State of South Carolina

Integrated Report for 2004

Part II: *Assessment and Reporting*

Submitted 4/1/2004

PREFACE

The South Carolina Department of Health and Environmental Control (SCDHEC) prepared this report as a requirement of Section 305(b) of Public Law 100-4, last reauthorized and commonly known as The Clean Water Act (CWA) of 1987, and as a public information document. The report presents a general assessment of water quality conditions and water pollution control programs in South Carolina. SCDHEC has published Watershed Water Quality Management Assessments (WWQA), that contain information pertaining to the specific watersheds and give a more complete picture of the waters referenced in this document. Section 303(d) of the CWA requirements will be submitted separately and are not included in this document.

The determinations of surface water quality were based on data collected by SCDHEC at ambient water quality monitoring stations, point source permit required monitoring and evaluation of nonpoint source (NPS) data. Other information in this report was obtained from SCDHEC programs associated with water quality monitoring and water pollution control.

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EXECUTIVE SUMMARY

The Clean Water Act (CWA) states "it is the national goal that wherever attainable, an interim goal of water quality that provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water shall be achieved by July 1, 1983."

The State of South Carolina has promulgated S.C. Regulation 61-68, *Water Classifications and Standards* and S.C. Regulation 61-69, *Classified Waters* that establish specific standards and general rules to protect and maintain these uses and designate classified uses for each waterbody. It is the intent and purpose of the regulations that waters that meet standards shall be maintained and waters that do not meet standards shall be improved.

S.C. Regulation 61-68 was modified effective June 2001 to include numeric total phosphorus, total nitrogen, and chlorophyll *a* criteria for lakes, and numeric turbidity criteria for all waters. This regulation update also changed the basis for several freshwater metals criteria.

Based on modified United States Environmental Protection Agency (USEPA) River Reach File (RF3), within the State of South Carolina's borders, there are approximately 29,794 miles of rivers; 407,505 acres of lakes; and 401 square miles of estuaries. Quality assured water quality data collected from 1998 through 2002 provided the database for this assessment. Physical, chemical, and biological data were available for 15,312 miles of rivers; 227,275 acres of lakes; and 221 square miles of estuaries. SCDHEC monitoring stations provide a representative database due to their strategic locations. Evaluation of these data determines if water quality in rivers, lakes, and estuaries is suitable to support State classified uses. The following tables include the level of use support for the waters of South Carolina and the cause of nonattainment affecting the largest size in each waterbody type for aquatic life and primary contact recreation uses.

Aquatic Life Use Support

Waterbody Type	Fully Supported	Partially Supported	Not Supported	Predominant Cause
Rivers	65%	12%	23%	Dissolved Oxygen
Lakes	63%	17%	20%	pH
Estuaries	68%	14%	18%	Dissolved Oxygen

Recreational Use Support

Waterbody Type	Fully Supported	Partially Supported	Not Supported	Predominant Cause
Rivers	59%	22%	19%	Fecal Coliform
Lakes	99%	1%	<1%	Fecal Coliform
Estuaries	94%	4%	1%	Fecal Coliform

BACKGROUND

1. Resource Overview

The following table gives a representation of state population and geographical information.

Table 1. Atlas

Topic	Value
State Population	3,602,900
State Surface Area (square miles)	30,203
Total miles of rivers and streams	29,794
- Border Miles	408
- Border Rivers: Chattooga, Tugaloo, Savannah, Catawba	
- Border Lakes: Hartwell, Thurmond, Russell, Wylie	
Number of lakes/reservoirs/ponds	
- 10 - 1000 acres (total acreage of 60,335)	1,598
- >1000 acres (total acreage of 461,402)	19
Estuarine waters (square miles)	401
Total miles of Ocean Coast	190
Freshwater wetlands (acreage)	4,146,510
Tidal wetlands (acreage)	512,490

2. Total Waters

The United States Environmental Protection Agency (USEPA) has developed a system to determine estimates of total river miles and total lake acres for the states to use in reporting for §305(b) reports. This system is based on the Digital Line Graph (DLG) database and the River Reach File 3 (RF3), that are in turn based on the United States Geological Survey (USGS) 1:100,000 scale topographic maps. The original DLG database was missing several lakes of relatively recent construction as well as a significant number of streams. Many of these missing features have been added by SCDHEC, with the cooperation and oversight of the USEPA. This revised system was utilized in this §305(b) report to estimate the sizes of the different use support categories, cause sizes, and source sizes for the Rivers and Streams, and Lakes summary statistics. Other base maps were used to estimate sizes for the Clean Lakes Program, Estuaries, and Shellfish Restrictions/Closures. These alternative databases are identified in the appropriate sections.

3. Water Pollution Control Program

A. Watershed Approach

SCDHEC conducts water quality assessment and protection on a watershed basis in order to promote a coordinated approach to river basin development and water quality maintenance or improvement, to better address congressional and legislative mandates, to better utilize current resources, and to better inform the public and regulated community of existing and future water quality issues. Watershed water quality management recognizes the interdependence of water quality and all the activities that occur in the associated drainage basin including: monitoring, assessment, problem identification and prioritization, water quality modeling, planning, permitting, and other activities. In the Watershed Water Quality Assessments (WWQA), these activities are integrated by basin leading to watershed management plans and implementation strategies and serve to appropriately refocus water quality protection efforts.

Watershed water quality management planning and strategy development provides SCDHEC with the tools and information necessary for program implementation. The planning process and the resulting strategy provide a structured and predictable schedule for carrying out program elements to ensure the protection of the State's water resources. While an important aspect of the program is water quality problem identification and problem solving, the emphasis of the program is on problem prevention.

SCDHEC has divided the state into eight major drainage basins along USGS hydrologic units (Figure 1), encompassing approximately 280 Natural Resources Conservation Service (NRCS) watersheds. These watersheds serve as the hydrologic boundaries that guide SCDHEC water quality activities. The majority of water quality activities in these watersheds are based on a five-year rotation.

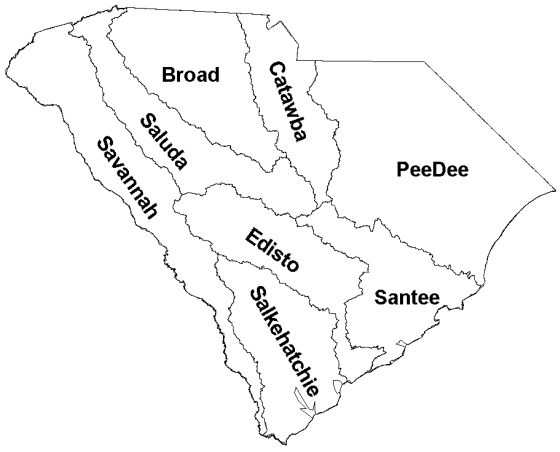

Figure 1. South Carolina Watershed Water Quality Management Basins

For most activities the Savannah and Salkehatchie basins are addressed in the same year, as are the Saluda and Edisto basins, and the Catawba and Santee basins. Five years are required to assess all basins in the State, and National Pollutant Discharge Elimination System (NPDES) permits have a five-year lifespan. Each year SCDHEC revises the assessment for the targeted basin(s). Planning on a watershed basis is consistent with basic ecological principles of watershed management. It allows the coordination of implementation activities so that all actual and potential impacts on water quality can be evaluated. Both point source and nonpoint source impacts can be evaluated

when making water quality protection decisions. Problem areas in a particular drainage basin can be identified and existing and potential contributors can be examined. Subsequently, waste assimilative capacities can be determined and allocated in a more equitable fashion.

Proposed permit issuances within a watershed are consolidated and presented to the public in groups rather than one at a time. By issuing all the NPDES permits during the same period, SCDHEC will be able to realize a resource savings and the public will realize an information advantage since all of the permitting activity for a specific area will occur in a specified period of time when public notices and public meetings and hearings will be conducted.

The watershed management process also focuses resources. Limited resources require targeting work efforts in order to maximize useful results. Focusing on specific basins each year allows SCDHEC to coordinate staff activities to make efficient use of available resources. While the statewide ambient monitoring network is maintained, the monitoring strategy has been revised so the district monitoring staff concentrate on the targeted basin(s). The monitoring activities support the development of wasteload allocations and total maximum daily loads (TMDLs). Developing wasteload allocations and TMDLs on a watershed basis allows for an equitable assessment of all actual and potential impacts on the water quality from both point sources and nonpoint sources. Focusing decision making efforts in a single watershed will highlight the need to examine water quality standards and use designation for the appropriate waterbodies. An examination of the water quality and use designations may point to the need for site specific standards or stream classification changes.

In preparing the eight watershed assessments and in updating and revising each one on a five-year rotation, SCDHEC will be able to respond more efficiently, and in a timely manner, to federal requirements. More importantly, SCDHEC will be better able to utilize available resources, coordinate water quality improvement efforts, and protect water quality in South Carolina. These watershed assessments serve as a starting point to fulfill a number of EPA reporting requirements. EPA requires various reporting activities under §303(d), §305(b), §314, and §319 of the Clean Water Act (CWA).

B. Water Quality Standards and Classifications

S.C. Regulations 61-68, *Water Classifications and Standards* and S.C. Regulation 61-69, *Classified Waters* were promulgated by SCDHEC pursuant to the South Carolina Pollution Control Act (48-1-10, *et seq*, S.C. Code of Laws, 1976).

The water quality standards regulation contains provisions that provide for the protection and maintenance of the existing and classified uses of the waters of the State. The water quality standards include general rules and specific water quality criteria, both narrative and numeric, to protect those classified and existing uses as well as antidegradation rules to protect the public health and welfare and maintain and enhance water quality.

The water quality standards also serve as the basis for decisions in the other water quality program areas. NPDES permit limitations for waste discharges are determined according to the

classification and standards of the receiving water. The standards and classifications also affect the control of toxic substances, thermal discharges, stormwater discharges, dredge and fill activities, and other water related activities. SCDHEC implements the antidegradation rules through its regulatory programs.

S.C. Regulation 61-69 alphabetically lists the waterbodies in South Carolina that have been specifically classified by name, gives the classification, describes the boundaries of the use classification, the county of location, and any applicable site-specific standards.

Revisions to water quality standards and any reclassification of waters of the State require a public hearing process, approval by the Board of SCDHEC, approval by the General Assembly, and publication in the State Register. S.C. Regulation 61-68 and 61-69 were last amended on June 22, 2001.

Surface Water Classes - Freshwaters

Table 2. Freshwater Classifications and Descriptions

Freshwaters	**Description**
Outstanding National Resource Waters	Exceptional national recreational and/or ecological resource.
Outstanding Resource Waters	Exceptional recreational and/or ecological resource and suitable for drinking water source with minimal treatment.
Trout Waters - (3 types) Natural Put, Grow and Take Put and Take	Suitable for supporting reproducing and/or stocked trout populations and cold water indigenous aquatic community and the survival and propagation of aquatic life. Primary and secondary recreational contact including fishing and as drinking water source. Suitable for industrial and agricultural uses. (See Freshwater Description)
Freshwater	Suitable for the survival and propagation of aquatic life; fishing and primary and secondary recreational contact and as drinking water source. Suitable also for industrial and agricultural uses.

Surface Water Classes - Saltwaters

Table 3. Saltwater Classifications and Descriptions

Saltwaters	Description
Outstanding National Resource Waters	Exceptional national recreational and/or ecological resource.
Outstanding Resource Waters	Exceptional recreational and/or ecological resource.
Shellfish Harvesting Waters	Suitable for survival and propagation of aquatic life; primary and secondary contact recreation. Suitable for harvesting of shellfish, crabbing, and fishing for market purposes and/or for human consumption.
Class SA	Suitable for survival and propagation of aquatic life; primary and secondary contact recreation; crabbing and fishing for market purposes and/or human consumption.
Class SB	Suitable for survival and propagation of aquatic life; primary and secondary contact recreation; crabbing and fishing for market purposes and/or human consumption.

Groundwater Classes

Table 4. Groundwater Classifications and Descriptions

Groundwater Type	Description
Class GA	Vulnerable to contamination due to hydrological characteristics.
Class GB	Suitable as an underground source of drinking water. All groundwaters of the State unless otherwise classified.
Class GC	Not suitable for underground drinking water source.

The following table summarizes the uses of each of the surface water classifications. No degradation of existing uses is permitted regardless of classification and no degradation of natural conditions is allowed in Outstanding Resource Waters or Outstanding National Resource Waters.

Table 5. Summary of Supported Classified Uses for South Carolina

Uses	Description
Fish and wildlife	All classes
Domestic water supply	All freshwater classes
Primary contact recreation	All classes
Secondary contact recreation	All classes
Industrial	All freshwater classes
Agriculture	All freshwater classes
Navigation	All classes

Reclassifications

SCDHEC is presently reclassifying several waterbodies to recognize their best and/or existing uses. Most reclassifications are initiated after receiving a written request from an individual, special interest group, or organization. SCDHEC also proposes waters for reclassification where existing water quality is better than required to protect the classified uses or if there is an existing use not recognized by the present classification. Another addition to the classification system is the designation of No Discharge Zones (NDZs). NDZs relate specifically to the discharge of treated waste from Marine Sanitation Devices (MSDs) and are authorized pursuant to §312 of the Federal Clean Water Act. Waters of the State designated as NDZ prohibit any discharge from MSDs into these waters and require that the MSDs be pumped out at an appropriate facility. SCDHEC has designated six waterbodies as NDZs and is currently considering designating other coastal waters as NDZs.

Site-specific criteria applicable to a single waterbody is also incorporated into R.61-69. SCDHEC has proposed the amendment of a dissolved oxygen (DO) standard for the lower Saluda River which is classed as a Trout- Put, Grow, and Take waterbody. The revised DO standard will better protect the trout resources of this waterbody.

