to detect surface MEC.
• If vegetation is extremely dense in some areas, vegetation clearing may be required using rotary mowers, chain saws and weed whackers.
• If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.
• Following the surface clearance, the area will be cleared for entry.</td><td>• MEC hazards
• EMR for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Heat Stress/Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Muscle strain carrying instruments/equipment.
• Lacerations and cuts from vegetation clearing equipment.
• Eye/face injuries due to use of vegetation clearing equipment.
• Noise
• Sunburn
• Glare of sun</td><td>• Training on MEC and equipment on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles.
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold.
• Training in biological hazards avoidance. (CSHP Chp 21)
• Follow appropriate lifting/ carrying procedures. (CSHP Chp21)
• PPE – leather gloves and leg chaps during vegetation clearance operations.
• PPE – safety glasses and hard hat with face shield during vegetation clearance operations.
• PPE – hearing protection during vegetation clearance operations
• PPE – wear long sleeved shirts, long pants and a cap, use sunscreen
• PPE – wear tinted glasses.
• SUXOS ensures UXO personnel are qualified to perform assigned tasks, in accordance with the Work Plan.</td></tr>
<tr><th>EQUIPMENT TO BE USED</th><th>INSPECTION REQUIREMENTS</th><th>TRAINING REQUIREMENTS</th></tr>
<tr><td>• Geophysical equipment (handheld magnetometers).
• Vegetation removal equipment: Rotary mowers, chain saws and weed whackers.
• Footwear with ankle support and non-slip soles.
• Communications to determine WBGT Index, drinking water.
• Appropriate clothing / PPE (to include protective eyewear, gloves, and chaps if necessary)
• Hard hat, face shield, hearing protection and leg chaps during vegetation clearance operations.
• Steel toe or composite toe boots, or slip on toe guards</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.
• Equipment inspected daily prior to use.
• PPE inspected daily prior to use</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific MEC training will be presented to all site personnel.
• Site specific training, slip/fall hazards.
• Heat Stress / Cold Stress symptoms/first aid.
• Site-specific flora/fauna to include first aid.
• Training in proper lifting techniques.
• Training in use of equipment.
• Noise prevention training
• PPE training.
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Subsurface Clearance using “Mag and Dig” Methods</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Lanes will be established throughout the footprint of each work site.
• UXO personnel will walk down each lane with handheld magnetometers to identify subsurface anomalies.
• If anomalies are identified that may be caused by MEC / MPPEH, it will be investigated by mechanical and / or hand digging.
• If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.</td><td>• MEC hazards
• EMR for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Heat Stress/Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Muscle strain carrying instruments/equipment.
• Lacerations and cuts from frag or tools.
• Eye/face injuries due to use of vegetation clearing equipment.
• Noise
• Sunburn
• Glare of sun
• Heavy equipment operation (noise, crushing, etc.)</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy leather, work boots with ankle support and non-slip soles.
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization. Proper cold weather clothing and warming areas in extreme cold.
• Training in biological hazards avoidance. (CSHP Chap 21)
• Follow appropriate lifting/ carrying procedures. (CSHP Chap 21)
• Training in heavy equipment operation and excavation procedures.
• PPE – leather gloves and leg chaps during vegetation clearance operations.
• PPE – safety glasses and hardhat with face shield during vegetation clearance operations.
• PPE – wear long sleeved shirts, long pants and a cap, use sunscreen
• Maintain minimum team separation distances and exclusion zones to protect workers and the public from unintentional detonation.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Geophysical equipment (handheld magnetometers).
• Excavation equipment: Shovels / backhoe/ excavator.
• Footwear with ankle support and non-slip soles.
• Back braces, optional.
• Communications to determine WBGT Index, drinking water.
• Appropriate clothing and PPE (to include protective tinted eyewear, leather gloves, and leg chaps if snakes are a problem)
• Hardhat, face shield, hearing protection and leg chaps during vegetation clearance operations.</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.
• Equipment inspected daily prior to use.
• Ensure safety features such as backup warnings, seatbelts, lights, gauges, etc. are in place and functioning properly.
• PPE inspected daily prior to use.</td><td>• UXO personnel will be properly trained / qualified.
• Site-specific MEC training will be presented to all site personnel.
• Site specific training, slip/fall hazards.
• Heat Stress / Cold Stress symptoms/first aid.
• Site-specific flora/fauna to include first aid.
• Training in proper lifting techniques.
• Training in use of equipment.
• Noise prevention training
• PPE training.
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Transport of Explosives (If Required)</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Inspect vehicles to ensure proper working condition.
• Ensure vehicles are properly equipped with seat belts, placards, fire extinguishers, and equipment for securing load
• Explosives will be packed so items are not touching one another.
• Explosives transported on public roads will be packed and labeled in accordance with Department of Transportation rules and regulations.
• Boxes are secured to prevent shifting.
• Transport to designated disposal location</td><td>• Explosive hazards
• Vehicle accidents
• Fire
• Heat stress</td><td>• Complete motor vehicle inspection form.
• Licensed driver
• Driver and all passengers will use seat belts when vehicle is in operation.
• Vehicle will be placarded while traveling on public roads.
• Explosives will be placed securely in back of vehicle and anchored to prevent movement.
• Vehicles will not be left unattended.
• Driver will observe posted speed limits.
• A minimum of 2 persons in vehicle during transport.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Vehicle
• Safety Equipment: seat belts, first aid kit, two-way communication, emergency eyewash kit, bloodborne pathogen kit, Hazard Material spill response kit, 2 fire extinguishers
• Explosive placards
• Explosive storage boxes
• Roadside emergency markers
• Level D PPE: Cotton clothing, leather gloves, leather work boots, safety glasses
• Drinking water and cups</td><td>UXOSO/QC will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.

• Equipment inspected daily prior to use.
• PPE inspected daily prior to use.
• Inspect packing, labeling, and security of explosives.</td><td>• UXO personnel will be properly trained / qualified.
• Driver must have valid driver’s license
• Training in fire extinguisher usage and trained not to fight fire involving explosives.
• Site-specific UXO training will be presented to all site personnel.
• Heat stress training and first aid
• Training in small quantity spill clean-up
• All site personnel will have current HAZWOPER training.</td></tr>
</table>

ACTIVITY HAZARD ANALYSIS		
ACTIVITY: Disposal of MEC	**ANALYZED BY/DATE: D. Farmer June 2014**	
PRINCIPLE STEPS	**POTENTIAL SAFETY/HEALTH HAZARDS**	**RECOMMENDED CONTROLS**
• Establish EZ based on MEC item around disposal area. • Make required notifications of demolition/venting operations. • Retrieve donor explosives. • Set up demolition charges IAW procedures • Use engineering controls, if required, to reduce the fragment travel range. • Post sentries outside Fragmentation Zone on all access roads • Ensure sentries have a full view of demolition and access areas. • Contact sentries to ensure that no pedestrian traffic is in the vicinity • Evacuate demolition crew to a safe location • Demolition occurs. • Inspect demolition site to ensure that demolition/venting has been completed properly.	• MEC hazards • Slips, trips and falls • Biological hazards – plants, spiders, ticks, mosquitoes, snakes, rodents, etc. • Heat stress • EMR/static electricity hazards • Overpressure hazards due to blast. • Fragmentation hazard due to blast. • Eye hazard • Noise hazard • Cuts and abrasions hazard • Unauthorized personnel entering EZ during operations • Sunburn	• Training on MEC on site. • Be observant when walking, and wear leather, work boots with ankle support and non-slip soles. • WBGT readings, drinking water, work/rest schedule. • Clothing, radios and cell phones will not be used in the area once the pit is primed or during the priming process, unless radios are at the firing point and the firing line is shunted. • Establish EZ to reduce blast and overpressure hazards. • Use PPE and distance to relieve fragmentation and overpressure hazards. • EZ sentries will be posted at access road barricades to prevent unauthorized entry. • EZ sentries will wear orange vests during operations and maintain radio communications with demolition team supervisor • Demolition crew will observe frag distance when seeking shelter from blasting. • Hearing protection. • Procedures for demolition operations in Work Plan will be followed.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
• Donor explosive materials • Blasting circuits • PPE (Orange safety vests, cotton clothing, leather gloves, leather work boots with non-slip soles, safety glasses, hearing protection. • Radio communications	**UXOSO/QC** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use	• UXO personnel will be properly trained / qualified. • Site-specific UXO training will be presented to all site personnel. • Heat stress training. • Training in safe operating procedures, emergency procedures and PPE requirements during demolition operations. • All site personnel will have current HAZWOPER training.

<table>
<tr><th colspan="3">ACTIVITY HAZARD ANALYSIS</th></tr>
<tr><td colspan="2">ACTIVITY: Mechanical Excavation (if required)</td><td>ANALYZED BY/DATE: D. Farmer June 2014</td></tr>
<tr><td>PRINCIPLE STEPS</td><td>POTENTIAL SAFETY/HEALTH HAZARDS</td><td>RECOMMENDED CONTROLS</td></tr>
<tr><td>• Establish exclusion zone around project site footprint.
• Prior to intrusive operations, locate large anomalies using hand held magnetometer equipment.
• Investigate when within one foot of anomalies using hand-digging methods.
• Carefully dig around the item, so that it can be identified and examined for condition.
• Excavate soil in lifts of up to 1 foot and re-sweep the area for large anomalies
• If MEC is encountered, the area will be marked and the item will be evaluated and disposed of in accordance with the work plan.
• If inert Munitions Debris (MD) is encountered, it will be inspected and certified as inert and secured at a collection point</td><td>• MEC hazards
• EMR for Electric Fuzes
• Uneven working surfaces – slip, trip, fall hazards.
• Muscle strain carrying instruments
• Heat Stress / Cold Stress
• Biological hazards - poisonous plants, bees, wasps, ticks, mosquitoes, rodents, and snakes.
• Unauthorized personnel entering site during operations
• Heavy equipment operations (noise, dust, exhaust, crushing hazards).
• Fueling hazards
• Pinching/crushing hazards from moving equipment
• Moving equipment hazards within arc of bucket</td><td>• Training on MEC on site.
• Controlled use of radios and cell phones.
• Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles.
• Follow appropriate lifting/ carrying procedures. (CSHP Chp21)
• Heat stress monitoring, drinking water, work-rest schedule, and acclimatization.
• Training in biological hazards avoidance; PPE. (CSHP Chp 21)
• Site control measures will be implemented and exclusion zone established.
• Training in heavy equipment operations and excavation procedures, PPE.
• Follow fueling precautions in Section 15.9.
• No one will be within the arc when equipment is operating.</td></tr>
<tr><td>EQUIPMENT TO BE USED</td><td>INSPECTION REQUIREMENTS</td><td>TRAINING REQUIREMENTS</td></tr>
<tr><td>• Geophysical equipment (handheld magnetometers).
• Footwear with ankle support and non-slip soles.
• Communications to determine WBGT Index, drinking water
• Appropriate clothing and PPE to include hard hats Hi-Visibility vests and hearing protection (around heavy equipment operations), leather gloves and leg chaps (as required), dust masks (as Required).
• Backhoes and/or Mini Excavators will be used for excavation</td><td>SUXOS/UXOSO will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training.

• Equipment inspected daily prior to use.
• PPE inspected daily prior to use.</td><td>• UXO personnel will be properly trained / qualified.
• Site specific MEC training.
• All UXO personnel will receive refresher training in excavating of anomalies.
• Site specific training on slip, trip and fall hazards.
• Training-lifting techniques.
• Heat/Cold Stress symptoms.
• Site specific flora/fauna to include first aid.
• All site personnel will have current HAZWOPER training.
• Heavy equipment training.</td></tr>
</table>

SITE SAFETY AND HEALTH PLAN

The following procedures are attached and intended to address Site Specific hazards and controls for the CRP project. The Site Description and History for this site are in Section 2.0 of the APP. AHA's are located in Section 14.

15.0 GENERAL SAFETY

Due to the nature of planned site operations, the potential risk for exposure to safety hazards is high. Anticipated safety hazards, which may be encountered during site activities, and precautions to be followed are listed below and in individual Activity Hazard Analyses, above.

15.1 Slips, Trips, and Fall Hazards

The project site is located between a river and a park area. Site conditions consist of light to moderate terrain and light brush, which make for the possibility of slips, trips, and fall hazards. Site personnel shall be instructed to make themselves aware of the placement of their feet at all times to avoid site conditions that attribute to slips, trips, and falls. As there will be some shallow excavation work taking place, site personnel will be instructed to stay at least two feet away from the edge of excavations. The use of sturdy leather work boots with ankle support and non-slip soles will reduce the risk of slips, trips and falls.

15.2 Cuts/Laceration Hazards

Power tools, MD surfaces and other buried debris can be expected to have sharp and rusted surfaces. Project personnel should expect a high likelihood of cuts/lacerations if proper care is not taken. During all activities involving the handling of MEC, scrap, and site materials, personnel will wear leather work gloves to prevent injury to hands.

15.3 Pinched/Crushed Fingers and Toes

The weight of MEC scrap expected to be recovered and handled during surface sweep and MEC inspection activities is expected to pose only a light to moderate hazard to fingers and toes. The mishandling of even light materials can cause injuries to site personnel. All site personnel are required to wear leather work boots and gloves while activities are being conducted. Personnel will utilize proper lifting techniques and when appropriate, will use additional personnel or material handling equipment for heavy objects.

15.4 Hand Tool Operation

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects prior to each use.
- Defective hand tools will be removed from service and repaired or discarded.
- Tools will be selected and used in the manner for which they were designed.
- Be sure of footing and grip before using any tool.
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.

- Gloves will be worn whenever they increase gripping ability or if cut, laceration or puncture hazards may exist during the use of hand tools.
- Safety glasses with side shields, goggles, or a face shield will be used if tool use presents an eye/face hazard.
- Do not use makeshift tools or other improper tools.
- Use non-sparking tools where there are explosive vapors, gases, or residue.

15.5 Material Lifting

Many types of objects are handled in normal day-to-day operations. Care shall be taken in lifting and handling heavy or bulky items because they are the cause of many upper extremity and back injuries. The following fundamentals address the proper lifting of materials to avoid upper extremity and back injuries:

- The size, shape and weight of the object to be lifted must be considered. Site personnel will not lift more than 50 lbs, or any uncomfortable weight, individually. The lift will otherwise be performed mechanically or with additional personnel.
- A firm grip on the object is essential; therefore, the hands and object shall be free of oil, grease and water, which might prevent a firm grip.
- The hands and especially the fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees and the object lowered.
- If the item to be lifted is too large, bulky, or heavy for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, use the equipment instead of trying to lift it yourself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

15.6 Munitions and Explosives of Concern

MEC may be present and located during CRP site activities. UXO qualified personnel will follow the requirements of the EOTI Safety Program, EP 385-97, and the EP 385-1-95a Basic Safety Concepts and Considerations for MEC Response Action Operations, which outline the safety and health precautions to be taken if MEC are encountered and/or destroyed. All non-UXO qualified personnel will follow the safe work practices listed below:

- Non-UXO qualified personnel will receive site-specific MEC recognition training prior to participation in site activities.

- No soil penetrating activities will be allowed without the area first being cleared by UXO qualified personnel.
- Non-UXO qualified personnel will be escorted on site by UXO qualified personnel, until such time as the area is cleared.
- Once an area has been cleared and flagged, non-UXO qualified personnel may perform non-intrusive duties in the area unescorted, but shall not leave the cleared area unescorted.
- Non-UXO qualified personnel will not touch or disturb any object, which could potentially be MEC, related, and will immediately notify the nearest UXO qualified person of the presence of the object.

EOTI will establish an EZ based on the Hazardous Frag Distance of the Munition with the Greatest Fragmentation Distance (MGFD) for all CRP UXO operations other than MEC Disposal. For MEC Disposal Operations, the EZ will be based on the Maximum Frag Distance of the MGFD. If unexpected hazardous MEC is located, a review of the MGFD may result in an adjustment to the size of the EZ. EOTI will have control of the entrance to the project area until the area has been cleared. Should personnel not associated with the project operations need to enter the EZ in order to gain access to the area, all MEC operations will halt for the duration of time the person is within the EZ. Once they have departed the area, MEC operations may resume.

Hazardous MEC disposal operations will be performed by EOTI. MPPEH will be inspected and, if determined to be inert, certified as non-hazardous, and will be collected in a secured location until the conclusion of the project work. After the project work has been completed, the non-hazardous scrap will be transferred to metal recycling facility.

15.7 Chemical Hazards

The only anticipated chemical hazards expected during CRP site activities are those fuels and oils brought on-site, for equipment maintenance. All site personnel will follow the procedures and precautions outlined in appropriate SDS. The SDS binder will be kept in the site office and will be available to all employees on request. CWM procedures are outlined in Section 2.1 of this appendix, but are not anticipated as necessary during this site operation.

15.8 Physical Hazards

For the planned site activities to be conducted, the potential for exposure to physical hazards is high. The physical hazards that may be encountered during site operations and precautions to be taken are listed below.

15.9 Flammable/Explosive Hazards from Fueling Equipment and Site Vehicles

The chance of fire and/or explosion during vehicle and equipment refueling and maintenance is high when improper procedures are used. All site vehicles will be equipped with a portable fire extinguisher readily available to fight a fire. Equipment will never be refueled on the back of a pick-up truck with a bed liner. Cellular phones will not be used around Flammable Liquids. Grounding and bonding procedures will be used during all fueling operations.

15.10 Noise Hazards

Protection against the effects of noise exposure shall be provided when the sound pressure levels exceed those shown below when measured on the A-scale of a standard sound level meter at slow response. When employees are subjected to sound exceeding those listed in the following table, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels to within these levels, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. If the variations in noise level involve maximal intervals of 1 second or less, it is to be considered continuous.

PERMISSIBLE NOISE EXPOSURES (1)	
Duration per Day, (Hours)	**Sound level dBA (Slow Response)**
8.00	90
6.00	92
4.00	95
3.00	97
2.00	100
1.50	102
1.00	105
0.50	110
0.25	115
Footnote (1). When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C1./T1. + C2./T2. C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C(n) indicates the total time of exposure at a specified noise level, and T(n) indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.	

EOTI will make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed whackers during thinning and pruning operations and when working in the vicinity of heavy equipment.

15.11 Cold and Heat Stress

Due to the duration, location and the time of year of this project, there is a moderate probability of encountering extreme heat. Precautions for prevention of cold stress are also provided for the possibility of unseasonable cold temperatures. For unseasonable cool temperatures, workers will dress in warm layered clothing to protect against low temperatures. Fluids will be available on site and workers will be encouraged to drink frequently. If required for cold temperatures, workers will be given opportunities to warm up in heated facilities base on the ACGIH recommended Work-Warming Regimen.

Heat Stress

Heat stress is one of the most common (and potentially serious) illnesses that affect hazardous waste site workers. When site personnel are engaged in operations involving hot environments and/or the use of semi- or impermeable clothing, a number of physiological responses can occur which may seriously affect the health and safety of the workers. These affects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program.

Level D PPE is being used at this site, so the heat stress program will be implemented if the ambient temperature exceeds 75°F according to the ACGIH Heat Stress Recommendations for unacclimatized workers.

Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75°F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines for Heat Stress.

Causes of Heat Stress

The most common cause of heat stress during site activities is the affect that PPE has on the body's natural cooling mechanism. Impermeable or semi-impermeable PPE interferes with the evaporation of perspiration and causes the body to retain metabolic and environmentally induced heat. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused by a number of interacting factors including environmental condition, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at hazardous waste sites, regular monitoring and other preventive precautions are vital.

Factors, which may predispose a worker to heat stress, include:

- Lack of physical fitness.
- Lack of acclimatization to hot environments.
- Degree of hydration.
- Level of obesity.
- Current health status (i.e., having an infection, chronic disease, diarrhea, etc.).
- Alcohol or drug use.
- The worker's age and sex.
- Sunburn.

Prior to initiating site activities each day, and periodically throughout the day, the UXOSO will inspect the site personnel for evidence of the previously mentioned factors to determine those personnel who are at increased risk for heat stress related disorders. Evidence of extreme dehydration, illness or drug or alcohol use may require the SUXOS/UXOSO to restrict the worker's activities until such time as the worker is fit for duty. Personnel identified as being at high risk for heat stress, who are allowed to participate in site operations, will be monitored frequently by the UXOSO throughout the day.

Heat Stress Disorders

This Section outlines the major heat related illnesses that may result from exposure to high heat environments and/or the use of semi- or impermeable clothing. For the purpose of this Program, reference to "liquids" will indicate the use of water or an electrolyte replacement solution, and not tea or coffee (unless it is decaffeinated) or carbonated soft drinks.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

Symptoms: Mild red rash, especially in areas of the body, which sweat heavily.

Treatment: Decrease the amount of time in protective gear and provide powder such as cornstarch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

Heat Cramps

Heat cramps are caused by a profuse rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

Symptoms: Acute, painful spasms of voluntary muscles such as the back, abdomen and extremities.

Treatment: Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have patient drink one to two cups of liquids immediately and every twenty minutes thereafter. Consult with physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with liquids. For maximum benefit this should be taken in at least a 2:1 ratio with at least two glasses of water to one glass of electrolyte replacement liquid.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by increased stress on various organs to meet increased demands to cool the body due to excessive loss of fluids from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated heat exhaustion can quickly develop into heat stroke.

Symptoms: Symptoms of heat exhaustion include pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. The body's temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache, be dizzy or nauseated.

Treatment: Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet and allow individual to rest. Consult a physician, especially in severe cases. Have the patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Total liquid consumption should be about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, immediate medical attention will be required.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The failure of the individual's temperature control system causes the perspiration system to stop working correctly. When this occurs the body core temperature rises very rapidly to a point (105+°F) where brain damage and death will result if the person is not cooled quickly.

Symptoms: The victim's skin is hot, and may or may not be red and dry, (due to the fact that the individual may still be wet from having sweat while wearing protective clothing earlier), nausea, dizziness, confusion, extremely high body temperatures, rapid respiratory and pulse rate, delirium, convulsions, unconsciousness or coma.

Treatment: Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. The victim should be moved to a shady area; lie down and keep the head elevated. Gradually cool the victim by either sponging or immersing the victim in cool water to reduce the core temperature to a safe level (<102°F). If they are conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not give the victim caffeinated or alcoholic beverages. Heat stroke is considered a medical emergency. Medical emergency assistance must be summoned.

Heat Stress Preventive Measures

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat exhaustion, that person may become predisposed to additional heat injuries. In order to avoid heat related illnesses proper preventive measures will be implemented whenever environmental conditions dictate the need. These preventive measures represent the minimal steps to be taken and will include the following procedures:

- SUXOS/UXOSO will examine each site worker prior to start of daily operations to determine the individuals susceptible to heat induced stress. Workers exhibiting factors ,which make them susceptible to heat stress will be closely monitored by the UXOSO.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms and treatment of heat stress disorders as outlined in this program.
- In order to maintain workers' body fluids at normal levels, workers will be encouraged to drink, as a minimum, approximately sixteen ounces of liquids prior to start of work in the morning, after lunch and prior to leaving the site at the conclusion of the day's activities.
- Disposable four (4) to twelve (12) ounce cups and liquids will be provided on site.
- Acceptable liquids will include water and an electrolyte replacement solution, with the recommended intake being two cups of water to each cup of electrolyte replacement solution.
- Liquids containing caffeine are to be avoided.

When ambient conditions and site workload requirements dictate, as determined by the SUXOS, workers will be required to drink a minimum of sixteen (16) to thirty-two (32) ounces of liquids during each rest cycle. The normal thirst mechanism is not sensitive enough to ensure that enough water will be taken to replace lost sweat. When heavy sweating occurs, workers should be encouraged to drink even though they may not be thirsty. The following strategies may useful in encouraging fluid intake:

- Maintain water temperature at 50°F to 60°F (10°C to 15.6°C).
- Provide small disposable cups that hold about 4 ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluids (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this Program. Site workers will be given time to acclimatize to site work conditions, temperature, and workload. Acclimatization usually takes about a week of continued work in hot environments, and allows the worker's body to become adjusted to this level and type of work. This process involves a gradual increase in the workload over the required period, the length of which depends upon the nature of the work performed, the ambient temperatures and the individual's susceptibility to heat stress. Work schedules will be adjusted as follows:

- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.
- Add additional personnel to work teams.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

Supplemental Preventive Measures

Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.

Administrative Controls and Work Practices

Training is the key to good work practices. Unless all employees understand the reasons for new or changing old work practices, the chances of such a program succeeding are greatly reduced. The following will be discussed during the site-specific training and repeatedly as determined by the SUXOS/UXOSO:

- Knowledge of the hazards of heat stress;
- Recognition of predisposing factors, danger signs, and symptoms;
- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment;
- Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs; and
- Dietary effects on heat stress.

Because the incidence of heat stress depends on a variety of factors all workers, even those not wearing protective equipment, should be monitored. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 15.1). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), recommendations for monitoring requirements and suggested work/rest schedules in the current ACGIH TLVs for Heat Stress shall be followed. If the actual clothing worn differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules accordingly.

The goal of all heat stress monitoring is to ensure that the worker's body temperature does not exceed 100.4°F. The physiological monitoring methods listed below are to be implemented based upon the severity of the heat and workload. As a minimum the UXOSO will perform WBGT monitoring. He may also choose to monitor the worker's heart rate as an indication of potential heat stress. The frequency of physiological monitoring will be determined using the information presented in Table 15.1.

Heart Rate Monitoring

The worker's baseline heart rate should be recorded prior to initiation of site activities by measuring the radial pulse rate for thirty seconds. After each work cycle the heart rate should be measured by taking the pulse rate (PR) for 30 seconds as early as possible into the resting period. Taking the radial (wrist) pulse rate is the preferred method however the carotid (neck) pulse rate may be taken if a worker has difficulty finding the radial pulse. The PR at the beginning of the rest period should not exceed one hundred and ten (110) beats per minute (bpm). If the PR is higher than 110 bpm, the next work period should be shortened by thirty-three percent, while the length of the rest period stays the same. If the PR exceeds 110 bpm at the beginning of the next rest period, the work cycle should be further shortened by thirty-three percent. This procedure will be continued until the worker's PR at the beginning of the rest cycle is maintained below 110 bpm.

Wet Bulb, Dry Globe Temperature (WBGT) Monitoring

For CRP site conditions where personnel are working in Level D PPE, and the ambient temperature is greater than 75°F, the UXOSO will conduct WBGT monitoring to assist in controlling the potential for site workers experiencing heat related adverse health affects. The SUXOS will use WBGT monitor readings obtained from the monitoring equipment, and after estimating the workload, use the values expressed in Table 15.2, to determine the work/rest schedule to be implemented. The values outlined in this table are designed such that nearly all acclimatized, fully clothed workers with adequate salt and water intake will be able to function without the body temperature exceeding 100.4°F.

Acclimatization is the adaptive process that results in a decrease of the physiological response produced by the application of a constant environmental stress. On initial exposure to a hot environment, there is an impaired ability to work and evidence of physiological strain. If the exposure is repeated on several successive days, there is a gradual return of the ability to work and a decrease in physiological strain. Within 4 to 7 days following initiation of the acclimatization process, a dramatic improvement in the ability to perform work is noticed, subjective discomfort practically disappears, body temperature and heart rate are lower, there is a more stable blood pressure, and the sweat is more profuse and dilute.

Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

Heat Stress Documentation

Should it be required due to site conditions, the UXOSO will be responsible for recording all heat stress related information. This will include training sessions and monitoring data. Training sessions will be documented using the Documentation of Training Form. Pulse rate monitoring data will be recorded on the Heat Stress Monitoring Log, with the WBGT being recorded in the Site Safety Log and/or Site Monitoring Log.

Table 15.1
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

ADJUSTED TEMPERATURE[b]	NORMAL WORK ENSEMBLE[c]	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-28.1°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
75°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour.
[b] Calculate the adjusted air temperature (at adj) by using this equation: at adj °F = ta °F + (13 x % sunshine). Measure air temperature (at) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Table 15.2
SCREENING CRITERIA WBGT HEAT EXPOSURE THRESHOLD LIMIT VALUES

Work - Rest Regimen	WORK LOAD		
	Light*	Moderate	Heavy
Continuous work	(29.5)	(27.5)	(26.0)
75% Work - 25% Rest, each hour	(30.5)	(28.5)	(27.5)
50% Work - 50% Rest, each hour	(31.5)	(29.5)	(28.5)
25% Work - 75% Rest, each hour	(32.5)	(31.0)	(30.0)

Consult the ACGIH TLV booklet for definitions of Light, Moderate and Heavy workloads. Values are given in (^{0}C) WBGT, and are intended for workers wearing single layer summer type clothing. Use of semi or totally impermeable clothing requires monitoring IAW the EOTI Heat Stress Prevention Program. As workload increases, the heat stress impact on a non-acclimated worker is exacerbated. For non-acclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5^0C.

15.12 Ionizing Radiation Hazards

Ionizing radiation is not expected to be an issue on this project site.

15.13 Biological Hazards

Biological hazards, which are usually found on site, include insects, such as ticks, spiders, poisonous snakes and hazardous plants. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

15.14 Hazardous Plants

During the conduct of CRP site activities the number and variety of plants that may be encountered is large and extensive. However, the plants presenting the greatest degree of risk to site personnel (i.e. potential for contact vs. affect produced) are those, which produce skin reactions and skin and tissue injury.

15.15 Plants Causing Skin and Tissue Injury

Contact with splinters, thorns and sharp leaf edges is of special concern to site personnel, as is the contact with the pointed surfaces found on branches, limbs and small trunks. This concern stems from the fact that punctures, cuts and even minor scrapes caused by accidental contact may result in non-infectious skin lesions, and the introduction of fungi or bacteria through the skin or eye. Personnel receiving any of the injuries listed above, even minor scrapes will report immediately to the UXOSO for initial and continued observation and care of the injury.

15.16 Plants Causing Skin Reactions

The poisonous plants of greatest concern are poison ivy, poison sumac and poison oak. Both poison ivy and poison oak thrive in all types of light and usually grow in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has shiny pointed leaves that grow in clusters of three. Poison oak can have shiny or dull, pointed leaves that grow in clusters of three. Poison oak leaves are more rounded rather than jagged and the underside of poison oak leaves are covered with hair. Poison sumac has smooth leaves, grows only in wetlands and has 7-9 leaves per stem.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact.
- Reddening, swelling, itching and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

If the rash is scratched, secondary infections can occur. The rash usually disappears in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe. Preventive measures, which can prove effective for most site personnel, are:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify report and mark poisonous plants found on site.
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday.
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing.
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.
- If burning of these plants occurs, make sure personnel are located upwind of the smoke, as inhalation of the smoke or contact with airborne particles from these plants can still cause a reaction to occur.

15.17 Snakes

When site activities are conducted in warm weather on sites that are located in wooded, grassy or rocky environments, the potential for contact with venomous snakes becomes a very real danger. There are 38 snake species in South Carolina, only six of which are venomous. These are Copperhead, Coral Snake, Cottonmouth, Pigmy Rattlesnake, Eastern Diamondback Rattlesnake and Timber Rattlesnake. Normally, if a person is approaching a snake, the noise created by the person is usually sufficient to frighten the snake off. However, during the warm months, extreme caution must be exercised when conducting site operations around areas where snakes might be found (i.e. rocks, bushes, logs, or in holes, crevices, and abandoned pipes). If venomous snakes are identified on the CRP site, EOTI will issue protective clothing, such as snake leggings, to site personnel. The rules to follow if a snake bites someone are:

- DO NOT cut “Xs” over the bite area, as this will intensify the effect of the venom.
- DO NOT apply suction to the wound since this has a minimal effective in removing venom.
- DO NOT apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area.
- If possible, try to get a good look at the snake so it can be identified for proper selection of anti-venom.
- DO NOT allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body.
- Keep the victim calm and immobile.
- Have the victim hold the affected extremity lower than the heart while waiting for medical assistance. Do not delay evacuation.

- Transport the victim to medical attention immediately.

15.18 Tick Bites

The Centers for Disease Control (CDC) has noted the increase of Lyme Disease and Rocky Mountain Spotted Fever (RMSF) which are caused by bites from infected ticks in and near wooded areas, tall grass, and brush. Ticks are small, ranging from the size of a comma up to about one quarter inch. They are sometimes difficult to see. The tick season extends from spring through summer. When embedded in the skin, they may look like a freckle.

Lyme disease has occurred in 43 states, with the heaviest concentrations in the Northeast, the upper Midwest, and along the northern California coast. It is caused by deer ticks and the lone star ticks which have become infected with spirochetes. Female deer ticks are about one quarter inch in size, and are black and brick red in color. Male deer ticks are smaller, and completely black. Lone star ticks are larger and chestnut brown in color.

Rocky Mountain Spotted Fever has occurred in 36 states, with the heaviest concentrations in Oklahoma, North Carolina, South Carolina, Texas, and Virginia. It is caused by Rocky Mountain wood ticks, and dog ticks which have become infected with rickettsia. Both are black in color.

Symptoms: The first symptoms of either disease are flu like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals recover fully in a short period of time. If not treated, more serious symptoms can occur.

If you believe a tick has bitten you, or if any of the signs and symptoms noted above appear contact the UXOSO, who will authorize you to visit a physician for an examination and possible treatment.

Protective Measures: Standard field gear (work boots, socks and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. Light-colored coveralls allow easier identification of ticks on clothing. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:

- When in the field, check yourself often for ticks, particularly on your lower legs and areas covered with hair.
- Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin or permanone. Apply deet (vapor-active repellent) to any exposed skin surface (except eyes and lips), and apply permethrin repellent spray to field clothing. Allow the permethrin to dry before using treated clothing. The repellent system, deet and permethrin, offer maximum protection.
- When walking in wooded areas, wear a hat, and avoid contact with bushes, tall grass, or brush as much as possible.
- If you find a tick, remove it by pulling on it gently with tweezers.
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers.
- DO NOT use matches, a lit cigarette, nail polish or any other type of chemical to “coax” the tick out.

- Be sure to remove all parts of the tick's body, and disinfect the area with alcohol or a similar antiseptic after removal.
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash that looks like a bulls-eye or an expanding red circle surrounding a light area, frequently seen with a small welt in the center.
- Also look for the signs of the onset of RMSF, such as an inflammation which is visible in the form of a rash comprising many red spots under the skin, which appears 3 to 10 days after the tick bite.

15.20 Bees, Hornets and Wasps

Contact with stinging insects like bees, hornets and wasps may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas.
- The nests can be situated in trees, rocks, and bushes or in the ground, and are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling, which can leave the worker incapacitated and in need of medical attention.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again.

With these things in mind, and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, he must inform the UXOSO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the UXOSO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged off and site personnel will be notified of its presence.

- If stung, site personnel will immediately report to the UXOSO to obtain first aid treatment and to allow the UXOSO to observe them for signs of allergic reaction. If a breathing emergency (anaphylactic shock) occurs as a result of the sting, immediately call 911.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times, and will let the SUXOS, UXOSO and co-workers know where it is kept.

15.21 Spiders

A large variety of spiders may be encountered during CRP site activities. While most spider bites merely cause localized pain, swelling, reddening and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological affects caused by their venom, are dangerous. These species include the black widow and the brown or violin spiders.

The black widow is a coal-black bulbous spider about ¾-inch in length, with a bright red hourglass on the underside of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite.
- Appearance of small punctures (but sometimes none are visible).
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities.

The brown recluse or violin spider is brownish to tan in color, rather flat, about 5/8-inch long with a dark brown “violin” shape on the top. Of the brown spider, there are three varieties found in the United States, which present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite.
- Formation of a large, red, swollen, postulating lesion with a bull’s-eye appearance.
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting.
- Pain may become severe after 8 hours, with the onset of tissue necrosis.

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, these spider bites are not considered to be life threatening; however, medical treatment must be sought to reduce the extent of damage caused by the injected toxins.

Scorpions are stinging arachnids found over much of the United States. All known scorpion species possess venom and use it primarily to kill or paralyze their prey so that it can be eaten; in general, it is fast-acting, allowing for effective prey capture. It is also used as a defense against predators. The venom is a mixture of compounds (neurotoxins, enzyme inhibitors, etc.) each not only causing a different effect, but possibly also targeting a specific animal. Each compound is made and stored in a pair of glandular sacs, and is released in a quantity regulated by the scorpion itself. Of the 1000+ known species of scorpion, only 25 have venom that is dangerous to humans.

The SUXOS/UXOSO will brief site personnel as to the identification and avoidance of the spiders and scorpions. As with stinging insects, site personnel shall report to the SUXOS/UXOSO if they locate either of these spiders or scorpions on site or notice any type of bite or sting while involved in site activities.

15.22 Hantavirus Pulmonary Syndrome

Basic Transmission Cycle – some rodents are infected with a type of Hantavirus that causes Hantavirus Pulmonary Syndrome (HPS). In the United States, deer mice (plus cotton rats and rice rats in the southeastern states and the white-footed mouse in the Northeast) are the rodents carrying hantaviruses that cause hantavirus pulmonary syndrome. Common house mice do not carry Hantavirus.

These rodents shed the virus in their urine, droppings and saliva. The virus is mainly transmitted to people when they breathe in air contaminated with the virus. This happens when fresh rodent urine, droppings or nesting materials are stirred up. When tiny droplets containing the virus get into the air, this process is known as aerosolization.

There are several other ways rodents may spread Hantavirus to people:

- If a rodent with the virus bites them, the virus may be spread this way – but this is very rare.
- Researchers believe that you may be able to get the virus if you touched something that had been contaminated with rodent urine, droppings, or saliva, and then touched your nose or mouth.
- Researchers also suspect that if virus-infected rodent urine, droppings or saliva contaminates food that you eat, you could also become sick.

Symptoms of HPS: Early symptoms include fatigue, fever, and muscle aches, especially the large muscle groups – thighs, hips, back, sometimes shoulders. These symptoms are universal. There may also be headaches, dizziness, chills and/or abdominal problems, such as nausea, vomiting, diarrhea and abdominal pain. About half of all HPS patients experience these symptoms.

How long could it be between the time you get the virus, and the time you start showing these symptoms? Because there have been so few cases of HPS, it is not quite clear what this “incubation time” is. However, it appears right now that it may be between one to five weeks after you are exposed to potentially infected rodents and the rodent’s droppings before you will show any symptoms.

Late symptoms – 4-10 days later – symptoms include coughing and shortness of breath, with the sensation of, as one survivor put it, a “tight band around my chest and a pillow over my face” as lungs fill with fluid.

MINIMIZE RISK - do not disturb rodents, burrows, or dens.

Preventive Measures: If there are signs of a rodent nest or rodent droppings, make it known to the SUXOS/UXOSO. To clean and disinfect the area, spray a disinfectant on the area and leave a waiting time of 20 minutes. Then clean it up using rubber or plastic gloves, coveralls, rubber boots or disposable shoe covers, protective goggles, and a half-face mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter. Bag the cleaning materials and dispose of it. Then, re-clean the area with disinfectant.

15.23 Mosquitoes

Mosquitoes are responsible for transmitting diseases such as malaria and West Nile Virus through bites to the skin. While malaria is much more contagious, it is not normally found in North America. West Nile virus is commonly found in Africa, West Asia and the Middle East. In recent years, West Nile virus has been increasingly found in the continental United States. It is believed to have first appeared in the United States in 1999. It is most common in late summer or early fall, which is the active season for mosquitoes, but in warmer southern climates where the temperatures are milder, West Nile virus can be transmitted year round.

Transmission Cycle: Mosquitoes become infected with the virus when they feed on infected birds, which may circulate the virus in their blood for a few days. Infected mosquitoes can then transmit the virus to humans and animals while biting to take blood. The virus is located in the mosquito's salivary glands, and may be injected into the animal or human, where it can multiply, possibly causing illness. Even in areas where the virus is circulating, few mosquitoes are infected with the West Nile virus. Even if the mosquito is infected, less than 1% of people who get bitten and become infected will get seriously ill. The majority of cases of West Nile virus have been identified in birds, it has also been found in horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits. It was recently found in a horse in New Mexico. Once West Nile virus has been contracted, the survivor of this illness is believed to carry a lifelong immunity to it. At this time there is no vaccine against West Nile virus.

Symptoms: West Nile virus is encephalitis, which causes an inflammation of the brain. Following transmission by an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of the brain tissue. Fatality rates range from 3%-15% of persons who develop severe illness, and rates are highest among persons over 50 years of age and those with weakened immune systems. This disease is not transmitted from person-to-person, so touching or working in the vicinity of someone with the disease will not increase the risk.

The incubation period for West Nile virus is normally 3-15 days. Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

If symptoms develop, seek medical attention immediately.

Preventive Measures: Prevention and control of West Nile virus is most effectively accomplished through vector management programs. Be alert for dead animals on the site, particularly birds. If a dead bird or other animal is found on site, bare-handed contact should be avoided. Using gloves or double plastic bags, wrap animal and call the Health Department. If the Health Department wants to test the bird, they will come and pick it up. If they are not testing the bird, it should remain wrapped in the plastic and disposed of in accordance with established procedures.

Other ways of reducing risk of becoming infected with West Nile Virus include:

- Implement mosquito control measures on the site.
- Make sure that there are no open containers of standing water on the site in which mosquitoes can breed.
- Wear long sleeved shirts and long pants while outdoors.
- Stay indoors at dawn, dusk, and in the early evening when mosquitoes are most active.
- Spray clothing with repellants containing permethrin or DEET.
- Apply insect repellant sparingly to exposed skin. An effective repellant will contain 35% DEET. Higher concentrations of DEET provide no additional protection. Always read the manufacturer's directions on the repellant prior to applying it to the skin.
- Vitamin B and "ultrasonic" devices are NOT considered to be an effective deterrent to mosquito bites.

Treatment: If symptoms have developed that are consistent with West Nile virus, a blood sample will be taken and sent for analysis. There is currently no specific therapy. In more severe cases, intensive supportive therapy is indicated, normally involving hospitalization, intravenous fluids, airway management, respiratory support (ventilator), prevention of secondary infections (pneumonia, urinary tract, etc.) and nursing care.

15.24 Hazard Mitigation

The hazards listed above will be addressed through a combination of training, engineering controls, and personal protective equipment, with engineering controls as the method of preference, when feasible.

Implementation of Engineering Controls and Work Practices

Training for site procedures and the use of site equipment is instrumental in preventing accidents from occurring. Training in MEC recognition will be given to all site workers, and all will be watchful for MEC or pieces of MEC, which could be hazardous. When MEC or pieces of MEC are encountered, it is everyone's duty to contact a UXO-qualified person to handle the situation. Other controls include the EZ, which will be used to keep unauthorized personnel out of the project site and shielding material to protect the operators of heavy equipment.

Upgrades/Downgrades in Levels of Personal Protective Equipment

Due to the types of hazards at the CRP site, Level D PPE will be required. This type of PPE is used for levels of contamination that may present a nuisance, but not an identifiable hazard. This consists of a hard hat, safety glasses, hearing protection, leather work gloves, rubber over-boots and non-steel-toed work boots to prevent interference with metal detectors. The hard hat will only be worn in head hazard areas, such as in the vicinity of the heavy equipment operations and during vegetation clearance operations. Rubber over-boots will only be worn over leather boots in watered areas. If hazards are encountered that are greater than estimated, the PPE level will be increased. This will be accomplished by the Corporate Health and Safety Staff, and the decision will be based on documented evidence of the hazards. If excessive dust levels near heavy equipment warrant via exposure monitoring, appropriate respiratory protection will be implemented in accordance with EOTI's corporate respiratory protection program. If the site is not as hazardous as originally anticipated, the level of PPE can be downgraded by the Corporate Health and Safety Staff. This decision would also be based on definitive data that demonstrates the conclusion that the PPE can be lessened. Normally to downgrade PPE would require at least one week's worth of data, during consistent site operation, demonstrating that the site is not as hazardous as originally suspected. PPE levels will conform to Section 5 of EM 385-1-1.

Work Stoppage and/or Emergency Evacuation of On-Site Personnel

All personnel are trained to be constantly aware of their work environment. Anyone has the ability to stop operations for safety reasons. No worker is expected to perform any operation for which he has not been trained, or to perform any operation that is considered to be unsafe. After operations are stopped for safety reasons, the SUXOS and UXOSO will be notified and they will evaluate the situation. The SUXOS will, in consultation with the Corporate Health and Safety Staff, determine what steps need to be taken to make the situation safe for operations to continue.

Emergency Evacuation

In the event of an emergency that requires evacuation of the site, verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point, which will be the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, advise and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;
- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS.

Prevention and/or Minimization of Public Exposure to Hazards Created by Site Activities

Establishment and maintenance of an EZ creates separation between the CRP site footprint and the general public acts as a safety cushion to protect the public against site hazards. Controlling access to the site, closing roads, signs and barricades are all means of keeping the general public from accidentally wandering into the site during site operations. Training all site workers in the hazards of MEC will have more eyes looking for MEC. Any worker observing MEC or pieces of MEC will not touch or handle it in any way. He will inform a UXO-qualified EOTI worker, who will then handle the situation. If unauthorized personnel are observed in the EZ, all MEC operations will cease until the area is cleared of unauthorized personnel.

16.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

Descriptions of qualifications and responsibilities of Safety Staff members are contained in Section 6.0 of the APP.

17.0 PERSONAL PROTECTION EQUIPMENT

PPE requirement are contained in Section 12.1 of the APP. PPE requirements will be reevaluated as appropriate per Section12.1 and section 15.24 and will comply with Section 5 of EM 385-1-1.

18.0 MEDICAL SURVEILLANCE

Medical surveillance of EOTI employees will be conducted IAW the requirements of OSHA 29 CFR 1910.120(f)(HAZWOPER), 29 CFR 1910.134(b)(10)(Respiratory Protection) and other established guidelines. Personnel to be included in the Medical Surveillance Program will be those who perform hazardous waste operations that may potentially expose the worker to hazardous substances or other significant safety and health threats. All EOTI personnel on the project site will be part of the EOTI Medical Surveillance Program. Visitors desiring entry into the EZ must be on their employer's Medical Surveillance Program and must have a current physician's statement prior to entry.

18.1 Baseline Health Assessment Physical or Annual Physical

A baseline health assessment physical or annual physical will be conducted prior to participating in site operations, to determine the worker's ability to perform hazardous waste operations in a safe and healthful manner. The Project Manager, in conjunction with the SUXOS/UXOSO, will ensure that all health assessments address the site-specific health hazards to which workers may be exposed.

Physicals will be scheduled through the services of a board certified occupational medicine physician in the vicinity of the employee's home or job site. The designated physician will perform the medical assessments and review medical examination results to determine each worker's ability to perform his assigned hazardous waste duties. The physician will also be responsible for determining if supplemental or follow-up examinations are required and for maintaining medical and exposure records IAW OSHA 29 CFR 1910.120(d).

The purposes of the Medical Surveillance Program are to:

- Assess the individual's health status prior to participation in hazardous waste operations; determine the individual's ability to perform work assignments requiring the use of personal protective equipment (PPE) and clothing;
- Establish baseline data for comparison to future medical data in order to provide a means of monitoring a worker's health status;
- Establish facilities and procedures for emergency and non-emergency medical treatment;
- Establish procedures for maintenance and storage of medical and exposure records.

18.2 Physician's Statement

The results of this examination will be made available to the employee and a written physician's statement will be sent to EOTI. A copy of the physician's statement will be kept in each employee's file at the project site for the duration of site operations. The physician's statement will include the following:

- The physician's opinion regarding any conditions which would place the employee at an increased risk from working in hazardous waste operations;
- The physician's recommended limitations upon the employee's assigned work, if any; and
- A statement that the employee has been informed by the physician of the results of the examination, and any conditions which may require further examination or treatment.

18.3 Supplemental Examination

Any site worker will undergo a supplemental examination if they have been:

- injured;
- received health impairment;
- developed signs or symptoms from possible over-exposure; or
- received a documented over-exposure without the use of respiratory protection.

The contents of this examination will be based upon the type of injury, illness, signs or symptoms of exposure involved and will be determined by the physician. Prior to reassignment to site activities, the physician will certify that the employee is fit to return to work. If necessary, the physician will specify in writing any activity restrictions or additional tests, which may be required.

18.4 Follow-up Health Assessments

If, during any pre-assignment, annual or supplemental examination, a condition is detected which requires follow-up tests, the physician will notify EOTI and the employee as to the nature of the follow-up health assessment. The physician will determine the schedule and content of the follow-up health assessment. A statement outlining the employee's fitness for work will be provided to EOTI and the employee upon conclusion of the follow-up health assessment.

18.5 Emergency and Non-emergency Medical Treatment

The medical treatment facility for use at this project site will be:

Hospital-Palmetto Health Richland
5 Richland Medical Park Dr
Columbia, SC 29203(803) 434-7000 ** For Emergency Dial 911*

Directions to the hospital can be found at Section 11.0 of this Appendix.

18.6 Record Keeping

EOTI will retain and maintain copies of all physician statements, exposure records, and associated information for all employees involved in hazardous waste operations. These records will be kept at the project site for the duration of site operations. When the site work is complete, the records will be retained by EOTI at the Knoxville, TN office. Examining physicians will be responsible for maintaining records related to laboratory and other tests for each employee examined. All records, whether maintained by EOTI or by the examining physician, will be kept on file for a period of thirty (30) years beyond an employee's termination OSHA 29 CFR 1910.1020(d).

18.7 Exposure Monitoring/Air Sampling Program

Due to the fact that there is not expected to be any significant exposure to hazardous chemicals or excessive levels of dust at this site, exposure monitoring will not be required. As the workers on this site will normally be in Level D PPE, heat stress monitoring will be required if the temperature goes above 75°F. Should it be required, site monitoring data will be recorded using the Site Monitoring Log and will be maintained as part of the project record.

18.8 Dust Monitoring

Dust or particulates created during excavation operations may be a nuisance to operators and those working around the equipment, but are not expected to exceed a permissible exposure level according to OSHA guidelines for total or respirable particulates. The team leaders will monitor the dust levels in the areas that their teams are working if airborne levels seem excessive.

18.9 Heat Stress Monitoring: Heat stress monitoring will be conducted using WBGT readings, in order to assure adequate work/rest cycles are implemented at the site if ambient dry-bulb temperatures exceed 75^{o}F. Pulse monitoring may also be used in addition to the WBGT readings, particularly during acclimatization, to assure workers are adapting to the conditions safely. Monitoring will be performed by the UXOSO and results will be documented. Heat stress monitoring will be used to determine work-rest cycles to be implemented on site as referenced by the ACGIH TLV guidelines detailed in Section 15 above.

18.10 Meteorological Monitoring

Rain and/or other weather conditions can constitute a safety hazard to field operations at this site. The SUXOS and UXOSO will monitor the weather closely. If the area becomes so wet, muddy, or slippery that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the SUXOS determines it to be safe to continue.

No MEC operations will take place if an electrical storm is within ten miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within ten miles of the site, and will not resume again until the SUXOS determines that the electrical storm is at least ten miles past the site.

19.0 STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

Using common sense and following safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities.

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and constantly be aware of the MEC, chemical and physical hazards that are or may be present.
- The number of personnel in the EZ will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- Team members will be familiar with the physical characteristics of each site including wind direction, site access, and the location of communication devices and safety/emergency equipment.
- The location of overhead power lines and underground utilities must be established.
- Contact with potentially contaminated surfaces, walking through puddles or pools of liquid, kneeling on the ground, or leaning, sitting, or placing equipment on the contaminated soil should be avoided.
- Detection or appearance of unusual liquids, odors or discolored soil could indicate the presence of contaminants and should be reported to the SUXOS/UXOSO immediately.

- Site personnel are to report any other unusual or potentially hazardous condition to the SUXOS/UXOSO for investigation and/or corrective action.

All personnel on site will be required to follow the safe work practices contained in this Program, as they relate to the hazards encountered during site activities. All site personnel will be required to read, understand and comply with the provisions of this APP. If new tasks or hazards are identified during site operations, which pose additional hazards, the APP will be amended by the Corporate Health and Safety Staff to include additional safe work practices and other control methods as needed.

19.1 Site Rules/Prohibitions

Safe practices can reduce hazards due to normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities. General personnel requirements include:

- Horseplay or fighting is prohibited.
- Eating, drinking, smoking, chewing gum, tobacco, or any other hands-to-face activities are prohibited on-site, except in designated areas after both face and hands have been washed.
- Wearing contact lenses is prohibited in the EZ.
- When required to sit or kneel on the ground, avoid contaminated surfaces.
- Placing equipment on contaminated surfaces should be avoided.
- Climbing on or over obstacles is prohibited. Stacks of materials can be unstable and could cause injury.
- Open flames of any type are prohibited on-site.
- Bringing defective or unsafe equipment on-site is prohibited.
- Only authorized employees may enter the work site. Only essential personnel will be admitted within the EZ during MEC operations. Visitors must check in with the SUXOS, receive an appropriate safety briefing, and be escorted by UXO-qualified personnel at all times while on-site.

19.2 Buddy System

The buddy system is a safety practice in which each individual is concerned with the health and well being of co-workers. The buddy system will be implemented during all on-site activities and will be incorporated whenever workers may be isolated or as determined by the SUXOS/UXOSO. The objective of the Buddy System is to insure that no individual is ever alone on-site.

- A minimum of two UXO-qualified personnel will be present during all MEC operations. A UXO Technician I may assist in MEC operations with the supervision of a UXO Technician III or higher. Non-UXO-qualified personnel who have been determined essential for the operations being performed may be utilized to perform MEC-related procedures when supervised by a UXO Technician III or higher.
- At no time will an individual desert his assigned team unless while working in pairs, his partner goes down, and it is considered too hazardous to render assistance. Technicians will enter and exit EZ together and frequently monitor one another for signs of fatigue, heat stress, and any other problems. In such cases, the worker in danger may not even be aware he/she is having a problem. The technicians must always be alert to changes in the behavior of his teammate so that he can remove him from the situation immediately.

- Technicians should inspect each other's equipment, including PPE, to ensure that it is adequate and in proper working order.

19.3 Work Permit Requirements

At this time EOTI does not anticipate work permits for its work on this project. Under the contract there are no requirements for hot work. All site personnel, to eliminate the hazards from ignition sources, will utilize the general, fire safety precautions and procedures. Excavation work is generally expected to be less than four feet in depth, and there are expected to be no confined spaces or radioactive work on this project. Should this situation change, this SSHP will be updated to include these additional hazards, and shall handle them in accordance with the EOTI Corporate Health and Safety Program, which addresses all of these issues.

19.4 Material Handling Procedures

Many types of objects are handled in normal day-to-day operations. Care will be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably. They will use mechanical lifting equipment for lifts greater than 50 lbs that are unassisted.
- A firm grip on the object is essential; therefore, the hands and object will be free of oil, grease, and water, which might prevent a firm grip.
- The hands, and especially the fingers, will be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves will be used, if necessary, to protect the hands.
- The feet will be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees, and the object lowered.
- If the item to be lifted is too large, bulky, or heavy (over 50 lb) for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, the employee should use the equipment instead of trying to lift the object himself/herself.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, will face the direction in which the object is being carried.

19.5 Spill Containment

Major spills are not expected on this site. Hazardous materials, where necessary, are being brought to the site in small quantity containers. This will minimize the amount of material involved, should a spill occur, as well as reducing the amount of hazardous material on hand to the minimum amount consistent with efficient operations. If a small amount of liquid hazardous material is spilled, it will be cleaned up with absorbent material by site personnel wearing appropriate chemical resistant gloves. It will then be containerized, labeled, and sent for disposal at an approved facility.

19.6 Drum/Container/Tank Handling

EOTI does not anticipate the use of drums/containers/tanks during activities under the PWS.

19.7 Comprehensive Activity Hazard Analysis of Treatment Technologies

Treatment technologies are not expected to be used on this project.

20.0 SITE CONTROL MEASURES

20.1 Site Map

A site map will be utilized during the Tailgate safety briefing to inform the workers of the location of hazardous areas on the site, the assembly areas to be used in the event of site evacuation, and any other information relevant to the day's activities. The site map will include:

- Site topography
- Site work zones
- Location of unusual/hazardous areas
- Prevailing winds
- Ingress and egress corridors
- Evacuation routes and assembly points
- Location of emergency supplies

20.2 Work Zone Delineation and Access Points

Site work zones will be established by the SUXOS/UXOSO prior to initiating operations to control site access. Establishment of site work zones is based upon site conditions, activities and exposure potentials. A site EZ will be set up, which includes the footprint of the area where work will take place and a distance based on the MGFD around that to protect areas outside the site from potential fragmentation, depending on the site activities. Site work zones will be marked using barricades and signage closing roads into the area to unauthorized vehicular traffic. Barricades and signs will remain in place for the duration of site work.

20.3 Site Access Control

The SUXOS will control access to each work zone and will ensure that all site workers and visitors have received the proper training and medical surveillance required to enter a specific zone. Access will be denied to any potential entrant not meeting these requirements.

20.4 Exclusion Zone

The EZ includes all areas where significant hazards do or could occur and includes all areas where PPE is required to control worker exposure to chemical or physical hazards. All personnel entering the EZ will be logged in/out by the SUXOS. All visitors to the EZ must be escorted by a UXO-qualified EOTI employee. The EZ of this site will be designated as the footprint area of actual project operations and the required separation distance surrounding the area. This distance is based on the MGFD during specifically defined site operations. When non-essential personnel are required to enter within the EZ, all UXO operations will cease until nonessential personnel are beyond the hazardous fragmentation area of the EZ.

20.5 Support Zone

The SZ is the area outside the EZ where site support activities are conducted. This zone includes break areas and sanitation facilities. Visitors desiring entry into the EZ must first meet with the SUXOS or UXOSO and receive the appropriate safety and emergency procedures briefing in the SZ before gaining admittance to the EZ, and they will be escorted at all times by a UXO-qualified employee while in the EZ.

Site access control will be implemented by the SUXOS/UXOSO and will be accomplished through a program that limits movement and activities of people and equipment at the project site. This control will be based on site-specific characteristics to include:

- Potential chemical, biological, physical or explosive hazards
- Terrain
- Expected weather conditions
- Planned site activities
- Site proximity to populated areas

The degree of site access control will include the following:

- Controlled site ingress/egress points – Work area will be clearly visible to anyone approaching the site and vice versa. Only authorized personnel will be permitted within the EZ during MEC operations. All others will remain in the SZ.
- Worker/visitor registration – All personnel working on the site sign in daily at the time of their daily safety briefing in the morning. All visitors to the site must sign the visitor log when they report to the site for their visitor briefing.
- Escort of visitors – All visitors to the site will be escorted by a UXO-qualified employee. Visitors will be briefed on site hazards, PPE requirements, and emergency procedures. Visitors who are not deemed essential will not be permitted within the EZ during MEC operations. If visitors need to access the EZ, all MEC operations will cease while they are in the area and the visitors will be escorted at all times.
- PPE requirements – PPE requirements have been established based on the site hazards. Personnel working in areas requiring PPE will wear required PPE for the duration of the operation. Visitors to the area will be required to have the required PPE for the area they will be visiting.

20.6 On and Off-Site Communication System

On and off-site communication will be established through the use of cellular telephones and radios. All personnel will have emergency phone numbers and understand how and under what conditions they are to be used. Cell phones will not be used around MEC where EMR may present a hazard, but will remain in the site vehicles with the emergency telephone number list for access during operating hours. Radios can be used to communicate to personnel on the site and in the site office.

21.0 PERSONAL HYGIENE AND DECONTAMINATION

Sanitation facilities will be provided in the SZ area so that employees can wash prior to eating, drinking, smoking, or engaging in any other hand-to-face activities. Chemical toilets may be available in the SZ of the work area and there are plumbed toilets. As chemical contamination is not expected to be an issue at this site, basic washing of equipment and standard hygiene practices are all that will be required. Site sanitation will be established and maintained in accordance with OSHA 29 *CFR* 1910.120(n) and USACE EM 385-1-1, Section 2. In particular:

Permanent restroom facilities are located on the project site. If they are disabled for the season or otherwise not available, EOTI will locate chemical toilets in the SZ, as required to support field personnel. Chemical toilets used in these locations and will be serviced every week. Each temporary toilet will be naturally lighted, have a toilet seat with a seat cover, have a urinal, have ventilation with vents screened, and be lockable from the inside. There will be at least one toilet for every 15 workers at the work site, if required.

Hand and face washing facilities will be set up at the EOTI work site and will be utilized by all personnel exiting the EZ prior to eating, drinking, tobacco use, or other hand-to-face activities. Paper towels will be provided for drying. A trash receptacle will be provided for discarded paper towels. In accordance with ANSI Z358.1-1998, eye-wash facilities will be available on the work site where operations in any of the work zones involve handling substances, which could be hazardous to the eyes. An eyewash kit will also be located in each site vehicle.

General work practices include the following:

- Safe work practices will be implemented whenever possible to eliminate or reduce the potential for employee exposure.
- Employees will wash their hands immediately or as soon as feasible after removal of gloves or other PPE.
- Employees will wash hands and any other skin with soap and water, or flush mucous membranes with water immediately following contact with blood or potentially infectious materials.
- If potentially contaminated sharps are encountered, the item will immediately be disposed of in an appropriate container or decontaminated.
- Eating, drinking, smoking, applying cosmetics or lip balm, handling of contact lenses, or storage/handling of food are prohibited in all areas where potentially infectious materials are present.
- Equipment that has become contaminated will be decontaminated prior to servicing or storage, unless decontamination is not feasible, in which case the equipment will be disposed of properly.

22.0 EQUIPMENT DECONTAMINATION

Due to the fact that chemical contamination is not anticipated at this site, basic washing of equipment is all that will be required.

23.0 EMERGENCY EQUIPMENT AND FIRST AID

Emergency equipment will be maintained on site for the duration of site operations. An approved, emergency first aid kit, bloodborne pathogen kit, and spill control kit will be kept in the UXOSO vehicle. Portable eyewashes will be located in the work area in the site vehicles. A 5-lb. ABC fire extinguisher will be kept in each site vehicle for emergency use on site. This equipment will be inspected on a weekly basis to assure they are maintained and ready to use. Any used items will be replaced immediately.

First aid kits are assigned by the Safety Office and approved by the Occupational Health Physician. The size and number of first aid kits shall be sufficient to accommodate the maximum number of people on site at any given time. First aid kits will be located in all operational vehicles, each team, and the site office. A large medical kit, with trauma supplies, will be located with the UXOSO.

Biohazard kits will be available in each operational vehicle and with each team working inside the EZ. The kit will be used any time an injury occurs or where there is the release of body fluids.

Portable kits of eyewash will be available during operations at the site where the potential for hazardous materials may contact the eyes. Portable eyewash bottles will be used while the injured person is being transported to the site eye wash station or medical attention.

Fire extinguishers will be stored where they are well marked and readily accessible. Fire extinguishers shall be protected from the damaging affects of environmental elements. The SUXOS is responsible to ensure that all fire extinguishers are visually inspected monthly and that these inspections are documented. All site personnel will be familiar with the locations of fire extinguishers and will be trained in their use.

24.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

The ERCP address the emergencies, which could occur during site operations, and outlines the appropriate response actions. EOTI will investigate magnetic anomalies to locate, identify, and dispose of MPPEH. MPPEH will be destroyed by site personnel using donor explosive charges obtained from commercial sources.

24.1 Pre-Emergency Planning

The SUXOS and UXOSO will perform pre-emergency planning before starting field activities and will coordinate emergency response with EMT/police/fire personnel and the servicing medical facility when appropriate. Pre-emergency planning meetings shall be used to inform local authorities of the nature of site activities that will be performed under the PWS and the potential hazards that activities may pose to site workers, the environment, and the public. An agreement will be established between EOTI and emergency response personnel and the hospital regarding responsibilities of each party in responding to a project site emergency. The UXOSO will verify all on-site emergency services information, to include telephone numbers and procedures for requesting services. It will be the UXOSO's responsibility to post these procedures and telephone contact numbers IAW the requirements of this APP. Pre-emergency planning tasks include:

- Locate telephone stations;

- Post emergency telephone numbers at accessible telephone locations;
- Inspect all emergency equipment and supplies to ensure they are in proper working order;
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies;
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in the office/break area, in the emergency evacuation vehicle and all other site vehicles;
- Conduct an emergency response drill to test the effectiveness of the ERCP; and
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP.

24.2 Personnel and Lines of Authority

In the event of an emergency, the SUXOS will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the ERCP and coordination with responding off site emergency services.

Once an emergency has occurred, the SUXOS will report the incident to the client representative, the Project Manager and the Corporate Health and Safety Staff as soon as the situation is under control.

If the emergency involves employee injury, SUXOS and UXOSO will complete the ENG Form 3394 Accident Report. The Corporate Health and Safety Staff will be responsible for notifying applicable Federal, state and local authorities/agencies. Once the emergency has been resolved, the SUXOS, UXOSO, Project Manager, and Corporate Health and Safety Staff will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

24.3 Criteria and Procedures for Emergency Recognition and Evacuation

Prevention of emergencies will be aided by the effective implementation of this SSHP, personnel awareness, contingency planning, and onsite safety meetings. Anticipated emergencies may include physical injury, fire, explosion, chemical spill or release, inclement weather and natural disasters. The SUXOS and UXOSO will use the site-specific briefing and/or the Tailgate Safety Briefings to inform site workers of the recognition, prevention, and response procedures for each anticipated emergency.

In the event of an emergency, site personnel will be notified by either visual/verbal communication. Personnel will be notified to:

- Stop work activities;
- Evacuate to the designated assembly point;
- Begin emergency procedures; and
- Notify off site emergency response organizations and adjacent industries.

In the event of an emergency that requires evacuation of the site verbal instruction will be given by the SUXOS to evacuate the area. Personnel will exit the area to the pre-designated assembly point.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The SUXOS will contact, counsel with and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;

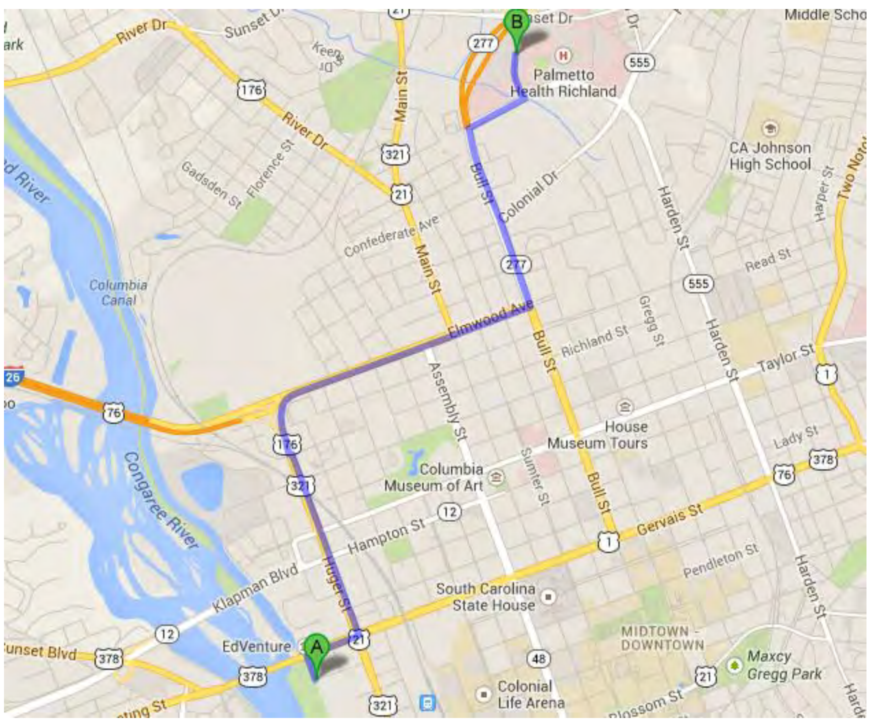
- The hazard has been reassessed;
- The Site Specific Safety and Health Plan has been revised and reviewed with onsite personnel, if needed; and
- Instructions have been given for authorized re-entry by the SUXOS/UXOSO.

24.4 Decontamination and Medical Treatment of Injured Personnel

It is not anticipated that hazardous waste decontamination shall be required during any activities under the PWS. This determination has been made based upon archival documentation and past activities conducted at the site.

24.5 Emergency Medical Facilities

The nearest medical facility address is: **Palmetto Health Richland**
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000 * *For Emergency Dial 911*



Driving directions to Palmetto Health Hospital

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N

0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E

1.1 mi

5. Turn left onto **Bull St**

0.7 mi

6. Turn right onto **Harden Street Extension**(signs for **Harden St**)

0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right

0.2 mi

The emergency telephone list can be found at Section 12.3.8 of this Appendix.

24.6 Criteria for Alerting the Local Community Responders

In the event of an on-site emergency the individual team leader or first person aware of the emergency will contact the SUXOS by field radio, cellular phone, or in person, as circumstances allow. The SUXOS will normally be responsible for requesting emergency services. If the order is given to evacuate the site of all personnel, each on-site team leader will assemble, account for, and evacuate all team personnel to the pre-designated staging area. The SUXOS/UXOSO will initially instruct the on-site CPR/First Aid trained personnel to respond to the emergency. These individuals shall render emergency first aid treatment and stay with the injured until relieved by off-site emergency services personnel, who would be called in at the discretion of the SUXOS.

24.7 Material Safety Data Sheets

As part of the EOTI Hazard Communication Program, an SDS binder will be maintained onsite, which includes copies of SDSs for all hazardous materials brought onto the site by EOTI. It will be kept in the site office during operations. This SDS binder will be available on request to all site personnel during all working hours of the site. If site workers have further questions about any of the hazardous materials they come into contact with, the EOTI Corporate Health and Safety Staff will locate the required information and pass it on to the employee.

24.8 Safe Distances and Places of Refuge

Normally, during an evacuation, personnel would evacuate to the office trailer and staging area in the SZ, where the SUXOS would take roll and account for all site personnel. An exception to this rule would be in the case of encountering a CWM item, in which case personnel would evacuate at least 450 feet upwind of the item. This location would change with the shifting winds, so it cannot be specifically identified.

24.9 Site Security and Control

During emergency procedures, the UXOSO will direct emergency vehicles into the site. The site personnel will also be notified that emergency vehicles are coming and be ready to assist where necessary. The UXOSO will assure that Fire Department personnel approach at no closer than fragmentation distance from any fire that might start in the area. EMT/ambulance personnel will be instructed by the UXOSO as to where to safely proceed to get to the injured worker. Site personnel will assist if required, at the direction of the SUXOS.

24.10 Evacuation Routes and Procedures

In the event of an emergency that requires evacuation of the site, an alarm will be sounded or verbal instruction given by the SUXOS/UXOSO to evacuate the area to the work site “Staging Areas.” This point will be established outside the EZ and in the SZ. Personnel will be shown the location of the staging areas daily, during the Site Safety Briefing. The location of the assembly point may change as work activity progresses within the project area. However, it will normally be at the office trailer.

After evacuation, the SUXOS will account for all personnel, ascertain information about the emergency, and advise responding on-site personnel. The SUXOS will contact, advise, and coordinate with responding off-site emergency personnel and points of contact for adjacent industries, if deemed necessary by the situation or the client Safety and Health Representative. In all situations that require evacuation, personnel will not re-enter the work area until the conditions causing the emergency have been corrected; the hazard reassessed; the APP has been revised and reviewed with on-site personnel, if needed; and instructions have been given for authorized re-entry by the SUXOS.

The route directions to the medical facility will be posted in the EOTI office, at the work site, and in site vehicles. This map also will indicate the evacuation route.

24.11 Decontamination

Due to the type of work on this project, it is not expected that a major chemical spill would occur that would require personnel decontamination prior to leaving the site. If a worker is accidentally injured using chemicals brought onto the site, the first aid procedures described in the SDS would be followed by co-workers to clean as much of the chemical off as possible before the ambulance arrives. In a case like this the SDS will be sent to the hospital with the worker to inform the medical staff of the exposure and how best to treat it.

24.12 Emergency Medical Treatment and First Aid

A minimum of two persons on the project site will be certified in First Aid/CPR. These persons will act as First Responders to any site emergency. First Aid kits will be available for their use in that capacity. The First Responders will perform first aid and/or CPR until medical personnel arrive on site. The SUXOS will contact the EMT/ambulance based on the type of injury received and send the injured worker to the designated emergency treatment facility. If the injury is not so serious, the SUXOS may ask a co-worker to take the injured worker to the hospital for treatment. Maps and directions to the hospital will be kept in all site vehicles. Directions to the hospital can be found in Section 11 of this Appendix.

Major hazardous substance spills are not expected due to the type of work taking place on this project. In the event of a minor hazardous substance spill causing an injury, the first responders would provide first aid based on the instruction in the SDS for the substances. The SDS would be taken with the injured worker to the hospital to provide information on treatment of that chemical.

24.13 Spill Alerting and Response Procedure

The emergency alerting procedure on the site will normally be a verbal warning to evacuate the site and the evacuation procedures outlined above would be implemented. Due to the fact that there should be no large quantities of chemicals found on this site, the only type of chemical spill would be a small one. If a small spill occurs, the individual who caused the spill will inform the SUXOS. He will then get the spill control kit, and use the absorbent material, clean up most of the spill. If some of the soil is contaminated, that soil will be dug up and placed with the rest of the spill clean-up materials. It will all be disposed of in a licensed hazardous waste disposal facility. Personnel involved in this clean-up will wear chemical resistant gloves. Larger spills might require the use of Tyvek suit and respirator as well, but spills of that size are not anticipated on this site.

24.14 Critique of Response and Follow-Up

After any type of site emergency, the SUXOS/UXOSO, the Project Manager, MEC Safety and health Coordinator, and the Corporate Health and Safety Staff will review the situation and determine if changes need to be made to the emergency procedures to make them more effective. Applicable changes will be made to the APP and these changes will be reviewed with all employees, so they are aware of the new procedures.

24.15 Emergency Response Team

There will be a minimum of two persons on the project site who are certified in first aid and CPR. These persons will serve as the first responders. They will respond to any site emergency and assist the victim until medical assistance arrives. The SUXOS will call for outside emergency assistance if it is needed. As soon as the professional emergency response services arrive onsite, the first responders will turn over medical care of the injured worker to them. They will be on stand-by to assist the ambulance crew if requested to do so.

24.16 Personnel Training Requirements

Personnel acting as first responders will be certified in First Aid and CPR from the American Red Cross or a similar other training entity. They will be qualified to provide basic first aid and CPR and will relinquish authority to the EMT/ambulance crew when they arrive on site.

24.17 Emergency Response Team Responsibilities

The responsibility of the emergency response team is to respond to on-site emergencies. They will provide only first aid and CPR, and they will attempt to calm and stabilize the patient until the professional help arrives.

25.0 LOGS, REPORTS AND RECORD KEEPING

Each person on the site will have an individual file folder, which contains a copy of the following:

- 40 hr HAZWOPER Certificate.
- Current 8 hr HAZWOPER Annual Refresher Certificate.
- 8 hr HAZWOPER Supervisor Certificate, if applicable.
- EOD/UXO Training Certificate
- Any other applicable training certificates.

Personnel folders will be maintained by the SUXOS on-site. Training/Tailgate Safety Record will be completed for all on-site daily training. The SUXOS/UXOSO will maintain the file, which will be made available for the client as requested. This form may be completed in ink, but it is preferred that it be completed with a computer in Word.

25.1 Daily Safety Inspection Logs

The UXOSO will perform daily inspections on a scheduled and non-scheduled basis, of all site operations. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined in Section 8.0. All inspections will be documented. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed.

25.2 Visitor Log

The Visitor’s Log will be maintained by the SUXOS. The log will document the visitor’s name, company name, date, time, and reason for visit. There will also be documentation that the visitor was given a visitor safety briefing prior to being permitted to enter the EZ of the site. Visitors will be escorted at all times within the EZ and MEC operations will cease during the time they are within the EZ.

25.3 Medical Surveillance Records and Certifications

A copy of the Physician Statement from a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine, regarding the current annual HAZWOPER physical examination will be maintained in the personnel folder with the other HAZWOPER certificates. The Physician Statements will remain in the individual’s file on the project site for the duration of site operations. The files will then be transferred to the Knoxville Office.

25.4 Air Monitoring Results

Due to the operations being performed on this project, air monitoring is not required.

25.5 Personal Exposure Records

As there is no chemical work taking place on this project, personal exposure records are not expected to be required.

25.6 Records Maintenance

All personal exposure and medical monitoring records, if generated, will be maintained in accordance with applicable OSHA standards, 29 CFR 1904, 1910, and 1926.

25.7 Final Report

EOTI will develop, retain and submit as part of the final report, all visitor registration logs, training logs, and daily safety inspection logs as part of the daily QC Reports.

25.8 Site Monitoring Results

All site-monitoring results will be documented. This will be kept in a file at the project site for reference, and will become a part of the permanent site record at the conclusion of site activities. At this site, heat exposure monitoring is the only monitoring anticipated to occur and that is dependent upon the site temperature.

25.9 Accident Reporting Records

Accidents/incidents shall be reported in accordance with DID MR-015 and EM 385-1-1 using the ENG Form 3394 Accident Report form in Appendix F. Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the Knoxville EOTI Office.

25.10 Safety Exposure Report

A Safety Exposure Report, a tabulation of field labor hours, lost workday accidents, and number of lost workdays shall be submitted.

26.0 UNFORESEEN HAZARDS

Should any unforeseen hazard become evident during the performance of work, the SUXOS and UXOSO shall bring such hazard information to the attention of the Corporate Health and Safety Staff and the on-site government representative (both verbally and in writing) for resolution as soon as possible. In the interim, necessary action shall be taken to reestablish and maintain safe working conditions until the procedures to address the new hazards can be put into place and the APP updated accordingly.

APPENDIX E
MUNITIONS CONSTITUENTS SAMPLING AND ANALYSIS PLAN

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

NOT APPLICABLE

APPENDIX F
CONTRACTOR FORMS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

TABLE OF CONTENTS

NOTE:

A CD containing all Contractor-specific forms will be maintained on site. The forms in this appendix are examples of the forms that the Contractors will be using during this project. Forms may be modified to meet specific project reporting needs.

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.
DOCUMENTATION OF TRAINING

Training Course Name: ______________________________
(General, UXO Equipment, Visitor, Special)

Presented By: ____________________ **Date:** ____________________

Topics Discussed

Work Plan/SSHP/APP: ______________________________

UXO/MEC Hazards: ______________________________

Chemical Hazards: ______________________________

Physical Hazards: ______________________________

Emergency Procedures: ______________________________

Weather Conditions: ______________________________

Other: ______________________________

____

____

Attendees

Printed Name	Signature	Date

Trainer: ______________________________ **Date:** ____________________

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

SSHP ACKNOWLEDGMENT

Project: Removal Action ____________ Site: ____________
Contract Number: ____________ Site Location: ____________

Project Manager: ____________
SUXOS: ____________
UXOSO: ____________

I acknowledge that I understand the requirements of this SSHP and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions concerning the SSHP and its requirements answered prior to performing field activities. Health and Safety Training and Medical Surveillance requirements applicable to my field activities at this site are current and will not expire during onsite activities.

EOTI PERSONNEL:

SIGNATURE	EMPLOYEE NO.	DATE

OTHER PERSONNEL:

SIGNATURE	ORGANIZATION	DATE

SSHP Acknowledgment Form

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC

WEEKLY SAFETY CHECKLIST

Location: ____________________

Site: ____________________

Description	Findings	Remarks
1. Personal Protection (PPE) per SSHP/APP	Pass/Fail	
2. Work Practices Follow SSHP/APP	Pass/Fail	
3. Site Control/Decon per SSHP/APP	Pass/Fail	
4. Eyewash Station(s)	Pass/Fail	
5. First Aid Kit(s)	Pass/Fail	
6. Fire Extinguisher(s)	Pass/Fail	
7. Monitoring Equipment	Pass/Fail	
8. Calibration	Pass/Fail	
9. Communications	Pass/Fail	
10. Overall Cleanliness of Site	Pass/Fail	
11. Other	Pass/Fail	

Printed Name: ____________________

Signature: ____________________

Date: ____________________

REMARKS: ____________________

____

____

____

DAILY SAFETY ATTENDANCE SIGN-IN SHEET

NAME	COMPANY	SIGNATURE	DATE
Person Presenting the Safety Briefing:			

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

QUALITY CONFORMANCE INSPECTION (QCI) RECORD
See Reverse for Completion Instructions

DATE: ________________ **PROJECT SITE:** ________________________________

QC SPECIALIST: ________________________________

TASK INSPECTED:
____

SCHEDULED INSPECTION ( ) **REINSPECTION ( )**
DAILY ( ) **WEEKLY ( )** **OTHER ( )** ____________________

RESULTS:
( ) TASK **IS** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.
( ) TASK **IS NOT** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE NOTED NONCONFORMANCE IS AS FOLLOWS: ____________________

REINSPECTION:

TASK AND DATE OF NONCONFORMANCE BEING REINSPECTED:

RESULTS:
( ) TASK **IS** BEING ACCOMPLISHED IN CONFORMANCE TO THE WP/SSHP.
( ) TASK **IS NOT** BEING ACCOMPLISHED IN CONFORMANCE TO WP/SSHP.

THE RE-OCCURRING NONCONFORMANCE IS AS FOLLOWS:

QUALITY CONFORMANCE INSPECTION (QCI) RECORD

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC

INSTRUCTIONS FOR COMPLETION

A QCI record will be completed on each task inspected.

Date: Enter the date the inspection took place.

Project Site: Enter the project site's name.

QC Specialist: Name of the QC Specialist conducting the QCI.

Task Inspected: Enter the name of the task being inspected as per the QCI Schedule.

Scheduled Inspection: Place a "X" in the appropriate ( ). If Other is applicable, note the reason for the QCI.

Results:
Enter a ""X" in the appropriate ( ).
If the task is in conformance, no other information is required on this form.
If the task is not in conformance, continue with the explanation in space provided.

Reinspection:
Date and Task being reinspected: Enter the date and pertinent task.
Results: Enter a "X" in the appropriate ( ).
If the task is still not in conformance, continue with the explanation in space provided.

Distribution of completed forms:

Conformances:
1- Project Manager
1 - On-site QC File (Inactive)

Nonconformances:
1 - Project Manager
1- Quality Manager
1 - On-site QC File (Active)

Reinspections:
1 - Project Manager
1 - Quality Manager
1 - On-Site QC File (Inactive) (if compliant)
(Active) (if noncompliant)

QUALITY CONFORMANCE INSPECTION (QCI) RECORD

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

EOTI
Quality Control
Corrective Action Log

Project: ____________________
Location: ____________________
SUXOS: ____________________
UXOQCS: ____________________

Non Conformance			Correction		
Date	Activity	Nature	Action Taken	Completed By	Date

Quality Control Corrective Action Log

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

MEC Accountability Log

Identification					Description			Disposition			
ID #	Anomaly #	Date	Grid/Area	Location	Nomenclature	Fuze Description	Fuze Condition	Method	Date	By Whom	Photo #

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

27. ADDITIONAL DATA

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

25. NATIONAL STOCK NO. & ADD (8-22)

24. DOCUMENT NUMBER & SUFFIX (30-44)

DOC IDENT · RI FROM · M & S · UNIT · QUANTITY · SER · SUPPLEMENTARY ADDRESS · SIG · FUND · DISTRIBUTION · PROJECT · PRI · REQD DEL DATE · ADV · RI · O/P · COND · MGT · UNIT PRICE DOLLARS CTS

1. TOTAL PRICE DOLLARS CTS

2. SHIP FROM

3. SHIP TO

4. MARK FOR

5. DOC DATE

6. NMFC

7. FRT RATE

8. TYPE CARGO

9. PS

10. QTY. REC'D

11. UP

12. UNIT WEIGHT

13. UNIT CUBE

14. UFC

15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

18. TY CONT

19. NO CONT

20. TOTAL WEIGHT

21. TOTAL CUBE

22. RECEIVED BY

23. DATE RECEIVED

PerFORM (DLA)

PREVIOUS EDITION MAY BE USED

EOTI

EOTI WEEKLY VEHICLE INSPECTION CHECKLIST

(This form to be used weekly for all site vehicles, EXCEPT explosive carriers, which must be inspected prior to EACH explosive transport)

Site Location: ______________________________

Inspector: ______________________________

Vehicle: ______________________________ (MAKE AND LICENSE PLATE #) **Owner:** ______________________ (RENTAL, EOTI, GRE, CONT.)

Date Inspected: ____________________ **Mileage:** ____________________

Use [✔] For Pass, Use [X] For Discrepancy

1. DOCUMENTATION:		2. BRAKES:	
Registration	[ ]	Hand/Emergency	[ ]
Insurance	[ ]	Service	[ ]
Emergency Route Map/ Phone Numbers	[ ]		
3. TIRES:		4. BELTS:	
Pressure	[ ]	Proper tension	[ ]
Condition	[ ]	Condition	[ ]
5. EQUIPMENT:		6. LIGHTS:	
Fire extinguishers	[ ]	Headlights (high & low)	[ ]
First Aid/CPR/Burn/ Eyewash kits	[ ]	Brake Lights	[ ]
*Tie downs	[ ]	Parking	[ ]
*Chocks	[ ]	Back-up	[ ]
*Placards	[ ]	Turn Signals	[ ]
		Emergency Flashers	[ ]
7. FLUID LEVELS:		8. GENERAL:	
Oil	[ ]	Windshield Wipers	[ ]
Coolant	[ ]	Horn	[ ]
Brake	[ ]	Seat Belts	[ ]
Steering	[ ]	Steering	[ ]
Transmission	[ ]	Windshield/Windows	[ ]
Windshield Wiper	[ ]	Gas Cap	[ ]
Fluid Leaks	[ ]	Mirrors	[ ]
		Exhaust System/ *Spark Arrester	[ ]
		Cleanliness	[ ]

(Note: Items marked with * apply to explosive carriers only)

Description of deficiencies:______________________________

____

____

____

Deficiencies corrected by:____________________ Date: ____________________

EOTI WEEKLY VEHICLE INSPECTION FORM

EOTI
EXPLOSIVE ORDNANCE TECHNOLOGIES, INC.

Site Name:____________________

Site Location:____________________

Date:____________________

SITE VISITOR'S LOG

PRINT NAME	SIGNATURE	AGENCY	PURPOSE OF VISIT	PHONE #	DATE/TIME ARRIVED	DATE/TIME DEPARTED

Site Visitor's Log

MAGAZINE DATA CARD

NOMENCLATURE: ____

EXEMPTION NO.: _________________________ MANUFACTURER ID NO.:__________________

===
===

DATE	ACTION TAKEN	QUANTITY RECEIVED	QUANTITY ISSUED	BALANCE	SIGNATURE

Instructions for Completion

Two sets of this form will be maintained on **each** separate item. One will be maintained with the materials and the other in the project office.
Nomenclature: Nomenclature of item.

Exemption No.: Exemption number of item, if applicable.
Manufacturer's ID No.: Manufacturer's ID number
Date: Enter date action is being completed.
Action taken: INT REC -Initial Receipt from shipper
ISSUED -Issued for Use
RTS -Returned to Stock
BCF -Balance Carried Forward

Quantity Received: Enter number of items received from shipper or returned to stock.
Quantity Issued: Enter number of items issued for use.
Balance: To be completed for each transaction.
Signature: Signature of the individual completing the transaction.
Last row on form should contain the entry BALANCE CARRIED FORWARD and the balance.
First row on a new form should contain the entry BALANCE BROUGHT FORWARD and the balance.

U.S. Department of Justice
Bureau of Alcohol, Tobacco, Firearms and Explosives

Federal Explosives License/Permit
(18 U.S.C. Chapter 40)

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555), you may engage in the activity specified in this license or permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. **THIS LICENSE IS NOT TRANSFERABLE UNDER 27 CFR 555.53.** See "WARNINGS" and "NOTICES" on reverse.

Direct ATF Correspondence To	ATF - Chief, FELC 244 Needy Road Martinsburg, WV 25405-9431	License/Permit Number	**8-NJ-025-33-5D-12250**
Chief, Federal Explosives Licensing Center (FELC)	Christopher R. Reeves	Expiration Date	**April 1, 2015**

Name
EXPLOSIVE ORDNANCE TECHNOLOGIES INC

Premises Address (Changes? Notify the FELC at least 10 days before the move.)
185 RUMSON RD
RUMSON, NJ 07760-

Type of License or Permit
33-USER OF EXPLOSIVES

Purchasing Certification Statement
The licensee or permittee named above shall use a copy of this license or permit to assist a transferor of explosives to verify the identity and the licensed status of the licensee or permittee as provided by 27 CFR Part 555. The signature on each copy must be an original signature. A faxed, scanned or e-mailed copy of the license or permit with a signature intended to be an original signature is acceptable. The signature must be that of the Federal Explosives Licensee (FEL) or a responsible person of the FEL. I certify that this is a true copy of a license or permit issued to the licensee or permittee named above to engage in the business or operations specified above under "Type of License or Permit."

Mailing Address (Changes? Notify the FELC of any changes.)
EXPLOSIVE ORDNANCE TECHNOLOGIES INC
185 RUMSON RD
RUMSON, NJ 07760-

Licensee/Permittee Responsible Person Signature ____________ Position/Title ____________

Printed Name ____________ Date ____________

Previous Edition is Obsolete EXPLOSIVE ORDNANCE TECHNOLOGIES INC:185 RUMSON RD 07760 8-NJ-025-33-5D-12250 April 1, 2015 33-USER OF EXPLOSIVES

ATF Form 5400.14/5400.15 Part I
Revised October 2011

Federal Explosives License (FEL) Customer Service Information

Federal Explosives Licensing Center (FELC)
244 Needy Road
Martinsburg, WV 25405-9431

Toll-free Telephone Number: (877) 283-3352
Fax Number: (304) 616-4401
E-mail: FELC@atf.gov

ATF Homepage: www.atf.gov

Change of Address *(27 CFR 555.54(a)(1))*. Licensees or permittees may during the term of their current license or permit remove their business or operations to a new location at which they intend regularly to carry on such business or operations. The licensee or permittee is required to give notification of the new location of the business or operations not less than 10 days prior to such removal with the Chief, Federal Explosives Licensing Center. The license or permit will be valid for the remainder of the term of the original license or permit. **(The Chief, FELC, shall, if the licensee or permittee is not qualified, refer the request for amended license or permit to the Director of Industry Operations for denial in accordance with § 555.54.)**

Right of Succession *(27 CFR 555.59)*. (a) Certain persons other than the licensee or permittee may secure the right to carry on the same explosive materials business or operations at the same address shown on, and for the remainder of the term of, a current license or permit. Such persons are: (1) The surviving spouse or child, or executor, administrator, or other legal representative of a deceased licensee or permittee; and (2) A receiver or trustee in bankruptcy, or an assignee for benefit of creditors. (b) In order to secure the right provided by this section, the person or persons continuing the business or operations shall furnish the license or permit for for that business or operations for endorsement of such succession to the Chief, FELC, within 30 days from the date on which the successor begins to carry on the business or operations.

(Continued on reverse side)

Cut Here ✂

Federal Explosives License/Permit (FEL) Information Card

License/Permit Name: **EXPLOSIVE ORDNANCE TECHNOLOGIES INC**

Business Name:

License/Permit Number: **8-NJ-025-33-5D-12250**

License/Permit Type: **33-USER OF EXPLOSIVES**

Expiration: **April 1, 2015**

Please Note: Not Valid for the Sale or Other Disposition of Explosives.

APPENDIX G
MUNITIONS FRAGMENTATION SHEETS

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

Fragmentation Data Review Form

Database Revision Date 8/21/2014

Category:	Black Powder Rounds
Munition:	10 in Cannonball Shell
Case Material:	Cast Iron, Grey, CL35
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Civil War Era
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	11/2/2009
Record Created By:	SDH
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	4
Diameter (in):	9.8500
Cylindrical Case Weight (lb):	93.88430
Maximum Fragment Weight (Intentional) (lb):	3.5556
Design Fragment Weight (95%) (Unintentional) (lb):	0.8186
Critical Fragment Velocity (fps):	1659

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.43
TNT Equivalent Weight - Impulse (lbs):	1.720
Kinetic Energy 10^6 (lb-ft²/s²):	4.8957

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	237
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3060
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2087

Overpressure Distances

TNT Equivalent (Pressure):	0.43
TNT Equivalent Weight - Pressure (lbs):	1.720
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	22
Public Traffic Route Distance (2.3 psi); K24 Distance:	29
Inhabited Building Distance (1.2 psi), K40 Distance:	48
Intentional MSD (0.0655 psi), K328 Distance:	393

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.80	7.40
Mild Steel:	2.21	1.23
Hard Steel:	1.81	1.01
Aluminum:	4.07	2.36
LEXAN:	11.35	7.93
Plexi-glass:	9.75	6.06
Bullet Resist Glass:	9.20	5.43

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

APPENDIX H
CONTRACTOR PERSONNEL QUALIFICATIONS CERTIFICATION LETTER

MUNITIONS RESPONSE WORK PLAN
CONGAREE RIVER PROJECT
REMOVAL ACTION AND CONSTRUCTION SUPPORT
COLUMBIA, SC

RESUMES OF KEY PERSONNEL

The following personnel are proposed as key personnel for the activities on this project:

Brian Woods	Project Manager	Resume included
James Haynie	SUXOS	CEHNC # 1142
Thomas Dailey	UXOSO/QCS	CEHNC # 1071
Wayne Madsen	UXO Technician III	CEHNC # 0184
Jay Johnson	UXO Technician II	CEHNC # 1418
Phillip Lewallen	UXO Technician II	CEHNC # 1843
Logan Daily	UXO technician I	CEHNC # 1989
De La Von Conner	UXO technician I	CEHNC # 2333

Personnel Qualifications Certification Letter

I, Matthew S. Norris, Assistant Project Manager, certify that the personnel listed above meet or exceed contract requirements for the function they will perform.

If changes in the identified personnel are required, due to the availability of the proposed personnel or schedule conflicts, EOTI will propose fully qualified personnel to fill the position. Resumes of proposed key personnel that are not in the CEHNC database will be submitted for review and approval.

C. Brian Woods, PG, PMP / Project Manager

Years Experience: With EOTI: 1 With Other Firms: 14

Education:

B.S., Environmental Science/Plant & Soil Science (Geology Minor)—University of Tennessee (1999)

Active Registration:

Project Management Professional (PMP)/Project Management Institute (#1230698; 2009)
Licensed Professional Geologist (PG)/Tennessee (#5559; 2008)

Chronological Job History:

2014-Present EOTI; Knoxville, TN; Project Manager

2011-2013 WESTON; Norcross, GA, TN; Project Manager

2005-2011 EODT; Lenoir City, TN; Project Manager

2004 HydroGeoLogic, Inc.; San Antonio, TX; Project Manager

1999-2004 TN & Associates, Inc. Project Geologist; and Project Manager

Program / Project Management: Mr. Woods

- 15 years of total experience performing both MMRP (8 years) and environmental project work.
- 12 years of experience as Project Manager.
- Managed 20 MMRP projects ranging from preliminary assessments and remedial investigations/feasibility studies to removal actions.
- Project experience in over 15 states for federal, commercial, state, and city government clients.
- Served as a speaker and facilitator at a dozen technical project planning and public meetings.
- Has routinely managed projects over $2M and multiple projects over $10M in the last 6 years.
- Clients include DOD, DOE, USACE, AFCEE, Navy, Air Force, Air National Guard, commercial, and city and state.

Key Projects

Tyndall AFB, FL, AFCEE. Project Managed 5 project areas involving petroleum soil and groundwater contamination under a large performance based base-wide project. Project involved development of work plans to meet state of Florida POL requirements. (2012-2013; Weston).

Former Hammond Bombing Range, LA, Private Client. Project involved review of historical documents and preparation of a professional opinion report to be used in a legal dispute over the level of potential contamination on Former Hammond Bombing range land. Because of report and deposition given by team member the case was settled out of court. (2012 Weston)

Munitions and Explosives of Concern (MEC) Remedial Investigation/Feasibility Study (RI/FS), Former Conway Bombing and Gunnery Range, Conway, SC, U.S. Army Corps of Engineers (USACE) Huntsville District, Project Manager. Supported and managed planning with stakeholders, public meetings, and field investigation to determine the nature and extent of MEC. Overall goal of contract was to obtain a decision document acceptable to stakeholders. [7-09 to 2-11; EODT]

MEC RI/FS, Former Camp Claiborne, Alexandria, LA, USACE Huntsville District, Project Manager. Supported and managed planning with stakeholders, public meetings, and field investigation to determine the nature and extent of munitions constituents using multi increment sampling and discrete sampling methods. [7-09 to 2-11; EODT]

MEC RI/FS, Former Five Points Outlying Field, Arlington, TX, USACE Huntsville District, Project Manager. Project work involved producing a RI/FS report based upon previous investigations and removal actions at the site. Five Points is located within a residential area (large subdivision). Challenges involved getting regulatory support for no further action after removal action has been completed. [7-09 to 2-11; EODT]

MEC Engineering Evaluation/Cost Assessment (EE/CA), Ft. McClellan, AL, USACE Huntsville District, Project Manager. Project work involved performing MEC investigation using geophysical transect and grid data collection to define the nature and extent of the Charlie Area at Ft. McClellan. Prepared and attended weekly planning phone calls with the McClellan BRAC team and USACE Huntsville. Brought the project through the critical planning and work plan stage. [7-10 to 12-10; EODT]

Unexploded Ordnance (UXO) Avoidance/Construction Support San Antonio Military Medical Centre, San Antonio, TX, USACE Huntsville District, Project Manager. Project involved a high probability of encountering munitions containing white phosphorus (a smoke and burning agent) in downtown San Antonio in the immediate vicinity of highways and a hospita . Mobilization of personnel and equipment was required in less than a days notice. Project performed safely. [6-09 to 12-09; EODT]

Ft. Benning Modified Record Firing Ranges 1, 5 & 7, MEC Removal Action, Ft. Benning, GA, USACE Huntsville District, Project Manager. Managed scope schedule and budget for this project which involved MEC clearance of 88 acres at former training ranges including securing, certifying, and disposing of scrap. [5-09 to 12-09; EODT]

UXO Avoidance/Construction Support, Crab Orchard National Wildlife Refuge, Marion, IL, Conastoga Rovers & Associates, Project Manager. Project Manager performing MEC clearance and support for site characterization. Work activities were performed at the Former Illinois Ordnance Plant. Successfully completed first phase (5-06 to 11-07) and awarded second phase [1-09 to 10-09; EODT]

MEC RI/FS, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget and planning with stakeholders, public meetings, and field investigation to determine the nature and extent of MEC munitions constituents (MC) contamination. Overall goal of contract was to obtain a decision document acceptable to stakeholders. [8-08 to 2-11; EODT]

UXO Avoidance/Construction Support, Conway, SC, Wild Wing Development Company, Project Manager. Managed scope, schedule, and budget on the project objectives for performing UXO removal and construction support for the Wild Wing Land Developer. Project activities are currently on hold because the current economic housing crisis has halted development. [6-08 to 2-11; EODT]

MEC Clearance of Remote Ranges, Eielson Air Force Base (AFB), AK, AFCEE, Project Manager. Project involved abbreviated mobilization of 8 days after award, which required acquiring and mobilizing staff, equipment, and supplies to a remote locations in Alaska without roads or lodging. One of the first UXO projects for AFCEE and received great accolades for execution. All UXO and munitions debris removal from range targets was completed on time, under budget, and at the satisfaction of Eielson AFB. Contract fulfilled and closed out**.** [6-08 to 9-08; EODT]

Non-Time Critical Removal Action, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Took over as project manager during report development stage and coordinated with USACE Huntsville Center (CEHNC) in achieving comment resolution, and produced an acceptable final report to regulators. Contract was fulfilled and closed out. [7-07 to 9-08; EODT]

Former Camp Bowie MEC EE/CA, Brownwood, TX, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget for the finalization of the EE/CA Report and Action Memorandum. Project work included development of EE/CA report and Action Memorandum based upon geophysical investigation activities. Work also involved close coordination with USACE, and state and local stakeholders through email, letters, phone conferencing and public meetings. Contract was fulfilled and closed out. [4-06 9-08; EODT]

Former Camp Wolters MEC EE/CA, Mineral Wells, TX, USACE Huntsville District, Project Manager. Managed scope, schedule, and budget for the finalization of the EE/CA Report and Action Memorandum. Took over project during the draft EE/CA report stage and worked with USACE Huntsville Center technical staff to reach comment resolution. Worked as the primary technical writer in revising the EE/CA and creating an action memorandum. Presented EE/CA results at the public meeting. Contract was fulfilled and closed out. [10-06 to 9-08; EODT]

MEC EE/CA, Former Camp Wheeler, Macon, GA, USACE Huntsville District, Project Manager. Took over as Project Manager and Primary Technical Writer during the reporting stage for the EE/CA at the Former Camp Wheeler, Macon, GA. Report elements included analyzing geophysical data, anomaly dig results, creation of ordnance operable units (OOUs), ordnance and explosives (OE) risk assessment, comparative analysis of response alternatives, institutional control plan, and developing a detailed engineering cost assessment. Contract was fulfilled and closed out. [7-07 to 7-08; EODT]

UXO Avoidance and Construction Support, Ft. Polk, LA, General Dynamics, Project Manager. Project included UXO Avoidance support to General Dynamics during construction/installation of fiber-optic lines and target installation at an improvised explosive device (IED) training course. Contract fulfilled and closed out. [5-08 to 6-08; EODT]

Former Camp Elliott MEC EE/CA, San Diego, CA, USACE Huntsville District, Project Manager. Project included development of EE/CA report, Abbreviated Feasibility Study, Proposed Plan, and Decision Document based upon geophysical investigation activities. Served as primary technical writer for the Abbreviated Feasibility Study, Proposed Plan, and Decision Document. Work involved close coordination with USACE, state and local stakeholders through email, letters, phone conferencing, and public meetings. All documents have been accepted by the government. Contract was fulfilled and closed out. [3-06 to 5-08; EODT]

UXO Avoidance, Milan Army Ammunition Plant, Milan, TN, Arcadis, Inc., Project Manager. Project included UXO Avoidance support to Arcadis Inc. during site characterization of an open burn/open detonation area. Contract was fulfilled and closed out. [3-08 to 5-08; EODT]

MEC Historical Site Assessment, Former Whittaker-Bermite Facility, Santa Clarita, CA, Whittaker Corporation, Project Manager. Project Manager for the remedial investigation and clearance activities at the former Whittaker-Bermite Facility. Served as primary researcher and technical writer on historical site assessment. This work required a review of historical documents, aerial photographs, drawings, site interviews, and site walk inspections. The Historical Site Assessment Report was accepted by State of California regulators, and subsequent activities have been awarded to execute report recommendations. Planning and execution of these recommended activities is currently ongoing. [3-05 to 1-08; EODT]

MEC and Scrap Processing, St. Juliens Creek Annex, Portsmouth, VA, USACE Huntsville District, Project Manager. Project work included inspection, segregation, demilitarization of two MEC areas located at a naval defense reutilization, and marketing office (DRMO) facility. One of these two areas involved inspection and demilitarization of palletized projectiles and bombs. Project was completed on time with full client satisfaction, as well as accident free. Project included unexpected discovery of 43 potentially explosive rounds, which were safely handled and removed without affecting the schedule or additional government costs. St. Juliens Creek received an exceptional rating in all categories (a perfect score) for its Past Performance Information Management System (PPIMS) rating. [01-06 to 6-06; EODT]

Historical Site Assessment/Remedial Investigation, Iowa Army Ammunition Plant, Burlington, Iowa, USACE Omaha District, Project Manager. Performed a self-obtained subcontract with Shaw E&I to lead their technical team on the development of a RI Investigation. The contract was obtained from previous experience and reputation with USACE Omaha District. [4-04 to 8-04; HGL]

Former Nansemond Ordnance Depot Remedial Action, VA USACE-Norfolk District, Project Geologist. Performed duties of Task Manager and primary technical writer on a pesticide soil removal action work plan. Work Plan elements involved excavation, sampling, soil and sediment control, waste management, health and safety, and construction quality control. This plan received a review of excellent, and was considered by HGL program management as an example of quality documents HGL should strive to produce. [4-04 to 5-04; HGL]

Substrate Injection for Chromates Bioremediation, Former Kelly AFB, TX, AFCEE, Project Geologist. Field Team Leader/project geologist in the injection of hydrogen release compound (HRC) into the saturated zone of a chromates contaminated aquifer area. Field elements included: bore-hole logging, identification of injection interval, as well as oversight of a drilling subcontractor. [6-04 to 8-04, HGL]

Soil Vapor Extraction (SVE) Installation and Maintenance, George AFB, CA, AFCEE, Project Geologist. Task Manager on the preparation of a construction quality control plan for the installation of SVE system and long-term maintenance at George AFB, CA. Work elements included implementing design specifications, SVE construction, initial operation and proving stage, and long-term maintenance operations. [4-04 to05-04; HGL]

Project and Administrative Record Research, USACE-Albuquerque Office, USACE Albuquerque District, Project Geologist. Collected and prepared administrative records of completed projects for the USACE Albuquerque Office. Work elements included the review of all project records, determination of applicable permanent project/administrative records, and set up a USACE data management system for cataloging purposes. [5-04 to 6-04; HGL]

Remedial Investigation/Feasibility Study, Iowa Army Ammunition Plant (AAP), Burlington, IA, USACE Omaha District, Project Manager. Performed as the Project Manager (12-02 to 02-04), Task Manager and primary technical writer on three historical site assessment and soil sampling analysis work plans/RI reports over a period of 4 years at this over 19,000-acre facility. This facility is the nation's second largest ammunition plant. Involved research of over 60 years of plant historical records. Thousands of drawings, over 200 aerial photographs, and over 500 historical documents were reviewed and summarized into encyclopedia-like documents, along with historical narratives of plant historical operations. EPA Region 7 commented that the historical site assessment work plans were the most comprehensive compiled to date associated with Iowa AAP investigations (over a 20-year period). The histories of the subject sites involved nuclear weapons production, conventional weapons production, research laboratories, and conventional weapon and nuclear weapon component test firing. Performed duties as a field team leader in the collection of 1,400 soil samples, from over 300 sample locations, in an active mile long production facility containing over 250 buildings. Responsibilities also included a 3.5-hour presentation to regulators, plant commander and government contractors on the plant history and possible areas of environmental contamination. EPA Region 7 commented that they had been waiting 10 years for someone to comprehensively pull together site history and potential waste streams. Additionally, EPA Region 7 commented that the historical site assessment reports "provide an excellent reference for describing past operating practices in specific buildings at IAAAP." "We will use this report,"…"as a benchmark for the type of effort and level of detail needed to complete similar evaluations of historical activities at the site." [5-00 to 2-0; TN&A]

Phase II Site Investigation, Former Gadsden Ordnance Plant, Mobile, AL, USACE Mobile District, Project Manager. Project Manager/Field Team Leader on a Phase II Site Investigation at the Former Gadsden Ordnance Plant. Project scope included soil sampling, well installation, groundwater sampling, well abandonment, and report writing. [7-03 to 7-04; TN&A]

Lead Contaminated Soil Remedial Action/Groundwater Sampling Lake City Army Ammunition Plant (LCAAP), Lake City, MI, USACE Kansas City District, Project Geologist. Served as primary technical writer on the LCAAP Area 18 Lead Contaminated Soil Remedial Action Work Plan. Duties included reviewing design specifications and creating a work plan based on those specifications. Work Plan elements involved excavation, sampling, soil and sediment control, waste management, health and safety, and construction quality control. Field team member in the collection of groundwater samples from over 160 wells using low flow bladder pump and data logging technology. [10-02 to 1-03; TN&A]

UST Removal/TN&A Underground Storage Tank Closure, Great Smoky Mountains National Park National Park Service, Project Geologist. Technical writer on the preparation and submittal of a UST Removal Action Work Plan for the Great Smoky Mountains National Park. Work Plan elements included: UST Closure Application preparation, CADD figure design, excavation, waste management, sampling, environmental protection, health and safety, and construction quality control. Field team member and sample coordinator during field activities. [7-02 to 1-03; TN&A]

Abandoned Landfill Interim Removal Action Management Work Plan, LCAAP, Lake City, MI, USACE Kansas City, Project Geologist. Technical support/contributing designer for the LCAAP Area 16 abandoned landfill interim removal action management work plan. Elements included construction of a leachate storage and transfer facility, landfill regrading and capping, environmental protection plan, installation of passive gas vents and leachate recovery trench, waste management, Health and Safety Plan, CQC Plan, and SAP Plan [5-01 to 2-02; TN&A]

Remedial Action Decontamination and Decommission (RADD), Y-12 Security Complex, Bechtel Jacob,; Oak Ridge, TN, Site Supervisor. Site Supervisor for decontamination and closure of 11 large waste storage tanks containing low-level mixed radioactive sludge. Served as responsible party at the site, and ensured that the work plan elements were followed. Duties also included sampling and tank inspection. [6-01 to 7-02; TN&A]

RADD Drum Removal Action Work Plan, Oak Ridge K-25 DOE Plant, Oak Ridge, TN, Bechtel Jacobs, Project Geologist. Designer of the RADD Task 20 Drum Removal Action Work Plan by reviewing DOE documents and designing an outline and figures. This report received good reviews for organization and for following DOE guidelines. [4-01 to 5-01; TN&A]

Limited RI Groundwater/Soil Sampling, Former Herington Army Airfield Herington, KS, USACE, Kansas City District. Performed monitoring well micro-purge groundwater sampling and soil sampling to support a Limited Remedial Investigation. Provided technical writing support and designed all figures for the report after field activities, including geologic cross sections, fence diagrams, potentiometric maps, and contamination plume maps. Used gINT software to create project boring logs. [10-00 to 1-01; TN&A]

Inert Disposal Area Well Installations, Iowa Army Ammunition Plant Middletown, IA, USACE Omaha District, Project Geologist. Task Manager, Field Team Leader, and technical writer on both the well installation work plan and well installation report. Supported and later led field team in well installation fieldwork. [4-00 to 11-00; TN&A]

Well Abandonment Project, Former K-25 Facility, Oak Ridge, TN, U.S. Department of Energy (DOE), Project Geologist. Field Team Leader and Health and Safety Officer: Technically advised and managed the abandonment of wells at a current DOE installation. Job was performed accident-free in the presence of radiological contamination and overhead hazards [5-00 to 6-00; TN&A]

Inert Disposal Area Annual Groundwater Report, Iowa Army Ammunition Plant, IA, USACE Omaha District, Project Geologist. Task Manager and technical writer for an annual groundwater study report. This report included hydrogeological result interpretation, groundwater data quality asesssment, and statistical comparisons between monitoring data and background data. Many graphical models and figures were created for this report using a CAD program. [11-99 to 1-00; TN&A]

Remedial Design Reports, Massachusetts Military Reserve, Cape Cod, MA, AFCEE, Project Geologist. Technical support and contributing designer in the design of figures and writing of text for Pre-Design and 100% Design Reports. These reports included sections on data and equipment evaluation for soil vapor extraction/biosparging design, asphalt batching design, wetland determination and delineation studies, geophysical survey for drum investigation, and contaminants of concern. [11-99 to 7-02; TN&A]

EXPLOSIVES SAFETY SUBMISSION

MUNITIONS AND EXPLOSIVES OF CONCERN

REMOVAL ACTION AND CONSTRUCTION SUPPORT

CONGAREE RIVER PROJECT

COLUMBIA, SOUTH CAROLINA

April 2015

Prepared by

Explosive Ordnance Technologies, Inc.

Contents

Acronyms

ATF&E	Bureau of Alcohol, Tobacco, Firearms and Explosives
BEM	Buried Explosion Module
BGS	below ground surface
BIP	blown in place
CD	Cultural Debris
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CM	Conventional Munitions
CRP	Congaree River Project
CWM	Chemical
DDESB	Department of Defense Explosives Safety Board
DHEC	Department of Health and Environmental Control
DMM	Discarded Military Munitions
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Assessment
EMM	Earth Moving Machinery
EOD	explosive ordnance disposal
ESS	Explosive Safety Submission
EZ	exclusion zone
IAW	In Accordance With
IDW	industrial derived waste
MDAS	Material Documented as Safe
MEC	Munitions and Explosives of Concern
MGFD	munitions with the greatest fragmentation distance
MGP	Manufactured Gas Plant
MPPEH	Material Potentially Presenting an Explosive Hazard
MRS	Munitions Response Site
MSD	Minimum Separation Distance
NEW	Net Explosive Weight
OE	Ordnance and Explosives
PM	Project Manager
QA	Quality Assurance
QC	quality control
QCM	Quality Control Manager
Q-D	Quantity Distance
RCWM	recovered chemical warfare materiel
SARA	Superfund Amendments and Reauthorization Act
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas

SUXOS	Senior Unexploded Ordnance Supervisor
TLM	tar-like materials
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center Huntsville
UXO	Unexploded Ordnance
UXOSO	Unexploded Ordnance Safety Officer
VCC	Voluntary Cleanup Contract

1. Background

1.1.Site location

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the "project area", begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on Figure A-1-Site Location. Underwater intrusive activities will also occur within the coffer dam footprint prior to their installation. See Appendix A for footprint of the coffer dam location.

Table 1-1

Area	Total Acreage	Munitions Response Action	Institutional Controls
Water/Land Area	12.65	Surface and Subsurface to Depth of Dam Footprint and Construction Support	Fencing and Signage

This interim response action is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and is part of the overall Remedial Action Process. Additional removal responses may be dictated in the future during the remainder of the remedial response process, as determined by subsequent action memoranda or other decision documents. If subsequent removal responses are determined to be necessary in the full remedial process, this ESS will be reviewed and amended in accordance with DoD 6055.09-M as necessary to support that response.

1.2.Site Description:

1.2.1. Terrain and Vegetation:

The predominant topographic feature within the project area is the Congaree River itself, which is a broad shallow river with numerous bedrock assemblages that are visible above the water level at normal river flows. The river slope in the vicinity of the project area is approximately 2.10 feet/mile (USACE, 1977).The river depth varies significantly in the project area due to the variability of the bedrock river bottom elevations.

The project area abuts the eastern shoreline, which rises sharply from the water's edge in most places due to a steep bank that varies in height from approximately 5 to 20 feet depending on location. The ground slopes more gently to the east once the top of the riverbank is reached with an approximate 28 feet increase in land surface elevation over approximately The riverbank is forested in this area with vegetative cover consisting of various trees and tall native grasses and shrubs. The undergrowth is periodically maintained and trimmed in the vicinity of the wooden scenic overlook and river walkway and is much thicker and overgrown further south. The terrain and vegetation are not anticipated to hinder the field activities at the site.

Access to the river is provided by a partially paved access road, which extends from the intersection of Senate and Gist Streets to the river.

1.2.2. Soil Condition:

The landside Congaree River bank soil/sediments are unconsolidated, ranged in particle size from clay to gravels, displayed layering, and were approximately 12 feet to 27 feet thick. Generally, soil/sediment thickness increased in the downriver direction, and is attributed to down cutting of the granite by the Congaree River. The upper most soil/sediments were generally found to range from clays to medium sands. Below this is a gray silt that overlies a sand and gravel layer. The Congaree River and project area can be generalized by shoreline (gray silt) and channel (sands and gravel). It is not anticipated that soils and or tar-like materials (TLM) will impact detection equipment results.

1.3. Site History:

In 1865, during the Civil War, MEC and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia.

Archeological investigations, conducted as late as 1980, recovered some MEC or Discarded Military Munitions (DMM) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several MEC cannonballs were identified during this operation and properly disposed of by trained explosive ordnance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of MEC within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Analysis of the survey data identified concentrations of anomalies with DMM potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance.

In June 2010, the occurrence of a TLM within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations, which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s prior to the existence of environmental regulations and permitting. Later this was the location of the city bus terminal until 2008.

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August

2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. Sediment removal from within the water area will occur after coffer dams are installed and water has been removed. Intrusive Dive removal operations of metallic anomalies with be conducted prior to installation of the coffer dams. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013, a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original pre-impacted state.

The removal of MEC from the riverbank, impacted sediments and assisting in the segregation and disposal of impacted sediment remove by APEX covered under this work plan is to protect worker safety and environment.

1.4. Current and Future Land Use:

Current land use for the project area is public and is being used as a public green space including a park and recreation activities of walking, river site-seeing, picnicking and playing. The future land use is expected to be the same or similar unrestricted use.

1.5. Project Area:

The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The MEC intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on Figure A-1-Site. Underwater intrusive activities will also occur within the coffer dam footprint prior to their installation. See Appendix A for footprint of the coffer dam location.

1.5.1. General:

This ESS covers the munitions response actions in support of removal of TLM at within the Congaree River. The area to be swept for of MPPEH consists of approximately 11.80 acres within the Congaree River. A shallow dive operation (covered in a separately submitted Dive

Operation Plan) will be performed to remove any potential MEC within a coffer dam footprint prior to its construction needed to dewater the sediment containing TLM.

MEC items determined acceptable to move will be hand carried out of the water. Any MEC deemed unsafe to move may be dragged out of the stream by essential personnel using rope or cable that is suitable for moving the MEC items remotely. Essential personnel must be separated from the operation 3060 ft, or by the K24 of 29 ft and must be protected by shields or barricades designed to defeat hazardous fragments until the MEC item has been dragged to the location where it will be blown in place.

Once the coffer dams have been constructed and water removed from within a sweep for MPPEH will be performed prior to excavation of TLM material by APEX environmental.

This area will be cleared of all surface MPPEH regardless of size (excluding small arms ammunition .50 caliber and below not visually detectable) and subsurface ferrous metal items (including MPPEH) 10 in "cannonball" or greater, to a depth of 11 times the item diameter up to one meter below ground surface (BGS). It is not anticipated that Conventional Munitions (CM) will be encountered during operations. The Senior Unexploded Ordnance Supervisor (SUXOS) and Unexploded Ordnance Safety Officer (UXOSO) will ensure all personnel are fully trained of the associated hazards and fully aware of the procedures to be followed when MEC operations commence.

1.5.2. History and Characterization Data Analysis:

Site History and previous characterization data is presented above in Site History section 1.2. The munitions response actions for additional areas will be addressed in future amendments to this ESS or separate ESS.

1.5.3. Selected Munitions Response Actions:

In order to support the removal of TLM from the project area a "mag and dig" type removal action of dewatered sediments and land area has been selected to remove the MEC prior to sediment/soil excavation performed by APEX. There will be no underwater removal of sediments prior to dewatering. A shallow wading/dive operation to sweep the area of the coffer dam footprint will be performed prior to coffer dam installation and is covered under a separate dive operations plan. Stand-by construction support will also be performed during sediment/soil excavation by Apex.

1.5.3.1. Land Use Controls

No permanent land use controls are being proposed. Currently there are signs announcing that no swimming allowed in the area of the TLM. Prior to field activities the entire site will be fenced and signs posted to keep public out for safety and protection of civil war era antiquities. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

1.6. Reason for Munitions and Explosives of Concern (MEC):

In 1865, during the Civil War, MEC and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia.

1.7. Type of MEC:

Based on historical information primarily from an Inventory of Stores Captured in Columbia, SC document dated February 17, 1865, MEC items of interest that could potentially be encountered are identified below. The historical list contained a more general nomenclature than that used in the DoD Fragmentation database of today. The list below is taken directly in name from the 1865 document.

- Case shot, fixed, 12 pounder gun
- Fuse-shell, fixed, 12 pounder gun
- Grape, 12 pounder gun
- Canister, fixed, 12 pounder gun
- Shot, fixed, 6 pounder gun
- Case, fixed, 6 pounder gun
- Fuse-shell, fixed, 6 pounder gun
- Canister, fixed, 6 pounder gun
- Shot, fixed, 24 pounder gun
- Shell, fixed, 24 pounder gun
- Canister, fixed, 24 pounder gun
- Shell, fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 8 inch
- Shot and shell, not fixed, 10 inch

According to historical information for Columbia, SC inventory, a variety of other munitions were identified as having been used or stored at the site. No information found to date associates any other munitions with the project site. Therefore, the 10 in "cannonball" shell has been selected as the munitions with the greatest fragmentation distance (MGFD) for the project.

Table 2-1 Type and Depth of MEC Recovered

MRS Name or Other Identifier	MEC Recovered	MAX Depth of MEC recovered during site investigation	MAX Geophysical Detection Depth BGS
Congaree River Project	Cannonball (reported historically)	No intrusive activities were conducted during the site investigation. Only a geophysical survey was performed to detect anomalies.	10-inch cannonball can be detected at approximately 11X diameter below ground surface this results in 110 inches BGS.

2. Maps

Figure A-1 in appendix A shows a map of the site in relation to the surrounding area. Figure A-3, demonstrates the phased clearance approach in regard to MEC clearance within the river. Figure A-2 is a map that shows the area with the Quantity Distance (Q-D) arcs that will be used during the MEC removal action in the area.

3. Explosive Safety Quantity -Distance

3.1. Munitions with Greatest Fragmentation Distance (MGFD):

The 10 inch cannonball was chosen as the Munitions with the Greatest Fragmentation Distance (MGFD) for the project area is based on the historical documentation and manifests dating to the relocation of the ordnance items from the a nearby ammunition storage area to the river by soldiers. Additionally, previous Archeological investigations recovered MEC from the river area that correlated with the above MGFD munitions type. This MGFD is the same for both intrusive dive and land operations.

See Appendix B for Fragmentation Data Sheets.

See Table 3-1 for Minimum Separation Distances. Quantity-Distance (Q-D) arcs are shown in Appendix A on Figure A-3.

<table>
<tr><td colspan="9">Table 3-1</td></tr>
<tr><td colspan="9">Minimum Separation Distances (MSD)</td></tr>
<tr><td rowspan="3">Area</td><td rowspan="3">MEC</td><td colspan="7">MSD (ft)[1]</td></tr>
<tr><td colspan="3">For Unintentional Detonations</td><td colspan="4">For Intentional Detonations</td></tr>
<tr><td>Team Separation Distance (K40)</td><td>Hazardous Fragment Distance (HFD)</td><td></td><td>Without Engineering Controls</td><td>Using Sandbag Mitigation[2]</td><td>Using Double sandbag Mitigation[2]</td><td>Using Water Mitigation[2]</td></tr>
<tr><td>Project area</td><td>10" Cannonball</td><td>48</td><td>237</td><td></td><td>3060</td><td>220</td><td>Not Permitted</td><td>275</td></tr>
<tr><td colspan="9">Notes:</td></tr>
<tr><td colspan="9">All Values in Bold Italics are the MSDs for unintentional detonations that must be used on-site for the Area.</td></tr>
<tr><td colspan="9">[1]See Appendix B for calculation sheets documenting MSDs. Note the NEW for the MGFD based on the HFD is the maximum NEW that may be collected at a collection point</td></tr>
<tr><td colspan="9">[2] See Appendix B for required sandbag thickness (HNC-ED-CS-S-98-7) and water containment system (HNC-ED-CS-S-00-3).</td></tr>
<tr><td colspan="9">3 MSD for sandbag mitigation per DDESB memo “Revision of DDESB Approval for Use of Sandbags for Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions” dated 22 May 2014.</td></tr>
</table>

3.2. MEC Area(s):

The MSD restrictions from MEC areas to non-essential personnel will be applied during all MEC operations. The MSD for the NTCRA Area is presented in Table 3-1. Preliminary site work such as surveying, laying grid lanes and anomaly avoidance do not require the establishment of a MSD for Q-D purposes. Essential personnel are defined as those on-site contractor and DoD personnel required to participate in the MEC removal, along with those approved and authorized visitors. All other personnel are non-essential personnel. The outer boundaries of the MSD arcs are depicted on the Q-D map in Figure A-3. The team separation distance at this site will be the K40 overpressure distance shown in Table 3-1. Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the contractor will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations.

Only UXO-qualified personnel (see DDESB Technical Paper 18 for definitions) will perform MEC Construction Support and Removal Activities. Activities will be accomplished in accordance with the procedures detailed in USACE Engineering Manual (EM) 385-1-97 (including Change 1 and Errata sheets 1 through 6), "Explosives Safety and Health Requirements Manual". The UXO personnel will clear all soil excavation locations to ensure there is no intentional physical contact with MEC during soil removal/excavation operations.

Any occupied buildings or public roadways in the MSD areas during MEC operations will be evacuated and/or roadways blocked to prevent non-essential personnel from entering during the conduct of MEC operations. In addition, spotters may be used to stop work when non-essential personnel enter the MSD on a roadway during the conduct of MEC operations.

3.3. Demolition Explosives:

3.3.1. Delivery on As-Needed Basis:

Donor explosives will be stored in a on-site type 2 ATF&E explosives magazine. This action is to mitigate the need for an afterhours guard. Should a magazine not be used, explosives will be provided by a local vendor on an as-needed basis. MEC will be marked and guarded until disposal is accomplished.".

3.3.2. Explosive Storage Magazines:

Due to the fact that on-going explosives needs might be present on the project, an on-site magazine to store commercial explosives will be utilized on this project. Commercial explosives will be stored in the un-barricaded type II ATF&E explosives magazine with an attached lockable cap box. The explosives will be used only for disposal of any MEC items recovered during operations and will be stored IAW DoD 6055.09-M, DA Pam 385-64 and any other local regulations. EOTI will maintain constant control the sited explosive storage magazine. Positioning of the magazine will be IAW DDESB 6055.09-M, EP 1110-1-18 and Section 55.206 of ATFP 5400.7. The closest occupied structure relative to the explosives magazine is 500 ft and nearest public road is 950 ft. The Magazine will be secured by the erection of a temporary fence that will be 8 to 10 ft in height and has one locked entry point. The maximum Net Explosive Weight (NEW) that will be stored will be less than 31 lbs. IAW DoD 6055.09-M Section V3.E3.1.2.1.1.5.1 its has been determined that the . Public Transportation Route Distance (PTRD) for the proposed magazine location has no public road access. The traffic for the area of the magazine is less than 400 car/rail passengers per day, and less than 80 ship passengers per day. Therefore, no Minimum Fragment Distance (MFD) is required for public traffic route (PTR) distance (DA PAM 385-64 Section 5-5, and DoD 6055.09-M Section C9.4.1.2.1.1.5.3). Inhabited Building Distance exclusion for the magazine is 200 ft, this is based on a NEW of less than 31 lbs IAW DoD 6055.09-M table V3. E3.T2.

These commercial explosives will have assigned DOD hazard division/storage compatibility groups (HD/SCG) and will be stored in accordance with DOD 6055.09-M, DA Pam 385-64 and any local regulations.

3.4. Planned or Established Demolition Areas:

Demolition area planned for this project is to be located within the fenced open area to be located far enough away from road and inhabited buildings as not to include them within 220 ft of the demolition area.

3.5. Footprint Areas:

3.5.1. Blow-in-place:

If a MPPEH is unacceptable-to-move it will be blown in place (BIP) on both land or water removal operations. BIP procedures will be conducted within each grid. All disposal activities will be performed by Technical Paper (TP)-18, “Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel”, 20 December 2004 qualified UXO personnel within the MRS. Please see table 3-1 for minimum separation distances for BIP procedures.

If it is determined that an item is acceptable to move then the MPPEH will be consolidated on land and a consolidated demolition shot will be performed IAW TP-18 as stated above.

3.5.2. Collection Points:

Collection points are those areas used to temporarily accumulate MEC pending destruction at the end of the day using consolidated shots. MEC items at collection points must be laid out as shown in “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites”. The maximum net explosive weight (NEW) at a collection point will be limited such that the K40 overpressure distance for the total NEW does not exceed the HFD for the area (see Table 3-1, footnote 1). The SUXOS and UXOSO are the authoritative individuals for this project to determine if items are acceptable to move.

3.5.3. In-Grid Consolidated Shots:

If determined acceptable to move by the SUXOS and UXOSO, consolidating multiple MEC within the MRS is anticipated for this project. US Army Engineering and Support Center, Huntsville (USAESCH) publication “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites”, dated March 2000 will be used and a copy of this report will be available on site. The maximum net explosive weight (NEW) for a consolidated shot will be limited such that the K328 overpressure distance for the total NEW (including donor charges) does not exceed the MFD-H for the intentional detonation."

3.6.Maximum Credible Event (MCE):

This section is not applicable to this project; no explosive soil, CWM, or explosives contaminated facilities are expected.

4. Start Date:

The anticipate start date for field activities is March 2, 2015.

5. MEC Migration:

MEC Migration could be a factor due to strong bottom current within the Congaree River. It is notable that MEC and other munitions items have the potential to migrate to tide actions and river flows. These events can re-distribute items outside of the AOI and much further away from its impact location.

6. Detection Equipment and Response Techniques:

6.1.Removal Depth:

The removal depths for MRS 1 Land / Water subsurface clearance of MEC, MPPEH, and any ferrous metal items as shown in table 1-1.

6.2.Detection Equipment:

The possible detectors for this project include but are not limited to Schondstedt 52-CX and an all metals detector (White's). All of these instruments have similar detection characteristics and can be expected to consistently detect the MEC items shown in Table 1-2 at their expected depths.

6.2.1. Analog Mag and Flag using Flux-Gate Magnetic Gradiometers:

The Flux-Gate Magnetic Gradiometers that will be utilized will be the Schondstedt 52-CX and an all metals detector (White Spectrum XLT). .

6.2.2. Analog Mag and Flag using Electromagnetic Induction:

Approved detectors for this project include the AN-PSS 12, White XLT, Fisher, Garrett, and MineLabs Explorer. All of these instruments have similar detection characteristics. However, unlike the other classes of instruments, they may only be used for targets less than 24 inches deep. The CEHNC MM-CX may approve other similar geophysical instruments.

6.3.Sweep Procedures:

Each UXO Technician will demonstrate proficiency with the hand held geophysical device before site activities begin. The site will be divided into grids and search lanes will be used to sweep for MEC. See work plan for more information on sweep procedures.

6.4. Exclusion Zone Control:

Positive control of the exclusion zone (EZ) based on the MSD will be maintained at all times that MEC operations are being conducted. Prior to beginning MEC operations, the EOTI will ensure that there are no nonessential personnel within the EZ and the contractor will ensure that, the EZ remains clear of non-essential personnel throughout the MEC operations. This will include barricading access roads as necessary and displaying appropriate signage indicating explosive operations at barricade points and personnel to facilitate the halting of traffic and pedestrians.

6.5. Intrusive Investigation:

Non-Mechanized MEC removal and identification of anomalies will be performed using the criteria and procedures outlined below. Only TP 18 qualified personnel will perform excavation and investigation of anomalies. To gain access to a subsurface anomaly, excavation will be initiated to the side of the anomaly, and will not be conducted directly over the anomaly until such time as the depth of the anomaly can be ascertained. Earth Moving Machinery (EMM) excavation of the soil overburden may be performed for anomalies for the purpose of removing overburden. However, the EMM will not be used within 12 inches directly over the anomaly. Additional excavation will be conducted with care using small hand tools only. A detailed accounting of all MEC located at each site will be made and maintained by the Senior UXO Supervisor (SUXOS). A log entry will be made for each MEC item indicating the item's identity, its explosive hazards, location (x, y, and z measurements) and final disposition. All munitions debris excavated during this investigation will be removed from the site

6.6. Quality Control and Quality Assurance:

Upon conclusion of the removal activities in each grid within each area, the UXO Quality Control Specialist (UXOQCS) will conduct a surface and subsurface quality control (QC) inspection. Lots that pass the QC inspection will be submitted to the USAESCH for Quality Assurance (QA) inspection per the Quality Assurance Surveillance Plan. Any non-conformance to contractual requirements will be documented and reported in writing to the Senior Unexploded Ordnance Supervisor (SUXOS), Quality Control Manager (QCM), and Project Manager (PM). The SUXOS will be responsible for the field remediation of the non-conformance.

6.7. Equipment Tests:

See section 6.3 Sweep Procedures for information regarding equipment tests.

7. Disposition Techniques:

7.1. Demolition Operations:

If disposal activities are required, they will be performed by personnel qualified in accordance with TP 18 within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-3.

7.1.1. Methods of Disposal:

a. If disposal activities are required, they will be performed by qualified UXO personnel within the MRS. The MSDs for intentional detonations are shown in Table 3-1 and Q-D Arcs are shown on Figure A-4.

b. MEC will be marked and guarded, if necessary, until disposal is accomplished.
c. All explosive operations will follow the procedures outlined in TM 60A-1-1-31 and EM 385-1-97, Explosives Safety and Health Requirements Manual, demolition operations will be performed daily or items properly guarded until operations can be conducted.

The magazine location chosen for this effort is located within a fenced open area. It has controlled access. All gates are to be locked at all times when not under supervision.
The nearest improved public road is approximately 0.1 miles away.
The nearest inhabited building is 0.1 miles away.

7.2. Explosive Storage, Accountability, and Transportation:

EOTI does not anticipate generating any hazardous waste that will require off-site transportation, treatment, storage, or disposal. MEC and/or MPPEH will be destroyed on-site and resulting scrap will be certified as Material Documented as Safe (MDAS) and turned over to a recycler for smelting before it is released to the public. Non-hazardous, CD and municipal waste generated during this project will be transported to a municipal landfill for disposal.

7.3. Engineering Controls:

Sandbags (HNC-ED-CS-S-98-7, HNC Safety Advisory dated 7 November 2011, the DDESB Memorandum "Clarifications Regarding Use of Sandbags for Mitigation of Fragmentation and Blast Effects due to Intentional Detonation of Munitions", Nov. 29 2010, and DDESB Memorandum "Revision of DDESB Approval for Use of Sandbag Mitigation of Fragmentation and Blast Effects Resulting from the Intentional Detonation of Munitions", May 22 2014) or Water Mitigation (HNC-ED-CS-S-00-3) may be used to reduce the intentional detonation MSD. Double Sandbag Mitigation is authorized for robust and non-robust items with fragmentation characteristics and a net explosive weight not exceeding that of a 75 mm M48, and a minimum withdrawal distance of 12.5 feet applies. Tamping (single or multiple items) may be used in accordance with DDESB Technical Paper 16 and the Buried Explosion Module (version 6.3.2.). These reports will be on site for all mitigation methods used.

7.4. Scrap Procedures:

7.4.1. Inspection and Certification:

MPPEH procedures will be IAW DoDI 4140.62 and EM1110-1-4009. All Material Potentially Presenting an Explosive Hazard (MPPEH) will be assessed and its explosives safety status determined and documented prior to transfer to a third party for disposal recycling or preservation. Prior to release to the public, MPPEH will be documented by authorized and technically qualified personnel as Material Documented as Safe (MDAS) after a 100% inspection and an independent 100% re-inspection to determine that it is safe from an explosives safety perspective. A DD Form 1348-1A will be completed for all munitions debris and range-related debris to be transferred for final disposition and certified by the USXQCS & SUXOS.

7.4.2. DD From 1348-1A:

Upon completion of all removal activities, EOTI will complete a DD Form 1348-1A IAW EM 11110-1-4009 Chapter 14 that will include the following statement regarding to processed MDAS & IDW materials:

"This certifies and verifies that the materials listed have been 100 percent inspected and to the best of our knowledge and belief, are inert / or free of explosive or related material."

7.5. Alternative Disposal Techniques:

No off-site destruction of recovered MEC is anticipated for this MEC removal action.

8. Environmental, Ecological or Cultural Consideration:

Dive activities will be conducted around the short nosed sturgeon spawn season which is anticipated in spring part of the year. APEX will under their effort determine when the area is safe to work in prior to giving notice to proceed of EOTI site work. In the event that any environmental, ecological, or cultural considerations arise during project performance, project activities or affected portions of project activities will immediately cease and the Project SUXOS, PM, and Government Representatives will be immediately notified. Project activities will not commence in project affected areas until the contractor is notified by the Government to proceed in a manner determined appropriate by the Government or the contractor in coordination with the Government.

9. Technical Support:

9.1. Military Support:

No chemical warfare materiel (CWM) is suspected at this site. However, if suspected CWM is encountered at the project site, all work will immediately cease. All project personnel will withdraw along identified, cleared paths upwind from the discovery. The senior UXO person on site will designate a two-person team to secure the area and prevent unauthorized access. This team will position themselves as far upwind as possible while still maintaining visual contact and control of the area. The senior UXO person on site following evacuation will immediately notify the EOTI PM who will immediately coordinate with forward Government Project Representatives to contact and facilitate military control and Explosive Ordnance Disposal (EOD) response. The contractor will maintain control of the site until control is relinquished to the military.

Additionally, local law enforcement will be contacted of the discovery. If the item is RCWM of has an unknown liquid filler, the on-site USACE OESS will notify the Chemical Warfare Design Center (CWM-DC)at the USAESCH by calling the 24/7 telephone number at 256-895-1180.

9.2.Contractor:

All on-site UXO Personnel will meet the required training and minimum experience required by DDESB TP 18.

10. Residual Risk Management:

10.1. LUC:

No permanent land use controls are being proposed. Temporary fencing to prevent unauthorized access to the site will be put up and maintained during the entire removal action project.

10.2. Long-Term Management:

Any long-term management is the responsibility of the military or other stakeholders related to the project.

11. UXO Safety Education Program:

EOTI has not been contract to perform any UXO Safety education program outside daily safety briefings that is utilized to make other site personnel award of hazards presented by Unexploded Ordnance and the proper procedures in notifying EOTI if evidence of UXO is discovered. Others will conduct all other education program material and training/education to public.

12. Stakeholder Involvement:

This project was coordinated with the USAESCH and EA Engineering. All agencies will remain active in the final planning and response stages of the project to include Work Plan review and final approval, progress review and schedule adjustments as required to accommodate construction schedules, EZ establishment and control support as necessary, unplanned environmental, emergency as necessary, and final report review, comment, and acceptance. All agencies concur with the selected response and support actions presented.

13. Contingencies:

No contingencies planned at this time.

Appendix A
Maps

Legend

Approximent Extent of Proposed TLM Location

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet
0 175 350 700
0 60 120 240
Meters

Site Location

FIGURE A-1
SITE LOCATION

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods

DATE	FILE
10/13/2014	Map1.mxd

PAGE #	SCALE
A-1	1 inch = 350 feet

Legend

Clearance Phase

- Phase 1 - Year 1
- Phase 2 - Year 2
- Approximate Cofferdam Location
- Sandbag Mitigation MSD 220 ft
- Hazardous Fragment Distance 237 ft
- Hazardous Fragment Distance Hoizontal 3060 ft

7° 15' 25"

NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC

Feet: 0, 400, 800, 1,600
Meters: 0, 122.5, 245, 490

Site Location

FIGURE A-2
INTENTIONAL AND UNINTENTIONAL DETONATION DISTANCES

Columbia, SC

APEX

Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.

EOTI

DRAWN	VERIFIED	APPROVED
M. Norris	J. Daffron	B. Woods
DATE 12/17/2014	FILE Map4.mxd	
PAGE # A-2	SCALE 1 inch = 800 feet	

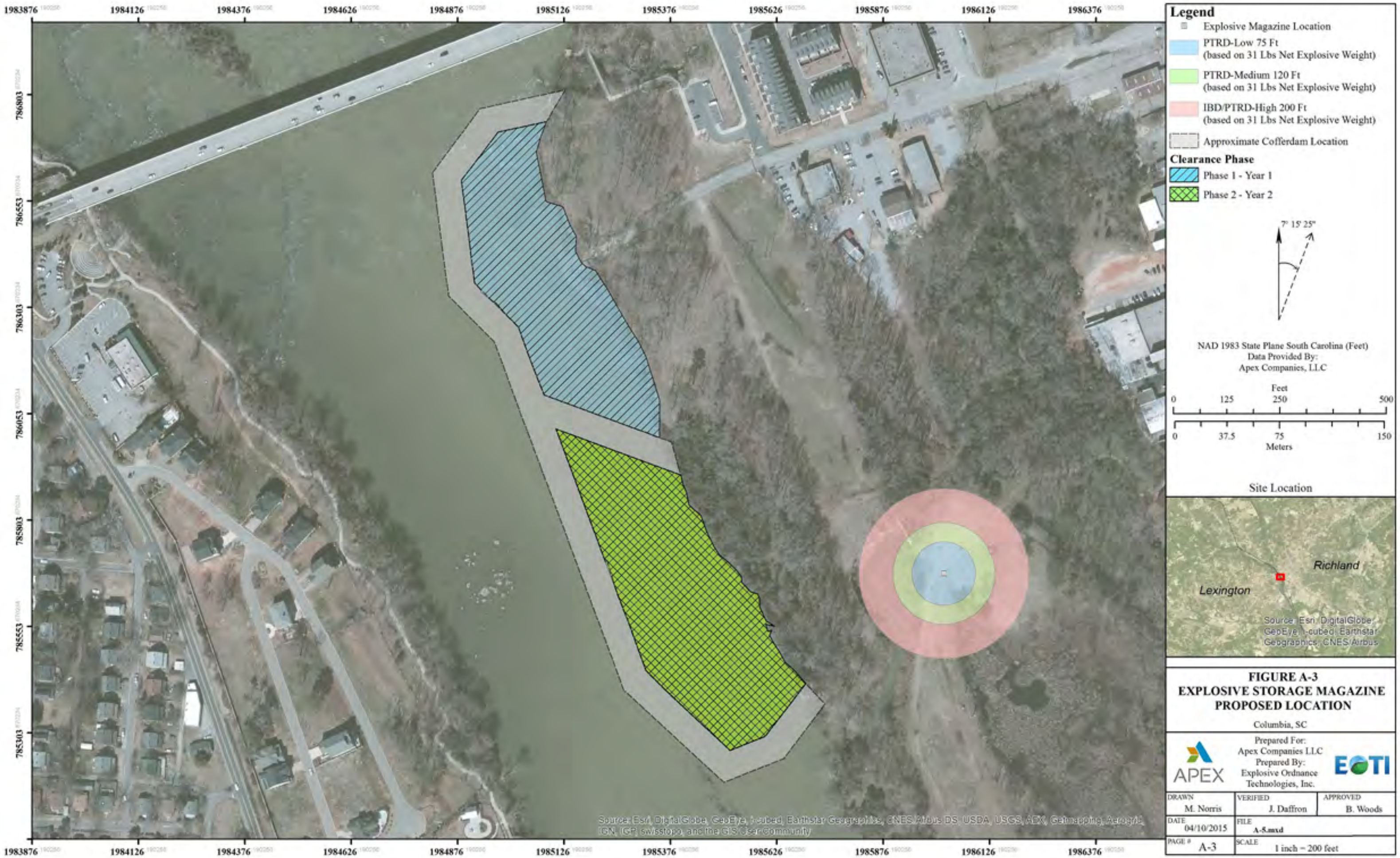


FIGURE A-3
EXPLOSIVE STORAGE MAGAZINE PROPOSED LOCATION
Columbia, SC

Appendix B
MSD Calculation Sheets

Fragmentation Data Review Form

Database Revision Date 8/21/2014

Category:	Black Powder Rounds
Munition:	10 in Cannonball Shell
Case Material:	Cast Iron, Grey, CL35
Fragmentation Method:	Naturally Fragmenting
Secondary Database Category:	Civil War Era
Munition Case Classification:	Extremely Heavy Case

DODIC:	
Date Record Created:	11/2/2009
Record Created By:	SDH
Last Date Record Updated:	4/15/2013
Individual Last Updated Record:	SDH
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Black Powder
Explosive Weight (lb):	4
Diameter (in):	9.8500
Cylindrical Case Weight (lb):	93.88430
Maximum Fragment Weight (Intentional) (lb):	3.5556
Design Fragment Weight (95%) (Unintentional) (lb):	0.8186
Critical Fragment Velocity (fps):	1659

Sandbag and Water Mitigation Options

TNT Equivalent (Impulse):	0.43
TNT Equivalent Weight - Impulse (lbs):	1.720
Kinetic Energy 10^6 (lb-ft²/s²):	4.8957

Single Sandbag Mitigation

Required Wall & Roof Thickness (in)	36
Expected Max. Throw Distance (ft):	220
Minimum Separation Distance (ft):	220

Double Sandbag Mitigation

Required Wall & Roof Thickness (in)	Not Permitted
Expected Max. Throw Distance (ft):	Not Permitted
Minimum Separation Distance (ft):	Not Permitted

Water Mitigation

Minimum Separation Distance (ft):	275
Water Containment System:	1100 gal tank

Note: Use Sandbag and Water Mitigation in accordance with all applicable documents and guidance. If a donor charge larger than 32 grams is utilized, the above mitigation options are no longer applicable. Subject matter experts may be contacted to develop site specific mitigation options.

Theoretical Calculated Fragment Distances

HFD [Hazardous Fragment Distance: distance to no more than 1 hazardous fragment per 600 square feet] (ft):	237
MFD-H [Maximum Fragment Distance, Horizontal] (ft):	3060
MFD-V [Maximum Fragment Distance, Vertical] (ft):	2087

Overpressure Distances

TNT Equivalent (Pressure):	0.43
TNT Equivalent Weight - Pressure (lbs):	1.720
Unbarricaded Intraline Distance (3.5 psi), K18 Distance:	22
Public Traffic Route Distance (2.3 psi); K24 Distance:	29
Inhabited Building Distance (1.2 psi), K40 Distance:	48
Intentional MSD (0.0655 psi), K328 Distance:	393

Note: Per V5.E3.2.2.1 of DoD 6055.09-M the minimum sited K328 distance may be no smaller than 200 ft.

Minimum Thickness to Prevent Perforation

	Intentional	Unintentional
4000 psi Concrete (Prevent Spall):	12.80	7.40
Mild Steel:	2.21	1.23
Hard Steel:	1.81	1.01
Aluminum:	4.07	2.36
LEXAN:	11.35	7.93
Plexi-glass:	9.75	6.06
Bullet Resist Glass:	9.20	5.43

Item Notes

The TNT equivalency for black powder rounds has been updated from 0.4 to 0.43 to agree with Rev 4 of TP 16. This has resulted in minor changes in values.

Diving Operations Plan

Prepared by:
Explosive Ordnance Technologies, Inc. (EOTI)
9050 Executive Park Drive 106-A
Knoxville, TN 37923

Under contract to:
Apex Companies, LLC
1600 Commerce Circle
Trafford, PA 15085

Dated: November 2014

Date Reviewed:

Project: Congaree River Project UXO Support

Diving Operations Plan

This Diving Operations Plan is a general overview of the underwater diving operations to be performed while conducting underwater intrusive activities at Congaree River Project in Columbia, SC.

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the Designated Diving Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

Plan prepared by:

Name: CBWoods ____________________

EOTI

9050 Executive Park Drive 106-A

Knoxville, TN 37923

Plan reviewed by:

Name: ____________________________

Apex Companies, LLC

1600 Commerce Circle

Trafford, PA 15085

Name: ____________________________

SCANA Services, Inc.

4077 Haywood Road

Miles River, North Carolina 28759

Contents

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AHA	activity hazard analysis
AOC	area of concern
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRP	Congaree River Remediation Project
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DFW	definable feature of work
DoD	Department of Defense
DOP	Diving Operations Plan
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
ESP	Explosives Site Plan
EZ	exclusion zone
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
HE	high explosives
IAW	in accordance with
IRA	Interim Removal Action
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
mm	millimeter
NAVFAC	Naval Facilities Engineering Command
No.	number
NWS	Naval Weapons Station
OSHA	Occupational Safety and Health Administration
PM	Project Manager
QA	quality assurance

QC	quality control
RI	Remedial Investigation
SCUBA	self-contained underwater breathing apparatus
SI	Site Investigation
SOW	scope of work
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
SWMU	solid waste management unit
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USCG	United States Coast Guard USN
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

1. Project Introduction

1.1 PROJECT WORK AUTHORITY

Apex Companies, LLC (Apex) has contracted EOTI to perform underwater clearance of Munitions and Explosives of Concern (MEC) in support of contaminated soil and sediment removal on the Congaree River Project (CRP), Columbia, South Carolina (SC).

This Diving Operations Plan (DOP) is a living document. A living document is one that can be modified, as necessary, to best achieve the goals and objectives stated within. Based on field observations, site conditions, and other unknown circumstances or conditions, this document may be modified in order to best achieve the objectives of the underwater intrusive activities. If for any reason the DOP is altered in procedures, depth, personnel, or equipment, the USACE Designated Dive Coordinator (DDC) will be contacted in order to review and accept the alteration prior to actual operation.

This DOP provides the technical approach, rationale, and field procedures to be followed in order to achieve the objectives of the underwater clearance activities during the CRP, Columbia, SC. This DOP was prepared in accordance with (IAW) the APEX Contract No. 875001, dated March 11, 2014 and EOTI proposal dated March 3, 2014.

1.2 PROJECT PURPOSE

The purpose of the CRP diving activities in remediation area shown on **Figure 1**, is to remove MEC in order to reduce hazards from Civil War era military munitions co-located within the coal tar contaminated soil and sediment removal area. EOTI will be performing dive operations to remove MEC from a coffer dam footprint prior to installation by Apex. The underwater intrusive activities will be completed IAW the USACE and the Department of Defense (DoD) Explosives Safety Board (DDESB) approved Explosives Safety Submission (ESS).

1.3 PROJECT LOCATION

The CRP area is located on the Congaree River in Columbia, SC. The site, also referred to as the “project area”, begins directly south of the Gervais Street Bridge, extends approximately 200-300 feet into the river from the eastern shoreline and approximately 2,000 feet downriver, towards the Blossom Street Bridge. The underwater intrusive activities will occur on eastern side of Congaree River between Gervais and Blossom Street Bridges, shown on **Figure 1**.


Legend
Approximent Extent of Proposed TLM Location
7° 15' 25"
NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC
0 175 350 700
Feet
0 60 120 240
Meters
Site Location
FIGURE 1
SITE LOCATION
Columbia, SC
Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.
APEX
EOTI
DRAWN
M. Norris
VERIFIED
J. Daffron
APPROVED
B. Woods
DATE
11/05/2014
FILE
Map1.mxd
PAGE #
1
SCALE
1 inch = 350 feet

1.4 SITE BACKGROUND, AND DESCRIPTION

In 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

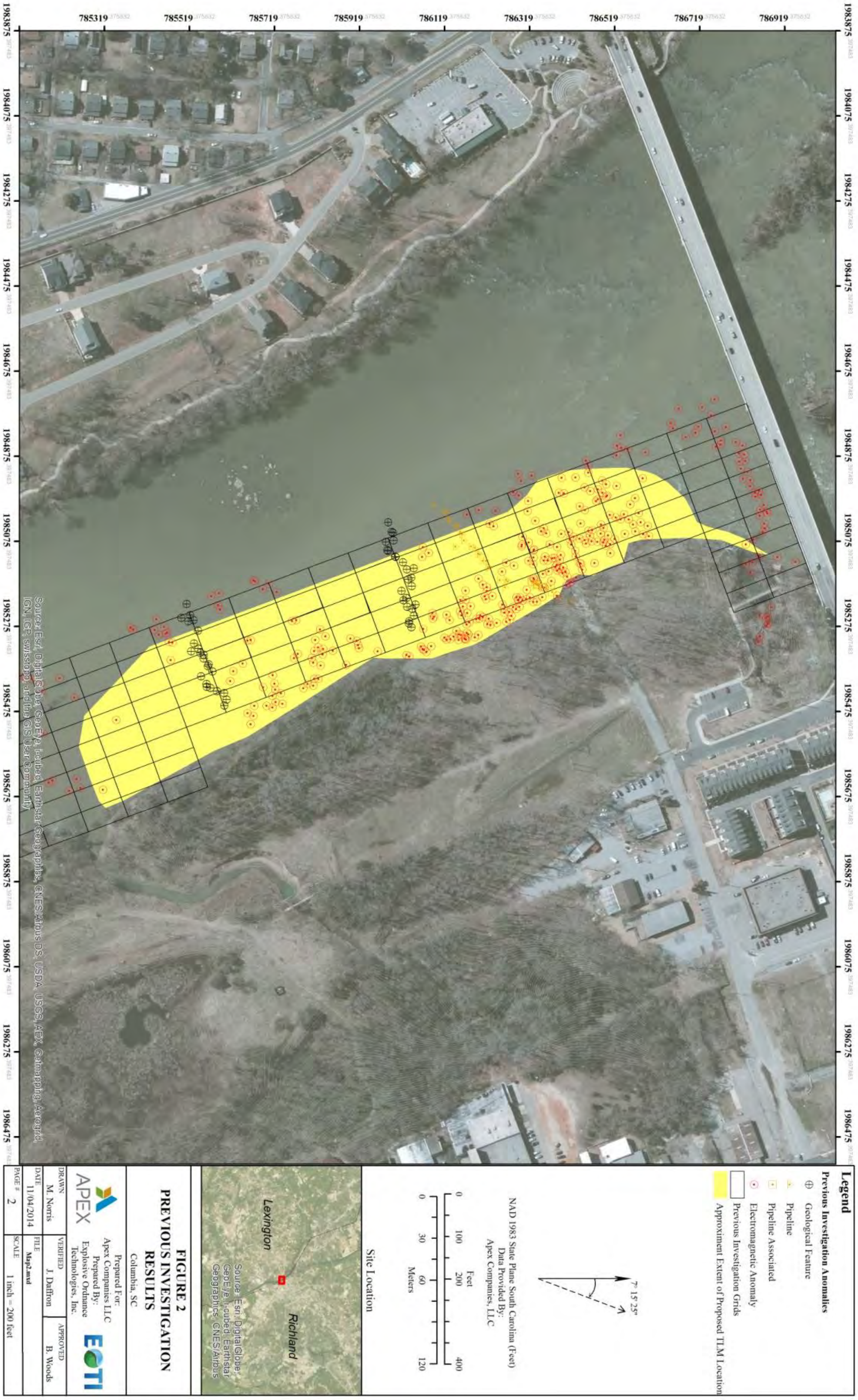
Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. An acoustic (side scan sonar) and magnetic (magnetometer) remote sensing survey was performed to identify ordnance and other submerged cultural resources in the remediation area by Tidewater Atlantic Research, Inc. and a report submitted on 8 February 2012. Analysis of the survey data identified concentrations of anomalies with unexploded ordnance (UXO) potential in the immediate vicinity of the Senate Street landing and scatters extending into the river. A terrestrial magnetometer investigation of the unnamed tributary below the Gervais Street Bridge was also carried out and that investigation identified eight additional anomalies with a potential association with ordnance. Figure 2 shows the location of anomalies detected during the February 2012 investigation.

In June 2010, the occurrence of a tar-like material (TLM) within the Congaree River was reported to the South Carolina Department of Health and Environmental Control (SCDHEC). Preliminary testing indicated that the material may be attributable to the Huger Street former Manufactured Gas Plant (MGP) that was operated by predecessor companies of SCE&G beginning in the early 1900s and ending in the 1950s.

Preliminary sample results conducted on the material by SCDHEC and South Carolina Electric and Gas Company (SCE&G) indicated that the TLM had similar chemical and physical characteristics as coal tar, a by-product of Manufactured Gas Operations which were common in cities from the late 1800s until the 1950s. Additional research found that the most likely source of the TLM was a former Manufactured Gas Plant (MGP) located northeast of the river at 1409 Huger Street that operated from about 1906 until the mid-1950s. Later this was the location of the city bus terminal until 2008.

MGPs produced a flammable gas from coal that was used for heating, cooking and lighting purposes prior to the construction of interstate natural gas pipelines. The coal tar material was a waste product from coal-gas production. Once the gas was produced, the coal tar by-product was discharged into a former stream which originated at what is known today as Finley Park, past the MGP site, and into the Congaree River just below the Gervais Street Bridge. The Huger Street MGP was operated by predecessor companies of South Carolina Electric & Gas (SCE&G) beginning in the early 1900s and ending in the 1950s, prior to the existence of environmental regulations and permitting.


Legend
Previous Investigation Anomalies
Geological Feature
Pipeline
Pipeline Associated
Electromagnetic Anomaly
Previous Investigation Grids
Approximent Extent of Proposed TLM Location
NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC
Feet
Meters
Site Location
Lexington
Richland
FIGURE 2
PREVIOUS INVESTIGATION RESULTS
Columbia, SC
Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance Technologies, Inc.
DRAWN M. Norris
VERIFIED J. Daffron
APPROVED B. Woods
DATE 11/04/2014
FILE Map2.mxd
PAGE # 2
SCALE 1 inch = 200 feet

SCE&G had previously entered into a Voluntary Cleanup Contract (VCC) with DHEC in August 2002 to conduct environmental assessment and cleanup activities at the former Huger Street MGP site. SCE&G has worked proactively and cooperatively with DHEC under its existing VCC to determine the extent of TLM in the Congaree River and to develop a plan for cleanup. Overall, the delineation activities extended from the Gervais Street Bridge downriver approximately 9,050 feet.

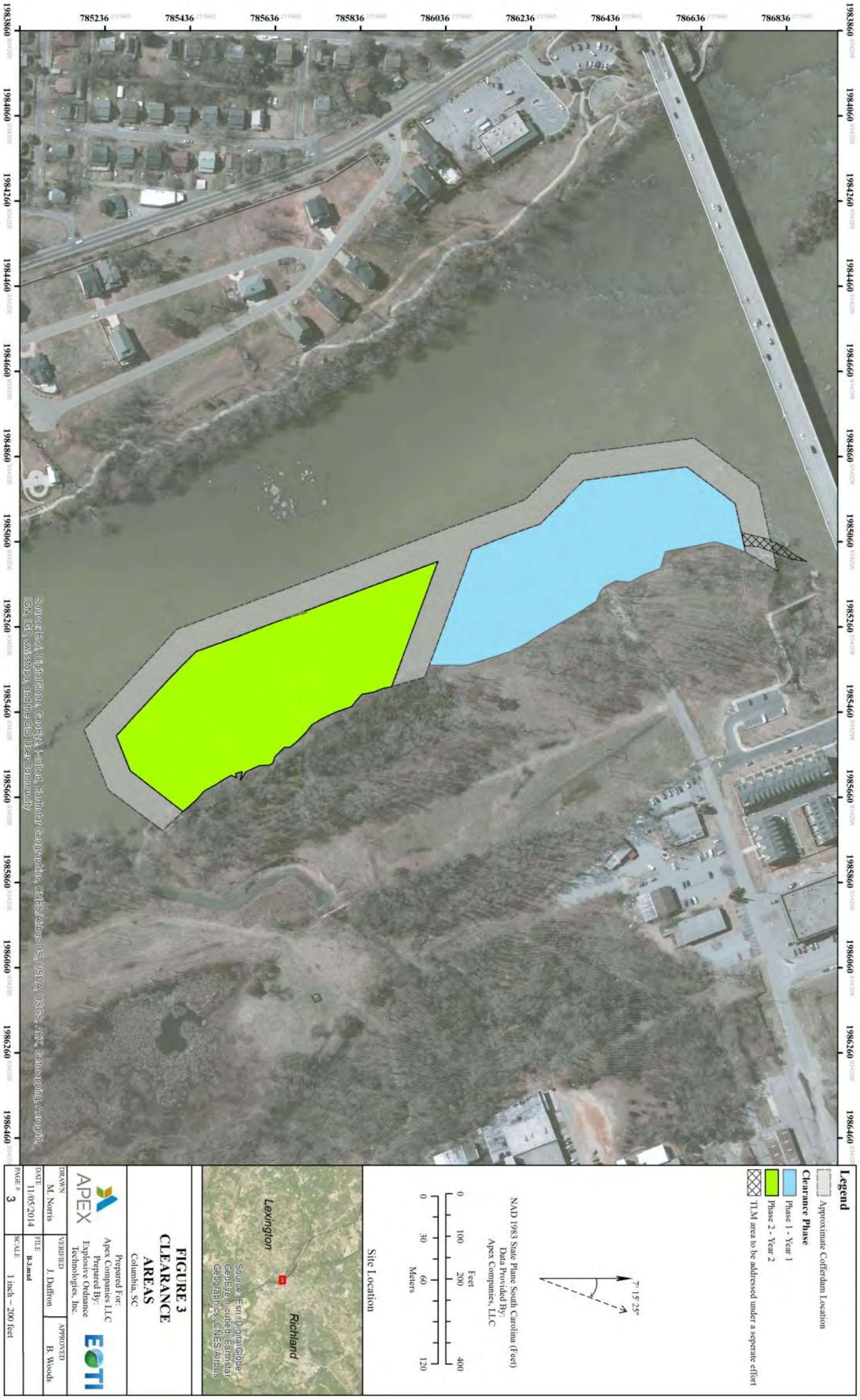
An Engineering Evaluation/Cost Assessment (EE/CA) was prepared and a Final was submitted in January 2013. A non-time critical removal action of the impacted river sediments was chosen as the alternative. The TLM-impacted sediment varies in thickness from a few inches to approximately 6 feet thick in some areas. The current total estimate of sediment requiring removal is approximately 40,000 tons. The total project area is estimated to be 23 acres, with 10.5 acres consisting of waters of the United States. The landside or upland portion of the project area consists of approximately 12.5 acres of mostly undeveloped land with a cleared utility right-of-way. Much of the area will not be disturbed.

On August 21, 2013 a public release was issued summarizing the project purpose and objectives detailing that this is an environmental clean-up project mandated by SCDHEC intended to remove approximately 40,000 tons of tar-like material (TLM) and impacted sediment from the Congaree River. The removal of the impacted sediment will result in a permanent improvement to the aquatic environment in the project area. Upon completion of the removal activities in the Congaree River, the project area will be allowed to return to its original preimpacted state.

The removal of MEC from the impacted sediments under the coffer dam structures under this dive plan is to protect worker safety, environment and assist in the segregation and disposal of impacted sediment.

1.5 Removal Objectives

The objective of this dive plan is to locate and remove MEC from underwater sediment in the location of future cofferdam area footprints. The cofferdams are to be installed prior to coal tar contaminated soil/sediment removal. The dive clearance of the cofferdam footprints will be performed in three separate phases in coordination with Apex three phase cofferdam installations. Figure 3 shows the location of the footprint to be cleared during each phase of the project. The project is performed in two phases "to minimize the potential for over-topping events and impacts on potential endangered species in the river, the "in-river" construction season will start on May 1 and continue through October 31 for each of the three years." The overall objective of removing MEC is to reduce the risk to environmental construction workers and reduce the potential of MEC within the removal action area boundaries.


Legend
Approximate Cofferdam Location
Clearance Phase
Phase 1 - Year 1
Phase 2 - Year 2
TLM area to be addressed under a seperate effort
NAD 1983 State Plane South Carolina (Feet)
Data Provided By:
Apex Companies, LLC
Site Location
Lexington
Richland
FIGURE 3
CLEARANCE
AREAS
Columbia, SC
Prepared For:
Apex Companies LLC
Prepared By:
Explosive Ordnance
Technologies, Inc.
DRAWN
M. Norris
VERIFIED
J. Daffron
APPROVED
B. Woods
DATE
11/05/2014
SCALE
1 inch = 200 feet
PAGE #
3

1.6 SCHEDULE

The underwater intrusive activities are tentatively scheduled to begin in Spring/Summer 2015. The preliminary schedule is as follows:

- Respond to comments and finalize DOP in May 2014.
- Begin Phase 1 coffer dam underwater intrusive activities in May to October 2015.
- Begin Phase 2 coffer dam underwater intrusive activities in May to October 2016.
- Begin Phase 3 coffer dam underwater intrusive activities in May to October 2017.
- Project reporting activities November to December 2017.

During the course of the underwater intrusive activities, modifications to the schedule may be necessary. The schedule modifications will be submitted to USACE, and will include:

- Reasons for the modification
- Descriptions of the alternatives evaluated to increase productivity (e.g., increase manpower, lengthen work days, more efficient equipment, etc.)
- Methods that will be used to prevent similar delays from happening again

1.7 DIVING OPERATIONS PLAN ORGANIZATION

This DOP is organized as follows:

- **Section 1 – Introduction**. Presents the authority, purpose, project description and general scope, personnel, site description and history, removal objectives, and tentative schedule for CRP underwater intrusive activities.
- **Section 2 – Dive Team**. Summarizes the names and duties of personnel involved with diving operations for CRP.
- **Section 3 – Equipment**. Provides a description of required equipment and platform to be utilized during diving operations.
- **Section 4 – Tasks**. Summarizes the tasks for underwater intrusive activities.
- **Section 5 – Dive Operations**. Details the procedures to be followed during diving operations, underwater intrusive activities, field Quality Control (QC) procedures and requirements to be followed.
- **Section 6 – Key Personnel**. Describes project key personnel and organization for diving activities.
- **Section 7 – Project Records and Reporting**. Lists project reporting deliverables for the CRP underwater intrusive activities.
- **Section 8 – References**. Provides references used to develop this DOP.

This section provides information on the CRP Dive Operations Team for underwater intrusive activities.

2. Dive Team

2.1 PERSONNEL

Listed in the Table 2-1 below are the team requirements, as defined in Appendix O of EM 385-1-1, that will be met for self-contained underwater breathing apparatus (SCUBA) diving operations:

TABLE 2-1

DIVE TEAM PERSONNEL COMPOSITION

Personnel Assignments	**Number of personnel**
Dive Supervisor (Dive qualified, unexploded ordnance [UXO] qualified)	1
Stand-By Diver	1
Diver in the water (tethered with communications)	1
Tender	1
Total Team Requirements	**4**

It is anticipated that one diver will be in the water at a time. The diver in the water will be tethered using a safety harness equipped with a positive buckling device, an attachment point for the safety line, and a lifting point to distribute the weight over the diver's body while maintaining a heads-up attitude if unconscious. The safety line will be a positive control link to the surface that can also be used for line pull signals and diver recall. The tender will maintain constant communication with the tethered diver using two way voice communications or using line pull signals as described in Attachment B of EOTI's Diving Safe Practices Manual. In visibility of less than three feet two way voice communication will be maintained and the diver will be line tended. The tender will not perform any other duties while the diver is in the water. This will ensure that the diver is in constant contact with at least one other member of the dive team. If it becomes necessary for the stand-by diver to enter the water, the Dive Supervisor will serve as his tender.

The Project Dive Operations Team is identified on **Table 2-2.**

TABLE 2-2

DIVE TEAM PERSONNEL AND DUTIES

NAME	DUTIES
Nelson Figeac	Dive Supervisor , Diver, Standby Diver, Tender, Senior Unexploded Ordnance Supervisor (SUXOS)-Qualified, Safety Boat Operator
Tom Dailey	Dive Supervisor, Diver, Standby Diver, Tender, UXOQCS
Rickey Hammer	Diver, Standby Diver, Tender, UXO Technician
Harry Craig or Kevin Kerns	Diver, Standby Diver, Tender, UXO Technician

If for some reason a diver is unable to complete the project (e.g., health, family problems, etc.) a qualified alternate diver will be substituted. Alternate diver qualification will be submitted to the USACE DDC prior to a new diver joining the dive operations.

Dive station will be manned by no less than a Dive Supervisor, Diver, Standby Diver and Tender. Under normal operations, one diver will be in the water at a time. The tender will maintain constant contact with the diver, tend the tether and monitor potential hazards to the diver. A standby diver will be dressed and ready to assist in an emergency any time that a diver is in the water. The primary Dive Supervisor is Nelson Figeac. He is the person responsible for all dive operations.

The Dive Supervisor is responsible for all dive-planning, briefings, monitoring diver depths and dive times, and recovering and deploying the dive teams accordingly.

Prior to mobilization, personnel training and requirements will be confirmed to ensure that dive personnel have the appropriate training, licenses, certifications, and experience. Copies of certifications/qualifications will be submitted for review two weeks prior to beginning dive operations and copies will be maintained on site and available for review by APEX and USACE representatives. The relevant personnel requirements for underwater intrusive activities at CRP will include the following:

- Workers who may be exposed to contaminated media will have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification, 8-hour HAZWOPER refresher certification as appropriate, and medical monitoring set forth in 29 Code of Federal Regulations (CFR) 1910.120. Workers who are not in direct contact with contaminated media will be exempt from this requirement. Exempt workers include Quality Assurance (QA) representatives and project management, as long as they are protected from exposure to contaminated media and remain outside the exclusion zone (EZ) for intrusive activities.[1]

[1] 29 CFR 1910.120(e)(3)(i) defines employees who are required to have 40-hour HAZWOPER training. It requires workers "…engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards…" to receive 40 hours of HAZWOPER training. An OSHA Interpretation Letter dated November 19, 1991 states that "if potential for exposure is extremely unlikely the standard would not apply." Employees protected from exposure and that remain outside of the exclusion zone during intrusive operations are extremely unlikely to be

- Divers will meet or exceed the minimum qualification in accordance with DDESB Technical Paper (TP) 18.
- Site supervisors must successfully complete the Occupational Safety and Health Administration (OSHA) 8-hour HAZWOPER Supervisor Course.
- Diver personnel have completed the OSHA-approved basic 40-hour health and safety training HAZWOPER course, annual refreshers of the same, military diver course for the apparatus utilized onsite, oxygen administrator, first aid, and cardiopulmonary resuscitation (CPR). Field personnel, required training, and the most current completion date of training are presented in a separate stand-alone document submitted to USACE and are not included in this DOP.
- Diver will meet or exceed the training and experience requirements of EM 385-1-1, Section 30.A.08.

All workers will be required to read and understand the Site Safety and Health Plan (SSHP), Diving Safe Practices Manual, Emergency Management Plan, Activity Hazards Analysis (AHA), and daily safety briefings will be completed as work progresses.

exposed to safety hazardous substances or health hazards associated with the hazardous waste operations.

This section provides information on the anticipated diving and support equipment to be utilized at CRP.

3. Equipment

3.1 Dive Equipment and Platform

The diving method will utilize SCUBA. The associated equipment to support SCUBA operations will include the following:

- SCUBA Tank -80 CF Steel or Aluminum Construction
- Diver Communications – Two way voice communication similar to Ocean Technologies System Model OTS-BUD-D2
- Emergency Gas Supply – 30 CF with separate regulator
- Diver Knife
- Full Face Diving Mask – with integral regulator
- Surface Communications
- Thermal Protection –Wet Suit or Dry Suite
- Diver Swim Fins
- Buoyancy Compensator
- Diver Computer
- Underwater Light

The minimum support equipment to be utilized will include the following:

- Dive Flag
- Medical Kit
- Underwater Camera
- Current Flow Probe
- Oxygen Kit
- Marine Radio
- Fathometer
- Litter/Backboard
- Cellular Phone

The diver will be walking in from the shore with safety boat attending in the water.

This section provides the required tasks for underwater intrusive activities at CRP.

4. Tasks

4.1 TASK 1 MOBILIZATION AND DEMOBILIZATION

Once pre-mobilization activities are complete, the dive crew and all associated materials and equipment necessary to perform the underwater intrusive activities will mobilize to CRP. The personnel and operations-specific equipment are summarized in **Sections 2** and **3**.

Demobilization of all diving-related personnel and equipment will occur after all underwater intrusive objectives have been safely completed and accepted by Apex and USACE.

4.2 TASK 2 DOCUMENTATION

EOTI will prepare all USACE required diving-related documents and plans for review by Apex and USACE. All plans will be approved by Apex and accepted by USACE prior to mobilization to CRP. Required documents include the Diving Safe Practices Manual and this Diving Operations Plan with its attachments including an Emergency Management Plan and AHA.

4.3 TASK 3 CRP REMOVAL ACTION

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint. The Dive Operations Team will perform underwater mag and dig of anomalies encountered using the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each anomaly identified will be manually investigated not to exceed 12 inches below river bottom.

This section details the procedures to be followed during diving operations, underwater intrusive activities.

5. Dive Operations

Diving operations shall be performed IAW with USACE Engineering Manual (EM) 385-1-1 and dive activity will be coordinated with the USACE Dive Safety Office. If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation.

Direct communications between the dive sites, project office, Apex Project Manager (PM), DDC and other involved personnel will be via cell phone. Divers will have communication with the surface, and diver-to-diver. Dive supervisor will positively control diver movement within the designated work area. Divers will be monitored by thru-water communication system.

Familiarization dives may be conducted to verify competency of the overall dive team.

5.1 CRP Removal Action

The goal of the removal action is to locate and remove MEC from within the cofferdam footprint in three separate phases, as shown on **Figure 3**. The Dive Operations Team will perform underwater mag and dig of anomalies encountered. Each anomaly identified will be manually investigated not to exceed a depth of 4 feet or to bedrock whichever is encountered first. Removal of MEC from the area between the coffer dams will be done after the water has been removed under a separate effort covered under a work plan for dry land portion of the MEC clearance.

Divers will gather information describing the source of each anomaly, including the following; item description, item weight, MEC condition, MEC nomenclature, bottom type/condition, and any other notable features. Acceptable to move MEC and MD will be transferred to land for final disposition. Unacceptable to move MEC will be detonated in place. Non-munitions-related debris will be left in place during this task.

Each MEC or MD item found will be marked using a GPS unit to an accuracy of +/- 3 meters. Once an item has been positively identified, and determined acceptable to move, it will be relocated within the land portion of the removal area. The final explosives safety status of a discovered MEC item as acceptable or not acceptable to move will be made by the SUXOS-qualified Dive Supervisor in consultation with the diver who investigated the item. Information such as the munition type, nomenclature, condition, and surrounding environment will be considered when determining if an item is acceptable to move or not.

Divers will use an all metals locator along grid lines established as part of the stationary jackstay method described in Section 2.7 of the EOTI Dive Safe Practice Manual. Each target anomaly location will be manually investigated and resolved not to exceed 12 inches below river bottom. The anticipated maximum depth of dives is 30 fsw. Divers will be utilizing a “no decompression limit” of 30 fsw for a maximum bottom time of 371 minutes (U.S. Navy Diving Manual, Rev. 6, 15 April 2008). A maximum single dive bottom time will be no greater than 180 minutes.

Munitions Constituent (MC) sampling of the sediment is not required for this field effort. Should MC sampling be needed it may be conducted by divers either during the removal process or as a separate dive. In the event that sediment sampling is needed, the EOTI Dive Supervisor will coordinate underwater sampling activities.

At the end of each diving day, all data including field notes, site photographs, and positioning data will be consolidated and submitted to the EOTI PM.

5.2 DIVING CONDITIONS

The Dive Operations Team will perform all assigned tasks during daytime within allowed current restrictions. Other factors that affect diving operations include:

- Surface conditions - No diving will be performed if the surface conditions do not permit the diver to maintain depth control. Dive operations will be suspended at Beaufort scale Sea State 3.
- Boat Traffic – Anticipate some boat traffic during the operation period. Whenever boat traffic is present in the vicinity of diving operations, the EOTI safety boat will keep other boats away from the area of dive operations. The safety boat will be positioned with visibility of the dive operation and avenues for approaching boats. Communication will be maintained between the safety boat and dive location. If possible the safety boat will divert boat traffic around the exclusion zone. If a boat enters the exclusion zone the dive supervisor will be notified and will immediately halt intrusive operation until the boat is safely outside of the exclusion zone.
- Underwater conditions – Shallow dives are heavily influenced by the surface conditions and may impact diving operations. No dives will be performed if conditions do not permit the diver to maintain depth control. The dive supervisor will have ultimate decision to cease diving operations if unsafe conditions occur.
- Visibility – Visual survey will be suspended when nominal visibility is less than 1 foot. A tactile survey with tethered divers may be conducted if visibility is degraded below 3 feet.
- Water Temperature – Thermal protection for the divers will be provided by a wetsuit or dry suit, as needed, to ensure diver protection and comfort. Divers will choose dive dress, and selection will be approved by the EOTI Dive Supervisor/SUXOS.
- Currents – Prior to conducting dive operations and prior to deploying any divers, the Dive Supervisor will measure current velocity using an FP 211 Global Flow Probe or similar instrument. If currents exceed 1-knot, divers will not be deployed and dive operations will be suspended until the current falls below 1-knot.

5.3 QUALITY ASSURANCE OVERSIGHT

Oversight of field activities may be requested by Apex or other stakeholders. At least 48 hours prior notice will be given to EOTI by those requesting oversight for purposes of coordination.

It is anticipated that Apex will have one person assigned in a safety and quality oversight role and may also be present during diving operations. If there is a need to answer questions, etc. the EOTI dive team leader/SUXOS will be the primary point of contact.

This section presents the project team, key personnel, and responsibilities for underwater intrusive activities during the MEC clearance dive activities.

6. Key Personnel

6.1 RESPONSIBILITIES

Project team responsibilities are discussed below.

6.1.1 Dive Supervisor

The Dive Supervisor is responsible for implementing the DOP, Diving Safe Practices Manual, Emergency Management Plan, and applicable AHA's. The Dive Supervisor will also serve as the UXOQCS and is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs) to the EOTI PM and Apex PM, and assisting in the preparation of progress reports.

The Dive Supervisor will report directly to the EOTI PM and is responsible for leading and coordinating the day-to-day activities of the various resource specialists. Specific Dive Supervisor responsibilities are identified in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.2 Diving UXO Specialist (Diver)

The diving UXO Specialist is the diver in the water. He is a U.S. Navy trained diver that is UXO qualified with the proper diving and MEC experience to perform assigned tasks. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.3 Standby Diver

The standby diver meets all of the requirements of the Dive UXO Specialist and is dressed and prepared to enter the water to assist the diver anytime the diver is in the water. Specific requirements and responsibilities for the position are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

6.1.4 Tender

A dedicated tender will be assigned to the diver while he is in the water. If the standby enters the water, the Dive Supervisor will serve as his tender. Responsibilities of the Tender are described in Section 3.3 of the EOTI Diving Safe Practices Manual.

This section presents the Project Records and Reporting for underwater intrusive activities during the MEC clearance diving activates.

7. Project Records and Reporting

7.1 PROJECT RECORDS

7.1.1 Field Documentation

Field documentation includes daily reports for each day of fieldwork that present information pertaining to field activities. These reports will be maintained by the Dive Supervisor and include field notes, photographs and positioning data. Reports are submitted to the EOTI PM and the Apex PM.

7.1.2 Dive Logs

Dive logs/records will be completed for each diver on each diving day during underwater intrusive activities. The individual dive logs will document conditions and exposure to diving. Dive logs will be maintained by members of the dive team and crosschecked for completeness at the end of each day by the Dive Supervisor. They will be signed and dated by each individual diver making their personal entries, their dive buddy (if applicable), and the Dive Supervisor. Dive logs will be submitted to USACE upon completion of dive operations per EM 385-1-1, Sec. 30.A.28.

7.2 PROJECT REPORTING

Project reporting requirements include preparation of reports that document all diving-related field activities completed at CRP. These will include draft/draft final deliverable project reports, as well as documents summarizing field activities. These reports will be based on project records that include field logbooks; discrepancy reports; and records of conversations, meetings, and correspondence.

8. References

Apex Companies, LLC. 2013. Design Drawings Figures 1 through 5. February - November

Department of the Army (DA). 2008. Technical Manual (TM) 60A-1-1-31, Explosive Ordnance Disposal Procedures, General Information on EOD Disposal Procedures (Revision 5). October.

Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.

Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M

Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.

DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.

Management and Technical Resources, Inc. 2013. Final Engineering Evaluation/Cost Analysis (EE/CA), Congaree River Sediments, Columbia, South Carolina. January.

Revision 4. August United States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)

South Carolina Department of Health and Environmental Control (SCDHEC) 2013. Public Notice-Congaree River Project. 21 August.

Tidewater Atlantic Research, Inc. 2012. A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase IV Report, Columbia, South Carolina. 8 February.

United States Army Corps of Engineers (USACE) 2013. Safety and Health Requirements Manual EM 385-1-1

United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.

United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Note: *This Emergency Management Plan is to be used in conjunction with the Site Safety and Health Plan. Ensure that all personnel are familiar with the policies, procedures, and requirements outlined in both plans.*

Emergency Service (Ambulance, Fire, Police)—911

Columbia Fire Dept.
1800 Laurel St
Columbia, SC
(803) 545-3700

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Nearest Hyperbaric Chamber Facility

Palmetto Health Richland
5 Richland Medical Park Drive
Columbia, SC 29203
(803) 434-7000

Divers Alert Network (D.A.N.)
Emergency +1-919-684-9111 Phone 1-800-446-2671

Poison Control Center
(800) 962-1253

United States Corps of Engineers
(Name) TBD
Office:
Email:

District Ordnance and Explosives Safety Specialist (OESS)
(Name) TBD
Cell:
Email:

Apex Project Manager
Rusty Contrael
Office: 412-829-9650
Cell: 412-721-6494
rcontrael@apexcos.com

EOTI Project Manager
James Daffron, PE
Office: 865-200-8081
jdaffron@eoti.net

Nearest Hospital Information and Route

Name: **Palmetto Health Richland**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

See description and map of the route below.

Nearest Recompression Chamber

Name: **Palmetto Health Richland Hyperbaric Medicine**
Address: 5 Richland Medical Park Drive
Columbia, SC 29203
Phone: (803) 434-7000

From the Project Area

Project Site

1. Head **north** on **Gist St** toward **City Club Dr**

482 ft

2. Take the 2nd right onto **Gervais St**

0.2 mi

3. Turn left onto **US-21 N/US-321 N/Huger St**
Continue to follow US-21 N/US-321 N

0.8 mi

4. Keep right at the fork, follow signs for **U.S. 21/U.S. 176/U.S. 321/Elmwood Avenue** and merge onto **US-176 W/US-21 N/US-321 N/US-76 E**
Continue to follow US-76 E

1.1 mi

5. Turn left onto **Bull St**

0.7 mi

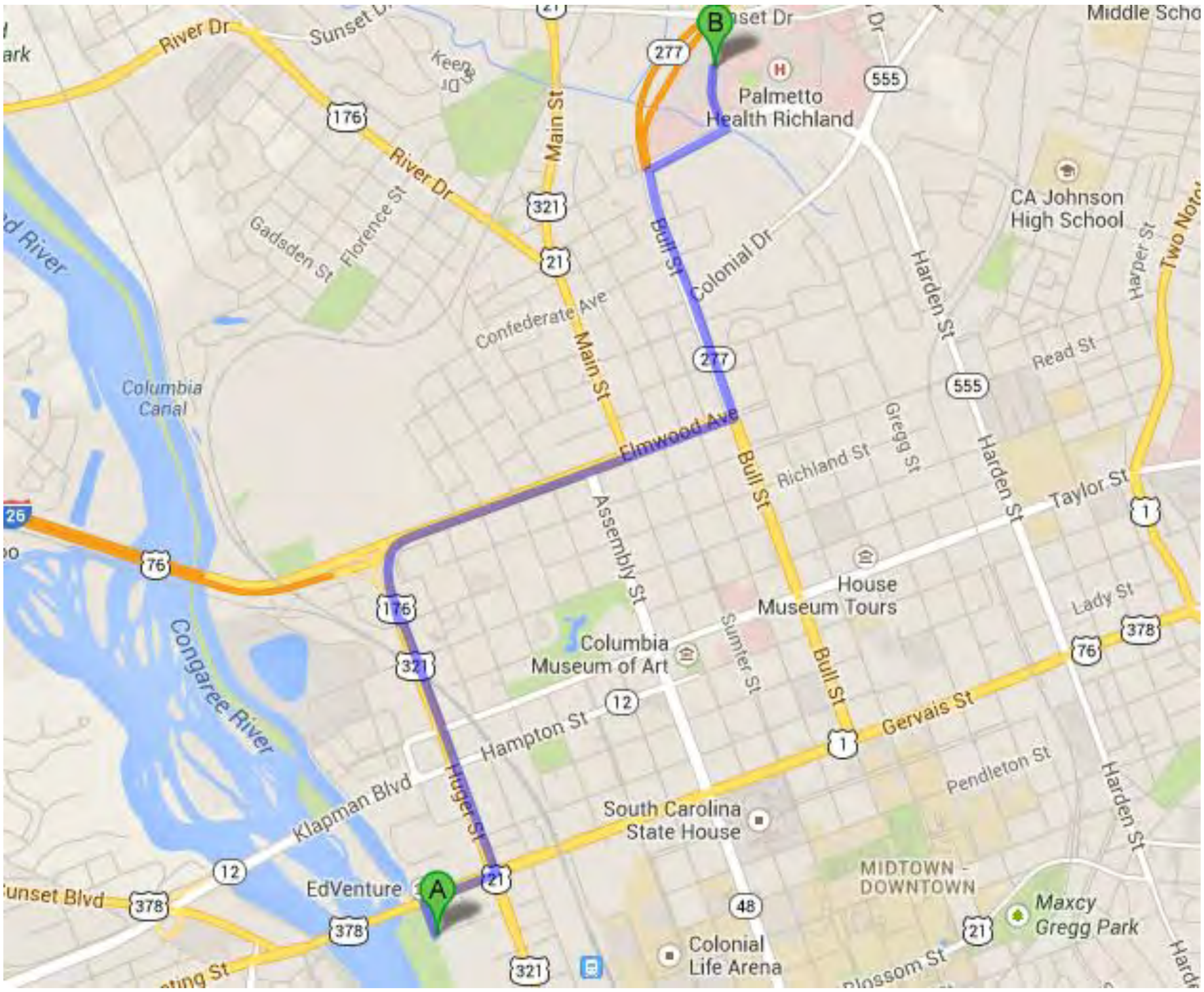
6. Turn right onto **Harden Street Extension**(signs for **Harden St**)

0.2 mi

7. Turn left onto **Richland Medical Park Dr**
Destination will be on the right

0.2 mi

5 Richland Medical Park Dr
Columbia, SC 29203



Emergency Procedures

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

1. **Buddy Separation**

- The divers will look/feel 360 degrees around for his dive partner; and
- Both divers will come to the surface with one hand above head.

2. **Lost Diver**

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to Apex Project Office and EOTI Corporate Offices; and
- Ensure stricken divers recovered get immediate, effective treatment.

3. Loss of Air/Equipment Malfunction

- Signal dive partner and abort dive;
- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repaired (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

4. Mechanical Injury

- Diver will inform the Dive Supervisor of any mechanical injuries no matter how slight they may seem;
- Dive Supervisor will rule out any doubt of decompression sickness; and
- If immediate treatment is required, recall all divers and transport to recompression chamber/emergency Room.

5. Decompression Sickness ("The Bends") or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify Apex Project Office and EOTI Corporate Office of circumstances;
- Perform neurological exam and record on (EOTI Diving Safe Practices Manual, Attachment J); and

- Treat for shock.

6. Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

7. **Explosive Detonation with Diver (s) in the Water**

- Attempt to establish communications with the diver via tending line:
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

8. **Diver Emergency Recall**

- If diver is tended use standard line-pull signals to recall diver (See Attachment B of the EOTI Diving Safe Practices Manual);
- If diver is untended use diver audible (Metal-on-metal in the water) or mechanical recall; and
- Upon notification of recall by any means the diver will surface immediately.

9. **Injured Diver:** If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

10. **Fire:** Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

11. **Inclement weather:** All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

12. **Medical Injury or Illness:** See Attachment A to the EOTI Diving Safe Practices Manual as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.

13. **Critical Equipment Failure:** In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

14. **Injury/illness of surface crew:** If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.

15. **Dive Blow Up / Over Rapid Ascent to the Surface:** Depths of dives for the project are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted. The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.

16. **Loss of Communications:** If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.

17. **Emergency Victim Transportation:** If an injury or illness requires treatment beyond first aid, the victim will be transported to the appropriate medical facility, identified above (or as determined by first responders). The first aid-trained technician treating the victim will make the initial assessment related to the need for additional treatment. First responders will be notified of the situation through a call to 911. If the situation requires transportation by ambulance the victim will be moved (if determined safe and necessary to do so) to a pick-up location where first responders can be directed. Two personnel will remain with the victim until emergency responders arrive. One will administer first aid and monitor the victim and the other will maintain communication with the first responders. If it is appropriate or necessary for EOTI to transport a victim for follow-up care, three personnel will accompany the victim. One will administer first aid and monitor the victim, one will drive and the third will maintain communication with the treatment facility, as necessary.

FIRST AID FOR DIVING RELATED INJURIES

1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

Disorientation or Fatigue

Skin Itch

Chest Pain

Numbness, Tingling, Paralysis or Weakness

Dizziness, Vertigo, or Ringing in the Ears

Blurred Vision

Personality Change

Signs (one or more of the following)

Bloody froth from nose or mouth

Paralysis or Weakness

Unconsciousness

Convulsions

Shortness of Breath or Cessation of Breathing

Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

CPR, if required

Open airway, prevent aspiration, and incubate if trained person available

Give O^2; remove only to open airway or if convulsion ensue

If conscious, give nonalcoholic liquids

Place in horizontal, neutral position

Restrain convulsing person loosely and resume O^2 as soon as airway is open

Protect from excessive cold, heat, water, or fumes

Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

Tired Feeling

Itching

Pain, arms, legs or trunk

Dizziness

Numbness, tingling or paralysis

Chest compression or shortness of breath

Anything unusual after the dive

Signs (one or more of the following)

Blotchy Rash

Paralysis or weakness anywhere in the body

Coughing Spasms

Staggering or instability

Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

2.1 Pneumothorax

Symptoms (one or more of the following)

Pains in the chest

Shortness of breath

Signs (one or more of the following)

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

Emergency Actions:

Call for help and immediate transport

2.2 Mediastinal Emphysema (Lung over pressure accident)

Recognition - Always associated with pneumothorax

Symptoms (one or more of the following)

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

Signs (one or more of the following)

Obvious difficulty breathing

Brassy change in voice

Emergency Actions:

Transport to medical facility for evaluation

2.3 Drowning-Near Drowning

Recognition

Unconsciousness

Lack of respiration

Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing

Assess ABC's airway, breathing and circulation

Removal of gear

Transport to the boat or shore

Immediate call for help and transport to facility

Start CPR

2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by

Convulsions

Symptoms (one or more of the following)

Nausea

Dizziness

Ringing in the ears

Abnormal Vision

Confusion

Prevention

Avoidance of gases with high O^2 concentrations (as in Nitrox at inappropriate depth)

Avoid CO^2 retention that can precipitate O^2 convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport

- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50^{o} C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

2.9 Hypothermia

- Keep core temperature above 95^{o} F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)
- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet

- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

3.1 Nitrogen Narcosis

Signs (one or more of the following)

Inappropriate behavior at depth

Ignoring hand signals and instructions

Stupor or coma

Symptoms (one or more of the following)

Inflexible thinking and attitude

Decrease or loss of judgment

False sense of security

Lack of concern for safety

Inability to think through problems

Panic

Near unconsciousness or loss of consciousness at depth

Treatment

Ascend until free of symptoms

Surface with controlled ascent

Transport to medical facility for evaluation

3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

Rapid breathing

Feeling of suffocation or shortness of breath

Headache, nausea, dizziness

Rapid heartbeat

Confusion and unclear thinking

Signs (one or more of the following)

Slowed responses

Muscle irritability (twitching)

Loss of consciousness

Treatment

Remove the cause (over-exertion, equipment failure, rebreathers, etc.)

Stop and rest during early symptoms to avoid loss of consciousness

Surface; Transport to medical facility for evaluation

3.3 Ear Disorders

Middle Ear Barotrauma

Keep quiet and calm

Without DCS or rupture of the round or oval windows, give Benadryl 25 mg

Transport to medical facility for evaluation

Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)

Keep head up and affected ear elevated

Discourage straining

Transport to medical facility for evaluation

EMT evaluation, no more diving until cleared by EMT

3.4 Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Mobilization**   Risk Assessment Code (RAC): M

Prepared By: Brian Woods   Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:
PPE Level D (outside exclusion zone): General work clothes, traffic vest, safety glasses, hard hat, steel-toed boots, hearing protection, work gloves

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Movement of materials to the site Installation of temporary facilities and utilities, to include: Ground preparation for trailer (site	Driving/vehicle movement (including trucks, heavy equipment)	• Obey traffic rules. • 15 miles per hour is the maximum speed allowed in the work area. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). • Do not use cell phones when operating vehicles. • Secure all loads, including equipment within the cab, containerize small equipment and secure container. • Wear seat belts, including those provided in cabs of heavy equipment. • Use caution and wear orange vests if working near active roads or around heavy equipment.	18.A 18.B 08.B

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
office) and milvan pads, dumpsters, and sanitary stations, Electricity connections to site office Explosive storage establishment Field engineering (survey of preliminary conditions)		• Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; "blind spots" of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. •	18.B.03 18.B.03 16.B.02 18.B
		•	
	Dust	• Minimize generation of dust. • Stay out of visible dust clouds. • Wet soil if necessary to eliminate visible dust.	06.A.04

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	• Reduce the volume of detection equipment before donning a headset. • Site-specific training and daily tailgate briefing.	05.C.01
	Electricity	• Assure electrical work is performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements.	11.A.01.c
	Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. • Inspect areas daily and findings are recorded on daily inspection reports. • Personnel will wear sturdy all leather work boot with traction sole and composite safety toe.	14.C
	Hand tools	• Inspect tools prior to use. • Use tools for their intended use only. • Don't use damaged tools. • Push, don't pull wrenches.	13.A.02 13.A.02 13.A.02

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): M

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Biological hazards	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes. • Check the area for poisonous plants, insects, snakes, spiders, and scorpions. • Avoid animal droppings they may contain the Hanta Virus. • Avoid holes and rocks that are potential animal habitats. • If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. • Avoid walking through dense foliage. • Wear protective clothing in areas where poison oak and poison ivy are present. • Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. • Site-specific training and daily tailgate briefings.	06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.02 06.D.02 06.D.01
	Material handling	• Use safe lifting techniques, bending at the knees and lifting with the legs. • Use caution and do not twist the back when carrying a load. • Use mechanical devices to move loads when possible. • Wear protective gloves when handling materials. •	14.A.01 14.A.01 14.A.04 05.A

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	• Wear cold weather clothing and provide shelter as needed based on site conditions. • Conduct temperature monitoring when temperatures fall below 45°F. • Site-specific training and daily tailgate briefing.	06.J.10 06.J.11
	Heat stress	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Adjust work/rest regimens during hot weather. • Use sun screen. • Avoid consuming caffeine. • Site-specific training and daily tailgate briefings.	06.I.03 06.I.04
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Monitor conditions and will call a safety stand down in the event of inclement weather.	06.J.01
	Fire	• Provide portable fire extinguishers in all equipment and in the field trailer. • Inspect fire extinguishers monthly. • Obtain hot work permits prior to any welding or torch cutting activities.	09.E 09.E 06.C

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Mobilization**   Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary facilities (if used, not anticipated)	• Anchor trailers with rods and cables or by steel straps to ground anchors designed to withstand winds and meet applicable standards. • Post signs warning of the presence of construction hazards every 300 feet. • Provide one portable toilet with adequate ventilation on site. • Provide washing facilities at the portable toilet location to maintain sanitary conditions. • Provide type II 16-unit first aid kits and make these kits accessible at the site.	04.A.03 04.A.04/08.A 02.C 02.D 03.B
	Powered machine tools	• Use, inspect, and maintain power tools according to manufacturer's recommendations. • Equip power tools with designed guards. • Provide electrical power control on each power tool to make it possible for the operator to cut off the power without leaving the point of operation. • Connect all electrical power tools to an in-line GFCI.	13.A.02 13.A.03 13.A.15 11.C.05

ATTACHMENT B
MOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Mobilization** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Temporary haul roads (if used, not anticipated)	• Construct haul roads with suitable width for safe operation at the speed anticipated. • Post speed limits on haul roads.	08.D.05 08.D.06

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project | Job: **Boat Use** | Risk Assessment Code (RAC): **L**

Prepared By: Brian Woods | Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:
PPE Level D: General work clothes, safety glasses, hard hat, safety-toed boots, leather work gloves, and respirator (when working in dry, dusty conditions).

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Mobilization, Demobilization, Loading and Unloading	Driving/vehicle movement (including truck/trailer bringing the boat to the job site) Unloading the boat from the trailer Loading the boat onto the trailer	• Obey traffic rules. • Use caution when entering roadways. • Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). • Do not use cell phones when operating vehicles. • Secure all loads, including equipment within the cab, containerize small equipment and secure container. • Wear seat belts, including those provided in cabs of heavy equipment. • Use caution and wear orange vests if working near active roads or around heavy equipment. • Leave enough time to get to your destination without hurrying. • Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; "blind spots" of some equipment can be very large. • Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view; use a back-up alarm or a spotter when backing up. •	16.A/18.A 08.B 16.B.08/18.B.03 16.B.01/18.B.03 16.B.02 16.B/18.B 16.B.12b

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Boat Use	Potential MEC (If in an area where MEC is suspected)	• Observe MEC/anomaly avoidance procedures in accordance with EP-75-1-2	
	Boat Operations to include: Diving, Sediment Sampling, water sampling, and surveying	• Boat shall be equipped with Coast Guard Approved Type III Personal Flotation Devices with attached whistles for each passenger/worker onboard. • Boat shall be equipped with at least one Coast Guard Approved Type IV Personal Flotation Device, first aid kit large enough for the crew, charts, compass, GPS, cell phone or radio, survival kit, anchor, and paddles. • For off-shore operations the boat shall be equipped with marine band radios, radars, bow hook, spotting mirrors, flare gun, and flares. • A qualified boat operator will be in charge of boat operations • The boat engine shall be placed in neutral prior to splashing divers (as conditions permit). • The boat engine shall be turned off (if conditions permit) when recovering divers. •	

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Slips, trips, and falls	• Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. • Inspect areas daily and findings and recorded on daily inspection reports. • Sturdy all leather work boots with traction sole and safety toe.	14.C
	Biological hazards	• Use repellents and proper clothing for protection against insects including ticks and mosquitoes. • Check the area for poisonous plants, insects, snakes, spiders, and scorpions. • Avoid animal droppings they may contain the Hanta Virus. • Avoid holes and rocks that are potential animal habitats. • If contact with insects, animals, animal droppings, or poisonous plants then wash area immediately. • Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. • Site-specific training and daily tailgate briefings.	06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.01 06.D.02 06.D.02 06.D.01

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project　　Job: **Boat Use**　　Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Cold stress	• Wear cold weather clothing and provide shelter as needed based on site conditions. • Conduct temperature monitoring when temperatures fall below 45°F. • Site-specific training and daily tailgate briefing .	06.J.10 06.J.11
	Heat stress	• Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. • Adjust work/rest regimens during hot weather. • Use sun screen. • Avoid consuming caffeine. • Site-specific training and daily tailgate briefings.	06.I.03 06.I.04
	Extreme weather	• When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. • Monitor conditions and will call a safety stand down in the event of inclement weather.	06.J.01
	Fire	• Provide Coast Guard Approved portable fire extinguishers onboard. • Inspect fire extinguishers monthly.	09.E 09.E

BOAT USE
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Boat Use** Risk Assessment Code (RAC): **L**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Noise	• Wear hearing protection when operating or working near the mower. • Site-specific training and daily tailgate briefing.	05.C.01

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project   Job: **Dive Operations**   Risk Assessment Code (RAC): M

Prepared By: Brian Woods   Reviewed By: James Daffron

Minimum Protective Clothing and Equipment:
Dry Suit/ Wet Suit, Tether, Reserve air. Dive flags, Dive boat, Hand tools, Back Board, Breathing gas supply, Buoys, Dive

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		PROBABILITY				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
MEC Dive Operations for Anomaly Investigation and Removal	**Radiation Hazards:** Sun	Use sunblock as appropriate. Avoid extended periods of direct exposure to sun.	06.J.13
	Chemical Hazards: Marine Battery- Lead Acid	Keep containers tightly closed when not in use. If battery case is broken, avoid contact with internal components. Do not handle near heat, sparks, or open flames. Protect containers from physical damage to avoid leaks and spills. Place cardboard between layers of batteries to avoid damage and short circuits. Do not allow conductive material to touch battery terminals. Use protective acid resistant gloves and eye protection if coming in contact with battery acid	05.A 05.B

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
		from leaks or spills.	
	Biological Hazards: Stinging and biting Insects Animals and Reptiles	Use appropriate insect repellents. Training to avoid poisonous insects and avoid contact. A poster indicating various types of biological hazards will be displayed in the site trailer. Training on symptoms of rabies and avoidance of animals.	06.D.01 06.D.02
	Physical Hazards: Slips, trips, and falls while walking on uneven walking surfaces; weather hazards, such as snow and ice; and poor visibility	Care will be exercised during off-loading and loading of boats to reduce slip, trip or fall hazards associated with the landing or docking area. Work areas will be kept organized; ice, snow, and mud will be cleared to reduce hazards. Work will be completed in adequate natural light or sufficient artificial illumination will be maintained. Site personnel will use the "buddy system" at all times.	14.C
	Underwater Hazards from stepping in holes or on sharp objects	Be observant while in the water and move cautiously.	14.C
	Manual lifting	Use proper lifting techniques—keep back straight, lift with legs, avoid twisting back, use mechanical equipment, or get help from others whenever possible. Heavy loads will be carried with assistance. Verify the path of travel is clear prior to the lift.	14.A.01 14.A.04 05.A

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Hands or fingers caught between objects; abrasions and lacerations	Personnel will be made aware of the hazard and asked to coordinate carefully the handling and placement of heavy objects. Materials and objects being handled will be inspected for rough or sharp edges and appropriate precautions will be taken to avoid contact with rough or sharp edges. Personnel will wear work gloves and avoid placing hands between objects.	05.A
	Hand tools, manual	Tools will be inspected prior to use. Damaged tools will be tagged out of service until repair can be performed by a qualified person. Tools will be used properly and for their intended purpose.	13.A.02
	Inclement weather, heat and cold stress	When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel. UXOSO will monitor conditions and will call a safety stand down in the event of inclement weather. Electrolyte/fluids replacement will be available to workers as needed. Work/rest periods will be established according to ACGIH and NIOSH guidelines. Personnel will be monitored. Dive gear will include appropriate thermal protection.	06.J.01
	Fire	Fire prevention will be a priority through awareness. A 1A:10BC extinguisher will be required to be on the boat during boating and diving activities.	09.E
	MEC Hazards	On-site MEC training will be conducted. UXO personnel will be EODS graduates. Perform MEC intrusive investigation using approved methods and techniques. EM-385-1-97 will be followed for performing MEC work.	

DIVE OPERATIONS
ACTIVITY HAZARD ANALYSIS

Date Prepared: 04/01/14

Project: Congaree River Remediation Project Job: **Dive Operations** Risk Assessment Code (RAC): **M**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Drowning Hazards	Two way communications system will be employed. Review dive procedures in the Safe Practices Manual. Standby diver will be dressed and ready when a diver is in the water. U.S. Navy No-Decompression tables will be used. All dive gear will be inspected and serviceable. Check lists will be used to insure all procedures are followed.	30.A 30.B
Post Diving	Decompression Stress resulting from Flying After Diving	Divers will not fly within 12 hours after diving or within 24 hours after multiple dives.	30.A.11

Explosive Ordnance Technologies Inc.