Water reclassifications, NDZ designations, and site-specific criteria are amendments to state regulation and, as such, are not effective until approved by the South Carolina General Assembly and published in the State Register.

C. Point Source Program - Municipal Facilities

The EPA has delegated the authority to SCDHEC for administering the National Pollutant Discharge Elimination System (NPDES) Program within the State. As a functional part of this NPDES program, all municipal and private domestic wastewater treatment works that discharge to

surface water in South Carolina are monitored by the Bureau of Water (BOW). Permit effluent limits of each surface water discharge are derived using water quality models and other tools.

Loan Program

Beginning with fiscal year 1989, the state established a State Revolving Loan Fund (SRF) program, with EPA providing annual capitalization grants to seed the SRF program. This program is a low-interest, revolving loan program established pursuant to Public Law (P.L. 100-4), Water Quality Act of 1987. The State, in accordance with EPA requirements, has established a project priority rating system. The State's priority list ranks each wastewater treatment project need as well as other projects based on water quality and sludge disposal needs.

Projects receiving SRF loans since fiscal year 1989 have totaled over $425,753,822 million through June 30, 2003.

The result of the newly constructed or upgraded treatment works using these funding sources has been improved wastewater treatment resulting in favorable water quality benefits. This construction has eliminated poorly treated effluent from many streams and provided improvements to facility capacity. The improvement of water quality has been seen by routine monthly discharge monitoring reports (DMRs) submitted by each treatment plant owner to SCDHEC. As an overall result, the SRF helps to improve and maintain water quality.

Pretreatment and Toxicity Program

The implementation of SCDHEC pretreatment program continues. The State approves implementation pretreatment programs for Publicly Owned Treatment Works (POTWs). The pretreatment programs are typically updated upon permit renewal or when the facility expands the discharge. An assessment of program requirements is conducted to insure that the latest pretreatment regulation requirements are in place. There has been a direct benefit to in-stream water quality demonstrated from many, if not all, of the implemented pretreatment programs. With the implementation of approved programs many industries previously discharging untreated wastewater to a POTW must pretreat their discharges. This has resulted in a significant reduction in the amounts of materials (contaminants) that POTWs are now receiving from the industries. This allows the POTW to adequately treat all wastewater prior to discharging to a State stream, resulting in the ability to better maintain the existing stream water quality standards.

Since FY 89 all major, significant minor (minors with pretreatment programs) and selected other permits have been issued or reissued with effluent toxicity monitoring requirements to be performed as appropriate based on the information related to the discharge characteristics. Depending on the in-stream waste concentration and presence or absence of a diffuser, there can be either an acute test, chronic test, or both required. The toxicity testing typically will be multi concentration tests that will allow an assessment of the potential toxicity of the effluent at varying concentrations.

Stormwater Controls

South Carolina has no known combined stormwater/sanitary sewer discharges associated with POTWs. Combined sewers are usually prohibited by local ordinance to preclude overloading treatment systems with stormwater. Stormwater runoff control on POTW sites is mandatory in some areas of the State.

SCDHEC is implementing a state stormwater permitting program policy in support of EPA guidelines of requirements required by the 1987 amendments to the Clean Water Act. See the Section on Stormwater Permits under "D. Point Source Program - Industrial and Agricultural Facilities."

Land Application of Treated Waste

SCDHEC issues State discharge permits to facilities that discharge directly to land as spray irrigation. This involves the application of, at least, secondary-treated wastewater to land surfaces with the applied effluent being further treated as it percolates through the plant-soil matrix. A portion of the applied effluent percolates to groundwater, some is absorbed by vegetation, and some evaporates to the atmosphere.

The primary objectives of this program are:

(a) Treatment and disposal of applied wastewater without exceeding ground-water quality standards as specified in S.C. Regulation 61-68 *Water Classifications and Standards*.

(b) Economic return from use of treated effluent, water and nutrients, to produce marketable crops.

(c) Water conservation by replacing potable water with treated effluent.

(d) Preservation of open space through vegetation.

As a permit requirement, a program for monitoring the quality of groundwater is typically established and implemented. Proper placement of ground-water monitoring wells will provide a check on the effectiveness of the wastewater renovation and will serve as an early warning system for ground-water quality protection for nearby ground-water users. The direction of groundwater flow determines the placement of ground-water monitoring wells.

Strategies to Improve the Municipal Permitting Program

SCDHEC district personnel inspect the operation and maintenance programs of POTWs on a routine basis. Deficiencies noted during inspections are conveyed to the POTW and may require SCDHEC to take formal enforcement action. Operational advice is provided on a limited basis by

SCDHEC staff. The South Carolina Environmental Training Center at Sumter Area Technical College also provides training for treatment plant operators.

SCDHEC has developed sludge management regulations and guidance for permittees. All NPDES permits issued or reissued have sludge disposal requirements. The permit typically requires the sludge generator to monitor the content of its sludge and to dispose of it in an environmentally acceptable manner. The permit authorizes specific methods (e.g., land application, land filling, etc.) and procedures to be fully implemented.

D. Point Source Program - Industrial and Agricultural Facilities

Industrial Facilities

SCDHEC reviews NPDES permit applications for new and existing facilities and determines whether treatment must be technology-based or based on water quality standards. The more stringent of these derived numbers are used as the applicable permit limits. Effluent guidelines, where promulgated by EPA, are used to determine technology-based limits. If EPA effluent guidelines have not been developed, best professional judgment of technology-based limits is used. Water quality limits are developed using computerized water quality modeling procedures that result in wasteload allocations for constituents affecting in-stream oxygen levels. South Carolina water quality standards and/or biological monitoring are used to determine limits for potentially toxic constituents. Where appropriate, permit limits are developed using a combination of water quality limitations for specific constituents, whole effluent toxicity limits, and in-stream biological monitoring to insure no adverse impacts from industrial point source dischargers.

Agricultural Facilities

Unregulated wastewater discharges from concentrated animal production or fruit and vegetable processing facilities may affect water quality. Additionally, South Carolina does not allow surface water discharges from these facilities under any circumstances. To ensure these wastes do not enter the waters of the State, SCDHEC requires that both solid and liquid agricultural wastes from these facilities be collected, treated, and disposed in an environmentally acceptable manner. This is accomplished through a State permitting and inspection program requiring recycling or land application of agricultural wastes. This type of disposal eliminates the need for direct surface water discharges of agricultural wastes and is effective in insuring water quality. In accordance with the 25-year, 24-hour storm event discharge exemption in the NPDES regulations for these animal facilities, an NPDES permit is not required as long as the exemption criteria are met. SCDHEC agrees with EPA that animal facilities that have or will have a discharge that was or is not caused by a 25-year, 24-hour storm event must have NPDES permit coverage since these discharges are not eligible for the 25-year, 24-hour storm event discharge exemption. Therefore, a general NPDES permit is being developed for use in this program to cover these situations. The general permit will be a strict no discharge permit and will not allow a discharge to surface water under any circumstances even though the federal effluent guidelines for animal facilities do allow discharges. South Carolina's state agricultural program is and will continue to be more stringent than the federal NPDES program for animal facilities. SCDHEC has drafted a general permit for

Confined Animal Feeding Operations (CAFOs) based on federal recommendations and guidelines, but modified to reflect the requirements of South Carolina's Regulation 61-43, *Standards for the Permitting of Agricultural Animal Facilities*.

Toxics Controls

Toxic pollutants are generally defined as substances that by themselves, or in combination with other chemicals, are harmful to animal life or human health. They include some of the metals, pesticides, and other synthetic organic pollutants that have the potential to contaminate water, fish tissue, and bottom sediments. Each NPDES permit application is reviewed for potential toxic pollutants. These pollutants are evaluated for aquatic life and human health concerns. If determined to be potentially toxic, a limitation is placed in the NPDES permit for that specific pollutant using South Carolina water quality standards. SCDHEC has EPA-approved standards for specific pollutants. Whole effluent toxicity testing is placed in many NPDES permits; those tests being for acute and/or chronic monitoring as appropriate. In-stream biological assessments are also being utilized in some cases (i.e., to evaluate stormwater runoff).

Land Application of Treated Wastewater

The process utilized for industrial and agricultural facilities is the same as that for municipal facilities. However, limitations for the spray effluent are not permitted as secondary limits, but are based on site-specific requirements.

Stormwater Permits

SCDHEC regulates storm water discharges associated with industrial activities. The State has issued two general NPDES permits for activities associated with industry. These permits are the Construction Activity NPDES Permit and the Associated with Industrial Activity, except construction, NPDES Permit.

The general permits require permittee's to develop and implement Storm Water Pollution Prevention Plans (SWPPPs) that will minimize pollutants in their storm water discharges. Some industrial activities, except construction, must monitor on either an annual or semiannual basis while all industrial activities, except construction, are required to update their SWPPP's on an annual basis. Industrial construction activities are required to conduct inspections weekly and after every rainfall event of 1 inch or greater.

Where appropriate, individual NPDES permits will be issued in accordance with EPA's tiered permitting strategy. Water quality monitoring will help identify the industrial activities that must receive individual permits instead of general permits. In the watershed approach, the individual permits will be tailored to address the water quality concerns of the storm water discharges from industrial activity.

SCDHEC also regulates Municipal Separate Storm Sewer Systems (MS4s) in the overall storm water program. There were only two medium-sized MS4s in SC (both counties) that fell under the

Phase I Storm Water NPDES program and both of these permits have been issued. With the promulgation of the Phase II Storm Water NPDES Permit regulations, there is an additional MS4 (a city) in South Carolina. SCDHEC has received an application for this MS4 and is presently reviewing the application to determine how to permit the MS4. Either an individual NPDES permit will be issued for this MS4 or the applicant will be made a co-permittee of the applicable county's existing MS4 permit. These permits help insure water quality protection within the boundaries of the affected municipal governments. SCDHEC has issued a general permit for small MS4s, but the permit has been appealed.

E. Permit Compliance and Enforcement

Compliance tracking is a complex activity that involves various program elements and activities within the Bureau of Water. Regulatory functions require ongoing monitoring of all permits, inspection activities, and investigatory work. A computer based tracking system, the WPC Network, is maintained for the storage, retrieval, and management of permit compliance information for individual permits, including all effluent limits and compliance schedule data, facility operation and maintenance and pretreatment status. The availability of this information and ability to manage the data electronically enhances the Bureau information base providing greater program management capabilities.

All data necessary for issuing permits and tracking the compliance of those individual permits is maintained on the Bureau's network. Staff have access to information on permitting status, compliance monitoring, enforcement status, etc.

The WPC Network is designed to interface with EPA's Permit Compliance System (PCS). Updated compliance data is batched to PCS weekly. The Bureau is continuing its efforts to improve its utilization of the computer generated EPA Quarterly Noncompliance Report (QNCR).

Enforcement activities are performed in order to identify and appropriately respond to facilities in permit noncompliance and other entities found to be in violation of state statutes and regulations. Data accessibility through the Bureau's networking system, as well as organizational changes, have greatly enhanced enforcement staff capabilities for efficient case development and management. Improvements in entry of limits and data will further improve tracking and enforcement efficiency.

An emphasis on enforcement activity will continue in accordance with implementation of the Bureau's Watershed Water Quality Management Program. Appropriate and timely enforcement responses in conjunction with the activities of other program areas are expected to contribute significantly to accomplishment of this program's goals through the development of TMDLs.

Enforcement staff will become more involved in the referral of cases for criminal investigation and providing assistance to criminal investigators. A greater emphasis has been placed upon pursuing prosecution of violators under the criminal statutes and the support and assistance of enforcement staff in this process will continue to be invaluable; however, criminal and administrative investigations must be conducted separately.

It is recognized that aggressive enforcement activity encourages compliance. In this regard, enforcement staff are committed to secure for South Carolina the benefits from these activities to protect our water resources through implementation of appropriate enforcement strategies. The development and continued improvement of automated tools and methodology to accomplish this is considered to be vital to this function and will be given priority.

F. Nonpoint Source Program

Nonpoint Source (NPS) water pollution generally comes from diffuse, numerous sources. Runoff occurring after a rain event may transport sediment from plowed fields, construction sites, or logging operations, pesticides and fertilizers from farms and lawns, motor oil and grease deposited on roads and parking lots, or bacteria containing waste from agricultural animal facilities or malfunctioning septic systems. The rain moves the pollutants across the land to the nearest water body or storm drain where they may impact the water quality in creeks, rivers, lakes, estuaries and wetlands. Nonpoint source pollution may also impact groundwaters when it is allowed to seep or percolate into aquifers. The adverse effects of NPS pollution include physical destruction of aquatic habitat, fish die-offs, interference with or elimination of recreational uses of a water body (particularly lakes), closure of shellfish beds, reduced water supply or taste and odor problems in drinking water, potential human health problems due to bacteria and toxic chemicals in NPS runoff, and increased potential for flooding because water bodies become choked with sediment.

The *South Carolina Nonpoint Source Management Program, 1999 Update* outlines the state's strategic plan for addressing statewide water quality impairments attributable to nonpoint source pollution discharges. To accomplish this strategy, 17 long-term goals for reducing or preventing NPS pollution are enumerated. Throughout the document, five-year action strategies are described that lead to attainment of the long-term goals, and annual milestones leading to attainment of the action strategies are further described. The Program is two-pronged; focusing on reducing NPS impacts in priority watersheds, and implementing activities statewide in order to prevent NPS pollution. Components include both regulatory and voluntary approaches.

To facilitate success in achieving water quality improvements, South Carolina's NPS program focuses federal Clean Water Act §319 funding and state resources on impaired §303(d) listed waterbodies in priority watersheds through the implementation of approved NPS Total Maximum Daily Loads (TMDLs). The State's Coastal Nonpoint Pollution Control Program under federal Coastal Zone Management legislation is also implemented.