Diving Safe Practices Manual

Underwater MEC Investigation/Removal
Using SCUBA

EOTI

Diving Safe Practices Manual

Underwater MEC Investigation/Removal Using SCUBA

Prepared Date
April 15, 2014

Reviewer Acknowledgment

EOTI Safety Manager	**Signature**	**Date**
EOTI Dive Safety Reviewer	**Signature**	**Date**
Prepared By	**Signature**	**Date**

Table of Contents

List of Attachments

Acronyms and Abbreviations

ACDE	Association of Commercial Diving Educators
AED	Automatic Emergency Defibrillator
AHA	activity hazard analysis
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
DDC	Designated Dive Coordinator
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Report
EM	Engineering Manual
EOD	Explosive Ordnance Disposal
EOTI	Explosive Ordnance Technologies, Inc.
fpm	feet per minute
fsw	feet of salt water
GPS	global positioning system
HAZWOPER	Hazardous Waste Operation and Emergency Response
MD	munitions debris
MEC	munitions and explosives of concern
MPPEH	material potentially presenting an explosive hazard
No.	number
OE	Ordnance and Explosives
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
QC	quality control
SCUBA	self-contained underwater breathing apparatus
SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
U.S.	United States
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer

1. INTRODUCTION

This manual establishes the Dive Operations guidelines for Explosive Ordnance Technologies, Inc. (EOTI) personnel engaged in munitions response diving operations. This manual combines and conforms to requirements outlined in Occupational Safety and Health Administration (OSHA) regulations, the United States (U.S.) Navy Diving Manual (Volume I) and the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual Engineering Manual (EM) 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 Code of Federal Regulations (CFR) 1910 Subpart T, Commercial Diving Operations has been integrated into this manual. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examination, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where documents are conflicting in policy, the most stringent regulations take precedence. A site-specific Diving Operation Plan is established for each project.

Safety is the primary consideration in planning and executing all jobs. The underwater investigation and removal of munitions and explosives of concern (MEC) adds a degree of complexity and additional hazards, not present in land based operations. All personnel engaged in these operations are screened carefully for the required training, experience, and physical capabilities required to perform underwater MEC work. Each individual is responsible for personal safety and for the safety of coworkers. Each individual must know their physical limits and technical capability and must immediately notify the Dive Supervisor if unable to safely complete assigned tasks. Site-specific dive plans and safety plans will be developed for each project.

This Safe Practices Manual will be available to Government representatives and all dive team members at all times at all diving locations.

2. DIVE SAFETY PROCEDURES (1910.422)

The success of any diving operation is a direct result of careful and complete planning. The procedures and checklist presented below are intended to help ensure careful planning and safe execution of dive operations. The Dive Supervisor shall comply with the following requirements during diving operations:

- A means capable of supporting the diver will be provided for water entry and exit when conducting dive operations from a boat. The means provided for exiting the water will extend below the water's surface; a means will be provided to assist an injured diver from the water to the dive boat; see Attachment A (Emergency Management Plan) for guidance.
- An operational two-way voice communication system will be used for communication between each diver and a member of the dive team at the dive location. Line-pull signals meet this requirement for SCUBA-diving mode.
- If line-pull signals are used in SCUBA mode, only Navy approved line-pull and hand signals will be used. (See Attachment B);
- Have operational two-way communications (handheld portable radios and cell phones) available at the dive location to obtain emergency assistance;
- Dive profiles will be kept at the dive location for each diver (See Attachment C).
- Explosives shall not be detonated while a diver is in the water;
- The Dive Supervisor will be on the site for all diving operations.
- The Dive Supervisor will devise a means for emergency diver recall. It must be a distinct, sure method and every diver must be made aware of the system being used.
- A standby diver will be utilized on all diving operations. Gear must be ready for immediate donning (i.e., harnesses adjusted, regulators attached, and air on etc.).
- Personnel involved in diving operations shall not hesitate to ditch, abandon, or destroy gear or equipment if, at any time, such action would, in the divers mind, be the proper course of action for his own safety or the safety of others;
- U.S. Navy Standard Air Decompression Tables will be used and available at the dive locations;
- Repetitive and no-decompression tables will be at the dive location; and
- Use a timekeeping device for recording the diving times of all SCUBA diving operations. The Dive Supervisor will ensure that a diver does not exceed the approved bottom time on any dive.
- Plan the dive, dive the plan.

2.1 PRE-DIVE PROCEDURES (1910.421)

The Dive Supervisor shall comply with the following requirements prior to each diving operation.

2.1.1 Emergency Aid

An Emergency Management Plan (Attachment A) shall be completed prior to diving operations and kept at the dive location that includes the telephone or call numbers of the following:

- Location of an operational recompression chamber;
- Location of accessible hospitals;
- Available means of emergency transportation; and
- The nearest U. S. Coast Guard Rescue Coordination Center.

2.1.2 Dive Operation Planning and Assessment

The planning of a dive operation shall include an assessment of the safety and health aspects of the following:

- Diving mode;
- Surface and underwater conditions and hazards;
- Breathing air supply (including reserves);
- Thermal protection;
- Diving equipment and systems;
- Dive team assignment, training in diving equipment/procedures and physical fitness of dive team members (including any impairment known to the employer);
- Dangerous marine life;
- Repetitive dive designation or residual air status of dive team members;
- Decompression and treatment procedures (including altitude corrections) as necessary; and
- Emergency procedures.

2.1.3 Pre-dive Brief

The Dive Supervisor shall brief the dive team members on the following prior to diving:

- Mission and location which will include drawings and/or photographs pertinent to the mission
- Safety procedures for the diving mode;
- Equipment and materials to be used or installed as part of the mission;
- Maximum working depth with estimated bottom times and water temperature;
- Names and duties of personnel on the team;
- Discussion of pertinent activity hazard analyses (AHAs) or new AHAs
- Any unusual hazards or environmental conditions likely to affect the safety of the diving operation;
- Any modifications to the Dive Plan necessitated by the specific diving activities (NOTE: If for any reason the Dive Plan is altered in the mission, depth, personnel, or equipment, the USACE Designated Dive Supervisor (DDC) will be contacted in order to review and accept the alteration prior to actual operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation); and

- Emergency procedures

Prior to making individual dive team member assignments, the Dive Supervisor will inquire into the dive team member's current state of physical fitness, and indicate to the dive team members the procedure for reporting physical problems or adverse physiological effects during and after the dive.

2.2 TERMINATION OF DIVE

The working interval of a dive shall be terminated when:

- A diver requests termination;
- A diver fails to respond correctly to communications or signals from a dive team member;
- Communications are lost and cannot be quickly re-established between the diver and a dive team member at the dive location, and between the Dive Supervisor and the boat operator; or
- A diver begins to use diver-carried reserve breathing gas;
- Emergency recall device is activated; or

2.3 POST-DIVE PROCEDURES

The Dive Supervisor shall comply with the following requirements after each diving operation.

- Check the physical condition of each diver;
- Instruct each diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;
- Advise each diver of the location of a recompression chamber which is ready for use;
- Alert each diver to the potential hazards of flying after diving (12 hours before flying after any dive and 24 hours following multiple days of repetitive dives);
- Each diver shall remain at the dive location or in close proximity to the Dive Supervisor for at least 30 minutes after completing dive; and
- Ensure that no diver has a bottom time longer than authorized for each dive.

2.4 RECORD OF DIVE

The following information shall be recorded (use Attachment C) and maintained for each diving operation.

- Names of dive team members including Dive Supervisor;
- Date, time and location of dive (s);
- Diving mode used;
- General nature of work performed;

- Surface and underwater conditions (visibility, water temperature and current);
- Maximum depth and bottom time for each diver; and
- Attachment C will be filled out for each dive operation by Dive Supervisor and filed in the permanent project files.

For each dive in which decompression sickness/pulmonary barotraumas are suspected or symptoms are evident, the following additional information will be recorded and maintained:

- Description of decompression sickness symptoms (including depth and time of onset);
- Description and results of treatment;
- Name, address and phone number of attending physician

A decompression procedure assessment shall be conducted by the Dive Supervisor to include the following.

- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of the decompression table used and individual susceptibility;
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness;
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness; and
- Written evaluations will be retained by EOTI for a period of five years and then forwarded to OSHA.

2.5 SCUBA Diving Requirements

2.5.1 Equipment

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet Department of Transportation (DOT) 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of

the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;

- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and

- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.

- Skin suit to protect from cuts and abrasions and thermal protection as required

- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

2.5.2 Requirements While Engaged In SCUBA Diving Operations

SCUBA diving shall not be conducted**:**

- Against currents, exceeding one (1) knot;

- In an enclosed or physically confining spaces unless line-tended;

- In water visibility less than one (1) meter unless line tended with diver/surface two-way voice communications

- When the diver does not have direct access to the surface

2.5.3 Procedures

- Divers will not exceed designated bottom time;

- Will have a layer of skin protection to prevent injury from cuts and scratches and thermal protection if water temperatures are below 75 degrees Fahrenheit.

- A standby diver shall be available while a diver is in the water;

- A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operation; and

- A diver-carried reserve breathing air supply shall be provided for each diver consisting of:

  - An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

  - The valve of the reserve breathing gas supply shall be in the closed position (lever in the up position) prior to the dive.

- All personnel will remain aware of conditions or hazards that might affect diving operations and will inform the Dive Supervisor and/or terminate the dive as necessary;

- Divers will use proper rates of descent/ascent during the dive (75 feet per minute [fpm] descent/30 fpm ascent).

- If communications are lost between a tender and diver and cannot be regained quickly, metal-on-metal audible recall signal will be sounded in the water and line pull signals will be used to recall the diver. If the diver does not surface in a reasonable amount of time after the audible re-call signal and line-pull signals have been initiated, the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately without waiting for the recall signal. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive. The Emergency Plan in Attachment A describes emergency procedures that apply to a situation where there is a lost diver in the water.

2.6 LIVE BOATING

EOTI will operate a safety boat in the area of dive operations. The boat will be positioned to monitor the dive operation and to help maintain a safety exclusion zone around the operation. Personnel on the safety boat will assist in emergency response as requested by the Dive Supervisor. The dive boat will be anchored during dive operations.

2.7 SEARCH METHOD (CIRCLE-LINE AND STATIONARY JACKSTAY)

The purpose of a munitions response dive is to locate and identify underwater MEC. The search shall be conducted using a circle-line search method described in the following paragraph; the diver will be equipped with an all metals detector and hand tools as necessary. The area to be searched will be located using the Global Positioning System (GPS) to locate the points provided by an aero-detection mapping operation.

The circle-line search method will be used to locate underwater MEC when the search area is small. A single clump attached to a buoy line will be lowered to the bottom. A second line with knots tied every four- or five-feet apart of a specified length will be attached to the clump. The diver will then use this second line to circle around the clump at increasing or decreasing radii while searching. After one complete circle, the diver moves out or in one knot as required. This search method can be utilized to reacquire single targets previously electronically positioned (see Figure 2.1).

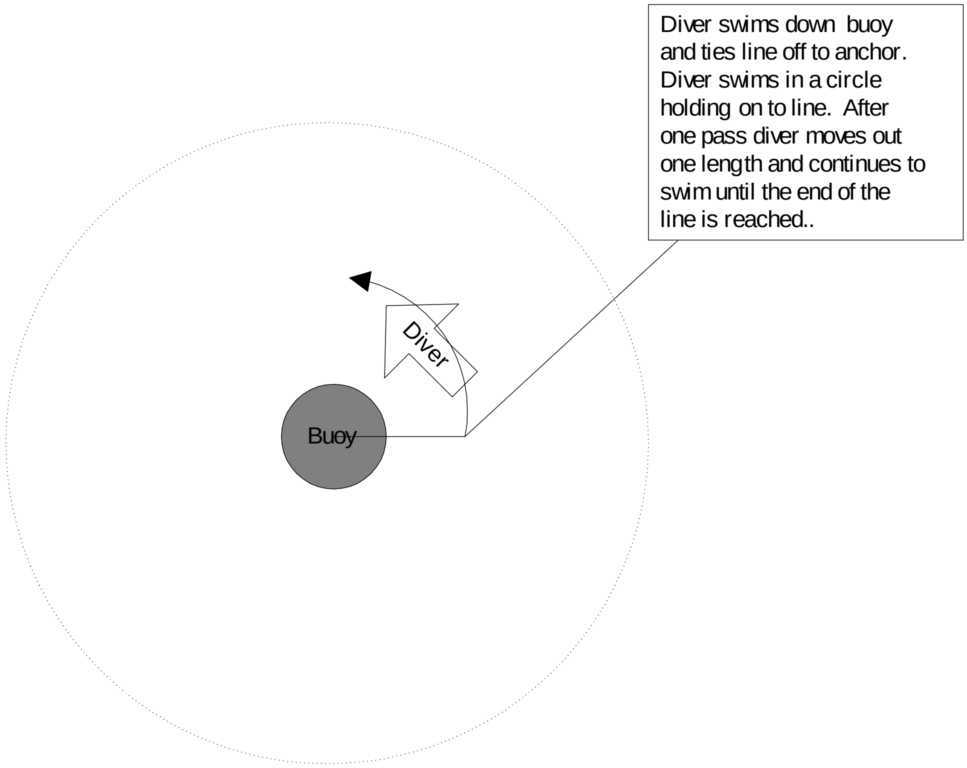


Figure 2.1 Circle Line Search Method

The Stationary Jackstay search method will be used to locate underwater MEC in the areas where specific anomaly locations are unknown. A diver will use a line as a guide as he sweeps a lane that is approximately five feet wide. At the end of the line he will turn around and swim the opposite direction, clearing a five feet wide lane on the other side of the line. The line will then be repositioned and the process is repeated until the entire area is cleared. Figure 2.2 shows how the Stationary Jackstay method is employed.

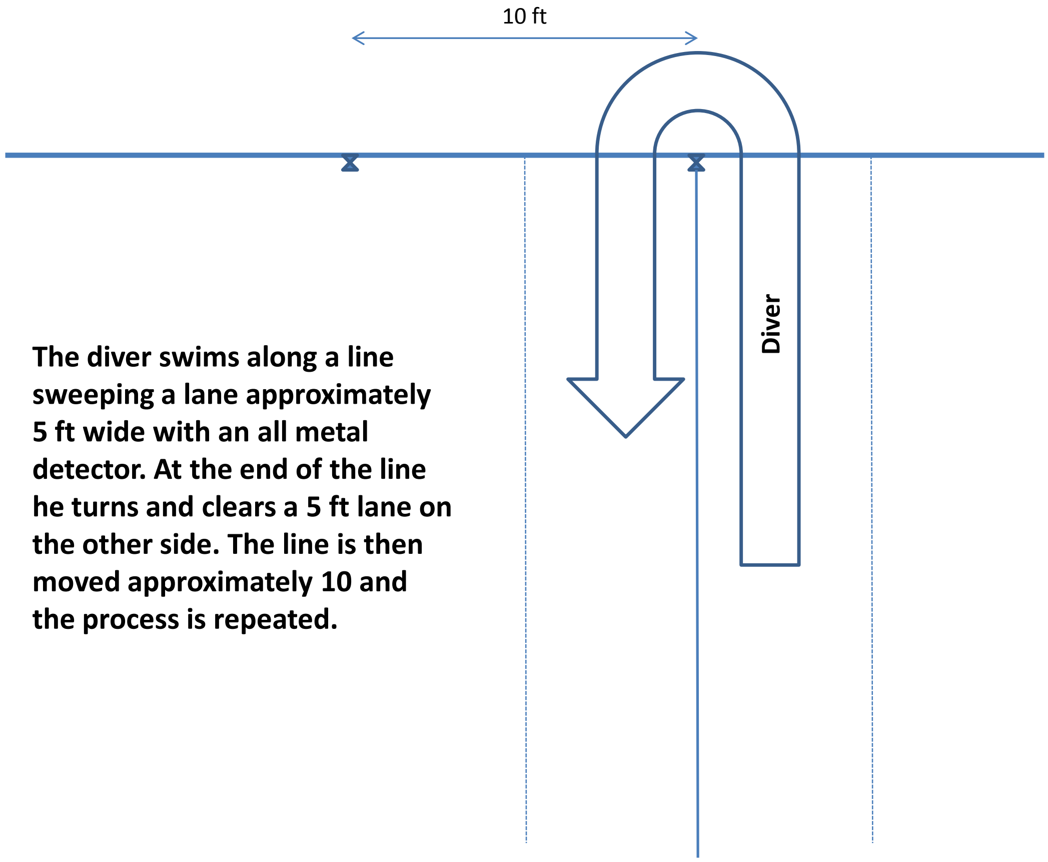


Figure 2.2 Stationary Jackstay Search Method

NOTE: If an item is identified as potential MEC, an attempt will be made to verify if the item is acceptable or unacceptable to move. If the item is acceptable to move the item will be removed to a safe location. If the item is unacceptable to move, it will be marked with a means to identify its location and left in place and the Senior Unexploded Ordnance Supervisor (SUXOS) will be notified immediately in order to coordinate with the Project Manager, Unexploded Ordnance Safety Officer (UXOSO), USACE Ordnance and Explosives (OE) Safety Specialist and/or others as appropriate to determine final disposition.

2.8 DIVE OPERATION CHECKLISTS

2.8.1 The General Planning Checklist

The *General Planning Checklist* (Attachment E) is used by the Dive Supervisor when planning dive operation and should be reviewed and updated prior to each dive.

2.8.2 The Dive Project Supervisor Checklist

The *Dive Project Supervisor Checklist* (Attachment F) is used by the Dive Supervisor to document basic data and to document pre-dive checks. It is completed prior to each dive.

2.8.3 The Project Dive Plan Checklist

The *Project Dive Plan Checklist* (Attachment G) is used by the Dive Supervisor to record basic information from the Dive Plan and to document specific team assignments and dive-specific information. It is completed prior to each dive.

2.8.4 The Dive Supervisor Pre-dive

The *Dive Supervisor Pre-dive Checklist* (Attachment H) is used by the Dive Supervisor to individual diver's readiness. It is completed prior to each dive.

2.8.5 The Dive Boat Operation

The *Dive Boat Operation Checklist* (Attachment I) is used by the Dive Supervisor or Boat Operator to inspect the dive boat. It is completed daily prior to operation of the boat.

3. TEAM MEMBERS

The Project Manager and Project UXO Dive Supervisor are responsible for ensuring all dive team members and boat support personnel, read, understand, and follow all the procedures outlined in this manual. All dive team personnel are responsible for ensuring that they read and follow the procedures outlined in this manual as it pertains to their individual work assignments. If discrepancies are found with procedural steps or any safety issues in this manual they will immediately be brought to the attention of the Project UXO Dive Supervisor and Project Manager for clarification and or corrective action.

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the USACE DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation.)

3.1 QUALIFICATIONS OF DIVERS ENGAGED IN MEC OPERATIONS

Each dive team member will be certified as appropriate for the type of diving to be conducted through formalized military training and will have the experience or training necessary to perform these assigned tasks. In addition, each dive team member shall have the experience and training in the following:

- Have documentation showing that the dive team members have successfully completed training to the appropriate level (e.g. SSA diver's certification, surface supplied mixed-gas diver certificate). Such training shall:
    - Be military school, Federal school, or an Association of Commercial Diving Educators (ACDE) accredited school, or
    - Meet the requirements contained in American National Standards Institute (ANSI)/ACDE-01.
- Have at least one (1) year commercial experience in the applicable position;
- Have completed at least four (4) working dives using the diving techniques and equipment to be used;
- Must demonstrate that at least one (1) of the four (4) qualification dives was performed in the last 6 months prior to the contract award date;
- A graduate of U.S. Naval School Explosive Ordnance Disposal, if engaged in munitions response diving operations;
- Trained in the use of tools, operation, and maintenance of equipment and systems relevant to assigned tasks;
- Trained in the techniques of the assigned diving mode;
- Trained in diving operations and emergency procedures;
- Trained in tasks to be accomplished (to include purpose and function);

- Trained in cardiopulmonary resuscitation (CPR) using emergency oxygen, Automatic Emergency Defibrillator (AED) and first aid as defined by OSHA; and
- All dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.
- 40-hour Hazardous Waste Operations (HAZWOPER) training with an 8-hour annual refresher training as required.

3.2 ASSIGNMENTS

Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to a person undergoing job orientation; provided that these tasks are performed under the direct supervision of an experienced dive team member.

EOTI will not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

The Dive Supervisor will not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition, which is known to the Dive Supervisor and is likely to affect adversely the safety or health of a dive team member.

The minimum manning level for dive teams shall be in accordance with Appendix O of EM 385-1-1.

3.3 RESPONSIBILITIES

3.3.1 Dive Supervisor

The Dive Supervisor will review this Safe Dive Practices Manual with the dive team prior to conducting any diving operations. This manual shall be made available at the dive location to each dive team member. The Safe Practices Manual includes:

- Safety Procedures and checklists for diving operations;
- Assignments and responsibilities of the dive team members; and
- Equipment procedures and checklists; and
- Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

The EOTI Project Manager will designate the Dive Supervisor in writing. The Dive Supervisor is responsible for ensuring complete compliance with the provisions of this manual, the Site Safety and Health Plan (SSHP), and the Project Work Plan. He is responsible for field equipment calibration, oversight of diving operations, field documentation, submittal of Daily Quality Control Reports (DQCRs), and assisting in the preparation of progress reports. The Dive Supervisor shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of the dive team members. The Dive Supervisor shall have the experience and training in the conduct of the assigned diving operation. The Dive Supervisor will be responsible for all diving operations described herein. The Dive Supervisor will:

- Ensure all dive team members possess current certification and are qualified for the type of diving operation;

- Ensure that the dive team is briefed on the appropriate ordnance safety precautions for ordnance that may potentially be present;

- Ensure safety and emergency equipment is in working order at the dive site;

- Brief the dive team prior to each dive on:

    - Dive objectives;

    - Unusual hazards or environmental conditions likely to affect the diving operation; and

    - Any modifications to the Dive Plan or Emergency Management Plan made necessary by conditions or the specific diving operation.

- Suspend diving operations if in his opinion, conditions are unsafe;

- Draft a site-specific Project Dive Plan and an Emergency Management Plan in accordance with Attachments G and A respectively prior to each diving operation;

- Determine the equipment requirements for all diving operations and ensure that adequate means are taken to make such equipment available at the scene;

- Plan the diving operation considering the job requirements, equipment and personnel available, and condition of the diving operation area utilizing the General Planning Checklist (Attachment E);

- Ensure that the Project Dive Supervisor Checklist, Project Dive Plan and Pre-Dive Checklist (Attachments F, G, H) are completed and adhered to for all diving operations including training;

- Act as timekeeper and maintain a Project Dive Log (Attachment C) at the diving location which will become part of the project official records;

- Obtain a copy of the certificate of analysis showing the breathing air meets the minimum acceptable criteria listed in section 30.F.05c of EM 385-1-1;

- Ensure that all AHA's are available and on site. The AHA will contain hazards associated with each phase of the work and includes hazards associated with flying before and after diving; and

- Maintain direct communications between the dive site, project office, and the EOTI Corporate Office.

- Implementing quality control (QC) for technical data provided by the field staff including field measurement data
- Adhering to work schedules
- Implementing and documenting corrective action procedures and provisions of communication between team and upper management

3.3.2 Diving UXO Specialist (Diver)

The Diver will be a trained and experienced diver, as well as trained in (UXO). The Diver responsibilities and experience will include:

- Required knowledge and experience to perform assigned tasks;
- Keep topside personnel informed of conditions on the bottom and progress of the task(s);
- Obey all signals from the surface and repeat all commands given from topside personnel;
- Acting as a tender for other divers;
- Notifying the Dive Supervisor of any symptoms that may be construed as diving sickness or a mechanical injury;
- Maintaining a personnel dive log which will include:
    - Inform Dive Supervisor or alternate if taking any medications;
    - Full name;
    - Date, time, and location of the dive;
    - Maximum depth and bottom time;
    - Surface interval between dives;
    - Breathing medium and type of equipment used;
    - Group classification at the beginning and the end of each interval and repetitive dive worksheet;
    - Underwater and surface conditions;
    - Depth(s) and duration(s) of any decompression stops (there will be no decompression dives and will only be required in emergency situations);and
    - Date and time of last previous dive.
    - Name of Dive Supervisor(s) during dive.
- Maintaining personal dive equipment (Attachment D);
- Identify and stop any operation that, in their opinion is unsafe

3.3.3 Standby Diver

A standby diver is a fully qualified diver and will be on station whenever a diver(s) is in the water to serve as immediate emergency assistance to the primary diver(s). A standby dive will deploy only after the dive supervisor has assessed the situation and instructed him/her to do so. The Standby Diver receives the same briefings and instructions as the working Diver, monitors the progress of the dive, and is fully prepared to respond if called upon for assistance. The SCUBA Standby Diver shall be equipped with a second regulator, referred to as an octopus.

The standby diver will:

- Be fully equipped to dive and readily available the entire time the diver is in the water;
- Don all specific gear (suits, harnesses, and equipment) up to mask they will wear/use and be checked by the Dive Supervisor;
- Test all gear for proper operation before the primary diver leaves the surface;
- The Standby Diver may then remove the mask and fins and have them ready to don immediately for quick deployment. For safety reasons at the discretion of the Dive Supervisor, the Standby Diver may remove the tank.
- Be dressed appropriately for the water and air temperature.

3.3.4 Tender

For each dive, a Diver will be designated as tender. The tender will:

- Assist the primary diver and the standby diver in donning, doffing, and checking gear;
- Be a diver prepared to dive each day;
- Maintain communications with the diver;
- Keep the Dive Supervisor informed of communications from and to the Diver;
- Tend the tether line for the diver;
- Monitor the diver's progress and status;
- Remain undistracted so he can monitor the surface for danger from boat traffic and any other hazards

If it becomes necessary for the standby diver to enter the water to assist the diver, the Dive Supervisor will immediately assume the role of tender for the standby diver.

3.3.5 Dive Team Support

The dive team is supported by a UXOSO/Quality Control Specialist (QCS) who is trained as a diver. When used, a safety boat will be positioned to safely observe dive operations and to direct other boat traffic away from the operation. The boat operator will be trained and proficient in the operation of the safety boat. He will position the boat as directed by the UXOSO/QCS to support the operation and will be aware of other boats operating in the area and other potential hazards or risk to the operation. The UXOSO/QCS will:

- Maintain communication with the Dive Supervisor;
- Monitor the operation with respect to worker safety and health and quality control;
- Monitor and maintain copies of certificates of training and medical surveillance;
- Verify certifications and conduct periodic audits of personnel qualifications;
- Conduct quality and safety inspection;
- Provide input to after action reviews of the operation;
- Assist in maintaining proper exclusion zones;

- Inspect munitions debris (MD) and material potentially presenting an explosive hazard (MPPEH) recovered;
- Ensure all project safety and quality requirements are met and documented and reports and potential nonconformance to the EOTI corporate quality or safety manager.

The UXOSO/QCS reports to the Corporate Quality Manager for quality related issues and to the Corporate Safety Manager for safety related issues. He also coordinates site activities with the Dive Supervisor and ensures that quality and safety requirements are met and documented.

4. EQUIPMENT

EOTI's policy on diving equipment is to use quality and state-of-the-art equipment to ensure the safety and well-being of the divers. Equipment used in diving operations, particularly those items which are classified as life-support equipment, must be properly maintained and kept in good working order.

4.1 EQUIPMENT INSPECTION

Prior to any dive, all equipment must be carefully inspected for signs of deterioration, damage, or corrosion and must be tested for proper operation. Pre-dive preparation procedures must be standardized, not altered for convenience, and must be the personal concern of each diver. All divers must always check their own equipment. An inspection of all dive gear and associated equipment will be conducted before each use, using Attachment D as a guide. Any equipment not in good working order will be removed from use.

4.2 DIVE FLAGS

In accordance with ER 385-1-86, an appropriate dive flag at least one meter in height, visible in all directions, and will be displayed at the dive location during dive operations. In accordance with 29 CFR 1910.421(h), the signal will be a rigid replica of the international code Alpha Flag.

A traditional red and white "Diver Down" flag will also be displayed in addition to the code Alpha Flag.

4.3 SCUBA EQUIPMENT

Each SCUBA team member will be equipped with:

- An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus;
- Buoyancy compensation device or inflatable life jacket capable of maintaining the diver at the surface in a face-up position;
- A submersible cylinder pressure gauge;
- A weight belt or assembly capable of quick release;
- A watch, pressure gauge and knife; and
- SCUBA air cylinders of seamless steel or aluminum which meet DOT 3AA and DOT 3AL specifications with identification symbols stamped into the shoulder of the tank. Annual inspections and hydrostatic testing will also be stamped into the cylinder as applicable;
- A safety harness with a positive buckling device, attachment point for the safety line, and a lifting point to distribute the pull force of the line over the diver's body while maintaining the body in a heads-up vertical position when unconscious or hurt; and
- A time keeping device will be used by the Dive Supervisor for recording dive times at the dive location and each diver will have a time keeping device to keep track of bottom times.
- Skin suit to protect from cuts and abrasions and thermal protection as required

- Air tanks will be filled from a certified dive shop. Prior to the initial start of dive operations, a copy of the air certification from the dive shop will be obtained and provided to the DDC upon request and maintained on file in the project office.

Each dive team member will be responsible for ensuring that his equipment is inspected prior to each dive using the checklist in Attachment D and report any deficiencies to the Dive Supervisor.

4.4 FIRST AID SUPPLIES

The following first aid supplies will be available on the dive boat:

- First aid kit appropriate for the diving operation;
- American Red Cross standard first aid handbook or equivalent;
- Emergency oxygen with transparent mask will be available at the dive location; and
- A Stokes litter or backboard.
- AED

5. EMERGENCY PROCEDURES

In every diving operation, the possibility of an accident occurring must be considered. The need for a prompt, decisive plan of action in an emergency is essential for the safety of all diving personnel. The Dive Supervisor will implement the following procedures for the respective situations described below.

5.1 FIRE

Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.2 EQUIPMENT FAILURE

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.3 ADVERSE WEATHER

All diving operations will be suspended if lightning is located within 10 nautical miles of the dive site. During high winds greater than 30 miles per hour, boating and platform operations will be suspended. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.4 MEDICAL ILLNESS OR INJURY

See Attachment A, *First Aid for Diving Related Injuries*, to this plan as well as the Site Safety and Health Plan submitted as part of the Work Plan. Contact first responders immediately. Render first aid as necessary until an emergency medical team arrives.

5.5 EMERGENCY PROCEDURES DURING DIVE OPERATIONS

5.5.1 Entrapped or Fouled Diver

- Diver will notify dive partner, if appropriate, otherwise will notify Dive Supervisor through line pull signals;
- If only one diver is in the water, then the standby diver will assist the fouled diver under the direction of the Dive Supervisor;
- Diver and dive boat personnel must remain calm; and
- Take additional cylinders of air to the fouled diver, if needed.

5.5.2 Loss of Vital Support Equipment

In the event of an equipment failure of a critical component of the dive operations, all dive operations will be discontinued until the equipment is replaced or repaired and the Dive Supervisor has given authorization for dive operations to continue.

5.5.3 Loss of Gas Supply

- Signal dive partner and abort dive;

- Buddy breath/activate reserve; and
- Exhale to the surface.

NOTE: No diving will proceed until the equipment is replaced/repaired (with functional checks performed) and the Dive Supervisor has given the OK to proceed with the operation.

5.5.4 Loss of Communication

If communications are lost between a tender and diver and cannot be regained quickly, an audible recall signal will be sounded. If the diver does not surface in a reasonable amount of time after the audible re-call signal has been initiated the stand-by diver will be dispatched to the last known location of the diver. If communications are lost between the diver and the tender and cannot be regained quickly, the diver will surface immediately. The reason for the loss of communications will be investigated and remedied prior to continuation of the dive.

5.5.5 Lost Diver Plan

- Initiate diver recall and wait one (1) minute for response;
- Mark the last known position of the lost diver with a buoy to establish a reference point where searches can start;
- Deploy the standby diver (Dive Supervisor direction) to swim after bubbles or to conduct a circle line search starting at the lost diver buoy;
- Notify ship/boats in the area to look out for the lost diver;
- Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and
- Ensure stricken divers recovered get immediate, effective treatment.

5.5.6 Injured Diver Plan

If a diver is injured and unable to enter the boat under his/her own power, the remaining team aboard the boat/platform (Dive Supervisor, Tender/assistant, etc.) will be used to assist or place the injured diver into/on the boat/platform or may hold onto the diver and use the boat/platform to get to the shoreline. Contact first responders immediately and render emergency first aid as necessary.

5.5.7 Actions upon Discovery of Fire

Recall the diver. Fire extinguishers will be maintained ready at the dive site location. Only attempt to put out small fires as necessary of prevent injury or loss of life. Contact first responders immediately upon discovery. Also see Site Safety and Health Plan submitted as part of the Work Plan.

5.5.8 Diver Blow-up/Over Rapid Ascent to Surface

Depths of dives typical of MEC projects performed by EOTI are unlikely to produce a requirement for decompression during ascent. If a diver is believed to have ascended too rapidly, the Dive Supervisor will evaluate the situation to confirm that no decompression stop was required. Dive tables will be consulted.

The diver will be observed on the surface for one hour. If symptoms of decompression sickness are observed or suspected, the diver will be treated for decompression sickness as described above.

5.5.9 Diver Loss of Consciousness

Slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver. Request emergency medical help and report situation to the Project Office and EOTI Corporate Office; and ensure the stricken diver gets immediate, effective treatment.

5.5.10 Injury or Illness of Surface Crew Member

If a severe injury or illness occurs while a diver is in the water, the diver will be recalled immediately to the surface. Diver will either enter the boat/platform to help render assistance or head to the shore and provide assistance as necessary.

5.5.11 Explosive Detonation with Diver (s) in the Water

- Attempt to establish communications with the diver via tending line;
- If communications are established with the diver immediately recall diver to the surface;
- If no communications are reestablished slowly pull the tending line to the surface to recover the diver. If the tending line is fouled deploy the standby diver;
- If the tending line has parted, mark the last location of the diver and begin a surface search of the area. If no contact is made, deploy the standby diver in the last known diver location and begin a systematic search of the area.

5.5.12 Decompression Sickness ("The Bends") or Arterial Gas Embolism (air embolism)

- Recall all divers from the water;
- Arrange immediate transport of stricken diver(s) to chamber;
- Notify the Project Office and EOTI Corporate Office of circumstances;
- Perform neurological exam and record on (Attachment J); and
- Treat for shock.

6. Internal Safety Inspection

A Site Specific Accident Prevention Plan is prepared for all projects. A qualified Site Safety and Health Officer (SSHO) is assigned to each project. The SSHO reports directly to the Corporate Safety Officer and is responsible for ensuring compliance with all site safety requirements. When the project involves potential underwater MEC the SSHO will be a Navy-trained diver and UXO technician who has the qualifications of a UXOSO. The UXOSO will be on site any time work is performed. The UXOSO provides initial training to all assigned personnel and visitors to ensure that they are familiar with the hazards and controls associated with the site and specific tasks that they may perform. The UXOSO performs daily safety inspection to ensure compliance with safety requirements and to identify unsafe conditions or acts that may present a hazard to workers or visitors. The UXOSO facilitates daily tailgate safety meetings and after action reviews in order to review potential hazards and the effectiveness of controls with all site personnel. The UXOSO makes on the spot corrections as required and works with the site supervisor to address potentially unsafe conditions or actions. He reports potential nonconformance issues to the Corporate Safety Officer and conducts or supports investigation of accidents or near misses.

7. Safety Compliance

EOTI dive operations are conducted in conformance with requirements outlined in OSHA regulations, the U.S. Navy Diving Manual (Volume I) and the USACE Safety and Health Requirements Manual EM 385-1-1. The requirements of OSHA, Department of Labor directive titled, 29 CFR 1910 Subpart T, Commercial Diving Operations has been integrated into this manual and a complete copy is included in Attachment K. U.S. Navy No- Decompression Dive Tables are included in Section 7. OSHA and EM 385-1-1 established safety and health criteria for personnel to include medical requirements, recommended physical examinations, operational procedures, equipment procedures and record keeping requirements which are incorporated herein. Where regulatory and guidance documents conflict, the most stringent requirement takes precedence.

It is EOTI's policy that all employees engaged in commercial dive operations, review the requirements of this safe practices manual (including 29 CFR 1910 Subpart T), as well as site specific dive and safety plans. Site-specific requirements and hazards are reviewed during the initial on-site training and throughout the project during daily safety meetings. The UXOSO ensures compliance with all safety requirements. Failure to comply is unacceptable.

8. Applicable Navy Tables

8.1 No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives

No-Decompression Limits and Repetitive Group Designators for No-Decompression Air Dives.

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	595	20	33	47	62	78	97	117	140	166	198	236	285	354	469	595	
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	60	7	12	17	22	28	33	39	45	51	57	60					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	30	4	7	11	14	17	21	24	28	30							
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	10	2	4	6	9	10											
140	10	2	4	6	8	10											
150	5	2	3	5													
160	5		3	5													
170	5			4	5												
180	5			4	5												
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

8.2 Residual Nitrogen Timetables for Repetitive Air Dives

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
A																:10 2:20 *
B															:10 1:16	1:17 3:36 *
C														:10 :55	:56 2:11	2:12 4:31 *
D													:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *
E												:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *
F											:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *
G										:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *
H									:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *
I								:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *
J							:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 7:00	7:01 8:16	8:17 10:36 *
K						:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *
L					:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:44	8:45 10:01	10:02 12:21 *
M				:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *
N			:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *
O		:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *

Repetitive Group at the End of the Surface Interval

Dive Depth	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

8.3 Standard Air Decompression

Air Decompression Table.
(DESCENT RATE 75 FPM—ASCENT RATE 30 FPM)

Bottom Time (min)	Time to First Stop (M:S)	Gas Mix	DECOMPRESSION STOPS (FSW) Stop times (min) include travel time, except first air and first O_2 stop									Total Ascent Time (M:S)	Chamber O_2 Periods	Repet Group
			100	90	80	70	60	50	40	30	20			
30 FSW														
371	1:00	AIR									0	1:00	0	Z
		AIR/O_2									**0**	1:00		
380	0:20	AIR									5	6:00	0.5	Z
		AIR/O_2									**1**	2:00		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
420	0:20	AIR									22	23:00	0.5	Z
		AIR/O_2									**5**	6:00		
480	0:20	AIR									42	43:00	0.5	
		AIR/O_2									**9**	10:00		
540	0:20	AIR									71	72:00	1	
		AIR/O_2									**14**	15:00		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
600	0:20	AIR									92	93:00	1	
		AIR/O_2									**19**	20:00		
660	0:20	AIR									120	121:00	1	
		AIR/O_2									**22**	23:00		
720	0:20	AIR									158	159:00	1	
		AIR/O_2									**27**	28:00		
35 FSW														
232	1:10	AIR									0	1:10	0	Z
		AIR/O_2									**0**	1:10		
240	0:30	AIR									4	5:10	0.5	Z
		AIR/O_2									**2**	3:10		
In-Water Air/O_2 Decompression or SurDO_2 Recommended														
270	0:30	AIR									28	29:10	0.5	Z
		AIR/O_2									**7**	8:10		
300	0:30	AIR									53	54:10	0.5	Z
		AIR/O_2									**13**	14:10		
330	0:30	AIR									71	72:10	1	Z
		AIR/O_2									**18**	19:10		
360	0:30	AIR									88	89:10	1	
		AIR/O_2									**22**	23:10		
Exceptional Exposure: In-Water Air Decompression ------------ In-Water Air/O_2 Decompression or SurDO_2 Required														
420	0:30	AIR									134	135:10	1.5	
		AIR/O_2									**29**	30:10		
480	0:30	AIR									173	174:10	1.5	
		AIR/O_2									**38**	44:10		
540	0:30	AIR									228	229:10	2	
		AIR/O_2									**45**	51:10		
600	0:30	AIR									277	278:10	2	
		AIR/O_2									**53**	59:10		
660	0:30	AIR									314	315:10	2.5	
		AIR/O_2									**63**	69:10		
720	0:30	AIR									342	343:10	3	
		AIR/O_2									**71**	82:10		

9. Repetitive Dive Worksheets

The Diving Profile Log is a chronological record of all dives conducted during a project. It contains information related to the specific dive operation conducted each day and to specific divers specific divers involved. A sample form is included in Attachment C.

Information recorded on the log includes:

- Date of dive
- Location of the dive
- Environmental conditions affecting the dive
- Equipment used
- Purpose of the dive
- Identification of divers and standby divers
- Times left and reached surface, bottom time
- Depth
- Decompression time
- Air and water temperature
- Signatures of Diving Supervisor

10. Fitness for Duty

10.1 Dive Physical Frequency

All divers must have a certificate signed by a licensed physician, stating that they have been medically examined within the last 12 months and have been determined fit and approved to dive. The dive medical examination will be repeated every 12 months with verifications submitted to the DDC as appropriate.

10.2 Physical Examinations

Initial and Periodic Re-examinations – All ages, require the following:

Medical History Complete

Physical Examination

Chest X-ray

Spirometry

Urinalysis

Vision

Other testing as required

10.3 Dive Physical Considerations

The physician conducting the examination should consider the following disorders, which may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

- History of seizure disorder other than early febrile convulsions.
- Malignancies (active) unless treated and without recurrence for 5 yrs.
- Chronic inability to equalize sinus and/or middle ear pressure.
- Cystic or cavitary disease of the lungs.
- Impaired organ function caused by alcohol or drug use.
- Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood-altering drugs, or insulin).
- Meniere's disease.
- Hemoglobinopathies.
- Obstructive or restrictive lung disease.
- Vestibular end organ destruction.
- Pneumothorax.
- Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).
- Juxta-articular osteonecrosis.

11. Administration and Recordkeeping

11.1 DIVING RECORD KEEPING REQUIREMENTS

The Dive Supervisor will provide to the SUXOS all project diving records for the project to be incorporated into the project files; these records will be kept in the project site office. Diving Related Injury or Illness.

The Dive Supervisor and the UXOSO/QCS will record and report any diving-related occupational injury and illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of the injury or illness on applicable EOTI Incident Report Forms. All injuries and illnesses will be immediately reported to the UXOSO and Project Manager.

11.2 AVAILABILITY OF RECORDS

Records and documents required by 29 CFR 1910 Subpart T shall be provided upon request to the:

- Assistant Secretary of Labor for Occupational Safety and Health (OSH);
- Director, National Institute for OSH; and
- Employee or his designated representative.

11.3 DIVING RECORD RETENTION PERIODS

Records and documents required by 29 CFR 1910 Subpart T shall be retained by EOTI for the following periods.

- Dive team member medical records – five (5) years;
- Safe Practices Manual - current document only;
- Depth-time profile - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;
- Recording of dive – one (1) year, except five (5) years when there has been an incident of decompression sickness;
- Decompression procedure assessment evaluations – five (5) years;
- Equipment inspections and testing records - current entry or tag, or until equipment is withdrawn from service;
- Records of hospitalization – five (5) years;
- After the expiration of the retention period of any record required for five (5) years, EOTI will forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

12. References

Department of the Army (DA). 2008. Technical Manual (TM) 60A-1-1-31, Explosive Ordnance Disposal Procedures, General Information on EOD Disposal Procedures (Revision 5). October.

Department of Defense Explosives Safety Board (DDESB). 2004. Technical Paper (TP) 18. Minimum ualifications for Unexploded Ordnance (UXO) Technicians and Personnel. 20 December.

Department of Defense (DoD) Ammunition and Explosives Safety Standards. 2012. DoD Ammunition and Explosives Safety Standards DOD Manual 6055.09-M

Department of Defense (DoD). 2008. DoD Instruction (DoDI) 4140.62, Material Potentially Presenting an Explosive Hazard. November.

DDESB. 2012. TP 16. Methodologies for Calculation Primary Fragment Characteristics.

Revision 4. AugustUnited States Army Corps of Engineers (USACE) 2006. Safety and Health Requirements Manual EM 385-1-97 (with Erratas)

United States Army Corps of Engineers (USACE) 2013. Safety and Health Requirements Manual EM 385-1-1

United States Army Corps of Engineers (USACE) 2010. USACE Dive Program. ER 385-1-86. September.

United States Navy (USN). 2008. USN Diving Manual. Revision 6. April.

Department of the Army Memorandum, Subject: Munitions Response Actions – Minimum Separation Distances (Relative to Impulse Water Pressure) from Underwater Detonations, 16 Sep 13

13. Glossary of Diving Terms

ACFM	Actual cubic feet per minute.
Alternate Project Dive Supervisor	Alternate designated, in writing, by the Project Manager to act on behalf of the Project Dive Supervisor.
ASME Code or equivalent	ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
ATA	Atmosphere absolute.
Bottom time	The total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time that the diver begins ascent.
Bursting pressure	The pressure at which a pressure containment device would fail structurally.
Circle line search	Descending line leading to a clump with a second line attached used by divers to rapidly search small areas.
Cylinder	A pressure vessel for the storage of gases.
Decompression sickness	A condition with a variety of symptoms which may result from gas of bubbles in the tissues of divers after pressure reduction.
Decompression table	A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure.
Dive location	A surface or vessel from which a diving operation is conducted.
Dive team	For all diving operations, the dive team will consist of a minimum of four people, including a Dive Supervisor, who are assigned to diving duty in writing by EOTI. The dive team members will be required to be graduates of an approved course of instruction.
Dive-location reserve breathing gas	A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.
Diver	An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
Diver Orientation	Diver orientation will be scheduled by the Project Dive Supervisor in order to familiarize or train diver personnel on new or unfamiliar technical functions to be performed by the dive team.
Diving Mode	A type of diving requiring specific equipment, procedures and techniques

	(SCUBA, surface-supplied air).
Dive Supervisor	The person in charge of diving operations. May be the Project UXO Dive Supervisor or an Alternate Dive Supervisor.
Diving Time/Water Time	Time spent in or underwater while engaged in a diving operation. Diving time will start at the time the diver enters the water and ends when the diver exits the water and returns to the pier, dive boat, or diving platform.
Diving Training	Training prescribed by the Project Dive Supervisor in order to maintain diver proficiency.
Diver	A graduate of U.S. Naval School Explosive Ordnance Disposal engaged in munitions response diving operations.
FSW	Feet of seawater (or equivalent static pressure head).
Hyperbaric condition	Pressure conditions in excess of (1 ATA) surface pressure.
Live boating	The practice of supporting a SCUBA, surface-supplied air, mixed-gas diver, from a vessel that is underway.
No-decompression limits	The depth-time limits of the "no-decompression limits and repetitive diving group designation table for no-decompression air dives", U. S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.
Observer/Assistant	A team member able to assist them in the water
Post-Dive preparation time	Time spent in the breakdown, cleaning, preservation, and maintenance of diving equipment upon completion of a diving operation.
Pre-Dive preparation time	Time spent by diver personnel preparing diving equipment for a diving operation.
Dive Supervisor	This person is responsible for the safe and efficient operation of all divingfunctions at the location to which he is assigned. The Dive Supervisor must be knowledgeable of diving operations in general and all specific diving assignments involved. He is assigned in writing by EOTI.
psi(g)	Pounds per square inch (as measured using a gauge).
Recompression chamber	A pressure vessel for human occupancy such as a surface recompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

SCUBA	A diving mode independent of surface air supply in which the diver uses open circuit Self-Contained Underwater Breathing Apparatus.
Standby diver	A diver at the dive location available to assist a diver in the water.
Stationary Jackstay grid search	Four clumps with buoy/buoy lines and four bottom lines connecting the four clumps used by divers to systematically and thoroughly search large areas.
SSA	A diving mode in which a diver uses Surface Supplied Air.
Underwater stage	A suspended underwater work platform, which supports a diver in the water.
Volume tank	A pressure vessel connected to the outlet of a compressor and used as air reservoir.
Walking Jackstay grid search	Two clumps with descending lines and a line of a specified length connecting the clumps used by divers to systematically and thoroughly search large areas.
Working pressure	The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

Attachments

A – Emergency Management Plan

B - Line Pull and Hand Signals

C – Diving Profile Log

D – Personal Dive Equipment Checklist

E – General Planning Checklist

F – Project Dive Supervisor Checklist

G – Project Dive Plan

H – Dive Supervisor Pre-dive Checklist

I – Checklist for Dive Boat Operations

J – Neurological Examination Checklist

K – 29 CFR 1910 Subpart T

Attachment A – Emergency Management Plan

A.1. FIRST AID FOR INJURIES REQUIRING IMMEDIATE TRANSPORT TO A CHAMBER FACILITY

A.1.1 Air Embolism

Recognition - Usually occurs during or immediately after surfacing

Symptoms (one or more of the following)

Disorientation or Fatigue

Skin Itch

Chest Pain

Numbness, Tingling, Paralysis or Weakness

Dizziness, Vertigo, or Ringing in the Ears

Blurred Vision

Personality Change

Signs (one or more of the following)

Bloody froth from nose or mouth

Paralysis or Weakness

Unconsciousness

Convulsions

Shortness of Breath or Cessation of Breathing

Apparent Death

Note: Symptoms and signs usually appear within 15 minutes to 12 hours after surfacing; in severe cases, symptoms may appear immediately or even before the dive is completed. Delayed occurrence of symptoms is rare but can occur, especially if air travel follows diving. The quicker treatment begins, the better the chances of a full recovery.

Early Management

CPR, if required

Open airway, prevent aspiration, and incubate if trained person available

Give O^2; remove only to open airway or if convulsion ensue

If conscious, give nonalcoholic liquids

Place in horizontal, neutral position

Restrain convulsing person loosely and resume O^2 as soon as airway is open

Protect from excessive cold, heat, water, or fumes

Arrange emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally.

A.1.2 Decompression Sickness

Recognition - Symptoms usually appear 15 minutes to 12 hours after surfacing

Symptoms (one or more of the following)

Tired Feeling

Itching

Pain, arms, legs or trunk

Dizziness

Numbness, tingling or paralysis

Chest compression or shortness of breath

Anything unusual after the dive

Signs (one or more of the following)

Blotchy Rash

Paralysis or weakness anywhere in the body

Coughing Spasms

Staggering or instability

Unconsciousness

Personality change

Early Management

Stabilize patient the same way as for Air Embolism

Arrange for emergency transport, send divers profile with the diver, and send all diving equipment for examination or have it examined locally

A.2.0 FIRST AID FOR INJURIES REQUIRING TRANSPORT TO A HOSPITAL FACILITY

A.2.1Pneumothorax

Symptoms (one or more of the following)

Pains in the chest

Shortness of breath

Signs (one or more of the following)

- Shallow Rapid Breathing
- Cyanosis (blue skin, lips, fingernails)
- Possible crackling under the skin of the neck
- Possible mediastinal shift (heart sounds not in the usual place)

Emergency Actions:

Call for help and immediate transport

A.2.2 Mediastinal Emphysema (Lung over pressure accident)

Recognition - Always associated with pneumothorax

Symptoms (one or more of the following)

Pain in the chest (beneath the breastbone)

Faintness

Shortness of breath

Signs (one or more of the following)

Obvious difficulty breathing

Brassy change in voice

Emergency Actions:

Transport to medical facility for evaluation

A.2.3 Drowning-Near Drowning

Recognition

Unconsciousness

Lack of respiration

Cyanosis (blue skin, lips, fingernails)

Management

Try to identify the time the victim was last seen breathing

Assess ABC's airway, breathing and circulation

Removal of gear

Transport to the boat or shore

Immediate call for help and transport to facility

Start CPR

A.2.4 Oxygen Toxicity (with convulsions)

Signs (one or more of the following)

Decreased or loss of consciousness; followed by

Convulsions

Symptoms (one or more of the following)

Nausea

Dizziness

Ringing in the ears

Abnormal Vision

Confusion

Prevention

Avoidance of gases with high O^2 concentrations (as in Nitrox at inappropriate depth)

Avoid CO^2 retention that can precipitate O^2 convulsions at any depth

If convulsions occur at depth, be prepared to treat near drowning and/or air embolism

TREATMENT - Call for help and immediate transport

A.2.5 Severe Trauma or Large Predator Injury (Head Injury, Limb Injury due to falls, Equipment Crush, Prop Injuries)

- call for help and immediate transport
- open airway
- treat for shock on site and stabilize before evacuation
- face up neutral position
- direct pressure over bleeding wounds
- CPR if no pulse or respiration
- keep warm
- be mindful of the possibility of neck injury
- splint limb injuries
- call for help and immediate transport

A.2.6 Suspected Heart Attack or Stroke

- Call for help and immediate transport
- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Call for help and immediate transport

A.2.7 Severe Allergic Reaction

- Remove any remnant of allergen (i.e., jellyfish tentacles, foreign material)
- Wash out wounds of injury with alcohol, vinegar, or water
- Call for help and immediate transport

- Treat for shock
- CPR if no pulse or respiration
- Keep warm
- Pain Relief, if available
- Transport to medical facility for evaluation

A.2.8 Stinging Fishes (Stingrays, Scorpion fish)

- Immobilize
- Remove spine and debride (scrub the wound)
- Irrigate wound
- Soak in hot water (thermolabile toxin) 50^{o} C, for 30-90 minutes
- Call for help and immediate transport
- Treat for shock, hydrate

A.2.9 Hypothermia

- Keep core temperature above 95^{o} F
- Keep airway open
- Immobilize
- Wrap in blankets, preferably next to another person
- Basic life support, CPR, if needed
- Warm liquids, if alert, unless very cold - then avoid due to possibility of ventricular tachycardia (rapid, useless fluttering of the heart)
- Call for help and immediate transport

A.2.10 Hyperthermia (Heat Exhaustion due to excessive fluid loss)

- Remove from source of heat
- Lower temperature (cool compresses at arterial points and head)

- Keep calm
- Keep airway open
- Call for help and immediate transport if unstable

A.2.11 Heat Stroke

- Remove all clothing
- Cover with cool wet sheet
- Place in air-conditioned area
- Cold packs to neck, scalp, groin and armpits
- If convulsions occur ensure victim does not cause further harm to themselves
- Call for help and immediate transport

A.3.0 AID FOR INJURIES THAT CAN BE TREATED ON BOARD

A.3.1 Nitrogen Narcosis

Signs (one or more of the following)

Inappropriate behavior at depth

Ignoring hand signals and instructions

Stupor or coma

Symptoms (one or more of the following)

Inflexible thinking and attitude

Decrease or loss of judgment

False sense of security

Lack of concern for safety

Inability to think through problems

Panic

Near unconsciousness or loss of consciousness at depth

Treatment

Ascend until free of symptoms

Surface with controlled ascent

Transport to medical facility for evaluation

A.3.2 Carbon Dioxide Poisoning

Symptoms (one or more of the following)

Rapid breathing

Feeling of suffocation or shortness of breath

Headache, nausea, dizziness

Rapid heartbeat

Confusion and unclear thinking

Signs (one or more of the following)

Slowed responses

Muscle irritability (twitching)

Loss of consciousness

Treatment

Remove the cause (over-exertion, equipment failure, rebreathers, etc.)

Stop and rest during early symptoms to avoid loss of consciousness

Surface; Transport to medical facility for evaluation

A.3.3 Ear Disorders

Middle Ear Barotrauma

Keep quiet and calm

Without DCS or rupture of the round or oval windows, give Benadryl 25 mg

Transport to medical facility for evaluation

Discontinue diving until cleared by EMT

Inner Ear Barotrauma

Recognize round or oval window damage (loss balance, ataxia, tinnitus, deafness)

Keep head up and affected ear elevated

Discourage straining

Transport to medical facility for evaluation

EMT evaluation, no more diving until cleared by EMT

A.3.4Sea Sickness

The best medications have been found to be Meclizine, Bonine, Dramamine and Trans-derm Scope.

Keep your eyes on the horizon

Stay on deck

Keep yourself well hydrated with non-alcoholic beverages

Try antacid tablets or lemon drops

If diving, try to be the first diver in water.

Attachment B - Line Pull and Hand Signals

LINE PULL SIGNALS - Line Pull Signals will be distinct pulls on the line which are strong enough to be felt by the diver but not strong enough to pull the diver away from the work. Acknowledgment consists of replying with the same signal. If a signal is not acknowledged, the signal will be re-sent. Continued absence of confirmation will be assumed to mean one of three things:

The line is fouled.

Too much slack in the line.

Diver in trouble.

If communication is lost, the Project Dive Supervisor will take immediate steps to identify the problem.

Line Pull Signals - From Tender to Diver:

1 Pull	"Are you All right?"
	When diver is descending, one pull means, "STOP".
2 Pulls	"Going down"
	During ascent, 2 Pulls means, "You have come up too far, go back down until we stop you"
3 Pulls	"Standby to come up"
4 Pulls	"Come up"
2-1 Pulls	"I understand" or "Answer the telephone"
3-2 Pulls	"Ventilate"
4-3 Pulls	"Circulate"

Line Pull Signals - From Diver to Tender:

1 Pull	"I am All right"
	When diver is descending, one pull means, "STOP" or "I am on the bottom"
2 Pulls	"Lower" or "Give me slack"
3 Pulls	"Take up my slack"
4 Pulls	"Haul me up"
2-1 Pulls	"I understand" or "Answer the telephone"
3-2 Pulls	"More Air"

4-3 Pulls "Less Air"

Special Line Pull Signals from the Diver:

1-2-3 Pulls "Send me a square mark"

5 Pulls "Send me a line"

2-1-2 Pulls "Send me a slate"

Line Pull Searching Signals - Without Circling Line

7 Pulls "Go on/off searching signals"

1 Pull "Stop, search where you are"

2 Pulls "Face the line and move away from the weight"

3 Pulls "Face the weight and go right"

4 Pulls "Face the weight and go left"

Emergency Line Pull Signals from the Diver:

2-2-2 Pulls "I am fouled and need the assistance of another diver"

3-3-3 Pulls "I am fouled but can clear myself"

4-4-4 Pulls "Haul me up immediately"

All Emergency Signals will be answered as given, EXCEPT 4-4-4.

Attachment C – Diving Profile Log

EOTI DIVING PROFILING LOG

Date of Last Previous Dive: **Time of Last Previous Dive:**

Date	Geographic Location	Air Temp(°F)
Equipment Used	Dress	Wave Height (ft)
Breathing Medium	Platform	Water Temp (°F)
Breathing Medium Source		Current (kts)
Depth of Dive (fsw)	Bottom Type	Bottom Visibility (ft)

Diver	LS	RB	LB	RS	TBT	TDT	TTD	Sched Used

Purpose of Dive, Tools Used, etc.	Repet Group
	Surface Interval
	New Repet Group
	RNT

Dive Comments
Signature (Dive Supervisor)

Attachment D – Personal Dive Equipment Checklist

_____Air Cylinders	Inspect air cylinders exteriors and valves for rust, cracks, dents, and any evidence of weakness. Remove valve cover and inspect O-ring.
_____Cylinder pressure	Gauge the cylinder and record pressure reading: _________ psig.
_____ Harness straps	Check for signs of rot and excessive wear. Adjust straps and backpack for individual use, and test quick release mechanisms. Check backpack for cracks and other unsafe conditions.
_____ Hoses	Check the hose(s) for cracks and punctures. Test the connections of each hose at the regulator and mouthpiece assembly by tugging on the hose. Check the clamps for corrosion and damage, replace as necessary.
_____ Regulator	Attach regulator to the cylinder manifold and ensure it is seated correctly. Open cylinder valve slowly all the way and back off one-quarter turn. Check that there are no leaks by listening for the sound of escaping air. Check that the regulator breathes properly by breathing the regulator for thirty seconds. If any leaks are noted or regulator does not breathe properly, inform the Project Dive Supervisor and remove regulator from service.
_____Emergency air supply	Ensure that it has no damage to the mouth piece, bottle, regulator body, purge valve or regulator. Ensure that the pressure indicator is showing a filled tank or gauge is reading a full tank (3000 psi) or in the safe (green) zone.
_____Life Preserver or BC	Orally inflate preserver to check for leaks, and then squeeze out air. Inspect the carbon dioxide cartridges to ensure they have not been used and are the proper size for the vest being used and for the depth of the dive. Firing pin(s) will not show wear and will move freely. The firing lanyards and life preserver straps must be free of any signs of deterioration.
_____ Dry Suit	Inspect the exterior of dry suit for holes, rips or tears. Inspect cuffs and neck dam for dry rot, rips, and tears. Ensure zippers are in good working order and no teeth are missing. Test the air fitting connection with an air hose and ensure it locks in place. Inspect air relief valve for damage.
_____CO_2 Cartridges	Weigh carbon dioxide cartridges and record weight: _______________. Weight will be within 10% of stamped weight.

	If weight is not within tolerance remove from service and notify Dive Supervisor.
_____Facemask	Check the seal of the mask and the condition of the head strap. Check for cracks in the skirt and faceplate.
_____Swim Fins	Check straps and inspect blades for signs for cracking.
_____Dive Knife	Test the edge of the knife for sharpness, and ensure the knife is fastened securely in the scabbard. Verify the knife can be removed from the scabbard.
_____Weight Belt	Check the condition of the weight belt and that the proper number of weights are secure and in place. Verify that the quick-release buckle is functioning properly.
_____Wristwatch	Ensure wristwatch is wound and set to the correct time. Inspect the pins and strap of the watch for wear.
_____Depth Gauge	Inspect pins and straps. If possible, check compass with another compass. Make comparative checks on depth gauges to ensure depth gauges read zero fsw on the surface.
_____Miscellaneous Equipment	Inspect any other equipment which will be used on the dive as well as any spare that may be needed during the dive including spare regulators, cylinders and gauges. Check all protective clothing, lines, tools, flares, and other optional gear.
______ Dive Lights	Checked to ensure they work
______ Metal Detector	Surface check to ensure it powers up
______ Standby Diver	Inspect line to make sure it is proper length and no deterioration
______ Observer/Assistant	Check line for proper length and no deterioration
______ Observer/Assistant	Properly stowed on board Throw bag or Ring Buoy

Attachment E – General Planning Checklist

E.1.0 STEPS IN PLANNING DIVING OPERATIONS

E.1.1. Analyze the Mission for Safety

Advanced planning is the greatest single safety precaution that can be taken. The following points must be considered individually and in depth:

- Objective definition;
- Environmental conditions;
- Emergency assistance (Recompression chamber and medical assistance);
- Route familiarization for all personnel; and
- Relevant instructions.

E.1.2 Pinpoint potential hazards

Atmospheric

_____ Extreme exposure of personnel to elements

_____ Adverse exposure of equipment and supplies to elements

_____ Delays or disruption caused by weather

Surface

_____ Sea sickness

_____ Water entry and exit

_____ Handling of heavy equipment in rough water

_____ Maintaining location in winds and currents

_____ Flotsam, kelp, petroleum disrupting operations

_____ Delays or disruption caused by water state

Underwater and Bottom

_____ Depth exceeds diving limits or limits of available equipment

_____ Exposure to cold temperatures

_____ Bottom obstructions

_____ Dangerous bottom conditions (mud, drop-offs, sewer outfalls, etc.)

_____ Visibility reduced or obstructed by suspension of bottom sediment

"On-site" Hazards

_____ Unusual site conditions

_____ High powered, active sonar

_____ Other conflicting water or shore operations

_____ Radiation contamination

_____ Pollution

Mission Hazards

_____ Decompression sickness/Pulmonary Barotraumas

_____ Communications problems

_____ Drowning

_____ Other trauma (injuries)

_____ Equipment malfunctions

Other Hazards

_____ Entrapment

_____ Entanglement

_____ Pollution, toxic

_____ Explosives or other ordnance

_____ Shifting or "working" of object

_____ Handing branches or limbs

E.1.3 Minimize Hazards and Plan for Emergencies.

E.1.3.1 Diving Personnel

_____ Assemble a complete and properly qualified Diving Team

_____ Assign each task to the most trained and experienced personnel

_____ Verify that each member of the Diving Team is properly trained and qualified for the equipment and depths involved

_____ Determine that each diver is physically fit to dive, paying attention to:

_____ General condition

_____ Last record of medical exam

_____ Ears and sinuses

_____ Severe cold or flu

_____ Use of stimulants or intoxicants

_____ Fatigue

_____ Last Repetitive Dive

_____ Time since last air travel

_____ Determine each person's emotional fitness to dive (as far as possible):

_____ Motivation (willingness)

_____ Stability

E.1.3.2 Diving Equipment

_____ Verify that the type of diving gear chosen (and diving technique) is adequate for the mission and particular task meeting OSHA and USACE requirements

_____ Verify that the type of equipment and diving technique is appropriate for the depth involved

_____ Verify that all equipment has been tested and approved

_____ Determine that all necessary support equipment and tools are readily available and are the best for accomplishing the job efficiently and safely

_____ Determine that all related support equipment such as winches, boats, cranes, floats, etc., are operable, safe, and under the control of trained personnel

_____ Check that all diving equipment has been properly maintained with appropriate records, and is in full operating condition

E.1.3.3 Provide for Emergency Equipment

_____ Obtain suitable communications equipment with sufficient capability to reach "outside help". Check all communications for proper functioning

_____ Verify that a recompression chamber is ready for use, or notify the nearest location having one that its use may be required within a given time frame

_____ Verify that a First Aid Kit is near at hand, and is completely stocked.

_____ If a resuscitator will be used, check the apparatus for function

_____ If conducting boat operations, check that all fire-fighting equipment is readily available and in full operating condition

_____ Verify that Emergency transportation is either standing by, or on immediate call

_____ Verify AED is on Site and personnel are trained in its use

E.1.3.4 Establish Emergency Procedures

_____ Know how to obtain medical assistance immediately

_____ Assign specific tasks to the Diving Team and support personnel for different emergencies

_____ Develop and post the emergency assistance checklist and ensure that all personnel are familiar with its location and use

_____ Verify that a copy of the latest U. S. Navy Standard Air Decompression, repetitive and no-decompression tables are available at the dive location

_____ Be sure that all divers, boat crews, and other support personnel understand all diver hand signals

_____ Verify that all personnel are familiar with emergency recall signals and procedures

_____ Pre-determine distress signals and call-signs with all members of the diving team, boat crews, and other activities

_____ Be sure that all divers have removed anything from their mouths which might choke them during a dive (gum, dentures, tobacco)

_____ Thoroughly drill and train all personnel in Emergency Procedures, with particular attention to cross training. Drills will include:

- Fire, for boat operations
- First Aid
- Decompression Sickness
- Embolism
- Restoration of Breathing
- Drowning
- Entrapment
- Lost Diver
- Unconscious Diver Recovery

E.1.4 Establish Safe Diving Operational Procedures

_____ Determine that all other means of accomplishing the mission have been considered before deciding to use divers.

_____ Be sure that contingency planning has been conducted.

_____ Carefully state the goals of each mission, and develop a flexible plan of operations.

_____ Completely brief the Diving Team and support personnel.

_____ Designate a properly qualified Dive Supervisor to be in charge of the mission.

_____ Designate a timekeeper and verify that he understands his duties and

responsibilities.

_____ Determine the exact depth at the job-site through the use of an electronic depth finder, lead line or fathometer.

_____ Verify the existence of an adequate supply of compressed air available for all planned diving operations plus an adequate reserve for emergencies.

_____ Be sure that operations or action on the part of the Diving Team, support personnel, boat crews, technicians, winch/crane operators, etc., do not start without the knowledge and direct command of the Project Dive Supervisor.

_____ All efforts must be made through proper planning, briefings, training, organization and other preparations to minimize "bottom-time". Remember in all cases, water depth and the condition of the diver (especially fatigue) rather than amount of work to be done will govern the diver's bottom time.

_____ Decompression tables will be on hand, be up-to-date, and be used in all planning and scheduling of diving operations.

_____ Instruct all divers and support personnel not to cut any lines until that action is approved by the Dive Supervisor.

_____ Be sure that the ship, boat, or diving craft is properly manned and in position to permit the safest and most efficient operation (except in the case of emergency).

_____ Ensure that, when conducting SCUBA operations, the boat can be quickly cast off and moved to a diver in distress.

_____ Ensure that each diver checks his own equipment in addition to checks made by tenders, technicians, or other support personnel.

_____ Designate a standby diver for all SCUBA operations~~,~~ and check that the standby diver is equipped and ready to enter the water if needed.

_____ All efforts will be made to prevent divers from being fouled on the bottom. If work is to be conducted inside a wreck or similar underwater structure, designate a team of divers to accomplish the task. One diver will enter the water; the other will tend his lines from the point of entry.

_____ When using explosives, take appropriate measures to ensure that no charge will be fired while divers are in the water.

_____ Brief all divers on the planned decompression schedules for each particular dive. Check provisions made for decompressing diver.

_____ Verify that the ship, boat, or diving craft is displaying the proper signals, flags, or lights to indicate diving operations are in progress.

_____ Ensure that proper protection against harmful marine life has been provided.

_____ When using the air compressor to fill air cylinders check that the intake hose is not near the exhaust of the compressor.

_____ Thoroughly brief the boat crew using the Diving Boat Operations Checklist.

_____ Verify that proper safety and operational equipment is aboard small diving boats or craft.

E.1.5 Notify Proper Parties that Dive Operations are Ready to Commence

_____ Local officials, military or civilian

_____ Cognizant Navy Organizations

_____ U. S. Coast Guard (if present).

If deemed necessary by the Dive Supervisor, notify emergency facilities having recompression chambers, as well as sources of emergency transportation that Diving Operations are under way and their assistance may be needed.

Attachment F – Project Dive Supervisor Checklist

F.1. Dive Supervisor: ____

F.2. Dive Location: ____

F.3. Dive Operation Scheduled: ____

F.4. Time Scheduled for Dive: ____

F.5. Chamber Location:

Primary: ____

Secondary: ____

Phone Number:____

F.6. Route to Chamber/Hospital: ____

____

F.7. U. S. Coast Guard Rescue Coordination Center:_________________________________

F.8. Pre Operational Checks:

_______ All equipment Pre-Dive maintenance accomplished

_______ Boat set-up

_______ Recompression Chamber notified

_______ Weather conditions checked

_______ Scuba bottles with gauge signifying pressure reading is no less than 90% of the capacity

_______ Personal dive gear inventoried

_______ Required equipment loaded

_______ Radio check with command center

______ Standby Diver Line loaded

F.9. Dive Supervisor checks:

_______ Dive flag posted

_______Verify water depth

_______ Conduct dive brief

_______ Divers properly dressed

_______ Fill in rough dive log

______ Emergency Equipment is checked, loaded and/or readily available

Attachment G – Project Dive Plan

(Note: If for any reason the Dive Plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation)

Name of Dive Supervisor: ______________________ Date/Time: ____________________________

Locations of Operation:_________________________ Durations of Operation: __________________

G.1. Dive team Assignments: ---

A. Dive team # _________ Dive Mission # ________

Name of Primary	Physical condition
Name of Secondary	Physical condition
Name of Standby	Physical condition
Observer/Assistant:	Remarks:

B. Support Personnel:

Communications:	First Aid/CPR certified person on site
Boat Operator:	Tender

G.2. Emergency Data: (See Emergency Management Plan in Appendix F)

A. DUTY CHAMBER:_______________ PHONE:_____________

B. AIR TRANSPORT:______________ PHONE:_____________

C. ROUTE TO CHAMBER:____

____

G.3. Diver Physical Fitness (Aches/Pains/Numbness/Medications):

____

G.4. TASK:

A. PURPOSE OF THE DIVE: ____

B. NATURE OF THE WORK TO BE PERFORMED: _________________________________

C. DIVING MODE (ie. SSA, SCUBA,) ____

D. MAXIMUM DEPTH PER DIVE: No dive will be no more than 100 feet

E. BOTTOM TYPE :____(no dive will exceed 45 minutes in length)

F. TABLE & SCHEDULE (All dive will be no-decompression dives):_____________________________

G. WEATHER/RIVER STATE (visibility, water temperature, etc.):

____

____

H.TYPE OF PLATFORM TO BE USED (boat, platform, shore): ______________________________

I. TOOLS AND MATERIALS INVOLVED: ____

Note:

1. All dives will be no-decompression dives and the following rates of ascent and descent will be observed: 30 FPM Ascent/75-FPM Descent.

2. Direct communications will be made available at all times between the dive site and the URS project office, the EOTI corporate office, the contracting officer, and the USACE project manager via hand-held two-way communication and or cell phone.

Attachment H – Dive Supervisor Pre-dive Checklist

_____ DIVERS (AND STAND-BY) ARE PHYSICALLY/MENTALLY FIT TO ENTER THE WATER?

_____ ANY DIVES WITHIN THE LAST 12 HOURS?

_____ ALL DIVERS HAVE MINIMUM EQUIPMENT (FINS, MASK, LIFE PRESERVER, WEIGHT BELT, KNIFE, SCUBA CYLINDER, DEPTH GAUGE, WATCH, REGULATOR, DIVE LIGHT)

_____ CYLINDERS HAVE BEEN GAUGED.

DV1: ________PSI **DV2:** ________PSI **STBY:** ________PSI

_____ ALL QUICK-RELEASE BUCKLES AND FASTENINGS CAN BE REACHED BY BOTH HANDS AND ARE RIGGED FOR PROPER RELEASE.

_____ WEIGHT BELT IS OUTSIDE OF ALL OTHER EQUIPMENT, BELTS, AND STRAPS?

_____ LIFE PRESERVER IS NOT CONSTRAINED, FREE TO EXPAND. CO2 CARTRIDGES ARE PROPERLY INSTALLED AND ALL AIR HAS BEEN REMOVED FROM VEST.

_____ KNIFE POSITIONED SO IT CANNOT BE JETTISONED.

_____ CYLINDER VALVE IS FULLY OPENED AND THEN BACKED OFF ¼ TURN. (DIVER PERFORM)

_____ CYCLE RESERVE MECHANISM AND ENSURE LEVER IS IN THE UP POSITION. (DIVER PERFORM)

_____ DIVER BREATHES FOR 30 SECONDS. ANY IMPURITIES?

_____ CONDUCT FINAL BRIEF.

_____ PROPER DIVING SIGNALS ARE BEING DISPLAYED.

_____ DIVER ENTER THE WATER WHEN READY AND CONDUCTS SURFACE CHECKS.

Attachment I – Checklist for Dive Boat Operations

All personnel involved in the operation of dive boats, launches, barges, floats, and other types of secondary small craft will be briefed and must understand the following safety precautions.

I.1. Inspect the specified boat or craft and determine its suitability for the intended mission and operating environment; ensure that:

_____ Boat (craft) is sound, and seaworthy.

_____ Engine is running well and fully tested.

_____ Required safety and running equipment is onboard and in workable condition.

_____ Proper gear for diving operation is onboard and operational.

_____ The assigned boat crew is fully qualified to operate that particular craft.

I.2. Know the details of the Emergency Assistance Checklist. Make sure it is completely filled out for small craft operations, with a legible copy placed onboard.

I.3. Inspect all communications gear, radios, underwater communications, power sources, walkie-talkies, cell phones, and ensure that they have been fully tested and are operational.

I.4. Determine that all non-powered communication equipment (flags, sounds signals, flares, air horn, etc.) are onboard, are complete and are operational.

I.5. Know all pre-determined signals, proper call signs, etc.

I.6. Know routine and emergency signals (for divers).

I.7. Determine that adequate and safe mooring equipment is onboard and personnel are familiar with proper mooring techniques.

I.8. Know who is in charge of the boat and responsible for giving orders to "Stop" and "Start". Orders to commence boat operations that affect divers are given only by the Dive Supervisor.

I.9. Before getting underway, check with the Dive Supervisor for:

_____ An "all aboard" head count

_____ Approval that all diving equipment lines, safety equipment, etc. are onboard.

I.10. Plans for various Boat Handling Procedures during Dive Operations include:

_____ Dropping off of divers (On small boat drop off both sides)

_____ Picking up divers s

_____ Towing divers, if applicable

_____ Getting underway in an emergency have anchors lines attached to buoys

_____ Handling of divers lines during descent, ascent, hanging-off, raising or lowering tools and gear drop-off/pick-up.

_____ Setting/retrieving of buoy markers.

_____ Moving or towing of platforms, rafts, rubber boats, search sleds, etc.

I.11. Ensure that stowage of diving supplies and gear does not block access to:

_____ Fire Extinguishers

_____ Life Preservers

_____ Ground tackle

_____ Engine spaces

_____ Communication gear

_____ Bilge pump or switch

_____ Boat hook

_____ Heaving line

_____ Emergency Lights

_____ Flares

_____ First Aid Kit

_____ Diving platform

I.12. Know these general safety precautions that apply to Boat Operations:

_____ Place all intakes for the diving air compressor upwind of engine or auxiliary power plant exhausts

_____ Ensure safety of the boat

_____ Handling gasoline, or other dangerous material

_____ Shoring and handling of heavy equipment

_____ Securing gear for heavy weather

_____ Cutting or other operations involving fire

When divers are in the water:

(1) Do not change moor if attached to divers

(2) Do not set anchors

(3) Do not drop heavy items overboard

(4) NEVER START ENGINES WHEN DIVERS OR SNORKLERS ARE ALONGSIDE OR DIRECTLY UNDER BOAT

I.13. The Dive Supervisor will ensure that the below listed equipment is ready and available for each Diving Operation:

_____ Boat Tool Box (if required)

_____ Binoculars

_____ SCUBA Bottles

_____ Standby Bottle

_____ Water Jug

_____ First Aid Kit

_____ Communications Line

_____ Tools required for job

_____ Paddles

_____ Marker Buoys & Lines

_____ Stand By Diver Tending Line

____ Diver Tending Line

____ Lost Diver Buoy, Line and Clump

____ Observer/Assistant Throw Bag or Ring Buoy

_____ Descent Line & Clumps

_____ Cell Phones/Radio Frequency

_____ Litter (Stokes)

_____ U/W Dive Lights (as required)

_____ Ladder

_____ Outboard Motor Oil (if required)

_____ Underwater Metal Detector

_____ Gas Cans (if required)

_____ Circle Line/with Snap hooks

_____ Anchors & lines

_____ Observer/Assistant Throw Line

_____ Search Buoys

I.14. The Dive Supervisor will ensure that the information contained below is recorded in the Diving Log:

Time Departed Shore/Pier (if applicable)___________

Time Commenced Dive ________

Time Completed Dive _________

Time Returned Shore/Pier (if applicable)___________

Notify URS Field Office upon completion of daily operation.

Attachment J – Neurological Examination Checklist

NEUROLOGICAL EXAMINATION CHECKLIST

(Sheet 1 of 2)

Patient's Name: ______________________ Date/Time: ______________

Describe pain/numbness: ______________________________________

HISTORY

Type of dive last performed: ____________ Depth: __________ How long: __________

Number of dives in last 24 hours: ______________________________

Was symptom noticed before, during or after the dive? ______________

If during, was it while descending, on the bottom or ascending? ______________

Has symptom increased or decreased since it was first noticed? ______________

Have any other symptoms occurred since the first one was noticed? ______________

Describe: ______________________________________

Has patient ever had a similar symptom before? ____________ When: __________

Has patient ever had decompression sickness or an air embolism before? ____ When: __________

MENTAL STATUS/STATE OF CONSCIOUSNESS

COORDINATION

Walk: _____
Heel-to-Toe: _____
Romberg: _____
Finger-to-Nose: _____
Heel Shin Slide: _____
Rapid Movement: _____

CRANIAL NERVES

Sense of Smell (I): _____
Vision/Visual Fld (II): _____
Eye Movements, Pupils (III, IV, VI): _____
Facial Sensation, Chewing (V): _____
Facial Expression Muscles (VII): _____
Hearing (VIII): _____
Upper Mouth, Throat Sensation (IX): _____
Gag & Voice (X): _____
Shoulder Shrug (XI): _____
Tongue (XII): _____

STRENGTH (Grade 0 to 5)

Upper Body

Deltoids	L _____	R _____
Latissimus	L _____	R _____
Biceps	L _____	R _____
Triceps	L _____	R _____
Forearms	L _____	R _____
Hands	L _____	R _____

Lower Body

Hips

Flexion	L _____	R _____
Extension	L _____	R _____
Abduction	L _____	R _____
Adduction	L _____	R _____

Knees

Flexion	L _____	R _____
Extension	L _____	R _____

NEUROLOGICAL EXAMINATION CHECKLIST

(Sheet 2 of 2)

REFLEXES

(Grade: Normal, Hyopactive, Hyperactive, Absent)

Biceps	L _____	R _____
Triceps	L _____	R _____
Knees	L _____	R _____
Ankles	L _____	R _____

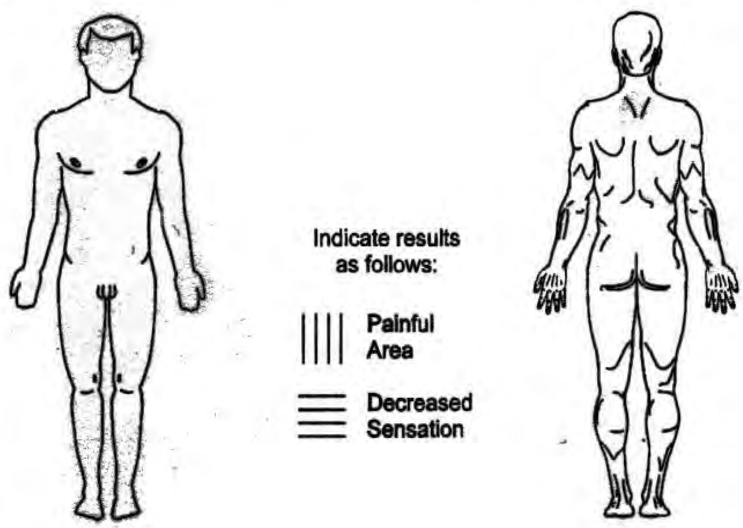
Ankles

Dorsiflexion	L _____	R _____
Plantarflexion	L _____	R _____
Toes	L _____	R _____

Sensory Examination for Skin Sensation

(Use diagram to record location off sensory abnormalities — numbness, tingling, etc.

LOCATION



COMMENTS

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Examination Performed by: ______________________

Attachment K – 29 CFR 1910 Subpart T

NFPA 70E–2000 *Standard for Electrical Safety Requirements for Employee Workplaces. (See also NFPA 70E–2004.)*

NFPA 77–2000 *Recommended Practice on Static Electricity.*

NFPA 80–1999 *Standard for Fire Doors and Fire Windows.*

NFPA 88A–2002 *Standard for Parking Structures.*

NFPA 91–2004 *Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids.*

NFPA 101–2006 *Life Safety Code.*

NFPA 496–2003 *Standard for Purged and Pressurized Enclosures for Electrical Equipment.*

NFPA 497–2004 *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.*

NFPA 505–2006 *Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.*

NFPA 820–2003 *Standard for Fire Protection in Wastewater Treatment and Collection Facilities.*

NMAB 353–1–1979 *Matrix of Combustion-Relevant Properties and Classification of Gases, Vapors, and Selected Solids.*

NMAB 353–2–1979 *Test Equipment for Use in Determining Classifications of Combustible Dusts.*

NMAB 353–3–1980 *Classification of Combustible Dust in Accordance with the National Electrical Code.*

[72 FR 7221, Feb., 14, 2007]

Subpart T—Commercial Diving Operations

AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, and 657); Sec. 107, Contract Work Hours and Safety Standards Act (the Construction Safety Act) (40 U.S.C. 333); Sec. 41, Longshore and Harbor Workers' Compensation Act (33 U.S.C. 941); Secretary of Labor's Order No. 8–76 (41 FR 25059), 9–83 (48 FR 35736), 1–90 (55 FR 9033), 3–2000 (65 FR 50017), or 5–2002 (67 FR 65008) as applicable; 29 CFR part 1911.

SOURCE: 42 FR 37668, July 22, 1977, unless otherwise noted.

GENERAL

§ 1910.401 Scope and application.

(a) *Scope.* (1) This subpart (standard) applies to every place of employment within the waters of the United States, or within any State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, Guam, the Trust Territory of the Pacific Islands, Wake Island, Johnston Island, the Canal Zone, or within the Outer Continental Shelf lands as defined in the Outer Continental Shelf Lands Act (67 Stat. 462, 43 U.S.C. 1331), where diving and related support operations are performed.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(i) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(ii) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(iii) Governed by 45 CFR part 46 (Protection of Human Subjects, U.S. Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(iv) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(A) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(B) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) *Alternative requirements for recreational diving instructors and diving guides.* Employers of recreational diving instructors and diving guides are not required to comply with the decompression-chamber requirements specified by paragraphs (b)(2) and (c)(3)(iii) of §1910.423 and paragraph (b)(1) of §1910.426 when they meet all of the following conditions:

(i) The instructor or guide is engaging solely in recreational diving instruction or dive-guiding operations;

(ii) The instructor or guide is diving within the no-decompression limits in these operations;

(iii) The instructor or guide is using a nitrox breathing-gas mixture consisting of a high percentage of oxygen (more than 22% by volume) mixed with nitrogen;

(iv) The instructor or guide is using an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus (SCUBA); and

(v) The employer of the instructor or guide is complying with all requirements of Appendix C of this subpart.

(b) *Application in emergencies.* An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(1) Notifies the Area Director, Occupational Safety and Health Administration within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(2) Upon request from the Area Director, submits such information in writing.

(c) *Employer obligation.* The employer shall be responsible for compliance with:

(1) All provisions of this standard of general applicability; and

(2) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 58 FR 35310, June 30, 1993; 69 FR 7363, Feb. 17, 2004]

§ 1910.402 Definitions.

As used in this standard, the listed terms are defined as follows:

Acfm: Actual cubic feet per minute.

ASME Code or equivalent: ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.

ATA: Atmosphere absolute.

Bell: An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.

Bottom time: The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.

Bursting pressure: The pressure at which a pressure containment device would fail structurally.

Cylinder: A pressure vessel for the storage of gases.

Decompression chamber: A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.

Decompression sickness: A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

Decompression table: A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive-guiding operations means leading groups of sports divers, who use an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, to local undersea diving locations for recreational purposes.

Dive location: A surface or vessel from which a diving operation is conducted.

Dive-location reserve breathing gas: A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.

Dive team: Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver: An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-carried reserve breathing gas: A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.

Diving mode: A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).

Fsw: Feet of seawater (or equivalent static pressure head).

Heavy gear: Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.

Hyperbaric conditions: Pressure conditions in excess of surface pressure.

Inwater stage: A suspended underwater platform which supports a diver in the water.

Liveboating: The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

Mixed-gas diving: A diving mode in which the diver is supplied in the water with a breathing gas other than air.

No-decompression limits: The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

Psi(g): Pounds per square inch (gauge).

Recreational diving instruction means training diving students in the use of recreational diving procedures and the safe operation of diving equipment, including an open-circuit, semi-closed-circuit, or closed-circuit self-contained underwater breathing apparatus, during dives.

Scientific diving means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

SCUBA diving: A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby diver: A diver at the dive location available to assist a diver in the water.

Surface-supplied air diving: A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

Treatment table: A depth-time and breathing gas profile designed to treat decompression sickness.

Umbilical: The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

Volume tank: A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

Working pressure: The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[42 FR 37668, July 22, 1977, as amended at 47 FR 53365, Nov. 26, 1982; 69 FR 7363, Feb. 17, 2004]

PERSONNEL REQUIREMENTS

§ 1910.410 Qualifications of dive team.

(a) *General.* (1) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(2) Each dive team member shall have experience or training in the following:

(i) The use of tools, equipment and systems relevant to assigned tasks;

(ii) Techniques of the assigned diving mode: and

(iii) Diving operations and emergency procedures.

(3) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).

(4) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(b) *Assignments.* (1) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(2) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(3) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(c) *Designated person-in-charge.* (1) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(2) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

GENERAL OPERATIONS PROCEDURES

§ 1910.420 Safe practices manual.

(a) *General.* The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(b) *Contents.* (1) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(2) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

§ 1910.421 Pre-dive procedures.

(a) *General.* The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(b) *Emergency aid.* A list shall be kept at the dive location of the telephone or call numbers of the following:

(1) An operational decompression chamber (if not at the dive location);

(2) Accessible hospitals;

(3) Available physicians;

(4) Available means of transportation; and

(5) The nearest U.S. Coast Guard Rescue Coordination Center.

(c) *First aid supplies.* (1) A first aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(2) When used in a decompression chamber or bell, the first aid kit shall be suitable for use under hyperbaric conditions.

(3) In addition to any other first aid supplies, an American Red Cross standard first aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(d) *Planning and assessment.* Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(1) Diving mode;

(2) Surface and underwater conditions and hazards;

(3) Breathing gas supply (including reserves);

(4) Thermal protection;

(5) Diving equipment and systems;

(6) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(7) Repetitive dive designation or residual inert gas status of dive team members;

(8) Decompression and treatment procedures (including altitude corrections); and

(9) Emergency procedures.

(e) *Hazardous activities*. To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(f) *Employee briefing*. (1) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(2) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(g) *Equipment inspection*. The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(h) *Warning signal*. When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[42 FR 37668, July 22, 1977, as amended at 47 FR 14706, Apr. 6, 1982; 54 FR 24334, June 7, 1989]

§ 1910.422 Procedures during dive.

(a) *General*. The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(b) *Water entry and exit*. (1) A means capable of supporting the diver shall be provided for entering and exiting the water.

(2) The means provided for exiting the water shall extend below the water surface.

(3) A means shall be provided to assist an injured diver from the water or into a bell.

(c) *Communications*. (1) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(2) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(d) *Decompression tables*. Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(e) *Dive profiles*. A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(f) *Hand-held power tools and equipment*. (1) Hand-held electrical tools and equipment shall be de-energized before being placed into or retrieved from the water.

(2) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(g) *Welding and burning*. (1) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(2) The welding machine frame shall be grounded.

(3) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(4) Insulated gloves shall be provided to divers performing welding and burning operations.

(5) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(h) *Explosives.* (1) Employers shall transport, store, and use explosives in accordance with this section and the applicable provisions of §1910.109 and §1926.912 of Title 29 of the Code of Federal Regulations.

(2) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(3) Explosives shall not be detonated while the diver is in the water.

(i) *Termination of dive.* The working interval of a dive shall be terminated when:

(1) A diver requests termination;

(2) A diver fails to respond correctly to communications or signals from a dive team member;

(3) Communications are lost and can not be quickly re-established between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(4) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

§ 1910.423 Post-dive procedures.

(a) *General.* The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(b) *Precautions.* (1) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(2) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(c) *Recompression capability.* (1) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(2) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(3) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within 5 minutes of the dive location.

(4) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(5) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(6) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(d) *Record of dive.* (1) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(2) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(3) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(e) *Decompression procedure assessment.* The employer shall:

(1) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(2) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(3) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[42 FR 37668, July 22, 1977, as amended at 49 FR 18295, Apr. 30, 1984]

SPECIFIC OPERATIONS PROCEDURES

§ 1910.424 SCUBA diving.

(a) *General.* Employers engaged in SCUBA diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* SCUBA diving shall not be conducted:

(1) At depths deeper than 130 fsw;

(2) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(3) Against currents exceeding one (1) knot unless line-tended; or

(4) In enclosed or physically confining spaces unless line-tended.

(c) *Procedures.* (1) A standby diver shall be available while a diver is in the water.

(2) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous visual contact during the diving operations.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(5) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

§ 1910.425 Surface-supplied air diving.

(a) *General.* Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits.* (1) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(2) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(3) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(c) *Procedures.* (1) Each diver shall be continuously tended while in the water.

(2) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(3) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of

the planned dive including decompression.

(4) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(5) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(6) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

§ 1910.426 Mixed-gas diving.

(a) *General*. Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(b) *Limits*. Mixed-gas diving shall be conducted only when:

(1) A decompression chamber is ready for use at the dive location; and

(i) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(ii) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(c) *Procedures*. (1) A separate dive team member shall tend each diver in the water.

(2) A standby diver shall be available while a diver is in the water.

(3) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(4) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(5) Each diving operation shall have a dive-location reserve breathing gas supply.

(6) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(7) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(8) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(9) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

§ 1910.427 Liveboating.

(a) *General*. Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(b) *Limits*. Diving operations involving liveboating shall not be conducted:

(1) With an inwater decompression time of greater than 120 minutes;

(2) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(3) Using mixed gas at depths greater than 220 fsw;

(4) In rough seas which significantly inpede diver mobility or work function; or

(5) In other than daylight hours.

(c) *Procedures*. (1) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(2) A device shall be used which minimizes the possibility of entanglement

of the diver's hose in the propeller of the vessel.

(3) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(4) A standby diver shall be available while a diver is in the water.

(5) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

EQUIPMENT PROCEDURES AND REQUIREMENTS

§ 1910.430 Equipment.

(a) *General.* (1) All employers shall comply with the following requirements, unless otherwise specified.

(2) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(b) *Air compressor system.* (1) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(2) Air compressor intakes shall be located away from areas containing exhaust or other contaminants.

(3) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 p/m;

(ii) A level of carbon dioxide (CO_2) greater than 1,000 p/m;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(4) The output of air compressor systems shall be tested for air purity every 6 months by means of samples taken at the connection to the distribution system, except that non-oil lubricated compressors need not be tested for oil mist.

(c) *Breathing gas supply hoses.* (1) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to 4 times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(2) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(3) Umbilicals shall:

(i) Be marked in 10-ft. increments to 100 feet beginning at the diver's end, and in 50 ft. increments thereafter;

(ii) Be made of kink-resistant materials; and

(iii) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(d) *Buoyancy control.* (1) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(2) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(3) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(4) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(e) *Compressed gas cylinders.* Compressed gas cylinders shall:

(1) Be designed, constructed and maintained in accordance with the applicable provisions of 29 CFR 1910.101 and 1910.169 through 1910.171.

(2) Be stored in a ventilated area and protected from excessive heat;

(3) Be secured from falling; and

(4) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(f) *Decompression chambers.* (1) Each decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(2) Each decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(3) Each decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25 percent oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(g) *Gauges and timekeeping devices.* (1) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(2) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every 6 months, and when there is a discrepancy greater than two percent (2 percent) of full scale between any two equivalent gauges.

(3) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(4) A timekeeping device shall be available at each dive location.

(h) *Masks and helmets.* (1) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A non-return valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(2) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(i) *Oxygen safety.* (1) Equipment used with oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be designed for oxygen service.

(2) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent (40%) by volume oxygen shall be cleaned of flammable materials before use.

(3) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(j) *Weights and harnesses.* (1) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(2) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[39 FR 23502, June 27, 1974, as amended at 49 FR 18295, Apr. 30, 1984; 51 FR 33033, Sept. 18, 1986]

RECORDKEEPING

§ 1910.440 Recordkeeping requirements.

(a)(1) [Reserved]

(2) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(b) *Availability of records.* (1) Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

(2) Records and documents required by this standard shall be provided upon

request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a)–(e) and (g)–(i). Safe practices manuals (§1910.420), depth-time profiles (§1910.422), recordings of dives (§1910.423), decompression procedure assessment evaluations (§1910.423), and records of hospitalizations (§1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (§1910.430) shall also be provided upon request to employees and their designated representatives.

(3) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (§1910.411)—5 years;

(ii) Safe practices manual (§1910.420)—current document only;

(iii) Depth-time profile (§1910.422)—until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording of dive (§1910.423)—1 year, except 5 years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (§1910.423)—5 years;

(vi) Equipment inspections and testing records (§1910.430)—current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (§1910.440)—5 years.

(4) After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

(5) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

[42 FR 37668, July 22, 1977, as amended at 45 FR 35281, May 23, 1980; 47 FR 14706, Apr. 6, 1982; 51 FR 34562, Sept. 29, 1986; 61 FR 9242, Mar. 7, 1996; 71 FR 16672, Apr. 3, 2006]

Appendix A to Subpart T to Part 1910—Examples of Conditions Which May Restrict or Limit Exposure to Hyperbaric Conditions

The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

History of seizure disorder other than early febrile convulsions.

Malignancies (active) unless treated and without recurrence for 5 yrs.

Chronic inability to equalize sinus and/or middle ear pressure.

Cystic or cavitary disease of the lungs.

Impaired organ function caused by alcohol or drug use.

Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, moodaltering drugs, or insulin).

Meniere's disease.

Hemoglobinopathies.

Obstructive or restrictive lung disease.

Vestibular end organ destruction.

Pneumothorax.

Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

Juxta-articular osteonecrosis.

Appendix B to Subpart T to Part 1910—Guidelines for Scientific Diving

This appendix contains guidelines that will be used in conjunction with §1910.401(a)(2)(iv) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

1. The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operations.

2. The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.

3. The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.

4. Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[50 FR 1050, Jan. 9, 1985]

APPENDIX C TO SUBPART T TO PART 1910—ALTERNATIVE CONDITIONS UNDER §1910.401(a)(3) FOR RECREATIONAL DIVING INSTRUCTORS AND DIVING GUIDES (MANDATORY)

Paragraph (a)(3) of §1910.401 specifies that an employer of recreational diving instructors and diving guides (hereafter, "divers" or "employees") who complies with all of the conditions of this appendix need not provide a decompression chamber for these divers as required under §§1910.423(b)(2) or (c)(3) or 1910.426(b)(1).

1. EQUIPMENT REQUIREMENTS FOR REBREATHERS

(a) The employer must ensure that each employee operates the rebreather (*i.e.*, semi-closed-circuit and closed-circuit self-contained underwater breathing apparatuses (hereafter, "SCUBAs")) according to the rebreather manufacturer's instructions.

(b) The employer must ensure that each rebreather has a counterlung that supplies a sufficient volume of breathing gas to their divers to sustain the divers' respiration rates, and contains a baffle system and/or other moisture separating system that keeps moisture from entering the scrubber.

(c) The employer must place a moisture trap in the breathing loop of the rebreather, and ensure that:

(i) The rebreather manufacturer approves both the moisture trap and its location in the breathing loop; and

(ii) Each employee uses the moisture trap according to the rebreather manufacturer's instructions.

(d) The employer must ensure that each rebreather has a continuously functioning moisture sensor, and that:

(i) The moisture sensor connects to a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) alarm that is readily detectable by the diver under the diving conditions in which the diver operates, and warns the diver of moisture in the breathing loop in sufficient time to terminate the dive and return safely to the surface; and

(ii) Each diver uses the moisture sensor according to the rebreather manufacturer's instructions.

(e) The employer must ensure that each rebreather contains a continuously functioning CO_2 sensor in the breathing loop, and that:

(i) The rebreather manufacturer approves the location of the CO_2 sensor in the breathing loop;

(ii) The CO_2 sensor is integrated with an alarm that operates in a visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) mode that is readily detectable by each diver under the diving conditions in which the diver operates; and

(iii) The CO_2 alarm remains continuously activated when the inhaled CO_2 level reaches and exceeds 0.005 atmospheres absolute (ATA).

(f) Before each day's diving operations, and more often when necessary, the employer must calibrate the CO_2 sensor according to the sensor manufacturer's instructions, and ensure that:

(i) The equipment and procedures used to perform this calibration are accurate to within 10% of a CO_2 concentration of 0.005 ATA or less;

(ii) The equipment and procedures maintain this accuracy as required by the sensor manufacturer's instructions; and

(iii) The calibration of the CO_2 sensor is accurate to within 10% of a CO_2 concentration of 0.005 ATA or less.

(g) The employer must replace the CO_2 sensor when it fails to meet the accuracy requirements specified in paragraph 1(f)(iii) of this appendix, and ensure that the replacement CO_2 sensor meets the accuracy requirements specified in paragraph 1(f)(iii) of this appendix before placing the rebreather in operation.

(h) As an alternative to using a continuously functioning CO_2 sensor, the employer may use a schedule for replacing CO_2-sorbent material provided by the rebreather manufacturer. The employer may use such a schedule only when the rebreather manufacturer has developed it according to the canister-testing protocol specified below in Condition 11, and must use the canister within the temperature range for which the manufacturer conducted its scrubber canister tests following that protocol. Variations above or below the range are acceptable only after the manufacturer adds that lower or higher temperature to the protocol.

(i) When using CO_2-sorbent replacement schedules, the employer must ensure that each rebreather uses a manufactured (*i.e.*, commercially pre-packed), disposable scrubber cartridge containing a CO_2-sorbent material that:

(i) Is approved by the rebreather manufacturer;

(ii) Removes CO_2 from the diver's exhaled gas; and

(iii) Maintains the CO_2 level in the breathable gas (*i.e.*, the gas that a diver inhales directly from the regulator) below a partial pressure of 0.01 ATA.

(j) As an alternative to manufactured, disposable scrubber cartridges, the employer may fill CO_2 scrubber cartridges manually with CO_2-sorbent material when:

(i) The rebreather manufacturer permits manual filling of scrubber cartridges;

(ii) The employer fills the scrubber cartridges according to the rebreather manufacturer's instructions;

(iii) The employer replaces the CO_2-sorbent material using a replacement schedule developed under paragraph 1(h) of this appendix; and

(iv) The employer demonstrates that manual filling meets the requirements specified in paragraph 1(i) of this appendix.

(k) The employer must ensure that each rebreather has an information module that provides:

(i) A visual (*e.g.*, digital, graphic, analog) or auditory (*e.g.*, voice, pure tone) display that effectively warns the diver of solenoid failure (when the rebreather uses solenoids) and other electrical weaknesses or failures (*e.g.*, low battery voltage);

(ii) For a semi-closed circuit rebreather, a visual display for the partial pressure of CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA; and

(iii) For a closed-circuit rebreather, a visual display for: partial pressures of O_2 and CO_2, or deviations above and below a preset CO_2 partial pressure of 0.005 ATA and a preset O_2 partial pressure of 1.40 ATA or lower; gas temperature in the breathing loop; and water temperature.

(l) Before each day's diving operations, and more often when necessary, the employer must ensure that the electrical power supply and electrical and electronic circuits in each rebreather are operating as required by the rebreather manufacturer's instructions.

2. Special Requirements for Closed-Circuit Rebreathers

(a) The employer must ensure that each closed-circuit rebreather uses supply-pressure sensors for the O_2 and diluent (*i.e.*, air or nitrogen) gases and continuously functioning sensors for detecting temperature in the inhalation side of the gas-loop and the ambient water.

(b) The employer must ensure that:

(i) At least two O_2 sensors are located in the inhalation side of the breathing loop; and

(ii) The O_2 sensors are: functioning continuously; temperature compensated; and approved by the rebreather manufacturer.

(c) Before each day's diving operations, and more often when necessary, the employer must calibrate O_2 sensors as required by the sensor manufacturer's instructions. In doing so, the employer must:

(i) Ensure that the equipment and procedures used to perform the calibration are accurate to within 1% of the O_2 fraction by volume;

(ii) Maintain this accuracy as required by the manufacturer of the calibration equipment;

(iii) Ensure that the sensors are accurate to within 1% of the O_2 fraction by volume;

(iv) Replace O_2 sensors when they fail to meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix; and

(v) Ensure that the replacement O_2 sensors meet the accuracy requirements specified in paragraph 2(c)(iii) of this appendix before placing a rebreather in operation.

(d) The employer must ensure that each closed-circuit rebreather has:

(i) A gas-controller package with electrically operated solenoid O_2-supply valves;

(ii) A pressure-activated regulator with a second-stage diluent-gas addition valve;

(iii) A manually operated gas-supply bypass valve to add O_2 or diluent gas to the breathing loop; and

(iv) Separate O_2 and diluent-gas cylinders to supply the breathing-gas mixture.

3. O_2 Concentration in the Breathing Gas

The employer must ensure that the fraction of O_2 in the nitrox breathing-gas mixture:

(a) Is greater than the fraction of O_2 in compressed air (*i.e.*, exceeds 22% by volume);

(b) For open-circuit SCUBA, never exceeds a maximum fraction of breathable O_2 of 40% by volume or a maximum O_2 partial pressure of 1.40 ATA, whichever exposes divers to less O_2; and

(c) For a rebreather, never exceeds a maximum O_2 partial pressure of 1.40 ATA.

4. Regulating O_2 Exposures and Diving Depth

(a) Regarding O_2 exposure, the employer must:

(i) Ensure that the exposure of each diver to partial pressures of O_2 between 0.60 and 1.40 ATA does not exceed the 24-hour single-exposure time limits specified either by the 2001 National Oceanic and Atmospheric Administration Diving Manual (the "2001 NOAA Diving Manual"), or by the report entitled "Enriched Air Operations and Resource Guide" published in 1995 by the Professional Association of Diving Instructors (known commonly as the "1995 DSAT Oxygen Exposure Table"); and

(ii) Determine a diver's O_2-exposure duration using the diver's maximum O_2 exposure (partial pressure of O_2) during the dive and the total dive time (*i.e.*, from the time the diver leaves the surface until the diver returns to the surface).

(b) Regardless of the diving equipment used, the employer must ensure that no a separate supply of emergency breathing gas, and the emergency breathing gas consists of air or the same nitrox breathing-gas mixture used during the dive.

(b) As an alternative to the "bail-out" system specified in paragraph 7(a) of this appendix, the employer may use:

(i) For open-circuit SCUBA, an emergency-egress system as specified in § 1910.424(c)(4); or

(ii) For a semi-closed-circuit and closed-circuit rebreather, a system configured so that the second stage of the regulator connects to a reserve supply of emergency breathing gas.

(c) The employer must obtain from the rebreather manufacturer sufficient information to ensure that the bail-out system performs reliably and has sufficient capacity to enable the diver to terminate the dive and return safely to the surface.

8. Treating Diving-Related Medical Emergencies

(a) Before each day's diving operations, the employer must:

(i) Verify that a hospital, qualified health-care professionals, and the nearest Coast Guard Coordination Center (or an equivalent rescue service operated by a state, county, or municipal agency) are available to treat diving-related medical emergencies;

(ii) Ensure that each dive site has a means to alert these treatment resources in a timely manner when a diving-related medical emergency occurs; and

(iii) Ensure that transportation to a suitable decompression chamber is readily available when no decompression chamber is at the dive site, and that this transportation can deliver the injured diver to the decompression chamber within four (4) hours travel time from the dive site.

(b) The employer must ensure that portable O_2 equipment is available at the dive site to treat injured divers. In doing so, the employer must ensure that:

(i) The equipment delivers medical-grade O_2 that meets the requirements for medical USP oxygen (Type I, Quality Verification Level A) of CGA G–4.3–2000 ("Commodity Specification for Oxygen");

(ii) The equipment delivers this O_2 to a transparent mask that covers the injured diver's nose and mouth; and

(iii) Sufficient O_2 is available for administration to the injured diver from the time the employer recognizes the symptoms of a diving-related medical emergency until the injured diver reaches a decompression chamber for treatment.

(c) Before each day's diving operations, the employer must:

(i) Ensure that at least two attendants, either employees or non-employees, qualified in first-aid and administering O_2 treatment, are available at the dive site to treat diving-related medical emergencies; and

(ii) Verify their qualifications for this task.

9. Diving Logs and No-Decompression Tables

(a) Before starting each day's diving operations, the employer must:

(i) Designate an employee or a non-employee to make entries in a diving log; and

(ii) Verify that this designee understands the diving and medical terminology, and proper procedures, for making correct entries in the diving log.

(b) The employer must:

(i) Ensure that the diving log conforms to the requirements specified by paragraph (d) ("Record of dive") of § 1910.423; and

(ii) Maintain a record of the dive according to § 1910.440 ("Recordkeeping requirements").

(c) The employer must ensure that a hardcopy of the no-decompression tables used for the dives (as specified in paragraph 6(a) of this appendix) is readily available at the dive site, whether or not the divers use dive-decompression computers.

10. Diver Training

The employer must ensure that each diver receives training that enables the diver to perform work safely and effectively while using open-circuit SCUBAs or rebreathers supplied with nitrox breathing-gas mixtures. Accordingly, each diver must be able to demonstrate the ability to perform critical tasks safely and effectively, including, but not limited to: recognizing the effects of breathing excessive CO_2 and O_2; taking appropriate action after detecting excessive levels of CO_2 and O_2; and properly evaluating, operating, and maintaining their diving equipment under the diving conditions they encounter.

11. Testing Protocol for Determining the CO_2 Limits of Rebreather Canisters

(a) The employer must ensure that the rebreather manufacturer has used the following procedures for determining that the CO_2-sorbent material meets the specifications of the sorbent material's manufacturer:

(i) The North Atlantic Treating Organization CO_2 absorbent-activity test;

(ii) The RoTap shaker and nested-sieves test;

(iii) The Navy Experimental Diving Unit ("NEDU")-derived Schlegel test; and

(iv) The NEDU MeshFit software.

(b) The employer must ensure that the rebreather manufacturer has applied the following canister-testing materials, methods, procedures, and statistical analyses:

(i) Use of a nitrox breathing-gas mixture that has an O_2 fraction maintained at 0.28 (equivalent to 1.4 ATA of O_2 at 130 fsw, the maximum O_2 concentration permitted at this depth);

(ii) While operating the rebreather at a maximum depth of 130 fsw, use of a breathing machine to continuously ventilate the rebreather with breathing gas that is at 100% humidity and warmed to a temperature of 98.6 degrees F (37 degrees C) in the heating-humidification chamber;

(iii) Measurement of the O_2 concentration of the inhalation breathing gas delivered to the mouthpiece;

(iv) Testing of the canisters using the three ventilation rates listed in Table I below (with the required breathing-machine tidal volumes and frequencies, and CO_2-injection rates, provided for each ventilation rate):

TABLE I—CANISTER TESTING PARAMETERS

Ventilation rates (Lpm, ATPS [1])	Breathing machine tidal volumes (L)	Breathing machine frequencies (breaths per min.)	CO_2 injection rates (Lpm, STPD [2])
22.5	1.5	15	0.90
40.0	2.0	20	1.35
62.5	2.5	25	2.25

[1] ATPS means ambient temperature and pressure, saturated with water.
[2] STPD means standard temperature and pressure, dry; the standard temperature is 32 degrees F (0 degrees C).

(v) When using a work rate (*i.e.*, breathing-machine tidal volume and frequency) other than the work rates listed in the table above, addition of the appropriate combinations of ventilation rates and CO_2-injection rates;

(vi) Performance of the CO_2 injection at a constant (steady) and continuous rate during each testing trial;

(vii) Determination of canister duration using a minimum of four (4) water temperatures, including 40, 50, 70, and 90 degrees F (4.4, 10.0, 21.1, and 32.2 degrees C, respectively);

(viii) Monitoring of the breathing-gas temperature at the rebreather mouthpiece (at the "chrome T" connector), and ensuring that this temperature conforms to the temperature of a diver's exhaled breath at the water temperature and ventilation rate used during the testing trial; [1]

(ix) Implementation of at least eight (8) testing trials for each combination of temperature and ventilation-CO_2-injection rates (for example, eight testing trials at 40 degrees F using a ventilation rate of 22.5 Lpm at a CO_2-injection rate of 0.90 Lpm);

(x) Allowing the water temperature to vary no more than ± 2.0 degrees F (± 1.0 degree C) *between* each of the eight testing trials, and no more than ± 1.0 degree F (± 0.5 degree C) *within* each testing trial;

(xi) Use of the average temperature for each set of eight testing trials in the statistical analysis of the testing-trial results, with the testing-trial results being the time taken for the inhaled breathing gas to reach 0.005 ATA of CO_2 (*i.e.*, the canister-duration results);

(xii) Analysis of the canister-duration results using the repeated-measures statistics described in NEDU Report 2–99;

(xiii) Specification of the replacement schedule for the CO_2-sorbent materials in terms of the lower prediction line (or limit) of the 95% confidence interval; and

(xiv) Derivation of replacement schedules only by interpolating among, but not by extrapolating beyond, the depth, water temperatures, and exercise levels used during canister testing.

[69 FR 7363, Feb. 17, 2004]

Subparts U–Y [Reserved]

§§ 1910.901–1910.999 [Reserved]

[1] NEDU can provide the manufacturer with information on the temperature of a diver's exhaled breath at various water temperatures and ventilation rates, as well as techniques and procedures used to maintain these temperatures during the testing trials.

DEPARTMENT OF THE ARMY
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REPLY TO
ATTENTION OF

CESAC-OP-N-S 30 September 2014

Dive Operations Plan Review
Project: Congaree River Project UXO Support

Background: The USACE District Dive Coordinator (DDC) has been requested to provide a review of the Congaree River Project UXO Support Dive Plan prepared by Explosive Ordnance Technologies, Inc. for a remediation project being conducted for SCDHEC by SCANA Services Inc and Apex Companies, LLC. The USACE DDC will provide comments and recommendations on the plan as it pertains to meeting the requirements for dive operations according to USACE Engineering Manual 385-1-1. The USACE DDC will not approve this plan as there will be no USACE Dive Inspector onsite during the duration of the project to provide oversight of the operation. The DDC recommends providing a diving safety inspector to conduct QA during the operation using Appendix F as the QA checklist.

Checklists and Comments:

APPENDIX E
DDC Checklist for Contractor's
Dive Operation Plan
DDEPLAN

A. Diving shall not be used as a work method if the work objective can be more safely and efficiently accomplished by another means (e.g. using remote controlled television systems in lieu of divers). (30.A.03)

B. Did the contractor submit following as a minimum for acceptance? (30.A.14)

1. **Contractor's Safe Practices Manual**. >See Appendix D

2. **Dive Operations Plan** as a minimum will contain the following: (30.A.17)
   a. Name of Contractor (and diving subcontractor if applicable); ✓
   b. Contract number; N/A
   c. Date of dive plan submission; ✓
   d. Name of diving supervisor preparing the dive plan; ✓
   e. Names and duties of dive team members, including diving supervisor; ✓
   f. List of diving equipment to be used; ✓
   g. Type of diving platform to be used; ✓

h. Detailed description of the mission; ✓

i. Date(s), time(s), duration, and location of operation; Will need updated plan for dates of diving.

j. Diving mode used (SCUBA, SSA, and snorkeling) including description of the backup air supply, as require; ✓

k. Nature of work to be performed by the divers, including tool used and materials to be handled or installed; ✓

1. Surface and underwater conditions, to include visibility, temperature, currents, tide, etc. Thermal protection will be considered as appropriate; ✓

m. Maximum single dive bottom time for the planned depth of dive for each diver. Altitude adjustments to dive tables will be calculated for dives made at altitudes of 1000 ft (304.8 m) or more above sea level. > See Appendix O; ✓

n. Name of each Person directly involved in topside assistance/support to the dive team (i.e., crane operator, lock operator, etc.): ✓

o. Means of direct communication between the dive site and the Contractor's project office, the contracting officer, and the lockmaster/USACE project manager:

✓ Mobile Phone

p. A justification and detailed description for live boating operations. (30.A.05)

✓ Safety Boat

NOTE: The dive plan will include the following statement: "if for any reason the dive plan is altered in mission, depth, personnel, or equipment, the DDC will be contacted in order to review and accept the alteration prior to actual operation."

A. Self Contained Underwater Breathing Apparatus (SCUBA) diving operations shall not be conducted: (30.B.01)

1. At depths greater than 100 ft (30.4 m); ✓
2. On dives outside the no-decompression limits; ✓
3. Against currents exceeding one knot; ✓
4. In enclosed or physically confining spaces; ✓
5. Using closed circuit or semi-closed circuit SCUBA; ✓
6. In visibility less than 3 ft (Q.9 m) unless line tended with diver/surface two-way voice communications. ✓

B. Surface-Supplied Air (SSA) shall be used whenever possible in accordance with the practical constraints of diving operations. All working dives requiring communications between the divers and topside to direct crane load movements, etc., shall be performed in SSA mode. A tender/diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces. (30.A.04) N/A

C. A snorkeling protocol will be developed and included in the project file. It will contain as a minimum, the following: (30.G. 16) N/A

1. An AHA for each specific snorkeling mission. Particular detail will be given to currents and other environmental considerations.
2. . Records for snorkeling activities will be maintained. These records will include as a minimum: annual Physician letter stating fitness to perform snorkeling survey, an AHA, and a snorkeling plan. The latter will be based on the requirements of 30.Al 6.

Note: Scientific snorkeling will be allowed only for environmental assessments such as fish surveys, stream surveys, and the like. It will not be used for structural inspections. 30.G.02

3. **Activity Hazards Analysis** (AHA) as a minimum the plan will address the following (30.A.18):

a. Equipment failure ✓
b. Extreme weather/environmental conditions ✓
c. Procedures for dealing with differential pressures if applicable N/A
d. Lockout/tagout procedures if applicable N/A
e. Hazards associated with flying after diving ✓
f. Cranes or other lifting devices if applicable (30.A.27) N/A
g. Welding or cutting if applicable (30.A.27) N/A
h. Blasting procedures if applicable (30.A.27) ✓
i. Other hazardous/unexpected situations. ✓

A copy of any clearances/permits to be issued to deal with identified hazards will be attached to the AHA.

4. **Emergency Management Plan** will contain as a minimum the following: (30.A.19)

a. Location and phone number of nearest operational recompression chamber if not located at the dive site; ✓
b. Location and phone number(s) of nearest hospital(s); ✓
c. Location and phone number of nearest USCG Rescue Coordination Center, where appropriate; N/A due to distance from dive site
d. Description of an emergency victim transport plan including phone numbers of appropriate emergency transport services; ✓
e. Procedures and phone numbers or other means of communications to activate emergency services at the facility where the work is being performed; ✓
f. Procedure to deal with entrapped or fouled diver including fouled umbilical (suction and entanglement/debris); ✓
g. Actions upon loss of vital support equipment; ✓
h. Actions upon loss of gas supply; ✓
i. Action upon loss of communication; ✓
j. Lost diver plan; ✓
k. Injured diver plan; ✓
1. Actions upon discovery of fire; ✓
m. Diver blow up/over rapid ascent to surface; ✓

n. Diver loss of consciousness; ✓
o. Injury/illness of member of surface crew with diver in the water; ✓
p. Adverse weather conditions. (30.A.16d) ✓
q. Actions related to crane or other lifting devices if applicable ; (30.A.27) N/A
r. Action related to welding or cutting if applicable; (30.A.27) N/A
s. Action related to blasting if applicable. (30.A.27) ✓

5. **Dive Personnel Qualifications**. (a through d below same as 1 through 4 of Appendix D, Paragraph L)

USACE Comment: Current Dive Personnel Qualification have not been submitted, recommend final reviewer review against requirements below.

Response: The following statement will be added to the text. "Current Dive Personnel Qualifications will be submitted two weeks prior to dive operations to ensure that they are current and are of the personnel performing the dive." The thought being that personnel may change and expiration dates on certifications may not be current at the time of the dive if submitted now.

a. The Contractor shall submit certification, signed by a licensed physician, stating that each diver has been medically examined within the previous 12 months and has been determined fit and approved to dive. The dive medical examination will be repeated every 12 months with verification submitted to the DDC. (30.A. 10)

b. Training documentation shall be in compliance with 29 CFR 1910.410 and shall show that the dive team members have successfully completed training to the appropriate level (e.g., SSA divers certificate, surface supplied mixed-gas diver certificate). Such training shall: (30.A.06)

1. Be from a commercial diving school within a particular State, military school, Federal school (e.g., USACE), or an Association of Commercial Diving Educators (ACDE) accredited school, or
2. Meet the requirements contained in ANSI/ACDE-01.

c. Any employed diver/team member may substitute a training certificate with a valid "Association of Diving Contractors (ADC) Commercial Diver Certification Card" for the appropriate training level. (30.A.07)

d. Each dive team member shall have current certification in CPR, First aid, and use of emergency oxygen systems. Evidence of this will be a Photocopy of the certificates. (30.A.09)

e. Contractors shall provide evidence that each dive team member has training and experience consistent with the performance requirements of the scope of work. As a minimum, each team member shall have at least 1 year of commercial experience in the applicable position: divers shall have completed at least four (4) working dives with similar decompression techniques as in the contract, using the particular diving techniques and equipment to be used under the contract. Divers shall demonstrate that at least one (1) of the four (4) qualification dives was performed in the last 6 months prior to the contract award date. (30.A.08)

APPENDIX D
DDC Checklist for Contractor's
Safe Practices Manual
DDDMAN

Does the Safe Practices Manual contain the following, as a minimum: (30.A.16)

A. Safety procedures and checklists; ✓

B. Assignments and responsibilities of dive team members; ✓

C. Equipment certifications, procedures, and inspection checklists;

(1) Equipment modifications, repairs, tests, calibrations, or maintenance shall be recorded by means of a tagging or logging system, and include the date and nature of work performed and the name of the individual performing the work. (30.E.01)

(2) Compressors shall be of sufficient capacity to overcome any line loss or other losses and deliver a minimum 4.5 cfm (2.1 L/s (actual) to each diver at the maximum diving depth. (30.E.03) N/A

(3) Air compressor intakes shall be located away from areas containing exhaust or other contaminants. Compressors shall be designed specifically for their intended use and shall be equipped with an approved regulator, suitable in-line air purifying Sorbent beds and filters inserted into the supply line to assure breathing air quality. Oil lubricated compressors shall be equipped with high-temperature, equipment failure, and carbon monoxide continuous monitoring alarm systems. All alarm systems shall be so designed that the dive supervisor will be made aware of the hazardous conditions. All systems will be calibrated daily or before use if not used daily. A record of the results of the testing shall be maintained. (Alarms shall be of a type specifically designed for use in line with oil-lubricated compressors.) (30.E.04) N/A

(4) Air compressor systems, both high pressure (SCUBA) and low pressure (surface supplied) will be tested by an accredited testing laboratory for air purity on a six-month basis by means of sampling at the connection to the distribution system. Purchased air

will also be tested and certified. (30.E.05) USACE Comment: Recommend including air certifications prior to diving.

Response: Agreed. Air certifications will be obtained and included prior to diving.

a. A copy of the certificate of analysis showing the breathing air meets the minimum acceptable criteria shall be provided to the designated authority.
b. Air purity standards are as follows:
(1) Air shall not contain a level of carbon monoxide greater than 20 ppm:
(2) Air shall not contain a level of carbon dioxide greater than 1,000 ppm;

(3) Air shall not contain a level of oil mist greater than 5 milligrams per cubic meter (Mg/M3);
(4) Air shall not contain a level of hydrocarbons other than methane greater than 25 ppm; and
(5) Air shall not contain a noxious or pronounced odor.

(5) Breathing supply hoses. (30.E.06) N/A
a. Breathing air supply hoses shall meet the specifications listed in SAE 1 00-R-3, have a working pressure of the total breathing gas system, and have a rated bursting pressure at least four times the working pressure.
b. Breathing air supply hoses shall have connectors made of corrosion resistant materials and have a working pressure at least equal to the working pressure of the hose to which they are attached: connectors must not be able to become accidentally disengaged.
c. Umbilicals shall be marked in 10 ft (3 m) increments to 100 ft (30.5 m) (beginning at the divers end) and in 50 ft (15.2 m) increments thereafter.
d. Umbilicals shall have a nominal breaking strength of 2650 lb (1202 kg) and shall be made of kink resistant materials.
e. A safety line of at least 3/8 in (0.9 cm) synthetic material shall be included as an integral part of each umbilical.
f. Hoses must be tested at least annually to 1.5 times the working pressure.
g. When hoses are not in use, their open ends must be closed by taping or other means.

E. Requirements for inspections;

F. A complete copy of OSHA, 29 CFR 1910, Subpart T, and the Contractor's proposed method of complying with each of it's pertinent parts; ✓

G. U.S. Navy Standard Air Decompression Table; ✓

H. A sample of the diving-log sheets to be used under the contract; ✓
(1). For each diver and dive, the following dive log information, as a minimum, shall be recorded and maintained at the dive location: (30.A.25)

a. Full name,
b. Date and location of dive,
c. Maximum depth and bottom time,
d. Surface interval between dives,
e. Breathing medium and type of equipment used,
f. Group classification at the beginning and end of each interval,
g. Water and ambient air temperature,
h. Depth(s) and duration(s) of any decompression stops, and
i. Date and time of last previous dive.

I. A sample of the repetitive dive worksheets or equivalent (dive profile method) to be used under the contract; ✓

J. U.S. Navy Table of No-Decompression Limits and Repetitive Group Designation for No-Decompression Air Dives; ✓

K. U.S. Navy Residual Nitrogen Timetables for Repetitive Air Dives; ✓

APPENDIX F

SCUBA Operation Quality Assurance Checklist

DDFSCUBA

If for any reason the dive mission is altered, the Contracting Officer shall be contacted by the dive inspector or the dive supervisor and a revised dive plan will be reviewed and accepted by the DDC prior to continuing the operation. This review may be conducted electronically and confirmed in writing after completion of the dive operation. (30.A.23)

A. General Checks

Does the dive supervisor have the following documents that have been accepted by the DDC on the dive site? (30.A.14, 30.A.15, 30.A.16)

a. Safe Practices Manual	Yes	No
b. Dive Operations Plan.	Yes	No
c. Activities Hazards Analysis.	Yes	No
d. Emergency Management Plan.	Yes	No
e. Dive Personnel Qualifications.	Yes	No
f. Breathing Air Certification. (30.E.05)	Yes	No

B. Dive Team Members Checks

1. Are the dive team members the same personnel specified in the accepted Dive Operation Plan? (30.A.17) Yes No

2. Does the dive team meet the minimum manning levels as required in 385-1-1, Appendix O? (30.B.02) Yes No

3. Does each dive team member have the following:

a. CPR certification. (30.A.09)	Yes	No
b. First aid certification. (30.A.09)	Yes	No
c. Emergency oxygen systems certifications. (30.A.09)	Yes	No
d. Licensed physician letter certifying fitness. (30.A.10)	Yes	No
e. Diver training documentation. (30.A.06, 30.A.07)	Yes	No

C. Equipment Checks

1. Does each diver have the following equipment? (30. B.03)
   a. A tank with a minimum of 90 cf of air and a regulator. Yes No
   b. A bailout bottle with a minimum of 30 cf of air and regulator.
   Yes No
   c. A buoyancy compensation device (BCD). Yes No
   d. A submersible cylinder pressure gauge capable of being monitored by the diver during the dive. Yes No
   e. A weight belt or assembly capable of quick release. Yes No
   f. A depth gauge and knife. Yes No
   g. A watch for recording dive times. Yes No
   h. A wet suit or dry suit with gloves and booties, if in cold water or other environmental hazards exist. (05.A.01) N/A Yes No
   i. A safety harness with the following: (also 30.E.10)
      (1). A positive buckling devise.
      (2) Attachment point for the safety line.
      (3) A lifting point that keep the divers head up.
      N/A Yes No

2. Does the dive supervisor have a watch? (30.B.03) Yes No

3. Does each tank and bailout bottle meet the following requirements? (30.B.03)
   a. Seamless steel or aluminum that meet DOT 3AA and DOT 3AL specifications.
   Yes No
   b. An identification symbols stamped into the shoulder of the tank.
   Yes No
   c. A hydrostatically test stamp in the shoulder of each tank, which is no older than 5 years. Yes No

4. Does the dive supervisor have certifications on all hand-held electric power tools? (30.E.13)
   N/A Yes No

D. Safety and Emergency Checks

1. Is a first-aid kit meeting the requirements of Section 3 of 385-1-1 on the dive site? (30.E.11, 30.A.27c) Yes No
2. Is an oxygen resuscitation system capable of delivering oxygen for a minimum of 30 minutes on the dive site? (30.E.11, 30.A.27c) Yes No

3. Is a stokes lifter or backboard, with attached floatation device on the dive site? (30.E.11, 30.A.27c) Yes No

4. Are both dive flags, international alpha code and recreational with minimum dimension of 23 inches square, displayed at least 3 feet above the water? (30.E.12, 30.A.27b) Yes No

E. Pre-Dive Actions Checks

1. Did the dive supervisor conduct a pre-dive conference with all the dive team present? (30.A.20) Yes No

2. Was a responsible employee of the floating plant or facility present at the pre-dive conference? (30.A.24) N/A Yes No

3. Were the following discussed as a minimum? (30.A.21)
   - a. The mission or scope of work. Yes No
   - b. The location. Yes No
   - c. Drawings and/or photographs. N/A Yes No
   - d. Equipment and materials that are to be installed as part of the mission. N/A Yes No
   - e. Diving apparatus/equipment and craft to be used. Yes No
   - f. Diving procedures. (30a27) Yes No
   - g. Maximum working depth with estimated bottom times. Yes No
   - h. Water temperatures. (also 30.A.27) Yes No
   - i. Water velocity, currents. (30.A.27) Yes No
   - j Visibility (30.A.27) Yes No
   - k. Names and duties of personnel on the dive team. Yes No

4. Was the Activities Hazards Analysis discussed? (30.A.21, 30.A27) Yes No

5. Was the Emergency Management Plan discussed? (30.A.21, 30A.27) Yes No

6. Were the following pre-dive checks performed? (30.A.27)
   - a. All tanks and bailout bottles have a minimum of 90% pressure capacity. Yes No
   - b. Lockout/tagout procedures discussed and followed. Yes No
   - c. Crane signals or radio communication with the crane operator are reviewed. N/A Yes No

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d. Welding or cutting procedures are reviewed. N/A Yes No

e. Blasting procedures are clearly reviewed. N/a Yes No

f. All diving equipment was checked for proper function prior to diver entry. Yes No

7. Do the dive logs on site contain the following information? (30.A.25)

a. Full name,
b. Date and location of dive,
d. Maximum depth and bottom time,
d. Surface interval between dives,
e. Breathing medium and type of equipment used,
f. Group classification at the beginning and end of each interval,
g. Water and ambient air temperature,
h. Depth(s) and duration(s) of any decompression stops, and
i Date and time of last previous dive.

NOTE: . A standby diver will be dressed out and readily available when a diver is in the water (the standby diver may remove his or her head gear after it is tested for proper operation) (30.B.02)

F. Post Dive Actions Checks

1. Did the dive supervisor have a dive team debriefing that covered the following as a minimum? (30.A.22)

a. The location of the nearest recompression chamber (if not located on site)? (30.A.22)

Yes No

b. A discussion of post dive activities including repetitive dives and flying? (30.A.22, 30.A.11) Yes No

Note: Divers will wait at least 12 hours before flying after any dive: this interval should be extended to 24 hours following multiple days of repetitive dives. (30.A.11)

2. If decompression sickness and/or pulmonary barotraumas is suspected or symptoms are evident, were the following recorded and maintained? (30.A.26)

a. Descriptions of signs and symptoms (including depth and time of onset);

Yes No

b. Description and results of treatment; and Yes No

c. Name, address, and phone number of attending physician. Yes No

3. Were copies of the Diving Operations Plan, AHA, Emergency Management Plan, and dive logs submitted to the DDC and placed in the project file? (30.A.28, 30.A.15)
Yes No

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IF THE ANSWER TO ANY OF THE ABOVE QUESTIONS IS *NO*, SUSPEND THE DIVE OPERATION AND RESOLVE THE ISSUE.

Dive Inspector ______________________________ **Date**______________

Project ____

Diving Contractor ______________________________ W912HP-______--_____--____________

Pre-dive Meeting Minutes: ____

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Dive team Debriefing Minutes____

F-5

U. S. ARMY ENGINEERING AND SUPPORT CENTER - HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT Congaree River Project, SC CN: N/A SD: N/A

☐ SITE DEV & GEO
☐ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL
☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS
☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS
☐ SYSTEMS ENG
☐ VALUE ENG
■ OTHER

REVIEW Final ESS
DATE 4/10/2015
NAME A Nore/CEHNC-EDS-O/256-895-1777

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.	General	I have reviewed the ESS, and have no further comments.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

U. S. ARMY ENGINEER DIVISION HUNTSVILLE

DESIGN REVIEW COMMENTS

PROJECT: ESS for MEC Clearance and Support, Congaree River Project, Columbia, South Carolina

CORPS OF ENGINEERS

Tasker 11-097-14

- ☐ SITE DEV & GEO
- ☐ ENVIR PROT& UTIL
- ☐ ARCHITECTURAL
- ☐ STRUCTURAL
- ☐ MECHANICAL
- ☐ MFG TECHNOLOGY
- ☐ ELECTRICAL
- ☐ INST & CONTROLS
- ■ OE SAFETY
- ☐ ADV TECH
- ☐ ESTIMATING
- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

Review: Back check Draft ESS

Date: 30 Nov 2014

Name: Brian D. McComas 256.689.0462

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		On 19 Nov 2014, I was assign to review the Back Check of the contractor comments of the Draft Explosive Safety Submission (ESS) for the Congeree River Project, Columbia, SC. After reviewing the contractors comments and the revised ESS, now dated November 2014 I have the following comments:	
1.	Previous Isadore comments	These comments have been adequately addressed and no further response is needed.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEERING AND SUPPORT CENTER - HUNTSVILLE

CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT Congaree River, SC CN: 01-010-15 SD: 16 January 2015

☐ SITE DEV & GEO
☐ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL
☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS
☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS
☐ SYSTEMS ENG
☐ VALUE ENG
■ OTHER

REVIEW Backcheck 2 Draft Final WP
DATE 1/6/15
NAME A Nore/CEHNC-EDS-O/256-895-1777

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.	General	I have reviewed the Draft Final of the Work Plan, and have no further comments.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

U. S. ARMY ENGINEER DIVISION HUNTSVILLE

DESIGN REVIEW COMMENTS

PROJECT Munitions Response MEC Clearance and Support
Congaree River Project

CORPS OF ENGINEERS
Tasker 01-010-15

☐ SITE DEV & GEO ☐ MECHANICAL ■ OE SAFETY ☐ SYSTEMS ENG
☐ ENVIR PROT& UTIL ☐ MFG TECHNOLOGY ☐ ADV TECH ☐ VALUE ENG
☐ ARCHITECTURAL ☐ ELECTRICAL ☐ ESTIMATING ☐ OTHER
☐ STRUCTURAL ☐ INST & CONTROLS ☐ SPECIFICATIONS

Review: Back Check Draft Work Plan
Date: 8 Jan 2015
Name: Brian D. McComas 256-895-8236

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		On 7 Jan 2015, I was assigned to review the Back Check of the contractor's comments of the Draft Work Plan for the Congeree River Project, Columbia SC, dated November 2014. I reviewed the contractor's comments and the revised Draft Work Plan, in accordance with (IAW) WERS-001.01 as stated in the approved statement of work. After reviewing the revised Draft Work Plan, now dated December 2014. I have the following comments:	
1	McComas previous comments # 2, 3, and 4	These comments were adequately addressed and no further response is needed.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

U. S. ARMY ENGINEERING AND SUPPORT CENTER – HUNTSVILLE | CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS | PROJECT: CN: 01-010-15 | NAME: **Congaree River, Columbus, SC** | SD: 16-JAN-15

☐ SITE DEV & GEO
■ ENVIR PROT& UTIL
☐ ARCHITECTURAL
☐ STRUCTURAL
☐ MECHANICAL
☐ MFG TECHNOLOGY
☐ ELECTRICAL
☐ INST & CONTROLS
☐ SAFETY
☐ ADV TECH
☐ ESTIMATING
☐ SPECIFICATIONS
☐ SYSTEMS ENG
☐ VALUE ENG
☐ OTHER

REVIEW: Revised DRAFT-FINAL Work Plan
DATE: January 14, 2015
NAME: Michael D'Auben / 256-895-1460

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1	General	After review of the revised work plan and associated documentation, no further issues requiring revision or correction were identified.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

U. S. ARMY ENGINEER DIVISION HUNTSVILLE | CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT EOTI Congeree CN 11-096-14

- ☐ SITE DEV & GEO
- ☐ ENVIR PROT& UTIL
- ☐ ARCHITECTURAL
- ☐ STRUCTURAL
- ☐ MECHANICAL
- ☐ MFG TECHNOLOGY
- ☐ ELECTRICAL
- ☐ INST & CONTROLS
- ■ SAFETY
- ☐ ADV TECH
- ☐ ESTIMATING
- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW APP back check
DATE 1 December 2014
NAME Greg Bayuga / SO / 256-895-5292

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
1.	General	The USAESCH Safety Office has reviewed EOTI's Congeree River Project dated November 2014 and finds the responses to my previous comments acceptable. APP is accepted.	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

CEHND FORM 7 (Revised)
15 Apr 89

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

U. S. ARMY ENGINEER DIVISION HUNTSVILLE — CORPS OF ENGINEERS

DESIGN REVIEW COMMENTS

PROJECT: Congeree River Project; CN: 01-101-15; S: 16 January 15

- ■ SITE DEV & GEO
- ☐ ENVIR PROT& UTIL
- ☐ ARCHITECTURAL
- ☐ STRUCTURAL
- ☐ MECHANICAL
- ☐ MFG TECHNOLOGY
- ☐ ELECTRICAL
- ☐ INST & CONTROLS
- ☐ SAFETY
- ☐ ADV TECH
- ☐ ESTIMATING
- ☐ SPECIFICATIONS
- ☐ SYSTEMS ENG
- ☐ VALUE ENG
- ☐ OTHER

REVIEW: Draft Final Work Plan
DATE: 14 January 15
NAME: D. Edwards/256-895-1626; EDC-G

ITEM	DRAWING NO. OR REFERENCE	COMMENT	ACTION
		The following comments are on the RTCs and the incorporation of comments into the Draft Final Work Plan:	
1.	2.14	Response to previous comment #1 is accepted, however, recommend that typo is corrected. In the second-to-last sentence, please change "… to approximately 4. feetThe …" to "… to approximately 4 feet. The …"	
		- End of Comments -	

ACTION CODES
A - ACCEPTED/CONCUR
D - ACTION DEFERRED
W - WITHDRAWN
N - NON-CONCUR
VE - VE POTENTIAL/VEP ATTACHED

ATTACHMENT C

PHASE I – FIELD DEMONSTRATION PROJECT WORK PLAN

PHASE I - FIELD DEMONSTRATION PROJECT WORK PLAN

CONGAREE RIVER SEDIMENTS
SOUTH CAROLINA ELECTRIC & GAS COMPANY
COLUMBIA, SOUTH CAROLINA

June 2015

Prepared for:

SCANA Services, Inc.
220 Operation Way
Cayce, South Carolina 29033

Prepared by:

Apex Companies, LLC
1600 Commerce Circle
Trafford, Pennsylvania 15085

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

This Field Demonstration Project (FDP) Work Plan was prepared by South Carolina Electric & Gas Company (SCE&G) to provide additional details pertaining to a proposed Unexploded Ordnance (UXO) removal project located adjacent to the Congaree River in Columbia, SC. The general project area is shown on Figure 1. The FDP is the first phase of a two-phase project currently planned to address a tar-like material (TLM) that is commingled with sediment within the Congaree River downstream of the Gervais Street Bridge. The proposed phases consist of:

- Phase 1 - Field Demonstration Project (Phase 1 - FDP), described in this work plan; and
- Phase 2 - Modified Removal Action (Phase 2 – MRA), (plans to address sediment removal work from within the river and to be finalized and submitted following completion of Phase 1).

A cultural resource identification survey (CRIS) was conducted by TRC and is provided as Attachment D in the PCN. The CRIS covered the overall planned project area and the general vicinity including the Gervais Street Bridge and former Columbia Canal. In addition, potential historical sites were researched using ArchSite, which is a geographic information system (GIS) maintained by the State Historic Preservation Office (SHPO), and South Carolina Institute of Archeology and Anthropology (SCIAA). The CRIS identified a number of archeological sites located in the vicinity of the planned FDP area. These areas are shown on Figure 7 of the PCN.

The Civil War era dump site (site ID: 38RD286) located in the river where the TLM exists is of primary concern for the FDP and the overall sediment removal project. Concerns for safety attributed to the items that may be encountered from or within this historic dump site (i.e., unexploded ordnance [UXO]) have been a driving factor for planning and implementing this project.

Therefore, because the TLM-impacted sediment within the Congaree River has the potential to also contain UXO, the primary purpose of this FDP is to implement, evaluate and improve [if necessary] the UXO management plans on “dry-land” (adjacent to the planned TLM removal area) prior to implementation of the sediment removal action. As proposed, the Phase 1 – FDP project will be conducted in the location referred to as the “alluvial fan” area, situated at the end of the Senate Street Extension, as shown on Figures 2 and 3. This Work Plan will provide a brief overview of the project background information and the general plan for support activities for completion of the FDP.

1.1 Background Information

The South Carolina Department of Health and Environmental Control (SCDHEC) and SCE&G have completed a great deal of work for the Congaree River Sediment Project and a significant amount of background information and reports are available within the administrative record, which is maintained by SCDHEC (http://www.scdhec.gov/environment/CongareeRiver/index.asp). The following is a brief description of the overall project.

Figure 1 provides the location of the Huger St., former Manufactured Gas Plant (MGP) site and a general outline of the planned FDP area. Conceptually, TLM (also referred to as coal tar) was released from the former MGP site, migrated via an open drainage ditch and was deposited within the Congaree River over a long period of time. The Huger St. MGP operated from the early 1900’s until the mid-1950s and it is presumed that most of the coal tar likely migrated to the river during the operational period of the plant. Since the coal tar was likely deposited over 50 to 100 years ago and has been submerged within the river, the coal tar has undergone significant weathering, and therefore, it is referred to as a “tar-like material” (TLM). Based on the previously submitted delineation work, the extent of the TLM in the river has been defined. Following completion of the delineation activities and development of preliminary designs for several remedial alternatives, SCDHEC more recently directed SCE&G to proceed with revising the previously submitted plans to implement a “targeted” or Modified Removal Action (MRA) to address impacted sediment within the Congaree River.

1.2 FDP Purpose

Due to the potential presence of UXO, a reconnaissance and screening of the project area was conducted prior to implementing the sediment investigative activities. The magnetometer survey work was conducted by Tidewater Atlantic Research, Inc. (Tidewater) of Washington, North Carolina. In summary, a total of 570 magnetic anomalies were detected within the study area, with 425 of these anomalies exhibiting **“*signature characteristics that could be associated with ordnance*”**. As shown on Figure 4, a total of approximately 74 metal anomalies are located within the proposed FDP boundary.

The potential for encountering metal anomalies that are, in fact UXOs, presents a significant physical hazard to removing the TLM from the river. Also, there is a very real possibility that there could exist more metal anomalies/UXOs than currently identified. Therefore, SCE&G believes that the “readily” accessible metal anomalies that currently exist within the alluvial fan area must be properly addressed prior to initiating any impacted sediment removal work within the river. The information obtained during the FDP will also likely increase the safety and efficiency of the Phase 2 removal effort.

Completion of the FDP will provide the project team and the regulatory agencies with valuable insight into the actual risks associated with the UXO management activities. Completion of the FDP will also result in “clearing” the alluvial fan area of potentially hazardous UXO, which will facilitate the primary access way into the river for the full-scale sediment MRA.

1.3 FDP Area Description

The FDP will be conducted within a small area of the “alluvial fan” as shown on Figures 2 and 3. The alluvial fan is a relatively flat portion of the project area that appears to have developed over time via sediment accumulation occurring as a result of erosion from urban landside activities and from depositional forces within the fluctuating river environment (during higher water level events). “Dry land” also referred to as the “landside” is defined as the alluvial fan area that extends from the edge of the low water level eastward to the normal high-water mark. The proposed FDP area is exposed and accessible during normal (lower) river levels, as seen on the photographic summaries provided as Figures 5 and 6. The precise area to be screened during the FDP will be determined in the field and will be largely dependent upon river conditions (water height), the weather forecast and shoreline characteristics at the time of implementation.

Due to its proximity to the river’s edge, the alluvial fan is submerged during high water events. Overall, the alluvial fan is approximately 650 feet long and 110 feet wide at its widest point (during normal river water levels). The sediment/soil thickness within the planned FDP area (a smaller area within the alluvial fan area) ranges from approximately 6 feet near the water's edge to approximately 10 feet at the furthest inland (eastern) point. Attachment A provides a number of geologic cross-sections that conceptually illustrate the subsurface characteristics of the alluvial fan.

Within the alluvial fan area, there were approximately 14 borings completed during the project delineation phase as shown on Figure 3. It is important to note that there were no TLM related impacts observed within the proposed FDP area. As a result, TLM is not expected to be encountered during completion of the FDP. However, if TLM is encountered it will be properly managed for disposal by SCE&G.

1.4 Access to the FDP Area

Access to the river in this area is provided by a semi-paved, asphalt road, which extends from the intersection of Senate and Gist Streets. The access road then transitions into a gravel ramp near the river's edge. It should also be noted that the toe of slope for the boat ramp is in need of improvements or repairs due to the effects of erosion. The repairs are to be completed as part of this scope of work.

A locked gate, adjacent to Gist Street, restricts vehicular access to the access road and the boat ramp area. The land between Gist Street and the river is private property, except for a public parking area that is located to the east, near the Gist and Senate Streets intersection. SCE&G also maintains a utility right-of-way in the project area, which will be used as a lay-down area. The easy access to the river results in significant public use of the area for fishing, swimming and a place to launch personal watercraft.

2.0 FIELD DEMONSTRATION PROJECT

The primary purpose of the FDP is to implement, evaluate and improve (if necessary) the UXO management plans on "dry-land", before expanding the work into the river. SCE&G and its consultants have been working with various offices of the USACE – (i.e., Huntsville, Alabama, Charleston, SC, etc.) to develop the appropriate plans and procedures to address the UXO issues. In summary, the following plans have been developed by Explosive Ordnance Technologies, Inc. (EOTI) to be consistent with the same level of expertise and scrutiny as a typical military operation to address UXOs. These plans have been reviewed and approved by the appropriate USACE UXO personnel and are included within the Pre Construction Notification (PCN) for this FDP. The approved UXO management plans will address metal anomalies in both the FDP and MRA areas and include:

- Draft Final Work Plan for Munitions Response Removal Action and Construction Support;
- Explosives Safety Submission Munitions and Explosives of Concern Removal Action and Construction Support;
- Diving Operations Plan; and
- Diving Safe Practices Manual.

The FDP basically entails screening the approximate alluvial fan area for the presence of metallic anomalies. A qualified UXO contractor (EOTI) will conduct the screening, removal and UXO management activities. All work will be completed in accordance with the approved plans referenced above. The USACE UXO team will also provide full-time oversight personnel during implementation of the FDP.

Obviously, safely managing the metallic anomalies (potential UXOs) takes precedence, but additional support components necessary for completing the FDP are required and described below. The overall approach is meant to be flexible to allow for field personnel to adapt to changing conditions.

For the FDP Work Plan purposes, the unearthed metallic anomalies will likely fall into one of the three categories listed below (and will be handled accordingly):

- Potentially hazardous unexploded ordinance (UXO);
- Historically significant items or artifacts; or
- Other, inert metallic debris.

To briefly summarize the process, after a metal anomaly has been determined to be safe to move by the UXO experts, it will be evaluated by the on-site archeologist and eventually transferred to SCIAA or SHPO, as applicable in accordance with the approved Archaeological Data Recovery Plan, TLM-impacted material or other recovered debris will be properly disposed of by SCE&G.

2.1.1 Health and Safety

As with any SCE&G field project, the health and safety of the field personnel and the local residents will be of paramount importance. UXO disposal experts will be utilized for conducting the screening and metallic anomaly identification and removal operations in accordance with their USACE approved plans.

Previous investigative activities did not identify any TLM in the planned FDP area, however the potential for encountering TLM does exist. In addition to the requirements set forth in the UXO management plans, the UXO contractor personnel will be properly trained in accordance with 40 CFR 1910.120 (HAZWOPER) requirements.

The Health and Safety Plan (HASP) for the Huger Street MGP site has been revised to include specific details relating to working in or near the river and was utilized by investigative personnel to safely complete the sediment investigation work. The HASP contains detailed information regarding the constituents of concern in addition to Safety Data Sheets (SDSs) for constituents that remediation workers may potentially be exposed to during intrusive activities at the site. The HASP also includes emergency response procedures to be implemented by field personnel in the event of an emergency situation at the site. As currently planned, air monitoring activities, as set forth in the HASP, will not be performed during the implementation of the FDP, because the area will be an exclusion zone limited to essential UXO personnel only and the presumed absence of TLM. In the unlikely event that TLM is encountered during the FDP, the need for air monitoring and any upgrades to personal protective equipment will be re-evaluated by environmental personnel.

2.1.2 Site Preparation and Security

The currently anticipated site operations plan scenario is shown on Figure 4. SCE&G and/or its consultants reserve the opportunity to adjust, relocate, and/or improve any of the elements discussed in this section, based on site conditions encountered and future planning discussions with the referenced project personnel.

Security fencing installation will be a vital component of this project because it will restrict the unauthorized or unknowing entry of third parties onto the site from the landside. This is especially important because the area is currently regularly utilized by the public for fishing, boating and swimming purposes. As currently envisioned, a chain link fence at least 6 feet in height with a security screen (visual barrier) will be installed at the approximate location shown on Figure 4. Other support and staging areas located further inland may also be fenced, as may be required. The fence will be equipped with gates or the temporary panels will be moved aside to permit personnel and equipment access. The gates or panels will remain locked during non-working hours and guarded while excavation operations are taking place. The appropriate signage will be affixed to the fence to communicate that access to the area is restricted to authorized personnel only.

City of Columbia police officers will be utilized to provide around-the-clock site security during the actual UXO work.

Two job trailers with electrical connections are currently planned to provide an area for shelter, meetings etc., and may potentially be used to further evaluate any recovered items. Temporary sanitary facilities will also be provided. Roll-off boxes will be staged on-site to store any debris or impacted sediment, if encountered. Frac tanks or other similar tanks, dewatering bags and pumps/hoses will be staged on-site as part of the water management plan detailed in Section 2.1.7. The trailer, roll-offs, water tanks and other equipment will likely be placed/staged in or near the utility right-of-way area shown on Figure 4. Use of this flat, previously graded and regularly mowed area will negate the need to conduct substantial clearing or other earth disturbing activities in support of the project. It is SCE&Gs intent to keep land disturbance activities to a minimum for this project.

Improvement (removing fallen trees and debris) of the access road that leads to the alluvial fan area will be required. Stone fill will also be placed at the end of the asphalt road extension to address previous erosion issues and facilitate access to the project area.

2.1.3 Survey

A licensed South Carolina surveyor will be employed to re-establish the previously identified anomaly locations shown on Figure 4 in the field based on coordinates provided by the geophysical contractor. Pin flags or stakes will be utilized to mark the locations and the corresponding anomaly number will be written on the stake or pin flag. [The UXO contractor will conduct a new and independent screening operation within the footprint of the FDP and the alluvial fan area.] However, marking the original locations will help correlate previously collected data with the findings of the FDP. This information will be useful in developing plans and evaluating potential anomalies during planning and implementation of the Phase 2 - MRA project.

2.1.4 Field Screening and Metallic Anomaly Identification and Management

Once the support zone, security components, access road improvements and water management system are in place, the UXO contractor will mobilize personnel and equipment to the area and begin preparations for the screening of the alluvial fan in accordance with USACE-approved plans and procedures. As envisioned, USACE UXO personnel will also be on-site providing oversight while the field work is being completed.

“Screening”, defined in simple terms, consists of evaluating an area using approved equipment such as a metal detector, etc. to determine the presence of a metal anomaly and carefully exposing the anomaly to ascertain its hazard potential and determining/rendering the object safe to move (i.e., the “mag and dig” approach). The UXO management plans attached to the PCN contain much more detail than this simplified summary. By design, SCE&G’s approach to addressing the potential UXO issue is identical to how experts in the UXO field and at the USACE would conduct the work.

The sediment thickness within the planned FDP area ranges from approximately 2-10 feet before the underlying bedrock is encountered. FDP screening activities are expected to extend to the underlying bedrock. Depending on the screening depth capability of the specific equipment utilized by the UXO contractor, excavation will occur in lifts (with a thickness to be determined) down to the bedrock. The carefully excavated material will be temporarily set aside and replaced once the anomaly has been identified/removed. Conducting these activities efficiently in small, manageable areas will reduce the potential for water intrusion into the excavations. Hand tools will likely be used initially and depending on the depth, a small excavator may be used.

If TLM is encountered, it will be placed in the lined roll-off boxes and transported off-site for disposal as described in Section 2.1.6. The area where the TLM was encountered will then be re-graded using surrounding material. No imported fill sand or gravel will be utilized during the FDP project other than for access improvements.

Extensive photographic and written documentation of field activities will be completed and provided in the FDP Documentation Report described in Section 2.1.9.

2.1.5 Identification and Management of UXOs or Artifacts

Each metallic object encountered will be examined by UXO and archeological personnel, and their significance with respect to safety or historical value will be determined. If a potential live explosive device is encountered, it will be managed accordingly by UXO disposal personnel. Metallic, non-UXO related items or other artifacts of potential historical value that may be recovered will be evaluated by an archeologist and eventually transferred to SCIAA or SHPO, as applicable. **AFTER THE UXO PERSONNEL HAVE DETERMINED THE RECOVERED OBJECT IS SAFE TO MOVE**. The original location of any recovered objects will be carefully documented. Approved plans for addressing artifact recovery and conservation are provided in the PCN.

It should be noted that the Archaeological Data Recovery Plan contains significant details that were envisioned at the time when it was submitted and approved and was based on the original scope of work for the Congaree River project. Since the approval date, the scope of the project has been greatly reduced to the currently envisioned Phase 2 – MRA. Although the intent and objectives of the plan will be fulfilled during execution of the FDP, the magnitude of the originally planned artifact-recovery support infrastructure will not be installed on-site for the FDP. However, the recovery and conservation work will be conducted in TRC’s conservation laboratory in Columbia, SC or other suitable off-site area, as required

2.1.6 Management and Disposal of Impacted Material

It is anticipated the majority of material evaluated from the alluvial fan area will be un-impacted (i.e., no TLM has been documented in this material). However, since the potential exists that TLM could be encountered, albeit unlikely, provisions will be in place to manage the material for proper disposal in accordance with SCDHEC-approved procedures.

Excavated material that is obviously impacted by tar or appears to contain other constituents of concern, will be containerized and transported off-site for disposal. A roll-off box or some other method for containerizing the material will be stationed nearby as a contingency measure. If the roll-off box cannot be placed near the project area, a loader or backhoe will be used to transport the material from the work area to the roll-off box.

Deleterious material generated from this project will be transported to the Richland County Landfill in Columbia, SC for disposal. For any TLM-impacted material, characterization and waste approval documentation have already been obtained from this location and the existing profiles will be utilized to dispose of investigative derived waste from the FDP activities.

2.1.7 Water Management and Excavation Dewatering

Sand bags and/or large filter socks will likely be placed at the western, (riverside) extent of the FDP project area to provide a buffer against minor river level fluctuations during completion of the project. A sand bag placement scenario is shown on Figure 4 and specifications for large sand bags is provided in Attachment B. The actual number and layout of the sandbags will be determined by field personnel at the time of implementation. Best Management Practices (BMPs) for Erosion and Sedimentation (E&S) controls will also be installed prior to starting intrusive work within the project area, as may be required.

River water or groundwater is expected to accumulate in the small excavations and require management in order to maintain visibility and suitable working conditions for the UXO management personnel. Excavation dewatering will be conducted and will likely entail use of an adequately sized pump to transfer water from the open/active work area to the adjacent landside support zone where it will be managed to remove sediment. It will be especially important to maintain a pumping and flow rate that controls the water level within the excavation during UXO investigation activities. Figure 4 provides the currently planned dewatering management scenario which includes the use of dewatering bags to filter out and collect sediment before the water is allowed to dissipate to the ground surface. As currently planned the filtered water will be allowed to infiltrate the ground surface in a vegetated area. Example specifications for the dewatering bags are provided in Attachment B

Other sediment collection and settling options may be utilized in conjunction with, or in lieu of, the dewatering bags based on the encountered conditions, the recharge volume or flow rate, and other project requirements. These options may include the use of settling tanks, such as weir tanks or frac tanks to allow for adequate residence time of the water to permit settling before being discharged to the upland vegetated ground surface. The dewatering bags or settling tanks will be cleaned out or replaced as needed to permit continued sediment filtering during completion of the project. Discharge water will be visually monitored to ensure proper sediment removal is occurring prior to discharge.

In the unlikely event that a sheen or odor is identified in excavation water, the water will be transferred directly to the frac tanks staged in the support zone. SCE&G will then conservatively manage this water via off-site disposal. The appropriate disposal facility approvals have already been secured and the disposal manifests will be included in the FDP Documentation Report, if needed.

As currently planned, the completed investigation locations will be promptly backfilled once the specific metal anomaly has been identified in order to reduce the amount of water infiltration. Collected sediment, from the dewatering bags, settling tanks or other means of containment, will be transported off-site for disposal as described in Section 2.1.6.

2.1.8 Site Restoration

Once the FDP is completed, the disturbed area will be restored, as necessary, to its original conditions. However, improvements to the boat ramp area will remain. As currently planned, the fencing, trailer and other support zone facilities will also remain in-place to be utilized during Phase 2 operations.

2.1.9 Reporting

An FDP Documentation Report will be prepared to document field activities. The report will include:

- A discussion of field activities;
- A summary of metallic anomalies identified and their final dispositions;
- A summary of the total amount of excavated material removed for off-site disposal and the associated manifests (if required);
- A figure depicting the actual extent of FDP activities and the locations of the identified objects; and
- A discussion of the findings, conclusions and/or recommendations for improving the existing work plans and approach to improve safety and/or efficiency.

3.0 PROJECT SCHEDULE

SCE&G desires to implement this FDP Work Plan in August or September due to historically favorable river condition and lower water elevations. Coordination with the appropriate project personnel is expected to take place over the next few months and details associated with this plan will likely evolve. However, site preparation activities can begin soon after the final access agreement has been executed. SCE&G anticipates that the actual UXO fieldwork will be completed within one week, depending upon the actual river conditions encountered.

FIGURES

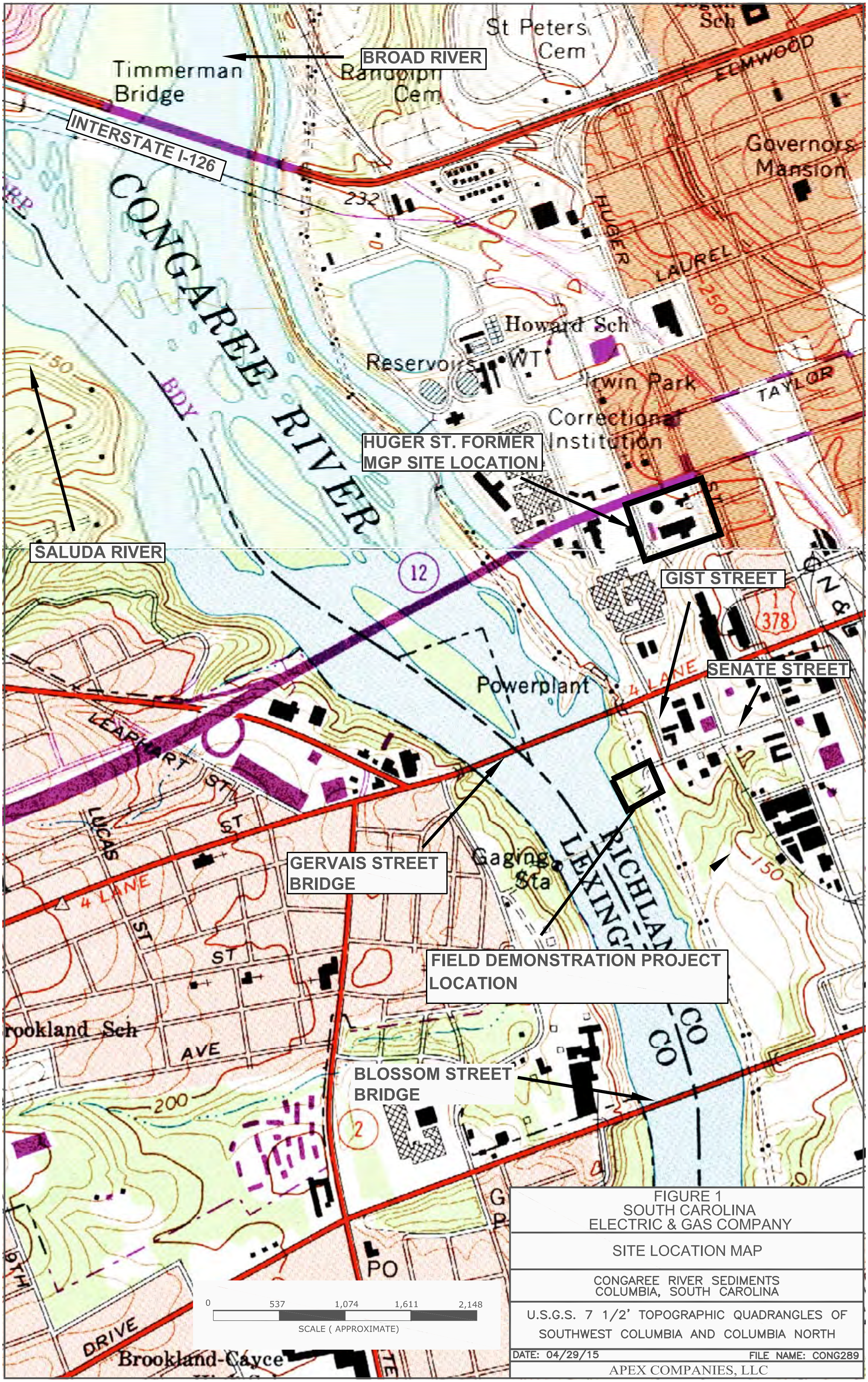

BROAD RIVER
INTERSTATE I-126
CONGAREE RIVER
SALUDA RIVER
HUGER ST. FORMER
MGP SITE LOCATION
GIST STREET
SENATE STREET
GERVAIS STREET
BRIDGE
FIELD DEMONSTRATION PROJECT
LOCATION
BLOSSOM STREET
BRIDGE
Timmerman
Bridge
St Peters
Cem
Randolph
Cem
ELMWOOD
Governors
Mansion
HUGER
LAUREL
Howard Sch
Reservoirs
WT
Irwin Park
TAYLOR
Correctional
Institution
BDY
Powerplant
4 LANE
LEAPHART
ST
LUCAS
Gaging
Sta
RICHLAND CO
LEXINGTON CO
Brookland Sch
AVE
200
150
250
232
12
378
2
PO
DRIVE
Brookland-Cayce
0
537
1,074
1,611
2,148
SCALE (APPROXIMATE)
FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
SITE LOCATION MAP
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
U.S.G.S. 7 1/2' TOPOGRAPHIC QUADRANGLES OF
SOUTHWEST COLUMBIA AND COLUMBIA NORTH
DATE: 04/29/15
FILE NAME: CONG289
APEX COMPANIES, LLC

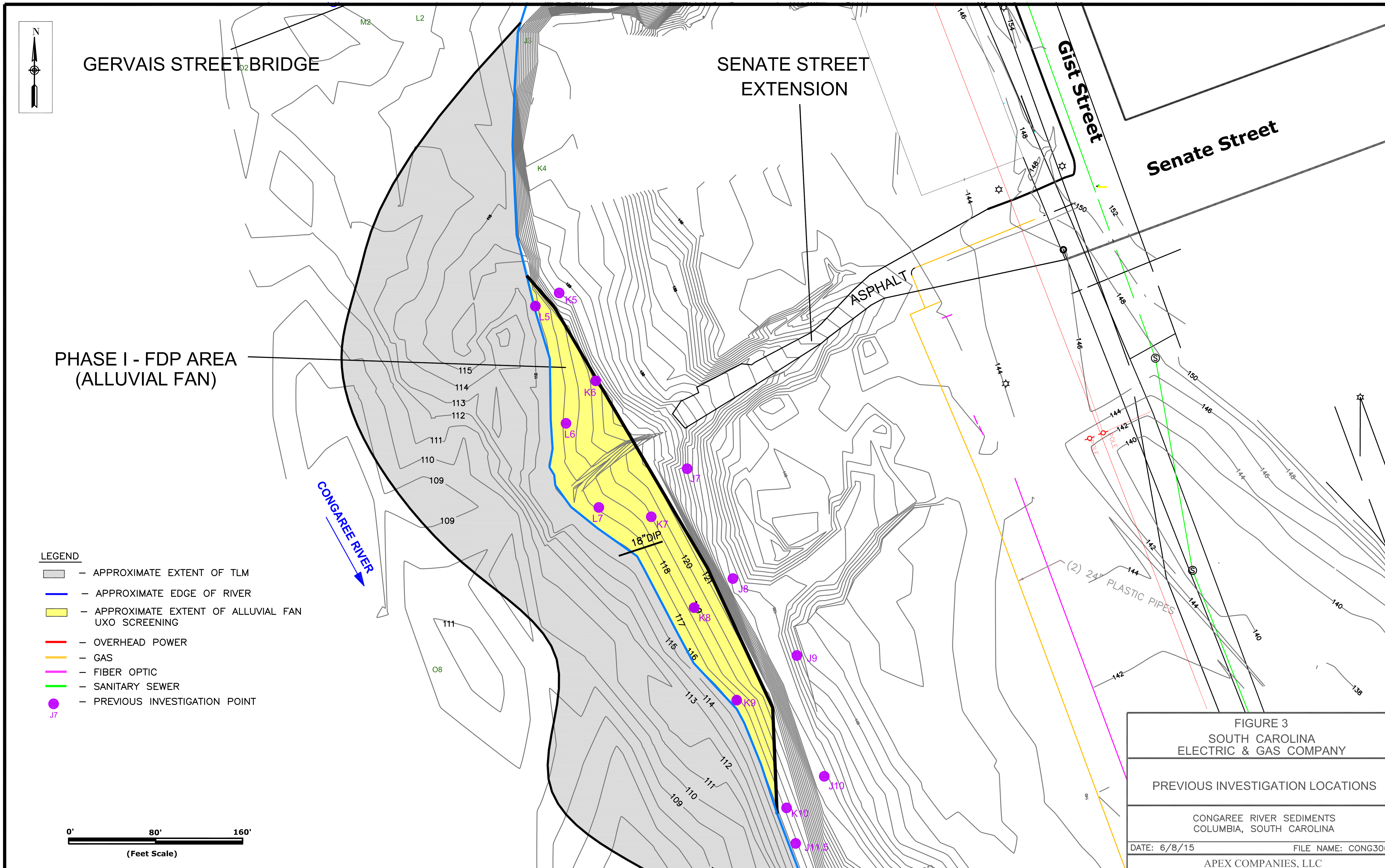
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

FIELD DEMONSTRATION
PROJECT AREA

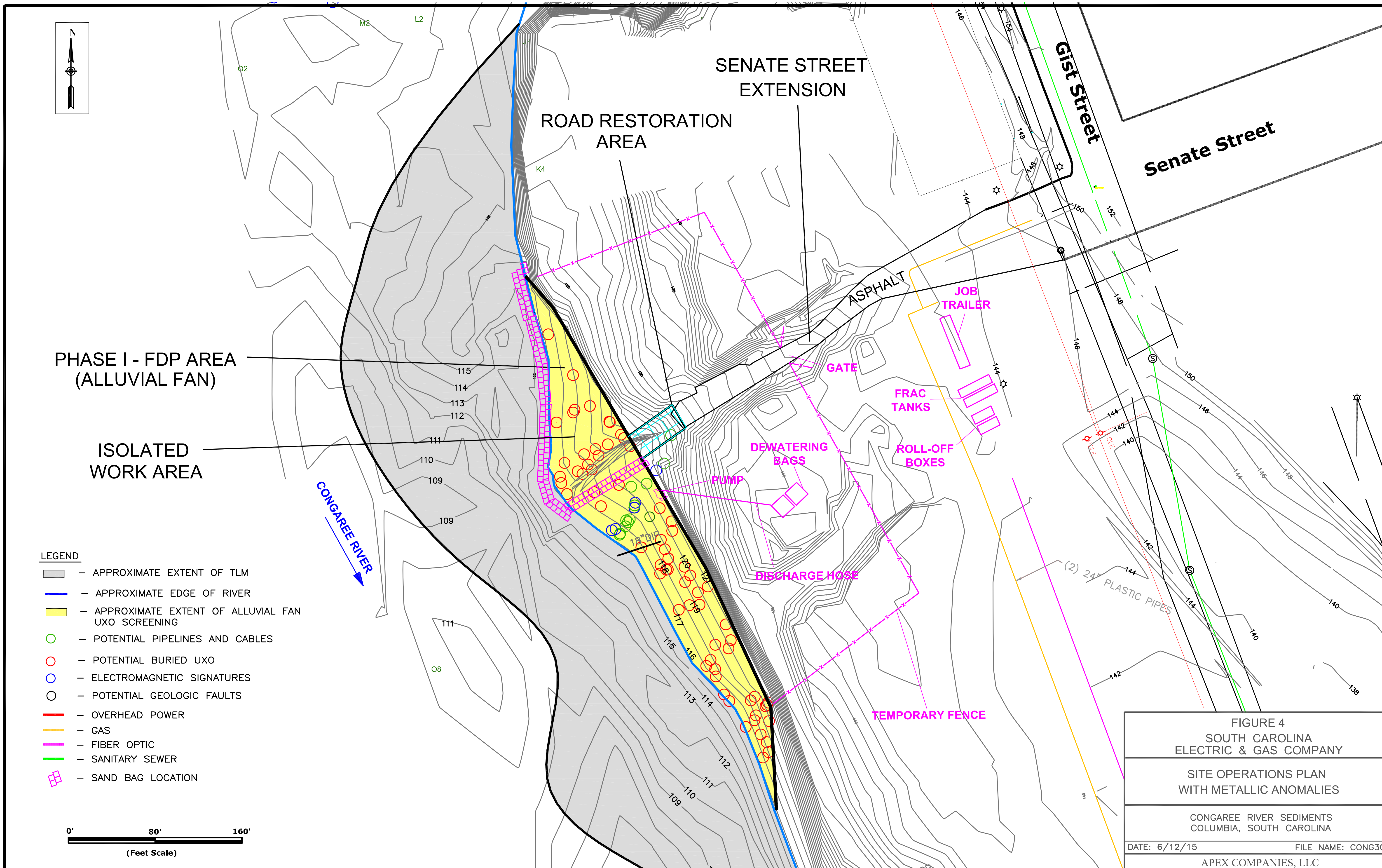
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 6/11/15 FILE NAME: CONG305

APEX COMPANIES, LLC



N
GERVAIS STREET BRIDGE
SENATE STREET
EXTENSION
Gist Street
Senate Street
ASPHALT
PHASE I - FDP AREA
(ALLUVIAL FAN)
CONGAREE RIVER
18"DIP
(2) 24" PLASTIC PIPES
K5
L5
K6
L6
J7
L7
K7
J8
K8
J9
K9
J10
K10
J11.5
LEGEND
— APPROXIMATE EXTENT OF TLM
— APPROXIMATE EDGE OF RIVER
— APPROXIMATE EXTENT OF ALLUVIAL FAN UXO SCREENING
— OVERHEAD POWER
— GAS
— FIBER OPTIC
— SANITARY SEWER
— PREVIOUS INVESTIGATION POINT
J7
0'
80'
160'
(Feet Scale)
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
PREVIOUS INVESTIGATION LOCATIONS
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/8/15
FILE NAME: CONG306
APEX COMPANIES, LLC


N
SENATE STREET
EXTENSION
ROAD RESTORATION
AREA
Gist Street
Senate Street
ASPHALT
JOB
TRAILER
GATE
FRAC
TANKS
ROLL-OFF
BOXES
DEWATERING
BAGS
PUMP
DISCHARGE HOSE
TEMPORARY FENCE
(2) 24" PLASTIC PIPES
PHASE I - FDP AREA
(ALLUVIAL FAN)
ISOLATED
WORK AREA
CONGAREE RIVER
LEGEND
– APPROXIMATE EXTENT OF TLM
– APPROXIMATE EDGE OF RIVER
– APPROXIMATE EXTENT OF ALLUVIAL FAN UXO SCREENING
– POTENTIAL PIPELINES AND CABLES
– POTENTIAL BURIED UXO
– ELECTROMAGNETIC SIGNATURES
– POTENTIAL GEOLOGIC FAULTS
– OVERHEAD POWER
– GAS
– FIBER OPTIC
– SANITARY SEWER
– SAND BAG LOCATION
0'
80'
160'
(Feet Scale)
FIGURE 4
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
SITE OPERATIONS PLAN
WITH METALLIC ANOMALIES
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA
DATE: 6/12/15
FILE NAME: CONG307
APEX COMPANIES, LLC

View of alluvial fan from Gervais Street Bridge

Close-up view of alluvial fan from Gervais Street Bridge

View of alluvial fan from end of Senate Street Extension

View of Congaree River from alluvial fan

View of Congaree River from alluvial fan

View of alluvial fan at normal river level

FIGURE 5

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SENATE STREET EXTENSION ALLUVIAL FAN PHOTO SUMMARY

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/04/15 FILE NAME: PHOTO FIG. 1

APEX COMPANIES, LLC

Senate Street Extension looking towards Gist Steet

View of proposed support area from Senate Street Extension

Senate Street Extension looking towards alluvial fan

Senate Street Extension looking towards alluvial fan
(Note tree limbs requiring removal)

End of Senate Street Extension looking towards alluvial fan and Congaree River

View of the end of Senate Street Extension from alluvial fan
(Note eroded area that will require reconstruction)

FIGURE 6

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SENATE STREET EXTENSION PHOTO SUMMARY

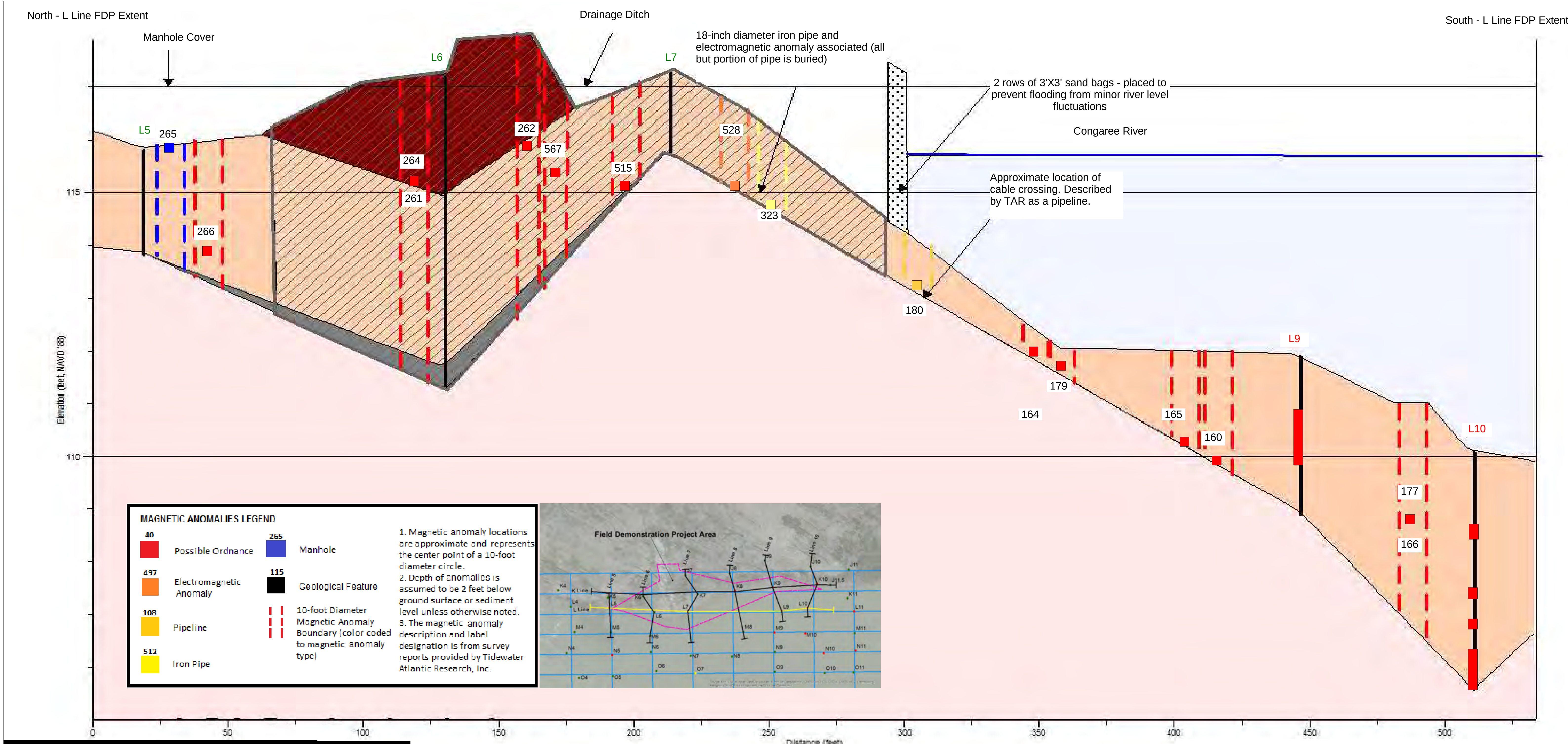
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 06/04/15 FILE NAME: PHOTO FIG. 2

APEX COMPANIES, LLC

ATTACHMENT A

ALLUVIAL FAN CONCEPTUAL CROSS-SECTIONS



PRELIMINARY DRAFT

LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:

1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "L" line and topography, bathymetry, and lithologies are approximately from and between locations L5 through L10.
4. The 0-2.3 interval at L6 is likely representative of a combination of river bank, river and shoreline lithologies, to outwash deposition from Senate Street.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 1

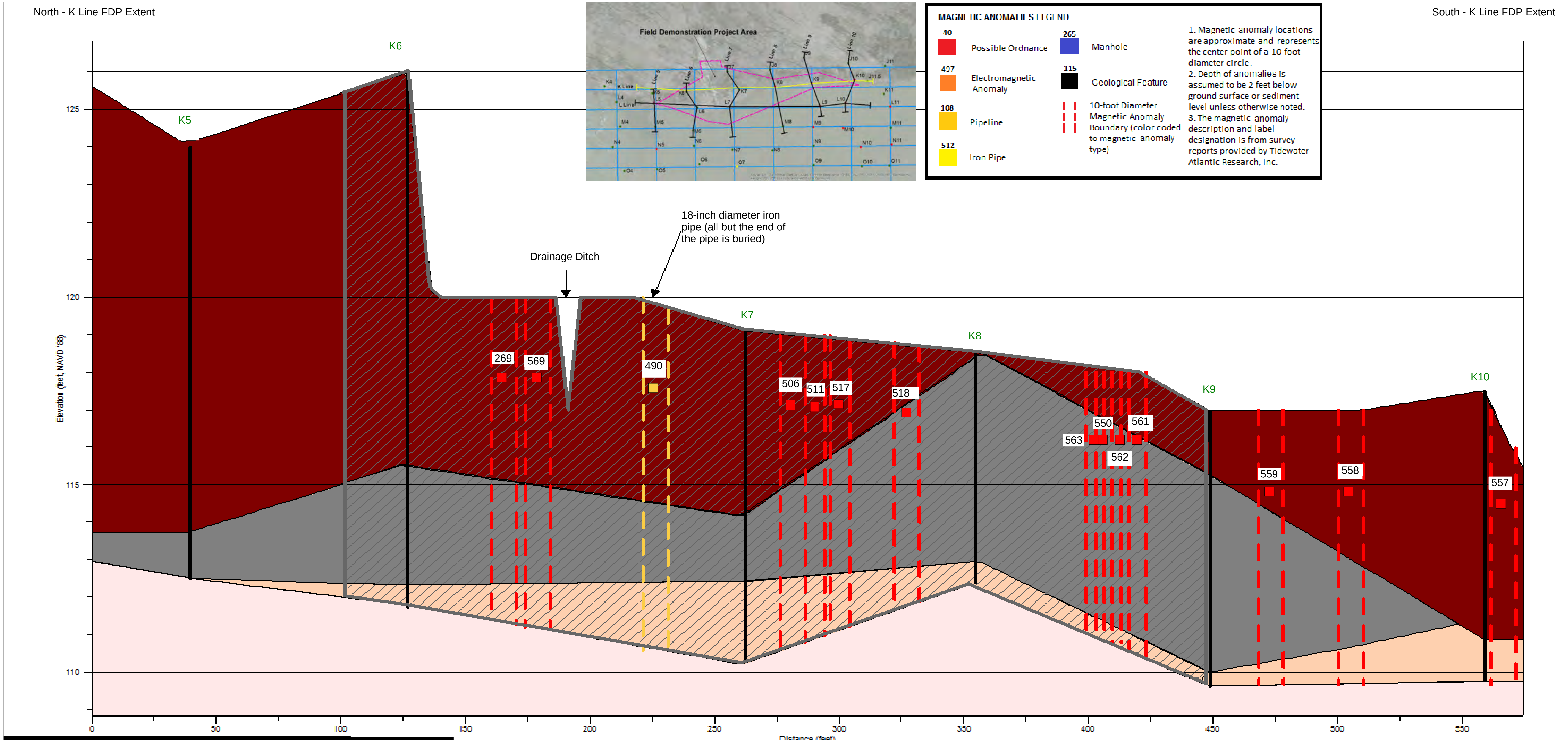
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG L, FDP EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 05/28/2015 FILE NAME: L LINE FDP

APEX COMPANIES, LLC



PRELIMINARY DRAFT

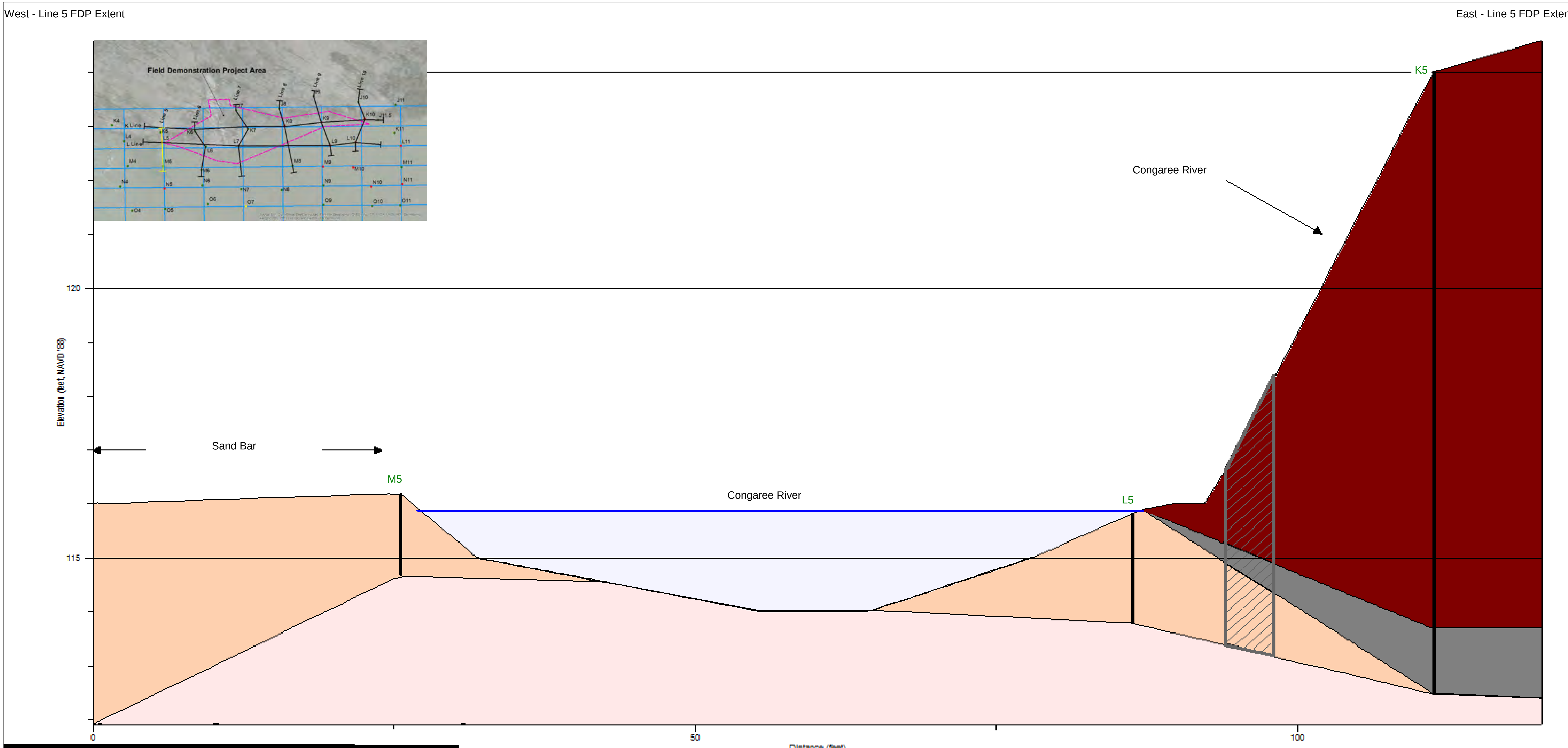
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:

1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study,1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "K" line and topography, bathymetry, and lithologies are approximately from and between locations K5 through K10.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 2
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG K, FDP EXTENT
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 05/29/2015 FILE NAME:K LINE FDP
APEX COMPANIES, LLC



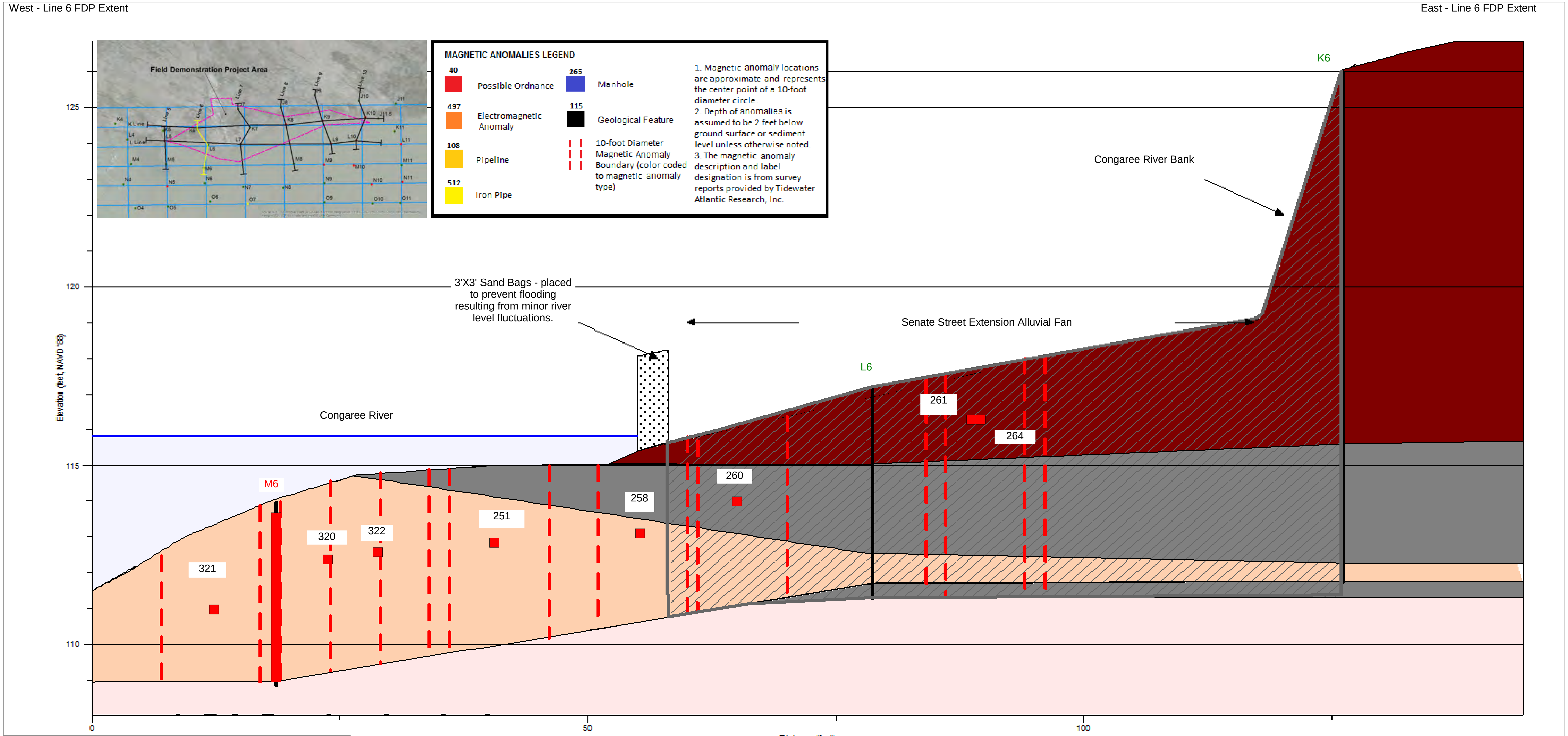
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

PRELIMINARY DRAFT

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. Corings L5 and M5 were drilled with a whacker/macrocore and depth of refusal encountered may or may not be representative of the granite bedrock surface.
4. The cross section developed is based on a fence line approximately corresponding to the "5" line and topography, bathymetry, and lithologies are approximately from and between locations M5 through K5.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 3
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG 5, FDP EXTENT
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 06/02/2015 FILE NAME. LINE 5 FDP
APEX COMPANIES, LLC



PRELIMINARY DRAFT

LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

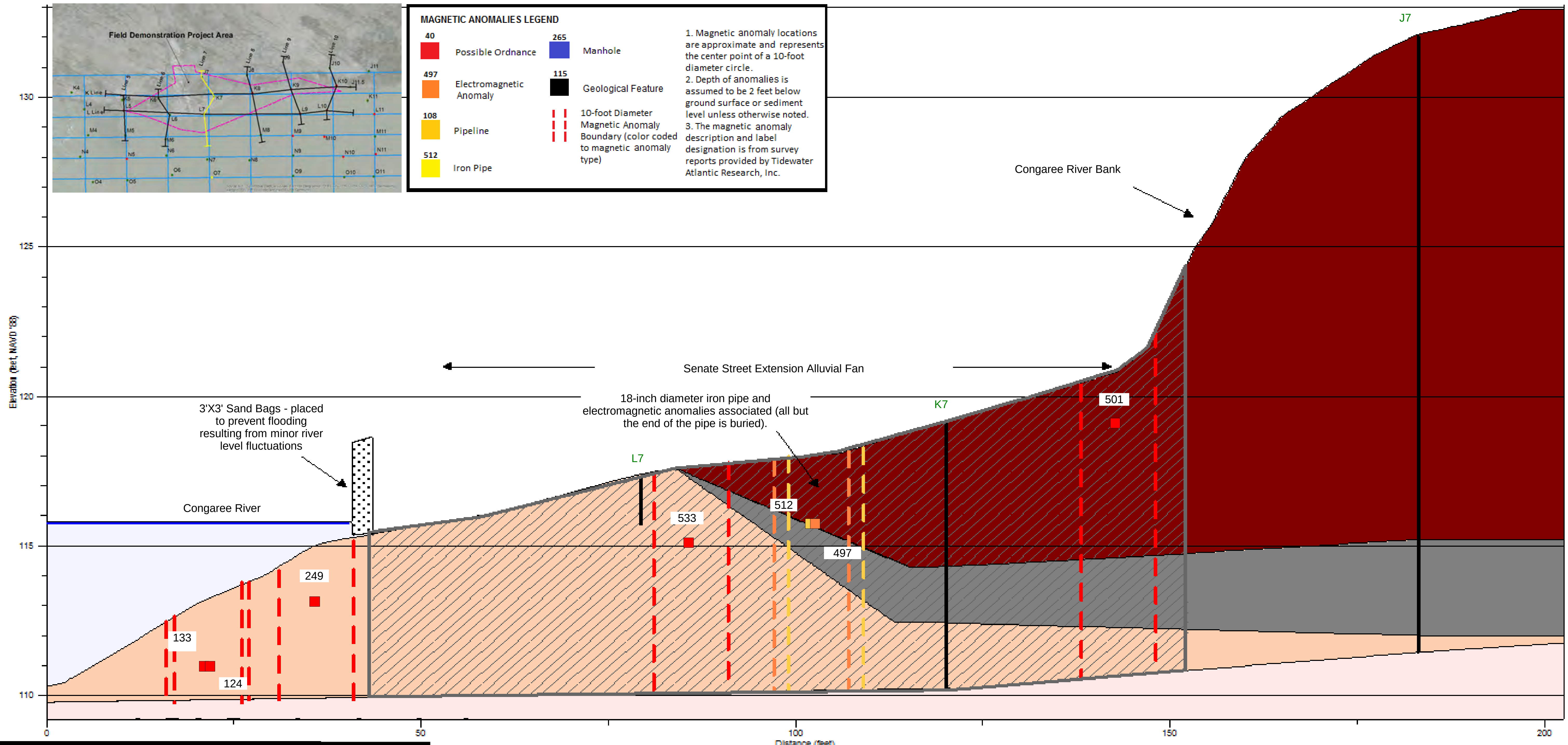
Notes:

1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River slope likely differs from that shown.
3. The 0-2.3 foot interval at L6 is assumed to be fill from the historic activities and/or washed in erosion.
4. The cross section developed is based on a fence line approximately corresponding to the "6" line and topography, bathymetry, and lithologies are approximately from and between locations M6 through K6.
5. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 4
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG 6, FDP EXTENT
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 06/01/2015 FILE NAME. LINE 6 FDP
APEX COMPANIES, LLC

West - Line 7 FDP Extent

East - Line 7 FDP Extent



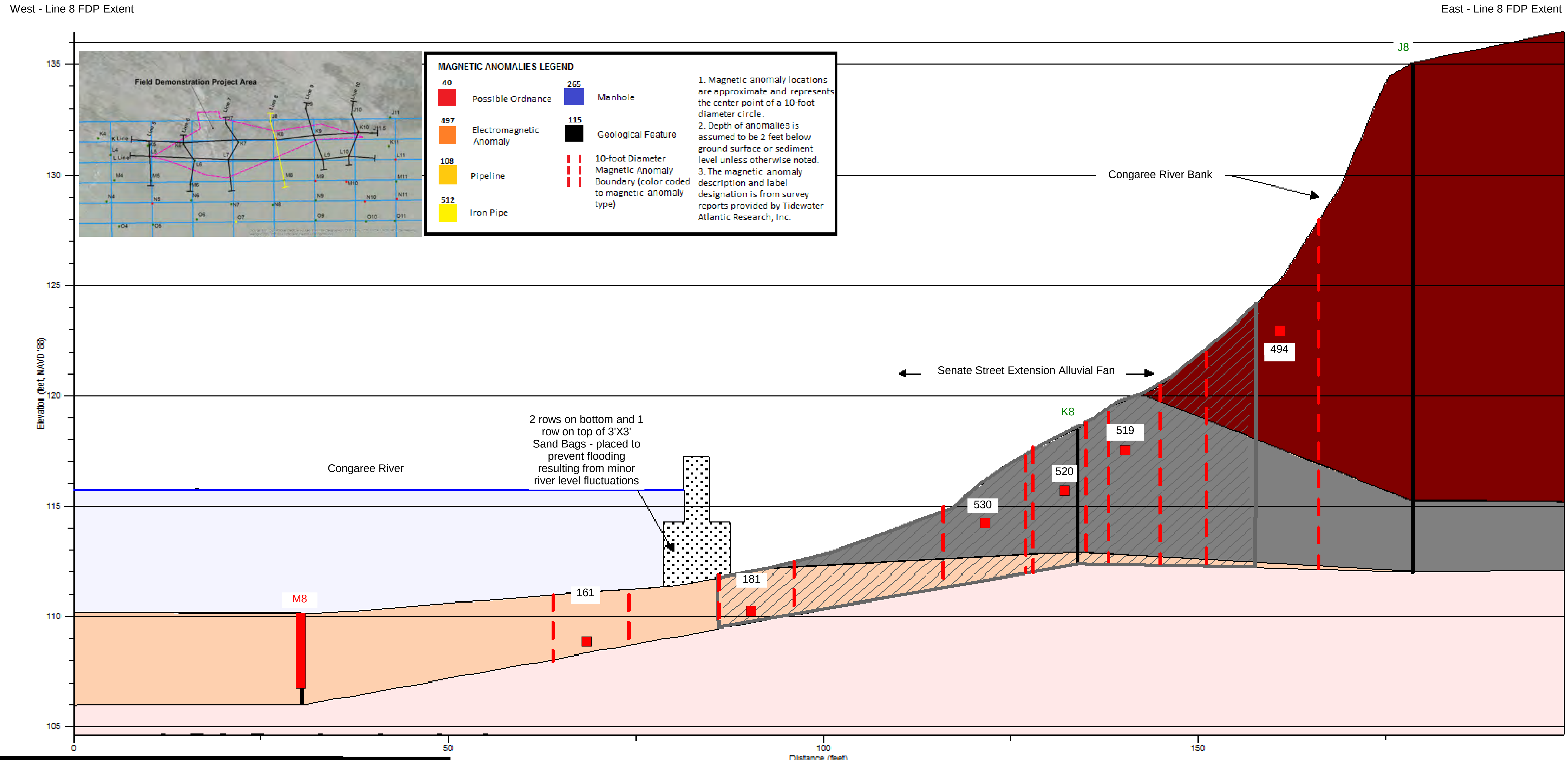
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

PRELIMINARY DRAFT

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. Total depth of coring L7 was only 1.2 feet and the aluminum tube used for vibra-coring may have been impeded by a large cobble and therefore depth to granite bedrock at this location is inferred.
4.The cross section developed is based on a fence line approximately corresponding to the "7" line and topography, bathymetry, and lithologies are approximately from and between locations L7 through J7.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 5	
SOUTH CAROLINA ELECTRIC AND GAS CO.	
CROSS SECTION ALONG 7, FDP EXTENT	
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA	
DATE: 06/01/2015	FILE NAME. LINE 7 FDP
APEX COMPANIES, LLC	



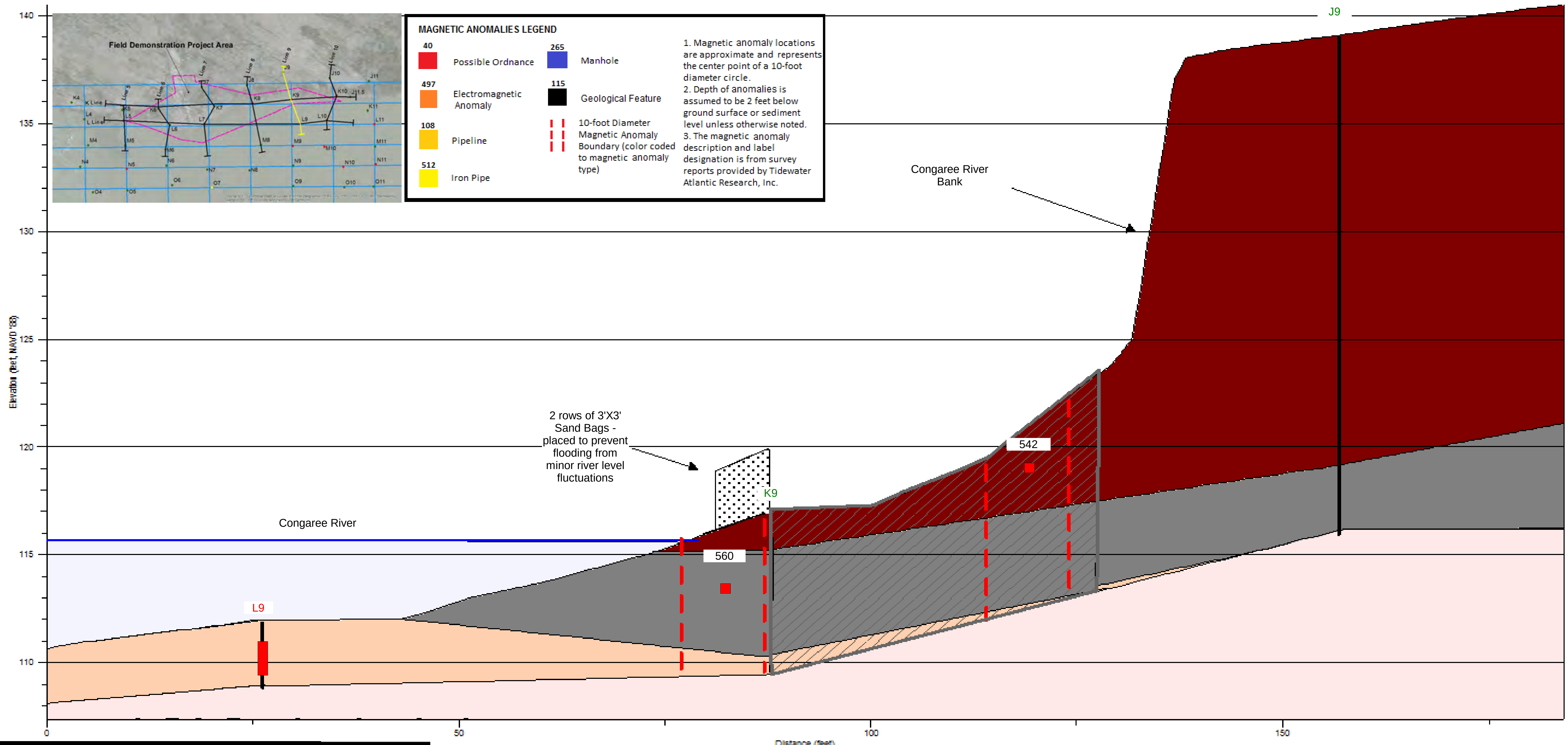
LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "8" line and topography, bathymetry, and lithologies are approximately from and between locations M8 through L8.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

PRELIMINARY DRAFT

FIGURE 6
SOUTH CAROLINA ELECTRIC AND GAS CO.
CROSS SECTION ALONG LINE 8, FDP EXTENT
CONGAREE RIVER SEDIMENTS COLUMBIA, SOUTH CAROLINA
DATE: 06/01/2015 FILE NAME. LINE 8 FDP
APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand , fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

PRELIMINARY DRAFT

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
2. The cross section developed is based on a fence line approximately corresponding to the "9" line and topography, bathymetry, and lithologies are approximately from and between locations L9 through J9.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

FIGURE 7

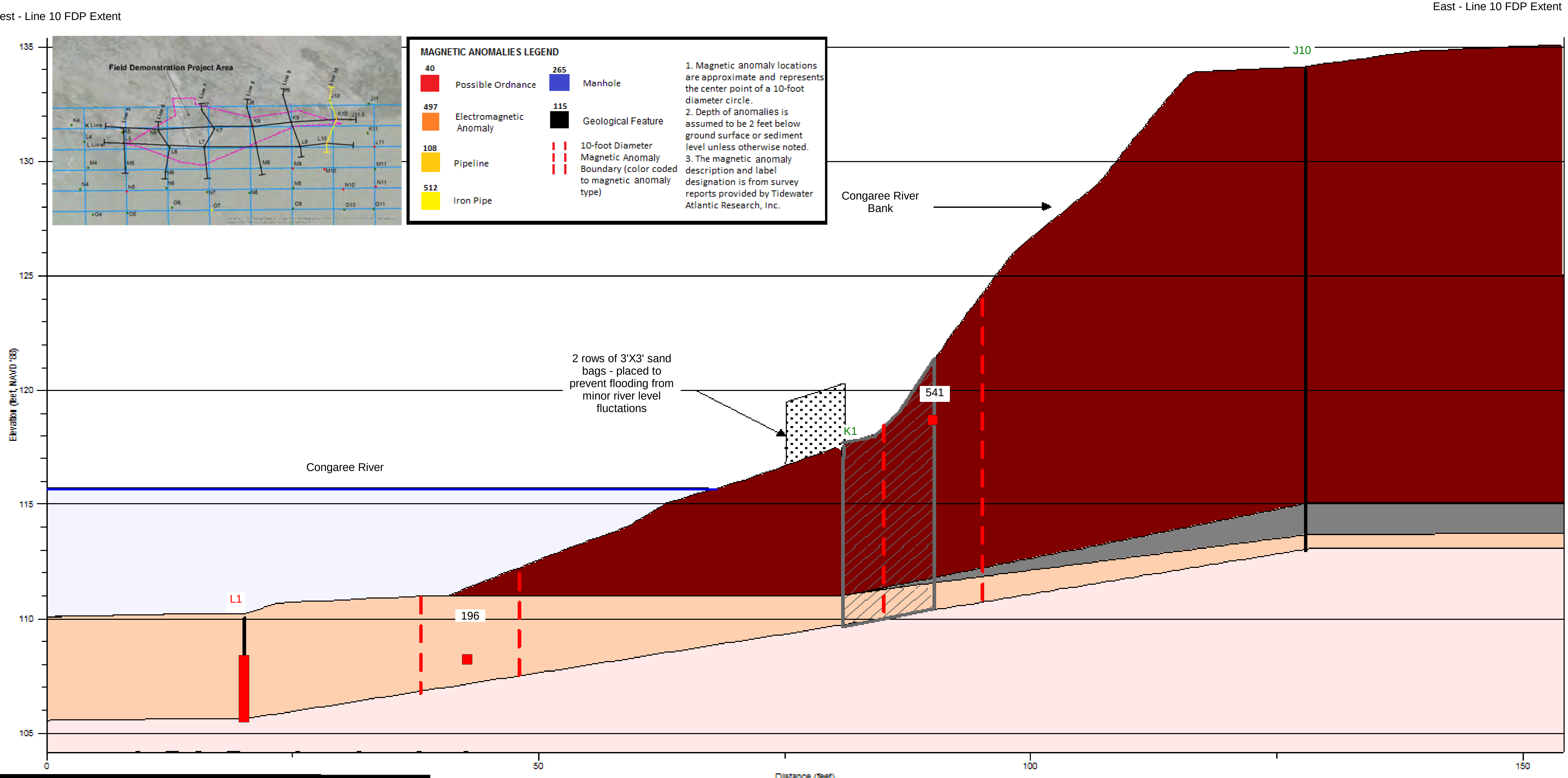
SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 9, FDP EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 05/29/2015 FILE NAME: LINE 9 FDP

APEX COMPANIES, LLC



LEGEND

- Congaree River Bank Deposits- Depositional environment is unknown but may be varied (fluvial to near shore marine [transgressive/regressive sequences]). Lithology ranges from clays, to silt, to fine to medium sands or combination thereof and is layered.
- Congaree River Sediments or Remnants- fine to coarse sand, fine to coarse gravels, cobbles, boulders, and in places can have varying amounts of silt.
- Congaree River Shoreline or Remnants- gray to black, silt, clay, and very fine to fine sand or combination thereof. Can be micaceous.
- Granite bedrock and/or boulders - assumed
- Visual tar like material (TLM)
- Approximate extent of sediment targeted for removal
- O6 — Coring or soil boring idnetification - vertical line represents depth, red coring or boring and portion of vertical line indicates visual TLM, and green coring or boring identifier indicates no visual TLM.
- Inferred Boundary

Notes:
1. The surface water level was determined by using the average of the maximum river gage heights recorded during the September-October 2010 investigations, accounting for river slope (2.10 feet/mile) (USACE Congaree River Basin Navigability Study, 1977) and referencing to the elevation (112.25 feet, NAVD '88) of USGS gage 02169500, Congaree River at Columbia, SC.
2. The Congaree River bank slope likely differs from that shown.
3. The cross section developed is based on a fence line approximately corresponding to the "10" line and topography, bathymetry, and lithologies are approximately from and between locations L10 through J10.
4. This geological cross-section was prepared by evaluating existing coring/boring logs and inferred site conditions between data points. As such, interpretation between data points was based on professional judgement. Actual site conditions depicted between existing corings/borings may vary.