Nine categories of NPS pollution that impact South Carolina's waters are identified and described: agriculture, forestry, urban areas, marinas and recreational boating, mining, hydrologic modification, wetlands disturbance, land disposal/groundwater impacts, and atmospheric deposition. Technology based controls, or management measures, are employed to address these categorical impacts. The program describes specific management measures for each category as well as implementation schedules. South Carolina has the legal authority to implement all of the necessary management measures.

SCDHEC is responsible for program implementation, but is dependent upon the cooperation of all levels of government, private sector stakeholders, and especially the citizens of the State in order to realize positive results. Many organizations have expertise that can be beneficial to the NPS pollution management program. For example, trade and environmental organizations have program delivery mechanisms that reach persons capable of implementing NPS controls, e.g., farmers, contractors, mine operators, and homeowners. These partnership roles are described in the program.

A system of evaluation/monitoring techniques is a necessary component of the NPS Management Program, in order to evaluate its progress and success. Evaluation will show whether the program is attaining the state's overall water quality vision, stated long-term goals, and five-year action strategies. In South Carolina, several monitoring and tracking efforts are described that address available information on improvements in water quality, implementation milestones, and available information on reductions in NPS pollution. Evaluation techniques include water quality monitoring, level of participation in management measure implementation, and stakeholder feedback.

This *South Carolina NPS Management Program Update* fulfills the requirements of both Section 319 of the Clean Water Act Amendments of 1987, and Section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) of 1990. It comprehensively describes a framework for agency coordination and cooperation and serves to implement a strategy for employing effective management measures and programs to control NPS pollution statewide for the next five years.

It incorporates nine key elements that are iterated in Environmental Protection Agency NPS guidance. Through the use of a framework that addresses these key elements, South Carolina will continue to have an effective NPS program that is designed to achieve and maintain beneficial uses of water. The USEPA has also designated South Carolina as an "Enhanced Benefits" State.

South Carolina receives funding in excess of $3 million annually for implementation of projects to reduce or eliminate NPS pollution through section 319 of the Clean Water Act. Some of these projects are statewide or regional in scope and include activities such as water quality monitoring, NPS outreach and education, and best management practice (BMP) compliance. Other projects are watershed based, aimed at remediation of NPS related problems from the State's §303(d) list. A relatively new focus for §319 funding is the development and implementation of total maximum daily loads (TMDLs). Beginning in FY 2003, one-half of the state's allocation is be used for this purpose.

G. Wasteload Allocations and Total Maximum Daily Loads

A total maximum daily load (TMDL) is the maximum load of a pollutant that can be assimilated by a waterbody without contravening water quality standards. Section 303(d) of the Clean Water Act requires that TMDLs be developed for waters that are determined to be impaired, that is, not meeting applicable water quality standards. A TMDL is made up of a wasteload allocation (WLA) that is the portion of the assimilative capacity allocated to point sources, a load allocation (LA) that is the portion of the assimilative capacity allocated to nonpoint sources, plus a margin of safety. A

TMDL can be developed for an individual pollutant, such as bacteria, or for a category of pollutants, such as oxygen demanding substances. In addition to developing WLAs in conjunction with TMDLs for waters on the State's 303(d) list of impaired waters, SCDHEC also develops WLAs as part of the routine review required for new discharges or for permit reissuance for existing discharges.

Various techniques, ranging from simple mathematical models to complex computer based models, are used by SCDHEC to determine the ability of a waterbody to assimilate various pollutants. TMDLs and WLAs developed using these techniques allow use of the assimilative capacity of a waterbody while ensuring that a level of water quality to protect existing and classified uses is maintained. WLAs are now developed as part of the basin review process as well as in response to proposals for new and expanded projects throughout the State. WLAs for oxygen demanding substances (carbonaceous and nitrogenous oxygen demand), ammonia toxicity and total residual chlorine are determined by the Water Quality Modeling Section. WLAs for metals, organic pollutants, and most toxicants are determined by the individual permitting sections.

Wasteload allocations fall into one of two categories. In instances when the assimilative capacity of a waterbody exceeds the existing or proposed pollutant loading, the waterbody is said to be effluent limited and a TMDL is not required. Effluent limitations for discharges to such waters are determined by the minimum standards required for the type of discharge involved. In instances where the permitted loading is equal to or a proposed loading is greater than the assimilative capacity, the stream is said to be water quality limited. The limits on the discharges to such waters are determined by the water quality of the receiving stream, rather than the minimum standards. TMDLs are not required for water quality limited streams that meet applicable standards. In cases where the water body is meeting standards but a previously permitted or proposed loading would cause the waterbody to be impaired, the new wasteload allocation is a maximum allowable loading. In multiple discharge situations, the load must be divided or allocated among the discharges.

To date, TMDLs have been developed for fecal coliform bacteria, phosphorus, pH, and oxygen demanding substances for many waterbodies. Development of additional TMDLs is currently underway. Wasteload allocations have been developed for numerous waterbodies for ammonia and oxygen demanding substances. While not TMDLs, these WLAs in many cases constitute the maxim allowable loading to the waterbody. Wasteload allocations for metals and toxicants, that in many cases can be considered the maximum available loading to the stream, are now developed on a routine basis. WLAs for phosphorus have been developed for several streams including Eighteen Mile Creek, Reedy River, Bush River and Catawba River, with efforts underway or planned for development of nutrient TMDLs for the Reedy and Catawba. Development of new TMDLs is expected to play an increasingly important part in the overall wasteload allocation process as SCDHEC continues implementation of the basin planning and permitting strategy with emphasis on restoring the State's impaired waters.

H. Special State Concerns and Recommendations

The Bureau of Water continues to implement the operational plan initiated in 2001. These efforts implement portions of the Agency's and Environmental Quality Control's strategic plans. Elements of the operational plan embrace the Bureau's mission and the Agency's values, and visions.

Bureau of Water Mission

The water people drink in South Carolina is safe, and that there is plenty of it.

Water resources of South Carolina are of such quality that they are suitable for use by all citizens and that all surface waters are of a quality suitable to support and maintain aquatic flora and fauna.

DHEC Values

Customer service
Teamwork
Use of applied scientific knowledge

DHEC Visions

Cultural competence
Excellence in government
Local solutions

Bureau of Water Goals

The eight goals of the Bureau of Water will ensure that our mission is accomplished while embracing the DHEC values and visions.

The primary way to accomplish this is reflected in **Goal 1**: Protect Surface and Ground Water Quality.

Goal 2: Adequately Assess Water Quality allows us to track the progress of achieving the first goal.

Goal 3: Reduce and Eliminate Water Pollution offers ways to improve upon the activities supporting Goal 1.

Water quality protection includes protecting the habitat necessary for aquatic organisms, indicators of water quality. This is reflected in **Goal 4**: Protect and Restore Aquatic Habitat.

Citizens of the State are the ultimate consumers requiring clean water. Safe, clean drinking water is essential for life and is accomplished through the activities in **Goal 5**: Provide Safe Drinking Water.

Many Bureau of Water Programs provide protection of health and safety for activities undertaken in or on waters. **Goal 6**: Protect Public Health and Safety accomplishes this.

It is important for citizens to understand their role in water quality protection as presented in **Goal 7**: Expand the Public's Knowledge about Water Issues.

Finally, if we implement **Goal 8**: Plan Effectively for Growth, water pollution impacts can be further minimized and the ability to achieve all other goals will be enhanced.

Program funding continues to be a central concern and overall limiting factor to the development of new programs or enhancement of existing water quality programs. In FY 02 and FY 03, the Bureau had an11.6% reduction of State funds. This followed a 15.75% reduction in the previous two fiscal years. Already in FY 04 there has been a 0.994% cut and additional reductions are almost certain. While minimal additional Federal funding and small fee increases have helped offset the loss of State funds to some extent, maintenance of existing effort in still in jeopardy.

SCDHEC's Bureau of Water continues implementation of a Watershed Water Quality Management Program that is designed to maximize the use of resources, equalize workloads on an annual basis, and develop strategies for water quality maintenance or improvement on a priority basis. Since the implementation of our Watershed Water Quality Management Program during FY 92, we have reduced the backlog of expired permits and significantly reduced the review time for permit applications. Completion of several complex TMDLs has helped reduce the backlog. The Watershed Water Quality Management Program also has allowed us to better utilize water quality monitoring resources to evaluate water quality in the State as well as wasteload modeling resources for permit limits development.

Our current or future activities will be focused on implementing the following recommendations and strategies. They are presented according to the goal they will help us attain.

Protect Surface and Ground Water Quality

The SCDHEC will continue to develop protective water quality standards that will meet the goals of South Carolina and the Clean Water Act. The Department completed a triennial review in December 2003. These regulation amendments are presently awaiting legislative approval. Major revisions are adoption of current federal criteria, revision of the bacterial indicator for coastal recreational waters, and inclusion of a variance from standards for NPDES permit holders.

The SCDHEC will continue an assertive process to evaluate and to properly classify SCDHEC waters, particularly shellfish harvesting waters. In 2003, we completed a reclassification for waters supporting a stocked tailwaters trout fishery. The operators of the hydroelectric facility conducted an extensive study to determine the appropriate dissolved oxygen standard to support growth of the stocked trout.

The SCDHEC will continue its point source permitting policy of issuing water quality based NPDES permits.

Adequately Assess Water Quality

Water quality monitoring efforts must be continually revised and expanded to address the additional potential impacts of increasing population and development. We have completed our third year of monitoring waters at statistically selected stations for lakes and rivers. There is a need for increased analytical capabilities to measure the presence of chemicals at very low concentrations. A greater emphasis on biological integrity is also a recognized need. The SCDHEC must continue to seek resources to develop and implement more extensive biological monitoring and assessment. EPA support for its STORET data system is essential to realize the benefits of that system's utility.

Reduce and Eliminate Water Pollution

Improving water quality of impaired waters continues to be a SCDHEC priority. The SCDHEC must develop Total Maximum Daily Loads (TMDLs) for all waters listed on the 303(d) list of impaired waters. The SCDHEC is using Federal Section 319 funds to assist with TMDL development. With the goal to improve as many waters as possible so that water quality standards are consistently met, we are using Section 319 funds to implement controls for water quality improvement in impaired waters. Fifty-five TMDLs have been approved, 24 have been completed, 106 are currently under development, and 26 are being implemented.

Regulations dealing with Phase II of the National Pollutant Discharge Elimination System (NPDES) storm water permit program have been finalized. The SCDHEC has adopted criteria for designation of small MS4s and has issued a general permit for them. The permit has been appealed. The SCDHEC is also reissuing general permits for industrial stormwater and construction activity. Additional inspectors would make this program more effective.

The SCDHEC has adopted federal requirements for concentrated animal feeding operations (CAFOs) and is developing a general NPDES permit for them. While the SCDHEC has an inspection program on agricultural facilities, more in-depth inspections will be necessary to ensure compliance with new State and Federal requirements. More resources must be sought to effectively implement this program.

Protect and Restore Aquatic Habitat

The SCDHEC will more aggressively integrate the Shellfish Sanitation Program into its ongoing efforts to maintain and enhance water quality by focusing corrective actions on impaired shellfish harvesting waters.

The SCDHEC will continue to protect wetlands as waters of the State through its water programs including 401 water quality certification, NPDES permitting, and State stormwater permitting. The SCDHEC is using State permitting programs in conjunction with the SC Pollution Control Act to protect isolated wetlands since a Supreme Court decision removed them from regulatory jurisdiction of the Corps of Engineers. Revisions to the water quality certification regulations to require permits for fill into non-jurisdictional wetlands have been promulgated by the SCDHEC Board and are at the legislature for approval.

Provide Safe Drinking Water

Source Water Protection and Wellhead Protection Programs will receive priority to insure drinking water uses of surface and ground waters are given the highest levels of protection. The SCDHEC completed all source water protection reports ahead of schedule and has provided them to the water systems for implementation.

Protect Public Health and Safety

The fish tissue monitoring program was previously expanded, but State budget cuts have affected this program greatly. We have maintained the capability to monitor a limited number of fish samples for mercury in order to keep our advisories current.

Ocean water quality monitoring with appropriate advisories to the public continues with federal funding under the BEACH Act. In Horry County, the SCDHEC is collecting rainfall data along with surf samples in order to use rainfall levels to predict bacterial levels thereby reducing the amount of monitoring needed.

Expand the Public's Knowledge about Water Issues

The SCDHEC publishes environmental quality data in its annual report, *Healthy People Living in Healthy Communities*, to inform and educate the general public, State legislature, and State congressional delegation as to the status of our progress to date and important issues. This effort to increase the general awareness of the citizens of the State to the mission, programs, and achievements of the SCDHEC and to help them better understand environmental issues should be expanded through other activities that facilitate interaction between citizens and SCDHEC representatives.

The Bureau of Water has a stable program to provide education in connection with nonpoint source pollution and drinking water issues. We also have a well-established Water Watch program to work with citizens groups interested in water quality monitoring and a partnership program, Champions of the Environment, for youth.

The Bureau of Water has developed an excellent Internet web page to facilitate information exchange and to provide public participation in the regulatory process. We continue to provide speakers to address issues of interest to the public and have participated in developing an education curriculum for primary and secondary schools.

In addition to public education on water quality issues, we also recognize the need to provide public forums for participation in water quality management planning and TMDL development.

The SCDHEC continues to expand and upgrade its computer and electronic capabilities, including implementation of the new STORET database system. We are also using a LIMS (Laboratory Information Management System) to input data from the lab into STORET. There are numerous

areas where electronic management and processing of data and tracking systems would relieve valuable manpower for other activities and allow a more effective use of available resources. EPA support for better utility of STORET is essential, as well as a modernized Permit Compliance data system.