PRELIMINARY DRAFT

FIGURE 8

SOUTH CAROLINA ELECTRIC AND GAS CO.

CROSS SECTION ALONG LINE 10, FDP EXTENT

CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 05/29/2015 FILE NAME: LINE 10 FDP

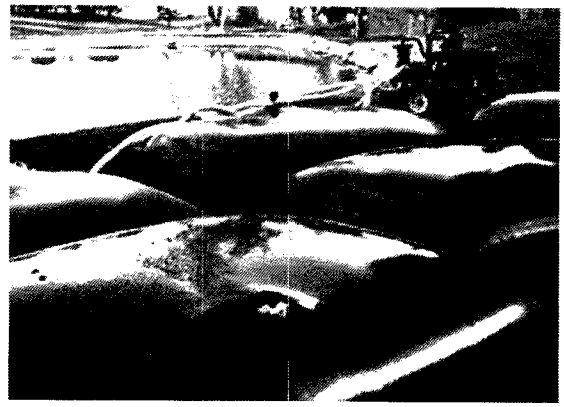
APEX COMPANIES, LLC

ATTACHMENT B

DEWATERING BAG AND SAND BAG INFORMATION

GRANITE environmental

Dewatering Bags



The Dewatering Bag is a water filtering bag that has been used for the **removal of sediment, oil, and other pollution** or waste from a water area. These filtering bags are typically made from a **non-woven geotextile fabric** that has been needle punched to allow only clean water to flow back out of the bag. Their high filtering qualities has made them perfect for **pumping trenches, construction sites, ponds, lakes and for dewatering in municipalities or plants**.

Typical Features:

- Needle Punched Non-Wove Geotextile Fabric
- Connects to Pipes up to 4"
- In Stock Sizes Available
- Filters Sediment, Oil & Waste
- Helps Comply with NPDES phase II

Material Options	8 oz. Non-Woven	10 oz. Non-Woven
Fabric Filter Rate for New Bag/ Clear Water	80 gpm/sq. ft	60 gpm/sq. ft
A.O.S	80 US Sieve	100 US Sieve
Microns	177 (0.177 mm)	149 (0.149 mm)
Typical Sizing	6' x 6' through 15' x25'	

GRANITE environmental

➔ Product Solutions for a Cleaner World

P.O. Box 780928 Sebastian, FL 32978   Toll Free: (1) 888.703.9889   Fax: (+1) 772.589.3343   Int: (+1) 772.646.0597   info@GraniteEnvironmental.com

www.GraniteEnvironmental.com

GRANITE environmental

Dewatering Bags

Sediment and Dewatering Bags are constructed from heavy-duty needle punched filter fabric that provides high permittivity pore structure that allows water to pass through while containing fine soils. These bags are **an economical and effective way to keep within NPDES phase II and Clean Water Act Compliance,** allowing you to avoid shut downs and fines.

Dewatering Bags Complete Specifications		
Size	**Material**	**Capacity Guide** (cubic yards/bag)**
6' x 6' (1.8m x 1.8m)	8 oz. Non-Woven	1.44
15' x 10' (4.57m x 3m)	8 oz. Non-Woven	6
15' x 15' (4.57m x 4.57m)	8 oz. Non-Woven	9.6
15' x 20' (4.57m x 6.1m)	8 oz. Non-Woven	12
15' x 25' (4.57m x 7.6m)	8 oz. Non-Woven	15
6' x 6' (1.8m x 1.8m)	10 oz. Non-Woven	1.44
15' x 10' (4.57m x 3m)	10 oz. Non-Woven	6
15' x 15' (4.57m x 4.57m)	10 oz. Non-Woven	9.6
15' x 20' (4.57m x 6.1m)	10 oz. Non-Woven	12
15' x 25' (4.57m x 7.6m)	10 oz. Non-Woven	15

**Capacity is estimated only and is intended as guide to users. Volume per bag is dependent on soil composition, site conditions, and use. Information is provided in good faith. Actual field trial are the only true bench mark for site specific results.

NOTE: It is important that you ALWAYS check with local regulators about permitting and local requirements.

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Dewatering Bags

Typical Installation & Uses

- Dewatering bags **should be sized based on:**
    - Volume of water being pumped (pump flow rate),
    - Quantity and type of sediment
    - Permittivity of the given bag size.

- Consideration should also be given to location. (Steep sloped surfaces are typically not recommended as the bag may roll). Placement may be in a **20' drop box, dump truck or similar for containment** to facilitate transportation.

- Each sediment bag can handle a **2", 3" or 4" discharge hose.** (The hose can be placed along any edge by making a small incision into the fabric, inserting the hose and then clamping the fabric to the hose via wire, ties, clamp, rope or similar to create a good seal.)

- To improve surface area and performance of the bag, **place it on a permeable/porous surface** such as hay bales, aggregate or similar. (take care to select a media that will not damage the bag – use of ground cloth can alleviate damage from occurring)

- These sediment bags are rugged, but not indestructible. Care should always be taken to properly monitor performance to ensure that pump rates or concentrations of sediment are not excessive. Failure to do so may cause bag to fail.

- **Avoid multiple pipe discharges into 1 bag.** One bag per discharge is recommended unless specifically designed.

- Filtered Water Runoff from the dewatering bag should be guided to the nearest inlet with care taken to avoid causing any erosion

P.O. Box 780928 Sebastian, FL 32978 Toll Free: (1) 888.703.9889 Fax: (+1) 772.589.3343 Int: (+1) 772.646.0597 info@GraniteEnvironmental.com

www.GraniteEnvironmental.com

Call Us Toll Free at 1-800-337-0537

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Dewatering Made Simple

Big Bags USA heavy-duty construction barriers provide a re-usable alternative to sheet pile cofferdams, sandbag barriers, water barriers, single FIBC bags, super sacks, and aqua dams. One system (comprised of 5 individual bags connected to one another) is 15' long, 36" wide, and 40" tall. One, five bag system, can be placed and filled by two men in less than 10 minutes. No other barrier can be filled and placed faster than the Big Bags USA construction barrier system. Fast, reusable barriers that save time and money.

Why is Big Bags USA in the Top Ten Construction Barriers list?

- 10mm thick polypropylene, made with the highest UV resistant polymers available to increase longevity in sunlight.
- The flexibility of the barrier allows the product to be used on any an all surfaces without the need for trenching or leveling to get a good seal.
- 200 times faster to deploy than traditional sandbag walls.

If you have a Flood Emergency call us at 1-800-337-0537

If you were searching for dewatering ideas, water diversion, cofferdam products, berms, weirs, or temporary barriers you have found the solution.

Big Bags USA construction barrier systems have unmatched versatility to handle the highest demands at a fraction of the costs compared to other products.

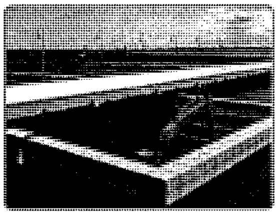
- Systems can be re-used. No need to budget for new systems on every project.
- Deploys faster than any other barrier on the market.
- Easy deployment with our patent-pending spreader bar.
- Clean-up is easy. Simply warehouse the bags, sand included, for the next use.

Big Bags USA Construction Barrier Uses:

- Cofferdam
- Weir
- Water Diversion
- Coastal Erosion & Soil Erosion
- Dewatering
- Temporary Barrier
- Large Sandbag Dam
- Flood Barriers
- Alternative to (Small Sandbags, Aqua Dams, Water Barriers, Super Sacks, FIBC, Bulk Bags, Big Bags.)

- Uses 1/2 the amount of sand used in a sandbag wall built to the same height.
- Not only is the barrier re-usable, the sand can be kept in the bags and stored in a warehouse for the next use.

- Berm



Large sandbag dams can be built to dewater any size work area. Big Bags USA construction barriers can be pyramid stacked to any height. Be sure to check out or patent pending spreader bar that lifts the filled five bag construction barrier systems into place. (Example of Large Sandbag Dams in a pyramid shape).

Shown above is an excavator working on a small cofferdam project. With Big Bags USA construction barriers you can build small or large sandbag dams with various types of equipment such as excavators or cranes. (Excavator working on small cofferdam project)

Shown above is an example of Big Bags USA construction barriers being used as a temporary barrier berm to protect a water treatment plant during reconstruction. (Temporary Barrier Protecting Water Treatment Plant)

Big Bags USA construction barriers can be used for coastal erosion projects. Regardless of whether or not you are dealing with erosion control for beachfront property, streams, rivers, or lakefronts, our construction barriers are a fast solution to your problems. (Big Bags USA barrier stopping coastal erosion)

Use our construction barriers to form arcs or right angles for your dewatering projects.

Big Bags USA construction barriers can be connected together on the shoreline and pulled out in the water to any length, then filled while sitting in the water, creating a cofferdam. Once the barriers are in place they can be filled exactly where you need them.

Make Cofferdams, Weirs, or Berms a breeze with our patent pending spreader bar.

In the photo gallery to the right you can see our flood barriers protecting a railroad track. Our flood barrier easily conforms to railroad tracks, tops of levees,

Our construction barriers carry the highest UV Protection available.

Big Bags USA construction barriers are rated for over 2,200 hours of direct sunlight. Our sand-filled demonstration barriers displayed outside of the factory remain uncompromised after 10 years of exposure to the elements. The heavy-duty construction, combined with the best UV protection available, allows the bags to reused on multiple cofferdam projects

Create additional work for your company supplying temporary barriers to your local communities in times of need like heavy rain events.

All contractors with excavators, front end loaders, and cranes streets, hillsides, over sewer drains and any other uneven topography.

should consider contacting a Big Bags USA representative for information on how to use our temporary barriers for deployment in your local communities when flood waters threaten. There is a high demand for rapid deployed barriers throughout the United States during the spring rainy period. If you are capable of deploying our product on your jobsites then you could easily be hired to deploy barriers by your state, county, or local municipalities in times of need.

BIG BAGS U.S.A.
D.R.I.P.S.
Disaster Relief & Innovative Protection Systems, LLC
(573) 480-6699

About Us
Services
Our Systems
Deployment
Cost & Savings
Spreader Bar

USGS National Water Information
National Weather Service River Forecasts
Red Cross Disaster Online Newsroom

DisasterAssistance.gov
FEMA Plan & Prepare

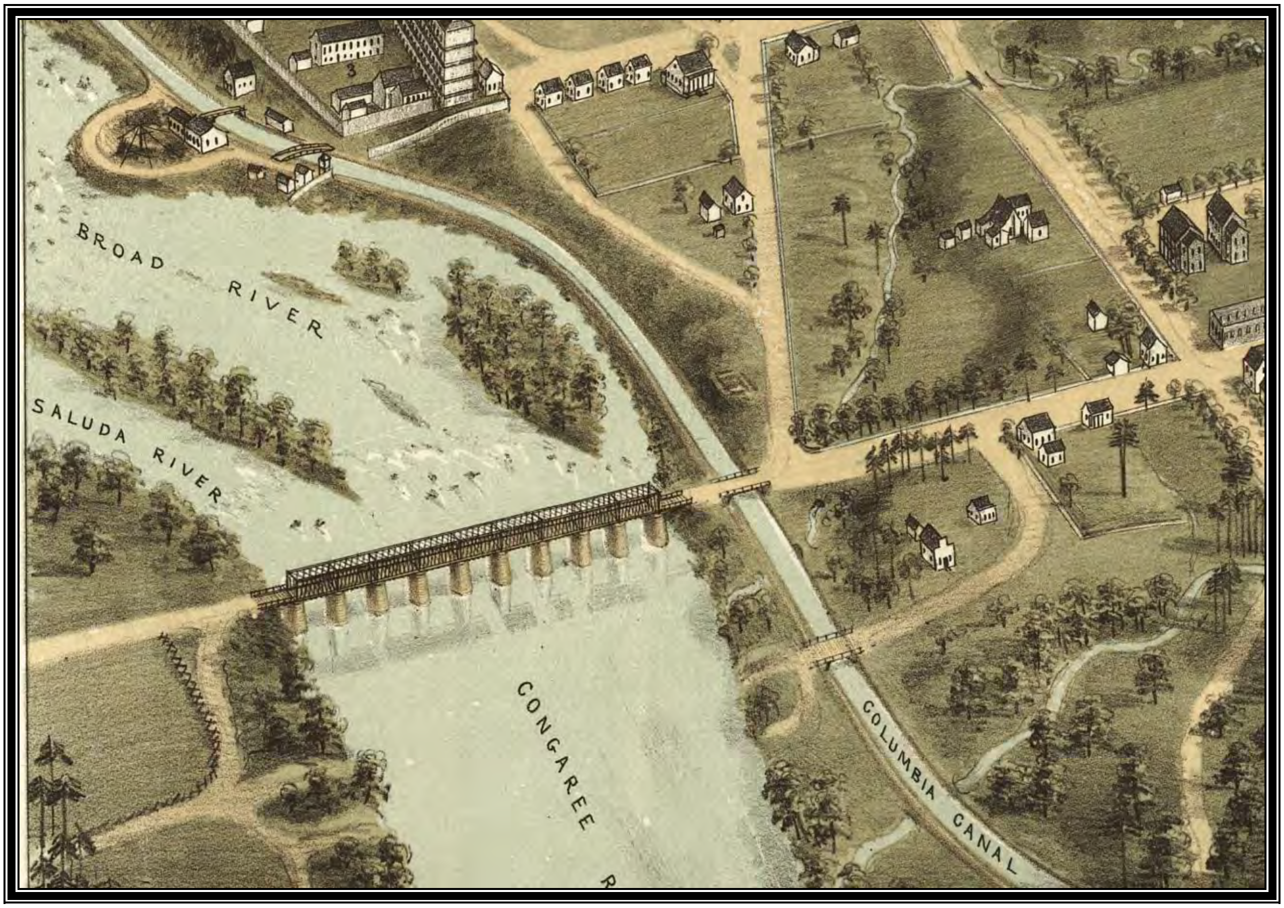
ATTACHMENT D

CULTURAL RESOURCE IDENTIFICATION SURVEY (CRIS), ARCHAEOLOGICAL DATA RECOVERY PLAN AND MEMORANDUM OF AGREEMENT (MOA)

CULTURAL RESOURCE IDENTIFICATION SURVEY FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT

RICHLAND COUNTY, SOUTH CAROLINA

Draft Report



September 2014

CULTURAL RESOURCE IDENTIFICATION SURVEY FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT RICHLAND COUNTY, SOUTH CAROLINA

DRAFT REPORT

Submitted to:
SCANA
COLUMBIA, SOUTH CAROLINA

Submitted by:
TRC
621 CHATHAM AVENUE
COLUMBIA, SOUTH CAROLINA 29205

Sean Norris, Principal Investigator, Author

September 2014

TABLE OF CONTENTS

FIGURES

TABLES

I. INTRODUCTION

TRC conducted a cultural resource identification survey in anticipation of federal permits required for the Congaree River Remediation Project. The project area is in the City of Columbia within and on the eastern bank of the Congaree River (Figure 1). In June 2010, tarlike material (TLM) was reported near the eastern bank of the Congaree River directly downstream of the Gervais Street Bridge. The South Carolina Department of Health and Environmental Control (SCDHEC) began sampling material from the river and concluded that the source of the TLM was a manufactured gas plant (MGP) that operated on Huger Street in downtown Columbia from 1906 to the mid-1950s. During its period of operation the MGP had allowed coat tar runoff to empty into the Congaree River.

This MGP, after a series of mergers and acquisitions, became one of South Carolina Electric and Gas's (SCE&G) predecessor companies. As a result SCE&G owned the land the former MGP occupied. In 2002 SCE&G had entered into a Voluntary Cleanup Contract with SCDHEC to mitigate the former MGP site. Beginning in 2008 SCE&G removed over 125,000 tons of MGP impacted soil and debris from the Huger Street location. Since the discovery of tar in the river SCE&G has worked with SCDHEC in order to define the extent of the TLM contamination, and has conducted a series of surveys to establish the vertical and horizontal distribution of the TLM. The project area begins directly south of the Gervais Street Bridge and extends downstream for approximately 2,000 feet; it extends approximately 300 feet into the river from the eastern bank (Figure 1).

In 2013 SCDHEC approved the Project Delineation Report and tasked SCE&G to develop an appropriate plan for the removal and mitigation of the contaminated soil. In 2013 a report detailing four "removal action" options was submitted to SCDHEC. The four options were:

1. No Action – Leave the TLM in place.

2. Monitoring and Institutional Controls – Leave the TLM in place; restrict access to the area, and conduct annual monitoring.

3. Sediment Capping and Institutional Controls – Place a physical barrier on top of the contaminated sediment effectively burying the TLM and conduct annual monitoring.

4. Removal – Physically remove the TLM and contaminated sediment.

SCDHEC approved option four as the preferred method of dealing with the TLM. This method was deemed to the most protective of human health and the environment because it would permanently remove the contaminated sediment. An average of two feet of sediment will need to be removed over the entire project area. This is equal to approximately 40,000 tons of sediment requiring removal and off-site treatment or disposal. The remediation and removal of the TLM and contaminated sediments will involve the following activities:

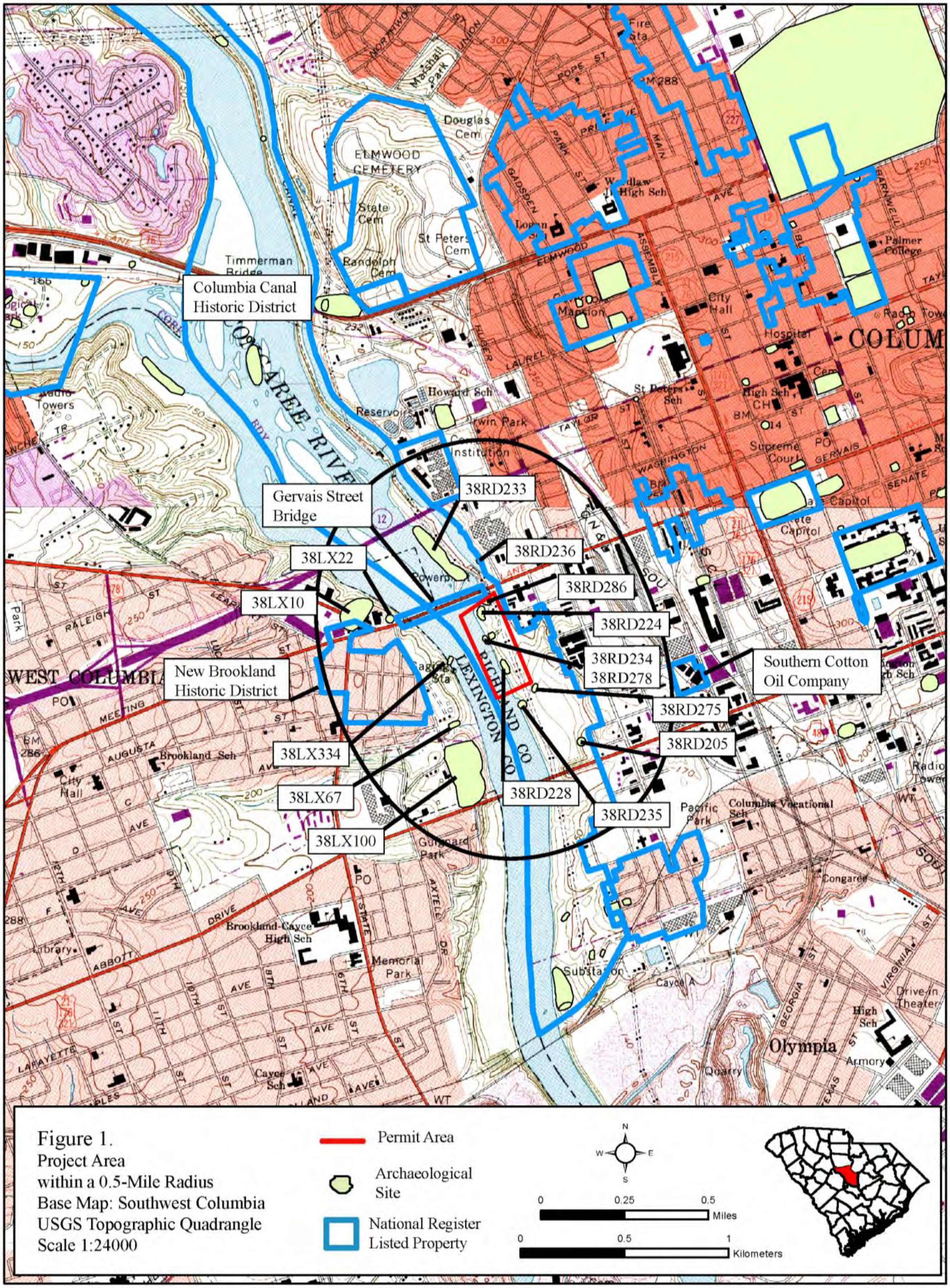


Figure 1.
Project Area
within a 0.5-Mile Radius
Base Map: Southwest Columbia
USGS Topographic Quadrangle
Scale 1:24000

- Conducting landside site setup activities;
- Installing a cofferdam of sufficient height to restrict river flow;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment and debris using conventional equipment;
- Conditioning the sediment material for transportation to the landfill;
- Backfill as necessary; and
- Off-site disposal.

Prior to activities in the river, construction on the eastern shoreline to improve access to the project area for personnel, equipment and material transportation trucks will be conducted. These construction activities would include clearing and grading operations in the area of the Senate Street alluvial fan and along the eastern shoreline as well as improving and/or creating access roads (Figure 2). Access road improvements will raise the existing Senate Street Extension by adding a layer of fill (depth will vary pending on-site conditions) over the existing ground surface to level and widen the access road. Next a geotextile pad will be place over the fill. Geotextile is a high tensile strength fabric that stabilizes the ground surface and prevents ruts and the intermixing of gravel with the existing ground surface. Geotextiles are commonly used on construction sites to prevent damage caused by heavy equipment. The fabric used will meet or exceed the South Carolina Department of Transportation's standards for geotextiles. This protective layer will be topped by eight to ten inches of compact gravel effectively raising the existing access road by approximately 12 inches (Figure 3). New access roads will be raised above the current grade using the same procedure. Portions of the riverbank may be excavated in order to create access to the dewatered area.

Site setup activities will also include the construction of a project compound with office trailers, support structures and associated electrical power and utilities. These facilities would be located within the existing utility line corridor. These structures will be temporary. An agreement with the current landowner dictates that no subsurface ground disturbance will be caused by the project compound. Consequently, all temporary structures will be raised above the current grade using layers of fill, geotextile and gravel. Protective fencing would also be installed to restrict access to the work areas by unauthorized personnel.

The first component of the sediment removal will be the construction of a cofferdam around the planned removal areas. The purpose of the coffer dam is to isolate and dewater the areas prior to initiating the removal operations. The coffer dam will be designed to be over-topped during high water events. At average water levels the dam will rise approximately eight feet above the waterline. The temporary dam will be constructed with an impermeable barrier covered by stone or rip rap. Figure 4 is a conceptual rendering showing the approximate height and attributes of the coffer dam.

Figure 2.
Aerial view of the project area.
Scale: 1:5000
Base Map:
2014 Aerial Photograph

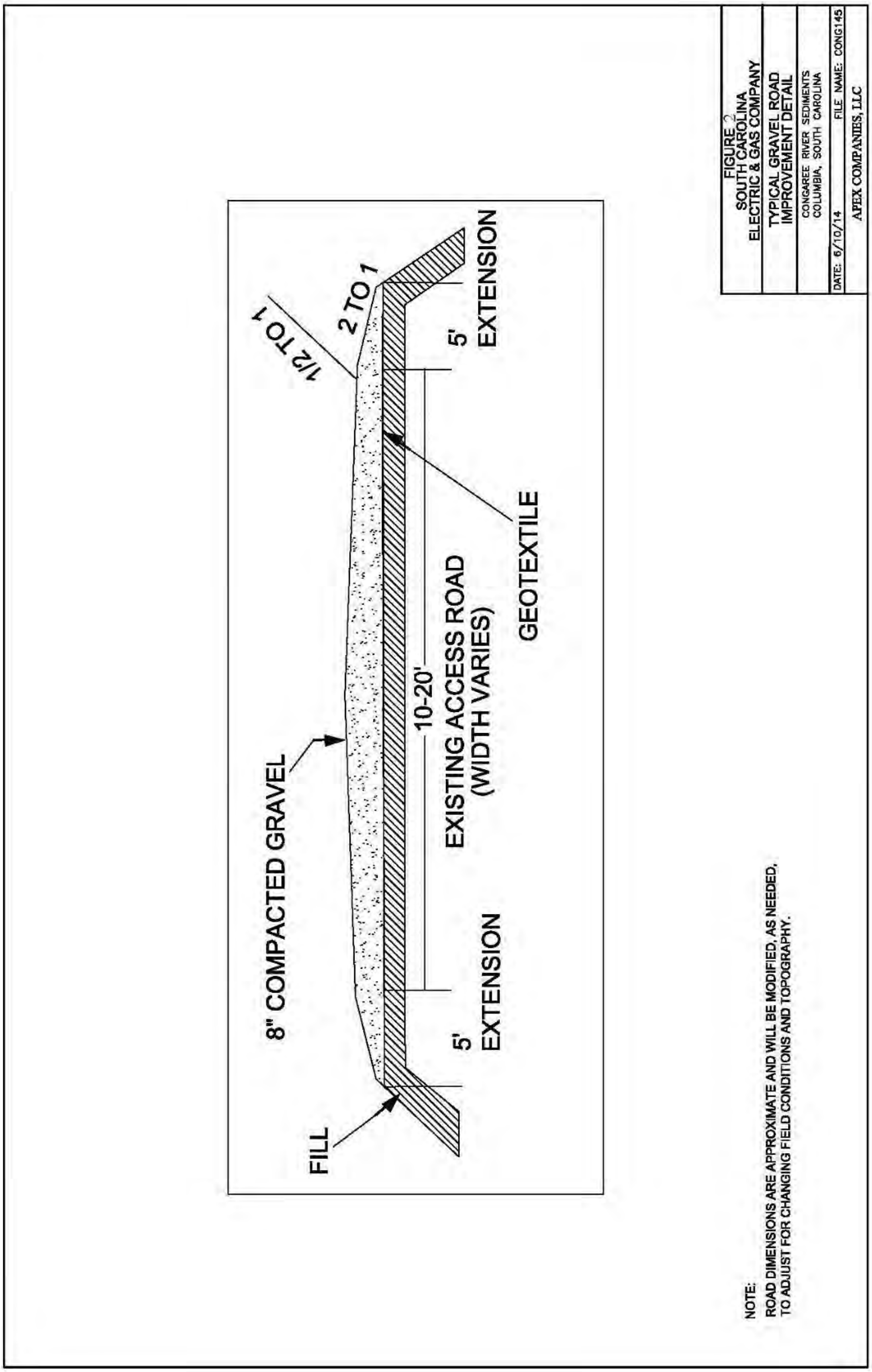


Figure 3. Conceptual construction plan for proposed access roads and improvements.

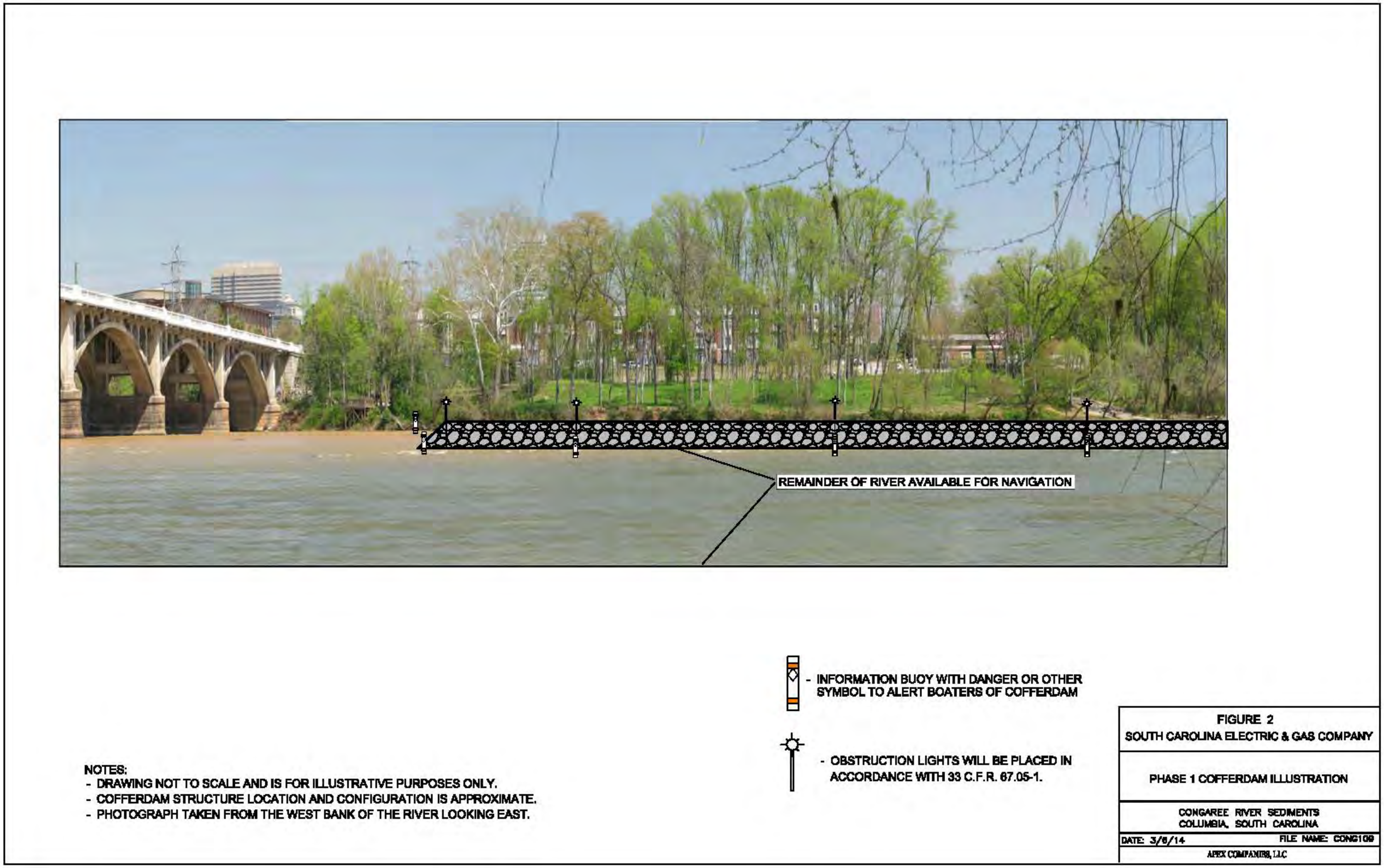


Figure 4. Conceptual drawing showing approximate height and style of proposed coffer dam.

Once the dam is in place there will be a period of dewatering and draining. After the area is dewatered sediment removal will begin. Due to the varying thickness of sediment, the uneven nature of the riverbed and changing conditions within the project area a number of different methodologies and equipment will be employed to complete the project. Generally speaking, heavy equipment/machine excavators coupled with vacuum removal or other techniques will be employed to remove the sediment to bedrock. The sediment will be removed in 50 × 50 foot grid squares.

Once removed, the sediment would likely require drying or solidification prior to transporting. Depending on the amount of TLM in the sediment the material will either be sent to an on-site sorting facility for screening or to an off-site facility for visual examination prior to disposal in a landfill. In order to minimize potential impacts on spawning migrations for threatened and/or endangered species a construction phase (for actual work in the river) would begin no earlier than May and need to end by October of each year. Because of this, and the amount of material to be removed, it is projected that multiple construction seasons or phases will be required. Once each construction phase is completed the river bottom would be restored to its approximate original conditions by the placement of imported fill sand or rock as may be required and the cofferdam would be removed, potentially to be reused as fill or erosion protection.

Due to the limited amount of ground disturbance proposed for this project the Area of Potential Effects (APE) for archaeology is considered to be the portion of the new access roads that will cut into the existing river bank. Due to the low visual profile and temporary nature of the coffer dam a 0.5-mile radius has been used as the APE for above ground resources.

The cultural resource investigations were performed under the direction of TRC Program Manager-Archaeologist Sean Norris, M.A., RPA. Fieldwork was conducted on August 5 and 26, 2014 by Mr. Norris and TRC archaeologist Ramona Grunden.

This report has been prepared in compliance with the National Historic Preservation Act of 1966 (as amended); the Archaeological and Historic Preservation Act of 1979; and procedures for the Protection of Historic Properties (36 CFR Part 800); 36 CFR Parts 60 through 79, as appropriate. Field investigations and the technical report meet or exceed the qualifications specified in the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (FR 48:44716–44742) and the South *Carolina Standards and Guidelines for Archaeological Investigations* (SHPO et al. revised 2013). All supervisory personnel meet or exceed the Secretary of the Interior's Professional Qualifications Standards set forth in 36 CFR Part 61.

II. ENVIRONMENTAL SETTING

PROJECT SETTING

The project area is in the Fall Line region of South Carolina. It is characterized by a natural levy overlooking the Congaree River to the west. The project corridor is generally flat and, as stated above, a cleared access, maintenance and utility easement corridor that has been disturbed by underground sewer and gas lines characterizes the project area. It begins at the intersection of Gist and Senate Streets and continues south for approximately 1500 feet. The eastern portion of the project area is in an existing power line and gas line utility easement (Figure 5). The western part of the project area is wooded and undeveloped. Surrounding this is the City of Columbia.

Figure 5. General condtions in the project area.

PALEOENVIRONMENT

The contemporary climate and vegetation of the study area are products of a long and complex process of natural and man-induced change. The average winter temperatures in the study area were obviously considerably colder during the last glacial period, which lasted from ca. 25,000 to 15,000 B.P. At that time, the study area was covered by a boreal forest in which pines and spruce were dominant (Delcourt and Delcourt 1983; Whitehead 1973). The climate warmed and precipitation increased during the Late Glacial Period (ca. 15,000 to 10,000 B.P.), the period during which the first humans arrived in the region. During the late Pleistocene, coniferous forests were replaced by northern hardwoods as dominant canopy species (Bryson et al. 1970; Watts 1975, 1980; Whitehead 1973). The period ca. 10,000–5000 B.P., referred to as the Altithermal or Hypsithermal, was a period of continued warming but decreased precipitation (Bryson et al. 1970; Watts 1975). The dominant vegetation that survived was the oak-hickory forest (Watts 1975; Whitehead 1973). The climate since ca. 5000 B.P. has cooled slightly, with a possible increase in precipitation. The oak-hickory forests of earlier times decreased in size and became increasingly intermixed with pines (Wharton 1977). Although the earliest settlers reported large stands of yellow pine in the oak-hickory forests of the Piedmont, it is not known whether those stands were products of natural forces or of Native American hunting methods, which used fire to drive and concentrate game.

HISTORIC ENVIRONMENT

The project area is in the Oak-Pine Forest zone characteristic of the Piedmont and Fall Line (Braun 1950). Oaks and hickories are prevalent in this forest, with white oak the predominant species. Pines are also widespread in this zone (Braun 1950). However, the vegetation of the project area has been greatly modified in the past through climatic change, agricultural and silvicultural practices, and development.

Several sources suggest significant changes in the forest composition of the project region during historic times. Lowland vegetation in this area of the state has increased since European settlement. Valley sedimentation led to river and stream aggradation and a general rise of groundwater tables in the valleys. Formerly well-drained valleys with clear streams became swampy, and the streams themselves became muddy and sluggish.

The upland hardwoods probably exhibit the most change since European settlement. These forests, formerly dominant over most of South Carolina, were severely impacted by agricultural clearing in the 1700s and 1800s (Trimble 1974), and again by extensive timbering in the late 1800s and 1900s. In the past, the project area has been subjected to extensive land clearing that has severely altered the natural landscape and environment. Mixed hardwoods, situated along drainages, and loblolly pines mixed with deciduous secondary growth in the uplands, are found in areas that have suffered the least impact from these activities.

CLIMATE

The regional climate is characterized by long, hot, humid summers. The maximum daily temperature is usually near or above 90 degrees Fahrenheit with the minimum in the 65 to 70 degree range. The winter season is short, mild, and relatively dry. The average daily temperatures range from 40 to 45 degrees Fahrenheit. Precipitation is fairly heavy throughout the year and sustained droughts are uncommon. Rainfall is adequate for most crops during the peak-growing season of April–September. Because of the mild winters, precipitation in the form of snowfall is light, averaging about 10–13 inches annually (Kovacik and Winberry 1987).

PHYSIOGRAPHY AND HYDROLOGY

Relief in the project area is generally flat. Immediately west of the corridor the land slopes quickly to the Congaree River. Elevations at the site range from 140 feet Above Mean Sea Level

(AMSL) along the top of the levy to 130 feet AMSL along the tributary bottom and at the jurisdictional wetlands found near the southern terminus of the corridor.

SOILS

The project area contains two soil types:

Chastain Silty Clay Loam is poorly drained and found on floodplain associated with the unnamed tributary that will be spanned and the wetlands near the southern end of the corridor.

Toccoa Loam is found along the natural levy along which the corridor runs. It is deep, moderately well-drained soil found on floodplains and natural levees.

III. CULTURAL OVERVIEW

PRECONTACT AND CONTACT PERIOD OVERVIEWS

Paleoindian Period (ca. 12,500–10,000 B.P.)

The earliest definitive evidence of human occupation in the Southeastern United States has been dated to between 13,500 and 10,000 years before present (B.P.) (Anderson et al. 1996; Goodyear 1999). This time frame, known as the Paleoindian Period, is characterized by a social structure of small, highly mobile groups. Subsistence strategies relied on the hunting of large mammals (e.g., deer, elk, horse, wild pig) combined with the opportunistic hunting of smaller game and the collecting of wild plants and nuts. Megafauna such as mammoth, mastodon, and giant sloth, also would have been obtained, but the extent to which these animals were part of the Paleoindian diet is unknown. The only direct evidence for the exploitation of megafauna in South Carolina is a mammoth rib with cut marks that was found on Edisto Beach near Charleston (Anderson et al. 1992).

The artifacts left by these earliest inhabitants are comprised mostly of diagnostic projectile points, scrapers, gravers, denticulates, specialized hafted unifacial knives, large bifacial knives and burins. The most common and widely recognized artifact associated with the Paleoindian period is the fluted point. One of the most recent inventories of Paleoindian artifacts indicated that approximately 350 fluted points have been reported in South Carolina (Anderson et al. 1996). Unfortunately, almost all of these points were recovered by amateur collectors or from surface contexts, making archaeological interpretation difficult. Within the last twenty years only a small amount of Paleoindian material has been recovered from intact contexts in South Carolina and surrounding areas (Anderson and Schuldenrein 1985; Elliott and Doyon 1981; Michie 1996; O'Steen 1994).

Regional variation in projectile point morphology began to emerge in portions of the Southeast by about 11,000 B.P., probably due to restricted movement and the formation of loosely defined social networks and habitual use areas (Anderson 1995). The common point types that have been found throughout South Carolina include Clovis, Cumberland, Suwannee, Quad and Dalton (Anderson et al. 1990; Justice 1987; Milanich and Fairbanks 1980). Some have suggested dividing the Paleoindian into Early, Middle and Late sub-periods based on differences in projectile point morphology (Anderson et al. 1990; O'Steen et al. 1986).

The arrival of new environmental conditions influenced how Paleoindians organized their society. Paleoindians were required to cope with environmental changes and the consequent social pressures that came about during the period of climatic transition associated with the onset of the Archaic Period.

Archaic Period (ca. 10,000–3000 B.P.)

The transition from Paleoindian to Archaic is loosely defined, and in the Southeast the chronological interface ranges from ca. 10,000 to 8500 B.P. In addition to changes in environmental conditions, changes in technology, settlement patterns, and social organization were developed to cope with this climatic shift. The Archaic period is typically divided into Early, Middle, and Late subperiods based on changes in technology and subsistence through time. It should be emphasized, however, that these subdivisions are artificial constructs and the rate of change across the Southeast varied through time and from place to place.

The Early Archaic (10,000–8000 B.P.) is typically separated from the Paleoindian period by a warming climate and the emergence of seasonal occupation sites. Projectile points are similar to the previous period, but exhibit an increased sophistication through rejuvenation strategies. The typical forms are smaller than those of the Paleoindian period, and include Hardaway, Palmer, and Kirk, Big Sandy, and several bifurcate styles such as MacCorkle, St. Albans, Kanawha, and LeCroy. Wear patterns suggest that these tools were utilized for activities such as killing, butchering, skinning game, and woodworking.

Based on the increased number and size of Early Archaic sites, a population increase appears to have occurred during this period. Consequently, the social landscape became much more complex and settlement models for the Early Archaic period currently are under debate (e.g., Anderson 1992; Daniel 1996, 1998; Ward 1983).

The Middle Archaic (8000–5000 B.P.) marks the introduction of dart points, atlatl weights, and groundstone implements to the lithic tool assemblage. Diagnostic hafted biface types of this period include Stanly, Morrow Mountain, and Guilford points, followed by transitional Middle and Late Archaic Brier Creek and Allendale types. Also included in the Middle Archaic tool kits are groundstone artifacts such as metates and nutting stones, and there is a decrease in the diversity of chipped stone artifacts.

Middle Archaic sites in the Sandhills have been described as small, randomly distributed occupations exhibiting very little intersite technological variability. Local raw materials were used almost exclusively, and the vast majority of tools were technologically expedient (Blanton and Sassaman 1989; Sassaman 1993a).

The Late Archaic (ca. 5000–3000 B.P.) is transitional between the horticultural-based economies of the Woodland period and the previous hunter-gatherer cultures of the Early and Middle Archaic. Population was relatively dense, with large sites documented near major river systems along the fall line and in the Coastal Plain. A variety of imported materials such as copper and steatite, have been recovered from Late Archaic sites. This suggests an increasing complexity in trade relations.

The tool most commonly associated with the Late Archaic period in South Carolina is the Savannah River point. These bifaces, known by various names from Florida all the way into Canada, are often very large (12+ cm in length is not uncommon) and exhibit a straight stem, straight base, and triangular blade. These "points" were likely multifunctional tools used as both spear points and as knives for cutting and skinning.

Other Late Archaic varieties found in the project region include Appalachian Stemmed, small Savannah River Stemmed and Otarre Stemmed, (Sassaman 1985). Like Savannah River hafted bifaces, they are characterized by triangular blades, straight or slightly contracting stems, and straight bases. The primary difference is size; Savannah River points tend to be longer and wider than the other types. For the most part these type names are more a product of parochial terminology than of actual morphological differences.

Fiber-tempered wares, known as Stallings Island, are found almost entirely along the Savannah River and on the southern South Carolina and northern Georgia coasts during this sub-period (Sassaman 1993b; Stoltman 1974). Inland and along the northern South Carolina coast, a coeval sand-tempered ware known as Thom's Creek is more common. In the Piedmont, pottery is not commonly found on Late Archaic sites, where soapstone vessels were utilized well after they were abandoned on the coast (Sassaman et al.1990; Sassaman 1993b).

Woodland Period (ca. 3000–900 B.P.)

Whereas the stylistic typologies of projectile points are used to differentiate the Archaic subperiods, changes in ceramic types are used to define the divisions of the Woodland period. The Early Woodland begins at approximately 3000 B.P. with the adoption of pottery across most of the eastern United States. The progression from the Late Archaic to the Early Woodland was gradual, with an increase in the reliance on seeds and planting, and the development of a "big-man" social structure. Reflective of this development in social structure are the use of conical burial mounds and the elaboration of a widespread exchange network that occurs during this period. In the project area, ceramic artifacts dating to this period include the Yadkin and Deptford series (Anderson 1985, Blanton et al. 1986).

Mississippian Period (ca. A.D. 900–1670)

Social, economic, and technological manifestations that are associated with the Mississippian period became established by approximately A.D. 900. Unlike the transitions between the sub-phases of the Woodland period, these changes were dramatic, and some have argued that they occurred when the loosely integrated Late Woodland populations in the region were colonized and acculturated by the chiefdom-level societies that had emerged in the Etowah and Oconee River valleys (Anderson et al. 1996).

This time period represents cultures that were present at the time of initial European contact. The period is marked by a rise of ceremonialism, large public constructions such as pyramidal mounds, and a heavy reliance on the production of domesticated imports such as maize, beans and squash (Smith 1983).

A highly organized village structure developed during this period. Associated with the village lifestyle were rigid social, political and religious systems. Society was stratified and a ruling class exerted ascribed and achieved power over the general population. Central villages were typically located along terraces or levees of major rivers. Smaller villages, hamlets, and isolated family settlements are also characteristic of this period (Ferguson 1971). The increase in population put a strain on the amount of available resources and warfare became endemic. Central towns and villages were fortified with palisades, while small villages and farmsteads were located around the periphery, presumably to facilitate a safe retreat within the palisade in the event of an attack. Smaller villages and farmsteads also would have contributed resources and labor to the main towns.

Ceramic styles have allowed for the differentiation of this period into subdivisions and at least two possible cultural areas. Trinkley (1983) has presented a discussion of the ceramic variability for this period in the South Carolina Coastal Plain and coast, while Anderson and Joseph (1988) have presented one applicable to the South Carolina Piedmont. There is increasing evidence that territorial boundaries between chiefdoms were closely maintained during the Mississippian period.

Evidence of Mississippian chiefdoms has been identified in Georgia, North Carolina, South Carolina, and across much of the southeast. Current research identifies a number of major Mississippian centers along the Fall Line including Hollywood and Lawton near Augusta, Santee Indian Mound on the Santee River, Mulberry and Adamson near Camden, and Town Creek along the Pee Dee River in North Carolina. In addition, one or more small chiefdoms, dating from A.D. 1225–1375, may have been present in the Broad River Valley of the South Carolina Piedmont, not far from the current study area (Green and Bates 2003). In terms of settlement organization, these mound centers formed the center of political power. The ruling elite and a resident population permanently occupied these villages. As political control waxed and waned among elite factions in this politically turbulent era, mound centers were periodically constructed, maintained, and abandoned (Anderson 1990). Many mound centers were abandoned and then reoccupied several times.

HISTORICAL OVERVIEW OF THE PROJECT VICINITY

Early Settlement in the South Carolina Midlands

The South Carolina Midlands, for the purposes of this section, are defined as the City of Columbia and the surrounding counties of Richland, Newberry, Saluda, and Lexington.

In the early eighteenth century, the majority of European settlements remained in the state's Lowcountry. A trading post/fort was erected at "Congaree" in the vicinity of present-day Cayce in the first quarter of the eighteenth century, but there was no large-scale civilian settlement until the 1730s. To protect coastal interests from Spanish and Indian incursion, and to attract European immigrants in the hopes of balancing the ever-growing African slave population, Governor Robert Johnson created 11 townships across the state's northern frontier in the 1730s (Figure 6). The townships were located along rivers in the northern portion of the colony. Saxe-Gothe Township was established on the west side of the Congaree River south of the confluence of the Saluda River. The promise of new land and opportunities brought a large influx of immigrants to South Carolina (Edgar 1998).

The land along the Congaree River became an inviting location for settlement. The area was very appealing to the settlers for the richness of its landscape, which consisted of forests with little undergrowth and large hickory, oak, and pine trees. Most of the new settlers took up farming, along with cattle-grazing, milling, and commercial endeavors including operating ferries and Indian Trade (Salley 1898).

In an effort to attract settlers those arriving in Saxe-Gotha were eligible for a town lot and 50 acres of land per family member (Kovacik and Winberry 1987). Colonists in the Midlands created settlements that were largely independent of the Lowcountry. Coastal settlements were strongly Anglican, whereas the Midlands people were for the most part dissenters who were often seeking sanctuary to practice their faith unmolested. The coastal citizens were often several generations past the rigors of colonization, unlike the newcomers to the interior. Language, religion, economics, and geography created a barrier of sorts that was not breached until the late eighteenth century and the Revolution.

Figure 6. Saxe-Gotha in 1757 (DeBrahms 1757).

The American Revolution

Poor soils and lack of transportation improvements slowed the growth of the Saxe-Gotha Township until after the Revolutionary War. Prior to the start of the war, the township was virtually abandoned. A small trading center called Granby on the west bank of the Congaree River below the shoals at Columbia was established prior to 1774, and the fort constructed there during the Revolution was active in supplying the military. Located at the head of navigation of the Congaree River, the town became an important shipping point for goods produced on the surrounding agricultural lands, including cotton, indigo, hemp ropes, corn, and beeswax. Likewise, manufactured goods such as fabrics and household wares, and staples such as salt and coffee were shipped upriver and distributed throughout the Upcountry (Central Midlands Regional Planning Council [CMRPC] 1982).

As the Revolution neared, the dissatisfaction felt by the colonists toward their British leaders was largely concentrated in the coastal areas. Residents of the Midlands and Upcountry became a source of concern for the delegates, however, since they were more disillusioned with the government in Charleston than that of the Royal government. In an attempt to win support from the backcountry settlers, a group of representatives from the Provincial Congress were sent to talk with the area's inhabitants. The first of three meetings took place in the Dutch Fork at McLaurin's Store in present-day Newberry County. William Drayton, leader of the group, later noted in his journal that the meeting went poorly. In the end, the two parties reached an accord; representatives from the South Carolina Midlands and Upcountry regions would sign an agreement stating that they would remain neutral in exchange for the promise that they would no longer be bothered with talk of revolution (Edgar 1998).

At the war's conclusion, South Carolina slowly began the process of reestablishing its government. After the Revolution, Ninety-Six, Orangeburg, Cheraw, and Camden Districts, created in 1769, had become too large to effectively govern. In 1783 the state government decided to divide the existing districts into smaller counties of no more than 40 square miles. Richland County was formed from that part of Camden District located between the Congaree and Wateree rivers. In 1786 vote by the legislature to move the state's capital from Charleston to a new town that would be constructed in a centralized location along the banks of the Congaree River in Richland County. After a great deal of debate, it was decided that the new town would be named Columbia, a name that symbolized the new nation (Edgar 1998).

The site for the capital was chosen because it was centrally located between the upcountry regions and the former capital of Charleston. The location proved to be well situated for the promotion of trade as well. Although it lay beyond the head of navigation by about two miles, the presence of the state and county governments, banks, law offices, and South Carolina College (established in 1801), encouraged growth of the capital. The Columbia Canal, completed in 1824, brought boats into the city, and a series of canals on the Broad, Wateree, and Saluda rivers was constructed to further facilitate trade. For the most part, the use of these canals did not justify the enormous cost to the state for their construction, since they were often inoperable because of a lack of water, damage caused by freshets, or structural and mechanical problems. Nevertheless, they were important in attracting business and industry to the Columbia area. By 1830 the town had a population of 3,310 and could boast of a thriving state college, a State House, town hall and marketplace, numerous churches, a Masonic Hall, two public libraries and a third at the college, a series of bridges spanning its three rivers, and a modest but active spirit of commerce and industry (Moore 1993).

Antebellum Agriculture in the Midlands

The introduction of the cotton gin in the late 1790s transformed the Midlands' economy. Short staple cotton and the cotton gin allowed Midlands farmers access to the wealth and opportunities that had been previously reserved for coastal planters. The possibility of making a large profit from the sale of their cotton crop was a driving reason behind the shift in interest. As a result, Midlands planters began to invest in infrastructure, educational institutions, and commercial enterprises.

Accompanying the cotton boom during the first portion of the nineteenth century was a statewide effort supporting internal improvements, including new roads and canals to connect the upper and lower parts of the state that had been separated for years both physically and economically. In 1818, the General Assembly established a Board of Internal Improvements to oversee a $1 million program of roads and canals to improve the state’s transportation network (Edgar 1998). Construction started on a system of canals was begun on the Saluda, Broad, Congaree, Catawba, and Wateree rivers.

The state’s canal system was largely a disappointment. The plan proposed by the Board of Internal Improvements called for eight canals. Four were to be located on the Catawba and Wateree Rivers above Camden. The Lockwood and Columbia Canals along the Broad River were intended to open up traffic 110 miles north of Columbia, and the Saluda and Dreher Canals along the Saluda River were meant to open up river traffic to Laurens and Abbeville west of Columbia (Edgar 1998). All eight canals were completed and totaled 25 miles of canals and 59 locks that connected every district in the state except Greenville.

The entire canal system was plagued with problems from the outset. Shoddy construction and damage from flooding resulted in the poor operation of the locks. Public disinterest added to operational problems. Lack of use by the public resulted in a failure to generate enough revenue to pay the lock keepers’ salaries (Ford 1988). The Saluda River Canals were infrequently used, and their operation was often plagued by either too much or too little water from upstream. No tolls had been collected at the Dreher Canal by 1824, and it was not until 1827 that any evidence has been found of revenues from the canal. Twenty-one boats used the canal that year, carrying 578 bales of cotton. The Columbia Canal can be seen on Mills’ 1825 Atlas of Richland District on the east side of the Congaree River (Figure 7).

Despite these setbacks, the area managed to prosper during the first quarter of the nineteenth century, as a result of the cotton boom. Besides the business generated by the state government, Columbia supported a large, but dispersed agricultural community in surrounding Richland and Lexington districts. Merchants, bankers, plantation owners, and real estate speculators capitalized on the flow of goods through Columbia, where cotton from the countryside was loaded onto barges for shipment to Charleston, and manufactured goods from New England and abroad was sold to farmers, peddlers, and storeowners. The new money from the trade encouraged investment, and some of the leading businessmen began to invest in manufacturing enterprises, in hopes of decreasing the state’s dependency on imports and improving the return on their money (Lansdell 2003). With a ready supply of cotton available, and a slave labor force to work in the factories, many felt that the South could become the next great textile center.

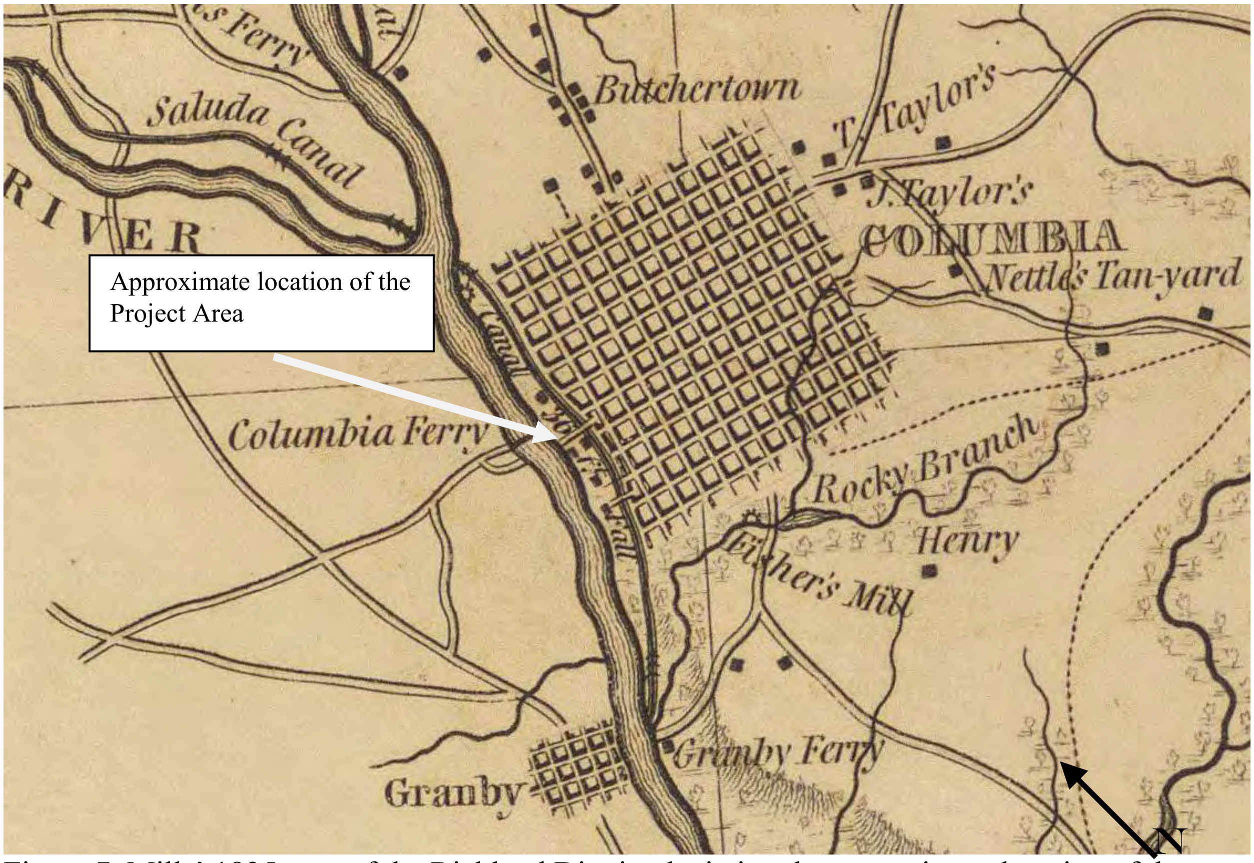


Figure 7. Mills' 1825 map of the Richland District depicting the approximate location of the project area.

Civil War

South Carolinians worried that Abraham Lincoln's victory in the 1860 election would lead to freedom for the black population and the end to wealth that relied heavily on slave labor. Upon hearing of Lincoln's victory, communities across South Carolina convened to discuss what action would be taken in retaliation. On 17 December 1860 delegates from communities across the state unanimously voted to draft an Ordinance of Secession. Following an outbreak of smallpox in Columbia, the convention reconvened in Charleston where the Ordinance was signed on 20 December 1860, and Francis W. Pickens of Edgefield District was elected governor (Pope 1992; Moore 1993).

The Midlands of South Carolina did not witness any military action until the waning months of the war, but the effects of the hostilities were keenly felt. Nearly every man of fighting age was pressed into service, leaving the farms to be run by old men, wives, children, and slaves. Many of the men who served never returned, or were permanently disabled.

Late in 1864, as Union troops moved into Georgia from the north, Confederate authorities began to move prisoners of war from Andersonville and other stockades to what was perceived as more secure territory. The ultimate destinations included Florence, South Carolina for enlisted men and Columbia for officers. It is a sign of the stress war had placed on the Confederate infrastructure that housing, feeding, and guarding the prisoners was left to the state. In both Florence and Columbia the guards were for the most part too young or too old for active military service. In Columbia the prisoners were first kept at “Camp Sorghum”, so named for the sorghum molasses that made up the bulk of the food supply. Camp Sorghum was located on the west side of the Saluda River in a field near the Saluda Factory. The camp was not fortified and escapes were common, becoming so prevalent that the prisoners were moved in December 1864 to the grounds of the South Carolina Lunatic Asylum.

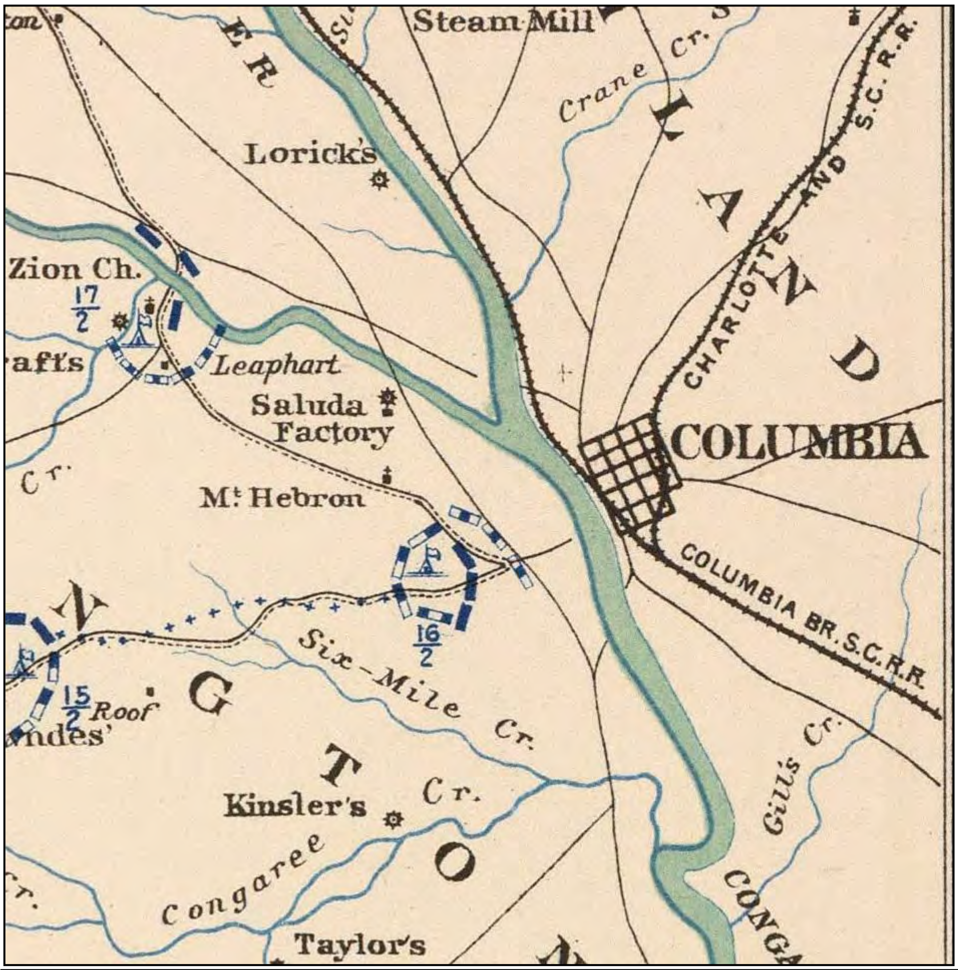


Figure 8. Union Troop locations February 15, 16 and 17, 1865

The infamous “March to the Sea” made by Union troops under the command of General William T. Sherman concluded with the surrender of Savannah in late December, 1864. Some troops remained in coastal Georgia while others were transported to Beaufort and its environs. In mid-January, 1865 the troops were again on the move, this time heading north in what became known as the “Campaign of the Carolinas”. The left wing of Sherman’s army (that is, those furthest west) crossed the Savannah River at several points, the bulk regrouping at Robertsville (in present day Jasper County) at the end of January, 1865. Heavy rains during the winter caused swollen streams and creeks and often bridges had been burned before the Union forces arrived, slowing the pace of the advance. Nonetheless, the troops averaged approximately 15 miles per day, skirmishing with Confederate troops before them and destroying railroads along the way.

By February 16, 1865 the First, Second and Third Divisions as well as Kirkpatrick’s Cavalry were camped on the west bank of the Congaree River directly across from Columbia (Figure 8). Meanwhile, Columbia's citizens were trying to evacuate the city, and bales of cotton were dragged into the street to be carried off and burned to keep them from falling into enemy hands.

Wade Hampton, hastily promoted to lieutenant general, was left to defend the city with General Joseph Wheeler's cavalry. Sensing the futility of the defense, Wheeler's men began looting the city, ostensibly to prevent capture by the Union army.

On the night of the 16th, Hampton announced that he planned to evacuate on the following morning, leaving behind the cotton, which he was unable to transport. Sherman's troops began shelling the city, which surrendered the following day. That evening, fueled by spirits dispensed without restriction, Union troops created more mischief through the city. When the cotton in the streets caught fire, they were unable or unwilling to contain the blazes, in some cases probably fanning the flames. The result was the near complete destruction of Columbia (Moore 1993). Having the run of the countryside for several days, Union troops burned many homes and farms in region.

Postbellum Agricultural Practices

Lee's surrender at Appomattox in April 1865 sealed the fate of the Confederacy and launched the South on a difficult course to remodel its social structure around free labor. Soldiers returned home to the Midlands to find desolation. Farmland was barren and plantation houses stood overgrown and decaying. Production and livestock holdings were still below 1860 levels by the time of the 1870 census; widespread corruption in state and local government during Reconstruction further hampered recovery. By 1880, however, cotton production had reached antebellum levels (Kennedy 1990).

The rapid increase in cotton production in the post-war years led to the abandonment of food crops and eventually to a statewide agricultural crisis. Prior to the introduction of cotton, farms had been small and self-sufficient, producing their own food. Eager to make a profit, most farmers reclaimed fields that had previously been reserved for food crops to grow more cotton. When prices began to fall, farmers became desperate to pay off overdue bank loans and in turn over-planted fields, used substandard land for planting, and heavily fertilized their crops in the hopes that increased production would lead to increased profits. In 1860, South Carolina produced 353,412 bales of cotton; by 1890 the figure had reached 747,190 bales. Eventually, the market became flooded with cotton resulting in a drop in the price per pound. Prices fell gradually, but consistently from 1881 through 1886 (Edgar 1998).

African-American farmers faced even greater hurdles in the postbellum period than did their white counterparts. Blocked from owning land by discriminatory banking and real estate practices, blacks generally took up as sharecroppers, sometimes on their old plantations, sometimes in a new location. The sharecropping system proved fundamentally detrimental to both tenants and landlords because of the opportunity for abuse by the landlords in the distribution of the proceeds and the lack of incentives for tenants to make improvements to the land. As lands became exhausted, tenants sought new arrangements, moving from farm to farm, but seeing no improvement in their situation.

A worldwide agricultural depression and the arrival of the boll weevil during the 1920s further eroded the established agricultural regime of the region. By 1930, tenancy levels in South Carolina had begun to stabilize, but the number of farms decreased as tenants left farming for other employment (Edgar 1998).

Although the tenant system led to widespread poverty in the region over the long run, cotton farming and the associated textile industry formed the basis of the region's economy from the end of the Civil War until the beginning of World War II.

Industrialization and Expansion in the Postbellum Era

While agriculture was the mainstay of the Midlands' economy until the mid-twentieth century, the late nineteenth and early twentieth centuries saw rapid changes in transportation and manufacturing. The post-Civil War years saw the continuing development of the state's railway system. By 1880, cities such as Columbia began to once again grow and prosper as the cotton market continued to expand. Many of these towns became major cotton markets as trains running through the area allowed the easy shipment of cotton and other agricultural products.

The opening of the improved Columbia Canal in 1891 resulted in new mills and factories being constructed, and between 1880 and 1900 the population of Columbia doubled to 21,108. The South Carolina textile industry saw a dramatic increase with 61 mills either built or expanded between 1895 and 1907, becoming the largest textile producing state in the South. Columbia Mills, on the east side of the Congaree River at Columbia, became the first mill in the state to operate solely on hydroelectric power generated from the Columbia Canal, and a host of other mills soon followed suit.

An Agricultural Depression and a National Depression

An economic depression hit South Carolina in 1921, almost a decade before it was felt throughout the rest of the country. The collapse of cotton and tobacco prices, overseas competition, and the advance of the boll weevil took a heavy toll on the local economy. The boll weevil arrived in South Carolina in 1917, but it was not until 1922 that short staple cotton crops were affected (Edgar 1998). The price would rebound slightly, but remained low until World War II.

The arrival of the 1930s saw an agricultural system on the brink of collapse. Farmland and associated buildings stood at half of their original value and many farms across the state were mortgaged with owners surviving on borrowed money. Over-planted and over-fertilized land caused major erosion problems (most notably in the upstate) and by 1934, eight million of the state's farming acreage had been declared useless (Edgar 1998). The agricultural crisis of the 1920s and 1930s triggered a mass exodus of residents from the state. Because of the growth of Columbia, Richland County did not see a large decline in population, but residents were moving from the rural areas to the more urbanized areas close to the capital (Moore 1993).

It took some time for the effects of the nationwide Depression that came on the heels of the 1929 Stock Market Crash to be felt in the South Carolina Midlands. The construction of Lake Murray and the active cotton mills kept employment high until the end of 1930. New Deal work programs such as the Civilian Conservation Corps, Works Progress Administration, and Public Works Agency helped bridge the gap until the material and personnel demands of World War II pulled the country out of economic collapse (Moore 1993).

A New Era in a Diversified Economy

World War II finally brought an end to the Depression in the region. The war years saw an increase in agricultural production and manufactured products, as many South Carolina businesses became government contractors. Fort Jackson, established in Richland County during World War I, but virtually abandoned since the end of that war, was revived during World War II for infantry training. In 1940, a site between Six Mile Creek and Congaree Creek in Lexington County was chosen by the U.S. Army for an airfield, which was completed that same year. After World War II, the facility was turned over to the local governments for a regional airport to serve the Columbia area. At the war's close, veterans came home with renewed ambition and many quickly stepped forward as leaders of their communities. Soldiers took advantage of the G.I. Bill, obtaining an education and utilizing their newly developed skills throughout the community. In the years immediately following World War II, veterans opened businesses throughout the area, some of which are still in operation today (Pope 1992; Moore 1993).

Previous Investigations in the Project Area

An examination of materials on file at the SCDAH and SCIAA revealed one project that has a bearing on the current survey. In 1981 the South Carolina Institute of Archaeology and Anthropology (SCIAA) conducted a preliminary archaeological assessment of the Riverfront Park area and adjacent portions of the Historic Columbia Canal (Canouts and Harmon, 1981). The work consisted of a background literature review and a field reconnaissance survey with limited subsurface testing. The goal of the work was to document specifics of the canal and its features that were not well defined in the National Register Nomination Form. Recommendations for further archaeological studies were provided.

The report found that the area south of Gervais Street "has been drastically altered by the construction of a transmission line and other activities" (Canouts and Harmon, 1981). Despite the disturbance a number of archaeological resources were identified. These resources will be discussed in Chapter IV. Interestingly, the report notes that the National Register nomination form for the Columbia Canal Historic District states that portions of the canal are visible from Gervais Street south to Green Street, however they were unable to locate the canal bed itself and state that the canal route disappears in the area of Bicentennial Park. The report recommended further study.

IV. METHODS AND RESULTS

METHODS

The APE for archaeology for this project is considered to be the areas to be impacted by the proposed project. This includes the dewatered portion of the Congaree River and the upland locations of access roads and project compound. Repeated requests to shovel test the APE were denied by the property owner. Consequently no subsurface testing was conducted during the course of the project. A pedestrian survey was carried out along the existing dirt and gravel access road and the wooded area adjacent to the project compound. The entire road was walked on two separate occasions. The road surface was visually inspected for cultural material. Transects spaced approximately 15 meters apart were walked within the wooded portion of the project boundary. Photographs were taken at the locations of previously recorded sites.

RESULTS

Background and Literature Search

Prior to fieldwork, TRC conducted background research at the site files of the South Carolina Office of State Archaeology housed at SCIAA. This research included examination of archaeological sites, structures, and National Register of Historic Places (NRHP) files. The background research gathered information concerning the presence of known archaeological sites, historic structures or cemeteries, or potential sites on or in close proximity to the project area. Previous Recorded Archaeological Sites

Background research established that there are five previously recorded sites within the permit area. Site 38RD223 is a large nineteenth to twentieth century dump/sanitary landfill site located on a bluff overlooking the Congaree River (Canouts and Harmon, 1981). It is noted that the site has been disturbed by pot hunters although portions of it may be in good condition. This site was not assessed as to its National Register eligibility.

Site 38RD224 is interpreted as the possible ruins of Briggs' sawmill. Canouts and Harmon (1981) note a building foundation adjacent to a small tributary of the Congaree River. This site has not been assessed for the National Register.

Site 38RD278 is an underwater discovery of historic ceramics and metal artifacts. It is adjacent to site 38RD234 and may be a dump site from that structure

38RD286 is Civil War era ordnance dump site. Its boundaries are currently defined as being localized to a small unnamed tributary of the Congaree River just south of the Gervais Street Bridge. Historic documentation indicates that the site extends beyond its currently defined boundaries. Recent side scan sonar magnetometer surveys conducted in advance of the Congaree River Cleanup project support this notion. Currently the site has not been formally investigated by professional archaeologists. The South Carolina State Underwater Archaeologist has issued salvage licenses in the past to recreational divers to conduct recovery work at this site. Log reports associated with these salvages confirm the presence of Civil War ordnance.

Site 38RD234 was recorded as the ruins of a late nineteenth to early twentieth century house with a visible brick porch house footings and a "square brick enclosure that could be a house well" (SCIAA Site Form 1982). No evaluation of this site was made at the time it was recorded.

Table 1. Archaeological Sites within a 0.5-Mile Radius of the Project Tract.

Site No.	Description	NRHP Status
38LX10	Paleoindian through Late Archaic Campsite	Not Assessed
38LX22	Woodland Period Lithic and Ceramic Scatter	Not Assessed
38LX67	Lithic Scatter	Not Eligible
38LX100	Guignard Brick Works	Listed
38LX334	Underwater Shipwreck Site	Not Assessed
38RD205	Middle-Late Archaic Lithic Scatter, destroyed	Not Eligible
38RD223	19^{th}-20^{th} Century bottle dump, land fill	Not Assessed
38RD224	Briggs Saw Mill	Not Assessed
38RD233	19^{th} – 20^{th} Century Artifact Scatter	Not Eligible
38RD234	Late 19^{th} Early 20^{th} Century structure foundation	Not Assessed
38RD235	V-shaped wooden object eroding out of river bank	Not Assessed
38RD236	Historic Period Dugout Canoe in Riverbank	Not Assessed
38RD275	Unknown Prehistoric lithic scatter, 20^{th} century	Not Eligible
38RD278	Underwater deposit of historic ceramics	Not Assessed
38RD286	Underwater Ordnance Dump Site	Not Assessed

Including the five sites mentioned above there are 15 previously recorded archaeological sites located within a 0.5-mile radius of the project area (Figure 1, Table 1). On the project side of the Congaree River,

Site 38RD205 is just north of Blossom Street in what is currently a parking lot. It was recorded in 1979 as a surface scatter of quartz thinning flakes and two quartz bifaces. The bifaces were dated to the Middle and Late Archaic Period. The South Carolina Site Form indicates that the artifacts were recovered from an active construction site and no further work was recommended for the site.

38RD233 is late nineteenth to early twentieth century dump site on an island across from the Columbia Canal Power House and the Gervais Street Bridge. It is not eligible for the National Register.

Canouts and Harmon (1981) initially identified site 38RD235 as an isolated find, it was later assigned an official site number. It is described as "V-shaped wooden object" measuring approximately 3.5 meters in length and 60 cm in width. They interpret this as being either a fragment from a boat or an industrial trough of some sort that was dumped in the river.

Site 38RD236 is on the same island as 38RD233. It is an historic period dugout canoe that was observed by Canouts and Harmon (1981) eroding out of the canal side of the island.

Site 38RD275 is a small surface scatter consisting of two prehistoric lithic flakes and a scatter of twentieth century brick fragments. It was noted as being disturbed and not recommended for additional work (SCIAA site form 1982).

On the opposite side of the river from the project area site 38LX10 is a large site investigated in the late 1930's by Robert Wauchope (SCIAA site form). It was recorded as containing a Clovis Point and net weights and a pipe carved out of steatite. The exact location of the site is unknown. 38LX22 and 38LX67 are prehistoric artifacts recovered by amateur collectors in the 1970's. They have not been formally assessed and their locations are approximate. 38LX100 is the Guignard Brick Works. This site is on the National Register of Historic Places. It is located on the west side of the Blossom Street Bridge. The brick works were active for the first half of the twentieth century. Structures associated with the brick works including "beehive" or circular kilns, and a one-story, brick office building are still standing. The brick works are approximately 0.28 mile southwest of the project area. A large, modern apartment complex and a tall trees lie between this site and the project area. The project will have no effect on this NRHP listed site.

38LX334 is an underwater resources identified by Canouts and Harmon (1981). It is the wreck of the City of Columbia, a steamship that sank in the early twentieth century. This wreck has not been evaluated. Underwater investigation and special conservation methods would be necessary to fully assess this site.

A review of Archsite website (online GIS database of recorded South Carolina cultural resources) indicates that the project area is within the Columbia Canal Historic District. The Columbia Canal Historic District encompasses an approximately 4.1 mile long area along the eastern bank of the Broad and Congaree Rivers. The northern boundary of the district is defined as the dam of the Columbia Reservoir approximately 0.5-mile upstream from the Broad River Road Bridge. The southern boundary is effectively at the railroad trestles and quarry on the south side of Granby Park. The National Register Nomination form defines this area as the "minimum acreage necessary to protect the historic integrity of the canal". The Nomination form indicates that the nominated area of the canal follows the area outlined in the *Columbia Canal Study* (Wilbur Smith and Associates 1979). The western boundary line of the district was delineated as the western bank of the Broad River until it meets the Saluda River and becomes the Congaree. From there south, the western boundary is defined as the Richland/Lexington County Line. The eastern boundary of the district was determined by using the property lines as they existed in 1979. Property lines were used to define the district since a complete appraisal of the area by archaeologists and a surveyor was not feasible. In the project area the district boundary follows the property lines of land belonging to Guignard Estates

There are four other National Register listed districts or structures, including the previously mentioned Guignard Brick Works (38LX100), within a 0.5-mile radius of the project area.

Table 2. National Register Listed Resources within a 0.5-Mile Radius of the Project Tract.

Resource	Description	NRHP Status
Columbia Canal	1824 and 1891 Canal and Associated Recouces	Listed
Gervais Street Bridge	Circa 1928 Bridge	Listed
Guignard Brick Works	20th Century Brick Kilns and facility	Listed
New Brookland Historic District	Early 20th Century Mill Village	Listed
Southern Cotton Oil Company	Early 20th Century Cotton Oil Mill	Listed

The Gervais Street Bridge overlooks the project area from the north. This is an open spandrel arch bridge constructed between 1926 and 1928. Ferry crossings and bridges have historically been present in this approximate location since the 1790's. During the Union invasion of Columbia in 1865 the wooden bridge that was at this location was burned in an attempt to slow Sherman's troop advancement into the city.

The New Brookland Historic District is approximately 0.2 miles west of the project area. This is a mill village constructed for the employees of the Columbia Duck Mill, the mill that was hydroelectrically powered by the Columbia Canal. A large number of commercial buildings and residences associated with the various growth phases of the mill are still present and in good condition.

The Southern Cotton Oil Company is approximately 0.50 miles east of the project corridor. This was one of the first and one of the largest cottonseed and cotton oil mills in the country. Similar to olive oil, cottonseed oil saw a boom period in the early 1900's thanks to aggressive promoters of the cotton oil industry. In 1994 there were seven extant structures associated with the Southern Cotton Oil Company. Subsequent to its listing on the National Register all seven buildings were demolished and removed.

Field Survey

Previously Recorded Resources

38RD223 – According to Canouts and Harmon (1981) this is a relatively large site measuring approximately 3000 square meters. This late nineteenth to early twentieth century bottle dump was located in a stand of hardwoods and dense undergrowth (Figure 9). They note that approximately 25% of the site was disturbed by pot hunters. A visit to the site identified an area relatively clear of undergrowth. The site has continued to be a dumping ground for the past 30 years. Plastic glass and metal containers, articles of clothing and modern refuse has been spread over and mixed with the bottle dump. It appears that the vegetation in the area is regularly mowed to minimize the undergrowth. It is unknown how much this grounds keeping has disturbed the site. No shovel tests were excavated at the site. It is believed that historic bottles may still be present. The plans for the Congaree River Sediment Removal Project call for the avoidance of this site. As seen in Figure 2 access roads are proposed to the north and south of this site. Monitoring during construction of the access roads is recommended to ensure that no significant artifact deposits are disturbed during the undertaking. The site remains unevaluated for the National Register. Further work in the form of subsurface shovel testing and artifact identification is necessary to determine the NRHP eligibility of this site.

38RD224 – In 1981 Canouts and Harmon located a building foundation approximately 60 meters downstream of a small unnamed tributary of the Congaree River (Figure 10). The ruins were noted as being in good condition and were assumed to be the remains of Briggs sawmill, a mill utilized by the Confederate government and burned by Union Troops in 1865. The site was considered significant and recommended for additional work.

This site was visited and an attempt to locate the foundation and any historic artifacts visible on the ground surface. A picture of the foundation shows stacked, large granite blocks. Transects

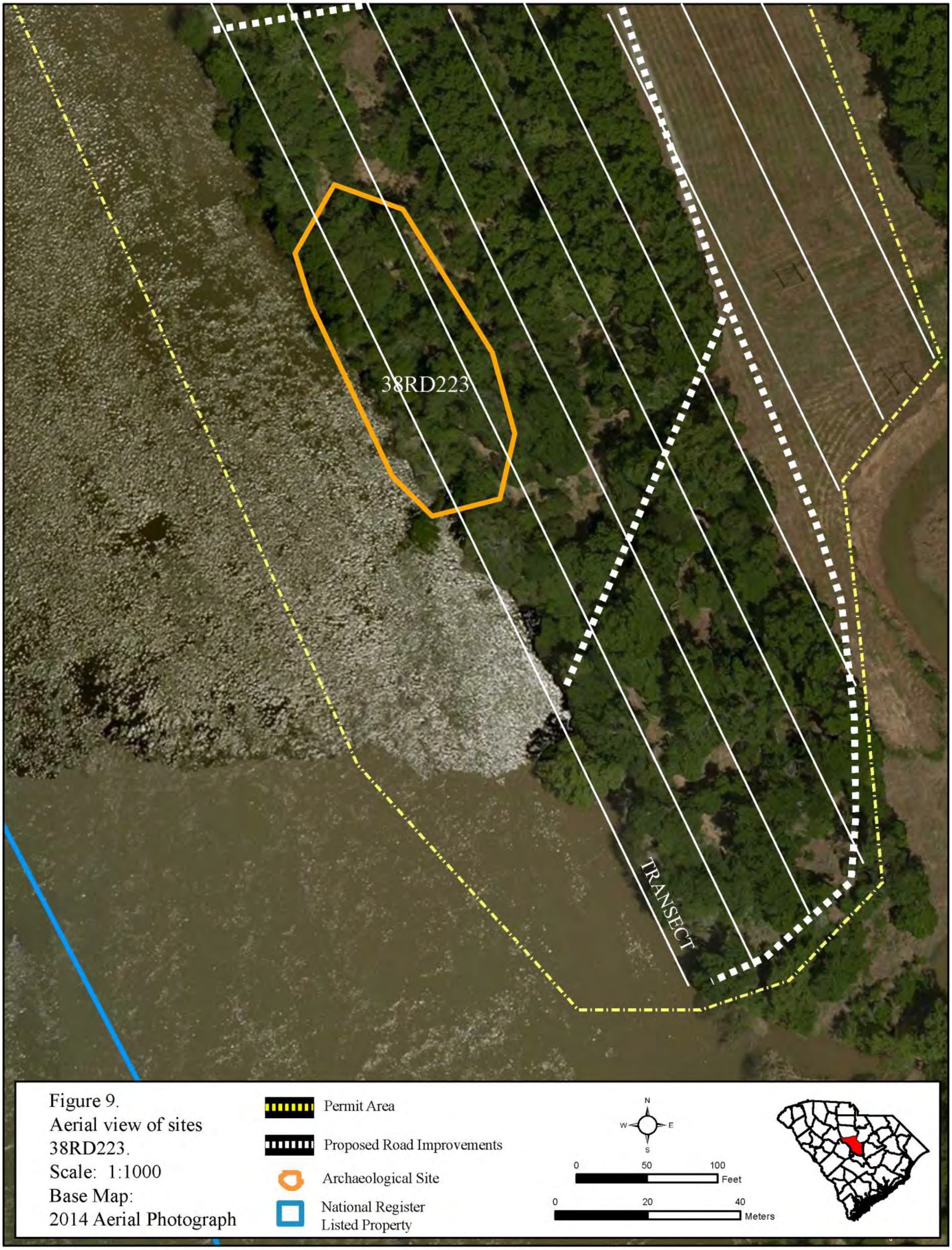


Figure 9.
Aerial view of sites
38RD223.
Scale: 1:1000
Base Map:
2014 Aerial Photograph

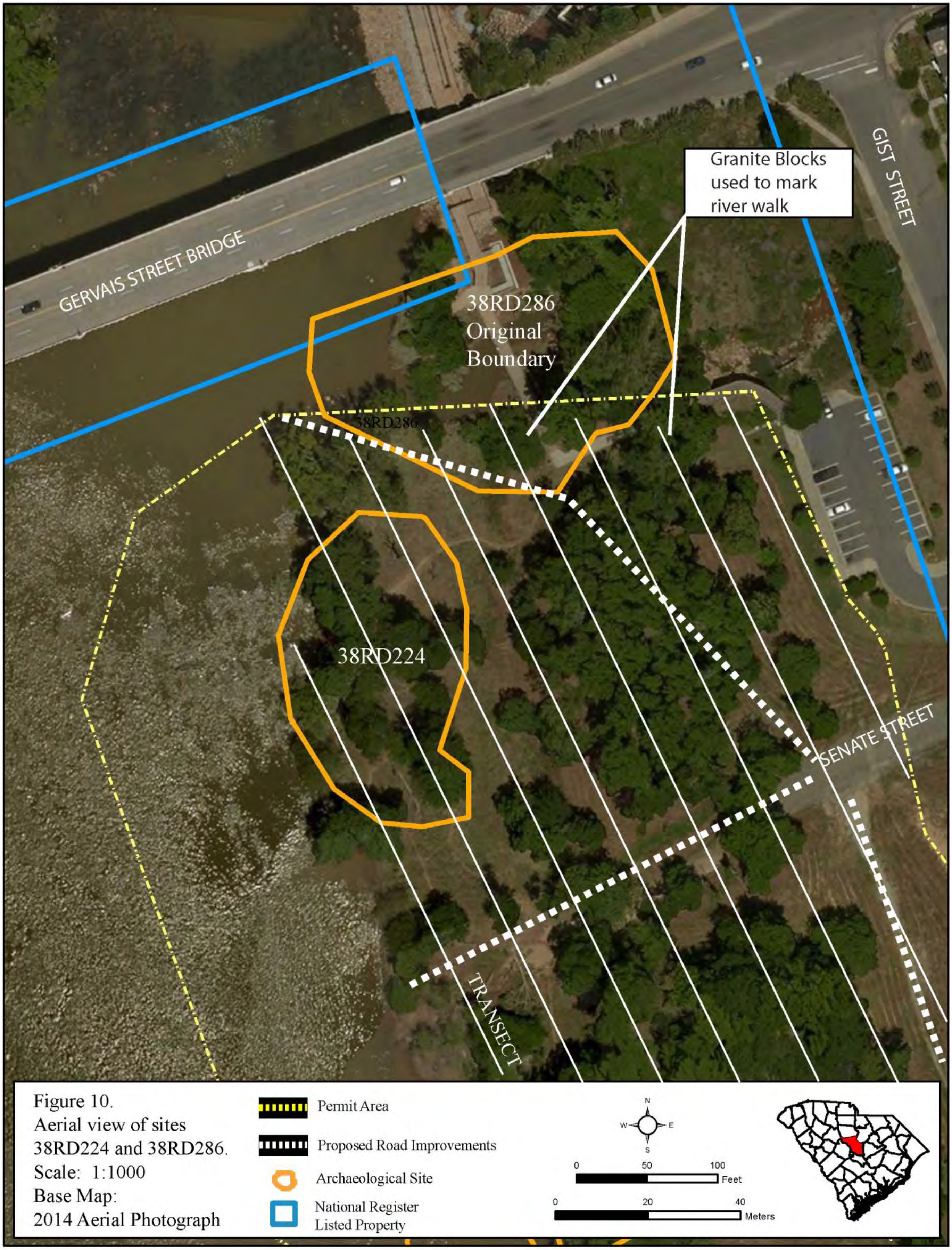


Figure 10.
Aerial view of sites 38RD224 and 38RD286.
Scale: 1:1000
Base Map:
2014 Aerial Photograph

Figure 11. Conditions at 38RD224.

Figure 12. Historic granite blocks used as river walk border.

separated by a 15 meter interval were walked in the mapped location of the site. Vegetation consisted of manicured grass in the upland portion of the site and shin high grasses and undergrowth closer to the river's edge (Figure 11). No trace of an intact granite foundation was found. While accessing the site via the City of Columbia River Walk large granite blocks were noted lining the pathway and marking drainage areas (Figure 12). These blocks are presumed to be the foundation stones identified in 1981 now repurposed as decorative elements to the river walk.

The foundation of the possible sawmill has been disturbed. However, it is possible that intact, subsurface features related to the mill are present. Currently the Congaree River Sediment Removal Project plans to avoid this area. An access road to facilitate dam construction is proposed just north of this site (see Figure 10). It is recommended that monitoring during construction of this road take place to ensure that no significant resources be impacted. Orange construction fencing may be needed to ensure that no activities take place within the boundaries of this site.

38RD234 – Was identified during a reconnaissance survey of the proposed Bicentennial Park. There is no official report of this survey however the SCIAA site form indicates that the site was recorded by SCIAA/Harmon in 1981. The site is recorded as nineteenth century architectural remains that include house footings, a partially intact brick porch and a square brick enclosure which was interpreted as a well house. Woodland Period pottery was also recovered. The site is located approximately 100 feet south of the Senate Street Landing (Figure 13). Similar to Site 38RD224 the area around this site has been periodically cleared over the last 30 years. Pedestrian transects within the boundaries of the site were unable to relocate the well house, brick porch or house footings. The site remains unassessed as to its National Register eligibility. Plans call for the avoidance of this site during the proposed undertaking. It is recommended that monitoring occur during any road construction in the vicinity of this site.

38RD278 -- This site is an underwater resource located immediately west of 38RD234 (see Figure 13). The site was examined in the early 1980s by Cleveland Huey under South Carolina Underwater Salvage License 26. Historic ceramics, a pewter spoon and prehistoric ceramics were reportedly recovered. It is likely that this site represents a dumping area for the structure associated with 38RD334. This site has not been evaluated for the National Reregister and due to it being underwater was not revisited. The site is in the permit area and will be impacted by the Congaree River Sediment Removal Project. The boundaries of this site will be encompassed within the newly expanded boundary of site 38RD286 (see below). Recovery and evaluation of artifacts associated with this site should occur concurrently with the mitigation of 38RD286.

38RD286 The Ordnance Dump Site – This site was originally recorded as being within an unnamed tributary of the Congaree River, immediately south of the Gervais Street Bridge (Figure 14). It is the recorded location of where munitions captured by the Union during the invasion of Columbia were dumped.

On February 17, 1865 General Sherman's troops captured Columbia. During the two day occupation, live munitions and other weapons of war housed at the Palmetto Armory were

Figure 13.
Aerial view of sites
38RD234 and 38RD278.
Scale: 1:1000
Base Map:
2014 Aerial Photograph

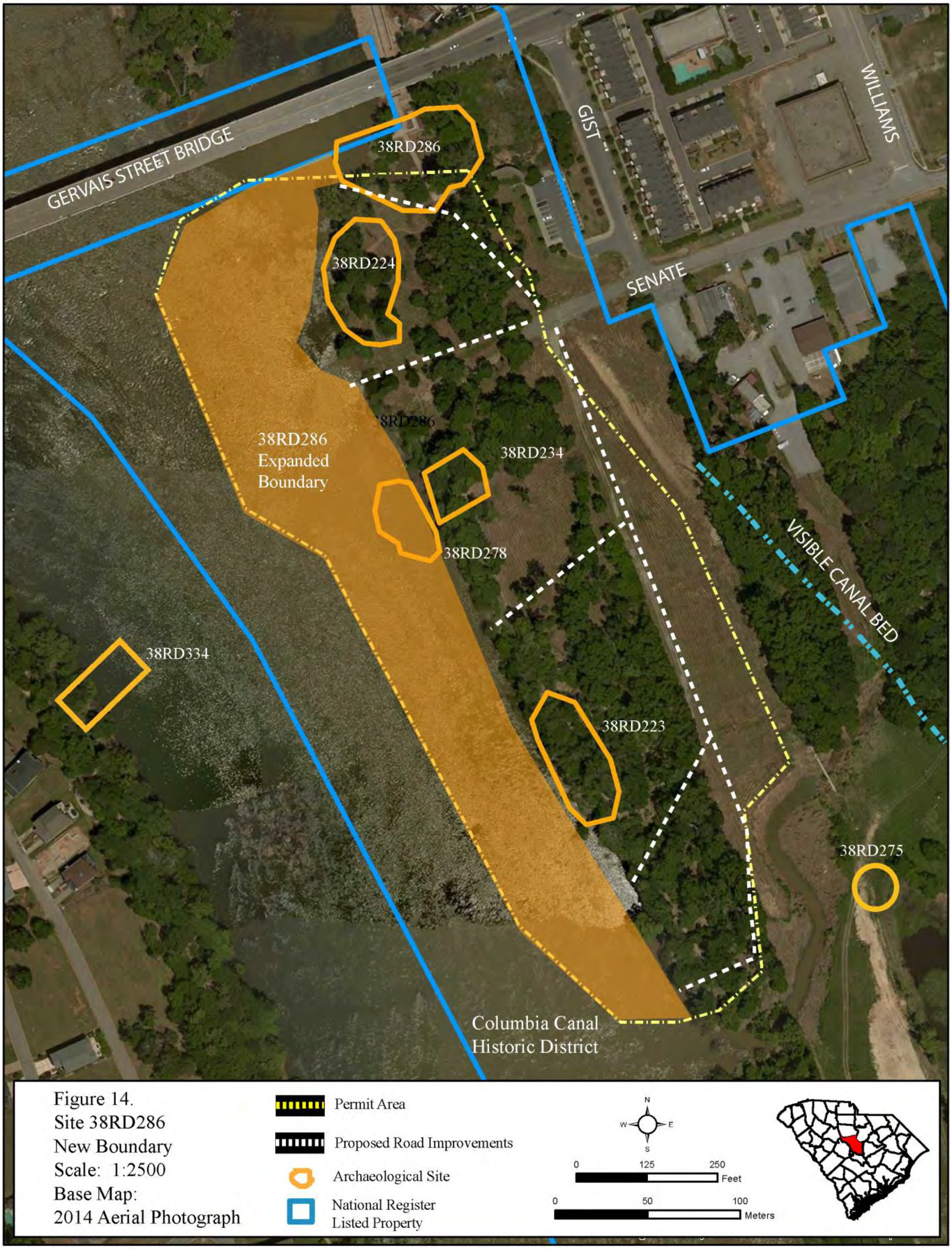


Figure 14.
Site 38RD286
New Boundary
Scale: 1:2500
Base Map:
2014 Aerial Photograph

dumped into the Congaree River near the Gervais Street Bridge. According to Civil War Records:

> *A detail of 500 men each from the First and Second Brigades, properly officered for fatigue duty, together with the pioneer corps and fifty wagons, reported to Captain Buel, chief ordnance officer, to destroy public works, machinery, ordnance, ordnance stores, and ammunition, of which there were large quantities.*
>
> *General John. E. Smith*

According to General Smith it took 1200 men and 50 wagons from 1 P.M. February 18 to 6 P.M. February 19 to destroy the machinery, ordnance, ordnance stores and ammunition. Figure 15 provides a list of the ordnance captured.

Soon after Union troops departed Columbia ordnance recovery began. The accounts of J. F. Williams indicated that industrious citizens of Columbia were quick to salvage powder from the boxes of paper cartridges that had been left on the bank and for years after the war people would dive into the river and recover cannon balls and shells (Williams 1929).

Newspaper articles dating to the 1930s and more formal recovery attempts conducted in the 1970s and 1980s provide supporting evidence that Civil War ordnance is still present in the river. In June 1930, *The State* reported that two fishermen recovered ammunition from the area of a small tributary near the base of the Gervais Street Bridge. The discovery motivated New Brookland Mayor L. Hall and Councilman D. A. Spigner to organize a project to recover the artifacts. Their recovery was extensive and labor intensive. A coffer dam was erected approximately where Senate Street terminates at the river. After digging through the mud and silt the project collected six 10-inch cannonballs, 1,010 round rifle balls, 767 pointed rifle balls, a number of cast-iron copper fused explosive cannon shells; and cast iron lead butt explosive shells; three cast-iron cannon balls; one brass cap explosive, 11 3½-inch round cannon balls, 51 2-inch cannon balls; 2 6-inch cannon balls; 3 3½-inch time fuse explosive bombs; and an artillery axe (*The State* 1930). According to the article Hall and Spigner believed they had recovered practically all the ammunition that was deposited in the river. Based on the inventory presented in Figure 3, however, the 1930s recovery accounts for only a fraction of what may be present.

Eight years after the Hall and Spigner conducted their recovery, the *Spartanburg Herald* reported that two New Brookland high school boys found an artillery projectile in the Congaree River. The boys, Luther J. Morris and Knowiton Jeffcoat, apparently attempted to melt lead out of the round causing a minor explosion that brought the find to the attention of New Brookland authorities (*The Spartanburg Herald* 1938).

Beginning in the 1970s a number of formal recovery and salvage projects have been conducted at the sites. A majority of these projects have been conducted with licenses provided by the South Carolina Institute of Archaeology and Anthropology (SCIAA) under the Underwater Antiquities Act, providing a precedent for conducting the currently proposed project under a similar Salvage License. In the winter of 1976 an acoustic survey in the Congaree River below the Gervais Street Bridge was conducted to identify concentrations of ordnance and artifacts. Although conditions were not ideally suited for an acoustic survey the project identified a concentration of ferrous material below the Gervais Street Bridge (Finkelstein 1976).

Inventory of ordnance and ordnance stores captured in Columbia, S. C., February 17, 1865.