Plan Effectively for Growth

South Carolina and Georgia are cooperatively studying the upper Floridian aquifer to insure groundwater demands can be met.

South Carolina and North Carolina share concerns for increased pollutant loadings into the Catawba River and are working on a plan to address future demands on the river.

Waccamaw and Low Country regions of the State have been designated capacity use areas for groundwater for many years. The Trident area was designated in 2002 and the Pee Dee area was designated in early 2004.

SURFACE WATER ASSESSMENT

1. Surface Water Monitoring Program

A. Purpose and Design

In an effort to evaluate the State's water quality, the SCDHEC operates and collects data from a statewide network of ambient monitoring sites. The ambient monitoring network is directed toward determining long-term water quality trends, assessing attainment of water quality standards, identifying locations in need of additional attention, and providing background data for planning and evaluating stream classifications and standards. The ambient monitoring network, as a program, involves sampling a wide range of physical and chemical parameters and analyzing them for the presence or effects of contaminants and comparing them to criteria to determine use support.

B. Networks and Programs

Extensive revisions to SCDHEC's ambient water quality monitoring network were implemented in 2001. One of the primary purposes of the changes was to establish a network of permanent sites with a greater focus on watersheds. Another goal was to establish more a consistent sampling frequency and more consistent parameter coverage at the permanent sites. Thus while most of the previous sampling locations were maintained, the sampling frequency and parameter coverage at each may have changed.

The previous monitoring design was comprised of four main station types: primary, secondary, watershed, and biological stations. Most of the data evaluated for this assessment were collected under the previous design. Monitoring site designations under the new design include: Integrator, Special Purpose, Watershed Sites, Summer-Only, Random Stream, Random Lake, Random Tide Creek, Random Open Water, and Biological.

Primary stations were sampled on a monthly basis year round. The static primary station network was operated statewide, and received the most extensive parameter coverage, thus making it best suited for detecting long-term trends. Integrator Sites are the approximate equivalent under the new design. Integrator Sites target the most downstream access of each of the Natural Resource Conservation Service (NRCS) 11-digit watershed units (WSU) in the state, as well as the major waterbody types that occur within these WSUs. Special Purpose Sites are also permanent, fixed-location sites, but represent locations of special interest to the Department that do no meet the location criteria of Integrator Sites.

Secondary stations were sampled monthly from May through October, a period critical to aquatic life, and characterized by higher water temperatures and lower flows. Secondary stations were located in areas where specific monitoring was warranted due to point source discharges, or in areas with a history of water quality problems. Secondary station parameter coverage was less extensive and more flexible than primary or watershed station coverages. The number and

locations of secondary stations had greater annual variability than did those in the primary station network, and during a basin's target year may have had parameter coverage and sampling frequency duplicating that of primary or watershed stations. Summer-Only Sites are the equivalent under the new design. There are very few Summer-Only Sites as they are intended to track specific reservoir eutrophication concerns.

Watershed stations were, and still are under the new design, sampled on a monthly basis, year round, during a basin's target year. Under the old design, additional watershed stations may have been sampled monthly from May through October to augment the secondary station network. Watershed stations were located to provide more complete and representative coverage within the larger drainage basin, and to identify additional monitoring needs. Watershed stations had the same parameter coverage as primary stations. Under the new design, Watershed Sites are locations with extensive historic monitoring data (e.g. primary or secondary monitoring sites under the previous design) and have the same parameter coverage as Integrator Sites. Changes in water quality can be identified by comparison of the new data to the historic data.

A statewide Probability-Based, or random sampling, component is part of the new monitoring design. A probability-based monitoring design is a type of a survey design in that the population of interest is sampled in a fashion that allows statements to be made about the whole population based on a subsample, and produces an estimate of the accuracy of the assessment results. The advantage of the probability-based sampling design is that statistically valid statements about water quality can be made about large areas based on a relatively small subsample. Separate monitoring schemes have been developed for stream, lake/reservoir, and estuarine resources. Each year a new statewide set of probability-based random sites is selected for each waterbody type. Site selection is done in association with the U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory (NHEERL), Corvallis, Oregon. Although statements about resource conditions can theoretically be made based on data from a single year, the compilation of data from additional years will increase the confidence and accuracy of statements about water quality. An additional advantage of the probability-based approach is that it presents the opportunity for previously unsampled locations to be selected for data collection. Random Sites are sampled on a monthly basis for one year with the same parameter coverage as Integrator Sites.

Ambient biological trend monitoring is conducted to collect data to indicate general biological conditions of State waters that may be subject to a variety of point and nonpoint source impacts. Ambient biological sampling is also used to establish regional reference or "least impacted" sites from that to make comparisons in future monitoring. Qualitative sampling of macroinvertebrate communities is the primary bioassessment technique used in ambient biological trend monitoring. A habitat assessment of general stream habitat availability and a substrate characterization is conducted at each site. Annual ambient biological monitoring is conducted during low flow "worst case" conditions in July - September. Some coastal plain streams that have no flow conditions in the summer months may be sampled in the winter (January-March).

C. Laboratory Analytical Support

The Analytical and Radiological Environmental Services Division provides laboratory services to the Bureaus of Water and Land and Waste Management. Radiological analyses are not performed for the Water Quality Monitoring Program under the Pollution Control and Clean Water Acts and will not be addressed here. The analytical services offered include bacteriological, chemical, and physical analyses. The types of samples analyzed include water, wastewater, leachate, soil, sediment, chemical wastes, fish, and shellfish.

The laboratory organizational structure encompasses five sections in the Central laboratory and seven regional laboratories. The Central Laboratory Sections include Sample Characterization/Automated Analysis/Data Management, Metals Analysis, GC/MS-HPLC Analysis, GC Analysis, and Environmental Microbiology. The seven regional laboratories are located in Aiken, Beaufort, North Charleston, Florence, Greenville, Lancaster, and Myrtle Beach.

The regional laboratories, except for Beaufort and Myrtle Beach, initiate all stream and wastewater analysis and the Central Laboratories provide support analyses, i.e., metal, nutrient, toxic extraction procedures, and organic analyses. The Beaufort and Myrtle Beach Regional Laboratories analyze microbiological samples only. The Central Laboratory also acts as the Regional Laboratory for the Central Midlands District, performing the same functions as the other Regional Laboratories. Drinking Water Chemical Analysis is essentially a Central Laboratory program with support from the Regional Laboratories. All regional laboratories except Myrtle Beach perform microbiological analyses for the Drinking Water Program.

The Division Director and the Quality Assurance Officer for Environmental Quality Control (EQC) coordinate the internal quality assurance program.

D. Quality Assurance

A quality assurance program is essential to produce valid data and to provide a means to systematically demonstrate its validity. It is the policy of Environmental Quality Control (EQC) that necessary quality assurance (QA) activities be conducted within the State of South Carolina to demonstrate that all environmental data generated, processed, or used will be scientifically valid, defensible, and of known and acceptable precision and accuracy. It is also the policy of EQC that all reported data will include documented precision and accuracy and be complete, representative, and comparable. The quality of all data generated shall meet or exceed all EQC and EPA program requirements.

The Deputy Commissioner for Environmental Quality Control has the overall responsibility for the development, implementation, and continued operation of EQC's QA Program. To insure that EQC's QA policy is uniformly applied to the generating and processing of all environmental data, a State Quality Assurance Management Office (SQAMO) has been established.

This office is responsible for the Environmental Quality Control Assurance Program. Environmentally-related measurement activities conducted by or for EQC shall be done only with

the approval of the State Quality Assurance Management Office (SQAMO) after assuring that adequate quality assurance guidelines and procedures have been incorporated. This includes study-planning, sample collection, preservation and analysis, data handling, and use of physical, chemical, biological, and other data related to the effects, sources, transport and control of pollution, as well as personnel review and training.

To accomplish these goals the Water Quality Monitoring Section, Aquatic Biology Section, and Pollution Source Compliance Section have developed and instituted SQAMO approved field study procedures and documentation, data review, and routine EPA operating overview. These procedures are documented in SCDHEC's Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (SOP) (2001). This document describes in detail the field sampling procedures, meter calibration and maintenance procedures, sample chain-of-custody documentation, sample preservation, holding times and recommended sample containers specifications, data sheet examples, and data submission requirements.

At least once yearly all field personnel are accompanied on sample collection activities by the appropriate program quality assurance officer for evaluation of adherence to standard operating procedures (SOP) for QA/QC. These evaluations each year are for water quality monitoring SOP review and for facility compliance sampling SOP review. Approximately every other year the EPA conducts on-site routine overviews of SCDHEC's QA/QC procedures.

The Division Director and the Quality Assurance Officer for EQC Laboratories coordinate the internal quality assurance program. The laboratory quality assurance program encompasses every aspect of the laboratory analysis from container preparation through the actual data release from the Analytical Services Laboratory to the Environmental Quality Control (EQC) Programs.

Analytical Services has developed two quality control manuals that detail the day-to-day operation of the quality assurance program: (1) Procedures and Quality Control Manual for Chemistry Laboratories--Analytical Services; and (2) Laboratory Procedures Manual for Environmental Microbiology-- Analytical Services. The elements of quality control addressed in the manuals include organization and sample chain of custody; personnel training; quality control of laboratory services, scope and application, equipment and supplies, reagents, standards, methodology, preservation and storage, calibration, performance criteria and quality assurance, and waste management.

The overall laboratory quality assurance program, that includes the previously discussed elements, requires a minimum of 25% of allocated resources. The frequency for analysis of replicates and spike recovery samples is noted in the manuals and is in compliance with U.S. EPA guidelines. Performance samples are also analyzed as noted in the manuals. The Environmental Microbiology Laboratories perform replicate analyses, positive test controls, media control tests, equipment control tests, etc., as required by EPA Laboratory Certification and Evaluation guidelines. In addition, Analytical Services and the seven regional laboratories participate in annual Water Supply and Water Pollution Proficiency Testing Programs. All district personnel who collect samples that require field testing participate in either the yearly Water Supply or Water Pollution Proficiency Testing Program, whatever is appropriate.

The laboratory analyses are conducted according to the List of Approved Test Procedures in the Federal Register, Volume 49, No. 209, October 26, 1984; Federal Register, Volume 59, No. 20, January 31, 1994; and Federal Register, Volume 67, No. 205, October 23, 2002. The Analytical Services quality control manuals include a section on methodology designed to reduce variations in applied techniques among the State laboratories where methods permit analyst interpretation, and thus provide a more uniform approach that will increase the reproducibility of results reported from the laboratory system.

E. Data Storage, Management and Interpretation

Data for samples that are analyzed in the regional laboratories are reported on the appropriate data sheets and released by the sample custodian. These data sheets are sent to the Analytical and Radiological Environmental Services Division in Columbia where they, along with data sheets generated in the Central Laboratory, are sent to the appropriate program areas. All stream and facility data is distributed by the Compliance Assurance Division to the appropriate program areas.

Routine ambient stream and sediment samples are collected by District personnel. Special study and biological samples are generally collected by Water Quality Monitoring Section or Aquatic Biology Section personnel. The physical and chemical data is sent to the Water Quality Monitoring Section through the Analytical and Radiological Environmental Services Division. The data are reviewed by the Water Quality Monitoring Section and physical and chemical data are sent to the Information Services Section for data entry. The data are edited and then stored in the new EPA's STORET distributed water quality database. Data sheets are kept on file in the Water Quality Monitoring Section.

After biological samples are collected, data sheets are kept on file in the Aquatic Biology Section until sample analysis is completed. Macroinvertebrate taxonomic and habitat assessment data are entered into a computerized in-house database. Data sheets describing biological data are kept on file in the Aquatic Biology Section.

2. Assessment Methodology

Beginning in this year's §305(b) report some of the preliminary assessment results from the probability-based survey will be presented in addition to the traditional approach employed in past reports.

Traditional §305(b) Assessment Approach

In South Carolina, waterbodies are designated using the U.S. Natural Resources Conservation Service (NRCS, formerly the U.S. Soil Conservation Service) eleven-digit watersheds indicated on a U.S. Geological Survey (USGS) map based on the 1:100,000 scale Digital Line Graph base and associated Arc/Info coverage. Each eleven-digit NRCS watershed depicted on this map is designated as a unique waterbody. All data are tied to each individual, geographically defined waterbody. Three key elements that can be tracked for each waterbody are water quality status,

causes of nonattainment (stressors), and possible sources of pollution. Water quality status is a measure of the extent to that designated uses are supported. Stressors are the types of pollution causing water quality problems, and sources are the types of point or nonpoint sources suspected to be responsible for the pollution.

Assessed waters are those waters directly monitored as part of SCDHEC ambient surface water monitoring network, during special Watershed Water Quality Assessment (WWQA) data collection activities, or quality assured data from other agencies. Data from 804 SCDHEC monitoring stations are included in this assessment. These monitoring sites include 62 macroinvertebrate sites without long-term water chemistry data. Eighty-six of the water chemistry sites also had associated macroinvertebrate data that were also assessed. Quality assured physical, chemical, and biological water quality data collected from 1998 through 2002 at each station were reviewed for the current assessment.

Stream mileage and lake area assessed was determined using SCDHEC's Geographical Information System (GIS) and modifications of USEPA's Reach File 3 (RF3) hydrographic coverage at a scale of 1:100,000. The RF3 database includes only those stream reaches and portions of lakes that are within the state of South Carolina's borders. For streams the process involved the use of a program that automatically traces hydrographic features upstream of a specified SCDHEC monitoring station. Then each automatic trace was evaluated individually, with reaches being added or deleted based on changes in hydrologic character or predominant adjacent land use or for reasons arising from an intimate knowledge of the area. The conditions at the monitoring station were used to represent the entire trace reach size. A monitoring site represented conditions of all mainstem reaches upstream of the site to the next monitoring site, to a major change in land use type (i.e., rural to urban, agriculture to forest, etc.), or to the headwaters of the stream as determined by professional judgment. A monitoring site also represented mainstem reaches downstream of the site to the next major confluence. Portions of tributary streams were considered represented by mainstem data where predominant land use was consistent with the mainstem. Most assignments of that reaches are represented by each monitoring site were arrived at by consensus of two or more individuals with some knowledge of the area and reference to other existing maps indicating major land use types. The GIS then calculated the total length of stream, in miles, represented by each monitoring site.

Lake area represented by individual monitoring sites was determined by partitioning each lake into areas around individual monitoring locations where conditions of depth and shoreline development are similar or where relatively homogenous water quality might be expected. The GIS then calculated the surface area represented by each area.

Estuarine areas were delineated similarly to lakes, however the National Wetlands Inventory (NWI) digital files at a scale of 1:24,000 were used as the basemaps.

Probability-Based §305(b) Assessment Approach

The U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory (NHEERL), Corvallis, Oregon, uses essentially the same basemaps to do the site

selections for the probability-based, or random, monitoring site locations. Independently for each waterbody type, rivers and streams, lakes and reservoirs, and estuarine habitat, a statewide grid system and computer selection program is used to randomly select a particular grid to achieve a statewide spatial distribution of sites, and then a specific location within a selected grid is chosen according to the specifics of each waterbody design as described below.

Rivers and Streams

Streams of different sizes may be more or less sensitive to different types of environmental perturbations. Because of this, three stream sizes have been specifically targeted to ensure they are represented in the selected random sites. Approximately 30 total randomly selected stream sites are sampled each year. Each site is sampled monthly for one year.

1. First Order streams, or headwater streams, are targeted because these represent streams with the least dilution capacity and therefore are most immediately impacted by adjacent land use activities and associated runoff. These streams may also serve as spawning areas for fish and refuge areas for young from larger aquatic predators.

2. Second Order streams, are also streams with relatively small dilution capacity and represent important habitat for reproduction and survival of aquatic life. They may also reflect the direct impacts of major land use activities.

3. Third Order and larger streams, that include the major rivers of the State. In general these streams have greater dilution capacity and are less affected by small scale land use perturbations and may be heavily utilized for contact recreation.

These different sizes do not occur in equal proportions in the state, therefore an unequal weighting procedure is used in the site selection process to guarantee inclusion of approximately equal numbers of sites in all three stream sizes. These differential weights are based on the relative proportions of these three size classes in the streams of the state and are used in the assessment to adjust the contribution of each stream site to the statewide resource size.

Lakes and Reservoirs

Eligible lakes/reservoirs are restricted to "significant lakes," that refers to those freshwater lakes/reservoirs with at least 40 acres surface area that offer public access. The size of significant lakes/reservoirs varies immensely; therefore two size classes of lakes/reservoirs have been specifically targeted to ensure that the smaller lakes/reservoirs are represented in the selected random sites. Approximately 30 total randomly selected lake and reservoir sites are sampled each year. Each site is sampled monthly for one year.

1. Major Lakes/Reservoirs greater than 850 acres surface area.

2. Minor Lakes/Reservoirs greater than 40 acres surface area, but less than or equal to 850 acres.

These different sizes do not occur in equal proportions in the state, therefore an unequal weighting procedure is used in the site selection process to guarantee inclusion of approximately equal numbers of sites in both sizes. These differential weights are based on the relative proportions of these two size classes in the lakes and reservoirs of the state and are used in the assessment to adjust the contribution of each lake site to the statewide resource size.

Estuaries

The coastal estuarine probability-based monitoring scheme has been developed jointly by SCDHEC, Bureau of Water, and the South Carolina Department of Natural Resources (SCDNR), Marine Resources Research Institute (MRRI). This effort has been dubbed the South Carolina Estuarine and Coastal Assessment Program (SCECAP) and sampling of the probability-based coastal estuarine sites is a cooperative venture between SCDHEC and SCDNR-MRRI. To ensure inclusion of a variety of estuarine ecosystems and habitats, the coastal estuaries have been divided into two discrete categories (strata) based on a common GIS cover developed and utilized by both agencies.

1. Tidal Creeks, identified as less than 100 meters wide on the GIS cover, serve as nursery areas for important marine species and are most immediately affected by upland land use activities and associated runoff.

2. Open Water areas, identified as greater than 100 meters wide on the GIS cover, represent larger estuarine rivers and sounds.

Within these waterbody types there are two distinct types of monitoring sites based on sampling frequency, Core Sites and Supplemental Sites. Core Sites are sampled monthly for one year by SCDHEC for water column physical and chemical parameters and are used for §305(b) reporting purposes.

The Supplemental Sites are sampled one time by SCDNR-MRRI and SCDHEC and are used in conjunction with one time samples collected at the Core Sites in the SCECAP reports and USEPA National Coastal Assessment.

Each year there will be approximately 15 Core Tidal Creek sites and 15 Core Open Water sites. Differential weights are based on the relative proportions of these two size classes in the estuarine areas of the state and are used in the assessment to adjust the contribution of each estuary site to the statewide resource size.

A. Determination of Attainment of Classified Uses

General Considerations

Physical, chemical and biological data were evaluated, as described below, to determine if water quality met the water quality criteria established to protect the State classified uses defined in S.C. Regulation 61-68, *Water Classifications and Standards*. Some waters may exhibit characteristics outside the appropriate criteria due to natural conditions. Such natural conditions do not constitute a violation of the water quality criteria. To determine the appropriate classified uses and water quality criteria for specific waterbodies and locations, refer to S.C. Regulation 61-69, *Classified Waters*, in conjunction with S.C. Regulation 61-68.

At the majority of SCDHEC's monitoring stations, water samples for analysis are collected as surface grab samples once per month, quarter, or year, depending on the parameter. Grab samples collected at a depth of 0.3 meters are considered to be a surface measurement. At most stations sampled by boat, dissolved oxygen and temperature are sampled as a water column profile, with measurements being made at either a depth of 0.3 meters below the water surface and at one-meter intervals to the bottom or at 0.3 meters, bottom and mid-depth. At stations sampled from bridges, these parameters are measured only at a depth of 0.3 meters. For the purpose of assessment, only surface samples are used in standards comparisons and trend assessments. Because of the inability to target individual high or low flow events on a statewide basis these data are considered to represent typical physical conditions and chemical concentrations in the waterbodies sampled. All water and sediment samples are collected and analyzed according to standard procedures (SCDHEC 2001).

Results from water quality samples can be compared to State and USEPA criteria, with some restrictions due to time of collection and sampling frequency. For certain parameters, the monthly sampling frequency employed in the ambient monitoring network is insufficient for strict interpretation of the standards. The USEPA does not define the sampling method or frequency other than indicating that it should be "representative". The grab sample method is considered to be representative for the purpose of indicating excursions relative to criteria, within certain considerations. A single grab sample is more representative of a one-hour average than a four-day average, more representative of a one-day average than a one-month average, and so on; thus, when inferences are drawn from grab samples relative to criteria, sampling frequency and the intent of the criteria must be weighed. When the sampling method or frequency does not agree with the intent of the particular standard, any conclusion about water quality should be considered as only an indication of conditions, not as a proven circumstance.

Macroinvertebrate community structure is analyzed routinely at selected stations as a means of detecting adverse biological impacts on the aquatic fauna of the state's waters due to water quality conditions that may not be readily detectable in the water column chemistry.

This statewide assessment is based on the last complete five years of available quality assured physical, chemical and biological water quality data (1998 - 2002).

Aquatic Life Use Support - One important goal of the Clean Water Act, the South Carolina Pollution Control Act, and the State Water Quality Classifications and Standards is to maintain the quality of surface waters to provide for the survival and propagation of a balanced indigenous aquatic community of fauna and flora. The degree to that aquatic life is protected (Aquatic Life Use Support) is assessed by comparing important water quality characteristics and the concentrations of potentially toxic pollutants with numeric criteria.

Support of aquatic life uses is determined based on the percentage of numeric criteria excursions and, where data are available, the composition and functional integrity of the biological community. The term excursion is used to describe a measured pollutant concentration that is outside of the acceptable range as defined by the appropriate criterion. Some waters may exhibit characteristics outside the appropriate criteria due to natural conditions. Such natural conditions do not constitute a violation of the water quality criteria. A number of waterbodies have been given waterbody-specific criteria for pH and dissolved oxygen, to reflect natural conditions. To determine the appropriate numeric criteria and classified uses for specific waterbodies and locations, please refer to S.C. Regulation 61-68, *Water Classifications and Standards* and S.C. Regulation 61-69, *Classified Waters*.

If the appropriate criterion for dissolved oxygen and pH are contravened in 10 percent or less of the samples, the criterion is said to be fully supported. If the percentage of criterion excursions is greater than 10 percent, but less than or equal to 25 percent, the criterion is partially supported, unless excursions are due to natural conditions. If there are more than 25 percent excursions, the criterion is not supported, unless excursions are due to natural conditions. The decision that criteria excursions are due to natural conditions is determined by consensus and/or the professional judgment of SCDHEC staff with specific local knowledge.

If the appropriate acute aquatic life criterion for any individual toxicant (heavy metals, priority pollutants, ammonia) is exceeded more than once in five years, representing more than 10 percent of the samples collected, the criterion is not supported. If the acute aquatic life criterion is exceeded more than once, but in less than or equal to 10 percent of the samples, the criterion is partially supported. The USEPA criteria to protect aquatic life for most toxicants are specified as a four-day average and a one-hour average, and have been adopted as state criteria. Because samples are collected as grab samples, and because of sampling frequency, comparisons to chronic toxicity criteria (four-day average concentration) are considered inappropriate; therefore, only the acute criterion (one-hour average) for the protection of aquatic life is used in the water quality assessment.

The total recoverable metals criteria for heavy metals are adjusted to account for solids partitioning following the approach set forth in the Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria, October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40CFR§131.36(b)(1). Under this approach, a default TSS value of 1 mg/L is used. Where the metals criteria are hardness based, a default value of 25 mg/L is used for waters where hardness is 25 mg/l or less.

If the appropriate criterion for turbidity in all waters, and for waters with numeric total phosphorus, total nitrogen, and chlorophyll-a criteria, is exceeded in more than 25 percent of the samples, the criterion is not supported. If the criterion is exceeded in 25 percent of the samples or less, then the criterion is fully supported.

If the conclusion for any single parameter is that the criterion is "not supported", then it is concluded that aquatic life uses are not supported for that waterbody, at that monitoring location. If there are no criteria that are "not supported", but the conclusion for at least one parameter criterion is "partially supported", then the conclusion is aquatic life uses are partially supported. Regardless of the number of samples, no monitoring site will be listed as partially or not supporting for any pollutant based a single sample result because of the possibility of an anomalous event.

The goal of the standards for aquatic life uses is the protection of a balanced indigenous aquatic community; therefore, biological data is the ultimate deciding factor, regardless of chemical conditions. If biological data shows a healthy, balanced community, the use is considered supported even if chemical parameters do not meet the applicable criteria.

Macroinvertebrate Data Interpretation - Macroinvertebrate community assessment data are used to directly determine Aquatic Life Use Support and to support determinations based on water chemistry data. Macroinvertebrate community data may also be used to evaluate potential impacts from the presence of sediment contaminants. Aquatic and semi-aquatic macroinvertebrates are identified to the lowest practical taxonomic level depending on the condition and maturity of specimens collected. The EPT Index and the North Carolina Biotic Index (BI) are the main indices used in analyzing macroinvertebrate data. To a lesser extent, taxa richness and occasionally, total abundances, may be used to help interpret data.

The EPT Index or the Ephemeroptera (mayflies) - Plecoptera (stoneflies) - Trichoptera (caddisflies) Index is the total taxa richness of these three generally pollution-sensitive orders. EPT values are compared with least impacted regional sites. The Biotic Index for a sample is the average pollution tolerance of all organisms collected, based on assigned taxonomic tolerance values.

Taxa richness is the number of distinct taxa collected and is the simplest measure of diversity. High taxa richness is generally associated with high water quality. Increasing levels of pollution progressively eliminate the more sensitive taxa, resulting in lower taxa richness. Total abundance is the enumeration of all macroinvertebrates collected at a sampling location. When gross differences in abundance occur between stations, this metric may be considered as a potential indicator.

Recreational Use Support - Recreational use support is defined as the degree to that the swimmable goal of the Clean Water Act is attained and is based on the frequency of fecal coliform bacteria excursions. A fecal coliform excursion is defined as an occurrence of a bacteria concentration greater than 400/100 ml for all surface water classes. Comparisons to the bacteria geometric mean standard are not considered appropriate based on sampling frequency and the

intent of the standard. If 10 percent or less of the samples are greater than 400/100 ml, then recreational uses are said to be fully supported. If the percentage of standards excursions is greater than 10 percent, but less than or equal to 25 percent, then recreational uses are said to be partially supported, and if the percentage of excursions is greater than 25 percent, it is considered to represent nonsupport of recreational uses.

Fish/Shellfish Consumption Use Support - Fish/shellfish consumption use support is determined by the occurrence of advisories or bans on consumption or harvesting for a waterbody. For the support of fish consumption uses, an advisory restricting fish consumption or conditionally approved or restricted shellfish harvesting status indicates partial use support, an advisory against eating any fish or prohibition of shellfish harvesting indicates nonattainment of uses.

Drinking Water Use Support - Nonattainment of drinking water use is indicated if the median concentration of the ambient surface water data for any pollutant exceeds the appropriate drinking water Maximum Contaminant Level (MCL), based on a minimum of three samples. Where MCLs do not exist, SCDHEC may use or develop other criteria such that pollutant concentrations or amounts do not interfere with drinking water use, actual or intended, as determined by SCDHEC.