Ball cartridges (no caps)		1,200,000
Percussion caps		100,000
Powder	pounds	26,150
12-pounder gun ammunition, fixed	rounds	1,007
6-pounder gun ammunition, fixed	do	3,852
24-pounder gun ammunition, fixed	do	546
8-inch shot and shell	do	2,364
10-inch shot and shell	do	1,320
Stands of arms		10,410
Unfinished arms		6,000
6-pounder guns		14
James guns		2
12-pounder mountain howitzers		5
Blakely guns		4
18-pounder rifled guns		3
Wiard gun		1
3-inch rifle		1
10-pounder guns		2
4-inch gun		1
4-inch mortars		2
6-inch Coehorn		1
Bronze guns, caliber 1½ and 2 inches		4
4-inch gun, smooth-bore		1
10-pounder Parrotts		2
Repeating battery		1
Gun carriages		9
Gun caissons		14
Gun (mountain howitzer) caissons		3
Forges		2
Anvils		4
Blacksmiths' vises		20
Sponges and rammers		1,125
Sabers, cavalry, artillery, and naval		3,100
Saber knots		700
Pairs cavalry pistol holsters		300
Saber belts		800
Bayonet scabbards		4,000
Cartridge-boxes (infantry)		5,150
Cartridge-box plates		3,500
Cartridge-box belts and plates		2,500
Waist-belts		2,900
Waist-belt plates		3,000
Ball screws		2,000
Pistol cartridge-boxes		550
Gunners' shot-pouches		600
Knapsacks		1,100
Haversacks		900
Slow match	yards	500
10-inch fuses		900
Tents		58

PHILIP MACCAHILL,
Lieut. and Actg. Ordnance Officer, First Div., Fifteenth Army Corps.

Figure 15. Inventory of ordnance caputured during the occupation of of Columbia.

Under a salvage license issued in 1980, diver Gerald Mahle discovered a cache of 10-inch cannon balls at the site. Mahle and his team estimated that 50 to 100 additional shot lay in the river. However, by the time they were able to return to the river divers associated with the Savannah River Dive Club in Hampton, South Carolina had removed the ordnance (Salvage License No. 26 file SCIAA).

Mahle continued work under the SCIAA permit from February through September 1981. Using a dragline, a backhoe and a gold dredge, Mahle and his team removed and screened sediment from

the river bed and apparently the alluvial fan near the foot of Senate Street. Fieldwork resumed in August 1981 using the backhoe for excavation. The project recovered numerous Civil War artifacts including a 3.5-inch shell, a 24-pound cannonball, two 10-inch shells and a post-Civil War projectile. Apparently the work did not produce sufficient material to justify continuation of the project (Salvage License No. 27 file SCIAA).

In 1983 a SCIAA Salvage License was issued for a metal detecting survey in the Congaree immediately south of the Gervais Street Bridge. Recovered artifacts associated with the Armory consist of 12 explosive shot for a 6-pounder cannon and one explosive shot for a 4-pounder (Salvage License No. 30 file SCIAA).Since the 1980s there are anecdotal reports of Civil War related artifacts being discovered in the river and on the alluvial fan at the terminus of Senate Street but there have been no additional formal recoveries.

Based on this information, there is sufficient documentary and formal survey evidence to establish the continuing presence of ordnance in this section of the river. With this in mind a series of magnetometer and side scan sonar surveys were conducted in advance of the Congaree River Sediment Clean-up project to determine the possible extent of ordnance within the contaminated area.

Over a period of 18 months, from 2010 to 2012, Tidewater Atlantic Research, Inc. conducted remote sensing surveys within the course of the river and on the eastern bank (Tidewater Atlantic Research 2010, 2011a, 2011b, 2012). The first phase of this work focused on the area from the Gervais Street to approximately 1500 feet downstream. The magnetometer survey identified 218 anomalies that were consistent with unexploded ordnance (UXO). Phase II of the survey began where Phase I ended and extended another 400 feet downstream. Ten anomalies that could be could represent UXO were identified in this phase. Phase III of the survey focused on the area from Unnamed Tributary 2 to just south of the Blossom Street Bridge. One hundred and twenty-two hits consistent with potential ordnance were recorded in this phase. Phase IV was the continuation of a terrestrial metal detector survey along the river bank and alluvial fan at the end of Senate Street. An additional 67 potential instances of UXO were recorded along the shoreline. Figure 16 is a map of the location of the magnetic anomalies. Attachment A provides a summary of magnetic anomaly survey along with a map detailing the precise locations of the possible UXO.

Based on the underwater survey work the boundaries of Site 38RD286 have expanded. The site now measures 90 meters east to west by 500 meters north to south. Historic documentation clearly indicates that disposal of the ordnance was a significant event associated with the capture and burning of Columbia. Historic accounts are clear and consistent as to the location of this site. Previous underwater salvage operations have confirmed the presence of Civil War ordnance and the underwater survey has confirmed the likelihood of additional artifacts. This site is recommended Eligible for the National Register of Historic Places under Criterion A based on its association with significant events related to the Civil War and Criterion D based on its potential to yield information important to history. This site will be adversely affected by the proposed undertaking. Mitigation will be required.

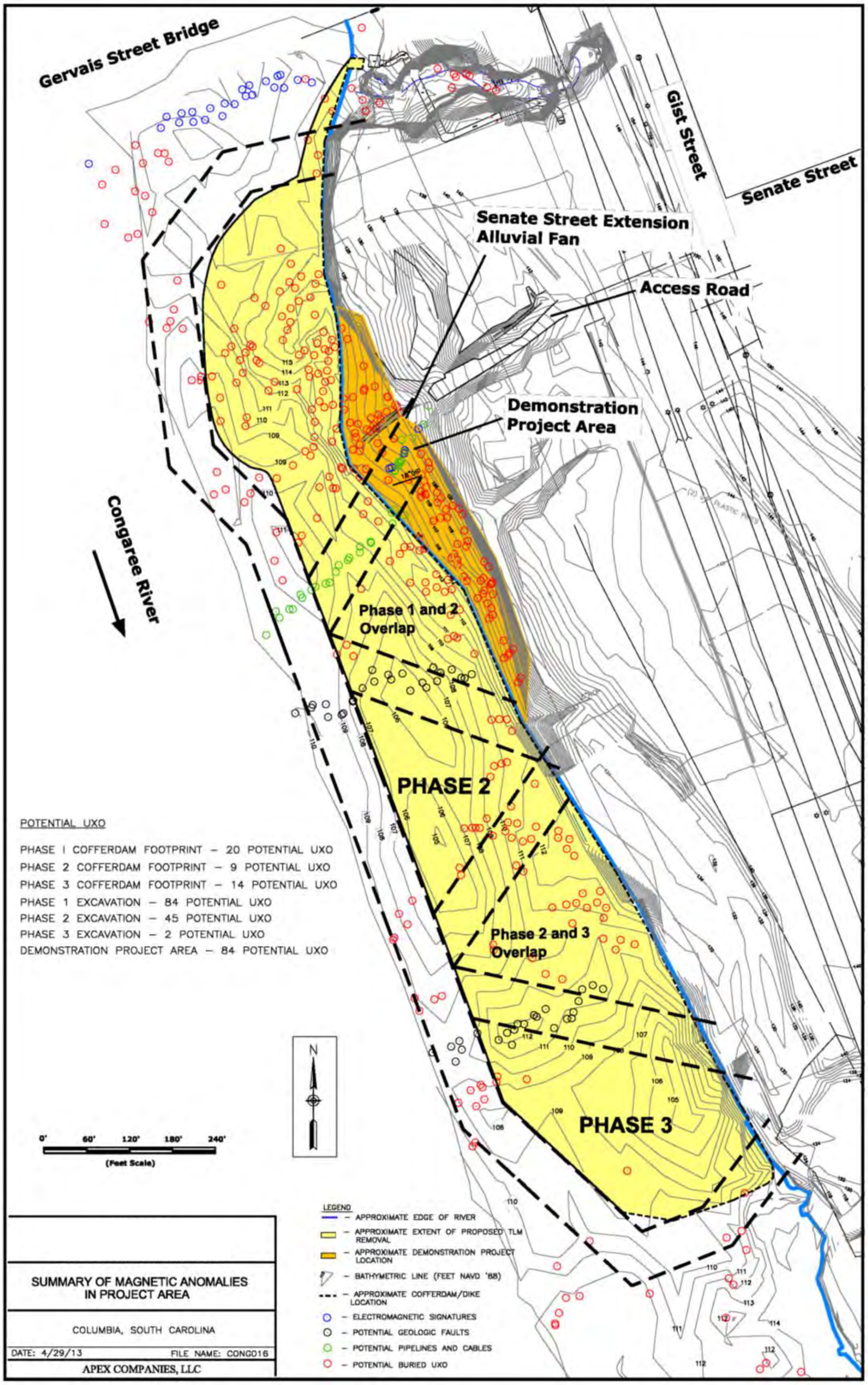


Figure 16. Locations of potential ordnance base on side magenetic anomolies.

National Register Listed Resources

New Brookland Historic District – The New Brookland District is approximately 0.25 miles west of the project area. This is a mill village constructed for the employees of the Columbia Duck Mill, the mill that was hydroelectrically powered by the Columbia Canal. A large number of commercial buildings and residences associated with the various growth phases of the mill are still present and in good condition. The mill district is screened by large trees that line the western bank of the Congaree River. The district cannot be seen from the project area (Figure 17) and will not be affected by the proposed undertaking.

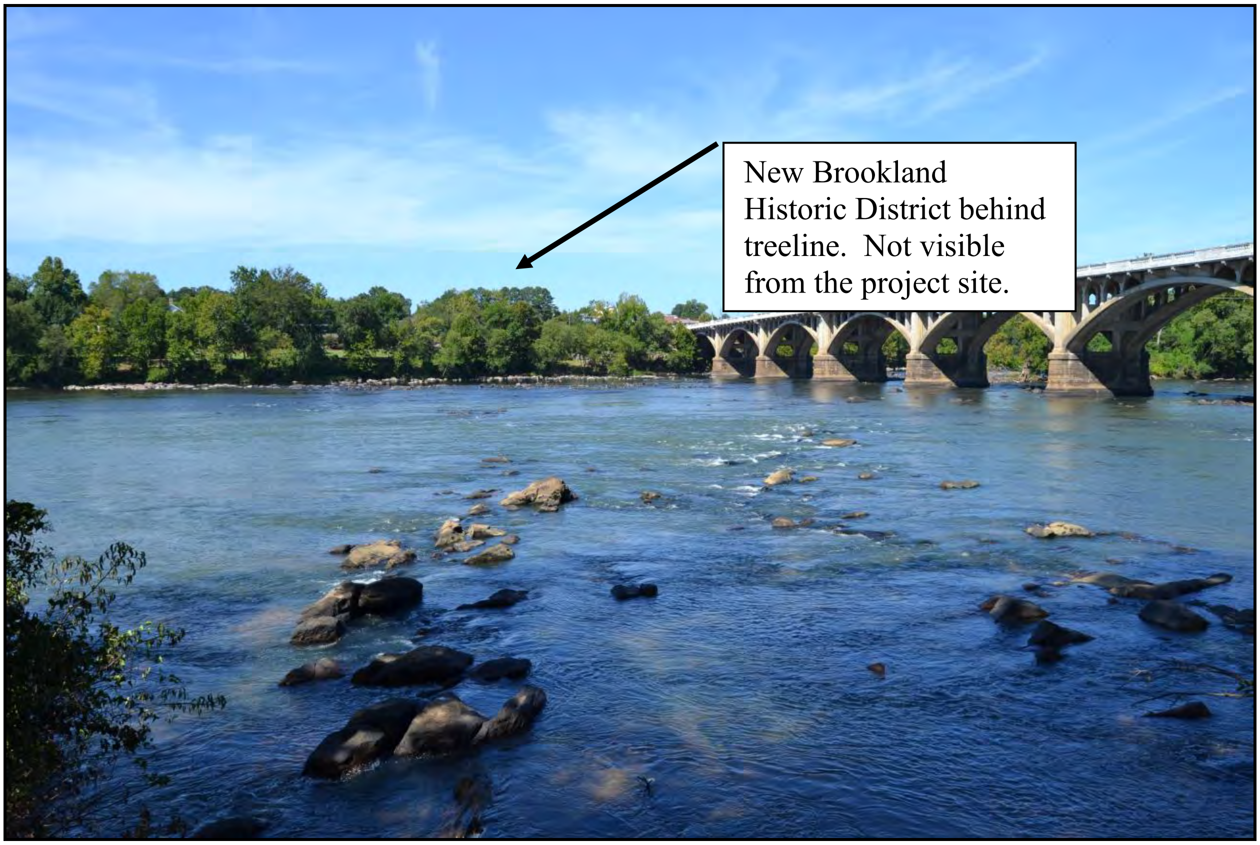


Figure 17. From the project area to the New Brookland Historic District.

Gervais Street Bridge – The Gervais Street Bridge is adjacent to the north side of the project area. Ferry crossings and bridges have historically been present in this approximate location since the 1790's. During the Union invasion of Columbia in 1865 the wooden bridge that was at this location was burned in an attempt to slow Sherman's troop advancement into the city. Another bridge was built at the same location and was owned privately until 1912 when it was purchased by Richland County (Figure 18). This bridge was demolished with completion of the current Gervais Street Bridge. Construction began on the current bridge 1926 and was completed in 1928. The 1415 foot bridge has nine open spandrel arch segments with closed arch spandrels at each end. Other than removal and repaving activities there have been no alterations to the bridge.

The bridge is one of four open spandrel arch bridges in South Carolina. It is significant for its design and its association with transportation and the growth of Columbia. It was listed on the National Register in 1978 as part of the Columbia Multiple Resource Area (National Register of Historic Places Nomination Form 1978).

Figure 18. Previous Gervais Street Bridge circa 1900 (photo curteusy of the Carolina Library).

The Congaree River Sediment Removal project proposes a temporary coffer dam immediately downstream of the the bridge. As stated previously the coffer dam will be constructed of rock/rip rap and will stand between 0 and 10 feet above the water line depending on river fluctuations. The coffer dam and the remediation project will have no effect on the design of the bridge nor will affect the bridge's significant role in transportation. There is little remaining of any historic viewshed that may have been associated with the bridge. Billboads are present at both ends of the bridge and a large modern apartemtent building is located on its western side (Figure 19). Develoment and the skyline of downtown Columbia are also clearly visible from the bridge. The coffer dam will be a temporary construction and will provide no significant visual impact to an already compromised historic viewshed.

Columbia Canal – The Columbia Canal Historic District was listed on the National Register in 1979 under a number of areas of significance. It is considered archaeologically/historically significant based on the likelihood that excavation around intact portions of the canal could obtain detailed information on the construction of the canal bed and associated features. This information could, in turn, be compared to work done on other canals of the period. Excavation of the canal beds could also recover artifacts that would help interpret how the canal was utilized when it was active. The engineering techniques utilized in the construction of both the original 1824 canal and 1891 improvement are considered significant.

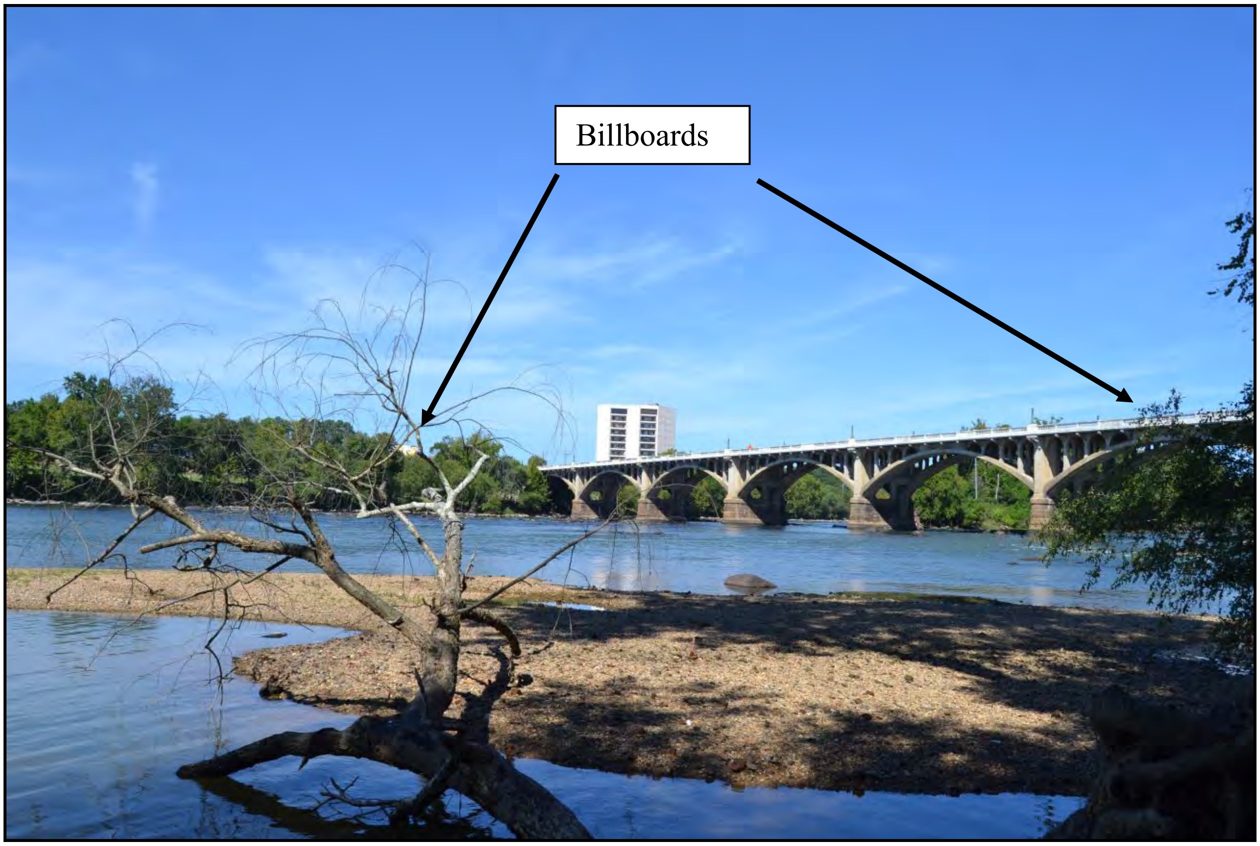


Figure 19. From project area to Gervais Street Bridge. Note modern apartment building.

The canal is also considered significant for the role it played in transportation and commerce. Because it was integral to the largest cotton shipping center in the state, the canal played a crucial role in the development of South Carolina's railroad system and the growth of Columbia. Expanding on the canal's role in commerce it was significant for its role in advancing industry in the state. From supporting ancillary small industries such as saw and grist mills to eventually becoming a valuable power source to larger mills the canal supported industry in Columbia. Finally the canal is considered significant under the category of "invention". In 1894 a large textile mill became the first in the country to use electrically generated power directly from a canal over a distance rather than an on-site power system like a waterwheel.

The original canal was constructed between 1820 and 1824. It was initially intended as a means of circumventing the unnavigable confluence of the Broad and Saluda rivers. This canal was over three miles long. It began above Richland Street on the Broad River and ended at Granby Ferry south of the project area. It had five turning basins with the largest being at the south end of Senate Street just north of the project tract. North of the Senate Street Turning Basin the canal was 12 feet wide and contained two and half feet of water. South of Senate Street, in the vicinity of the project area, the canal was 18 feet, contained four feet of water and was flanked by eight foot wide tow paths (Nomination Form 1978). With the increasing reliance on the railroad for shipping the 1824 canal was gradually allowed to deteriorate and by 1842 was used primarily to power waterwheels for mill sites rather than transport goods. Its route is visible on Russell's 1850 map of Columbia (Figure 20) and the 1870 Tingle map of the Columbia Canal (Figure 21).

In 1888 the Board of Trustees for the Columbia Canal approved a plan to develop the portion of the canal north of Gervais Street into a new power source for the city. This project involved widening the canal to 150 feet across and dredging it to a depth of 10 feet (Wilbur Smith and Associates 1979). The expanded canal was completed on November 21, 1891. Power houses and the associated Hydro Plant used for generating electricity for the Duck Mill opened up north of Gervais Street. South of Gervais the canal was abandoned.

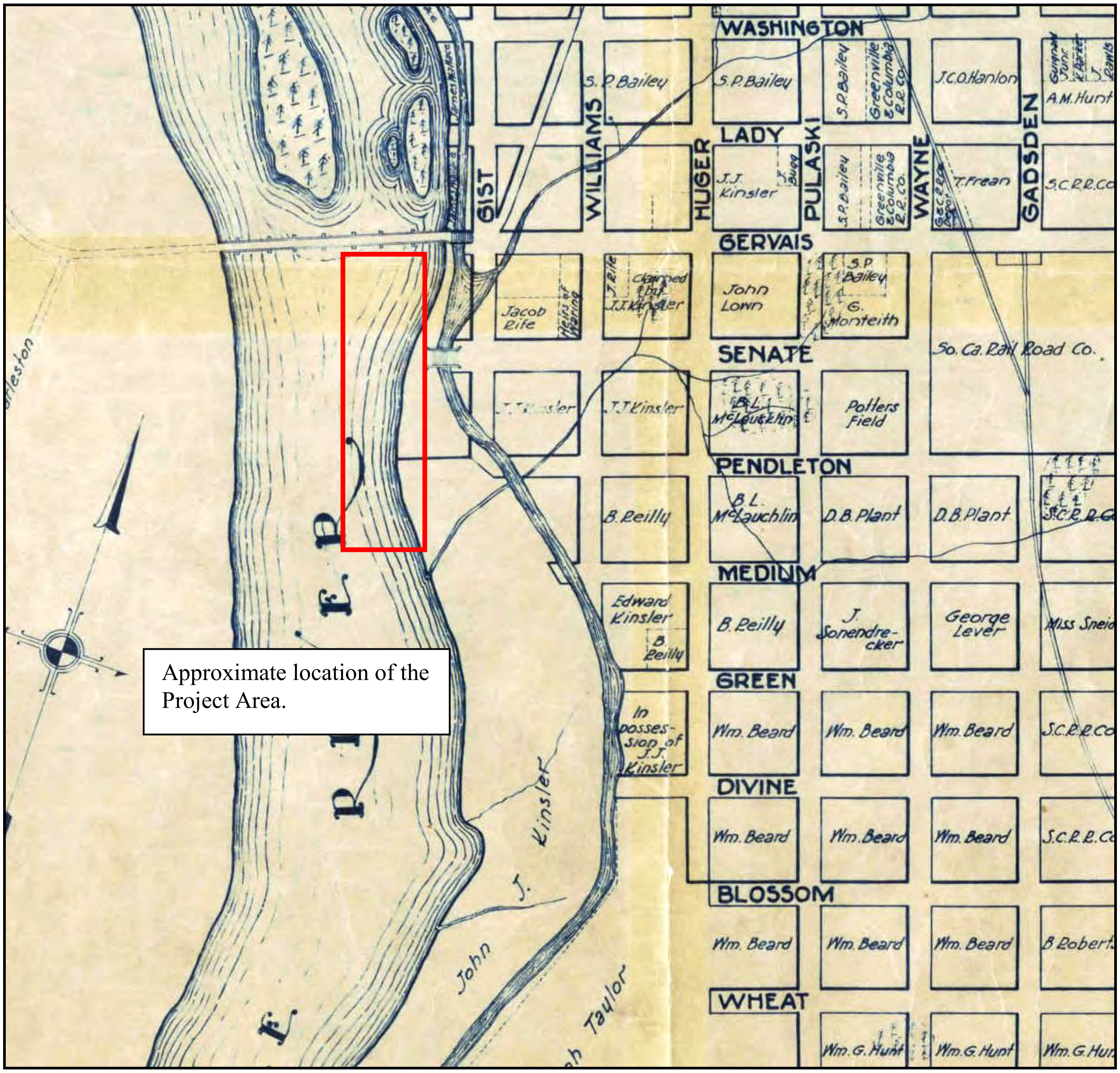


Figure 20. Location of the Canal bed in relation to the project area in 1850.

Figure 21. Location of the canal bed in relation to the project area in 1870.

The Hydro Plant was built in 1896. It furnished electricity for lights in the city of Columbia, as well as supplied current for public and private manufacturing and the Street Railway System. The plant is still operational and provides a large portion of power for the city. While the internal workings of the Hydro Plant have been updated and modified to meet today's demand for electricity the building itself remains much as it was when it was first built. It is a brick structure with symmetrical arches that allow the canal to flow back into the river. The plant can be seen from the northern edge of the project area (Figure 22).

Figure 22. View from project location to Canal Hydro Plant, facing north.

The plant is part of the Columbia Canal Historic District and adds to the district's significant contribution to Industry and Invention. The proposed coffer dam will not affect those areas of significance. The historic nature viewshed of the Hydro Plant will also not be affected by the proposed undertaking.

The temporary coffer dam will be similar in appearance to the existing rip rap and stone embankment that currently abuts the Hydro Plant (Figure 23). The coffer dam will in fact be similar in construction to the canal itself. Canouts and Harmon (1981) note that an 1867 profile drawing shows the canal banks as rip rap along the river's edge. They also indicate that the 1891 canal had rip rap placed along erosional areas. Additionally there are numerous modern intrusions to the Hydro Plant's viewshed. The Edventure Children's Museum with its modern three story glass façade is adjacent to the plant compromising the historic integrity of Canal District (Figure 24). The proposed project will have no impact on the visual landscape of the Columbia Canal Historic District.

Figure 23. View from Columbia Canal Hydro Plant to project area. Note rip rap.


Figure 24. Example of modern buildings adjacent to the Canal Hydro Plant.

V. SUMMARY AND RECOMMENDATIONS

Five archaeological sites and two National Register Listed properties/districts were identified within or adjacent to the permit area. A background study and pedestrian survey were employed to determine if the proposed project would have any effect on significant cultural resources.

Project plans have been designed to avoid impacts to archaeological sites 38RD223, 38RD224 and 38RD234. These are upland, terrestrial sites that fall within the permit area. These sites were identified 33 years ago during a reconnaissance survey. At the time they were recorded all three sites had clearly visible, above ground components. In the intervening years periodic land clearing and maintenance appear to have displaced and removed the structural ruins associated with 38RD224 and 38RD234. Modern dumping has obscured the historic nature of the late nineteenth to early twentieth century bottle dump at 38RD223. These three site potentially have intact subsurface deposits. Avoidance of these sites is recommended as they have not been evaluated for the NRHP. Monitoring is recommended during construction activities in the vicinity of these sites to ensure that no significant cultural deposits be impacted.

There are two underwater archaeological sites that were previously recorded in the project area. 38RD278 is a small scatter of historic and prehistoric artifacts. The historic artifacts may be associated with the historic structure recorded as site 38RD234. This site was not evaluated for the NRHP. It will be adversely impacted by the proposed undertaking. Site 38RD286 is the location where Union troops dumped ordnance from the Palmetto Armory during the capture and burning of Columbia. Recent magnetometer and side-scan SONAR surveys have led to an expansion of the boundary of this site. The site now measures 90 by 500 meters and encompasses site 38RD278. 38RD278 is effectively a component of the ordnance dump site. Historic accounts, past salvage operations and recent underwater survey work have led to the recommendation that this site is eligible for the NRHP. If this site cannot be avoided additional archaeological work will be required to mitigate the adverse effects of the Congaree Sediment Removal Project.

The project area is within the Columbia Canal Historic District. The project will not affect the integrity or National Register significance of the district nor will affect any individual components of the district such as the extant canal bed and the Columbia Canal Hydro Plant.

The Gervais Street Bridge is adjacent to the project area. The bridge is significant for its contribution to transportation and for its design. The project will cause no alteration to the bridge's design nor affect its role in transportation. The bridge is flanked by the City of Columbia to the east and Cayce to the west. The modern skyline associated with this metropolitan area is clearly visible from the bridge. The proposed project will have no effect on the viewshed of the bridge.

REFERENCES

Anderson, David G.

1985 Middle Woodland Societies in the Lower South Atlantic Slope: A View from Georgia and South Carolina. *Early Georgia* 13(1-2):29–66.

1995 Paleoindian Interaction Networks in the Eastern Woodlands. *Native American Interactions: Multiscalar Analyses and Interpretations in the Eastern Woodlands,* edited by Michael S. Nassaney and Kenneth E. Sassaman, in press. University of Tennessee Press, Knoxville.

Anderson, David G., and J. Joseph

1988 *Richard B. Russell Reservoir Technical Synthesis of Cultural Resource Investigations.* Russell Papers. TRC Garrow Associates, Inc., and Interagency Archaeological Services, National Park Service, Atlanta.

Anderson, David G., R. Jerald Ledbetter, and Lisa D. O'Steen

1990 *Paleoindian Period Archaeology of Georgia.* Georgia Archaeological Research Design Paper No. 6. University of Georgia, Athens.

Anderson, David G., Lisa D. O'Steen, and Kenneth E. Sassaman

1996 Environmental and Chronological Considerations. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 3-15. The University of Alabama Press, Tuscaloosa.

Anderson, David G., Kenneth E. Sassaman, Christopher Judge (editors)

1992 *Paleoindian and Early Archaic Period Research in the Lower Southeast: A South Carolina Perspective.* Council of South Carolina Professional Archaeologists in conjunction with Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Anderson, David G., and Joseph Schuldenrein (assemblers)

1985 *Prehistoric Human Ecology Along the Upper Savannah River: Excavations at the Rucker's Bottom, Abbeville and Bullard Site Groups*. 2 vols. Gilbert/Commonwealth Associates, Inc., Jackson, Michigan. Submitted to National Park Service, Archeological Services Branch, Atlanta.

Blanton, Dennis B., and Kenneth E. Sassaman

1989 Pattern and Process in the Middle Archaic Period in South Carolina. In *Studies of South Carolina Archaeology*, edited by Albert C. Goodyear III and Glen T. Hanson, pp. 53–72. University of South Carolina Institute of Archaeology and Anthropology, Anthropological Studies No. 9. Columbia.

Braun, E.L.

1950 *The Deciduous Forests of Eastern North America.* Philadelphia, Blakiston.

Bryson, Reid A., David A. Baerreis, and W. M. Wendland
1970 The Character of the Late Glacial and Post Glacial Climatic Changes. In *Pleistocene and Recent Environments of the Central Great Plains,* edited by W. Dort, Jr., and J. K. Jones, Jr., pp. 53–74. University of Kansas Special Publications 3.

Bullen, Ripley P., and H. B. Greene
1970 Stratigraphic Tests at Stallings Island, Georgia. *Florida Anthropologist* 23:8–28.

Canouts, Veletta and Michael Harmon
1981 *Where the Waters Meet: An Archaeological Study of the Columbia Canal Historic District.* Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

Central Midlands Regional Planning Council (CMRPC)
1982 Town of Lexington and Unincorporated Lexington County, S.C. Historic Resources (Multiple Resource National Register Nomination). On file, South Carolina Department of Archives and History, Columbia.

Daniel, I. Randolph, Jr.
1996 Hardaway Revisited: Early Archaic Settlement in the Southeast. University of Alabama Press, Tuscaloosa.

1998 Stone Raw Material Availability and Early Archaic Settlements in the Southeastern United States. *American Antiquity* 66(2):237–265.

Delcourt, P. A., and H. A. Delcourt
1983 Late Quaternary Vegetational Dynamics and Community Stability Reconsidered. *Quaternary Research* 19:265–271.

Edgar, Walter
1998 *South Carolina: A History*. University of South Carolina Press, Columbia.

Elliott, Daniel T., and Roy Doyon
1981 Archaeology and Historical Geography of the Savannah River Floodplain Near Augusta, Georgia. Series Report No. 22. Laboratory of Archaeology, University of Georgia, Athens.

Ferguson, Leland G.
1971 *South Appalachian Mississippian*. Ph.D. dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

Ford, Lacy K Jr.
1988 Origins of Southern Radicalism: The South Carolina Upcountry, 1800–1860. Oxford University Press, New York.

Goodyear, Albert C.
1999 *A Hypothesis for the Use of Cryptocrystalline Raw Materials Among Paleo-Indian Groups of North America*. The University of South Carolina Institute of Archaeology and Anthropology Research Manuscript Series 156. Columbia.

Green, William, and James Bates
2003 The Broad River Chiefdom: A Possible Unrecognized Chiefdom in the Central South Carolina Piedmont. Paper presented at the Southeastern Archaeological Conference, Charlotte.

Justice, Noel D.
1987 Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States. Indiana University Press, Bloomington.

Kennedy, Joseph C. G. (compiler)
1990 *Population of the United States in 1860; Compiled from the Original Returns of the Eighth Census under the Direction of the Secretary of the Interior*. Reprinted. Norman Publishing, Inc., New York. Originally published in 1865, Government Printing Office, Washington, D.C.

Kovacik, Charles F., and John J. Winberry

1987 *South Carolina: The Making of a Landscape*. University of South Carolina Press, Columbia.

Lansdell, Brent
2003 *Assessment of Known and Potential Archaeological Sites in the Saluda Dam Remediation Project at Lake Murray, Lexington, Newberry, Richland and Saluda Counties, South Carolina.* Brockington and Associates, Inc., Atlanta and Columbia. Submitted to South Carolina Electirc and Gas, Columbia, South Carolina.

Michie, James L.
1996 The Taylor Site: An Early Occupation in Central South Carolina. In *The Paleoindian and Early Archaic Southeast*, edited by David G. Anderson and Kenneth E. Sassaman, pp. 238-269. The University of Alabama Press, Tuscaloosa.

Milanich, Jerald T. and Charles H. Fairbanks
1980 *Florida Archaeology*. Academic Press, New York.

Mills, Robert
1980 *Atlas of the State of South Carolina*. Baltimore: F. Lucas, Jr., 1825. Reprint. Southern Historical Press, Inc., Greenville, South Carolina.

Moore, John Hammond
1993 Columbia & Richland County: A South Carolina Community, 1740–1990. University of South Carolina Press, Columbia.

National Register of Historic Places Nomination Form
1978 The Columbia Canal. Prepared by Charles E. Lee, South Carolina State Historic Preservation Officer.
1978 Columbia Multiple Resource Area. Prepared by Charles E. Lee, South Carolina State Historic Preservation Officer.

O'Steen, Lisa D.
1993 *Early Archaic Settlement Patterns in the Wallace Reservoir: An Inner Piedmont Perspective.* Unpublished Master's thesis, Department of Anthropology, University of Georgia, Athens.

O'Steen, Lisa D., R. Jerald Ledbetter, Daniel T. Elliott, and William W. Barker
1986 Paleo-Indian Sites of the Inner Piedmont of Georgia: Observations of Settlement in the Oconee Watershed. *Early Georgia* 14(1, 2):1–63.

Pope, Thomas H
1973 *The History of Newberry County, Vols. I and 2*. Columbia: University of South Carolina Press.

Salley, A.S.
1892 *The History of Orangeburg County South Carolina From its First Settlement to the Close of the Revolutionary War*. Regional Publishing Company, Baltimore.

Sassaman, Kenneth E.
1985 A Preliminary Typological Assessment of MALA Hafted Bifaces from the Pen Point Site, Barnwell County, South Carolina. *South Carolina Antiquities* 17:1–17.

1993a Mims Point 1992: Archaeological Investigations at a Prehistoric Habitation Site in the Sumter National Forest, South Carolina. *Savannah River Archaeological Research Papers* 4. Occasional Papers of the Savannah River Archaeological Research Program, South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Columbia.

1993b *Early Pottery in the Southeast*. University of Alabama Press, Tuscaloosa.

1996 Technological Innovations in Economic and Social Contexts. In *Archaeology of the Mid-*

Smith, Marvin T.
1983 *Depopulation and Culture Change in the Early Historic Period Interior Southeast*. Ph.D. dissertation, Department of Anthropology, University of Florida, Gainesville.

Tidewater Atlantic Research, Inc
2010 *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011a *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase II Addition.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011b *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase III Report.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2012 *A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

Trimble, Stanley W.
1974 *Man-Induced Soil Erosion on the Southern Piedmont, 1700–1970*. Soil Conservation Society of America, Ankeny, Iowa.

Trinkley, Michael
1985 Ceramics of the Central South Carolina Coast. *South Carolina Antiquities* 12:1–35.

Ward, H. Trawick
1983 A Review of Archaeology in the North Carolina Piedmont: A Study of Change. In *Prehistory of North Carolina: An Archaeological Symposium,* edited by Mark Mathis and Jeffery Crow, pp. 53-81. Raleigh: Department of Cultural Resources, North Carolina Division of Archives and History.

Watts, W. A.
1975 *Vegetation Record for the Past 20,000 Years from a Small Marsh on Lookout Mountain, Northwestern Georgia.* Geologic Society of America Bulletin 86.

Wharton, Charles H.
1977 *The Natural Environments of Georgia*. Georgia Department of Natural Resources, Atlanta.

Whatley, John, Jr.
1985 The Possible Extension of the Paris Island Stemmed Point to the Georgia Coastal Plain. *The Profile* 47:11–13.

Whitehead, Donald R.
1973 Late-Wisconsin Vegetational Changes in Unglaciated Eastern North America. *Quaternary Research* 3:621–631.

Wilbur Smith and Associates
1979 *The Columbia Canal Study.* Wilbur Smith and Associates, Columbia.

ATTACHEMENT 1 – ANOMALY SUMMARY

DRAFT

Congaree River Anomaly Summary
Congaree River Project
Columbia, SC

Site Location

The report summarizes the results of the magnetometer surveying activities conducted in support of the South Carolina Electric and Gas (SCE&G) Company Congaree River Project located in Columbia, SC. The Congaree River begins at the confluence of the Saluda River and the Broad River in Columbia, SC. The portion of the Congaree relevant to this project is the approximate eastern third of the river beginning directly south of the Gervais Street Bridge and extending for approximately 3,700 feet downstream to approximately 500 feet below the Blossom Street Bridge. Figure 1 provides the location of the area in question.

Background Information

In June 2010, the South Carolina Department of Health and Environmental Control (SCDHEC) noted tar-like material (TLM) near the eastern shoreline of the Congaree River directly downstream of the Gervais Street Bridge. SCDHEC collected samples of this material and the analytical results indicated that the source of the TLM might be attributable to the former manufactured gas plants (MGP) that operated in Columbia starting in the mid-1800s and ending in the late 1940’s to early 1950’s. Predecessor companies of SCE&G operated the Huger Street manufactured gas plant (Huger Street MGP). Its location is provided on Figure 1. SCE&G has recently completed a removal action at the Huger Street site where over 125,000 tons of MGP impacted soil and debris was excavated and removed with oversight provided by SCDHEC.

SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012. SCDHEC approved the PDR on April 23, 2012. The PDR presented the results of delineation activities completed to determine the extent of the TLM within the river. The delineation work was completed in five separate phases over approximately 18 months. The magnetometer surveying operations described in this summary report were a component of the investigative activities and were necessary due to the potential presence of Civil War era explosive ordnance within the project area. Details pertaining to the ordnance are provided below.

Potential Presence of Historical Items and Unexploded Ordnance (UXO)

It has been confirmed that in 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia. A list of munitions and other Confederate items captured by the Union forces is provided in Attachment A. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Figure 2 shows this location and a daily activity log documenting some of the archeological work is provided in the initial Tidewater Atlantic Research Inc. report (Attachment B). Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Acoustic (side scan sonar) and magnetic (magnetometer) remote sensing surveying activities were completed in order to determine if potential munitions were present prior to conducting the sediment sampling activities. A description of these activities and their subsequent results are provided below.

Surveying Activities

Magnetometer surveying of the project area was conducted over four separate phases. The first phase was focused on the area directly downstream of the Gervais Street Bridge (grid lines 1 through 16 on Figure 2) and included some limited shoreline surveying near the Senate Street Extension Alluvial Fan (Figure 2). A sidescan sonar survey was also performed during Phase I. The purpose of the side scan sonar was to complement the magnetometer survey by potentially visually identifying objects (e.g., ordnance) that may be lying on the Congaree River bottom. The sidescan sonar survey results were inconclusive and it was not utilized in the subsequent phases.

Magnetometer surveying progressed downstream in conjunction with the continuing investigation activities with Phase II extending the survey area from grid line 16 to grid line 20. Survey of the unnamed tributary that is located south of the Gervais Street Bridge was also conducted during Phase II. Phase III encompassed the portions of the project area between grid lines 20 and 37 and Phase IV completed the shoreline surveying in the vicinity of the Senate Street Extension Alluvial Fan that was not conducted during the other phases due to access constraints.

The specific details pertaining to the surveying equipment and methodology are provided in the phase specific reports produced by Tidewater Atlantic Research Inc. provided in Attachment B. In general, depending on the area to be surveyed and the presence of rock outcrops and water level conditions, either a small boat with an outboard motor or an inflatable boat was utilized to carry the surveying equipment. The inflatable boat was pushed through areas where water levels and the presence of rocks precluded the use of the motorboat. Terrestrial surveying was done on foot with handheld and backpack mounted equipment.

The magnetometer surveys were generally run on north-south trending lines and were controlled via a differential global positioning system (DGPS) using a Trimble AgCPS 132 navigation system. HYPACK navigation software was used to translate the DGPS data into real-time data that was used to direct the survey along a predetermined grid or transects. In general, the magnetometer transects lines were located approximately 20 feet apart. In some areas of the river where obstructions were encountered and navigation had to be altered, the distance between the transect lines varied and could be decreased to less than 10 feet.

The magnetometer survey was performed with an EG&G Geometrics G-858 cesium magnetometer that is capable of +/- 0.001 gamma resolution. The magnetic data was collected at a frequency of six samples per second. The locations of the magnetic readings were determined from the DGPS.

The side scan sonar survey was performed from approximately the 4 to 16 Lines and boulders and shallow water prevented performing the survey above the 4 Line. A 445/900 kHz Klein System 3900 digital side scan sonar was employed. The side scan sonar data was horizontally tied to the DGPS and reconciled with the HYPACK survey software. Where navigation was possible, a total of five side scan sonar survey passes were made on a 50-foot transect spacing.

The magnetometer detects changes in earth's magnetic field that may be attributed to buried anthropogenic influences (e.g., UXOs, electrical cables, etc.) or naturally occurring geologic features (e.g., remnant thermal magnetism, ore bodies, etc.). Once the magnetometer data was collected it was systematically analyzed to identify potential targets. A variety of characteristics of the targets including configuration, areal extent, intensity and contrast with background were analyzed and compared to signature characteristics previously found to be reliable indicators of historic ordnance. The results are discussed below.

Results

Following each phase of fieldwork the accumulated data was analyzed and the potential UXO locations were identified. Table 1 provides the results of the magnetometer surveying activities by investigation phase and Figure 3 provides the anomaly locations for the project area. Each phase is also described in more detail in the phase specific reports provided in Attachment B. Table 2 provides a summary of the anomaly locations and interpretation and Table 3 provides a summary of the anomalies located within the planned project area and located in the planned cofferdam footprint.

As the historical and anecdotal evidence suggested, the majority of anomalies were located in the Phase I survey area nearest the Gervais Street Bridge and the boat apron. A total of 323 anomalies were detected in the Phase I area with 218 of those locations exhibiting signature characteristics that could be associated with ordnance. Some of the non-ordnance anomalies included discarded debris and appliances, an electrical cable crossing and a geologic feature.

Phase II produced 10 potential UXOs in grid lines 16 through 20 and an additional 8 in the unnamed tributary. For Phase III the number of anomalies continued to be relatively low from grid line 20 to 31 but increased directly downstream of the Blossom Street Bridge. This increase can be potentially attributable to more recent objects being thrown from the bridge and not necessarily historical UXO. The total number of targets for Phase III was 145 with 121 exhibiting signature characteristics that could be associated with ordnance.

Finally, Phase IV was conducted to obtain information in the area directly downstream of the boat apron, which was not completed during Phase I due to access constraints. A total of 84 anomalies were detected with 67 exhibiting signature characteristics that could be associated with ordnance. The total for all four phases of magnetometer surveying is 570 anomalies located within the investigated area with 425 or 75 percent of those potentially being ordnance.

Due to the nature of the potential historical objects and UXO deposited within the study area and their real or perceived value and/or potential hazard to public safety, the information contained in this summary report must remain confidential. This information was compiled by SCANA for use during completion of the investigative and subsequent remedial activities associated with the Congaree River Project. Any use or dissemination of the information for other purposes is not permitted and may be subject to legal action.

TABLE 1

MAGNETOMETER STUDY RESULTS SUMMARY

Congaree River Sediments
Columbia, South Carolina

Study	Dates	Study Area	Total Magnetic Anomalies	Potential Ordnance (UXO)	Other Anomalies
Phase I	Aug. 25-26, 2010	Congaree River - Grid Lines: 1 thru 16	323	**218**	105
Phase II	Jan. 4-5, 2011	Congaree River - Grid Lines: 16 thru 20	10	**10**	0
		Unnamed Tributary #1 - Outfall to River	8	**8**	0
Phase III	June 30, 2011	Congaree River - Grid Lines: 20 thru 37	145	**122**	23
Phase IV	January 31 - February 2, 2012	Senate Street Extension / Alluvial Fan Area	84	**67**	17
		Total Anomalies	570	**425**	145
		Percentage with UXO Potential		**75%**	

Notes:
1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "have signature characteristics that could be associated with ordnance" and "those anomalies should be considered potentially hazardous until material generating the signatures can be identified".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
1	078-1-nm262g175f	Geological Feature
2	078-2-dp280g49f	Pipeline
3	078-3-mc48g59f	Possible Ordnance
4	078-5-mc1854g71f	Possible Ordnance
5	077-1-nm758g34f	Possible Ordnance
6	077-2-mc40g45f	Possible Ordnance
7	077-3-mc52g76f	Possible Ordnance
8	077-4-pm203g68f	Pipeline
9	077-5-pm320g176f	Geological Feature
10	077-6-30g18f	Possible Ordnance
11	077-7-dp57g58f	Possible Ordnance
12	077-8-dp63g83f	Geological Feature
13	077-9-mc149g71f	Possible Ordnance
14	076-1-pm130g44f	Possible Ordnance
15	076-2-pm137g288f	Possible Ordnance
16	076-3-nm31g37f	Possible Ordnance
17	076-4-nm34g49f	Possible Ordnance
18	076-5-pm307g190f	Geological Feature
19	076-6-pm510g66f	Pipeline
20	076-7-mc76g69f	Possible Ordnance
21	076-8-mc627g66f	Possible Ordnance
22	075-1-dp116g50f	Possible Ordnance
23	075-2nm18g40f	Possible Ordnance
24	075-3-dp52g65f	Possible Ordnance
25	075-4-dp70g65f	Possible Ordnance
26	075-5-pm301g60f	Pipeline
27	075-5-pm289g178f	Geological Feature
28	075-7-dp36g30f	Possible Ordnance
29	075-8-nm59g80f	Possible Ordnance
30	075-9-pm48g35f	Geological Feature
31	075-10-pm125g70f	Possible Ordnance
32	074-1-dp207g40f	Possible Ordnance
33	074-2-dp121g40f	Geological Feature
34	074-3-pm32g20f	Possible Ordnance
35	074-4-pm288g215f	Geological Feature
36	074-5-nm861g50f	Pipeline
37	074-6-pm27g20f	Possible Ordnance
38	074-7-dp42g40f	Possible Ordnance
39	074-8-dp71g65f	Possible Ordnance
40	074-9-nm58g90f	Possible Ordnance
41	073-1-nm36g22f	Possible Ordnance
42	073-2-nm21g30f	Possible Ordnance
43	073-3-dp21g40f	Possible Ordnance
44	073-4-dp149g65f	Possible Ordnance
45	073-5-dp527g60f	Pipeline
46	073-6-pm302g199f	Geological Feature
47	073-7-pm41g18f	Possible Ordnance
48	073-8-nm60g70f	Possible Ordnance
49	073-9-dp64g31f	Geological Feature
50	073-10-dp42g17f	Possible Ordnance
51	072-1-pm46g11f	Possible Ordnance
52	072-2-pm88g23f	Geological Feature
53	072-3-pm310g167f	Geological Feature
54	072-4-pm2310g36f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
55	072-5-dp62g49'	Possible Ordnance
56	071-1-nm28g10f	Possible Ordnance
57	071-2-pm46g62f	Possible Ordnance
58	071-3-pm170g55f	Possible Ordnance
59	071-4-dp494g96f	Pipeline
60	071-5-pm324g202f	Geological Feature
61	071-6-pm117g97f	Geological Feature
62	071-7-pm70g33f	Possible Ordnance
63	070-1-pm66g25f	Possible Ordnance
64	070-2-pm251g132f	Geological Feature
65	070-3-dp235g21f	Possible Ordnance
66	070-4-nm549g33f	Pipeline
67	070-5-pm159g46f	Possible Ordnance
68	070-6-nm36g18f	Possible Ordnance
69	070-7-dp48g55f	Possible Ordnance
70	070-8-nm44g15f	Possible Ordnance
71	069-1-dp23g10f	Possible Ordnance
72	069-2-dp78g44f	Possible Ordnance
73	069-3-nm1841g50f	Pipeline
74	069-4-dp252g53f	Possible Ordnance
75	069-5-pm214g155f	Geological Feature
76	069-6-pm63g17f	Geological Feature
77	068-1-pm72g94f	Geological Feature
78	068-2-dp238g167f	Possible Ordnance
79	068-3-nm402g55f	Pipeline
80	068-4-dp38g40f	Possible Ordnance
81	067-1-dp32g38f	Possible Ordnance
82	067-2-mc181g93f	Pipeline
83	067-3-pm221g300f	Geological Feature
84	067-5-mc68g90f	Geological Feature
85	067-6-dp22g30f	Possible Ordnance
86	066-1-dp61g40f	Geological Feature
87	066-2-pm182g193f	Geological Feature
88	066-3-nm190g95f	Pipeline
89	066-4-dp127g77f	Possible Ordnance
90	066-5-dp48g18f	Possible Ordnance
91	066-6-nm43g42f	Possible Ordnance
92	066-7-pm27g10f	Possible Ordnance
93	066-8-dp9g10f	Possible Ordnance
94	065-1-dp143g31f	Possible Ordnance
95	065-2-nm19g10f	Possible Ordnance
96	065-3-pm11g7f	Possible Ordnance
97	065-4-dp32g60f	Possible Ordnance
98	065-5-dp127g20f	Possible Ordnance
99	065-6-nm363g52f	Pipeline
100	065-7-pm176g186f	Geological Feature
101	065-8-pm24g38f	Possible Ordnance
102	065-9-pm44g37f	Possible Ordnance
103	065-10-mc69g110f	Geological Feature
104	064-1-pm108g121f	Geological Feature
105	064-2-mc67g61f	Possible Ordnance
106	064-3-pm27g21f	Possible Ordnance
107	064-4-pm193g210f	Geological Feature
108	064-5-nm363g63f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
109	064-6-pm63g16f	Possible Ordnance
110	064-7-dp415g60f	Possible Ordnance
111	063-1-dp395g68f	Possible Ordnance
112	063-2-pm67g14f	Possible Ordnance
113	063-3-nm188g73f	Possible Ordnance
114	063-4-nm334g26f	Pipeline
115	063-5-pm224g187f	Geological Feature
116	063-6-pm111g143f	Geological Feature
117	062-1-pm99g136f	Geological Feature
118	062-2-pm203g163f	Geological Feature
119	062-3-nm257g48f	Pipeline
120	062-4-dp373g110f	Possible Ordnance
121	062-5-mc68g107f	Possible Ordnance
122	062-6-pm59g55f	Possible Ordnance
123	061-1-pm127g57f	Possible Ordnance
124	061-2-pm182g43f	Possible Ordnance
125	061-3-pm113g52f	Possible Ordnance
126	061-4-nm198g67f	Pipeline
127	061-5-pm225g210f	Geological Feature
128	061-6-pm112g147f	Geological Feature
129	060-1-pm109g18f	Geological Feature
130	060-2-pm66g46f	Possible Ordnance
131	060-3-pm246g205f	Geological Feature
132	060-4-nm107g38f	Pipeline
133	060-5-dp288g93f	Possible Ordnance
134	059-1-nm124g99f	Possible Ordnance
135	059-2-dp73g64f	Possible Ordnance
136	059-3-pm240g200f	Geological Feature
137	059-4-dp76g55f	Possible Ordnance
138	059-5-dp140g102f	Possible Ordnance
139	059-6-dp241g37f	Geological Feature
140	058-1-dp114g101f	Geological Feature
141	058-2-nm65g51f	Possible Ordnance
142	058-3-pm87g33f	Possible Ordnance
143	058-4-mc248g200f	Geological Feature
144	058-5-nm44g15f	Possible Ordnance
145	058-6-dp137g91f	Possible Ordnance
146	057-1-pm144g94f	Pipeline
147	057-2-pm67g62f	Possible Ordnance
148	057-3-dp54g14f	Possible Ordnance
149	o57-4-mc231g180f	Geological Feature
150	057-5-pm55g57f	Possible Ordnance
151	057-6-nm30g36f	Possible Ordnance
152	057-7-dp138g78f	Possible Ordnance
153	057-8-dp135g41f	Geological Feature
154	056-1-pm144g157f	Geological Feature
155	056-2-nm36g22f	Possible Ordnance
156	056-3-pm129g33f	Possible Ordnance
157	056-4-dp34g15f	Possible Ordnance
158	056-5-dp83g70f	Possible Ordnance
159	056-6-mc210g153f	Geological Feature
160	056-7-dp53g21f	Possible Ordnance
161	056-8-dp103g46f	Possible Ordnance
162	056-9-mc178g110f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
163	055-1-pm277g110f	Pipeline
164	055-2-nm75g32f	Possible Ordnance
165	055-3-dp54g15f	Possible Ordnance
166	055-4-pm127g62f	Possible Ordnance
167	055-5-pm195g58f	Geological Feature
168	055-6-dp221g64f	Possible Ordnance
169	055-7-dp28g10f	Possible Ordnance
170	055-8-pm146g36f	Possible Ordnance
171	055-9-dp18g20f	Possible Ordnance
172	055-10-pm136g123f	Geological Feature
173	054-1-dp65g44f	Possible Ordnance
174	054-2-dp66g30f	Possible Ordnance
175	054-3-dp62g38f	Possible Ordnance
176	054-4-pm196g90f	Geological Feature
177	054-5-dp100g48f	Possible Ordnance
178	054-6-dp106g20f	Possible Ordnance
179	054-7-dp47g15f	Possible Ordnance
180	054-8-pm479g50f	Pipeline
181	053-1-nm71g18f	Possible Ordnance
182	053-2-nm21g26f	Possible Ordnance
183	053-3-mn90g46f	Possible Ordnance
184	053-4-dp26g17f	Possible Ordnance
185	053-5-nm32g15f	Possible Ordnance
186	053-6-pm71g56f	Possible Ordnance
187	053-7-pm199g57f	Geological Feature
188	053-8-nm111g38f	Iron Pipe
189	053-9-nm51g20f	Possible Ordnance
190	0543-10-dp43g40f	Possible Ordnance
191	053-11-nm70g66f	Possible Ordnance
192	053-12-pm115g105f	Geological Feature
193	052-1-pm129g142f	Geological Feature
194	052-2-dp99g63f	Possible Ordnance
195	052-3-mc292g160f	Iron Pipe
196	052-4-dp60g42f	Possible Ordnance
197	052-5-pm63g30f	Possible Ordnance
198	052-6-dp47g12f	Possible Ordnance
199	052-7-dp251g53f	Possible Ordnance
200	051-1-mc601g117f	Iron Pipe
201	051-2-nm97g26f	Possible Ordnance
202	050-1-nm94g33f	Possible Ordnance
203	050-2-dp102g45f	Possible Ordnance
204	050-3-pm50g17f	Possible Ordnance
205	050-4-pm818g20fEOL	Possible Ordnance
206	049-1-pm112g64f	Possible Ordnance
207	049-2-pm111g78f	Possible Ordnance
208	049-3-dp74g66f	Possible Ordnance
209	049-4-dp75g70f	Possible Ordnance
210	048-1-nm74g38f	Possible Ordnance
211	048-2-dp13g14f	Possible Ordnance
212	049-3-nm104g28f	Possible Ordnance
213	048-4-pm127g53f	Possible Ordnance
214	048-5-pm22g28f	Possible Ordnance
215	047-1-nm119g46fEOL	Possible Ordnance
216	047-2-dp13g15f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
217	047-3-nm89g33f	Possible Ordnance
218	046-1-nm223g37f	Possible Ordnance
219	078-1-pm1949g7f	Possible Ordnance
220	068-1-dp311g7f	Possible Ordnance
221	045-1-mc6548g8f	Electromagnetic Anomaly
222	062L-1-pm150g5f	Possible Ordnance
223	062L-2-nm109g11f	Possible Ordnance
224	061L-1-nm135g4f	Possible Ordnance
225	061L-2-pm95g6f	Possible Ordnance
226	061L-3-dp105g20f	Possible Ordnance
227	060L-1-pm113g3f	Possible Ordnance
228	060L-2dp93g27f	Possible Ordnance
229	059L-1-nm150g25f	Possible Ordnance
230	058L-1-pm302g11f	Possible Ordnance
231	058L-2-pm79g16f	Possible Ordnance
232	057L-1-dp257g7f	Possible Ordnance
233	056L-dp150g11f	Possible Ordnance
234	056L-2-pm43g10f	Possible Ordnance
235	055L-1-dp201g11f	Possible Ordnance
236	054L-1-nm166g9f	Possible Ordnance
237	001SL-1-pm4902g20	Boiler
238	001SL-2-pm4554g4f	Possible Ordnance
239	001SL-3-mc8907g11f	Electromagnetic Anomaly
240	002SL-1-dp8978g9f	Possible Ordnance
241	002SL-2-dp3987g7f	Possible Ordnance
242	002SL-3-mc7345g7f	Possible Ordnance
243	003SL-1-pm269g10f	Possible Ordnance
244	003Sl-2-pm515g7f	Possible Ordnance
245	003SL-3-nm80g5f	Possible Ordnance
246	003SL-4-dp168g19f	Boiler
247	003SL-5-pm129g6f	Washing Machine
248	060L-1-nm105g20f	Possible Ordnance
249	059L-1-nm279g5f	Possible Ordnance
250	059L-2-pm423g34f	Possible Ordnance
251	058L-1-dp209g6f	Possible Ordnance
252	058L-2-pm35g11f	Possible Ordnance
253	057L-1-nm17g11f	Possible Ordnance
254	057L-2-pm98g8f	Possible Ordnance
255	057L-3-pm37g9f	Possible Ordnance
256	057L-4-pm38g11f	Possible Ordnance
257	057L-5-dp75g10f	Sign
258	056L-1-mc8186g11f	Possible Ordnance
259	055L-1-mc5360g20f	Possible Ordnance
260	055L-2-nm357g19f	Possible Ordnance
261	054L-1-261g11f	Possible Ordnance
262	054L-2-pm3122g8f	Possible Ordnance
263	053L-1-nm110g9f	Possible Ordnance
264	053L2-dp109g16f	Possible Ordnance
265	052L-1-dp286g3f	Manhole
266	052L-2-pm327g9f	Possible Ordnance
267	052L-3-nm248g21f	Possible Ordnance
268	052L-4-dp259g26f	Possible Ordnance
269	051L-1-nm109g13f	Possible Ordnance
270	067-1-dp48g33f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
271	067-2-dp142g44f	Possible Ordnance
272	0701-dp480g13f	Possible Ordnance
273	070-2-pm49g11f	Possible Ordnance
274	072-1-pm89g13f	Possible Ordnance
275	073-1-nm80g5f	Possible Ordnance
276	073-2-nm356g23f	Possible Ordnance
277	075-1-nm364g11f	Possible Ordnance
278	075-2-dp1039g39f	Possible Ordnance
279	077-1-dp123g14f	Possible Ordnance
280	077-2-dp776g30f	Possible Ordnance
281	078R-3mc8302g20f	Electromagnetic Anomaly
282	068-1-dp320g7f	Possible Ordnance
283	068R-2-mc9213g15f	Electromagnetic Anomaly
284	066R-1-mc8334g15f	Electromagnetic Anomaly
285	065R-1-mc8486g18f	Electromagnetic Anomaly
286	064R-1-mc9633g18f	Electromagnetic Anomaly
287	063R-1-mc9404g19f	Electromagnetic Anomaly
288	062R-2-mc9746g18f	Electromagnetic Anomaly
289	061R-1-mc7773g16f	Electromagnetic Anomaly
290	060R-1-mc8127g8f	Electromagnetic Anomaly
291	059R-1-mc5961g11f	Electromagnetic Anomaly
292	058R-1-mc6758g17f	Electromagnetic Anomaly
293	057R-1-mc7119g24f	Electromagnetic Anomaly
294	056R-1-mc7891g16f	Electromagnetic Anomaly
295	055R-1-mc6461g17f	Electromagnetic Anomaly
296	054R-1-mc9645g16f	Electromagnetic Anomaly
297	053R-1-mc6680g13f	Electromagnetic Anomaly
298	052R-1-mc9795g10f	Electromagnetic Anomaly
299	051R-1-mc6531g15f	Electromagnetic Anomaly
300	050R-1-mc6531g14f	Electromagnetic Anomaly
301	049R-1-mc9574g7f	Electromagnetic Anomaly
302	048R-1-mc6550g12f	Electromagnetic Anomaly
303	047BR-1-mc6477g7f	Electromagnetic Anomaly
304	045R-1mc6548g8f	Electromagnetic Anomaly
305	003-4-dp103g12f	Possible Ordnance
306	004-1-pm93g10f	Possible Ordnance
307	003-3-pm58g16f	Possible Ordnance
308	002-1-dp38g9f	Possible Ordnance
309	003-2-pm96g11f	Possible Ordnance
310	004-3-pm95g12f	Possible Ordnance
311	001-1-pm54g6f	Possible Ordnance
312	006-2-nm207g12f	Possible Ordnance
313	004-2-pm81g9f	Possible Ordnance
314	003-1-pm19g4f	Possible Ordnance
315	004-4-pm78g8f	Possible Ordnance
316	006-1-dp191g16f	Possible Ordnance
317	002-2-dp53g11f	Possible Ordnance
318	004-5-pm85g11f	Possible Ordnance
319	004-6-pm71g10f	Possible Ordnance
320	004-7-pm82g12f	Possible Ordnance
321	004-8-dp156g19f	Possible Ordnance
322	002-3-nm32g8f	Possible Ordnance
323	053L-4-dp437g70f	Iron Pipe
324	022-1-pm100g25f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
325	021-2-nm400g25f	Possible Ordnance
326	021-2-pm70g20f	Possible Ordnance
327	012-1-pm270g23f	Possible Ordnance
328	011-1-dp225g75f	Possible Ordnance
329	010-1-nm50g15f	Possible Ordnance
330	020-1-dp22g15f	Possible Ordnance
331	016-1-pm38g37f	Possible Ordnance
332	020-2-dp23g13f	Possible Ordnance
333	020-3-dp18g16f	Possible Ordnance
334	A	Possible Ordnance
335	B	Possible Ordnance
336	C	Possible Ordnance
337	D	Possible Ordnance
338	E	Possible Ordnance
339	F	Possible Ordnance
340	G	Possible Ordnance
341	H	Possible Ordnance
342	1-1-mc806g44f	Possible Ordnance
343	1-2-pm100g9f	Possible Ordnance
344	1-3-dp533g47f	Possible Ordnance
345	1-4-dp233g24f	Possible Ordnance
346	1-5-pm73g13f	Possible Ordnance
347	1-6-dp210g33f	Possible Ordnance
348	22-1-dp544g65f	Pipeline
349	21-1-pm323g42f	Possible Ordnance
350	21-2-dp1330g64f	Pipeline
351	20-1-dp94g25f	Possible Ordnance
352	20-2-dp2601g102f	Pipeline
353	19-1-pm79g8f	Possible Ordnance
354	19-2-pm113g18f	Possible Ordnance
355	19-3-dp154g31f	Possible Ordnance
356	19-3-dp1419g86f	Pipeline
357	18-1-dp333g16f	Possible Ordnance
358	18-2-dp40g17f	Possible Ordnance
359	18-3-dp105g24f	Possible Ordnance
360	18-4-dp196g34f	Possible Ordnance
361	18-5-pm13g8f	Possible Ordnance
362	18-6-dp2092g60f	Pipeline
363	18-6-dp83g22f	Possible Ordnance
364	18-7-dp?1687+g18+f	Pipeline
365	17-1-dp1497g47f	Pipeline
366	17-2-dp47g44f	Possible Ordnance
367	17-3-pm29g16f	Possible Ordnance
368	17-4-mc53g35f	Possible Ordnance
369	16-1-nm61g10f	Possible Ordnance
370	16-2-dp136g17f	Possible Ordnance
371	16-3-pm50g27f	Possible Ordnance
372	16-5-dp10g6f	Possible Ordnance
373	16-6-pm47g26f	Possible Ordnance
374	15-1-dp59g30f	Possible Ordnance
375	15-2-pm43g16f	Possible Ordnance
376	15-3-dp304g29f	Possible Ordnance
377	14-1-dp136g21f	Possible Ordnance
378	14-2-dp185g32f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
379	14-4-pm95g31f	Possible Ordnance
380	10-1-nm29g25f	Possible Ordnance
381	10-2-dp31g260f	Possible Ordnance
382	10-2-nm57g13f	Possible Ordnance
383	13-1-dp66g23f	Possible Ordnance
384	13-2-pm40g21f	Possible Ordnance
385	13-3-pm27g17f	Possible Ordnance
386	13-4-dp46g10f	Possible Ordnance
387	12-1-dp40g30f	Possible Ordnance
388	12-2-pm46g33f	Possible Ordnance
389	11-1-pm22g39f	Possible Ordnance
390	11-2-pm39g31f	Possible Ordnance
391	10-1-dp95g21f	Possible Ordnance
392	9-1-dp78g23f	Possible Ordnance
393	8-1-dp247g13f	Possible Ordnance
394	7-1-dp180g23f	Possible Ordnance
395	7-2-dp145g20f	Possible Ordnance
396	6-1-dp138g15f	Possible Ordnance
397	6-2-dp235g26f	Possible Ordnance
398	5-1-pm103g31f	Possible Ordnance
399	5-2-dp53g57f	Possible Ordnance
400	4-1-pm103g15f	Possible Ordnance
401	4-2-dp49g12f	Possible Ordnance
402	2-1-pm110g13f	Possible Ordnance
403	15-1-mc16g4f	Possible Ordnance
404	14-1-dp68g16f	Possible Ordnance
405	13-1-dp53g7f	Possible Ordnance
406	13-2-dp188g28f	Possible Ordnance
407	12-1-pm11g29f	Possible Ordnance
408	11-1-dp528g20f	Possible Ordnance
409	9-1-dp342g22f	Possible Ordnance
410	8-1-dp135g24f	Possible Ordnance
411	8-2-dp72g23f	Possible Ordnance
412	8-1-dp34g16f	Possible Ordnance
413	6-1-pm32g5f	Possible Ordnance
414	5-1-dp47g21f	Possible Ordnance
415	4-1-dp218g25f	Possible Ordnance
416	4-2-dp80g21f	Possible Ordnance
417	3-1-dp146g27f	Possible Ordnance
418	3-2-pm123g17f	Possible Ordnance
419	3-3-dp85g22f	Possible Ordnance
420	1-1-dp112g18f	Possible Ordnance
421	22-1-dp122g37f	Possible Ordnance
422	22-3-nm28g10f	Possible Ordnance
423	22-2-pm17g10f	Possible Ordnance
424	1-1-pm73g12f	Possible Ordnance
425	1-2-pm215g23f	Possible Ordnance
426	2-1-dp185g16f	Possible Ordnance
427	2-2-mc287g46f	Possible Ordnance
428	2-3-dp107g24f	Possible Ordnance
429	1-1-dp55g16f	Possible Ordnance
430	1-2-dp223g45f	Possible Ordnance
431	1-3-dp700g35f	Possible Ordnance
432	1-4-dp97g25f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
433	5-1-dp89g22f	Possible Ordnance
434	13-1-dp44g15f	Possible Ordnance
435	13-2-dp37g24f	Possible Ordnance
436	14-1-dp28g14f	Possible Ordnance
437	11-1-dp52g44f	Possible Ordnance
438	11-2-dp72g43f	Possible Ordnance
439	10-1-pm41g18f	Possible Ordnance
440	10-2-pm20g11f	Possible Ordnance
441	10-3-dp72g35f	Possible Ordnance
442	10-4-pm74g23f	Possible Ordnance
443	9-1-dp281g31f	Possible Ordnance
444	7-1-dp208g20f	Possible Ordnance
445	7-2-dp125g23f	Possible Ordnance
446	7-3-pm115g10f	Possible Ordnance
447	6-1-dp152g34f	Possible Ordnance
448	6-2-mc175g49f	Possible Ordnance
449	5-1-pm60g11f	Possible Ordnance
450	5-2-pm32g6f	Possible Ordnance
451	5-3-pm63g12f	Possible Ordnance
452	5-4-pm50g7f	Possible Ordnance
453	5-5-dp65g4f	Possible Ordnance
454	5-6-mc6558g70f	Possible Ordnance
455	4-1-dp164g41f	Possible Ordnance
456	4-2-pm177g20f	Possible Ordnance
457	4-3-nm220g17f	Possible Ordnance
458	11-1-dp208g48f	Possible Ordnance
459	11-2-dp28g17f	Possible Ordnance
460	14-1-pm293g50f	Possible Ordnance
461	14-1-pm153g18f	Possible Ordnance
462	15-1-pm136g14f	Possible Ordnance
463	001-1-mc30093g25f	Possible Ordnance
464	022-1-mc31539g13f	Possible Ordnance
465	021-1-mc28767g12f	Possible Ordnance
466	020-1-mc31683g35f	Possible Ordnance
467	018-1-mc31942g23f	Possible Ordnance
468	018-1-mc31657g24f	Possible Ordnance
469	017-1-mc26003g23f	Possible Ordnance
470	017-1-dp67g14f	Possible Ordnance
471	014-1-mc26324g17f	Electromagnetic Anomaly
472	013-1-mc31252g8f	Electromagnetic Anomaly
473	013-2-mc16747g7f	Electromagnetic Anomaly
474	012-1-mc27653g21f	Electromagnetic Anomaly
475	011-1-mc34257g22f	Electromagnetic Anomaly
476	010-1-mc26761g24f	Electromagnetic Anomaly
477	009-1-mc29279g28f	Electromagnetic Anomaly
478	008-1-mc30182g22f	Electromagnetic Anomaly
479	07-1-mc21762g7f	Electromagnetic Anomaly
480	006-1-mc27687g21f	Electromagnetic Anomaly
481	005-1-mc30284g22f	Electromagnetic Anomaly
482	004-1-mc26874g21f	Electromagnetic Anomaly
483	003-1-mc28428g18f	Electromagnetic Anomaly
484	002-1-mc30321g12f	Electromagnetic Anomaly
485	007-1-pm6g10f	Tire
486	010-1-pm38g15f	Lamp

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
487	01-1-nm77g7f	Possible Ordnance
488	01-2-mc187g13f	Pipeline Associated
489	02-1-dp662gEOL	Pipeline Associated
490	03-1-mc795g52f	Pipeline Associated
491	03-2-nm47g6f	Pipeline Associated
492	03-3-nm321g45f	Possible Ordnance
493	03-4-pm190g2f	Possible Ordnance
494	03-5-dp2178gEOL	Possible Ordnance
495	03-6-dp156g18f	Possible Ordnance
496	04-1-dp2770g35f	Pipeline Associated
497	04-2-dp44891g35f	Electromagnetic Anomaly
498	04-3-mc44891g7f	Electromagnetic Anomaly
499	05-1-pm2582g30f	Possible Ordnance
500	05-2-pm705g21f	Pipeline Associated
501	05-3-pm139g13f	Possible Ordnance
502	05-4-nm169g17f	Possible Ordnance
503	06-1-pm1537g21f	Possible Ordnance
504	06-2-dp216g15f	Possible Ordnance
505	06-3-dp2658g33f	Pipeline Associated
506	06-4-pm96g13f	Possible Ordnance
507	06-5-pm90g10f	Possible Ordnance
508	06-6-dp109g12f	Possible Ordnance
509	06-7-pm36g4f	Possible Ordnance
510	07-1-dp1681g38f	Possible Ordnance
511	07-2-pm70g6f	Possible Ordnance
512	07-3-mc3436g43f	Pipeline Associated
513	07-4-dp608g39f	Possible Ordnance
514	08-1-nm61g14f	Possible Ordnance
515	08-2-mc138g24f	Possible Ordnance
516	08-3-dp2380g51f	Pipeline Associated
517	08-4-pm1479g40f	Possible Ordnance
518	08-5-nm20g2f	Possible Ordnance
519	08-6-mc244gEOL	Possible Ordnance
520	09-1-nm157g9f	Possible Ordnance
521	09-2-pm2592g48f	Possible Ordnance
522	09-3-dp129g6f	Possible Ordnance
523	09-4-dp4790g50f	Pipeline Associated
524	09-5-pm23864g4f	Electromagnetic Anomaly
525	09-6-pm34g13f	Possible Ordnance
526	10-1-pm37g24f	Possible Ordnance
527	10-2-dp6063g73f	Pipeline Associated
528	10-3-mc34109g1f	Electromagnetic Anomaly
529	10-4-pm2385g43f	Possible Ordnance
530	10-5-mc92g2f	Possible Ordnance
531	11-1-pm1474g41f	Possible Ordnance
532	11-2-dp2385g29f	Pipeline Associated
533	11-3-mc207g22f	Possible Ordnance
534	11-4-dp52g19f	Possible Ordnance
535	12-1-pm52g7f	Possible Ordnance
536	12-2-nm398g18f	Possible Ordnance
537	12-3-pm75g7f	Possible Ordnance
538	12-4-nm29g4f	Possible Ordnance
539	12-5-nm24g3f	Possible Ordnance
540	12-6-nm115g3f	Possible Ordnance

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
541	12-7-nm23g8f	Possible Ordnance
542	12-8-mc457g25f	Possible Ordnance
543	12-9-mc613g30f	Possible Ordnance
544	12-10-nm642g43f	Possible Ordnance
545	13-1-dp244g28f	Possible Ordnance
546	13-2-nm213g24f	Possible Ordnance
547	13-3-nm224g18f	Possible Ordnance
548	13-4-nm156g14f	Possible Ordnance
549	13-5-dp25g9f	Possible Ordnance
550	14-1-nm61g15f	Possible Ordnance
551	14-2-nm234g18f	Possible Ordnance
552	14-3-dp193g23f	Possible Ordnance
553	14-4-dp462g36f	Possible Ordnance
554	14-5-nm19g6f	Possible Ordnance
555	14-6-dp646g26f	Possible Ordnance
556	14-7-dp1357g24f	Possible Ordnance
557	16-1-dp400g18f	Possible Ordnance
558	16-2-pm160g17f	Possible Ordnance
559	16-3-dp368g20f	Possible Ordnance
560	16-4-mc403g30f	Possible Ordnance
561	16-5-pm36g11f	Possible Ordnance
562	16-6-pm12g4f	Possible Ordnance
563	16-7-pm35g13f	Possible Ordnance
564	17-1-dp273g42f	Possible Ordnance
565	18-1-dp527g12f	Possible Ordnance
566	18-2-pm91g8f	Possible Ordnance
567	19-1-dp528g38f	Possible Ordnance
568	19-2-pm166g7f	Possible Ordnance
569	19-3-dp1000g33f	Possible Ordnance
570	20-1-mc48849g8f	Electromagnetic Anomaly

TABLE 3

ANOMALIES BY PLANNED PROJECT AREA

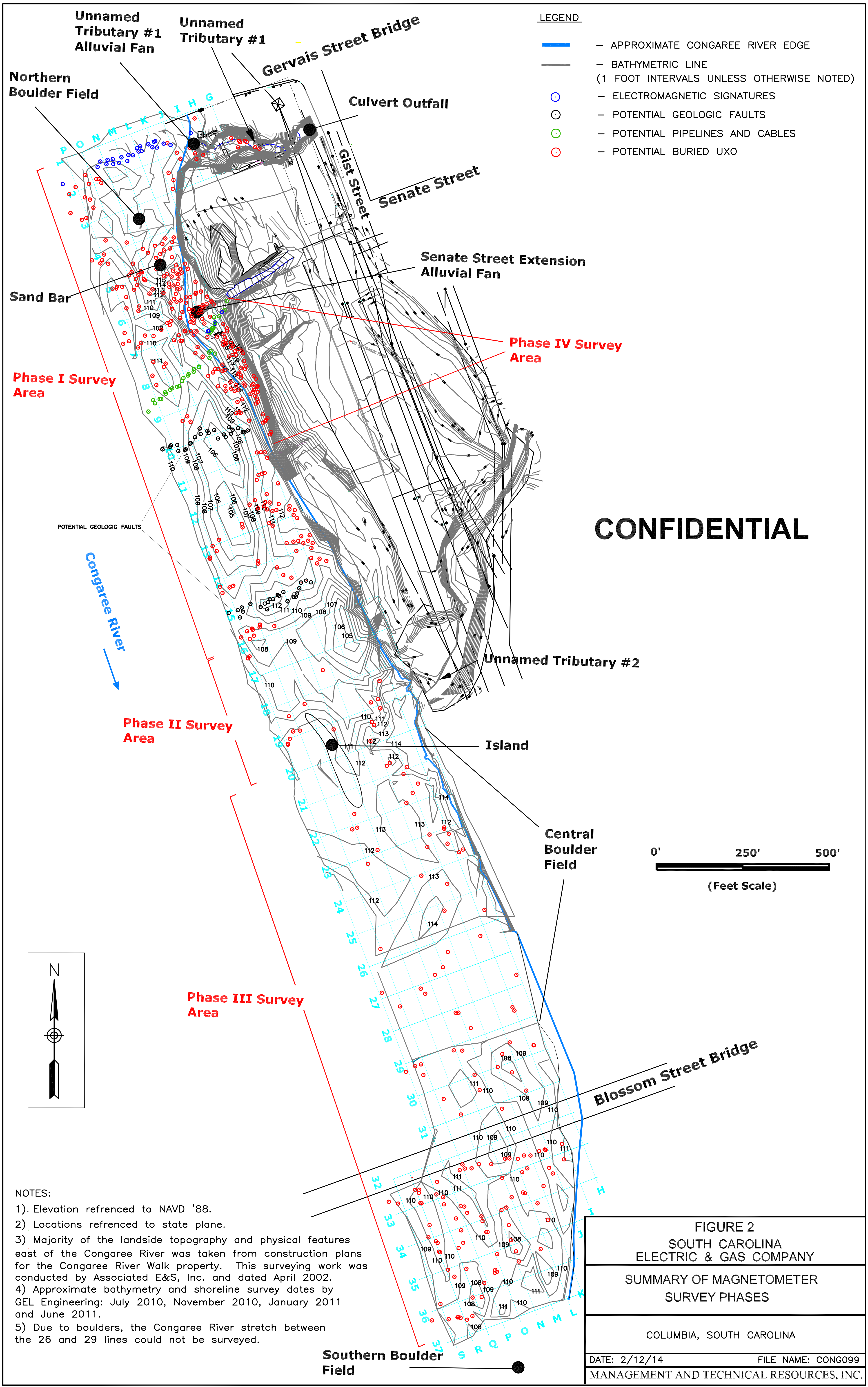
Congaree River Sediments
Columbia, South Carolina

Construction Phase	Potential Ordnance (UXO)	Potential UXO Under the Footprint of the Cofferdam	Other Anomalies	Total Magnetic Anomalies
Field Demonstration Project Area	84	0	17	101
Phase I	84	20	14	118
Phase II	45	9	16	70
Phase III	2	14	17	33
Outside of Project Area	210	0	38	248
Total Anomalies	**425**	**43**	**102**	**570**

Notes:

Please refer to Figures 2 and 3.

1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "*have signature characteristics that could be associated with ordnance*" and "*those anomalies should be considered potentially hazardous until material generating the signatures can be identified*".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.



NOTES:

1). Elevation refrenced to NAVD '88.

2). Locations refrenced to state plane.

3) Majority of the landside topography and physical features east of the Congaree River was taken from construction plans for the Congaree River Walk property. This surveying work was conducted by Associated E&S, Inc. and dated April 2002.

4) Approximate bathymetry and shoreline survey dates by GEL Engineering: July 2010, November 2010, January 2011 and June 2011.

5) Due to boulders, the Congaree River stretch between the 26 and 29 lines could not be surveyed.

FIGURE 2

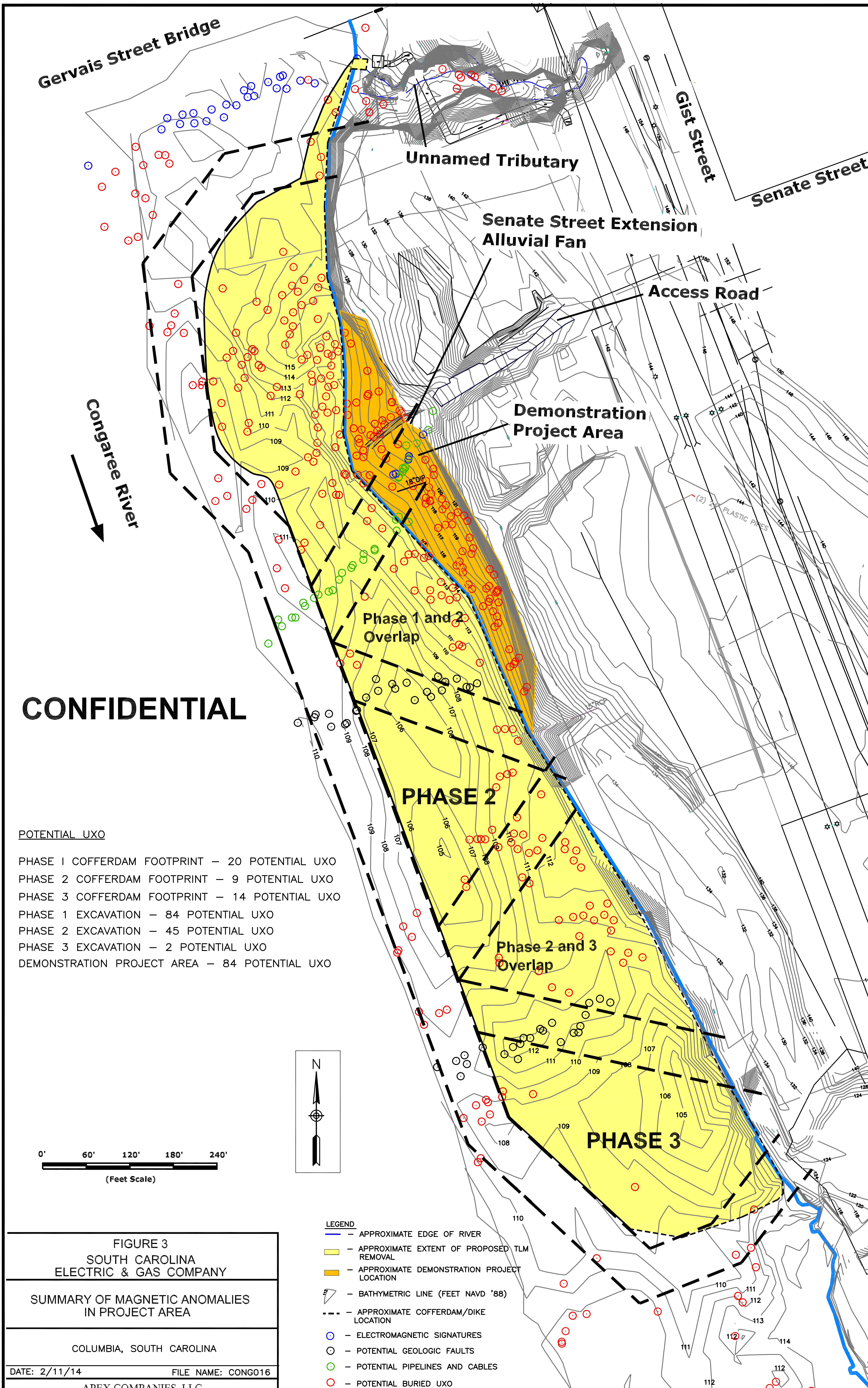
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SUMMARY OF MAGNETOMETER SURVEY PHASES

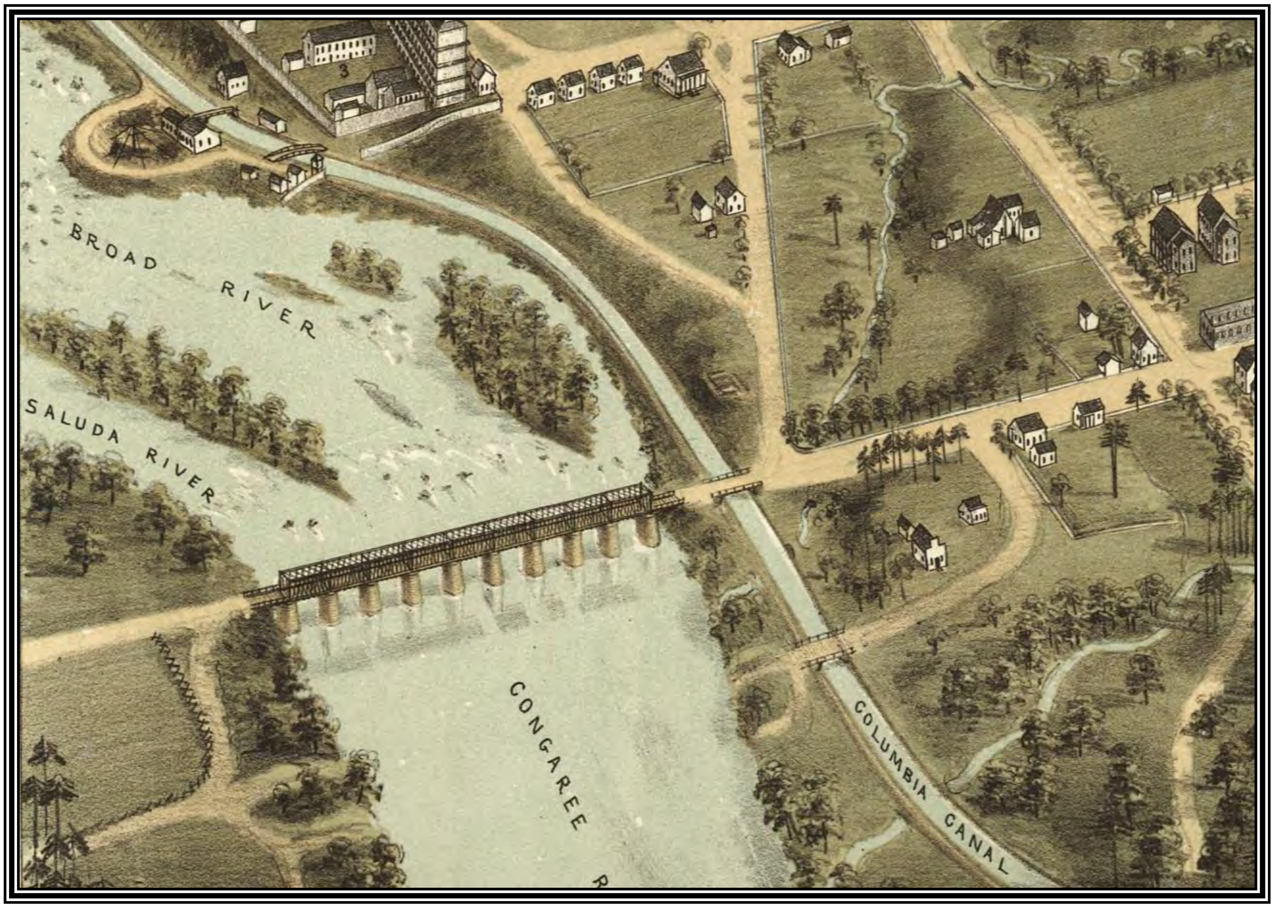
COLUMBIA, SOUTH CAROLINA

DATE: 2/12/14 FILE NAME: CONG099

MANAGEMENT AND TECHNICAL RESOURCES, INC.


Gervais Street Bridge
Unnamed Tributary
Gist Street
Senate Street
Senate Street Extension
Alluvial Fan
Access Road
Demonstration
Project Area
Congaree River
Phase 1 and 2
Overlap
CONFIDENTIAL
PHASE 2
Phase 2 and 3
Overlap
PHASE 3
POTENTIAL UXO
PHASE I COFFERDAM FOOTPRINT – 20 POTENTIAL UXO
PHASE 2 COFFERDAM FOOTPRINT – 9 POTENTIAL UXO
PHASE 3 COFFERDAM FOOTPRINT – 14 POTENTIAL UXO
PHASE 1 EXCAVATION – 84 POTENTIAL UXO
PHASE 2 EXCAVATION – 45 POTENTIAL UXO
PHASE 3 EXCAVATION – 2 POTENTIAL UXO
DEMONSTRATION PROJECT AREA – 84 POTENTIAL UXO
N
0' 60' 120' 180' 240'
(Feet Scale)
LEGEND
– APPROXIMATE EDGE OF RIVER
– APPROXIMATE EXTENT OF PROPOSED TLM REMOVAL
– APPROXIMATE DEMONSTRATION PROJECT LOCATION
– BATHYMETRIC LINE (FEET NAVD '88)
– APPROXIMATE COFFERDAM/DIKE LOCATION
– ELECTROMAGNETIC SIGNATURES
– POTENTIAL GEOLOGIC FAULTS
– POTENTIAL PIPELINES AND CABLES
– POTENTIAL BURIED UXO
FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY
SUMMARY OF MAGNETIC ANOMALIES
IN PROJECT AREA
COLUMBIA, SOUTH CAROLINA
DATE: 2/11/14
FILE NAME: CONG016
APEX COMPANIES, LLC

ARCHAEOLOGICAL DATA RECOVERY PLAN FOR THE MITIGATION OF SITE 38RD286, THE ORDNANCE DUMP SITE, FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT,COLUMBIA, SOUTH CAROLINA



Birdseye View of the city of Columbia showing the Gervais Street Bridge (C. Drie, 1872).

September 2014

ARCHAEOLOGICAL DATA RECOVERY PLAN FOR THE MITIGATION OF SITE 38RD286, THE ORDNANCE DUMP SITE, FOR THE CONGAREE RIVER SEDIMENT REMOVAL PROJECT,COLUMBIA, SOUTH CAROLINA

Submitted to:

SCANA SERVICES, INC.
200 Operation Way
Cayce, South Carolina 29033

By:

TRC ENVIRONMENTAL CORPORATION
621 Chatham Avenue
Columbia, South Carolina 29205

Sean Norris, Program Manager Archaeology

March 2014

INTRODUCTION

TRC Environmental Corporation (TRC) is pleased to provide the following information for Artifact Recovery and Artifact Conservation for Site 38RD286 as related to the Congaree River Sediment Removal Project. This plan is being submitted as one the stipulations agreed upon in a Memorandum of Agreement between the U.S. Army Corps of Engineers, the State Historic Preservation Office and SCANA. It also serves as the application for an Exclusive Commercial Data Recovery Salvage License as pursuant to the Underwater Antiquities Act of 1991 (Article 5, Chapter 7, Title 54, Code of Laws of South Carolina, 1976). Due to the extensive nature of the undertaking a one year license is being requested with the expectation that up to three additional year-long extensions will be requested. Mr. Robert Apple, SCANA Project Manager, will be the license holder.

The excavation and recovery of submerged artifacts will be conducted in support of and concurrently with a large scale environmental remediation project. The project involves the removal of contaminated sediments in the Congaree River. In June 2010, tarlike material (TLM) was reported near the eastern shoreline of the Congaree River directly downstream of the Gervais Street Bridge. The South Carolina Department of Health and Environmental Control (SCDHEC) began sampling material from the river and concluded that the source of the TLM was a manufactured gas plant (MGP) that operated on Huger Street in downtown Columbia from 1906 to the mid-1950s. During its period of operation the MGP had allowed coat tar runoff to empty into the Congaree River.

This MGP, after a series of mergers and acquisitions, became one of South Carolina Electric and Gas's (SCE&G) predecessor companies. As a result SCE&G owned the land the former MGP occupied. In 2002 SCE&G had entered into a Voluntary Cleanup Contract with SCDHEC to mitigate the former MGP site. Beginning in 2008 SCE&G removed over 125,000 tons of MGP impacted soil and debris from the Huger Street location. Since the discovery of tar in the river SCE&G has worked with SCDHEC in order to define the extent of the TLM contamination, and has conducted a series of surveys to establish the vertical and horizontal distribution of the TLM. The project area begins directly south of the Gervais Street Bridge and extends downstream for approximately 2,000 feet; it extends approximately 300 feet into the river from the eastern bank (Figure 1).

In 2013 SCDHEC approved the Project Delineation Report and tasked SCE&G to develop an appropriate plan for the removal and mitigation of the contaminated soil. In 2013 a report detailing four "removal action" options was submitted to SCDHEC. The four options were:

1. No Action – Leave the TLM in place.
2. Monitoring and Institutional Controls – Leave the TLM in place, restrict access to the area, and conduct annual monitoring.
3. Sediment Capping and Institutional Controls – Place a physical barrier on top of the contaminated sediment effectively burying the TLM and conduct annual monitoring.
4. Removal – Physically remove the TLM and contaminated sediment.

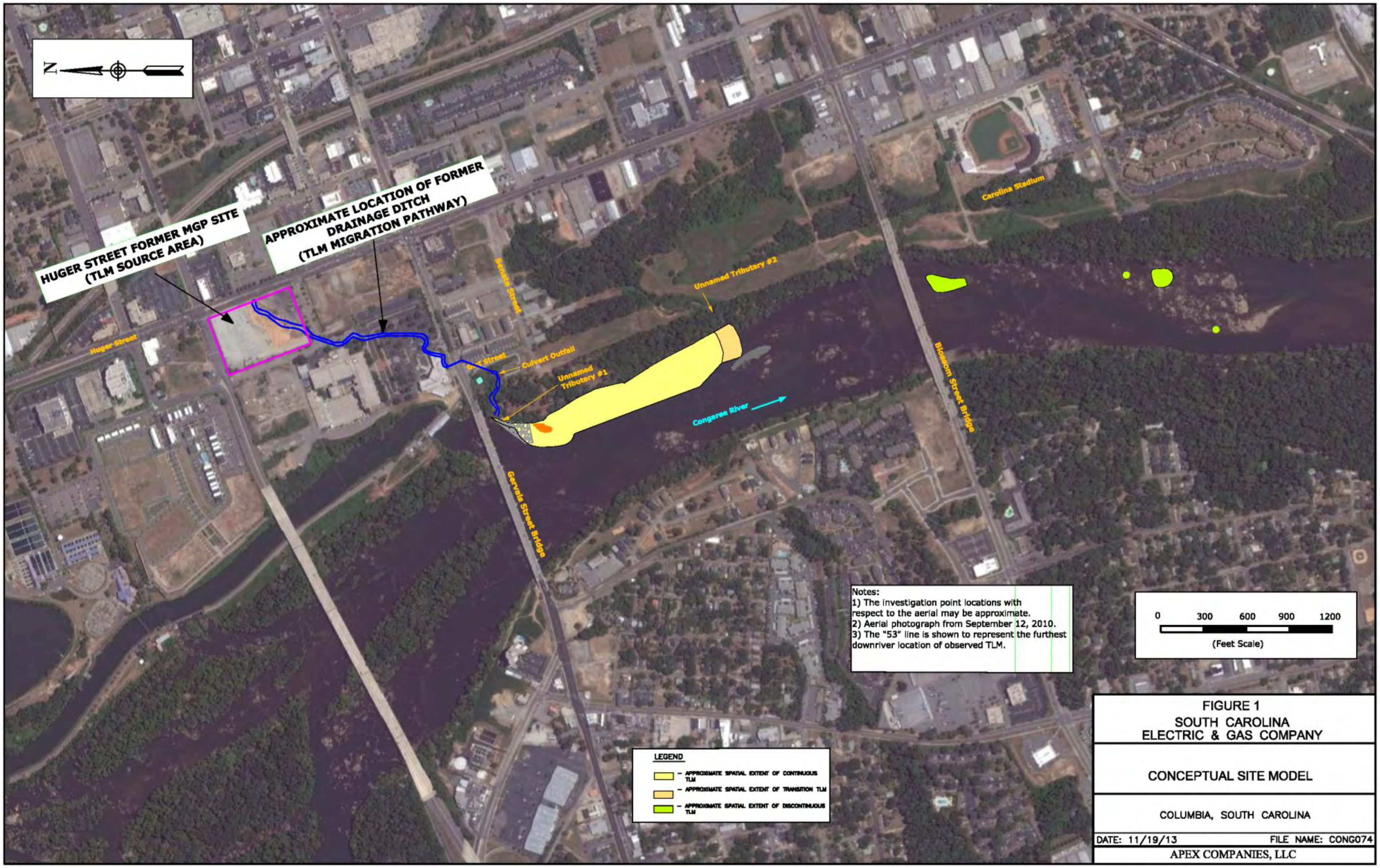


Figure 1. Project location map.

SCDHEC approved option four as the preferred method of dealing with the TLM. This method was deemed to the most protective of human health and the environment because it would permanently remove the contaminated sediment.

PROJECT DESCRIPTION

The recovery of archaeologically significant artifacts Site 38RD286 will take place concurrently with the proposed environmental remediation project. The remediation and removal of the TLM and contaminated sediments will involve the following activities:

- Conducting landside clearing, grading and site setup activities;
- Installing a cofferdam of sufficient height to restrict river flow;
- Dewatering of the area to be excavated;
- Physically removing TLM-impacted sediment and debris using conventional equipment;
- Conditioning the sediment material for transportation to the landfill;
- Backfill as necessary; and
- Off-site disposal.

An average of two feet of sediment will need to be removed over the entire project area. This is equal to approximately 40,000 tons of sediment requiring removal and off-site treatment or disposal. Prior to activities in the river, construction on the eastern shoreline to improve access to the project area for personnel, equipment and material transportation trucks will be conducted. These construction activities would include improving and/or creating access roads by using fill, gravel and geotextile over the existing landscape. A project compound with office trailers, support structures and associated electrical power and utilities would be required. Protective fencing would also be installed to restrict access to the work areas by unauthorized personnel.

The first component of the sediment removal will be the construction of a cofferdam around the planned removal areas. Figure 2 provides a potential sediment removal scenario with an assumed cofferdam configuration. The purpose of the coffer dam is to isolate and dewater the areas prior to initiating the removal operations. Due to the varying thickness of sediment, the uneven nature of the riverbed and changing conditions within the project area a number of different methodologies and equipment will be employed to complete the project. Generally speaking, heavy equipment/machine excavators coupled with vacuum removal or other techniques will be employed to remove the sediment to bedrock. The sediment will be removed in 50 × 50 foot grid squares.

Once removed, the sediment would likely require drying or solidification prior to transporting. Depending on the amount of TLM in the sediment the material will either be sent to an on-site sorting facility for screening or to an off-site facility for visual examination prior to disposal in a landfill. In order to minimize potential impacts on spawning migrations for threatened and/or endangered species a construction phase (for actual work in the river) would begin no earlier

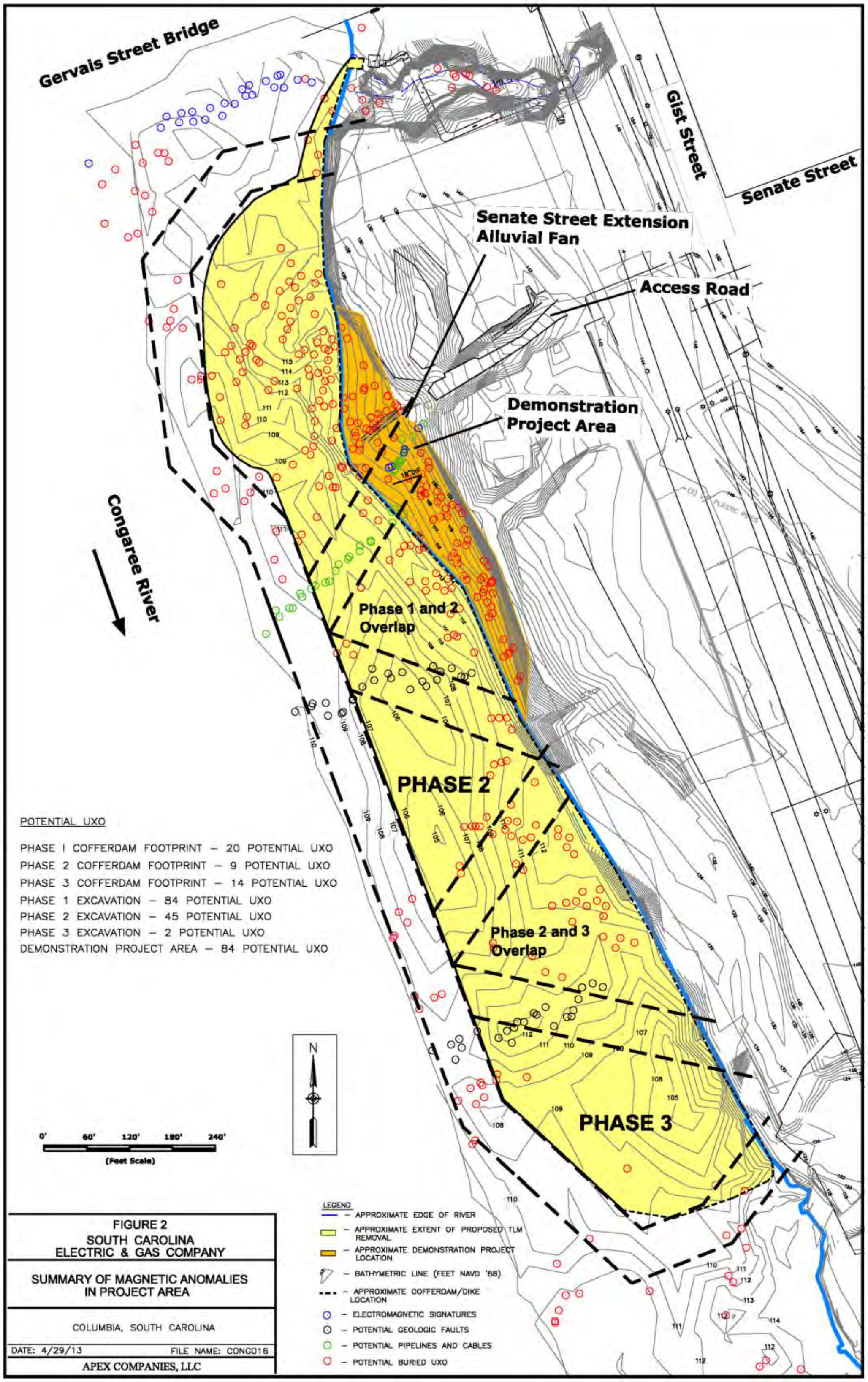


Figure 2. Recovery phase plan map.

than May and need to end by October of each year. Because of this, and the amount of material to be removed, it is projected that multiple construction seasons or phases will be required. Once each construction phase is completed the river bottom would be restored to its approximate original conditions by the placement of imported fill sand or rock as may be required and the cofferdam would be removed, potentially to be reused as fill or erosion protection.

ARCHAEOLOGICAL SIGNIFICANCE

On February 17, 1865 General Sherman's troops captured Columbia. During the two day occupation, live munitions and other weapons of war housed at the Palmetto Armory were dumped into the Congaree River near the Gervais Street Bridge. According to Civil War Records:

> *A detail of 500 men each from the First and Second Brigades, properly officered for fatigue duty, together with the pioneer corps and fifty wagons, reported to Captain Buel, chief ordnance officer, to destroy public works, machinery, ordnance, ordnance stores, and ammunition, of which there were large quantities.*
>
> *General John. E. Smith*

According to General Smith it took 1200 men and 50 wagons from 1 P.M. February 18 to 6 P.M. February 19 to destroy the machinery, ordnance, ordnance stores and ammunition. Figure 3 provides a list of the ordnance captured.

Soon after Union troops departed Columbia ordnance recovery began. The accounts of J. F. Williams indicated that industrious citizens of Columbia were quick to salvage powder from the boxes of paper cartridges that had been left on the bank and for years after the war people would dive into the river and recover cannon balls and shells (Williams 1929).

Newspaper articles dating to the 1930s and more formal recovery attempts conducted in the 1970s and 1980s provide supporting evidence that Civil War ordnance is still present in the river. In June 1930, *The State* reported that two fishermen recovered ammunition from the area of a small tributary near the base of the Gervais Street Bridge. The discovery motivated New Brookland Mayor L. Hall and Councilman D. A. Spigner to organize a project to recover the artifacts. Their recovery was extensive and labor intensive. A coffer dam was erected approximately where Senate Street terminates at the river. After digging through the mud and silt the project collected six 10-inch cannonballs, 1,010 round rifle balls, 767 pointed rifle balls, a number of cast-iron copper fused explosive cannon shells; and cast iron lead butt explosive shells; three cast-iron cannon balls; one brass cap explosive, 11 3½-inch round cannon balls, 51 2-inch cannon balls; 2 6-inch cannon balls; 3 3½-inch time fuse explosive bombs; and an artillery axe (*The State* 1930). According to the article Hall and Spigner believed they had recovered practically all the ammunition that was deposited in the river. Based on the inventory presented in Figure 3, however, the 1930s recovery accounts for only a fraction of what may be present.

Eight years after the Hall and Spigner conducted their recovery, the *Spartanburg Herald* reported that two New Brookland high school boys found an artillery projectile in the Congaree River. The boys, Luther J. Morris and Knowiton Jeffcoat, apparently attempted to melt lead out of the round causing a minor explosion that brought the find to the attention of New Brookland authorities (*The Spartanburg Herald* 1938).

Beginning in the 1970s a number of formal recovery and salvage projects have been conducted at the sites. A majority of these projects have been conducted with licenses provided by the South Carolina Institute of Archaeology and Anthropology (SCIAA) under the Underwater Antiquities Act, providing a precedent for conducting the currently proposed project under a similar Salvage License. In the winter of 1976 an acoustic survey in the Congaree River below the Gervais Street Bridge was conducted to identify concentrations of ordnance and artifacts. Although conditions were not ideally suited for an acoustic survey the project identified a concentration of ferrous material below the Gervais Street Bridge (Finkelstein 1976).

Inventory of ordnance and ordnance stores captured in Columbia, S. C., February 17, 1865.

Ball cartridges (no caps)		1,200,000
Percussion caps		100,000
Powder	pounds	26,150
12-pounder gun ammunition, fixed	rounds	1,007
6-pounder gun ammunition, fixed	do	3,852
24-pounder gun ammunition, fixed	do	546
8-inch shot and shell	do	2,364
10-inch shot and shell	do	1,320
Stands of arms		10,410
Unfinished arms		6,000
6-pounder guns		14
James guns		2
12-pounder mountain howitzers		5
Blakely guns		4
18-pounder rifled guns		3
Wiard gun		1
3-inch rifle		1
10-pounder guns		2
4-inch gun		1
4-inch mortars		2
6-inch Coehorn		1
Bronze guns, caliber 1½ and 2 inches		4
4-inch gun, smooth-bore		1
10-pounder Parrotts		2
Repeating battery		1
Gun carriages		9
Gun caissons		14
Gun (mountain howitzer) caissons		3
Forges		2
Anvils		4
Blacksmiths' vises		20
Sponges and rammers		1,125
Sabers, cavalry, artillery, and naval		3,100
Saber knots		700
Pairs cavalry pistol holsters		300
Saber belts		800
Bayonet scabbards		4,000
Cartridge-boxes (infantry)		5,150
Cartridge-box plates		3,500
Cartridge-box belts and plates		2,500
Waist-belts		2,900
Waist-belt plates		3,600
Ball screws		2,000
Pistol cartridge-boxes		550
Gunners' shot-pouches		600
Knapsacks		1,100
Haversacks		900
Slow match	yards	500
10-inch fuses		900
Tents		58

PHILIP MACCAHILL,
Lieut. and Actg. Ordnance Officer, First Div., Fifteenth Army Corps.

Figure 3. Inventory of ordnance caputured during the occupation of of Columbia.

Under a salvage license issued in 1980, diver Gerald Mahle discovered a cache of 10-inch cannon balls at the site. Mahle and his team estimated that 50 to 100 additional shot lay in the river. However, by the time they were able to return to the river divers associated with the Savannah River Dive Club in Hampton, South Carolina had removed the ordnance (Salvage License No. 26 file SCIAA).

Mahle continued work under the SCIAA permit from February through September 1981. Using a dragline, a backhoe and a gold dredge, Mahle and his team removed and screened sediment from

the river bed and apparently the alluvial fan near the foot of Senate Street. Fieldwork resumed in August 1981 using the backhoe for excavation. The project recovered numerous Civil War artifacts including a 3.5-inch shell, a 24-pound cannonball, two 10-inch shells and a post-Civil War projectile. Apparently the work did not produce sufficient material to justify continuation of the project (Salvage License No. 26 file SCIAA).

In 1983 a SCIAA Salvage License was issued for a metal detecting survey in the Congaree immediately south of the Gervais Street Bridge. Recovered artifacts associated with the Armory consist of 12 explosive shot for a 6-pounder cannon and one explosive shot for a 4-pounder (Salvage License No. 30 file SCIAA).Since the 1980s there are anecdotal reports of Civil War related artifacts being discovered in the river and on the alluvial fan at the terminus of Senate Street but there have been no additional formal recoveries. The site was designated 38RD286.

Based on this information, there is sufficient documentary and formal survey evidence to establish the continuing presence of ordnance in this section of the river. With this in mind a series of magnetometer and side scan sonar surveys were conducted in advance of the Congaree River Sediment Clean-up project to determine the possible extent of ordnance within the contaminated area.

Over a period of 18 months, from 2010 to 2012, Tidewater Atlantic Research, Inc. conducted remote sensing surveys within the course of the river and on the eastern bank (Tidewater Atlantic Research 2010, 2011a, 2011b, 2012). The first phase of this work focused on the area from the Gervais Street to approximately 1500 feet downstream. The magnetometer survey identified 218 anomalies that were consistent with unexploded ordnance (UXO). Phase II of the survey began where Phase I ended and extended another 400 feet downstream. Ten anomalies that could be could represent UXO were identified in this phase. Phase III of the survey focused on the area from Unnamed Tributary 2 (as seen in figure 1) to just south of the Blossom Street Bridge. One hundred and twenty-two hits consistent with potential ordnance were recorded in this phase. Phase IV was the continuation of a terrestrial metal detector survey along the river bank and alluvial fan at the end of Senate Street. An additional 67 potential instances of UXO were recorded along the shoreline. Attachment A provides a summary of magnetic anomaly survey along with a map detailing the precise locations of the possible UXO.

SCOPE OF WORK

The following Scope of Work outlines our approach to artifact recovery and conservation at the Congaree River Project. The design will outline the goals of the salvage project followed by a detailed methodology for three stages of artifact recovery. Laboratory and artifact conservation methods will be outlined and initial plans for project deliverables, public outreach and the final disposition of the artifacts will be discussed.

PROJECT GOALS

Historic documents, previous salvage projects and intensive remote sensing surveys have confirmed the presence of artifacts related to the burning of Columbia and destruction of the stores at the State Armory in 1865. This previous work has also established that ordnance in the river may not possess locational or depositional integrity. In other words, the location of the artifacts may not be able to provide any pertinent or useful information as allowing interpretation of intra and inter-site feature patterns or depositional positioning however, grid recovery and unexploded ordnance recovery will provide information on depositional positioning. The main goal and value of this project is the recovery of the artifacts and their final inventory and analysis. Secondary goals will be to document the TLM as a man-made artifact and address the events that led to its deposition in the river, and make a formal evaluation of Site 38RD278, an underwater resource that is also within the project boundaries. The Congaree River Sediment Removal Project is designed in such a way as to remove the sediment down to bed rock. That material will then be deposited in a landfill. Recognizing the presence of artifacts invaluable to the history of South Carolina and the nation, recovering them has become a priority to SCANA. Because of the lack of depositional integrity and the nature of the remediation project, the recovery of artifacts will focus on salvage and collection of as many artifacts as possible rather than the collection of traditional archaeological data.

In addition to satisfying salvage objectives and essential rescue of artifacts that would otherwise be confined to a landfill, it is expected that the cataloging of the ordnance will provide substantive contributions to the archaeology of the Civil War. Archaeological inquiry applied to this collection will not only corroborate or refute the historical record but ideally also provide what Smith (1994) describes as the relevant facts upon which to build the discipline of Civil War archaeology. This is vital in defining history because historical records are often confusing, disorganized, contradictory, incomplete, and biased (Smith 1994). For example in Sherman's memoirs he mentions that the ordnance from the Columbia Armory:

> *…were hauled in wagons to the Saluda River, under the supervision of Colonel Baylor, chief of ordnance, and emptied into deep water, causing a very serious accident by the bursting of a percussion-shell, as it struck another on the margin of the water. The flame followed back a train of powder which had sifted out, reached the wagons, still partially loaded, and exploded them, killing sixteen men and destroying several wagons and teams of mules.* (Sherman 2006: 443)

We know from other historic documents that it was the Congaree River and that one commissioned officer (Captain William Davis, whose tombstone stands in Florence National Cemetery, Florence, SC) and three enlisted men (Jesse Johnson, James Kilpatrick and Coleman Wright) were killed by the explosion. By drawing on both the historical record and archaeological evidence a more informed account of the past will established. Consequently, the data gathered during each phase of this project will be used as far as possible to address research questions specific to this site as well as pertinent to Civil War archaeology in general. These include the following topics:

- A comparison of the reported inventories and the collected material;
  - The 1930 salvage inventory lists an "artillery axe", which is presumably a pick axe or axe carried by a caisson. No axes are listed in the official Civil War inventories. Are there items in the river that were not identified in the historic inventories?
- Identification of different styles and types of ordnance and ammunition;
  - During the Civil War more varieties of artillery were used than in another conflict in history. Can it be determined if the ammunition present was created at the Columbia Armory?
  - Are there shells and munitions present that were shipped to Columbia during this latter stage of the war from other armories?

- Can an evolution or time line of ordnance types be identified?
- Are there shells from the beginning of the war as well as well as more technologically advanced material from later in the war?

- Identification of military rank or distinction between the quality of side arms, personal weaponry and miscellaneous items that may be deposited in the river;
  - At the start of the war high quality French and British arms and armaments were purchased and utilized by officers. Are examples of these weapons present?
  - Were higher quality items appropriated and distributed to Union troops during the initial destruction of the State Armory or were all items deposited in the river?
  - Reports indicate that muskets and sabers were destroyed at the site of the Armory itself. Might any of these destroyed weapons have made it to the wagons that were depositing material in the river?
  - A number of side arms and weapons were present at the Citadel Arsenal Academy and listed on some inventories of the captured and destroyed items from Columbia. Did any of these items make it into the river and can it be determined if they were cadet issued items?

FIELD METHODS

Based on previous archaeological work conducted at manufactured gas plants (e.g., Cherau and Bannister 2006; Stratton et al. 2004; Warren et al. 2002) and consultation with SCANA on the nature of the project the following recovery plan for this unique project is proposed. Artifact recovery will take place in three different locations pending the disposition of the material: *in situ*, within enclosed structures, and in an off-site location. The flow chart presented in Figure 4 provides a guide to how artifacts will be identified and recovered at various locations during the course of the project. Generally speaking 100% of the project area will be assessed by pedestrian survey and remote sensing equipment including, but not necessarily limited to, metal detectors and magnetometers during the *in situ* ordnance removal phase. All sediment removed from the project area will be evaluated as to its level of TLM contamination. Sediment determined to be lightly impacted or "clean" will be sent to a screening facility for sorting and artifact recovery. Sediment determined to be too viscous to effectively screen will be sent to an off-site location where it will be spread out in thin layers and subject to visual inspection and/or metal detecting to facilitate artifact recovery. It is expected that reviewers and monitors from SCIAA and SHPO will periodically visit the recovery operations and provide feedback on the recovery methods.

Details for artifact recovery for each of these stages follow.

***In Situ* Ordnance Removal/Geophysical Survey**

During each phase of the sediment removal project the area to be removed will be divided into 50 foot by 50 foot grid squares. Removing the soil in units of this size accomplishes three goals. It provides an organized system that expedites the removal of contaminated soil. It also provides a system to easily identify the boundaries for UXO clearance, and provides additional provenience for use in assessing the distribution of the artifacts.

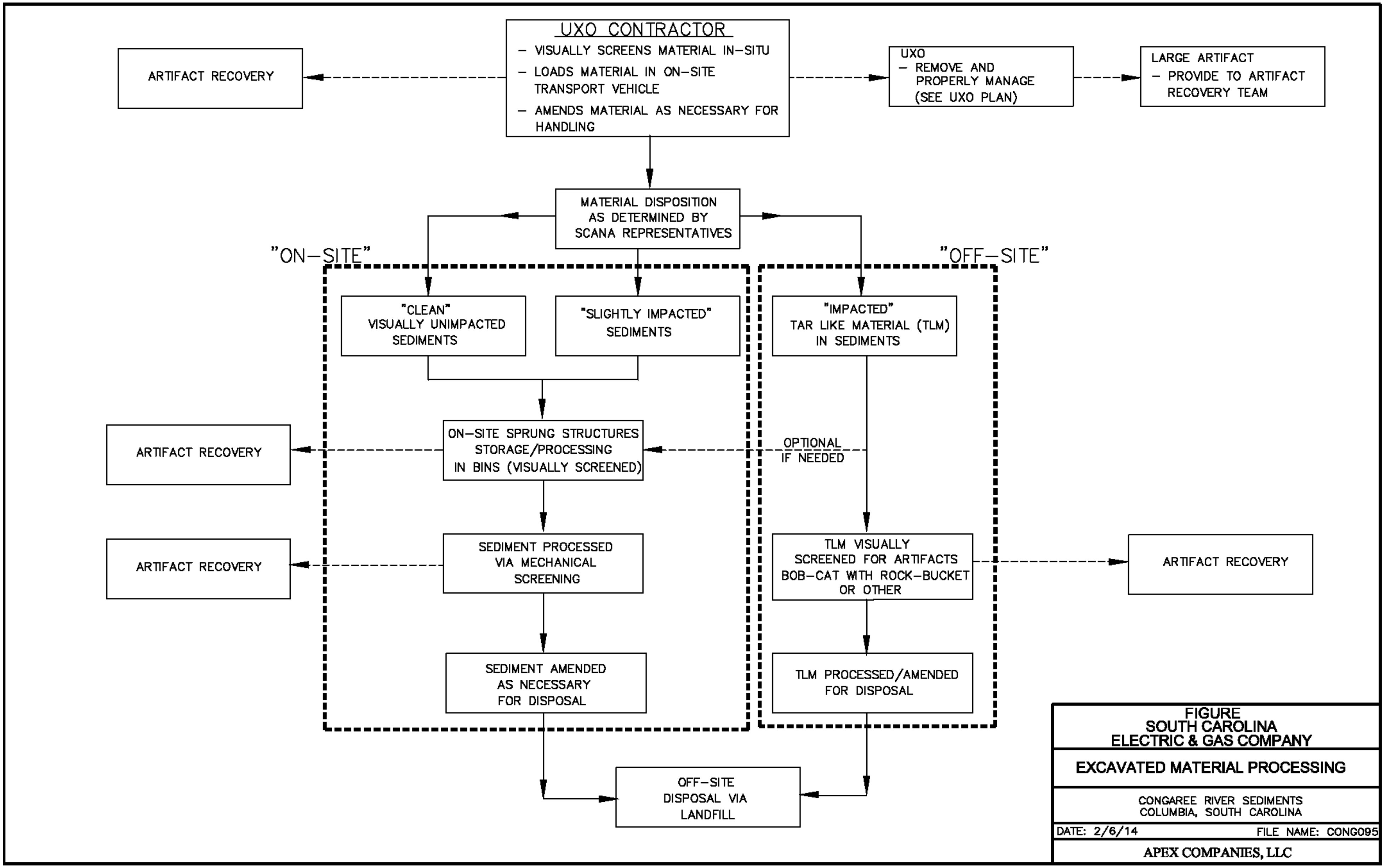


Figure 4. Process for recovering artifacts during sediment removal.

The overarching goal of the project is the timely removal of the contaminated soil rather than the recovery of the artifacts themselves. As stated earlier the material in the river possesses no depositional context. Locational information for the artifacts will not result in the identification of any patterns or organizational system that can be applied to any other Civil War site or archaeological context. Given these facts, the 50 foot by 50 foot system constitutes a practical grid size that will facilitate recovery and processing of the materials and artifacts, and is believed to be the minimum grid size possible for the time constraints required by the sediment removal. The grid size along with the locational data attained during the magnetometer survey will provide acceptable locational information of larger artifacts. Smaller artifacts will have been displaced by river currents, the actual disposal into the river and modern day activities.

The final plan for removal of UXO will be determined by the UXO contractor, in consultation with TRC and TRC's subcontractor James Legg. It is believed the plan will generally follow the guidelines and procedures outlined in *Handbook on the Management of Munitions Response Actions* (EPA 2005) and *EPA Munitions Response Guidelines OWSER Directive 9200.1-101* (EPA 2010) for UXO recovery in areas other than operational ranges. Site specific modifications to these guidelines will be generated due to the historic nature of the potential UXO and the conditions of the project area.

In the first step of the *in situ* recovery nonintrusive geophysical detection technologies will be deployed to locate surface and subsurface anomalies that may be UXO. Distinguishing the ordnance from modern material and other non-ordnance materials based solely on the geophysical signature will be a challenge and will likely require continual adjustments in equipment and procedures throughout the recovery. It is presumed that each 50 foot by 50 foot grid square will be subdivided into lanes in order to facilitate and coordinate the geophysical survey. It is likely that a combination of technologies will then be utilized to evaluate each lane. Magnetometers will be used to detect subsurface ferrous anomalies. The amount of river rock containing ferrous inclusions may cause false positives with this type of sensor. Electromagnetic Induction (EMI) sensors will use electric currents to identify both ferrous and non-ferrous ordnance. Ground Penetrating Radar (GPR) does not appear to be a viable option based on an initial evaluation of the conditions at the site, however, the option is available should the UXO contractor deem it appropriate.

A positioning system will likely be employed to map the location of anomalies based on the geophysical readings. This map will provide data on the anomalies that can be processed by the UXO contractor. They UXO contractor will determine if an anomaly meets the minimum threshold for potential ordnance. The map produced during this phase can be compared to and combined with the results of the underwater magnetometer survey to provide additional locational information of artifacts.

Once identified, the potential UXO will be recovered. A combination of mechanized, manual, and possibly remote control recovery techniques will be employed in order to recover the items. Excavators or front end loaders will be used to remove the surrounding soil matrix from large or deeply buried UXO. Shovels and other hand tools will be utilized for the final clearing of deeply buried UXO once a sufficient level is reached, and for surface or near surface finds. Once an item is uncovered it will be visually assessed to determine they type of ordnance, whether it is inert and can safely be removed for on-site processing, whether it is live (fused or unfused) and if so whether it can be safely removed for off-site detonation or whether on-site demolition will be

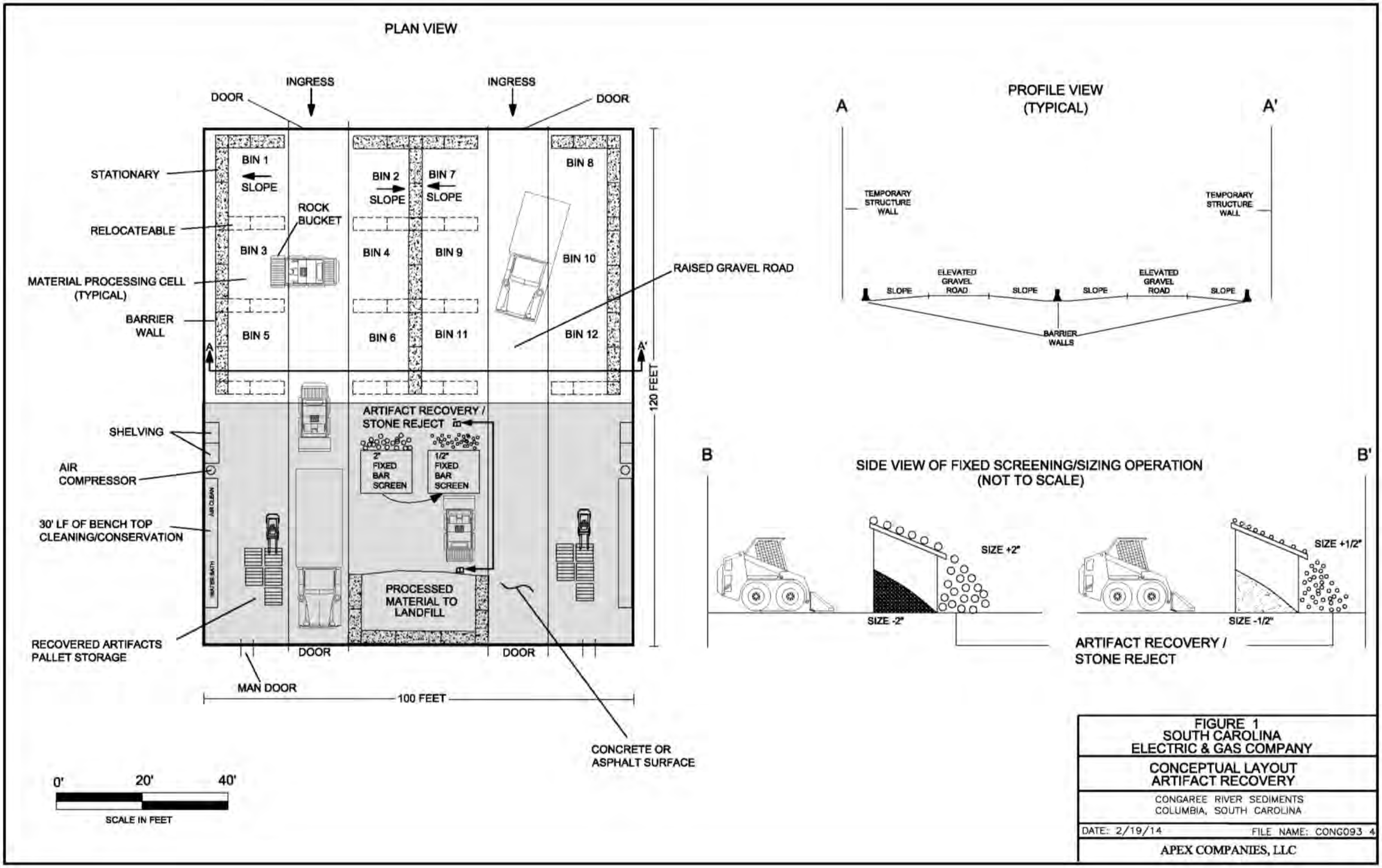


Figure 5. Artifact processing facility.

required. Proper safety measures and protocols will be strictly adhered to for any blow-in-place situation or removal of live ordnance. Ordnance that is found to be inert will be excavated and removed by the UXO contractor with the possible assistance of the on-site archaeologist. The item will be delivered to the archaeologist who will bag it and label the item with provenience information including the grid square from which it was removed and any identifiers assigned to the item by the UXO contractor (Survey lane number, anomaly number etc...). The item will then be temporarily stored at the on-site artifact sorting facility before being taken to the TRC office for cleaning, analysis and conservation.

On-Site Recovery

Once a grid square has been cleared by the UXO contractor heavy equipment will be utilized to remove the sediment. If saturated the soil will be either be placed in roll off containers or in discrete piles. It will then be allowed to dry (or processed with a drying agent such as cement dust) in preparation for transport. At the time of the removal a project manager familiar with the excavation and characteristics of TLM will assess the soil and make a determination whether the soil is too contaminated to pass through a screen. If the soil is “clean” it will be transported to an enclosed facility (Figure 5) and screened for artifacts

Once in the processing facility soil will be stored in discrete piles based on grid square. The soil from each grid square will then undergo a three stage screening process. The first sort of the material will be by a Bobcat outfitted with a skid steer rock bucket attachment that has finger tines spaced 4 inches apart (Figure 6). The rock bucket will be used to remove items, including modern debris (tires, bottles, etc…), over four inches in diameter. It is assumed that any potential ordnance over four inches will be detected during the *in situ* removal phase. However all material that does not fall through the tines will be visually inspected before being loaded into a roll off container for removal to the landfill. Any larger artifacts identified during this phase will be set aside for processing. If an artillery shell or potential UXO is identified safety protocols will be implemented and the UXO contractor will be immediately notified.

Figure 6. Example of a rock bucket to sort larger artifacts and sort rocks and debris.

Material that falls through the tines of the rock bucket will be subject to a second sort through a narrower gauge 2-inch bar sorter (Figure 7) similar to those used to sort rock and gravel. Material that does not fall through the bars will be visually examined. This sort is designed to recover items smaller ordnance and items or fragments of items that may have been broken up prior to disposal in the river (sabers, rifles, side arms, tools, buckles). The castoff material will be place in roll-off containers for disposal.

Figure 7. Example of a bar sorter

The remaining material will be taken to a screening and sorting station. This final stage of on-site recovery will be designed to recover the smaller artifacts. The soil will be sifted through various methods depending on the nature of the material and amount of time available for recovery. Options include ½-inch or ¼-inch mesh screens set up on sawhorses where the sediment can be manually screened. Water screening stations over shop sinks and standard archaeological shaker screens are also options. Artifacts recovered at the on-site processing facility will be bagged and labeled according to grid square and any other pertinent provenience.

With this final station up to 100% of the soil capable of falling through a screen will be screened. Due to time constraints and the throughput requirements of the project, however, circumstances may arise where it may not be feasible to screen all the "clean" sediment from a particular grid square. Therefore it is proposed that a minimum of 50% of the "clean" sediment removed from each grid square will be screened. Every effort will be made to screen 100% of this material, but if that fails, it is believed that recovery from 50% of this soil along with the *in situ* recovery will provide a viable study sample.

Off-Site Recovery

The viscous nature of the TLM in the river requires a creative solution to artifact recovery. Above a certain threshold of TLM in the sediment screening will result in clogged mesh, soil consolidating into large tar balls and ineffectual artifact recovery. For this reason, sediment that is determined to contain too much TLM will be sent to an off-site location, tentatively identified as the landfill where the contaminated material will be disposed of, and examined. Examination will take place visually and through geophysical methods.

When it arrives at the off-site facility the soil will once again be stored according to grid location. An area measuring up to 50 feet by 50 feet (final dimensions will depend on the amount of open land available) will be covered with heavy, industrial plastic sheeting. A backhoe will be used to spread the sediment from a selected grid square in a thin layer, up to 2 inches thick, on the sheeting. Five foot wide lanes will be established across the examination area. A crew of archaeological field technicians will then walk the lanes and make a visual survey of the sediment collecting artifacts as they are encountered.

In the early stages of the recovery process a metal detector will be employed on every other lane. A comparison will be made of the amount and type of artifacts recovered from the metal detected lanes and the visually inspected lanes. If there is a large discrepancy the method found to recover the most artifacts will be employed throughout the remainder of the project. If there is no discernable difference the method found to be the most effective use of time and personnel will be the procedure of choice for the project.

Artifacts recovered from this facility will be more contaminated. They will be safely bagged, labeled and stored until they can be effectively cleaned and conserved.

Recovery Conclusions

The complex nature of this project must be recognized. Not only will conditions change during each proposed field session, but they have the potential to change on a weekly and daily basis. The characteristics of the coal-tar plume vary along the 2,000-foot length of the project area. The amount of TLM will vary from little to nearly 100% tar. It is because of this that different recovery strategies were developed.

The plan is designed to maximize the amount of sediment examined and minimize the time in which that examination takes place. If reported inventories are correct nearly 1.5 million items were potentially discarded into the river over a two day period. Official recovery projects account for around 2000 of those artifacts. Unofficial recoveries dating back to the Civil War have likely accounted for thousands if not tens of thousands more. That only accounts for a fraction of the potential material that may be present. The proposed recovery plan is focused heavily on recovering the larger artifacts that may be present. The Minié balls, round shot and percussion caps that account for much of the inventory will be collected to the extent possible. It is felt that if they are still present a fairly large representative sample of these smaller items will be recovered from ½-inch screening and visual examination. Similarly, artifacts not related to the Civil War and of a smaller size, including prehistoric tools and projectiles, prehistoric ceramics, and historic artifacts dating from the populating of Columbia to the early twentieth century, will be collected with the proposed strategy. While these artifacts are not the primary focus of the salvage every effort will be made to recover significant diagnostic material.

ARTIFACT ANALYSIS AND CONSERVATION

Civil War documents indicate that artifacts recovered during this project may include lead ammunition, rifle barrels and wood stocks, percussion caps, sabers and cutlasses, artillery shells, cannons, scabbards, and munitions containers. Other artifacts may be present in addition to the military artifacts. There are a number of sites adjacent to the project area, including a 19th century saw mill and a possible ferry crossing (Figure 8). Likewise, prehistoric Native American artifacts have been recorded as being present on the shoreline adjacent to the project area. Artifacts from these sites may have eroded or been deposited into the river and may be present in the project area as well; the condition of potential artifacts from these sites is unknown.

The Artifact Analysis and Conservation Plan has been designed to accommodate this broad range of materials. The laboratory operations from the time a specimen is delivered to its ultimate place of storage or exhibition can be separated into five basic stages:

1. Initial documentation.
2. Storage prior to conservation process.
3. Encrustation removal.
4. Analysis.
5. Curation.

Initial Documentation

As an artifact is recovered, it will be bagged, labeled and recorded on the site log sheet documenting its associated unique provenience number (grid square). In this manner the recovered material can be roughly tracked and artifact density information by proveniences can be monitored. Inert and defused materials recovered during the in situ/ordnance removal phase will be similarly bagged and labeled according to grid square and UXO identifiers. Blow-in-place ordnance and live ordnance transported off-site for detonation will be photographed and measured in place (as safety allows) and assigned a specific inventory number.

At this stage artifacts may be lightly washed or dry brushed to remove excess sediment and TLM. Based on information provided by SCANA, some artifacts may be entirely encased in TLM. The time and effort needed to clean and conserve these artifacts may be cost prohibitive. Depending on the information collected as the project goes on, it may be appropriate to propose sorting criteria based on the amount of tar affecting an artifact and the type of artifact as part of the conservation plan. For example if thousands of rounds of ammunition are recovered and found to be entirely encased in TLM an initial cleaning might remove as much material as possible, the lab crew would add the artifact type, quantities, and description to the field excavation forms and the items (or a percentage of the items) would be discarded. The details of a triage procedure such as this will be determined through consultation with SCANA and SCIAA personnel.

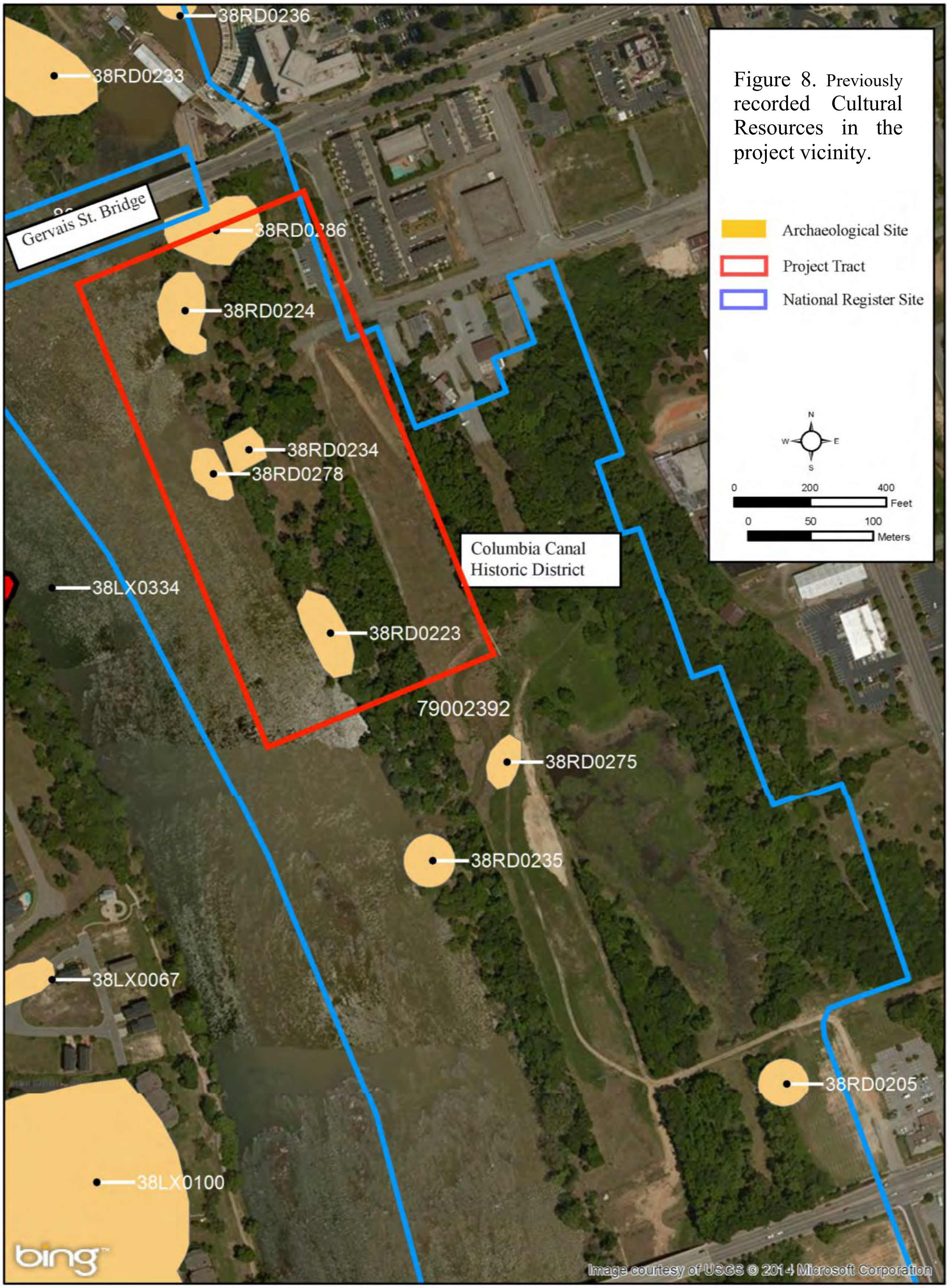


Figure 8. Previously recorded Cultural Resources in the project vicinity.

Storage Prior to Treatment

Removal of TLM will take place at this stage. In order to remove potentially hazardous contaminants artifacts will be lightly brushed and bathed in a solution of BioSolve. This is a water-based, biodegradable formulation of surfactants and performance additives. It is used in soil remediation projects and been found to be effective in cleaning oily residue and TLM from heavy equipment used in MGP remediation projects. This process will likely take place in TRC's Treatability Lab in Greenville, SC or in a designated area at the on-site processing facility where contaminants can be disposed of with the overburden.

Once the TLM has been removed the artifacts will be stored and conserved according to methods outlined in *Methods of Conserving Archaeological Material from Underwater Sites* (Hamilton 1999). Due to the potential volume of artifacts it is anticipated that some materials may need to be stored for a time before they can be properly cleaned and conserved. As part of this storage stage any adhering encrustation or corrosion layers will largely be left intact until the objects are treated, since they form a protective coating which retards further corrosion. Therefore all metal objects determined to be suitable for analysis will initially be kept in tap water with an inhibitor added to prevent further corrosion. For long-term storage, an oxidizing solution of potassium dichromate and sodium hydroxide or an alkaline inhibitive solution may be used (Hamilton 1999).

Encrustation Removal/Conservation

For most metal items, this will consist of thorough reduction in electrolysis, alternating with manual cleaning. After the rust has been removed, the artifact will be boiled in distilled water to remove salts, and then dried. The artifacts will finally be sealed with microcrystalline wax. Non-ferrous or fragile items may be treated by boiling in distilled water, drying, and sealing. Below are more details of possible cleaning and conservation methods based on expected material types.

<u>IRON/FERROUS OBJECTS</u>
Iron artifacts will be stored in an aqueous solution until they are subject to electrolysis. Electrolysis will take place in tanks specially equipped with a battery charger and a copper pipe; alligator clips are used to suspend the artifacts in a solution of tap water and sodium bicarbonate. A low voltage electric current is passed through the tank, removing the rust from the artifacts. Electrolysis is continued in the tap water electrolyte until the chloride level of the electrolyte approximates the level found in the tap water. The artifacts will remain in the tanks for as long as it takes to remove all rust.

The artifact is then rinsed thoroughly in several changes of alternate boiling and cold de-ionized water to remove any residuum. The artifact will be submerged in the last vat of rinse water for a minimum of 24 hours. After rinsing, the moisture absorbed by the artifact must be removed before any sealant is applied. The artifact may be baked or if exposure to air is found to cause too much oxidation the object may be submerged in water-free isopropanol to dehydrate for a minimum of 24 hours. It may also be expedient to eliminate the drying process altogether and simply towel off the artifacts before dipping them in microcrystalline wax (Hamilton 1999). If larger object such as cannons are recovered a wax sealant may not be feasible. In such a case coats of polyurethane or Rustoleum may be appropriate.

LEAD

A majority of the artifacts recovered will presumably be made of lead. Lead will initially be stored in a tap water and sodium sesquicarbonate solution. In the case of lead artifacts, use of electrolysis is minimal. The lead will be immersed in 10 percent hydrochloric acid, which will remove any adhering marine encrustation, along with lead carbonates, lead monoxide, lead sulfide, calcium carbonate, and ferric oxide. This will be followed by a rinsing and gentle removal of adhering materials. Lead objects will be allowed to dry and finally sealed with microcrystalline wax.

COPPER, BRONZE AND BRASS

Artifacts made of copper and its alloys will be subject to the same electrolysis procedures as described for iron. The main variations in treatment involve the fact that the duration of electrolysis for cupreous objects is significantly shorter than that for comparable iron objects. Small cupreous artifacts, such as coins, require only a couple of hours in electrolysis (Hamilton 1999). Following electrolytic cleaning, the artifacts will be put through a series of hot rinses in de-ionized water until the pH of the last rinse bath is neutral. Because copper tarnishes in water, a wet paste of sodium bicarbonate may be used as polish. After polishing, a coat of benzotriazole (BTA), commercially known as KrylonClear Acrylic Spray will be applied.

WOOD

Waterlogged wood artifacts in the form of gun stocks, pistol butts or wagon/caisson wheels or parts may be recovered. Wood artifacts will be assessed as to their preservation potential and either discarded after being documented or submerged to await conservation. If wood is to be conserved it will be done with the Polyethylene glycol (PEG) method. This process simultaneously removes water from the object while also strengthening and consolidating the wood. The procedure is simple but time consuming. The wood artifact is placed in a solution of PEG and water or alcohol where it is allowed to sit. Over a period of months or years (depending on the size of the artifact) the PEG level is gradually raised until the solution consists of at least 70% PEG. At this level wood will remain stable and no further treatment of the wood should be necessary.

CERAMICS, STONE AND GLASS

Ceramic artifacts, stone tools or projectiles and glass objects that have been submerged in water do not typically require special treatment. Glazed and hard fired historic ceramics such as stoneware and porcelain are impervious to water. Low fired earthenware and prehistoric ceramics may encounter some erosion but will remain structurally solid. Glass and lithic material may become discolored be will largely remain unaffected. Rinsing with tap water and light brushing to remove excess sediment is typically all that will be required. A mild detergent may be used in an attempt to remove deep stains. Care will be taken not to remove paint or surface treatments. The artifacts will then be allowed to air dry on rack. Reconstruction or re-fitting of vessel or container fragments may be attempted using proper fixatives. No sealant is required.

LEATHER

Leather conservation will follow the same procedures as detailed for ceramic items. Rinsing with tap water and light brushing to remove ingrained soil is typically all that will be required. If leather is waterlogged it can be subject to the same PEG treatment as wood. Treating leather with PEG will generally take less time than wood.

Analysis

Artifacts will be separated into functional groups that are then subdivided by use category and object type. The artifact pattern model, as devised by South (1977) and revised by Garrow (1982) is the basic formatting procedure for all artifacts. This model offers a rational approach for the organization of artifacts on a provenience to provenience level, or all the way up to total site contents. This system also allows for analytical modifications when collections of a specialized nature are recovered and was used to generate the functional categories outlined above for the Civil War artifacts.

This system will consolidate large quantities of like artifacts under descriptive headings and facilitate interpretation. A final and compelling reason to use the artifact pattern model is that it provides a good format within which to present the contents of the site, and can lead to cross-comparisons with other sites formatted in that manner. Functional groups, categories and sub-categories will consist of:

- Arms
    - Artillery
        - Cannons
        - Howitzer/Mortar
        - Ordnance - Fixed
            - Shot (24-pounder, 12-pounder, 6-pounder)
            - Case (24-pounder, 12-pounder, 6-pounder)
            - Fuse (24-pounder, 12-pounder, 6-pounder)
            - Grape (24-pounder, 12-pounder, 6-pounder)
            - Canister (24-pounder, 12-pounder, 6-pounder)
        - Ordnance – Not Fixed
            - Shot (10 inch, 8 inch)
            - Shell (10 inch, 8 inch)
        - Artillery Accoutrements
            - Carriages and parts
            - Caissons and parts
            - Tools
            - Fuses
    - Firearms
        - Small Arms (pistols, pistol parts)
            - Small Arms Ammunition (shot)
            - Small Arms Accoutrements (holsters, belts, cartridge boxes, tools)
        - Long Arms (muskets, rifles, parts)
            - Long Arms Ammunition (shot, Minié balls)
            - Long Arms Accoutrements
    - Edged Weapons
        - Sabers
            - Cavalry
            - Artillery
            - Naval
        - Bayonets

            - Cavalry
        - Edged Weapon Accoutrements
            - Saber knots
            - Saber scabbards
            - Bayonet scabbards
- Clothing
    - Button
    - Buckles
    - Insignias/Pins
    - Knapsacks
    - Haversacks
    - Other

- Tools
    - Anvil
    - Forge
    - Vise
    - Other

- Personal – Civil War
    - Jewelry
    - Writing
    - Food storage, preparation and consumption
    - Indulgence (alcohol and tobacco related items)
    - Medicine

Information recorded during the analysis of the Civil War related artifacts will vary depending on what objects are recovered. It is anticipated that a majority of artifacts recovered will be lead shot. These will be and measured, perpendicular to the ball's mold seam, for diameter (*not caliber*) to 1000ths of an inch. The catalog description will include a conclusion regarding each shot's function based on its diameter or former diameter as implied by weight. Shot and shell will similarly be measured and weighed. Distinguishing characteristics that denote armory or metalworks of origin, and when possible range of manufacture, will be noted and photographed. Guns and fire arm parts as well as saber parts will be identified, photographed and cataloged.

Clothing items will be weighed and measured. Photographs will be taken. Detailed photographs of insignias or devises apparent on the durable clothing items will be documented and attempts will be made to identify insignias by military unit. Since their presence in the river is not necessarily documented and their recovery is not anticipated we are collapsing some material culture categories outlined by Legg and Smith (1989) into the single category of Personal Items. These items are items that would be in the possession of an individual soldier.

Historic artifacts will be analyzed by functional groups according to the procedures outlined in South (1977). Historic ceramic artifacts will be classified according to recognized types (e.g., pearlware, ironstone), and by decorative technique (e.g., hand-painted, transfer print, decal) and vessel form. Bottles are described by type, color, size, and closure type. Where possible, standard references such as Miller (2000), Noel Hume (1970), Jones and Sullivan (1985) and South (1977), as well as more specific published and on-line references for particular artifact types will be used to obtain date ranges for historic ceramics and glass.

The prehistoric artifact analysis will focus on identifying assemblages and/or technological attributes diagnostic of particular temporal and geographical cultural trends. The artifacts will be identified according to established regional types or styles. In the case of projectile points, morphological attributes will be used as typological markers. Ceramics will be typed according to paste, temper, and surface decoration.

The following descriptions define the categories in the lithic artifact typology to be used in the lithic analysis. Lithics refer to stone tools and debris from producing stone tools. The following categories are derived in part from those developed by Blanton et al. (1986) and Garrow (1982), which have been used with excellent success on many projects in South Carolina.

The two major groups of lithics are debitage and functional artifacts. Debitage can be divided into the following categories:

> *Biface Thinning Flakes.* Biface thinning flakes are relatively thin and flat to slightly curved in cross section. Secondary flake scars are frequently present on the dorsal surface. The platform may be faceted and may exhibit a distinct lip, and the bulb of percussion is usually diffuse. These features are characteristic of soft hammer percussion, and the flakes of this type are most often the result of late stage biface reduction and maintenance.
>
> *Blades and Bladelike Flakes.* These flakes approach or exceed a length-to-width ratio of 2:1. Blades and bladelike flakes frequently have a ridge oriented along the dorsal surface. They are typically manufactured for a specific purpose, such as replacing edges in cutting or grating implements.
>
> *Bipolar Flakes.* Bipolar flakes exhibit a bulb of percussion on the ventral surface of both the distal and proximal ends. They are often curved in cross section. These flakes are manufactured by placing the raw material on a hard surface, such as an anvil stone, and striking its superior surface with a hard implement.
>
> *Unspecialized Flakes.* These flakes are relatively thick and wide with little or no indication of having a particular function or representing a specific stage of manufacture.
>
> *Flake Fragment*. This category includes those flakes that have only nondiagnostic medial or distal portions. Any flake lacking a proximal end will be placed in this category.
>
> *Shatter.* Shatter is debitage that is angular and blocky. Specimens in this category cannot be oriented in relation to their proximal or distal end.
>
> Chipping debris also will be subdivided based on the amount of cortex present on the dorsal surface. Classifications are assigned based on whether more than half (>50%), less than half (<50%), or no cortex was present on the dorsal surface. This measure should give an approximate indication of the stage of reduction represented in the assemblage. All lithic artifacts will be identified as to debitage class and raw material.

The second major lithic group is functional artifacts. The categories in this group are defined as follows:

> *Bifaces.* This category comprises artifacts that are bifacially flaked and do not have haft elements. They can be finished tools, projectile points, knives, scrapers, or preforms. Bifaces usually cannot be given an established type name.
>
> *Hafted Bifaces.* Hafted bifaces are bifacially worked artifacts that have a hafting element (i.e., stem and notches). They are often described as projectile points or knives and may conform to established type names.

Cobble Tools. Cobble tools are altered or unaltered cobbles used as hammerstones, nutting stones, anvils, and other similar tools.

Cores. Cores consist of parent raw material and are the remnants of flake manufacture. They can be blocky or discoidal in appearance and exhibit one or more flake scars.

Ground Stone. Artifacts in this category are manufactured by polishing or grinding stone into a desired shape—celts, axes, and manos, for example. These tools are often used in woodworking and food processing.

Manuports. Manuports are unaltered pieces of stone that are not indigenous to the area and obviously have been transported to the site by humans.

Retouched, Used, or Modified (RUM) Flakes. The category of RUM flakes includes all flakes that have been retouched into a unifacial tool, exhibit use wear, or have been modified by undetermined means. This category includes scrapers and utilized flakes.

Soapstone. Soapstone is a very soft stone that is easily worked. Artifacts frequently constructed of soapstone include bowls, pipes, and beads.

Fire-Cracked Rock. Although fire-cracked rock is not a tool per se, these are rocks that exhibit evidence of having been in or near a fire due to human activity. Alteration in color and/or luster, angular fractures, and potlidded surfaces are diagnostic of fire-cracked rock.

The analysis of prehistoric sherds will begin with a basic characterization of the entire assemblage. Sherds smaller than 2 × 2 cm will be counted, weighed, and examined to determine the presence of surface treatments or vessel forms that could prove useful in the analysis. If not, they will receive no further analysis. All larger sherds will be classified by surface decoration and aplastic content. The aplastic content will be documented as the type (or raw material) and size of the major aplastics. Size will be determined through comparison with the Wentworth scale, used by most archaeologists to standardize aplastic descriptions. Aplastic size will be recorded as no apparent temper, fine, medium, coarse, and very coarse. Surface decoration will be recorded by type (e.g., incised), and major decorative mode characteristics will be recorded.

The preliminary analysis will allow a characterization of the sherd assemblage. During this initial analysis, sherds will be labeled and pulled for cross-mending, so the subsequent analyses can focus on the vessel assemblage. The surface decoration–aplastic content classes from the preliminary analysis will be compared to published type descriptions; type names will be applied where possible.

Surface decoration, aplastic content, thickness, and interior surface treatment will be considered in cross-mending the sherds. The analysis will seek to reconstruct as many vessels as possible to help determine vessel form and function. The following attributes will be recorded for each vessel to provide a detailed technological description of the wares. They will be examined to determine technological patterns within and between types.

- Type, size, shape, and density of major aplastics
- Type and size of minority aplastics
- Degree of carbon core retention
- Sherd core cross-section configuration
- Thickness 3 cm below rim
- Rim form
- Presence of coil breaks

- Dominant paste color
- Interior surface treatment

Curation

SCANA realizes a disposition agreement with SCIAA regarding the percentage of artifacts to be received is required as part of the application process. SCANA is committed to displaying and making the artifacts recovered from this site available to the public. At the conclusion of the analysis the artifacts will be prepared for curation following accepted guidelines. Copies of all records, including, but not limited to, field notes, maps, catalog sheets, and representative photographs shall be submitted for curation with the artifacts. After project clearance has been obtained, artifacts and relevant notes will be curated in accordance with the selected repository. It has not yet been determined where the material will be curated. It is possible that due to the volume of material expected multiple curation facilities may be needed. .

DOCUMENTATION

Daily logs and records will be kept at each artifact processing area during the recovery phase. These logs will be available for review by COE, SHPO and SCIAA personnel during monitoring visits. Interim reports/management summaries will be provided documenting each phase of the remediation project. These management summaries will minimally include maps depicting the area cleared during the related field season, a description of the work completed to date, a preliminary inventory of the artifacts recovered and a status update that will provide detail of the next field season.

At the conclusion of the remediation project a draft technical report will be produced and delivered to review agencies. The report will follow the format and content specified in the *South Carolina Standards and Guidelines for Archaeological Investigations*, including a description of past archaeological research in the project vicinity, a discussion of local history, an explanation of the research design, the field methods employed, evaluation methods, findings, conclusions, and recommendations. TRC will promptly address all comments and revisions provided in writing by SCIAA in a final technical report.

All maps and drawings will be high quality and produced in a professional manner. Project maps will be produced in color using ArcGIS software, CAD or other appropriate mapping programs. These maps will depict each phase of the project and include grid square boundaries. Individual maps of grid squares may be used to identify the locations of ordnance removed during the UXO recovery stages of the project. Overlays of historic maps and plats may be used where appropriate. High quality color photographs or measured drawings, as appropriate, will be provided that show details of representative diagnostic or other interesting artifacts. The report will be bound in a durable cover (minimum 80 lbs cover stock), and contain an identifying label. The paper will be high quality laser printed paper, minimum 24 lbs stock, and will be acid free. Pages will be printed on both sides and project maps and photographs will be produced in color. Electronic copies of the final report in Adobe Portable Document File (PDF) format will be provided to SCIAA and outside reviews as appropriate. In addition a CD or DVD with photographs of the artifacts will be provided if desired.

At the discretion of SCANA a popular report suitable for public distribution may be produced. This report may also be reviewed and commented on by review agencies prior to publication. This report, if produced, will be part of the public outreach program that SCANA is committed to in order to inform and educate the public on this significant find.

PUBLIC INFORMATION

Salvage of the Civil War material deposited in the Congaree River offers an amazing opportunity to educate and involve the public about a historically significant site. The recovery of tangible evidence of the capture of Columbia will take place almost exactly 150 years from when it occurred. There will be multiple opportunities for the general public to benefit from this project. Initial plans call for an on-site structure dedicated to exhibiting the history of the site, the on-going work and the interpretation of the artifacts. This structure will be open to the public and will tentatively be staffed by SCANA personnel and an archaeological docent.

An electronic presentation or social media site suitable for hosting by SCANA or other appropriate website may be created to present the on-going recovery process. Museum quality artifact displays and/or traveling artifact shows at museums throughout the state can be generated. A book/booklet depicting the artifacts and history of the site suitable for presentation to the general public can be authored. Additional public outreach may involve professional papers and presentations at national and regional archaeological conferences, tours and talks for school age children as well as avocational groups is also an option. Some or all of these potential public outreach approaches will be completed as a result of this project.

QUALIFICATIONS

Company Profile

A pioneer in groundbreaking scientific and engineering developments since the 1960s, TRC is a national engineering and consulting firm providing integrated services to the energy, environmental, and infrastructure markets. We serve a broad range of clients in government and industry, implementing complex projects from initial concept to operations. TRC employs over 2,600 technical professionals and support personnel at more than 70 offices throughout the U.S.

TRC's cultural resource group in the Southeast originated as Garrow and Associates, an Atlanta-based small business that was founded in 1983 and acquired by TRC in 1997. We offer a complete range of cultural resource services in the Southeast from our offices in Atlanta, Georgia; Chapel Hill, North Carolina; Columbia, South Carolina; and Nashville, Tennessee; including archaeological investigations, historic structure surveys and evaluations, and cemetery studies. Our local office in Columbia is within a ten-minute drive of the Congaree River Project site. With the Principal Project Manager and Key Project Team members being local to Columbia, we will be able to respond quickly to all SCANA's needs. Our office provides us rapid access to SCIAA, SHPO, the South Carolina Department of Archives and History (SCDAH), the University of South Carolina at Columbia, and other regulatory offices and research facilities. Our organizational depth will allow us to draw on resources from our nearby offices to support this project as needed.

TRC's core cultural resources staff in the Southeast consists of approximately 55 professional archaeologists, crew chiefs, preservation planners, historians, and support personnel. Our archaeologists possess M.A. or Ph.D. degrees in Anthropology, meet the Secretary of the Interior's standards, and are Register of Professional Archaeologists (RPA) certified or eligible.

Our Columbia office contains 2,400 square feet of laboratory, office, and storage space. It possesses wet lab and dry lab capabilities and has ample room to conduct electrolysis and metal conservation operations. TRC's Atlanta facility includes 2,500 square feet of fully equipped laboratory space that includes tanks capable of conserving metal objects up to four feet in length, and the Chapel Hill office has similar lab and storage capabilities. Our Greenville office contains a wet lab and research/treatability laboratories complete with ventilation hoods and resources for preparing and storing solvents for use in cleaning coal tar from artifacts.

Key Personnel

TRC's proposed key staff for the Congaree River Sediment Removal Project includes highly experienced researchers with extensive experience managing and directing large scale projects that require consultation with multi-disciplinary teams as well as state and Federal agencies. Our team also has experience with both complex projects that involve creative approaches to archaeological issues and with Civil War era projects that involve recovery and conservation of artifacts similar to those anticipated for the Congaree River Project.

TRC Columbia Program Manager Sean Norris, M.A., RPA, will serve as Principal Project Manager for the project. Ms. Ramona Grunden, Senior Archaeologist in our Columbia office will serve as the Assistant Project Manager. Both Mr. Norris and Ms. Grunden will be available for rapid deployment to any meetings or consultations required by SCIAA.

<u>Principal Project Manager</u>

Mr. Sean Norris is the Program Manager for Archaeology at the Columbia Office of TRC. He handles administrative duties and manages all projects and contracts that originate in that office. Mr. Norris will serve as Principal Project Manager and will attend meetings with SCANA and other team members, lead the development of the Artifact Recovery/Salvage and Artifact Conservation and Stabilization plans, and act as TRC's point of contact for this project. Mr. Norris has over 15 years of experience in the eastern U.S. and is RPA certified. Mr. Norris has served as Principal Investigator on numerous projects in South Carolina and has experience in project planning, the development and implementation of research designs and field and laboratory methodologies, and technical and popular reporting. Mr. Norris is President of the Council of South Carolina Professional Archaeologists and routinely interacts and sits on committees with employees of SCIAA and the South Carolina SHPO. He has authored Memorandums of Agreement (MOAs) and Memorandums of Understanding (MOUs) as well as Protective Covenants for significant archaeological sites that have included the SHPO, SCDHEC, and the COE as signatories.

<u>Assistant Project Manager</u>

Ms. Ramona Grunden is a Senior Archaeologist and Laboratory Director in TRC's Columbia Office. She will serve as the Assistant Project Manager. Her duties for this phase of the project will include providing input on artifact recovery strategies related to Civil War sites, she will also be present to attend meetings should Mr. Norris be unavailable. Ms. Grunden has over 30 years of experience in South Carolina archaeology including seven years as an archaeologist at SCIAA. Ms. Grunden has conducted and managed numerous large-scale projects in the Southeast. She has extensive experience in all phases of historic sites investigations, and has worked on numerous Civil War projects and others involving military instillations and military components.

Senior Technical Advisor

Mr. Paul Webb is TRC's Cultural Resource Program Leader, and is stationed in the Chapel Hill office. He has over 25 years of experience in cultural resource management, including planning, implementing, and reporting all aspects of cultural resource studies. His qualifications include extensive experience with large and technically complex archaeological projects, and in assisting multidisciplinary teams in developing creative approaches to cultural resource issues. Mr. Webb will assist in the development of the artifact recovery/salvage and conservation and stabilization plans, and will also assist in agency negotiations as appropriate. Mr. Webb's background includes service to public, tribal, and private-sector clients, including the North Carolina Department of Transportation; Federal Highway Administration Eastern Federal Lands Highway Division (FHWA EFLHD); National Park Service (NPS); National Forests in North Carolina; Eastern Band of Cherokee Indians; U.S. Army Corps of Engineers; U.S. Army Construction Engineering Research Laboratory (USACERL); U.S. Army Environmental Center; Maryland State Highway Administration; Iroquois Gas Transmission System; Duke Energy; Piedmont Natural Gas; North Carolina Natural Gas; Spectra Energy; and Progress Energy; along with numerous engineering and environmental firms.

Safety Advisor/Technical Advisor

Dr. Larry McKee has over 25 years of experience and progressive responsibility in archaeological research and cultural resource management. His qualifications include extensive field investigation, artifact analysis, consultation at the tribal, state, and federal level, and large-scale project management. Mr. McKee came to TRC in 1999 following twenty years of academic and museum based archaeological research. He currently serves as a Senior Program Manager with the southeastern cultural resources division of TRC, with responsibility for the business functions and technical performance of the Nashville, TN office.

Laboratory Director

Mr. Thomas Garrow is the Laboratory Manager for TRC's Atlanta office, a position he has held since 1993. Mr. Garrow is responsible for artifact processing, analysis, conservation, and cataloging, as well as specialized recovery techniques such as flotation. Mr. Garrow has nearly 30 years of experience in cultural resource management, including field and laboratory work across the eastern United States. Mr. Garrow has participated in numerous archaeological investigations covering a wide range of site types, including those dating to the Civil War. Mr. Garrow has received training in artifact conservation techniques and curation standards, and few cultural resource practitioners in the region can match his depth of experience in metal conservation. Mr. Garrow will assist in development of the Artifact Recovery/Salvage and Conservation and Stabilization plans.

Senior Scientific Advisor

Dr. Karen Saucier has over 25 years of experience, and has worked extensively in the areas of CERCLA- and RCRA-mandated investigations, risk evaluations and remediations. Dr. Saucier will act as TRC's in-house technical advisor with experience on Manufactured Gas Plant sites. Her expertise includes providing strategic technical services, and assessing regulatory and business implications of environmental remediations and historic liabilities. Dr. Saucier supports client/agency negotiations with respect to risk-based decision making, sediment, soil and groundwater remediation approaches, and liability portfolio life-cycle costing and management. She routinely serves as Project Manager with responsibility for coordination and integration of multidisciplinary technical resources through the various stages of liability project life cycles. She advises on and leads project communications to corporate, regulatory and community stakeholders.

Additional Consultants/Staff

TRC will retain the services of Mr. James Legg as an archaeologist and consultant to assist in the General Consulting and planning tasks requested in this RFP. Mr. Legg currently works as a project archaeologist for SCIAA and has more than 40 years of experience in archaeological research involving battlefields and other military sites. He has worked with Ms. Grunden on a number of those sites. He has a particular interest in 18th and 19th century ordnance, including both small arms and artillery ammunition. He is a recognized expert who has handled all of the major types of Civil War ammunition and has disarmed and conserved many examples.

Mr. Legg has 32 years of experience in archaeological metal detecting, and has a regional reputation as an authority on the subject. Mr. Legg is also highly experienced in metal conservation. Over the last 35 years he has conserved several thousand metal artifacts from private collections as well as significant archaeological collections including those from 16th century Santa Elena, the Camden Battlefield, and a number of other projects conducted by SCIAA and other research entities.

REFERENCES CITED

Blanton, Dennis B., Christopher T. Espenshade, and Paul E. Brockington Jr.
1986 *An Archaeological Study of 38SU83: A Yadkin Phase Site in the Upper Coastal Plain of South Carolina*. Garrow & Associates, Inc., Atlanta. Submitted to South Carolina Department of Transportation, Columbia.

Cherau, Suzanne and Jennifer Bonner Bannister
2006 *Archaeological Investigations Chadwick Lead Mill Site, Salem and Marblehead, Massachusetts*. Public Archaeology Laboratory, Pawtucket, Rhode Island.

Finkelstein, Charles
1976 *Sonar Survey of the Congaree River, Columbia, South Carolina*. Conservation Research Laboratory Center for Maritime Archaeology and Conservation. Texas A&M University. College Station, Texas.

Garrow, Patrick H.
1982 *Archaeological Investigations of the Washington, D.C. Civic Center Site*. Soil Systems, Inc., Marietta, Georgia. Submitted to the Department of Housing and Community Development, Government of the District of Columbia, Washington, D.C.

Hamilton, Donny
1999 *Methods of Conserving Archaeological Material from Underwater Sites*. Report to Bruce Hoverman, Columbia, South Carolina, from Massachusetts Institute of Technology, Cambridge, MA.

Jones, Olive and Catherine Sullivan
1985 *The Parks Canada Glass Glossary.* National Parks and Sites, Ottawa.

Legg, James B. and Steven D. Smith
1989 *The Best Ever Occupied…Archaeological Investigations of a Civil War Encampment on Folly Island, South Carolina*. Research Manuscript Series 209. South Carolina Institute of Archaeology and Anthropology, Columbia, SC.

Miller, George L.
2000 Telling Time for Archaeologists. *Northeast Historical Archaeology* 29:1–22.

Noel Hume, Ivor
1970 *A Guide to Colonial Artifacts of America*. Alfred A. Knopf, New York.

Sherman, William Tecumseh
2006 *Memoirs of General W. T. Sherman*. Reprint of the 1889 revised and corrected second edition. Echo Library, Teddington, Middlesex, England.

South, Stanley
1977 *Method and Theory in Historical Archaeology*. Academic Press, New York.

Smith, Steven D.
1994 Archeological Perspectives on the Civil War: The Challenge to Achieve Relevance. In Geier, Clarence R. and Susan E. Winter, editors. *Look to the Earth: Historical Archaeology and the American Civil War*. Knoxville, Tennessee: The University of Tennessee Press. pp. 3-20.

The Spartanburg Herald
1938 YOUNGSTERS TRY TO MELT LEAD FROM OLD WAR SHELLS: EXPLOSION ALMOST REOPENS CONFEDERATE CONFLICT. *The Spartanburg Herald* 5 January:1.
Spartanburg, SC.

The State
1930 Confederate Ammunition, Dug From River, To Go on Display in Columbia This Week. *The State* 3 June 1930:1. Columbia, SC.

Stratton, Susan K., Barry A. Price, and M. Colleen Hamilton
2004 Hazardous Site Archaeology: A Case Study of a Manufactures Gas Plant. *Proceeding of the Society for California Archaeology*, Volume 14 (pp 21-24)

Tidewater Atlantic Research, Inc
2010 *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011a *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase II Addition.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2011b *A Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge, Phase III Report.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

2012 *A Terrestrial Remote-Sensing Survey of the Congaree River Below the Gervais Street Bridge.* Submitted to Management and Technical Resources, Inc. Tidewater Atlantic Research. Wilmington, NC.

Warren, Keith, Wendy Nettles, and Colleen Hamilton
2002 *Test Excavations and Evaluation of Historic Archaeological Resources at the Santa Barbara I Manufactured Gas Plant*. Applied Earthworks, Inc., Hemet, California.

Williams, J.F.
1929 *Old and New Columbia.* Epworth Orphanage Press, Columbia, SC.

ATTACHMENT A – SUMMARY OF UNDERWATER ANOMALIES

DRAFT

Congaree River Anomaly Summary
Congaree River Project
Columbia, SC

Site Location

The report summarizes the results of the magnetometer surveying activities conducted in support of the South Carolina Electric and Gas (SCE&G) Company Congaree River Project located in Columbia, SC. The Congaree River begins at the confluence of the Saluda River and the Broad River in Columbia, SC. The portion of the Congaree relevant to this project is the approximate eastern third of the river beginning directly south of the Gervais Street Bridge and extending for approximately 3,700 feet downstream to approximately 500 feet below the Blossom Street Bridge. Figure 1 provides the location of the area in question.

Background Information

In June 2010, the South Carolina Department of Health and Environmental Control (SCDHEC) noted tar-like material (TLM) near the eastern shoreline of the Congaree River directly downstream of the Gervais Street Bridge. SCDHEC collected samples of this material and the analytical results indicated that the source of the TLM might be attributable to the former manufactured gas plants (MGP) that operated in Columbia starting in the mid-1800s and ending in the late 1940's to early 1950's. Predecessor companies of SCE&G operated the Huger Street manufactured gas plant (Huger Street MGP). Its location is provided on Figure 1. SCE&G has recently completed a removal action at the Huger Street site where over 125,000 tons of MGP impacted soil and debris was excavated and removed with oversight provided by SCDHEC.

SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012. SCDHEC approved the PDR on April 23, 2012. The PDR presented the results of delineation activities completed to determine the extent of the TLM within the river. The delineation work was completed in five separate phases over approximately 18 months. The magnetometer surveying operations described in this summary report were a component of the investigative activities and were necessary due to the potential presence of Civil War era explosive ordnance within the project area. Details pertaining to the ordnance are provided below.

Potential Presence of Historical Items and Unexploded Ordnance (UXO)

It has been confirmed that in 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman's occupation and subsequent destruction of Columbia. A list of munitions and other Confederate items captured by the Union forces is provided in Attachment A. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Figure 2 shows this location and a daily activity log documenting some of the archeological work is provided in the initial Tidewater Atlantic Research Inc. report (Attachment B). Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Acoustic (side scan sonar) and magnetic (magnetometer) remote sensing surveying activities were completed in order to determine if potential munitions were present prior to conducting the sediment sampling activities. A description of these activities and their subsequent results are provided below.

Surveying Activities

Magnetometer surveying of the project area was conducted over four separate phases. The first phase was focused on the area directly downstream of the Gervais Street Bridge (grid lines 1 through 16 on Figure 2) and included some limited shoreline surveying near the Senate Street Extension Alluvial Fan (Figure 2). A sidescan sonar survey was also performed during Phase I. The purpose of the side scan sonar was to complement the magnetometer survey by potentially visually identifying objects (e.g., ordnance) that may be lying on the Congaree River bottom. The sidescan sonar survey results were inconclusive and it was not utilized in the subsequent phases.

Magnetometer surveying progressed downstream in conjunction with the continuing investigation activities with Phase II extending the survey area from grid line 16 to grid line 20. Survey of the unnamed tributary that is located south of the Gervais Street Bridge was also conducted during Phase II. Phase III encompassed the portions of the project area between grid lines 20 and 37 and Phase IV completed the shoreline surveying in the vicinity of the Senate Street Extension Alluvial Fan that was not conducted during the other phases due to access constraints.

The specific details pertaining to the surveying equipment and methodology are provided in the phase specific reports produced by Tidewater Atlantic Research Inc. provided in Attachment B. In general, depending on the area to be surveyed and the presence of rock outcrops and water level conditions, either a small boat with an outboard motor or an inflatable boat was utilized to carry the surveying equipment. The inflatable boat was pushed through areas where water levels and the presence of rocks precluded the use of the motorboat. Terrestrial surveying was done on foot with handheld and backpack mounted equipment.

The magnetometer surveys were generally run on north-south trending lines and were controlled via a differential global positioning system (DGPS) using a Trimble AgCPS 132 navigation system. HYPACK navigation software was used to translate the DGPS data into real-time data that was used to direct the survey along a predetermined grid or transects. In general, the magnetometer transects lines were located approximately 20 feet apart. In some areas of the river where obstructions were encountered and navigation had to be altered, the distance between the transect lines varied and could be decreased to less than 10 feet.

The magnetometer survey was performed with an EG&G Geometrics G-858 cesium magnetometer that is capable of +/- 0.001 gamma resolution. The magnetic data was collected at a frequency of six samples per second. The locations of the magnetic readings were determined from the DGPS.

The side scan sonar survey was performed from approximately the 4 to 16 Lines and boulders and shallow water prevented performing the survey above the 4 Line. A 445/900 kHz Klein System 3900 digital side scan sonar was employed. The side scan sonar data was horizontally tied to the DGPS and reconciled with the HYPACK survey software. Where navigation was possible, a total of five side scan sonar survey passes were made on a 50-foot transect spacing.

The magnetometer detects changes in earth's magnetic field that may be attributed to buried anthropogenic influences (e.g., UXOs, electrical cables, etc.) or naturally occurring geologic features (e.g., remnant thermal magnetism, ore bodies, etc.). Once the magnetometer data was collected it was systematically analyzed to identify potential targets. A variety of characteristics of the targets including configuration, areal extent, intensity and contrast with background were analyzed and compared to signature characteristics previously found to be reliable indicators of historic ordnance. The results are discussed below.

Results

Following each phase of fieldwork the accumulated data was analyzed and the potential UXO locations were identified. Table 1 provides the results of the magnetometer surveying activities by investigation phase and Figure 3 provides the anomaly locations for the project area. Each phase is also described in more detail in the phase specific reports provided in Attachment B. Table 2 provides a summary of the anomaly locations and interpretation and Table 3 provides a summary of the anomalies located within the planned project area and located in the planned cofferdam footprint.

As the historical and anecdotal evidence suggested, the majority of anomalies were located in the Phase I survey area nearest the Gervais Street Bridge and the boat apron. A total of 323 anomalies were detected in the Phase I area with 218 of those locations exhibiting signature characteristics that could be associated with ordnance. Some of the non-ordnance anomalies included discarded debris and appliances, an electrical cable crossing and a geologic feature.

Phase II produced 10 potential UXOs in grid lines 16 through 20 and an additional 8 in the unnamed tributary. For Phase III the number of anomalies continued to be relatively low from grid line 20 to 31 but increased directly downstream of the Blossom Street Bridge. This increase can be potentially attributable to more recent objects being thrown from the bridge and not necessarily historical UXO. The total number of targets for Phase III was 145 with 121 exhibiting signature characteristics that could be associated with ordnance.

Finally, Phase IV was conducted to obtain information in the area directly downstream of the boat apron, which was not completed during Phase I due to access constraints. A total of 84 anomalies were detected with 67 exhibiting signature characteristics that could be associated with ordnance. The total for all four phases of magnetometer surveying is 570 anomalies located within the investigated area with 425 or 75 percent of those potentially being ordnance.

Due to the nature of the potential historical objects and UXO deposited within the study area and their real or perceived value and/or potential hazard to public safety, the information contained in this summary report must remain confidential. This information was compiled by SCANA for use during completion of the investigative and subsequent remedial activities associated with the Congaree River Project. Any use or dissemination of the information for other purposes is not permitted and may be subject to legal action.

TABLE 1

MAGNETOMETER STUDY RESULTS SUMMARY

Congaree River Sediments
Columbia, South Carolina

Study	Dates	Study Area	Total Magnetic Anomalies	Potential Ordnance (UXO)	Other Anomalies
Phase I	Aug. 25-26, 2010	Congaree River - Grid Lines: 1 thru 16	323	**218**	105
Phase II	Jan. 4-5, 2011	Congaree River - Grid Lines: 16 thru 20	10	**10**	0
		Unnamed Tributary #1 - Outfall to River	8	**8**	0
Phase III	June 30, 2011	Congaree River - Grid Lines: 20 thru 37	145	**122**	23
Phase IV	January 31 - February 2, 2012	Senate Street Extension / Alluvial Fan Area	84	**67**	17
		Total Anomalies	570	**425**	145
		Percentage with UXO Potential		**75%**	

Notes:
1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "have signature characteristics that could be associated with ordnance" and "those anomalies should be considered potentially hazardous until material generating the signatures can be identified".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
1	078-1-nm262g175f	Geological Feature
2	078-2-dp280g49f	Pipeline
3	078-3-mc48g59f	Possible Ordnance
4	078-5-mc1854g71f	Possible Ordnance
5	077-1-nm758g34f	Possible Ordnance
6	077-2-mc40g45f	Possible Ordnance
7	077-3-mc52g76f	Possible Ordnance
8	077-4-pm203g68f	Pipeline
9	077-5-pm320g176f	Geological Feature
10	077-6-30g18f	Possible Ordnance
11	077-7-dp57g58f	Possible Ordnance
12	077-8-dp63g83f	Geological Feature
13	077-9-mc149g71f	Possible Ordnance
14	076-1-pm130g44f	Possible Ordnance
15	076-2-pm137g288f	Possible Ordnance
16	076-3-nm31g37f	Possible Ordnance
17	076-4-nm34g49f	Possible Ordnance
18	076-5-pm307g190f	Geological Feature
19	076-6-pm510g66f	Pipeline
20	076-7-mc76g69f	Possible Ordnance
21	076-8-mc627g66f	Possible Ordnance
22	075-1-dp116g50f	Possible Ordnance
23	075-2nm18g40f	Possible Ordnance
24	075-3-dp52g65f	Possible Ordnance
25	075-4-dp70g65f	Possible Ordnance
26	075-5-pm301g60f	Pipeline
27	075-5-pm289g178f	Geological Feature
28	075-7-dp36g30f	Possible Ordnance
29	075-8-nm59g80f	Possible Ordnance
30	075-9-pm48g35f	Geological Feature
31	075-10-pm125g70f	Possible Ordnance
32	074-1-dp207g40f	Possible Ordnance
33	074-2-dp121g40f	Geological Feature
34	074-3-pm32g20f	Possible Ordnance
35	074-4-pm288g215f	Geological Feature
36	074-5-nm861g50f	Pipeline
37	074-6-pm27g20f	Possible Ordnance
38	074-7-dp42g40f	Possible Ordnance
39	074-8-dp71g65f	Possible Ordnance
40	074-9-nm58g90f	Possible Ordnance
41	073-1-nm36g22f	Possible Ordnance
42	073-2-nm21g30f	Possible Ordnance
43	073-3-dp21g40f	Possible Ordnance
44	073-4-dp149g65f	Possible Ordnance
45	073-5-dp527g60f	Pipeline
46	073-6-pm302g199f	Geological Feature
47	073-7-pm41g18f	Possible Ordnance
48	073-8-nm60g70f	Possible Ordnance
49	073-9-dp64g31f	Geological Feature
50	073-10-dp42g17f	Possible Ordnance
51	072-1-pm46g11f	Possible Ordnance
52	072-2-pm88g23f	Geological Feature
53	072-3-pm310g167f	Geological Feature
54	072-4-pm2310g36f	Pipeline

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
55	072-5-dp62g49'	Possible Ordnance
56	071-1-nm28g10f	Possible Ordnance
57	071-2-pm46g62f	Possible Ordnance
58	071-3-pm170g55f	Possible Ordnance
59	071-4-dp494g96f	Pipeline
60	071-5-pm324g202f	Geological Feature
61	071-6-pm117g97f	Geological Feature
62	071-7-pm70g33f	Possible Ordnance
63	070-1-pm66g25f	Possible Ordnance
64	070-2-pm251g132f	Geological Feature
65	070-3-dp235g21f	Possible Ordnance
66	070-4-nm549g33f	Pipeline
67	070-5-pm159g46f	Possible Ordnance
68	070-6-nm36g18f	Possible Ordnance
69	070-7-dp48g55f	Possible Ordnance
70	070-8-nm44g15f	Possible Ordnance
71	069-1-dp23g10f	Possible Ordnance
72	069-2-dp78g44f	Possible Ordnance
73	069-3-nm1841g50f	Pipeline
74	069-4-dp252g53f	Possible Ordnance
75	069-5-pm214g155f	Geological Feature
76	069-6-pm63g17f	Geological Feature
77	068-1-pm72g94f	Geological Feature
78	068-2-dp238g167f	Possible Ordnance
79	068-3-nm402g55f	Pipeline
80	068-4-dp38g40f	Possible Ordnance
81	067-1-dp32g38f	Possible Ordnance
82	067-2-mc181g93f	Pipeline
83	067-3-pm221g300f	Geological Feature
84	067-5-mc68g90f	Geological Feature
85	067-6-dp22g30f	Possible Ordnance
86	066-1-dp61g40f	Geological Feature
87	066-2-pm182g193f	Geological Feature
88	066-3-nm190g95f	Pipeline
89	066-4-dp127g77f	Possible Ordnance
90	066-5-dp48g18f	Possible Ordnance
91	066-6-nm43g42f	Possible Ordnance
92	066-7-pm27g10f	Possible Ordnance
93	066-8-dp9g10f	Possible Ordnance
94	065-1-dp143g31f	Possible Ordnance
95	065-2-nm19g10f	Possible Ordnance
96	065-3-pm11g7f	Possible Ordnance
97	065-4-dp32g60f	Possible Ordnance
98	065-5-dp127g20f	Possible Ordnance
99	065-6-nm363g52f	Pipeline
100	065-7-pm176g186f	Geological Feature
101	065-8-pm24g38f	Possible Ordnance
102	065-9-pm44g37f	Possible Ordnance
103	065-10-mc69g110f	Geological Feature
104	064-1-pm108g121f	Geological Feature
105	064-2-mc67g61f	Possible Ordnance
106	064-3-pm27g21f	Possible Ordnance
107	064-4-pm193g210f	Geological Feature
108	064-5-nm363g63f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

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Designation	Characteristics	Potential Interpretation
109	064-6-pm63g16f	Possible Ordnance
110	064-7-dp415g60f	Possible Ordnance
111	063-1-dp395g68f	Possible Ordnance
112	063-2-pm67g14f	Possible Ordnance
113	063-3-nm188g73f	Possible Ordnance
114	063-4-nm334g26f	Pipeline
115	063-5-pm224g187f	Geological Feature
116	063-6-pm111g143f	Geological Feature
117	062-1-pm99g136f	Geological Feature
118	062-2-pm203g163f	Geological Feature
119	062-3-nm257g48f	Pipeline
120	062-4-dp373g110f	Possible Ordnance
121	062-5-mc68g107f	Possible Ordnance
122	062-6-pm59g55f	Possible Ordnance
123	061-1-pm127g57f	Possible Ordnance
124	061-2-pm182g43f	Possible Ordnance
125	061-3-pm113g52f	Possible Ordnance
126	061-4-nm198g67f	Pipeline
127	061-5-pm225g210f	Geological Feature
128	061-6-pm112g147f	Geological Feature
129	060-1-pm109g18f	Geological Feature
130	060-2-pm66g46f	Possible Ordnance
131	060-3-pm246g205f	Geological Feature
132	060-4-nm107g38f	Pipeline
133	060-5-dp288g93f	Possible Ordnance
134	059-1-nm124g99f	Possible Ordnance
135	059-2-dp73g64f	Possible Ordnance
136	059-3-pm240g200f	Geological Feature
137	059-4-dp76g55f	Possible Ordnance
138	059-5-dp140g102f	Possible Ordnance
139	059-6-dp241g37f	Geological Feature
140	058-1-dp114g101f	Geological Feature
141	058-2-nm65g51f	Possible Ordnance
142	058-3-pm87g33f	Possible Ordnance
143	058-4-mc248g200f	Geological Feature
144	058-5-nm44g15f	Possible Ordnance
145	058-6-dp137g91f	Possible Ordnance
146	057-1-pm144g94f	Pipeline
147	057-2-pm67g62f	Possible Ordnance
148	057-3-dp54g14f	Possible Ordnance
149	o57-4-mc231g180f	Geological Feature
150	057-5-pm55g57f	Possible Ordnance
151	057-6-nm30g36f	Possible Ordnance
152	057-7-dp138g78f	Possible Ordnance
153	057-8-dp135g41f	Geological Feature
154	056-1-pm144g157f	Geological Feature
155	056-2-nm36g22f	Possible Ordnance
156	056-3-pm129g33f	Possible Ordnance
157	056-4-dp34g15f	Possible Ordnance
158	056-5-dp83g70f	Possible Ordnance
159	056-6-mc210g153f	Geological Feature
160	056-7-dp53g21f	Possible Ordnance
161	056-8-dp103g46f	Possible Ordnance
162	056-9-mc178g110f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
163	055-1-pm277g110f	Pipeline
164	055-2-nm75g32f	Possible Ordnance
165	055-3-dp54g15f	Possible Ordnance
166	055-4-pm127g62f	Possible Ordnance
167	055-5-pm195g58f	Geological Feature
168	055-6-dp221g64f	Possible Ordnance
169	055-7-dp28g10f	Possible Ordnance
170	055-8-pm146g36f	Possible Ordnance
171	055-9-dp18g20f	Possible Ordnance
172	055-10-pm136g123f	Geological Feature
173	054-1-dp65g44f	Possible Ordnance
174	054-2-dp66g30f	Possible Ordnance
175	054-3-dp62g38f	Possible Ordnance
176	054-4-pm196g90f	Geological Feature
177	054-5-dp100g48f	Possible Ordnance
178	054-6-dp106g20f	Possible Ordnance
179	054-7-dp47g15f	Possible Ordnance
180	054-8-pm479g50f	Pipeline
181	053-1-nm71g18f	Possible Ordnance
182	053-2-nm21g26f	Possible Ordnance
183	053-3-mn90g46f	Possible Ordnance
184	053-4-dp26g17f	Possible Ordnance
185	053-5-nm32g15f	Possible Ordnance
186	053-6-pm71g56f	Possible Ordnance
187	053-7-pm199g57f	Geological Feature
188	053-8-nm111g38f	Iron Pipe
189	053-9-nm51g20f	Possible Ordnance
190	0543-10-dp43g40f	Possible Ordnance
191	053-11-nm70g66f	Possible Ordnance
192	053-12-pm115g105f	Geological Feature
193	052-1-pm129g142f	Geological Feature
194	052-2-dp99g63f	Possible Ordnance
195	052-3-mc292g160f	Iron Pipe
196	052-4-dp60g42f	Possible Ordnance
197	052-5-pm63g30f	Possible Ordnance
198	052-6-dp47g12f	Possible Ordnance
199	052-7-dp251g53f	Possible Ordnance
200	051-1-mc601g117f	Iron Pipe
201	051-2-nm97g26f	Possible Ordnance
202	050-1-nm94g33f	Possible Ordnance
203	050-2-dp102g45f	Possible Ordnance
204	050-3-pm50g17f	Possible Ordnance
205	050-4-pm818g20fEOL	Possible Ordnance
206	049-1-pm112g64f	Possible Ordnance
207	049-2-pm111g78f	Possible Ordnance
208	049-3-dp74g66f	Possible Ordnance
209	049-4-dp75g70f	Possible Ordnance
210	048-1-nm74g38f	Possible Ordnance
211	048-2-dp13g14f	Possible Ordnance
212	049-3-nm104g28f	Possible Ordnance
213	048-4-pm127g53f	Possible Ordnance
214	048-5-pm22g28f	Possible Ordnance
215	047-1-nm119g46fEOL	Possible Ordnance
216	047-2-dp13g15f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

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Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
217	047-3-nm89g33f	Possible Ordnance
218	046-1-nm223g37f	Possible Ordnance
219	078-1-pm1949g7f	Possible Ordnance
220	068-1-dp311g7f	Possible Ordnance
221	045-1-mc6548g8f	Electromagnetic Anomaly
222	062L-1-pm150g5f	Possible Ordnance
223	062L-2-nm109g11f	Possible Ordnance
224	061L-1-nm135g4f	Possible Ordnance
225	061L-2-pm95g6f	Possible Ordnance
226	061L-3-dp105g20f	Possible Ordnance
227	060L-1-pm113g3f	Possible Ordnance
228	060L-2dp93g27f	Possible Ordnance
229	059L-1-nm150g25f	Possible Ordnance
230	058L-1-pm302g11f	Possible Ordnance
231	058L-2-pm79g16f	Possible Ordnance
232	057L-1-dp257g7f	Possible Ordnance
233	056L-dp150g11f	Possible Ordnance
234	056L-2-pm43g10f	Possible Ordnance
235	055L-1-dp201g11f	Possible Ordnance
236	054L-1-nm166g9f	Possible Ordnance
237	001SL-1-pm4902g20	Boiler
238	001SL-2-pm4554g4f	Possible Ordnance
239	001SL-3-mc8907g11f	Electromagnetic Anomaly
240	002SL-1-dp8978g9f	Possible Ordnance
241	002SL-2-dp3987g7f	Possible Ordnance
242	002SL-3-mc7345g7f	Possible Ordnance
243	003SL-1-pm269g10f	Possible Ordnance
244	003Sl-2-pm515g7f	Possible Ordnance
245	003SL-3-nm80g5f	Possible Ordnance
246	003SL-4-dp168g19f	Boiler
247	003SL-5-pm129g6f	Washing Machine
248	060L-1-nm105g20f	Possible Ordnance
249	059L-1-nm279g5f	Possible Ordnance
250	059L-2-pm423g34f	Possible Ordnance
251	058L-1-dp209g6f	Possible Ordnance
252	058L-2-pm35g11f	Possible Ordnance
253	057L-1-nm17g11f	Possible Ordnance
254	057L-2-pm98g8f	Possible Ordnance
255	057L-3-pm37g9f	Possible Ordnance
256	057L-4-pm38g11f	Possible Ordnance
257	057L-5-dp75g10f	Sign
258	056L-1-mc8186g11f	Possible Ordnance
259	055L-1-mc5360g20f	Possible Ordnance
260	055L-2-nm357g19f	Possible Ordnance
261	054L-1-261g11f	Possible Ordnance
262	054L-2-pm3122g8f	Possible Ordnance
263	053L-1-nm110g9f	Possible Ordnance
264	053L2-dp109g16f	Possible Ordnance
265	052L-1-dp286g3f	Manhole
266	052L-2-pm327g9f	Possible Ordnance
267	052L-3-nm248g21f	Possible Ordnance
268	052L-4-dp259g26f	Possible Ordnance
269	051L-1-nm109g13f	Possible Ordnance
270	067-1-dp48g33f	Possible Ordnance

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Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
271	067-2-dp142g44f	Possible Ordnance
272	0701-dp480g13f	Possible Ordnance
273	070-2-pm49g11f	Possible Ordnance
274	072-1-pm89g13f	Possible Ordnance
275	073-1-nm80g5f	Possible Ordnance
276	073-2-nm356g23f	Possible Ordnance
277	075-1-nm364g11f	Possible Ordnance
278	075-2-dp1039g39f	Possible Ordnance
279	077-1-dp123g14f	Possible Ordnance
280	077-2-dp776g30f	Possible Ordnance
281	078R-3mc8302g20f	Electromagnetic Anomaly
282	068-1-dp320g7f	Possible Ordnance
283	068R-2-mc9213g15f	Electromagnetic Anomaly
284	066R-1-mc8334g15f	Electromagnetic Anomaly
285	065R-1-mc8486g18f	Electromagnetic Anomaly
286	064R-1-mc9633g18f	Electromagnetic Anomaly
287	063R-1-mc9404g19f	Electromagnetic Anomaly
288	062R-2-mc9746g18f	Electromagnetic Anomaly
289	061R-1-mc7773g16f	Electromagnetic Anomaly
290	060R-1-mc8127g8f	Electromagnetic Anomaly
291	059R-1-mc5961g11f	Electromagnetic Anomaly
292	058R-1-mc6758g17f	Electromagnetic Anomaly
293	057R-1-mc7119g24f	Electromagnetic Anomaly
294	056R-1-mc7891g16f	Electromagnetic Anomaly
295	055R-1-mc6461g17f	Electromagnetic Anomaly
296	054R-1-mc9645g16f	Electromagnetic Anomaly
297	053R-1-mc6680g13f	Electromagnetic Anomaly
298	052R-1-mc9795g10f	Electromagnetic Anomaly
299	051R-1-mc6531g15f	Electromagnetic Anomaly
300	050R-1-mc6531g14f	Electromagnetic Anomaly
301	049R-1-mc9574g7f	Electromagnetic Anomaly
302	048R-1-mc6550g12f	Electromagnetic Anomaly
303	047BR-1-mc6477g7f	Electromagnetic Anomaly
304	045R-1mc6548g8f	Electromagnetic Anomaly
305	003-4-dp103g12f	Possible Ordnance
306	004-1-pm93g10f	Possible Ordnance
307	003-3-pm58g16f	Possible Ordnance
308	002-1-dp38g9f	Possible Ordnance
309	003-2-pm96g11f	Possible Ordnance
310	004-3-pm95g12f	Possible Ordnance
311	001-1-pm54g6f	Possible Ordnance
312	006-2-nm207g12f	Possible Ordnance
313	004-2-pm81g9f	Possible Ordnance
314	003-1-pm19g4f	Possible Ordnance
315	004-4-pm78g8f	Possible Ordnance
316	006-1-dp191g16f	Possible Ordnance
317	002-2-dp53g11f	Possible Ordnance
318	004-5-pm85g11f	Possible Ordnance
319	004-6-pm71g10f	Possible Ordnance
320	004-7-pm82g12f	Possible Ordnance
321	004-8-dp156g19f	Possible Ordnance
322	002-3-nm32g8f	Possible Ordnance
323	053L-4-dp437g70f	Iron Pipe
324	022-1-pm100g25f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

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Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
325	021-2-nm400g25f	Possible Ordnance
326	021-2-pm70g20f	Possible Ordnance
327	012-1-pm270g23f	Possible Ordnance
328	011-1-dp225g75f	Possible Ordnance
329	010-1-nm50g15f	Possible Ordnance
330	020-1-dp22g15f	Possible Ordnance
331	016-1-pm38g37f	Possible Ordnance
332	020-2-dp23g13f	Possible Ordnance
333	020-3-dp18g16f	Possible Ordnance
334	A	Possible Ordnance
335	B	Possible Ordnance
336	C	Possible Ordnance
337	D	Possible Ordnance
338	E	Possible Ordnance
339	F	Possible Ordnance
340	G	Possible Ordnance
341	H	Possible Ordnance
342	1-1-mc806g44f	Possible Ordnance
343	1-2-pm100g9f	Possible Ordnance
344	1-3-dp533g47f	Possible Ordnance
345	1-4-dp233g24f	Possible Ordnance
346	1-5-pm73g13f	Possible Ordnance
347	1-6-dp210g33f	Possible Ordnance
348	22-1-dp544g65f	Pipeline
349	21-1-pm323g42f	Possible Ordnance
350	21-2-dp1330g64f	Pipeline
351	20-1-dp94g25f	Possible Ordnance
352	20-2-dp2601g102f	Pipeline
353	19-1-pm79g8f	Possible Ordnance
354	19-2-pm113g18f	Possible Ordnance
355	19-3-dp154g31f	Possible Ordnance
356	19-3-dp1419g86f	Pipeline
357	18-1-dp333g16f	Possible Ordnance
358	18-2-dp40g17f	Possible Ordnance
359	18-3-dp105g24f	Possible Ordnance
360	18-4-dp196g34f	Possible Ordnance
361	18-5-pm13g8f	Possible Ordnance
362	18-6-dp2092g60f	Pipeline
363	18-6-dp83g22f	Possible Ordnance
364	18-7-dp?1687+g18+f	Pipeline
365	17-1-dp1497g47f	Pipeline
366	17-2-dp47g44f	Possible Ordnance
367	17-3-pm29g16f	Possible Ordnance
368	17-4-mc53g35f	Possible Ordnance
369	16-1-nm61g10f	Possible Ordnance
370	16-2-dp136g17f	Possible Ordnance
371	16-3-pm50g27f	Possible Ordnance
372	16-5-dp10g6f	Possible Ordnance
373	16-6-pm47g26f	Possible Ordnance
374	15-1-dp59g30f	Possible Ordnance
375	15-2-pm43g16f	Possible Ordnance
376	15-3-dp304g29f	Possible Ordnance
377	14-1-dp136g21f	Possible Ordnance
378	14-2-dp185g32f	Possible Ordnance

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Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
379	14-4-pm95g31f	Possible Ordnance
380	10-1-nm29g25f	Possible Ordnance
381	10-2-dp31g260f	Possible Ordnance
382	10-2-nm57g13f	Possible Ordnance
383	13-1-dp66g23f	Possible Ordnance
384	13-2-pm40g21f	Possible Ordnance
385	13-3-pm27g17f	Possible Ordnance
386	13-4-dp46g10f	Possible Ordnance
387	12-1-dp40g30f	Possible Ordnance
388	12-2-pm46g33f	Possible Ordnance
389	11-1-pm22g39f	Possible Ordnance
390	11-2-pm39g31f	Possible Ordnance
391	10-1-dp95g21f	Possible Ordnance
392	9-1-dp78g23f	Possible Ordnance
393	8-1-dp247g13f	Possible Ordnance
394	7-1-dp180g23f	Possible Ordnance
395	7-2-dp145g20f	Possible Ordnance
396	6-1-dp138g15f	Possible Ordnance
397	6-2-dp235g26f	Possible Ordnance
398	5-1-pm103g31f	Possible Ordnance
399	5-2-dp53g57f	Possible Ordnance
400	4-1-pm103g15f	Possible Ordnance
401	4-2-dp49g12f	Possible Ordnance
402	2-1-pm110g13f	Possible Ordnance
403	15-1-mc16g4f	Possible Ordnance
404	14-1-dp68g16f	Possible Ordnance
405	13-1-dp53g7f	Possible Ordnance
406	13-2-dp188g28f	Possible Ordnance
407	12-1-pm11g29f	Possible Ordnance
408	11-1-dp528g20f	Possible Ordnance
409	9-1-dp342g22f	Possible Ordnance
410	8-1-dp135g24f	Possible Ordnance
411	8-2-dp72g23f	Possible Ordnance
412	8-1-dp34g16f	Possible Ordnance
413	6-1-pm32g5f	Possible Ordnance
414	5-1-dp47g21f	Possible Ordnance
415	4-1-dp218g25f	Possible Ordnance
416	4-2-dp80g21f	Possible Ordnance
417	3-1-dp146g27f	Possible Ordnance
418	3-2-pm123g17f	Possible Ordnance
419	3-3-dp85g22f	Possible Ordnance
420	1-1-dp112g18f	Possible Ordnance
421	22-1-dp122g37f	Possible Ordnance
422	22-3-nm28g10f	Possible Ordnance
423	22-2-pm17g10f	Possible Ordnance
424	1-1-pm73g12f	Possible Ordnance
425	1-2-pm215g23f	Possible Ordnance
426	2-1-dp185g16f	Possible Ordnance
427	2-2-mc287g46f	Possible Ordnance
428	2-3-dp107g24f	Possible Ordnance
429	1-1-dp55g16f	Possible Ordnance
430	1-2-dp223g45f	Possible Ordnance
431	1-3-dp700g35f	Possible Ordnance
432	1-4-dp97g25f	Possible Ordnance

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Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
433	5-1-dp89g22f	Possible Ordnance
434	13-1-dp44g15f	Possible Ordnance
435	13-2-dp37g24f	Possible Ordnance
436	14-1-dp28g14f	Possible Ordnance
437	11-1-dp52g44f	Possible Ordnance
438	11-2-dp72g43f	Possible Ordnance
439	10-1-pm41g18f	Possible Ordnance
440	10-2-pm20g11f	Possible Ordnance
441	10-3-dp72g35f	Possible Ordnance
442	10-4-pm74g23f	Possible Ordnance
443	9-1-dp281g31f	Possible Ordnance
444	7-1-dp208g20f	Possible Ordnance
445	7-2-dp125g23f	Possible Ordnance
446	7-3-pm115g10f	Possible Ordnance
447	6-1-dp152g34f	Possible Ordnance
448	6-2-mc175g49f	Possible Ordnance
449	5-1-pm60g11f	Possible Ordnance
450	5-2-pm32g6f	Possible Ordnance
451	5-3-pm63g12f	Possible Ordnance
452	5-4-pm50g7f	Possible Ordnance
453	5-5-dp65g4f	Possible Ordnance
454	5-6-mc6558g70f	Possible Ordnance
455	4-1-dp164g41f	Possible Ordnance
456	4-2-pm177g20f	Possible Ordnance
457	4-3-nm220g17f	Possible Ordnance
458	11-1-dp208g48f	Possible Ordnance
459	11-2-dp28g17f	Possible Ordnance
460	14-1-pm293g50f	Possible Ordnance
461	14-1-pm153g18f	Possible Ordnance
462	15-1-pm136g14f	Possible Ordnance
463	001-1-mc30093g25f	Possible Ordnance
464	022-1-mc31539g13f	Possible Ordnance
465	021-1-mc28767g12f	Possible Ordnance
466	020-1-mc31683g35f	Possible Ordnance
467	018-1-mc31942g23f	Possible Ordnance
468	018-1-mc31657g24f	Possible Ordnance
469	017-1-mc26003g23f	Possible Ordnance
470	017-1-dp67g14f	Possible Ordnance
471	014-1-mc26324g17f	Electromagnetic Anomaly
472	013-1-mc31252g8f	Electromagnetic Anomaly
473	013-2-mc16747g7f	Electromagnetic Anomaly
474	012-1-mc27653g21f	Electromagnetic Anomaly
475	011-1-mc34257g22f	Electromagnetic Anomaly
476	010-1-mc26761g24f	Electromagnetic Anomaly
477	009-1-mc29279g28f	Electromagnetic Anomaly
478	008-1-mc30182g22f	Electromagnetic Anomaly
479	07-1-mc21762g7f	Electromagnetic Anomaly
480	006-1-mc27687g21f	Electromagnetic Anomaly
481	005-1-mc30284g22f	Electromagnetic Anomaly
482	004-1-mc26874g21f	Electromagnetic Anomaly
483	003-1-mc28428g18f	Electromagnetic Anomaly
484	002-1-mc30321g12f	Electromagnetic Anomaly
485	007-1-pm6g10f	Tire
486	010-1-pm38g15f	Lamp

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
487	01-1-nm77g7f	Possible Ordnance
488	01-2-mc187g13f	Pipeline Associated
489	02-1-dp662gEOL	Pipeline Associated
490	03-1-mc795g52f	Pipeline Associated
491	03-2-nm47g6f	Pipeline Associated
492	03-3-nm321g45f	Possible Ordnance
493	03-4-pm190g2f	Possible Ordnance
494	03-5-dp2178gEOL	Possible Ordnance
495	03-6-dp156g18f	Possible Ordnance
496	04-1-dp2770g35f	Pipeline Associated
497	04-2-dp44891g35f	Electromagnetic Anomaly
498	04-3-mc44891g7f	Electromagnetic Anomaly
499	05-1-pm2582g30f	Possible Ordnance
500	05-2-pm705g21f	Pipeline Associated
501	05-3-pm139g13f	Possible Ordnance
502	05-4-nm169g17f	Possible Ordnance
503	06-1-pm1537g21f	Possible Ordnance
504	06-2-dp216g15f	Possible Ordnance
505	06-3-dp2658g33f	Pipeline Associated
506	06-4-pm96g13f	Possible Ordnance
507	06-5-pm90g10f	Possible Ordnance
508	06-6-dp109g12f	Possible Ordnance
509	06-7-pm36g4f	Possible Ordnance
510	07-1-dp1681g38f	Possible Ordnance
511	07-2-pm70g6f	Possible Ordnance
512	07-3-mc3436g43f	Pipeline Associated
513	07-4-dp608g39f	Possible Ordnance
514	08-1-nm61g14f	Possible Ordnance
515	08-2-mc138g24f	Possible Ordnance
516	08-3-dp2380g51f	Pipeline Associated
517	08-4-pm1479g40f	Possible Ordnance
518	08-5-nm20g2f	Possible Ordnance
519	08-6-mc244gEOL	Possible Ordnance
520	09-1-nm157g9f	Possible Ordnance
521	09-2-pm2592g48f	Possible Ordnance
522	09-3-dp129g6f	Possible Ordnance
523	09-4-dp4790g50f	Pipeline Associated
524	09-5-pm23864g4f	Electromagnetic Anomaly
525	09-6-pm34g13f	Possible Ordnance
526	10-1-pm37g24f	Possible Ordnance
527	10-2-dp6063g73f	Pipeline Associated
528	10-3-mc34109g1f	Electromagnetic Anomaly
529	10-4-pm2385g43f	Possible Ordnance
530	10-5-mc92g2f	Possible Ordnance
531	11-1-pm1474g41f	Possible Ordnance
532	11-2-dp2385g29f	Pipeline Associated
533	11-3-mc207g22f	Possible Ordnance
534	11-4-dp52g19f	Possible Ordnance
535	12-1-pm52g7f	Possible Ordnance
536	12-2-nm398g18f	Possible Ordnance
537	12-3-pm75g7f	Possible Ordnance
538	12-4-nm29g4f	Possible Ordnance
539	12-5-nm24g3f	Possible Ordnance
540	12-6-nm115g3f	Possible Ordnance

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
541	12-7-nm23g8f	Possible Ordnance
542	12-8-mc457g25f	Possible Ordnance
543	12-9-mc613g30f	Possible Ordnance
544	12-10-nm642g43f	Possible Ordnance
545	13-1-dp244g28f	Possible Ordnance
546	13-2-nm213g24f	Possible Ordnance
547	13-3-nm224g18f	Possible Ordnance
548	13-4-nm156g14f	Possible Ordnance
549	13-5-dp25g9f	Possible Ordnance
550	14-1-nm61g15f	Possible Ordnance
551	14-2-nm234g18f	Possible Ordnance
552	14-3-dp193g23f	Possible Ordnance
553	14-4-dp462g36f	Possible Ordnance
554	14-5-nm19g6f	Possible Ordnance
555	14-6-dp646g26f	Possible Ordnance
556	14-7-dp1357g24f	Possible Ordnance
557	16-1-dp400g18f	Possible Ordnance
558	16-2-pm160g17f	Possible Ordnance
559	16-3-dp368g20f	Possible Ordnance
560	16-4-mc403g30f	Possible Ordnance
561	16-5-pm36g11f	Possible Ordnance
562	16-6-pm12g4f	Possible Ordnance
563	16-7-pm35g13f	Possible Ordnance
564	17-1-dp273g42f	Possible Ordnance
565	18-1-dp527g12f	Possible Ordnance
566	18-2-pm91g8f	Possible Ordnance
567	19-1-dp528g38f	Possible Ordnance
568	19-2-pm166g7f	Possible Ordnance
569	19-3-dp1000g33f	Possible Ordnance
570	20-1-mc48849g8f	Electromagnetic Anomaly

TABLE 3

ANOMALIES BY PLANNED PROJECT AREA

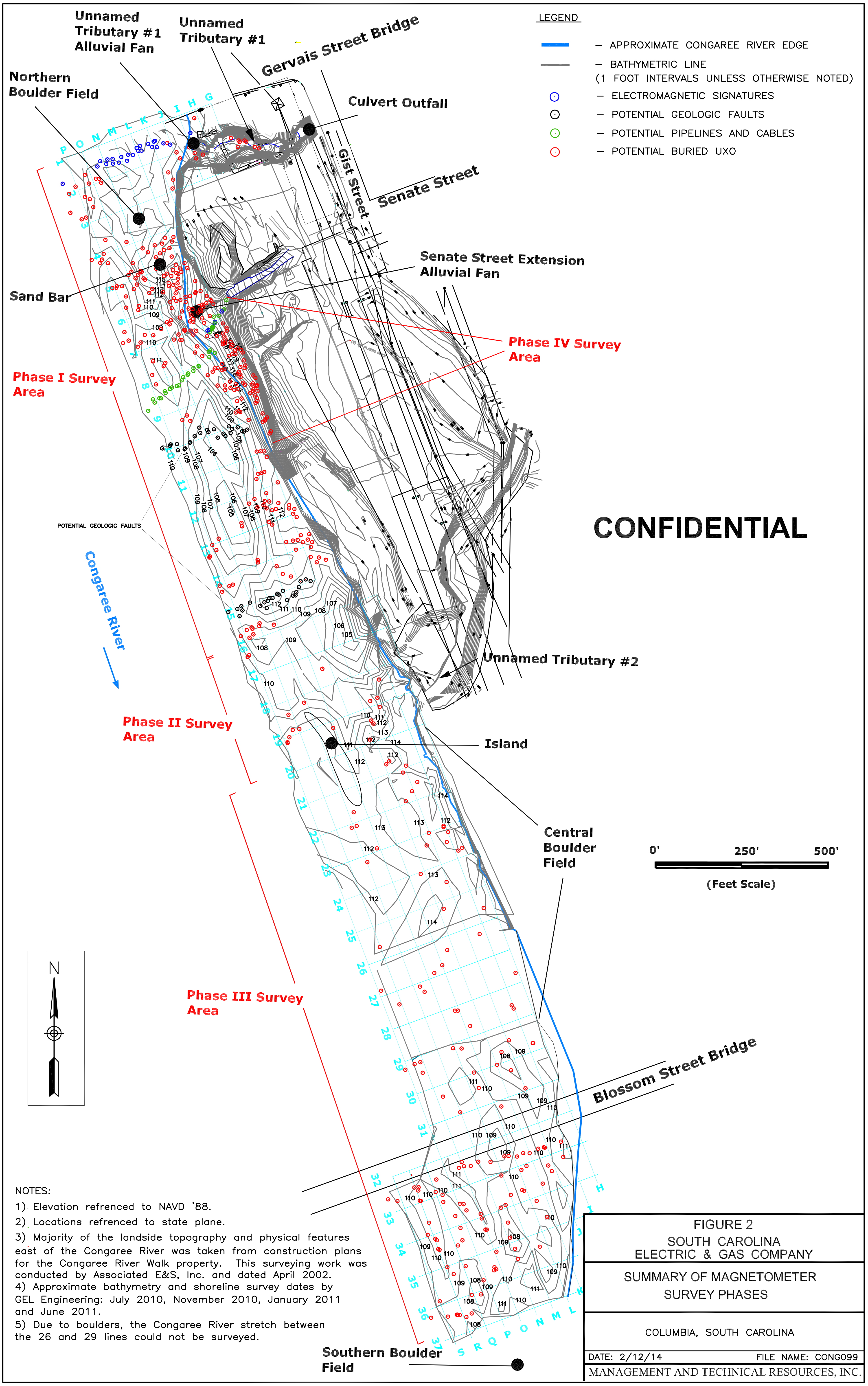
Congaree River Sediments
Columbia, South Carolina

Construction Phase	Potential Ordnance (UXO)	Potential UXO Under the Footprint of the Cofferdam	Other Anomalies	Total Magnetic Anomalies
Field Demonstration Project Area	84	0	17	101
Phase I	84	20	14	118
Phase II	45	9	16	70
Phase III	2	14	17	33
Outside of Project Area	210	0	38	248
Total Anomalies	**425**	**43**	**102**	**570**

Notes:

Please refer to Figures 2 and 3.