Potential Sources - The identification of potential sources of nonattainment is based on suggestions from individuals with local knowledge, and professional judgment. The identified potential sources are not based on actual data, but range from particular activities in the immediate vicinity of the monitoring site to general activities within the watershed. The identification of a potential source does not necessarily mean it is responsible for criteria excursions, only that the activity could add to the overall loading of the pollutant of concern. No regulatory action will be taken based solely on this identification. Specific source identification will be undertaken during TMDL development.

B. Additional Screening and Prioritization Tools

Although not used directly in making use support assessments, the following tools are useful in ranking and prioritizing waterbodies for implementation of corrective actions.

Long-Term Trend Assessment - As part of the watershed water quality assessments, surface data from each station are analyzed for statistically significant long-term trends using the Seasonal Kendall Test Without Correction (SKWOC) for significant serial correlation, using procedures in the WQHYDRO computer package developed by Eric Aroner of WQHYDRO Consulting. Flows are not available for most stations, and the parametric concentrations are not flow-corrected. Seasonal Kendall's tau analysis is used to test for the presence of a statistically significant trend of a parameter, either increasing or decreasing, over a fifteen-year period. It indicates whether the concentration of a given parameter is exhibiting consistent change in one direction over the specified time period. A two sided test at $p=0.1$ is used to determine statistically significant trends, and the direction of trend. An estimate of the magnitude of any statistically significant trend is calculated.

A rigorous evaluation for trends in time-series data usually includes a test for autocorrelation. The data are not tested for autocorrelation prior to the trend analysis. It is felt that autocorrelation would not seriously compromise a general characterization of water quality trends based on such a long series of deseasonalized monthly samples.

One of the advantages of the seasonal Kendall test is that values reported as being below detection limits (DL) are valid data points in this nonparametric procedure, since they are all considered to be tied at the DL value. When the DL changed during the period of interest, all values are considered to be at the highest DL occurring during that period. Since it is possible to measure concentrations equal to the value of the DL, values less than DL are reduced by subtraction of a constant so that they remain tied with each other, but are less than the values equal to the DL. Since fecal coliform bacteria detection limits vary with sample dilution, there is no set DL; therefore, for values reported as less than some number, the value of the number is used.

Sediment Screening - There are no sediment standards; therefore, in order to identify sediments with elevated metals concentrations, percentiles are constructed using five years of statewide sediment data. Only values greater than the detection limit were used for chromium, copper, nickel, lead, and zinc. Because so few concentrations of cadmium and mercury are measured above the detection limit, all samples were pooled for these metals. A sediment metal concentration is considered to be high if it is in the top 10% of the pooled results, and very high if it is in the top 5%. Any analytical result above detection limits is flagged for pesticides, PCBs, and other priority pollutants. Sites with noted high metals concentrations or the occurrence of other contaminants above detection limits are prioritized for the collection of biological data, or additional monitoring and investigation, to verify the true situation.

For saltwater sediments, national studies have been conducted by the National Oceanic and Atmospheric Administration (NOAA) and the State of Florida that have developed Sediment Quality Guidelines (SQGs) for the United States and the southeastern region. These SQGs summarize all published toxicology and biomonitoring studies for a given contaminant and ranked them from lowest to highest concentration where an adverse effect was observed. The tenth percentile of the ranked data, from all published studies that reported an adverse effect, is termed the Effects Range Low (ERL) or Threshold Effects Level (TEL) and represents the threshold concentration for toxicity to occur. The median concentration where adverse effects in benthos are observed (the fiftieth percentile) is termed the Effects Range Median (ERM) or Probable Effects Levels (PEL). Measured sediment contaminant levels may be compared with ERLs/ERMs or TELs/PELs to predict potential probability for sediment bound contaminants to cause toxicity in benthic faunal communities. Saltwater sites with sediments that have individual chemical contaminant concentrations that exceeded ERL/TEL and ERM/PEL guideline levels may be potentially toxic to estuarine organisms.

3. Rivers and Streams Water Quality Assessment

The U.S. Environmental Protection Agency has developed a system to determine estimates of total river miles and total lake acres for the states to use in reporting for §305(b) reports. The estimates are based on the Digital Line Graph (DLG) database and the River Reach File 3 (RF3), that are in

turn based on the U.S. Geological Survey 1:100,000 scale hydrologic maps. The original DLG database was missing a significant number of South Carolina streams. Many of these missing features have been added by SCDHEC, with the cooperation and oversight of the USEPA. This revised system was utilized for the traditional §305(b) assessment in this report to estimate the total number of stream miles, as well as the sizes of the different use support categories, cause sizes, and source sizes for the Rivers and Streams summary statistics. Recent improvements in the analytical precision reported by the SCDHEC Analytical and Radiological Environmental Services Division has had the effect of an increased detection of criteria excursions for some metals, in particular copper.

Based on the modified USEPA Reach File 3 hydrologic database used for the traditional §305(b) assessment approach, South Carolina has approximately 29,794 miles of freshwater rivers and streams within the borders of the State. Although 15,312 miles were assessed using data collected at 630 SCDHEC water quality monitoring stations, the strategic location of these monitoring stations allows these data to provide a representative assessment of water quality for the entire state.

A. Summary Statistics

A summary of classified use support statewide, along with causes and sources for partial or nonattainment, is presented below. In instances where no potential source of observed fecal coliform bacteria excursions was apparent, the source was listed as natural conditions, but because of the potential for human health concerns the use support determination was still listed as partial or nonattainment of recreational uses as the frequency of excursions dictated.

Table 6. Rivers and Streams Use Support Summary (Miles)

Use	Size Assessed	Size Fully Supported	Size Partially Supported	Size Not Supported	Percent Fully Supported
Aquatic Life	15,311.83	10,004.11	1,859.54	3,448.18	65%
Recreation	14,661.29	8,698.80	3,152.31	2,810.17	59%
Drinking Water Supply	15,311.83	15,310.11	0.00	1.72	>99%
Agriculture	15,311.83	15,311.83	0.00	0.00	100%

Table 7. Summary of Fully Supporting and Impaired Rivers and Streams (Not including Fish Consumption Use)

Degree of Use Support	Size (Miles)
Size Fully Supporting All Assessed Uses	6,395.61
Size Impaired for One or More Uses	8,916.22
Total Assessed	15,311.83

Table 8. Total Sizes of Rivers and Streams Impaired by Various Cause Categories (Miles)

Cause Category	Size of Waters by Contribution to Impairment
Metals (Combined)	1,343.32
Chromium	71.00
Copper	1,076.08
Zinc	197.96
pH	1,099.38
Dissolved Oxygen	2,841.17
Turbidity	131.87
Fecal Coliform Bacteria	5,962.49
Macroinvertebrate Community Impacts Cause Unknown	614.35

Table 9. Total Sizes of Rivers and Streams Impaired by Various Source Categories* (Miles)

Potential Sources by Category	Size of Waters by Contribution to Impairment
Industrial Point Sources	116.92
Municipal Point Sources	543.73
Collection System Failures	106.86
Agriculture (Total)	953.64
Grazing Related Specifically	351.04
Intensive Animal Feeding Operations Specifically	223.34
Construction	83.33
Urban Runoff	1,870.82
Resource Extraction	18.13
Land Disposal	156.53
Hydromodification	35.55
Debris and Bottom Deposits	8.40
Natural Sources	327.04
Recreation and Tourism Activities (Golf Course)	4.06
Groundwater Loadings	10.43
Unknown Sources	6,694.73

*Potential Sources range from specific activities in the immediate vicinity of the monitoring site to general activities within the watershed, see Assessment Methodology.

The following table summarizes the use of macroinvertebrate data in the preparation of this report. Although macroinvertebrate data are available for other locations in South Carolina, no estimates of the mileage represented by these sites were available. The River Reach File 3 (RF3) does not contain attributes by that determination of that stream reaches are wadeable could be made, so the following table represents all stream miles in the State.

Table 10. Categories of Data Used in Aquatic Life Use Support (ALUS) Assessments for All Rivers and Streams

Degree of ALUS	Miles Assessed Based on Physical/ Chemical Data Only	Miles Assessed Based on Biological/ Habitat Data Only	Miles Assessed Based on Physical/Chemical and Biological/Habitat Data	Total Miles Assessed for ALUS
Fully Supporting	8,180.11	487.98	1,336.02	10,004.11
Partially Supporting	1,352.20	121.03	386.31	1,859.54
Not Supporting	3,341.17	39.99	67.03	3,448.18

Comparison of Traditional and Probability-Based Assessment Results

Data from a total of 58 randomly located stream sites are summarized for the probability-based assessment conclusions, 29 sampled in 2001 and 29 sampled in 2002. Since the size estimates between the traditional approach and the random design are based on different size/resource representation approaches, using the absolute sizes doesn't provide a meaningful comparison. Therefore the numbers were converted to the percentage of miles assessed in each category for the traditional §305(b) approach by dividing the size in each category by the total number of miles assessed for the appropriate use. For the probability-based approach it represents the percentage of total stream miles in the State, weighted by stream size as per the design discussed previously.

For the traditional §305(b) approach, miles impaired for individual pollutants (causes) were divided by the total miles assessed (Recreational Use for Fecal Coliform Bacteria, Aquatic Life Use for all other parameters) to get the percentage of stream miles assessed that were impaired.

Note that some of the causes noted in the traditional §305(b) assessment did not cause impairments at any of the random sites, so there is no percent impaired for the probability-based estimates in this comparison, e.g. chromium in streams.

Table 11. Comparison of Traditional and Probability-Based Assessment Results for All Rivers and Streams

Indicator	Category	Percent of Miles Assessed - Traditional §305(b)	Probability-Based Estimated Percent of Total Resource	Lower 95 Percent Confidence Interval	Upper 95 Percent Confidence Interval
Aquatic Life Use	Fully Supporting	65.3%	79.0%	68.2%	89.8%
	Partially Supporting	12.1%	5.9%	0.8%	11.0%
	Not Supporting	22.5%	15.0%	6.3%	23.7%
Recreational Use	Fully Supporting	59.3%	49.9%	31.6%	68.2%
	Partially Supporting	21.5%	14.6%	5.8%	23.4%
	Not Supporting	19.2%	35.5%	17.3%	53.8%
Support of All Assessed Uses	Fully Supporting All	41.8%	39.0%	20.6%	57.3%
	Impaired for One or More	58.2%	61.0%	42.7%	79.4%
Percent of Rivers and Streams Impaired by Various Cause Categories					
Macroinvertebrate Community		4.0%	7.6%	2.0%	13.2%
Turbidity		0.9%	2.9%	0.0%	5.9%
Dissolved Oxygen		18.6%	8.9%	2.4%	15.4%
pH		7.2%	0.8%	0.0%	2.2%
Chromium		0.5%	0%		
Copper		7.0%	4.0%	0.0%	9.4%
Zinc		1.3%	0.8%	0.0%	2.2%
Fecal Coliform Bacteria		40.7%	50.1%	31.8%	68.4%

The Lower and Upper 95 Percent Confidence Intervals for the probability-based estimates signify that it is 95% certain that the true percentage is between the upper and lower confidence limits. As more probability-based sites are monitored the 95% confidence interval will become a tighter fit. It is reassuring that many of the estimates derived by the traditional approach also fall close to or within the 95% confidence interval estimates based on the probability-based approach. The fact

that chromium was detected as a cause of impairment for such a small percentage of miles assessed under the traditional §305(b) approach and at none of the probability-based sites suggests that it is not a widespread pollutant problem. In fact only two sites used in the traditional §305(b) assessment were impaired for chromium, and one of those locations was specifically chosen because of known groundwater contamination that was intersecting surface water. This example demonstrates one of the advantages of the probability approach towards characterizing general conditions without over-emphasizing small scale, local pollution issues. It also provides evidence of the need to retain resources for targeted monitoring of specific known or suspected problems.

4. Lakes Water Quality Assessment

A. Summary Statistics

Based on the modified USEPA River Reach File 3 (RF3), South Carolina has approximately 407,505 acres of lakes within its State boundaries. For lakes along the State boundary, the Reach File 3 database included only lake acres actually within the State of South Carolina. The original USGS DLG files used to develop the RF3 database were missing many lakes constructed in recent decades. Many of these missing lakes have been added by SCDHEC, with the cooperation and oversight of the USEPA. This revised system was utilized in this §305(b) report to estimate the total number of lake acres, as well as the sizes of the different use support categories, cause sizes, and source sizes for the Lakes summary statistics.

A significant amount of data associated with the probability-based lake and reservoir monitoring sites is still awaiting final QA/QC verification. Therefore the assessment of the probability-based results will be postponed until all of the data are available.

The assessment in the next four tables is based on data collected at 107 SCDHEC water quality monitoring stations representing 227,275 acres. A summary of classified use support statewide, along with causes and sources for partial or nonattainment, is presented below. Recent improvements in the analytical precision reported by the SCDHEC Analytical and Radiological Environmental Services Division has had the effect of an increased detection of standards excursions for some metals, in particular copper.