1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "*have signature characteristics that could be associated with ordnance* " and "*those anomalies should be considered potentially hazardous until material generating the signatures can be identified*".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.



NOTES:

1). Elevation refrenced to NAVD '88.

2). Locations refrenced to state plane.

3) Majority of the landside topography and physical features east of the Congaree River was taken from construction plans for the Congaree River Walk property. This surveying work was conducted by Associated E&S, Inc. and dated April 2002.

4) Approximate bathymetry and shoreline survey dates by GEL Engineering: July 2010, November 2010, January 2011 and June 2011.

5) Due to boulders, the Congaree River stretch between the 26 and 29 lines could not be surveyed.

FIGURE 2

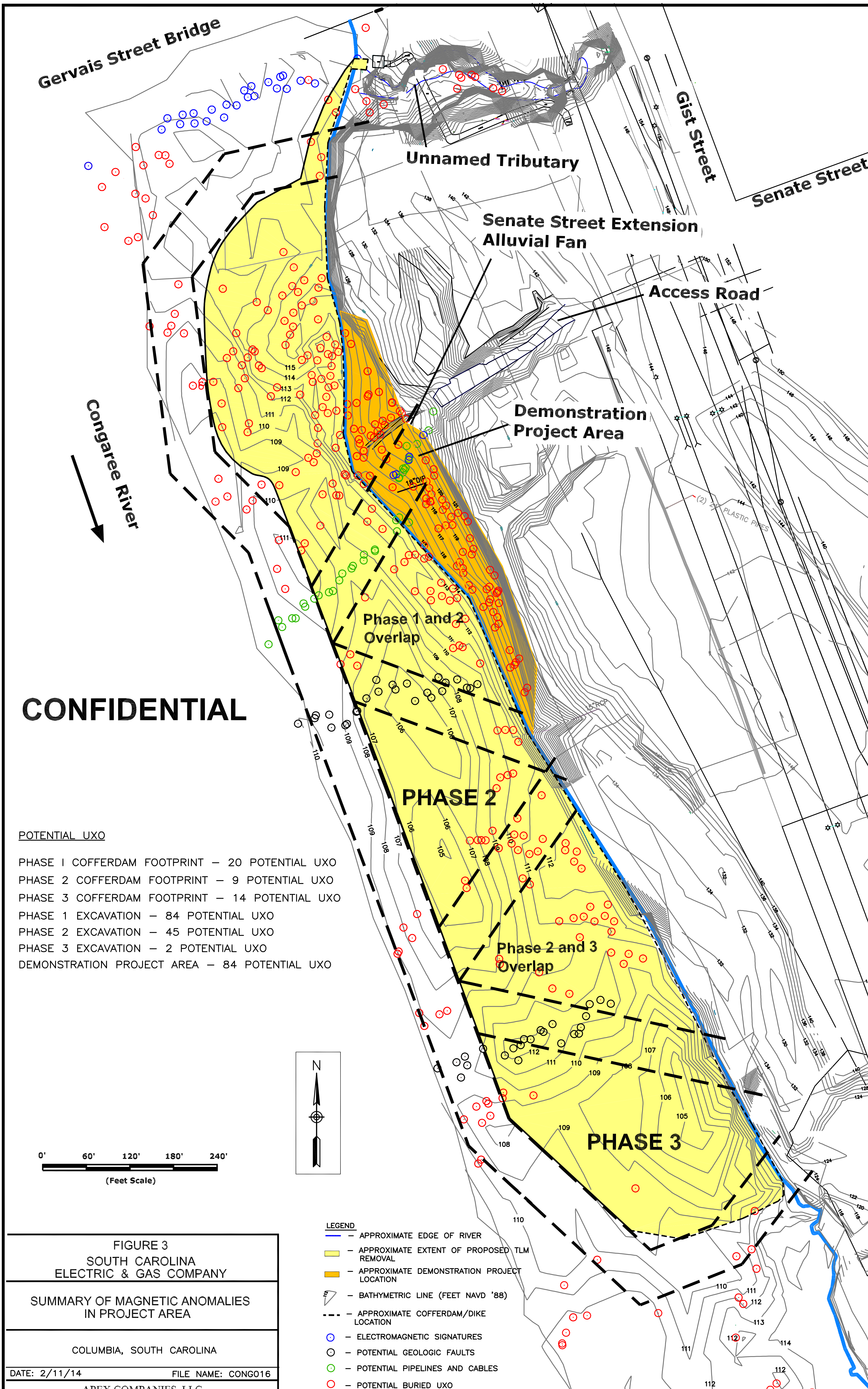
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SUMMARY OF MAGNETOMETER SURVEY PHASES

COLUMBIA, SOUTH CAROLINA

DATE: 2/12/14 FILE NAME: CONG099

MANAGEMENT AND TECHNICAL RESOURCES, INC.



POTENTIAL UXO

PHASE I COFFERDAM FOOTPRINT – 20 POTENTIAL UXO
PHASE 2 COFFERDAM FOOTPRINT – 9 POTENTIAL UXO
PHASE 3 COFFERDAM FOOTPRINT – 14 POTENTIAL UXO
PHASE 1 EXCAVATION – 84 POTENTIAL UXO
PHASE 2 EXCAVATION – 45 POTENTIAL UXO
PHASE 3 EXCAVATION – 2 POTENTIAL UXO
DEMONSTRATION PROJECT AREA – 84 POTENTIAL UXO

LEGEND
– APPROXIMATE EDGE OF RIVER
– APPROXIMATE EXTENT OF PROPOSED TLM REMOVAL
– APPROXIMATE DEMONSTRATION PROJECT LOCATION
– BATHYMETRIC LINE (FEET NAVD '88)
– APPROXIMATE COFFERDAM/DIKE LOCATION
– ELECTROMAGNETIC SIGNATURES
– POTENTIAL GEOLOGIC FAULTS
– POTENTIAL PIPELINES AND CABLES
– POTENTIAL BURIED UXO

FIGURE 3
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SUMMARY OF MAGNETIC ANOMALIES
IN PROJECT AREA

COLUMBIA, SOUTH CAROLINA

DATE: 2/11/14 FILE NAME: CONGO16

APEX COMPANIES, LLC

MEMORANDUM OF AGREEMENT

AMONG THE U.S. ARMY CORPS OF ENGINEERS; THE SOUTH CAROLINA STATE HISTORIC PRESERVATION OFFICE; AND SCANA

REGARDING THE CONGAREE RIVER REMEDIATION PROJECT

WHEREAS, Pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and Sections 401 and 404 of the Clean Water Act (33 U.S.C. 1344), an application (P/N # 2011-1356-6IO) has been submitted to the U. S. Army Corps of Engineers, Charleston District (Corps) by SCANA for a permit to construct a cofferdam and remove a Tar-Like Material that is comingled with sediment in the Congaree River, Richland County, South Carolina, and

WHEREAS, the Corps has determined that the undertaking may adversely affect Archaeological Site 38RD286/38RD278 (the Ordnance Dump Site/historic underwater site), which is eligible for listing in the National Register of Historic Places and Archaeological Sites 38RD223, 38RD224, and 38RD234 which are considered Geographic Areas of Potential Concern (GPAC), and has consulted with the South Carolina State Historic Preservation Officer (SHPO) pursuant to 36 CFR part 800, the regulations implementing Section 106 of the National Historic Preservation Act (16 USC Part 470f); and

WHEREAS, the Corps has consulted with SCANA regarding the effects of the undertaking on sites 38RD286/38RD273, 38RD223, 38RD224, and 38RD234 and has invited SCANA to sign this Memorandum of Agreement (MOA) as an invited signatory; and

WHEREAS, in accordance with 33 CFR Part 325, Appendix C, 36 CFR Part 800.6(a)(1), and 36 CFR Part 800.6(b)(1)(iv) the Corps has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination with specified documentation and the ACHP has chosen not to participate in the consultation pursuant to 36 CFR Part 800.6(a)(1)(iii);

NOW, THEREFORE, the Corps, the SHPO and SCANA agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic artifacts.

STIPULATIONS

Failure to comply with this MOA may result in the modification, suspension, or revocation of the above-referenced Corps authorizations as described in the special conditions and pursuant to 33 CFR 325.7.

The Corps shall ensure that the following measures are carried out:

1. SCANA and any successors or assigns engaged in the removal of the contaminated sediment shall allow representatives from the Corps and the SHPO to inspect the authorized activity at any time that is deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of this MOA. During

any inspection the Corps and the SHPO will follow all safety protocols established at the work site.

2. All plans and reports developed for the salvage of historic artifacts shall incorporate guidance provided by the Secretary of Interior's *Standards and Guidelines for Archaeological Documentation* (48 FR 44734-37) and the President's Advisory Council on Historic Preservation publication, *Treatment of Archaeological Properties* (ACHP 1980). Additionally, all plans and reports will be consistent with *South Carolina Standards and Guidelines for Archaeological Investigations* (Council of South Carolina Professional Archaeologists, et al. 2005).

3. SCANA's archaeological consultant will develop a recovery plan (Plan) for the portions of Archaeological Site 38RD286/38RD278 contained within the project area and identified in Attachement A. The recovery plan will include a description of the undertaking's research design and methodology for artifact recovery. The recovery plan will be submitted to the Corps and the SHPO for review and approval prior to any fieldwork. The Corps and the SHPO will be afforded thirty (30) days to review the recovery plan and provide comments.

4. SCANA will protect and preserve the areas labeled as Archaeological Sites 38RD223, 38RD224 and 38RD234 as shown in Exhibit A by completing the requirements stated in Stipulation 5 below until such time as sites are determined not eligible for the NRHP or potential adverse effects to those Sites determined eligible are mitigated with data recovery in accordance with this MOA and the Plan.

5. No less than ten (10) days prior to any land disturbing activities SCANA shall ensure that:

    a. Archaeological Sites 38RD223, 38RD224 and 38RD234 are marked on construction and maintenance plans with treatment notes and this MOA referenced.

    b. All newly constructed roads in the vicinity of site 38RD223, 38RD224 and 38RD234 will be elevated above grade with successive layers of fill, geotextile matting and gravel in order to protect potential subsurface deposits.

    c. The boundaries of Archaeological Sites 38RD223, 38RD224 and 38RD234 are cordoned off in the field with orange safety fencing, or a similar highly visible barrier which shall remain in place until all construction activity is complete.

    d. An archaeologist will be present to monitor construction activities in the vicinity of Archaeological Sites 38RD223, 38RD224 and 38RD234.

6. At least one copy of the draft technical report of data recovery operations and final public information plans will be submitted to the SHPO for review and approval within two (2) years from the last day of fieldwork. The draft technical report will be consistent with the standards outlined in *South Carolina Standards and Guidelines for Archaeological Investigations* (Council of South Carolina Professional Archaeologists, et al. 2005). The

SHPO reserves the right to submit the draft technical report to qualified professional archaeologists for peer review. If the SHPO elects to utilize this option, SCANA's archaeological consultant will be advised and additional report copies may be requested. If revisions of the draft report are recommended, SCANA is responsible for ensuring that these revisions are addressed in the final report. The final report will be submitted to the SHPO within three (3) months of the receipt of all agency and peer review comments.

7. SCANA, and the SHPO will consult to determine the appropriate format for a public education component. SCANA will ensure that a public education plan is developed and submitted to the SHPO with the draft technical report. All public education materials will be implemented within two (2) years of the last day of fieldwork.

8. SCANA and the SHPO will consult to determine the final disposition of the artifacts recovered in accordance with the Underwater Antiquities Act of 1991 (Article 5, Chapter 7, Title 54, Code of Laws of South Carolina, 1976). SCANA will ensure that artifacts are stabilized and processed prior to their final disposition.

LATE DISCOVERIES

If any unanticipated cultural materials (e.g. large, intact artifacts or animal bones, large clusters of artifacts or animal bones, large soil stains or patterns of soil stains, buried brick or stone structures, or clusters of brick or stone indicating a former structure) in the project area prior to or during construction activities (a "Late Discovery"), then SCANA will temporarily halt any activities in the vicinity of such Late Discovery and will notify the SHPO and the Corps as soon as practical of the Late Discovery. The halt will afford the Corps and the SHPO the opportunity to assess the situation and recommend a course of action within two (2) business days after such notification.

A buffer will be established around the Late Discovery by the construction project manager. The buffer will be flagged by appropriate personnel and posted with signage indicating that no land altering activities will be allowed within this buffer zone until the course of action hereinafter described has been established.

If unanticipated human remains are found or suspected, they should be left in place and protected until appropriate consultation is completed. SCANA is responsible for notifying the Corps, the SHPO, and the local authorities to initiate consultation. Human remains are subject to South Carolina law that addresses abandoned cemeteries and burials including but not limited to S.C. Code Ann. §§ 27-43-10 to 27-43-30, 16-16-600 and 61-19-28 to 61-19-29.

MONITORING AND REPORTING

Every one (1) year following the execution of this agreement, for the life of the agreement, SCANA will provide the Corps and the SHPO a written report describing all work begun or accomplished during the past year under this agreement. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received relating to the efforts to carry out the terms of this MOA. SCANA will also report on plans for the next year. This report may be submitted to the Corps and the SHPO via e-mail.

DISPUTE RESOLUTION

SCANA, the Corps and the SHPO will attempt to resolve any disagreement arising from the implementation of the MOA. This will include any disputes that arise concerning the contents of the report(s), including but not limited to its merit as a cultural resource management document.

AMENDMENT AND MODIFICATION

Any party to this MOA may request that it be amended or modified at any time, whereupon the parties will consult with each other to consider such amendment or modification. Amendments must be agreed to in writing and signed by all signatories. Amendment of this MOA may require a concurrent request to amend the applicable license.

EXECUTION AND DURATION OF THE MOA

This MOA may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the original MOA. The date of the execution shall be the date of the signature of the last party to sign. This MOA will be in effect for the life of the Permit or until all stipulations are met, whichever is longer. Prior to such time the Corps may consult with the other signatories to reconsider the terms of the MOA and amend it in accordance with the stipulation outlined above.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the parties hereto have caused this MOA to be executed by their duly authorized representative of the last signed date.

SIGNATORIES:

Department of the Army, Corps of Engineers

By:____________________ Date ___________

Print Name:______________________________

Title: _________________________________

INVITED SIGNATORIES:

South Carolina Department of Archives and History

By:____________________ Date ___________

Print Name:______________________________

Title: _________________________________

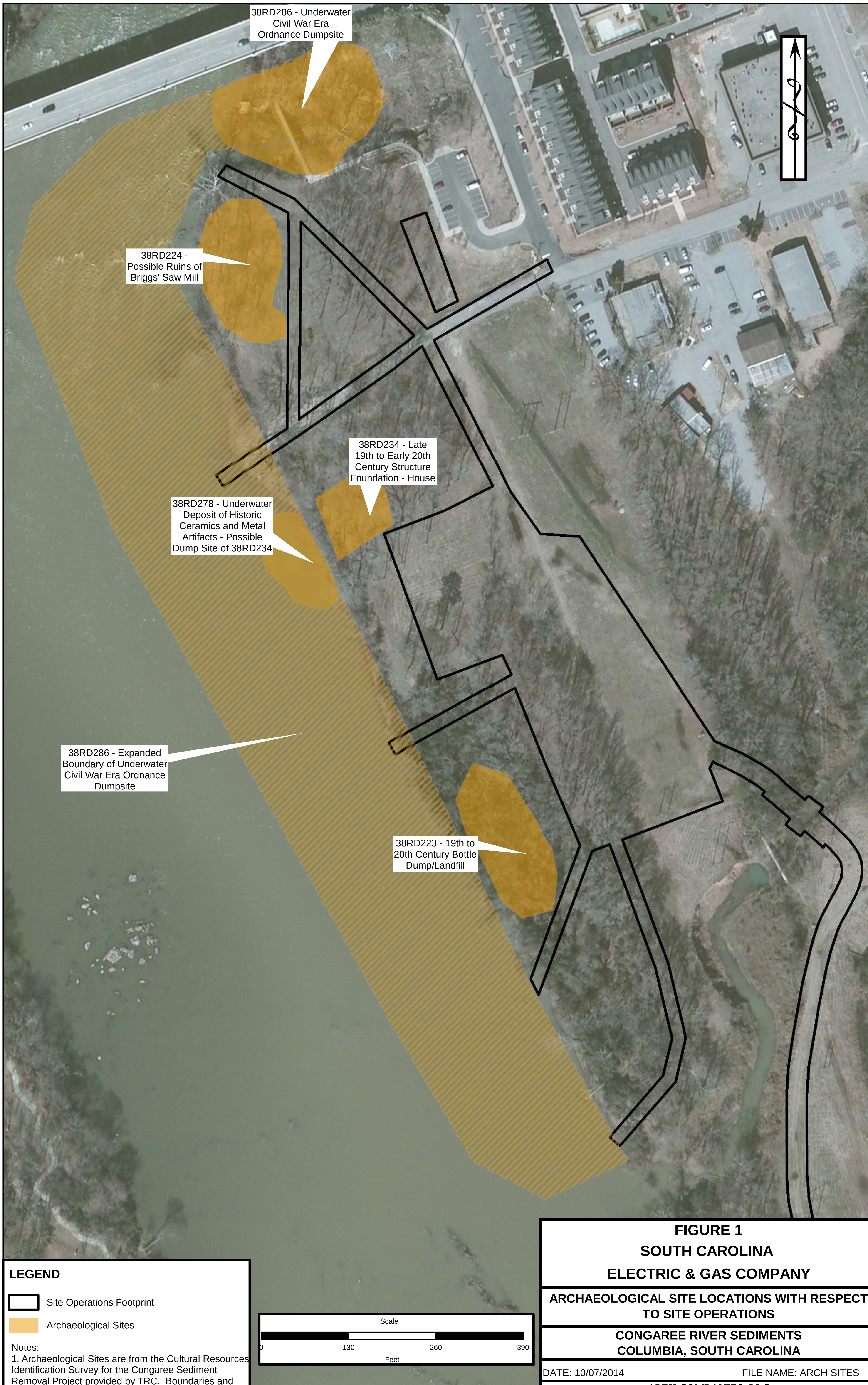
SCANA

By:____________________ Date ___________

Print Name:______________________________

Title: _________________________________

ATTACHMENTS



LEGEND

Site Operations Footprint

Archaeological Sites

Notes:
1. Archaeological Sites are from the Cultural Resources Identification Survey for the Congaree Sediment Removal Project provided by TRC. Boundaries and locations are approximate.

FIGURE 1
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

ARCHAEOLOGICAL SITE LOCATIONS WITH RESPECT TO SITE OPERATIONS

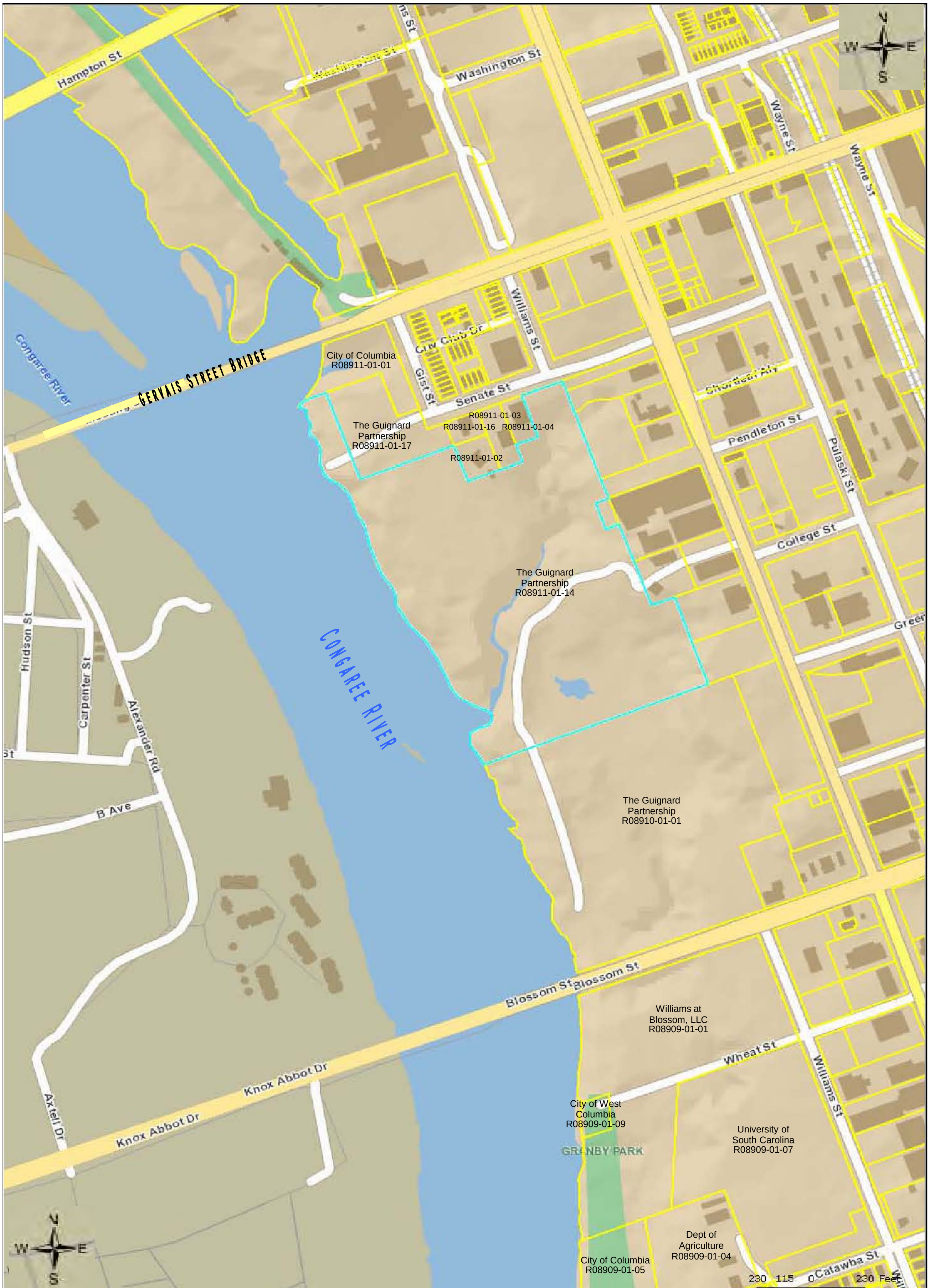
CONGAREE RIVER SEDIMENTS
COLUMBIA, SOUTH CAROLINA

DATE: 10/07/2014 FILE NAME: ARCH SITES

APEX COMPANIES, LLC

ATTACHMENT E

ADJACENT PROPERTY OWNERS MAP


Hampton St
Washington St
Williams St
Gist St
City Club Dr
Senate St
Shortleaf Aly
Pendleton St
Pulaski St
College St
Wayne St
Gervais Street Bridge
Congaree River
City of Columbia
R08911-01-01
The Guignard
Partnership
R08911-01-17
R08911-01-03
R08911-01-16
R08911-01-04
R08911-01-02
The Guignard
Partnership
R08911-01-14
The Guignard
Partnership
R08910-01-01
Hudson St
Carpenter St
Alexander Rd
B Ave
Blossom St
Knox Abbot Dr
Axtell Dr
Williams at
Blossom, LLC
R08909-01-01
Wheat St
City of West
Columbia
R08909-01-09
University of
South Carolina
R08909-01-07
GRANBY PARK
Dept of
Agriculture
R08909-01-04
City of Columbia
R08909-01-05
Catawba St
230 115 0 230 Feet

APPENDIX R

CONGAREE RIVER ANOMALY SUMMARY

DRAFT

Congaree River Anomaly Summary
Congaree River Project
Columbia, SC

Site Location

The report summarizes the results of the magnetometer surveying activities conducted in support of the South Carolina Electric and Gas (SCE&G) Company Congaree River Project located in Columbia, SC. The Congaree River begins at the confluence of the Saluda River and the Broad River in Columbia, SC. The portion of the Congaree relevant to this project is the approximate eastern third of the river beginning directly south of the Gervais Street Bridge and extending for approximately 3,700 feet downstream to approximately 500 feet below the Blossom Street Bridge. Figure 1 provides the location of the area in question.

Background Information

In June 2010, the South Carolina Department of Health and Environmental Control (SCDHEC) noted tar-like material (TLM) near the eastern shoreline of the Congaree River directly downstream of the Gervais Street Bridge. SCDHEC collected samples of this material and the analytical results indicated that the source of the TLM might be attributable to the former manufactured gas plants (MGP) that operated in Columbia starting in the mid-1800s and ending in the late 1940’s to early 1950’s. Predecessor companies of SCE&G operated the Huger Street manufactured gas plant (Huger Street MGP). Its location is provided on Figure 1. SCE&G has recently completed a removal action at the Huger Street site where over 125,000 tons of MGP impacted soil and debris was excavated and removed with oversight provided by SCDHEC.

SCE&G submitted a Project Delineation Report (PDR) [MTR, March 2012] to SCDHEC on March 23, 2012. SCDHEC approved the PDR on April 23, 2012. The PDR presented the results of delineation activities completed to determine the extent of the TLM within the river. The delineation work was completed in five separate phases over approximately 18 months. The magnetometer surveying operations described in this summary report were a component of the investigative activities and were necessary due to the potential presence of Civil War era explosive ordnance within the project area. Details pertaining to the ordnance are provided below.

Potential Presence of Historical Items and Unexploded Ordnance (UXO)

It has been confirmed that in 1865, during the Civil War, live munitions and other articles of war produced by the Confederacy were dumped into the Congaree River near the Gervais Street Bridge by Union forces under the direction of General Sherman. This activity took place during Sherman’s occupation and subsequent destruction of Columbia. A list of munitions and other Confederate items captured by the Union forces is provided in Attachment A. The Union Army kept some of these items for its own use and the remainder was destroyed. One of the methods for destruction was dumping the items into the river.

Archeological investigations, conducted as late as 1980, recovered some live and unstable munitions or unexploded ordinance (UXO) from the area as well as some other potentially historically significant artifacts. Specifically this work was focused in and adjacent to the unnamed tributary that enters the river just south of the Gervais Street Bridge. Figure 2 shows this location and a daily activity log documenting some of the archeological work is provided in the initial Tidewater Atlantic Research Inc. report (Attachment B). Several live cannonballs were identified during this operation and properly disposed of by trained explosive ordinance disposal (EOD) personnel located at nearby Fort Jackson.

Due to the potential presence of live munitions within the project area, an additional reconnaissance and screening of the area in question was conducted as part of the investigative activities. Acoustic (side scan sonar) and magnetic (magnetometer) remote sensing surveying activities were completed in order to determine if potential munitions were present prior to conducting the sediment sampling activities. A description of these activities and their subsequent results are provided below.

Surveying Activities

Magnetometer surveying of the project area was conducted over four separate phases. The first phase was focused on the area directly downstream of the Gervais Street Bridge (grid lines 1 through 16 on Figure 2) and included some limited shoreline surveying near the Senate Street Extension Alluvial Fan (Figure 2). A sidescan sonar survey was also performed during Phase I. The purpose of the side scan sonar was to complement the magnetometer survey by potentially visually identifying objects (e.g., ordnance) that may be lying on the Congaree River bottom. The sidescan sonar survey results were inconclusive and it was not utilized in the subsequent phases.

Magnetometer surveying progressed downstream in conjunction with the continuing investigation activities with Phase II extending the survey area from grid line 16 to grid line 20. Survey of the unnamed tributary that is located south of the Gervais Street Bridge was also conducted during Phase II. Phase III encompassed the portions of the project area between grid lines 20 and 37 and Phase IV completed the shoreline surveying in the vicinity of the Senate Street Extension Alluvial Fan that was not conducted during the other phases due to access constraints.

The specific details pertaining to the surveying equipment and methodology are provided in the phase specific reports produced by Tidewater Atlantic Research Inc. provided in Attachment B. In general, depending on the area to be surveyed and the presence of rock outcrops and water level conditions, either a small boat with an outboard motor or an inflatable boat was utilized to carry the surveying equipment. The inflatable boat was pushed through areas where water levels and the presence of rocks precluded the use of the motorboat. Terrestrial surveying was done on foot with handheld and backpack mounted equipment.

The magnetometer surveys were generally run on north-south trending lines and were controlled via a differential global positioning system (DGPS) using a Trimble AgCPS 132 navigation system. HYPACK navigation software was used to translate the DGPS data into real-time data that was used to direct the survey along a predetermined grid or transects. In general, the magnetometer transects lines were located approximately 20 feet apart. In some areas of the river where obstructions were encountered and navigation had to be altered, the distance between the transect lines varied and could be decreased to less than 10 feet.

The magnetometer survey was performed with an EG&G Geometrics G-858 cesium magnetometer that is capable of +/- 0.001 gamma resolution. The magnetic data was collected at a frequency of six samples per second. The locations of the magnetic readings were determined from the DGPS.

The side scan sonar survey was performed from approximately the 4 to 16 Lines and boulders and shallow water prevented performing the survey above the 4 Line. A 445/900 kHz Klein System 3900 digital side scan sonar was employed. The side scan sonar data was horizontally tied to the DGPS and reconciled with the HYPACK survey software. Where navigation was possible, a total of five side scan sonar survey passes were made on a 50-foot transect spacing.

The magnetometer detects changes in earth's magnetic field that may be attributed to buried anthropogenic influences (e.g., UXOs, electrical cables, etc.) or naturally occurring geologic features (e.g., remnant thermal magnetism, ore bodies, etc.). Once the magnetometer data was collected it was systematically analyzed to identify potential targets. A variety of characteristics of the targets including configuration, areal extent, intensity and contrast with background were analyzed and compared to signature characteristics previously found to be reliable indicators of historic ordnance. The results are discussed below.

Results

Following each phase of fieldwork the accumulated data was analyzed and the potential UXO locations were identified. Table 1 provides the results of the magnetometer surveying activities by investigation phase and Figure 3 provides the anomaly locations for the project area. Each phase is also described in more detail in the phase specific reports provided in Attachment B. Table 2 provides a summary of the anomaly locations and interpretation and Table 3 provides a summary of the anomalies located within the planned project area and located in the planned cofferdam footprint.

As the historical and anecdotal evidence suggested, the majority of anomalies were located in the Phase I survey area nearest the Gervais Street Bridge and the boat apron. A total of 323 anomalies were detected in the Phase I area with 218 of those locations exhibiting signature characteristics that could be associated with ordnance. Some of the non-ordnance anomalies included discarded debris and appliances, an electrical cable crossing and a geologic feature.

Phase II produced 10 potential UXOs in grid lines 16 through 20 and an additional 8 in the unnamed tributary. For Phase III the number of anomalies continued to be relatively low from grid line 20 to 31 but increased directly downstream of the Blossom Street Bridge. This increase can be potentially attributable to more recent objects being thrown from the bridge and not necessarily historical UXO. The total number of targets for Phase III was 145 with 121 exhibiting signature characteristics that could be associated with ordnance.

Finally, Phase IV was conducted to obtain information in the area directly downstream of the boat apron, which was not completed during Phase I due to access constraints. A total of 84 anomalies were detected with 67 exhibiting signature characteristics that could be associated with ordnance. The total for all four phases of magnetometer surveying is 570 anomalies located within the investigated area with 425 or 75 percent of those potentially being ordnance.

Due to the nature of the potential historical objects and UXO deposited within the study area and their real or perceived value and/or potential hazard to public safety, the information contained in this summary report must remain confidential. This information was compiled by SCANA for use during completion of the investigative and subsequent remedial activities associated with the Congaree River Project. Any use or dissemination of the information for other purposes is not permitted and may be subject to legal action.

TABLE 1

MAGNETOMETER STUDY RESULTS SUMMARY

Congaree River Sediments
Columbia, South Carolina

Study	Dates	Study Area	Total Magnetic Anomalies	Potential Ordnance (UXO)	Other Anomalies
Phase I	Aug. 25-26, 2010	Congaree River - Grid Lines: 1 thru 16	323	**218**	105
Phase II	Jan. 4-5, 2011	Congaree River - Grid Lines: 16 thru 20 Unnamed Tributary #1 - Outfall to River	10 8	**10** **8**	0 0
Phase III	June 30, 2011	Congaree River - Grid Lines: 20 thru 37	145	**122**	23
Phase IV	January 31 - February 2, 2012	Senate Street Extension / Alluvial Fan Area	84	**67**	17
		Total Anomalies	570	**425**	145
		Percentage with UXO Potential		**75%**	

Notes:
1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "have signature characteristics that could be associated with ordnance" and "those anomalies should be considered potentially hazardous until material generating the signatures can be identified".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
1	078-1-nm262g175f	Geological Feature
2	078-2-dp280g49f	Pipeline
3	078-3-mc48g59f	Possible Ordnance
4	078-5-mc1854g71f	Possible Ordnance
5	077-1-nm758g34f	Possible Ordnance
6	077-2-mc40g45f	Possible Ordnance
7	077-3-mc52g76f	Possible Ordnance
8	077-4-pm203g68f	Pipeline
9	077-5-pm320g176f	Geological Feature
10	077-6-30g18f	Possible Ordnance
11	077-7-dp57g58f	Possible Ordnance
12	077-8-dp63g83f	Geological Feature
13	077-9-mc149g71f	Possible Ordnance
14	076-1-pm130g44f	Possible Ordnance
15	076-2-pm137g288f	Possible Ordnance
16	076-3-nm31g37f	Possible Ordnance
17	076-4-nm34g49f	Possible Ordnance
18	076-5-pm307g190f	Geological Feature
19	076-6-pm510g66f	Pipeline
20	076-7-mc76g69f	Possible Ordnance
21	076-8-mc627g66f	Possible Ordnance
22	075-1-dp116g50f	Possible Ordnance
23	075-2nm18g40f	Possible Ordnance
24	075-3-dp52g65f	Possible Ordnance
25	075-4-dp70g65f	Possible Ordnance
26	075-5-pm301g60f	Pipeline
27	075-5-pm289g178f	Geological Feature
28	075-7-dp36g30f	Possible Ordnance
29	075-8-nm59g80f	Possible Ordnance
30	075-9-pm48g35f	Geological Feature
31	075-10-pm125g70f	Possible Ordnance
32	074-1-dp207g40f	Possible Ordnance
33	074-2-dp121g40f	Geological Feature
34	074-3-pm32g20f	Possible Ordnance
35	074-4-pm288g215f	Geological Feature
36	074-5-nm861g50f	Pipeline
37	074-6-pm27g20f	Possible Ordnance
38	074-7-dp42g40f	Possible Ordnance
39	074-8-dp71g65f	Possible Ordnance
40	074-9-nm58g90f	Possible Ordnance
41	073-1-nm36g22f	Possible Ordnance
42	073-2-nm21g30f	Possible Ordnance
43	073-3-dp21g40f	Possible Ordnance
44	073-4-dp149g65f	Possible Ordnance
45	073-5-dp527g60f	Pipeline
46	073-6-pm302g199f	Geological Feature
47	073-7-pm41g18f	Possible Ordnance
48	073-8-nm60g70f	Possible Ordnance
49	073-9-dp64g31f	Geological Feature
50	073-10-dp42g17f	Possible Ordnance
51	072-1-pm46g11f	Possible Ordnance
52	072-2-pm88g23f	Geological Feature
53	072-3-pm310g167f	Geological Feature
54	072-4-pm2310g36f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
55	072-5-dp62g49'	Possible Ordnance
56	071-1-nm28g10f	Possible Ordnance
57	071-2-pm46g62f	Possible Ordnance
58	071-3-pm170g55f	Possible Ordnance
59	071-4-dp494g96f	Pipeline
60	071-5-pm324g202f	Geological Feature
61	071-6-pm117g97f	Geological Feature
62	071-7-pm70g33f	Possible Ordnance
63	070-1-pm66g25f	Possible Ordnance
64	070-2-pm251g132f	Geological Feature
65	070-3-dp235g21f	Possible Ordnance
66	070-4-nm549g33f	Pipeline
67	070-5-pm159g46f	Possible Ordnance
68	070-6-nm36g18f	Possible Ordnance
69	070-7-dp48g55f	Possible Ordnance
70	070-8-nm44g15f	Possible Ordnance
71	069-1-dp23g10f	Possible Ordnance
72	069-2-dp78g44f	Possible Ordnance
73	069-3-nm1841g50f	Pipeline
74	069-4-dp252g53f	Possible Ordnance
75	069-5-pm214g155f	Geological Feature
76	069-6-pm63g17f	Geological Feature
77	068-1-pm72g94f	Geological Feature
78	068-2-dp238g167f	Possible Ordnance
79	068-3-nm402g55f	Pipeline
80	068-4-dp38g40f	Possible Ordnance
81	067-1-dp32g38f	Possible Ordnance
82	067-2-mc181g93f	Pipeline
83	067-3-pm221g300f	Geological Feature
84	067-5-mc68g90f	Geological Feature
85	067-6-dp22g30f	Possible Ordnance
86	066-1-dp61g40f	Geological Feature
87	066-2-pm182g193f	Geological Feature
88	066-3-nm190g95f	Pipeline
89	066-4-dp127g77f	Possible Ordnance
90	066-5-dp48g18f	Possible Ordnance
91	066-6-nm43g42f	Possible Ordnance
92	066-7-pm27g10f	Possible Ordnance
93	066-8-dp9g10f	Possible Ordnance
94	065-1-dp143g31f	Possible Ordnance
95	065-2-nm19g10f	Possible Ordnance
96	065-3-pm11g7f	Possible Ordnance
97	065-4-dp32g60f	Possible Ordnance
98	065-5-dp127g20f	Possible Ordnance
99	065-6-nm363g52f	Pipeline
100	065-7-pm176g186f	Geological Feature
101	065-8-pm24g38f	Possible Ordnance
102	065-9-pm44g37f	Possible Ordnance
103	065-10-mc69g110f	Geological Feature
104	064-1-pm108g121f	Geological Feature
105	064-2-mc67g61f	Possible Ordnance
106	064-3-pm27g21f	Possible Ordnance
107	064-4-pm193g210f	Geological Feature
108	064-5-nm363g63f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
109	064-6-pm63g16f	Possible Ordnance
110	064-7-dp415g60f	Possible Ordnance
111	063-1-dp395g68f	Possible Ordnance
112	063-2-pm67g14f	Possible Ordnance
113	063-3-nm188g73f	Possible Ordnance
114	063-4-nm334g26f	Pipeline
115	063-5-pm224g187f	Geological Feature
116	063-6-pm111g143f	Geological Feature
117	062-1-pm99g136f	Geological Feature
118	062-2-pm203g163f	Geological Feature
119	062-3-nm257g48f	Pipeline
120	062-4-dp373g110f	Possible Ordnance
121	062-5-mc68g107f	Possible Ordnance
122	062-6-pm59g55f	Possible Ordnance
123	061-1-pm127g57f	Possible Ordnance
124	061-2-pm182g43f	Possible Ordnance
125	061-3-pm113g52f	Possible Ordnance
126	061-4-nm198g67f	Pipeline
127	061-5-pm225g210f	Geological Feature
128	061-6-pm112g147f	Geological Feature
129	060-1-pm109g18f	Geological Feature
130	060-2-pm66g46f	Possible Ordnance
131	060-3-pm246g205f	Geological Feature
132	060-4-nm107g38f	Pipeline
133	060-5-dp288g93f	Possible Ordnance
134	059-1-nm124g99f	Possible Ordnance
135	059-2-dp73g64f	Possible Ordnance
136	059-3-pm240g200f	Geological Feature
137	059-4-dp76g55f	Possible Ordnance
138	059-5-dp140g102f	Possible Ordnance
139	059-6-dp241g37f	Geological Feature
140	058-1-dp114g101f	Geological Feature
141	058-2-nm65g51f	Possible Ordnance
142	058-3-pm87g33f	Possible Ordnance
143	058-4-mc248g200f	Geological Feature
144	058-5-nm44g15f	Possible Ordnance
145	058-6-dp137g91f	Possible Ordnance
146	057-1-pm144g94f	Pipeline
147	057-2-pm67g62f	Possible Ordnance
148	057-3-dp54g14f	Possible Ordnance
149	o57-4-mc231g180f	Geological Feature
150	057-5-pm55g57f	Possible Ordnance
151	057-6-nm30g36f	Possible Ordnance
152	057-7-dp138g78f	Possible Ordnance
153	057-8-dp135g41f	Geological Feature
154	056-1-pm144g157f	Geological Feature
155	056-2-nm36g22f	Possible Ordnance
156	056-3-pm129g33f	Possible Ordnance
157	056-4-dp34g15f	Possible Ordnance
158	056-5-dp83g70f	Possible Ordnance
159	056-6-mc210g153f	Geological Feature
160	056-7-dp53g21f	Possible Ordnance
161	056-8-dp103g46f	Possible Ordnance
162	056-9-mc178g110f	Pipeline

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
163	055-1-pm277g110f	Pipeline
164	055-2-nm75g32f	Possible Ordnance
165	055-3-dp54g15f	Possible Ordnance
166	055-4-pm127g62f	Possible Ordnance
167	055-5-pm195g58f	Geological Feature
168	055-6-dp221g64f	Possible Ordnance
169	055-7-dp28g10f	Possible Ordnance
170	055-8-pm146g36f	Possible Ordnance
171	055-9-dp18g20f	Possible Ordnance
172	055-10-pm136g123f	Geological Feature
173	054-1-dp65g44f	Possible Ordnance
174	054-2-dp66g30f	Possible Ordnance
175	054-3-dp62g38f	Possible Ordnance
176	054-4-pm196g90f	Geological Feature
177	054-5-dp100g48f	Possible Ordnance
178	054-6-dp106g20f	Possible Ordnance
179	054-7-dp47g15f	Possible Ordnance
180	054-8-pm479g50f	Pipeline
181	053-1-nm71g18f	Possible Ordnance
182	053-2-nm21g26f	Possible Ordnance
183	053-3-mn90g46f	Possible Ordnance
184	053-4-dp26g17f	Possible Ordnance
185	053-5-nm32g15f	Possible Ordnance
186	053-6-pm71g56f	Possible Ordnance
187	053-7-pm199g57f	Geological Feature
188	053-8-nm111g38f	Iron Pipe
189	053-9-nm51g20f	Possible Ordnance
190	0543-10-dp43g40f	Possible Ordnance
191	053-11-nm70g66f	Possible Ordnance
192	053-12-pm115g105f	Geological Feature
193	052-1-pm129g142f	Geological Feature
194	052-2-dp99g63f	Possible Ordnance
195	052-3-mc292g160f	Iron Pipe
196	052-4-dp60g42f	Possible Ordnance
197	052-5-pm63g30f	Possible Ordnance
198	052-6-dp47g12f	Possible Ordnance
199	052-7-dp251g53f	Possible Ordnance
200	051-1-mc601g117f	Iron Pipe
201	051-2-nm97g26f	Possible Ordnance
202	050-1-nm94g33f	Possible Ordnance
203	050-2-dp102g45f	Possible Ordnance
204	050-3-pm50g17f	Possible Ordnance
205	050-4-pm818g20fEOL	Possible Ordnance
206	049-1-pm112g64f	Possible Ordnance
207	049-2-pm111g78f	Possible Ordnance
208	049-3-dp74g66f	Possible Ordnance
209	049-4-dp75g70f	Possible Ordnance
210	048-1-nm74g38f	Possible Ordnance
211	048-2-dp13g14f	Possible Ordnance
212	049-3-nm104g28f	Possible Ordnance
213	048-4-pm127g53f	Possible Ordnance
214	048-5-pm22g28f	Possible Ordnance
215	047-1-nm119g46fEOL	Possible Ordnance
216	047-2-dp13g15f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
217	047-3-nm89g33f	Possible Ordnance
218	046-1-nm223g37f	Possible Ordnance
219	078-1-pm1949g7f	Possible Ordnance
220	068-1-dp311g7f	Possible Ordnance
221	045-1-mc6548g8f	Electromagnetic Anomaly
222	062L-1-pm150g5f	Possible Ordnance
223	062L-2-nm109g11f	Possible Ordnance
224	061L-1-nm135g4f	Possible Ordnance
225	061L-2-pm95g6f	Possible Ordnance
226	061L-3-dp105g20f	Possible Ordnance
227	060L-1-pm113g3f	Possible Ordnance
228	060L-2dp93g27f	Possible Ordnance
229	059L-1-nm150g25f	Possible Ordnance
230	058L-1-pm302g11f	Possible Ordnance
231	058L-2-pm79g16f	Possible Ordnance
232	057L-1-dp257g7f	Possible Ordnance
233	056L-dp150g11f	Possible Ordnance
234	056L-2-pm43g10f	Possible Ordnance
235	055L-1-dp201g11f	Possible Ordnance
236	054L-1-nm166g9f	Possible Ordnance
237	001SL-1-pm4902g20	Boiler
238	001SL-2-pm4554g4f	Possible Ordnance
239	001SL-3-mc8907g11f	Electromagnetic Anomaly
240	002SL-1-dp8978g9f	Possible Ordnance
241	002SL-2-dp3987g7f	Possible Ordnance
242	002SL-3-mc7345g7f	Possible Ordnance
243	003SL-1-pm269g10f	Possible Ordnance
244	003Sl-2-pm515g7f	Possible Ordnance
245	003SL-3-nm80g5f	Possible Ordnance
246	003SL-4-dp168g19f	Boiler
247	003SL-5-pm129g6f	Washing Machine
248	060L-1-nm105g20f	Possible Ordnance
249	059L-1-nm279g5f	Possible Ordnance
250	059L-2-pm423g34f	Possible Ordnance
251	058L-1-dp209g6f	Possible Ordnance
252	058L-2-pm35g11f	Possible Ordnance
253	057L-1-nm17g11f	Possible Ordnance
254	057L-2-pm98g8f	Possible Ordnance
255	057L-3-pm37g9f	Possible Ordnance
256	057L-4-pm38g11f	Possible Ordnance
257	057L-5-dp75g10f	Sign
258	056L-1-mc8186g11f	Possible Ordnance
259	055L-1-mc5360g20f	Possible Ordnance
260	055L-2-nm357g19f	Possible Ordnance
261	054L-1-261g11f	Possible Ordnance
262	054L-2-pm3122g8f	Possible Ordnance
263	053L-1-nm110g9f	Possible Ordnance
264	053L2-dp109g16f	Possible Ordnance
265	052L-1-dp286g3f	Manhole
266	052L-2-pm327g9f	Possible Ordnance
267	052L-3-nm248g21f	Possible Ordnance
268	052L-4-dp259g26f	Possible Ordnance
269	051L-1-nm109g13f	Possible Ordnance
270	067-1-dp48g33f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
271	067-2-dp142g44f	Possible Ordnance
272	0701-dp480g13f	Possible Ordnance
273	070-2-pm49g11f	Possible Ordnance
274	072-1-pm89g13f	Possible Ordnance
275	073-1-nm80g5f	Possible Ordnance
276	073-2-nm356g23f	Possible Ordnance
277	075-1-nm364g11f	Possible Ordnance
278	075-2-dp1039g39f	Possible Ordnance
279	077-1-dp123g14f	Possible Ordnance
280	077-2-dp776g30f	Possible Ordnance
281	078R-3mc8302g20f	Electromagnetic Anomaly
282	068-1-dp320g7f	Possible Ordnance
283	068R-2-mc9213g15f	Electromagnetic Anomaly
284	066R-1-mc8334g15f	Electromagnetic Anomaly
285	065R-1-mc8486g18f	Electromagnetic Anomaly
286	064R-1-mc9633g18f	Electromagnetic Anomaly
287	063R-1-mc9404g19f	Electromagnetic Anomaly
288	062R-2-mc9746g18f	Electromagnetic Anomaly
289	061R-1-mc7773g16f	Electromagnetic Anomaly
290	060R-1-mc8127g8f	Electromagnetic Anomaly
291	059R-1-mc5961g11f	Electromagnetic Anomaly
292	058R-1-mc6758g17f	Electromagnetic Anomaly
293	057R-1-mc7119g24f	Electromagnetic Anomaly
294	056R-1-mc7891g16f	Electromagnetic Anomaly
295	055R-1-mc6461g17f	Electromagnetic Anomaly
296	054R-1-mc9645g16f	Electromagnetic Anomaly
297	053R-1-mc6680g13f	Electromagnetic Anomaly
298	052R-1-mc9795g10f	Electromagnetic Anomaly
299	051R-1-mc6531g15f	Electromagnetic Anomaly
300	050R-1-mc6531g14f	Electromagnetic Anomaly
301	049R-1-mc9574g7f	Electromagnetic Anomaly
302	048R-1-mc6550g12f	Electromagnetic Anomaly
303	047BR-1-mc6477g7f	Electromagnetic Anomaly
304	045R-1mc6548g8f	Electromagnetic Anomaly
305	003-4-dp103g12f	Possible Ordnance
306	004-1-pm93g10f	Possible Ordnance
307	003-3-pm58g16f	Possible Ordnance
308	002-1-dp38g9f	Possible Ordnance
309	003-2-pm96g11f	Possible Ordnance
310	004-3-pm95g12f	Possible Ordnance
311	001-1-pm54g6f	Possible Ordnance
312	006-2-nm207g12f	Possible Ordnance
313	004-2-pm81g9f	Possible Ordnance
314	003-1-pm19g4f	Possible Ordnance
315	004-4-pm78g8f	Possible Ordnance
316	006-1-dp191g16f	Possible Ordnance
317	002-2-dp53g11f	Possible Ordnance
318	004-5-pm85g11f	Possible Ordnance
319	004-6-pm71g10f	Possible Ordnance
320	004-7-pm82g12f	Possible Ordnance
321	004-8-dp156g19f	Possible Ordnance
322	002-3-nm32g8f	Possible Ordnance
323	053L-4-dp437g70f	Iron Pipe
324	022-1-pm100g25f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
325	021-2-nm400g25f	Possible Ordnance
326	021-2-pm70g20f	Possible Ordnance
327	012-1-pm270g23f	Possible Ordnance
328	011-1-dp225g75f	Possible Ordnance
329	010-1-nm50g15f	Possible Ordnance
330	020-1-dp22g15f	Possible Ordnance
331	016-1-pm38g37f	Possible Ordnance
332	020-2-dp23g13f	Possible Ordnance
333	020-3-dp18g16f	Possible Ordnance
334	A	Possible Ordnance
335	B	Possible Ordnance
336	C	Possible Ordnance
337	D	Possible Ordnance
338	E	Possible Ordnance
339	F	Possible Ordnance
340	G	Possible Ordnance
341	H	Possible Ordnance
342	1-1-mc806g44f	Possible Ordnance
343	1-2-pm100g9f	Possible Ordnance
344	1-3-dp533g47f	Possible Ordnance
345	1-4-dp233g24f	Possible Ordnance
346	1-5-pm73g13f	Possible Ordnance
347	1-6-dp210g33f	Possible Ordnance
348	22-1-dp544g65f	Pipeline
349	21-1-pm323g42f	Possible Ordnance
350	21-2-dp1330g64f	Pipeline
351	20-1-dp94g25f	Possible Ordnance
352	20-2-dp2601g102f	Pipeline
353	19-1-pm79g8f	Possible Ordnance
354	19-2-pm113g18f	Possible Ordnance
355	19-3-dp154g31f	Possible Ordnance
356	19-3-dp1419g86f	Pipeline
357	18-1-dp333g16f	Possible Ordnance
358	18-2-dp40g17f	Possible Ordnance
359	18-3-dp105g24f	Possible Ordnance
360	18-4-dp196g34f	Possible Ordnance
361	18-5-pm13g8f	Possible Ordnance
362	18-6-dp2092g60f	Pipeline
363	18-6-dp83g22f	Possible Ordnance
364	18-7-dp?1687+g18+f	Pipeline
365	17-1-dp1497g47f	Pipeline
366	17-2-dp47g44f	Possible Ordnance
367	17-3-pm29g16f	Possible Ordnance
368	17-4-mc53g35f	Possible Ordnance
369	16-1-nm61g10f	Possible Ordnance
370	16-2-dp136g17f	Possible Ordnance
371	16-3-pm50g27f	Possible Ordnance
372	16-5-dp10g6f	Possible Ordnance
373	16-6-pm47g26f	Possible Ordnance
374	15-1-dp59g30f	Possible Ordnance
375	15-2-pm43g16f	Possible Ordnance
376	15-3-dp304g29f	Possible Ordnance
377	14-1-dp136g21f	Possible Ordnance
378	14-2-dp185g32f	Possible Ordnance

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MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
379	14-4-pm95g31f	Possible Ordnance
380	10-1-nm29g25f	Possible Ordnance
381	10-2-dp31g260f	Possible Ordnance
382	10-2-nm57g13f	Possible Ordnance
383	13-1-dp66g23f	Possible Ordnance
384	13-2-pm40g21f	Possible Ordnance
385	13-3-pm27g17f	Possible Ordnance
386	13-4-dp46g10f	Possible Ordnance
387	12-1-dp40g30f	Possible Ordnance
388	12-2-pm46g33f	Possible Ordnance
389	11-1-pm22g39f	Possible Ordnance
390	11-2-pm39g31f	Possible Ordnance
391	10-1-dp95g21f	Possible Ordnance
392	9-1-dp78g23f	Possible Ordnance
393	8-1-dp247g13f	Possible Ordnance
394	7-1-dp180g23f	Possible Ordnance
395	7-2-dp145g20f	Possible Ordnance
396	6-1-dp138g15f	Possible Ordnance
397	6-2-dp235g26f	Possible Ordnance
398	5-1-pm103g31f	Possible Ordnance
399	5-2-dp53g57f	Possible Ordnance
400	4-1-pm103g15f	Possible Ordnance
401	4-2-dp49g12f	Possible Ordnance
402	2-1-pm110g13f	Possible Ordnance
403	15-1-mc16g4f	Possible Ordnance
404	14-1-dp68g16f	Possible Ordnance
405	13-1-dp53g7f	Possible Ordnance
406	13-2-dp188g28f	Possible Ordnance
407	12-1-pm11g29f	Possible Ordnance
408	11-1-dp528g20f	Possible Ordnance
409	9-1-dp342g22f	Possible Ordnance
410	8-1-dp135g24f	Possible Ordnance
411	8-2-dp72g23f	Possible Ordnance
412	8-1-dp34g16f	Possible Ordnance
413	6-1-pm32g5f	Possible Ordnance
414	5-1-dp47g21f	Possible Ordnance
415	4-1-dp218g25f	Possible Ordnance
416	4-2-dp80g21f	Possible Ordnance
417	3-1-dp146g27f	Possible Ordnance
418	3-2-pm123g17f	Possible Ordnance
419	3-3-dp85g22f	Possible Ordnance
420	1-1-dp112g18f	Possible Ordnance
421	22-1-dp122g37f	Possible Ordnance
422	22-3-nm28g10f	Possible Ordnance
423	22-2-pm17g10f	Possible Ordnance
424	1-1-pm73g12f	Possible Ordnance
425	1-2-pm215g23f	Possible Ordnance
426	2-1-dp185g16f	Possible Ordnance
427	2-2-mc287g46f	Possible Ordnance
428	2-3-dp107g24f	Possible Ordnance
429	1-1-dp55g16f	Possible Ordnance
430	1-2-dp223g45f	Possible Ordnance
431	1-3-dp700g35f	Possible Ordnance
432	1-4-dp97g25f	Possible Ordnance

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
433	5-1-dp89g22f	Possible Ordnance
434	13-1-dp44g15f	Possible Ordnance
435	13-2-dp37g24f	Possible Ordnance
436	14-1-dp28g14f	Possible Ordnance
437	11-1-dp52g44f	Possible Ordnance
438	11-2-dp72g43f	Possible Ordnance
439	10-1-pm41g18f	Possible Ordnance
440	10-2-pm20g11f	Possible Ordnance
441	10-3-dp72g35f	Possible Ordnance
442	10-4-pm74g23f	Possible Ordnance
443	9-1-dp281g31f	Possible Ordnance
444	7-1-dp208g20f	Possible Ordnance
445	7-2-dp125g23f	Possible Ordnance
446	7-3-pm115g10f	Possible Ordnance
447	6-1-dp152g34f	Possible Ordnance
448	6-2-mc175g49f	Possible Ordnance
449	5-1-pm60g11f	Possible Ordnance
450	5-2-pm32g6f	Possible Ordnance
451	5-3-pm63g12f	Possible Ordnance
452	5-4-pm50g7f	Possible Ordnance
453	5-5-dp65g4f	Possible Ordnance
454	5-6-mc6558g70f	Possible Ordnance
455	4-1-dp164g41f	Possible Ordnance
456	4-2-pm177g20f	Possible Ordnance
457	4-3-nm220g17f	Possible Ordnance
458	11-1-dp208g48f	Possible Ordnance
459	11-2-dp28g17f	Possible Ordnance
460	14-1-pm293g50f	Possible Ordnance
461	14-1-pm153g18f	Possible Ordnance
462	15-1-pm136g14f	Possible Ordnance
463	001-1-mc30093g25f	Possible Ordnance
464	022-1-mc31539g13f	Possible Ordnance
465	021-1-mc28767g12f	Possible Ordnance
466	020-1-mc31683g35f	Possible Ordnance
467	018-1-mc31942g23f	Possible Ordnance
468	018-1-mc31657g24f	Possible Ordnance
469	017-1-mc26003g23f	Possible Ordnance
470	017-1-dp67g14f	Possible Ordnance
471	014-1-mc26324g17f	Electromagnetic Anomaly
472	013-1-mc31252g8f	Electromagnetic Anomaly
473	013-2-mc16747g7f	Electromagnetic Anomaly
474	012-1-mc27653g21f	Electromagnetic Anomaly
475	011-1-mc34257g22f	Electromagnetic Anomaly
476	010-1-mc26761g24f	Electromagnetic Anomaly
477	009-1-mc29279g28f	Electromagnetic Anomaly
478	008-1-mc30182g22f	Electromagnetic Anomaly
479	07-1-mc21762g7f	Electromagnetic Anomaly
480	006-1-mc27687g21f	Electromagnetic Anomaly
481	005-1-mc30284g22f	Electromagnetic Anomaly
482	004-1-mc26874g21f	Electromagnetic Anomaly
483	003-1-mc28428g18f	Electromagnetic Anomaly
484	002-1-mc30321g12f	Electromagnetic Anomaly
485	007-1-pm6g10f	Tire
486	010-1-pm38g15f	Lamp

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
487	01-1-nm77g7f	Possible Ordnance
488	01-2-mc187g13f	Pipeline Associated
489	02-1-dp662gEOL	Pipeline Associated
490	03-1-mc795g52f	Pipeline Associated
491	03-2-nm47g6f	Pipeline Associated
492	03-3-nm321g45f	Possible Ordnance
493	03-4-pm190g2f	Possible Ordnance
494	03-5-dp2178gEOL	Possible Ordnance
495	03-6-dp156g18f	Possible Ordnance
496	04-1-dp2770g35f	Pipeline Associated
497	04-2-dp44891g35f	Electromagnetic Anomaly
498	04-3-mc44891g7f	Electromagnetic Anomaly
499	05-1-pm2582g30f	Possible Ordnance
500	05-2-pm705g21f	Pipeline Associated
501	05-3-pm139g13f	Possible Ordnance
502	05-4-nm169g17f	Possible Ordnance
503	06-1-pm1537g21f	Possible Ordnance
504	06-2-dp216g15f	Possible Ordnance
505	06-3-dp2658g33f	Pipeline Associated
506	06-4-pm96g13f	Possible Ordnance
507	06-5-pm90g10f	Possible Ordnance
508	06-6-dp109g12f	Possible Ordnance
509	06-7-pm36g4f	Possible Ordnance
510	07-1-dp1681g38f	Possible Ordnance
511	07-2-pm70g6f	Possible Ordnance
512	07-3-mc3436g43f	Pipeline Associated
513	07-4-dp608g39f	Possible Ordnance
514	08-1-nm61g14f	Possible Ordnance
515	08-2-mc138g24f	Possible Ordnance
516	08-3-dp2380g51f	Pipeline Associated
517	08-4-pm1479g40f	Possible Ordnance
518	08-5-nm20g2f	Possible Ordnance
519	08-6-mc244gEOL	Possible Ordnance
520	09-1-nm157g9f	Possible Ordnance
521	09-2-pm2592g48f	Possible Ordnance
522	09-3-dp129g6f	Possible Ordnance
523	09-4-dp4790g50f	Pipeline Associated
524	09-5-pm23864g4f	Electromagnetic Anomaly
525	09-6-pm34g13f	Possible Ordnance
526	10-1-pm37g24f	Possible Ordnance
527	10-2-dp6063g73f	Pipeline Associated
528	10-3-mc34109g1f	Electromagnetic Anomaly
529	10-4-pm2385g43f	Possible Ordnance
530	10-5-mc92g2f	Possible Ordnance
531	11-1-pm1474g41f	Possible Ordnance
532	11-2-dp2385g29f	Pipeline Associated
533	11-3-mc207g22f	Possible Ordnance
534	11-4-dp52g19f	Possible Ordnance
535	12-1-pm52g7f	Possible Ordnance
536	12-2-nm398g18f	Possible Ordnance
537	12-3-pm75g7f	Possible Ordnance
538	12-4-nm29g4f	Possible Ordnance
539	12-5-nm24g3f	Possible Ordnance
540	12-6-nm115g3f	Possible Ordnance

TABLE 2

MAGNETIC ANOMALY LOCATION AND INTERPRETATION

Congaree River Sediments
Columbia, South Carolina

Designation	Characteristics	Potential Interpretation
541	12-7-nm23g8f	Possible Ordnance
542	12-8-mc457g25f	Possible Ordnance
543	12-9-mc613g30f	Possible Ordnance
544	12-10-nm642g43f	Possible Ordnance
545	13-1-dp244g28f	Possible Ordnance
546	13-2-nm213g24f	Possible Ordnance
547	13-3-nm224g18f	Possible Ordnance
548	13-4-nm156g14f	Possible Ordnance
549	13-5-dp25g9f	Possible Ordnance
550	14-1-nm61g15f	Possible Ordnance
551	14-2-nm234g18f	Possible Ordnance
552	14-3-dp193g23f	Possible Ordnance
553	14-4-dp462g36f	Possible Ordnance
554	14-5-nm19g6f	Possible Ordnance
555	14-6-dp646g26f	Possible Ordnance
556	14-7-dp1357g24f	Possible Ordnance
557	16-1-dp400g18f	Possible Ordnance
558	16-2-pm160g17f	Possible Ordnance
559	16-3-dp368g20f	Possible Ordnance
560	16-4-mc403g30f	Possible Ordnance
561	16-5-pm36g11f	Possible Ordnance
562	16-6-pm12g4f	Possible Ordnance
563	16-7-pm35g13f	Possible Ordnance
564	17-1-dp273g42f	Possible Ordnance
565	18-1-dp527g12f	Possible Ordnance
566	18-2-pm91g8f	Possible Ordnance
567	19-1-dp528g38f	Possible Ordnance
568	19-2-pm166g7f	Possible Ordnance
569	19-3-dp1000g33f	Possible Ordnance
570	20-1-mc48849g8f	Electromagnetic Anomaly

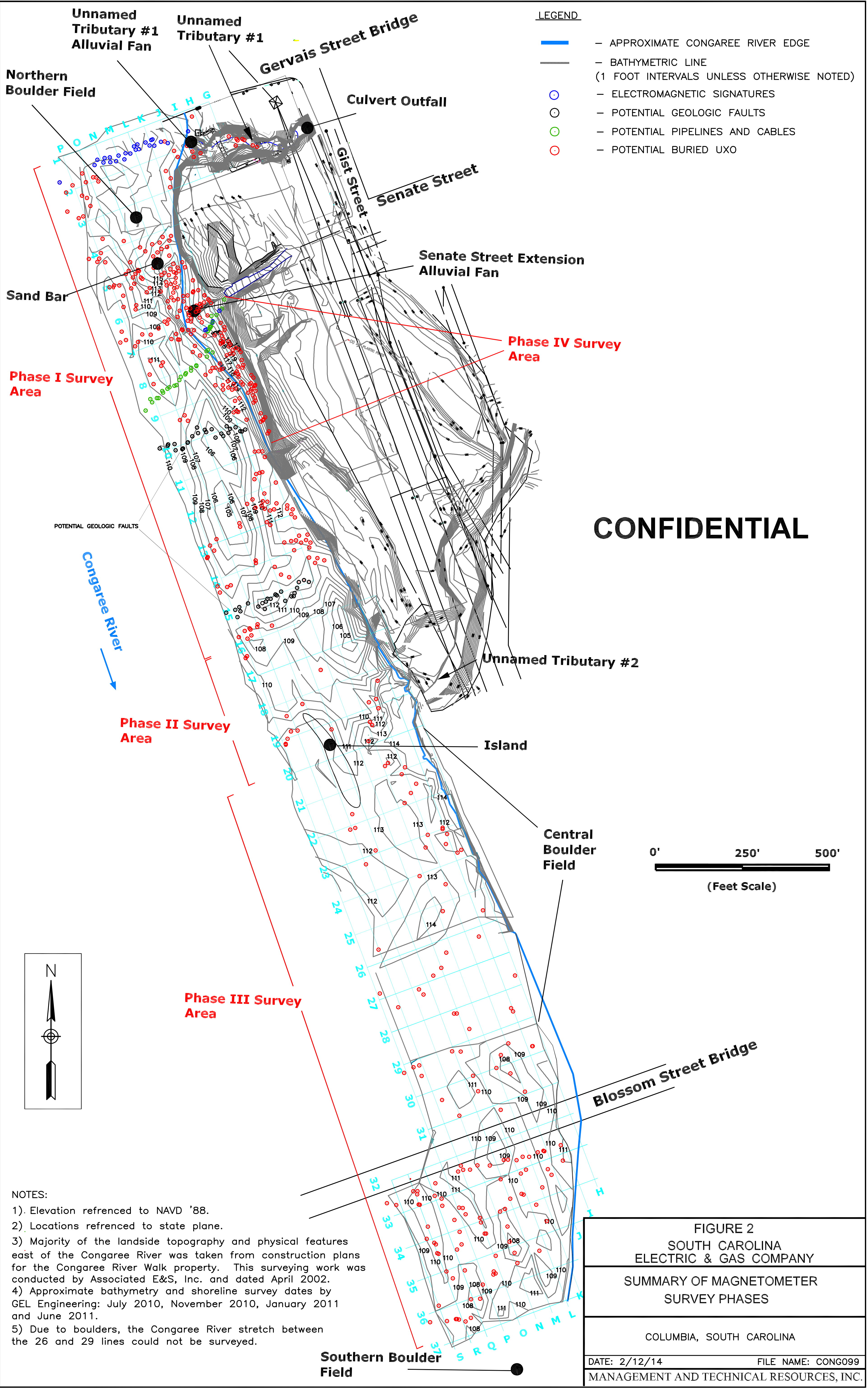
TABLE 3

ANOMALIES BY PLANNED PROJECT AREA

Congaree River Sediments
Columbia, South Carolina

Construction Phase	Potential Ordnance (UXO)	Potential UXO Under the Footprint of the Cofferdam	Other Anomalies	Total Magnetic Anomalies
Field Demonstration Project Area	84	0	17	101
Phase I	84	20	14	118
Phase II	45	9	16	70
Phase III	2	14	17	33
Outside of Project Area	210	0	38	248
Total Anomalies	**425**	**43**	**102**	**570**

Notes:
Please refer to Figures 2 and 3.
1. All magnetometer work was completed by Tidewater Atlantic Research, Inc of Washington, North Carolina.
2. Magnetic Anomalies - As determined by Tidewater by the magnetic, remote-sensing survey.
3. UXO - Unexploded Ordnance
4. UXO Potential - Refering to Magnetic Anomalies that "*have signature characteristics that could be associated with ordnance*" and "*those anomalies should be considered potentially hazardous until material generating the signatures can be identified*".
5. Other - Other magnetic anomalies include pipelines, geologic features, modern debris etc.



NOTES:

1). Elevation refrenced to NAVD '88.

2). Locations refrenced to state plane.

3) Majority of the landside topography and physical features east of the Congaree River was taken from construction plans for the Congaree River Walk property. This surveying work was conducted by Associated E&S, Inc. and dated April 2002.

4) Approximate bathymetry and shoreline survey dates by GEL Engineering: July 2010, November 2010, January 2011 and June 2011.

5) Due to boulders, the Congaree River stretch between the 26 and 29 lines could not be surveyed.

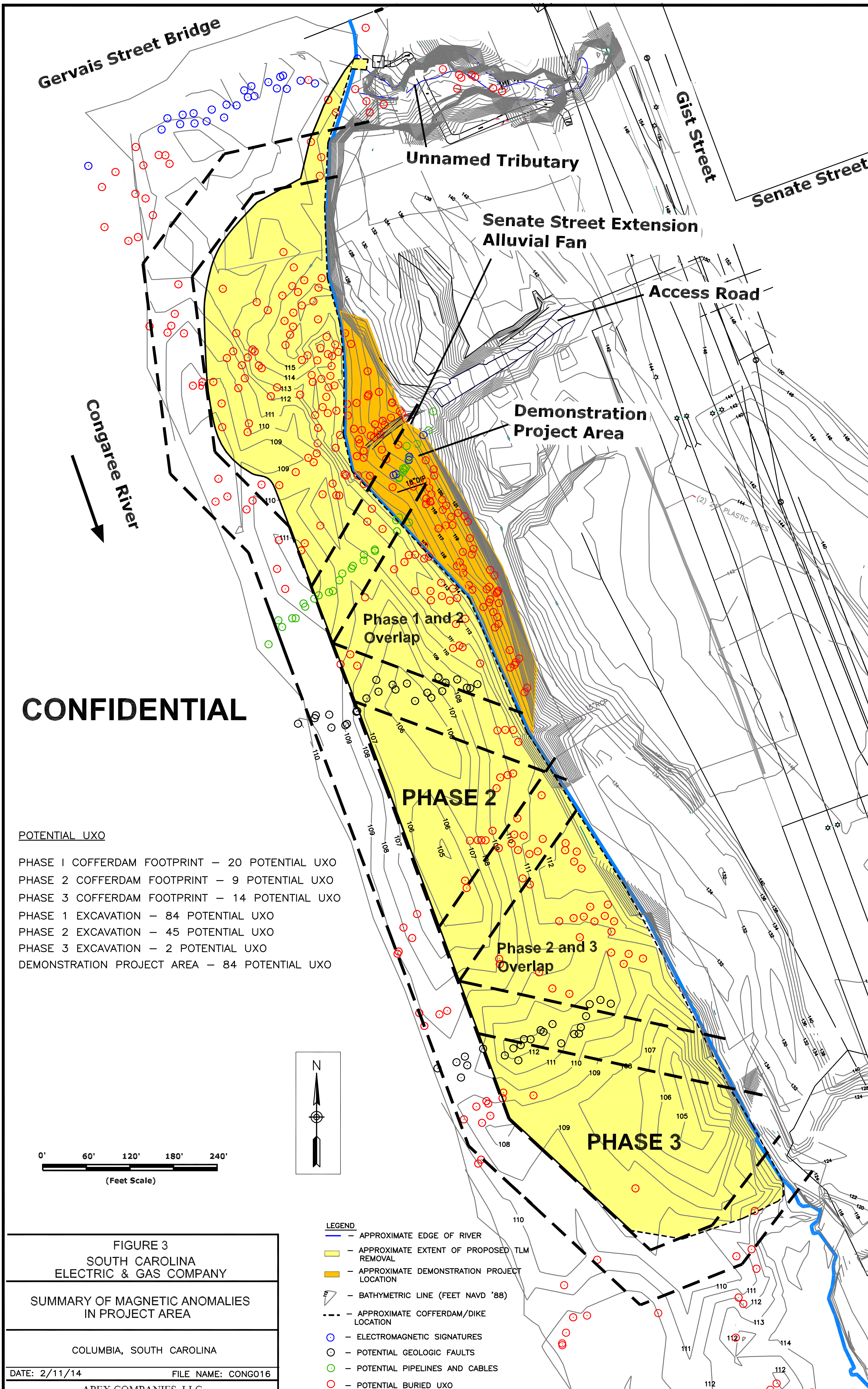
FIGURE 2
SOUTH CAROLINA
ELECTRIC & GAS COMPANY

SUMMARY OF MAGNETOMETER
SURVEY PHASES

COLUMBIA, SOUTH CAROLINA

DATE: 2/12/14 FILE NAME: CONG099

MANAGEMENT AND TECHNICAL RESOURCES, INC.



POTENTIAL UXO

PHASE I COFFERDAM FOOTPRINT – 20 POTENTIAL UXO
PHASE 2 COFFERDAM FOOTPRINT – 9 POTENTIAL UXO
PHASE 3 COFFERDAM FOOTPRINT – 14 POTENTIAL UXO
PHASE 1 EXCAVATION – 84 POTENTIAL UXO
PHASE 2 EXCAVATION – 45 POTENTIAL UXO
PHASE 3 EXCAVATION – 2 POTENTIAL UXO
DEMONSTRATION PROJECT AREA – 84 POTENTIAL UXO

LEGEND

- APPROXIMATE EDGE OF RIVER
- APPROXIMATE EXTENT OF PROPOSED TLM REMOVAL
- APPROXIMATE DEMONSTRATION PROJECT LOCATION
- BATHYMETRIC LINE (FEET NAVD '88)
- APPROXIMATE COFFERDAM/DIKE LOCATION
- ELECTROMAGNETIC SIGNATURES
- POTENTIAL GEOLOGIC FAULTS
- POTENTIAL PIPELINES AND CABLES
- POTENTIAL BURIED UXO

FIGURE 3
SOUTH CAROLINA ELECTRIC & GAS COMPANY

SUMMARY OF MAGNETIC ANOMALIES IN PROJECT AREA

COLUMBIA, SOUTH CAROLINA

DATE: 2/11/14 FILE NAME: CONGO16

APEX COMPANIES, LLC

Attachment A

Inventory of Ordnance Stores

APPENDIX A

Inventory of Ordnance Stores Captured in Columbia, S. C., February 17, 1865

Source: *War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, Ser. 1, XLVII, pt. 1: 180–182.

Article		*Total*
Ball cartridges (no caps)		1,200,000
Percussion caps		100,000
Rifle powder (kegs)	pounds	13,600
Cannon powder (kegs and boxes)	pounds	8,750
Meal powder (kegs and boxes)	pounds	3,800
Case-shot, fixed, 12-pounder gun		183
Fuse-shell, fixed, 12-pounder gun		216
Grape, 12-pounder gun		460
Canister, fixed, 12-pounder gun		148
Shot, fixed, 6-pounder gun		1,680
Case, fixed, 6-pounder gun		550
Fuse-shell, fixed, 6-pounder gun		372
Canister, fixed, 6-pounder gun		1,250
Shot, fixed, 24-pounder gun		112
Shell, fixed, 24-pounder gun		120
Canister, fixed, 24-pounder gun		314
Shell, fixed, 8-inch		64
Shot and shell, not fixed, 8-inch		2,280
Shot and shell, not fixed, 10-inch		1,320
Yager muskets		960
Palmetto rifles		500
Remington rifles		100
Mississippi rifles		200

U.S. muskets, caliber .69	3,440
Enfield rifled muskets	1,900
Enfield rifles (short, sword bayonet)	2,000
Austrian rifled muskets (old)	560
Whitney rifles (old)	50
Springfield rifled muskets	100
Morse rifles (South Carolina)	400
Musket barrels and stocks, unfinished	6,000
Pikes	4,000
6-pounder guns (bronze)	10
6-pounder guns (iron)	4
Blakely guns (rifled, iron)	4
James guns (rifled, bronze)	2
12-pounder mountain howitzers	5
3-inch gun (rifled, iron)	1
10-pounder gun (iron)	2
10-pounder gun (rifled, iron)	1
18-pounder gun (rifled, iron)	2
18-pounder gun (re-enforced, iron)	1
4-inch rifled gun (iron)	1
4-inch mortars	2
1 (.10)-inch Coehorn (bronze)	1
Bronze guns (caliber 1½ inch)	2
2-pounder gun (bronze)	1
Repeating battery (caliber 1 inch)	1
Breech-loading gun (caliber 1½ inch)	1
10-pounder Parrotts found and destroyed by General Hazen	2
Gun carriages	9
Gun caissons	14
Mountain howitzer caissons	3
Forges	2
Sponges and rammers	1,125
Blacksmith vises	20
Anvils	11
Artillery harness, sets	38
Naval cutlasses	175
Artillery sabers	220
Cavalry sabers (all kinds)	2,700
Saber knots	700
Cavalry-pistol holsters, pairs	300
Saber belts	800
Bayonet scabbards	4,000

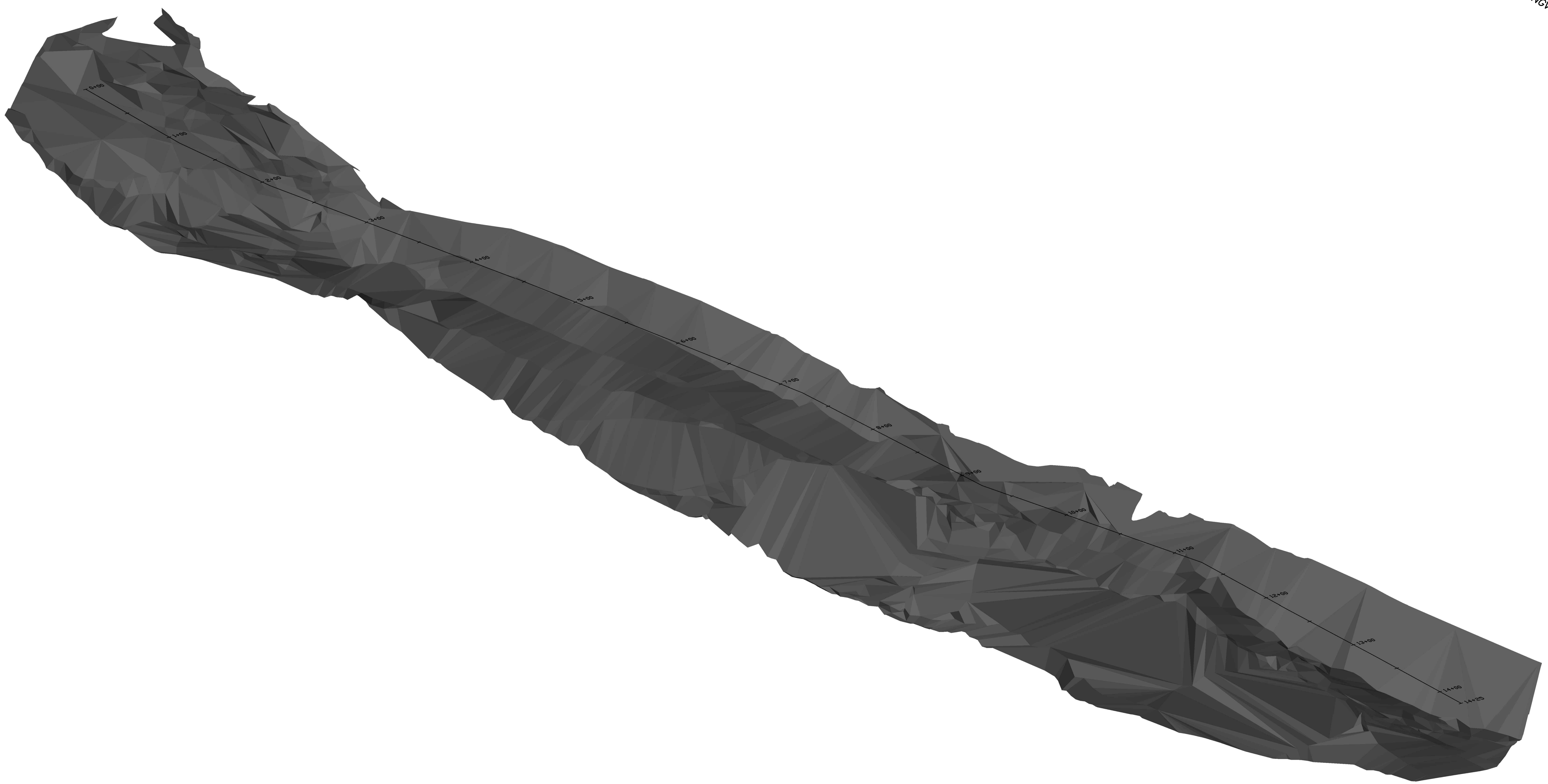
Cartridge-boxes, caliber .54	2,450
Cartridge-boxes, caliber .69	1,400
Cartridge-boxes, caliber .68	300
Cartridge-box plates	3,500
Cartridge-box belts and plates	2,500
Waist-belts	2,900
Waist-belt plates	3,000
Bail screws	2,000
Pistol-cartridge boxes	550
Shot-pouches (gunners)	600
Knapsacks	1,100
Haversacks	900
Slow match, yards	500
Ten-inch fuses	900
Wall tents	8
Wedge tents	50
Cartridge paper, tons	20

Attachment B

Tidewater Reports

APPENDIX S

3D GRAPHIC REPRESENTATIONS



STATE GRID NORTH
BY GNSS
FROM SCVRS
NAD83 (2011)
VERTICAL DATUM NGVD-29

__NOTE:__ THE 3D MESH WAS GENERATED USING AUTOCAD CIVIL 3D 2018 TO CREATE A TIN SURFACE. THE SURFACE WAS GENERATED USING THE GLENN ASSOCIATES SURVEY DATA CAPTURED ON 7/17/18

FIGURE 1

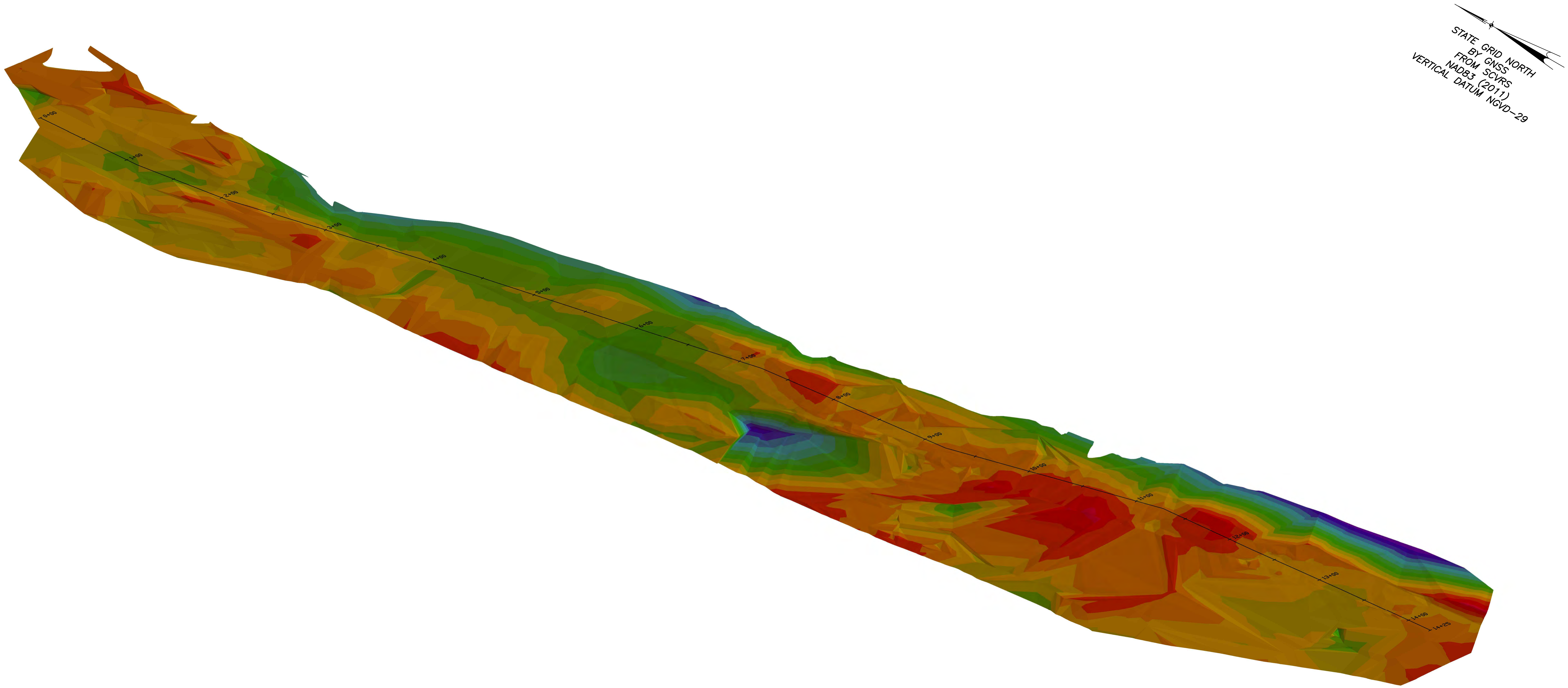
3D REPRESENTATION OF PROJECT AREA RIVER BOTTOM
(5x VERTICAL EXAGGERATION)
AUGUST 29, 2018

0 40' 80' 120' 160'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

DRAWN BY TOMMY MADDALENA

13951-2



NOTE: THE 3D MESH WAS GENERATED USING AUTOCAD CIVIL 3D 2018 TO CREATE A TIN SURFACE. THE SEDIMENT THICKNESS WAS GENERATED BY COMPARING THE GLENN ASSOCIATES SURVEY DATA CAPTURED ON 7/17/18 TO THE TOP OF BEDROCK DATA PROVIDED BY APEX ON 8/20/18.

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area (sqft)	Color
1	-3.00	-2.00	400.27	
2	-2.00	-1.00	5,162.36	
3	-1.00	0.00	25,035.40	
4	0.00	1.00	74,709.49	
5	1.00	2.00	83,475.58	
6	2.00	3.00	58,046.13	
7	3.00	4.00	34,035.74	
8	4.00	5.00	17,444.67	
9	5.00	6.00	12,280.78	
10	6.00	7.00	7,063.90	
11	7.00	8.00	3,640.52	
12	8.00	9.00	2,603.89	
13	9.00	10.00	1,399.74	
14	10.00	11.00	650.39	
15	11.00	12.00	300.87	
16	12.00	13.00	3.48	

GLENN ASSOCIATES SURVEYING, INC.

FIGURE 2

3D REPRESENTATION OF PROJECT AREA RIVER BOTTOM CONTOURS WITH SEDIMENT THICKNESS SHOWN VIA COLOR VARIATION

AUGUST 29, 2018

0 40' 80' 120' 160'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

DRAWN BY TOMMY MADDALENA

13951-2

SURFACE COMPARISON: TOP OF SEDIMENT COMPARED TO TOP OF BEDROCK
VOLUME = 25,550 yd^3

NOTE: THE VOLUME WAS CALCULATED USING AUTOCAD CIVIL 3D 2018 TO CREATE A TIN VOLUME SURFACE. THIS SURFACE WAS CREATED BY USING THE GLENN ASSOCIATES SURVEY DATA CAPTURED ON 7/17/18 AS THE BASE SURFACE AND THEN COMPARED IT TO THE BEDROCK DATA PROVIDED BY APEX ON 8/20/18.

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area (sqft)	Color
1	−3.00	−2.00	400.27	
2	−2.00	−1.00	5,162.36	
3	−1.00	0.00	25,035.40	
4	0.00	1.00	74,709.49	
5	1.00	2.00	83,475.58	
6	2.00	3.00	58,046.13	
7	3.00	4.00	34,035.74	
8	4.00	5.00	17,444.67	
9	5.00	6.00	12,280.78	
10	6.00	7.00	7,063.90	
11	7.00	8.00	3,640.52	
12	8.00	9.00	2,603.89	
13	9.00	10.00	1,399.74	
14	10.00	11.00	650.39	
15	11.00	12.00	300.87	
16	12.00	13.00	3.48	

GLENN ASSOCIATES SURVEYING, INC.

FIGURE 3
PLAN VIEW OF PROJECT AREA
SHOWING SEDIMENT THICKNESS
AUGUST 29, 2018

0 50' 100' 150' 200'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

DRAWN BY TOMMY MADDALENA

13951-2

SURFACE COMPARISON: TLM TOP COMPARED TO TLM BOTTOM
VOLUME = 5,745 yd^3

NOTE: THE VOLUME WAS CALCULATED USING AUTOCAD CIVIL 3D 2018 TO CREATE A TIN VOLUME SURFACE. A SURFACE WAS CREATED FOR TOP OF TLM AND THEN COMPARED TO A SURFACE CREATED FOR BOTTOM OF TLM. THE TLM DATA USED TO CREATE THESE SURFACES WAS PROVIDED BY APEX ON 8/20/18.

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area (sqft)	Color
1	-5.00	-4.50	0.00	
2	-4.50	-4.00	0.63	
3	-4.00	-3.50	519.48	
4	-3.50	-3.00	1,488.65	
5	-3.00	-2.50	3,383.48	
6	-2.50	-2.00	8,283.48	
7	-2.00	-1.50	15,148.78	
8	-1.50	-1.00	26,679.52	
9	-1.00	-0.50	45,356.56	
10	-0.50	0.00	202,787.99	

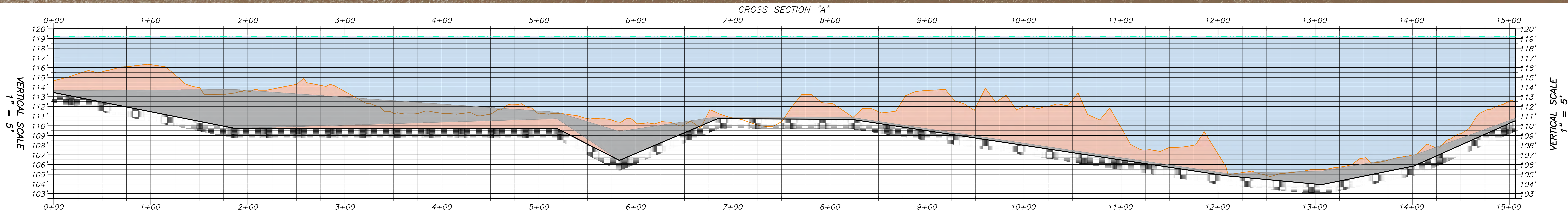
FIGURE 4
PLAN VIEW OF TLM DISTRIBUTION AND THICKNESS OVER THE PROJECT AREA
AUGUST 29, 2018

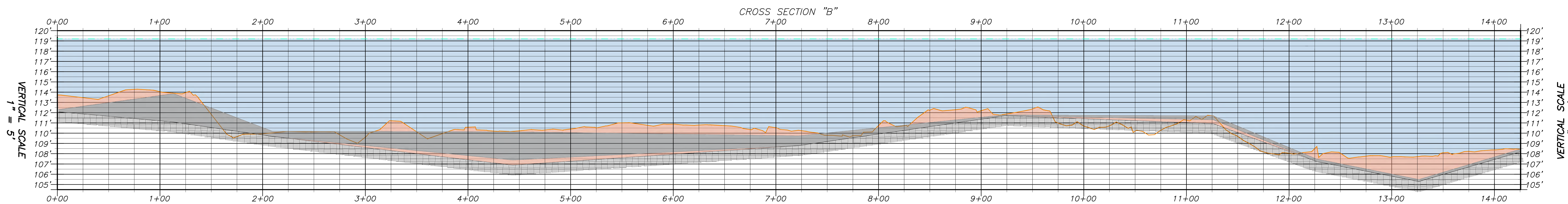
0 50' 100' 150' 200'

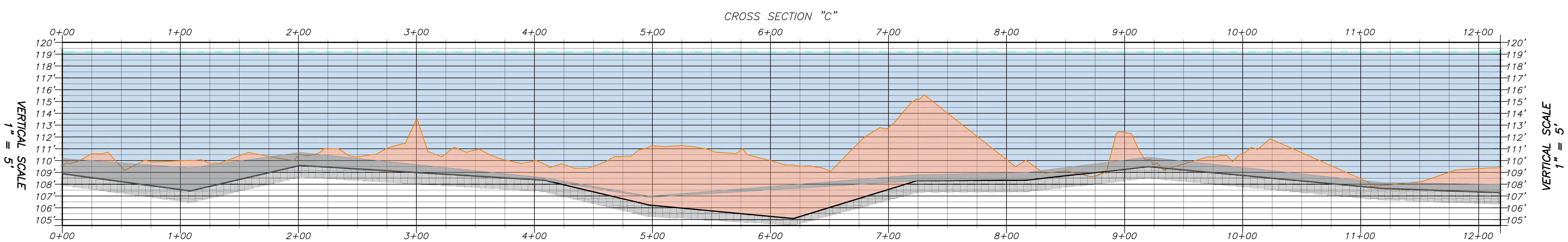
SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

DRAWN BY TOMMY MADDALENA

13951-2







LEGEND

- WATER
- SEDIMENT
- TLM
- BEDROCK

FIGURE 5

CROSS-SECTIONS SHOWING SEDIMENT AND TLM THICKNESS OVER THE PROJECT AREA

AUGUST 29, 2018

0 50' 100' 150' 200'

SURVEYED BY GLENN ASSOCIATES SURVEYING, INC.
P.O. BOX 12 JENKINSVILLE, S.C. 29065 telephone (803) 345-5297

GLENN ASSOCIATES SURVEYING, INC.

DRAWN BY TOMMY MADDALENA

13951-2