Table 12. Lake Use Support Summary (Acres)

Use	Size Assessed	Size Fully Supported	Size Partially Supported	Size Not Supported	Percent Fully Supported
Aquatic Life	227,274.92	142,899.34	38,574.81	45,800.78	63%
Recreation	179,583.77	178,484.03	1,084.07	15.67	99%
Drinking Water Supply	227,274.92	227,274.92	0.00	0.00	100%
Agriculture	227,274.92	227,274.92	0.00	0.00	100%

Table 13. Summary of Fully Supporting and Impaired Lakes (Not including Fish Consumption Use)

Degree of Use Support	Size (Acres)
Size Fully Supporting All Assessed Uses	142,628.09
Size Impaired for One or More Uses	84,646.83
Total Assessed	227,274.92

Table 14. Total Sizes of Lakes Impaired by Various Cause Categories (Acres)

Cause Category	Size of Waters by Contribution to Impairment
Metals (Copper)	12,619.02
Turbidity	545.91
Nutrients	31,161.88
Chlorophyll *a*	887.73
pH	54,747.15
Dissolved Oxygen	12,050.19
Fecal Coliform Bacteria	1,099.74

A very large proportion of the area impaired for copper can be attributed to a single monitoring site located in the middle of the main body of Lake Hartwell, a major reservoir of approximately 56,000 total surface acres. The monitoring location is located in the middle of the main body of the lake, away from any reasonable influence from direct point source discharges or nonpoint source runoff of sufficient volume to affect that location. Because of its location, it is used to represent a very large proportion of the total lake area. Other monitoring sites representing various other arms and coves in the lake did not show copper impairments. There is no readily apparent explanation for this observed impairment.

Table 15. Total Sizes of Lakes Impaired by Various Source Categories* (Acres)

Potential Source by Category	Size of Waters by Contribution to Impairment
Industrial Point Source	14,534.09
Municipal Point Source	17,319.58
Collection System Failure	32.27
Agriculture	17,319.58
Urban Runoff	17,323.83
Land Disposal	32.27
Hydromodification	21.76
Internal Nutrient Cycling	1,811.98
Unknown Source	78,188.10

*Potential Sources range from specific activities in the immediate vicinity of the monitoring site to general activities within the watershed, see Assessment Methodology.

B. Section 314 Reporting

Note: Lake areas reported in this section were obtained from Inventory of Lakes in South Carolina (SCDNR 1991). Total lake area is included for border lakes.

Section 314(a) of the Clean Water Act of 1987 directs each State to prepare or establish: (1) an identification and classification according to trophic condition of publicly-owned freshwater lakes within such State; (2) procedures, processes, and methods to control sources of pollution of such lakes; (3) methods and procedures, in conjunction with appropriate Federal agencies, to restore the quality of such lakes; (4) a list and description of lakes for that uses are known to be impaired; and (5) an assessment of the status and trends of water quality in lakes. Further, States are required to submit a biennial assessment of lake trophic condition as part of their §305(b) report.

Background

Forty significant lakes were included in South Carolina's Clean Lakes Classification Survey of 1980-81. For the purposes of this report, significant lakes refers to those freshwater lakes with at least 40 acres surface area. These lakes were classified according to trophic state and ranked in order of priority for restoration. The 40 lakes were divided into major and minor classes, and ranked within each class. This survey was updated in FY 1986-87 for major lakes and some minor lakes. In FY 1989, the classification survey was updated through a reassessment of all lakes. The information collected facilitated trend detection and was used in the FY 1990 §305(b) report.

SCDHEC conducted lake trophic condition assessments each year during FY 1991-2000. Monthly sampling is conducted each year in lakes throughout the state. Beginning in FY 1991, additional data collection for lake trophic condition assessments was coordinated with SCDHEC's Watershed Water Quality Assessments. Information on trophic status is updated for each significant lake at least every five years as part of the WWQA. In 2001, South Carolina adopted numeric nutrient criteria for lakes by ecoregion. Beginning FY 2002, trophic condition assessment was based upon the criteria for Total Phosphorus (TP), Total Nitrogen (TN) and Chlorophyll *a* (CHL-A).

Trophic Status

Southeastern lakes tend to be more turbid and more nutrient-rich than northern lakes; therefore many South Carolina lakes can be classified "eutrophic." The overall trophic status of significant South Carolina lakes is summarized in the following table. Trophic status was determined using a median total phosphorus concentration of 0.025 mg/l as the threshold of mesotrophy.

Table 16. Trophic Status of Significant South Carolina Lakes, 2002

	Number of Lakes	Acreage of Lakes
Total	59	479,413
Assessed	42	472,584
Oligotrophic/Mesotrophic	27	316,783
Eutrophic/Hypereutrophic	15	155,801
Unknown	17	6,829

Table 17. Condition of Significant South Carolina Lakes

Lake Sites Not Attaining Numeric Nutrient Criteria		
PIEDMONT		
STATION ID(S)	**Location**	**Parameters**
S-097	LAKE GREENWOOD - CANE CK ARM AT SC 72 3.1 MI SW CROSS HILL	TP
S-131	LK GREENWOOD AT US 221 7.6 MI NNW 96	TP
S-308	LAKE GREENWOOD, REEDY RVR ARM, 150 YDS US RABON CK	TP
SV-268	LAKE HARTWELL - EIGHTEEN MILE CK ARM AT S-04-1098	TP
S-223	BLACKS BR, LK MURRAY AT SC 391	TP
S-309	LAKE MURRAY, BUSH RVR ARM, 4.6 KM US SC 391	TP
CL-021	LAKE OLIPHANT, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	CHL-A
CW-207	LK WATEREE AT END OF S-20-291	TP
CW-209	LK WATEREE AT SMALL ISLAND 2.3 MI N OF DAM	TP
CW-231	LK WATEREE HEADWATERS APPROX 50 YDS DS CONFL CEDAR CK	TP
RL-02314	LAKE WATEREE 1.0 MI SW FROM MOUTH OF BEAVER CK	TP
CW-208	LK WATEREE AT S-20-101 11 MI ENE WINNSBORO	TP, CHL-A
RL-01029	LAKE WELCHEL 2.7 M N OF GAFFNEY	CHL-A
S-311	BOYD MILL POND .6 KM W DAM	TN, TP
CW-033	CEDAR CK RESERVOIR 100 M N OF DAM	TP
CW-175	CEDAR CK RESERVOIR/ROCKY CK AT S-12-141 SE OF GREAT FALLS	TP
RL-02319	CEDAR CK RES FROM W OF BIG ISL 7 MI BELOW ROCKY CK CONFL	TP
RL-02452	CEDAR CK RES 0.15 MI SE OF S TIP PICKETT ISLAND	TP
CW-174	CEDAR CK RESERVOIR AT UNIMP RD AB JCT WITH ROCKY CK	TN, TP
RL-01007	CEDAR CK RES 2.15 M SE OF GREAT FALLS	CHL-A
SV-291	CLARKS HILL RESERVOIR AT US 378 7 MI SW MCCORMICK	TP
CW-016F	FISHING CK RES 2 MI BL CANE CREEK	TP
CW-057	FISHING CK RES 75 FT AB DAM NR GREAT FALLS	TP
RL-01012	FISHING CK RES 3.8 M S OF FORT LAWN OFF W SHORE OF THE TOWN OF LAKE VIEW	CHL-A
SOUTHEASTERN PLAINS		
STATION ID(S)	**Location**	**Parameters**
C-058	LK INSPIRATION - ST MATTHEWS (FRONT OF HEALTH DEPT)	TN, TP
ST-025 / SC-015	LK MARION AT OLD US 301/15 BRDG AT SANTEE (SC-015)	TP
SC-014	LAKE MARION, HEADWATERS OF CHAPEL BRANCH CR.	TN, TP, CHL-A
SC-040	LAKE MARION AT CHANNEL MARKER 79	TP
MIDDLE ATLANTIC COASTAL PLAIN		
STATION ID(S)	**Location**	**Parameters**
ST-032	GOOSE CREEK RESERVOIR 100 M US OF DAM	TP, CHL-A
ST-033	GOOSE CK RESERVOIR AT 2ND POWERLINES US OF BOAT RAMP	TP, CHL-A

Lake Sites Attaining Numeric Nutrient Criteria		
BLUE RIDGE		
STATION ID(S)	**Location**	**Parameters**
CL-019	LK JOCASSEE IN FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
SV-334	LK JOCASSEE, MAIN BODY	
SV-335	LK JOCASSEE AT TOXAWAY, HORSE PASTURE, & LAUREL FORK CONFLUENCE	
SV-336	LK JOCASSEE AT CONFLUENCE OF THOMPSON AND WHITEWATER RVRS	
SV-337	LK JOCASSEE OUTSIDE COFFER DAM AT BAD CK PROJECT	
RL-01030	YONAH LAKE 0.8 M UPLAKE FROM YONAH DAM WHERE IT EMPTIES INTO TUGALOO RIVER	

Lake Sites Attaining Numeric Nutrient Criteria		
SV-358	LAKE YONAH, 50% BETWEEN CENTER OF SPILLWAY AND OPPOSITE SHORE	
S-292	NORTH SALUDA RESERVOIR AT WATER INTAKE	
S-291	TABLE ROCK RESERVOIR AT WATER INTAKE	
SV-359 / RL-02320	TUGALOO LAKE, FOREBAY EQUIDISTANT FROM SPILLWAY AND SHORELINES	
PIEDMONT		
STATION ID(S)	**Location**	**Parameters**
B-347	LAKE BLALOCK IN FOREBAY NEAR DAM	
RL-01019	LAKE BLALOCK 4 M SSW OF CHESNEE AND 0.3 M NE OF BUCK CREEK CHURCH	
RL-02323	LAKE BLALOCK AT S-42-43	
B-339	LAKE BOWEN 0.3 MI W OF SC 9	
B-340	LAKE BOWEN NEAR HEADWATERS, 0.4 KM W OF S-42-37	
RL-02455	LAKE BROADWAY 0.2 MI NW OF ALLEN PARK	
B-343	LAKE CHEROKEE IN FOREBAY NEAR DAM	
B-348 / RL-02325	LAKE COOLEY IN FOREBAY NEAR DAM	
CL-033	LAKE CRAIG 45 M NORTHWEST OF DAM	
RL-01005	LAKE CRAIG IS IN CROFT STATE PARK 7.5 M SE OF SPARTANBURG	
RL-01035	LAKE CRAIG IS IN CROFT STATE PARK 7.95 M SE OF SPARTENBURG	
B-341	LAKE CUNNINGHAM IN FOREBAY NEAR DAM	
RL-02311	LAKE GREENWOOD 1.0 MI NW OF SEABOARD RR CROSSING	
S-022	REEDY FORK OF LK GREENWOOD AT S-30-29	
S-024	LAKE GREENWOOD, HEADWATERS, JUST US S-30-33	
S-303	LAKE GREENWOOD 200 FT US OF DAM	
S-307	LAKE GREENWOOD, RABON CK ARM, .8 KM N RD S-30-307	
RL-01018	LAKE HARTWELL, 12 M WSW OF ANDERSON AND 3.5 M W OF ROBERTS CHURCH	
RL-01020	LAKE HARTWELL 6 M NNW OF ANDERSON	
RL-02315	LK HARTWELL 12.0 NW OF ANDERSON 2.0 MI N OF SADLERS CK ST PK	
RL-02330	LK HARTWELL 0.4 MI SE OF OCONEE/ANDERSON CO LINE 5.0 M W OF SANDY SPRINGS	
SV-106	MARTIN CK ARM OF LAKE HARTWELL AT S-37-65 N OF CLEMSON	
SV-107	LAKE HARTWELL - TWELVE MI CK ARM AT SC 133	
SV-200	TUGALOO RVR ARM OF LAKE HARTWELL AT US 123	
SV-236	LAKE HARTWELL AT S-37-184 6.5 MI SSE OF SENECA	
SV-249	LAKE HARTWELL HEADWATERS, SENECA RVR ARM AT SC 183 3.8 MI WSW SIX MILE	
SV-288	LK HARTWELL, SENECA RVR ARM AT USACE BUOY BTWN MRKRS S-28A & S-29	
SV-339	LK HARTWELL, SENECA RVR ARM AT USACE BUOY BTWN S-14 AND S-15	
SV-340	LK HARTWELL, MAIN BODY AT USACE WQ BUOY BTWN MRKRS 11 & 12	
SV-363	LAKE HARTWELL OFF GLENN FORD LANDING US BEAVERDAM CK COVE	
SV-360	LAKE ISSAQUEENA, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
CL-035	LAKE JOHNSON AT SPILLWAY AT S-42-359	
RL-02304	LAKE KEOWEE 7.0 MI E OF WALHALLA	
SV-311	LK KEOWEE AT SC 188 - CANE CK ARM 3.5 MI NW SENECA	
SV-312	LK KEOWEE AT SC 188 - CROOKED CK ARM 4.5 MI N SENECA	
SV-338	LK KEOWEE ABOVE SC ROUTE 130 AND DAM	
SV-361	LK KEOWEE IN FOREBAY OF LITTLE RIVER DAM	

Lake Sites Attaining Numeric Nutrient Criteria		
B-099A	ON # 1 INLET LK LANIER IN GREENVILLE CO	
B-099B	AT DAM LK LANIER IN GREENVILLE CO	
RL-01010	LAKE LONG 7.75 MI NE OF UNION AND 3.5 M W OF SUMTER NATIONAL FOREST	
B-344	LAKE JOHN D. LONG IN FOREBAY NEAR DAM	
CL-083	LK MURRAY IN FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
RL-01023	LAKE MURRAY 9.3 M N OF GILBERT AND 0.75 M NNE FROM THE END OF S-32-443	
RL-02316	LAKE MURRAY SW OF JAKES MARINA	
S-204	LK MURRAY AT DAM AT SPILLWAY (MARKER 1)	
S-211	HOLLANDS LANDING LK MURRAY OFF S-36-26 AT END OF S-36-3	
S-212	MACEDONIA LANDING LK MURRAY AT END OF S-36-26 MACEDONIA	
S-213	LAKE MURRAY AT S-36-15	
S-222	LAKE MURRAY, LITTLE SALUDA ARM AT SC 391	
S-273	LK MURRAY AT MARKER 166	
S-274	LK MURRAY AT MARKER 143	
S-280	LK MURRAY AT MARKER 102	
S-310	LAKE MURRAY, SALUDA RVR ARM, US BUSH RVR, 3.8 KM US SC 391	
S-279 / RL-02318	LK MURRAY AT MARKER 63	
RL-02307	LAKE OOLENOY SAMPLED FROM S SIDE OF SC 11 BRIDGE	
S-798	LAKE OOLENOY AT DRAIN NEAR SPILLWAY AT SC 11	
RL-01014	LAKE RABON 7.6 M W OF THE TOWN OF LAURENS	
RL-02303	LAKE RABON NEAR NE SHORE AND BELOW US 76	
RL-02305	LAKE RABON NEAR BOAT LANDING ON UNN CNTY RD OFF S-30-54	
S-312	LAKE RABON, S RABON CK ARM, JUST DS S-30-312	
S-296	LAKE RABON 300 FT US OF DAM	
S-313	LAKE RABON, N RABON CK ARM, 2.5 MI US DAM	
CL-100	LAKE ROBINSON, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
RL-01025	LAKE ROBINSON 5.9 M NNW OF GREER (PREVIOUSLY THE SOUTH TYGER RIVER)	
RL-02321	LAKE ROBINSON 6.3 MI NNW OF GREER	
RL-02327	LAKE ROBINSON 0.4 MI S OF S-23-113	
RL-02453	LAKE ROBINSON 0.7 MI S OF S-23-113	
SV-098	LAKE RUSSELL AT SC 72 3.1 MI SW CALHOUN FALLS	
SV-100	LAKE RUSSELL AT SC 181 6.5 MI SW STARR	
SV-357	LAKE RUSSELL, ROCKY RVR ARM BETWEEN MARKERS 48 & 49, DS FELKEL	
SV-331	LK SECESSION, 1 1/4 MI BELOW SC ROUTE 28	
SV-332	LK SECESSION APPROX 400 YDS ABOVE DAM	
RL-02301	LAKE THICKETTY NEAR SE SHORE APPROX 1.0 MI FROM MACEDONIA	
B-342	LAKE THICKETTY IN FOREBAY NEAR DAM	
CL-089	LK WATEREE IN FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
RL-01003	LAKE WATEREE 11.25 NW OF CAMDEN ON WESTERN SHORE OF LAKE	
RL-01033	LAKE WATEREE 9.7 M NW OF CAMDEN, TOWARD THE SOUTHERN END OF THE LAKE	
CW-197	LAKE WYLIE AB MILL CK ARM AT END OF S-46-557	
CW-198	LAKE WYLIE OUTSIDE MOUTH OF CROWDERS CK ARM	
CW-200	LK WYLIE AT SC 274 9 MI NE OF YORK	
CW-201	LK WYLIE N LAKEWOODS S/D AT EBENEZER ACCESS	
CW-230	LAKE WYLIE AT DAM, UNDER POWERLINES	

Lake Sites Attaining Numeric Nutrient Criteria		
CW-245	LAKE WYLIE, CROWDERS CK ARM AT FIRST POWERLINES US OF MAIN POOL	
B-737	LAKE YORK IN KINGS MOUNTAIN STATE PARK	
SV-258	BROADWAY LAKE, NEALS CK ARM 50% BETWEEN BANKS AT GOLF COURSE	
SV-319	BROADWAY LAKE, BROADWAY CK ARM UPSTREAM OF PUBLIC ACCESS	
SV-321	BROADWAY LAKE FOREBAY, 50% BETWEEN SPILLWAY AND OPPOSITE LAND	
RL-01017	CEDAR CK RES 2.5 M SE OF GREAT FALLS	
CL-023	CHESTER STATE PARK LAKE 100 M EAST OF SPILLWAY	
CL-039	LITTLE RIVER ARM OF CLARKS HILL RESERVOIR	
CL-040	CLARKS HILL RESERVOIR HEADWATERS (SAVANNAH RVR)	
CL-041	CLARKS HILL RESERVOIR IN FOREBAY NEAR DAM	
B-735	DUNCAN CREEK RESERVOIR 6B IN FOREBAY NEAR DAM	
B-110	ELIZABETH LAKE AT SPILLWAY ON US 21	
B-327	MONTICELLO LK-LOWER IMPOUNDMENT BETWEEN LARGE ISLANDS	
B-328	MONTICELLO LK-UPPER IMPOUNDMENT AT BUOY IN MIDDLE OF LAKE	
B-345	PARR RESERVOIR IN FOREBAY NEAR DAM	
B-346	PARR RESERVOIR 4.8 KM N OF DAM, UPSTREAM MONTICELLO RESERVOIR	
RL-01015	SALUDA LAKE IS 5 M W OF GREENVILLE AND .8 M NE OF WESTWOOD CHURCH	
S-250	SALUDA LAKE AT FARRS BRDG ON SC 183 7 MI NE EASLEY	
S-314	SALUDA LAKE, .5 MI US OF LANDING	
B-113	SPARTANBURG RESERVOIR #1 ON S-42-213 NE OF INMAN	
SV-294	STEVENS CK RESERVOIR HEADWATERS AT CLARKS HILL DAM BOAT RAMP	
RL-01004	STROM THURMOND RES 0.65 M SW OF SC-81 LAKE BRIDGE ON SHORE NEAREST DELA HOWE SCHOOL	
RL-01024	STROM THURMOND RES 1.5 M SE (ALONG SHORELINE) FROM US-378 BRIDGE BETWEEN GA AND SC	
RL-01028	STROM THURMOND RES 0.4 M N OF THE DAM SEPERATING THE LAKE AND THE SAVANNAH RIVER	
RL-01034	STROM THURMOND RES 4.9 M NE F MCCORMICK, NEAR BAKER CREEK STATE PARK	
RL-02309	LAKE STROM THURMOND NEAR HAMILTON BRANCH ST PK	
SOUTHEASTERN PLAINS		
STATION ID(S)	**Location**	**Parameters**
CL-077	LAKE ASHWOOD, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
C-025	LK CAROLINE SPILLWAY AT PLATT SPRINGS RD	
CL-064	LAKE EDGAR BROWN IN FOREBAY NEAR DAM	
RL-01001	LAKE MARION 2.5 M DIRECTLY SW OF I-95 BRIDGE (MIDDLE) OVER LAKE	
RL-01016	LAKE MARION 1.6 M DIRECTLY SW OF I-95 BRIDGE (MIDDLE) OVER LAKE	
RL-01021	LAKE MARION 3 M WSW OF EADYTOWN IN SE CORNER OF THE LAKE MARION	
RL-01031	LAKE MARION 3.75 M DIRECTLY SW OF I-95 BRIDGE OVER LAKE MARION	
RL-02310	LAKE MARION NEAR SANTEE NATL WILDLIFE REFUGE	
ST-024	LK MARION AT END OF S-14-64 AT CAMP BOB COOPER	
RL-02306 / SC-012	LK MARION @ JACK'S CK EMBAYMENT; USE SANTEE COOPER SC-012	
RL-02308 / SC-016	LK MARION @ CHANNEL MARKER 69; USE SANTEE COOPER SC-016	
CL-042 / SC-022	LAKE MARION FOREBAY, SPILLWAY MARKER 44 (SC-022)	

Lake Sites Attaining Numeric Nutrient Criteria		
ST-036 / SC-023A	LK MARION, WYBOO CREEK ARM DS OF CLUBHOUSE BR (SC-023A)	
RL-01011 / SC-035	LAKE MARION 1.10 M SSE OF SANTEE NAT. WILDLIFE REFUGE AND 1MI S OF EAGLE POINT (SC-035)	
RL-01002 / ST-034 / SC-008	LAKE MARION BELOW THE TRAIN BRIDGE OVER THE LAKE, 10.5 M NW UPLAKE OF I-95 BRIDGE (ST-034 & SC-008)	
CL-094	LK ROBINSON IN FOREBAY EQUIDISTANT FROM DAM AND SHORELINES FROM PRIVATE ACCESS	
PD-327	LK ROBINSON AT S-13-346 5 MI E MCBEE BY BOAT	
CL-086	LAKE WALLACE, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
RL-02324	LAKE WALLACE S OF S-35-47	
CL-078	ADAMS MILLPOND, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
SV-686	FLAT ROCK POND IN FOREBAY NEAR DAM	
C-068	FOREST LAKE AT DAM	
SV-722	GRANITEVILLE POND #2 IN FOREBAY NEAR DAM	
CL-088	JUNIPER LAKE, FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
CL-069	LANGLEY POND IN FOREBAY NEAR DAM	
RL-02317	LANGLEY POND NEAR NW SHORE AND 0.6 MI NE OF SPWY	
PD-081	PRESTWOOD LK AT US 15	
PD-268	SONOVISTA CLUB HARTSVILLE OFF DOCK OF PRESTWOOD LK	
CL-067	VAUCLUSE POND IN FOREBAY NEAR DAM	
C-048	WINDSOR LK SPILLWAY ON WINSDOR LK BLVD	
MIDDLE ATLANTIC COASTAL PLAIN		
STATION ID(S)	**Location**	**Parameters**
RL-01009	LAKE WARREN IN STATE PARK 3.9 M SW OF HAMPTON	
RL-01006	LAKE MOULTRIE 5.5 M N OF MONCKS CORNER AND 1.5 M NW OF CAMP MOULTRIE	
RL-01026	LAKE MOULTRIE 4.5 M N OF MONCKS CORNER, 1.5 M NNE OF WHERE S-08-5 ENDS	
RL-02322	LAKE MOULTRIE NE 3.0 MI FM BONNEAU BEACH	
RL-02328	LAKE MOULTRIE SW NEAR DUCK PD AND APPROX 2.0 E OF CROSS	
RL-02454	LAKE MOULTRIE SW IN OPEN WATER	
ST-037 / SC-030	LAKE MOULTRIE AT CHANNEL MARKER 17 (SC-030)	
CSTL-075	LAKE WARREN, BLACK CK ARM, AT S-25-41 5 MI SW OF HAMPTON	
CL-062 / RL-02451	LAKE GEORGE WARREN IN FOREBAY NEAR DAM	
CSTL-124	BACK RIVER RES IN FOREBAY EQUIDISTANT FROM DAM AND SHORELINES	
RL-01008	GOOSE CK RES 2.3 M S OF GOOSE CREEK TOWN CENTER	

Control Methods

NPDES permits and nonpoint source control programs, that were previously described in the Municipal and Industrial permitting sections, are designed to protect lake water quality. South Carolina's water classifications and criteria are applicable to lakes.

Restoration Efforts

Plans to restore and/or protect lake quality are integrated with the watershed water quality management approach and other watershed pollution control plans. Table 18 contains information

regarding the general restoration techniques that have recently been applied in South Carolina. There are other recognized restoration techniques.

Table 18. Lake Rehabilitation Techniques

Rehabilitation Technique	Number of Lakes Where Technique Has Been Used	Acres of Lakes Where Technique Has Been Used
In-Lake Treatments		
Sediment Removal/Dredging	1	300
Aquatic Macrophyte Harvesting	1	600
Application of Aquatic Plant Herbicides	6	2308
Hypolimnetic Aeration	2	38,050
Biological Controls	7	173,956
Watershed Treatments		
Sediment Traps/Detention Basins	1	300
Integrated Pest Management Practices Applied	1	1,600
Animal Waste Management Practices	1	51,000
Unspecified Type of Best Management Practice Installed	1	1,600
Oxygen Injection System in Upstream Lake	1	70,000
Other Lake Protection/Restoration Controls		
Public Information/Education Program/Activities	11	266,017
Point Source Controls	6	85,462

Acid Effects on Lakes

SCDHEC measures pH as part of its routine monitoring program at all lake sites. Acidic conditions, for the purposes of this report, existed in any lake for that pH was less than the appropriate State standard in more than 10% of samples. Four lakes, Lake Caroline in Lexington

County, Windsor Lake in Richland County, the South Rabon Creek arm of Lake Rabon in Laurens County, and the headwater area of Stephens Creek Reservoir in McCormick County were found to experience acidic conditions.

State water quality criteria specify, with few exceptions, a pH of at least 6.0 SU to protect classified and existing uses. EPA's Eastern Lake Survey reported high acid neutralizing capacity in Southern Blue Ridge region lakes, including those in northwestern South Carolina.

Toxic Effects on Lakes

As part of the State's long-term trend monitoring all lake sites are monitored for metals and/or ammonia. In the Summary Statistics for this section, Table 14 lists causes for partial or non-support of lake classified uses, Table 15 lists potential sources of partial or non-support and Tables 25 lists the total size affected by toxicants. The section on Public Health: Aquatic Life Impacts contains a discussion of fish consumption advisories issued in South Carolina.

Trends in Lake Trophic Condition

Due to the transition from Legacy STORET to Modernized STORET and data incompatibility with in-house trend analysis software, trend analysis for nutrient concentrations could not be conducted for this report.

5. Estuary and Coastal Assessment

A GIS coverage of the National Wetlands Inventory maps was utilized for the traditional §305(b) assessment approach in this report for estimating total square miles of estuary. South Carolina has approximately 401 square miles of estuaries based on the GIS coverage of the NWI maps used for the traditional §305(b) assessment. These estuaries were assessed using water quality data collected at 79 SCDHEC monitoring stations representing 221 square miles. The strategic location of these monitoring stations allows the determination of water quality for these waters to provide a representative picture of the overall water quality of South Carolina's estuarine systems. Recent improvements in the analytical precision reported by the SCDHEC Analytical and Radiological Environmental Services Division has had the effect of an increased detection of standards excursions for some metals, in particular copper.

A. Summary Statistics

A summary of classified use support statewide, along with causes and sources for partial or nonattainment, is presented below. In instances where no potential source of observed fecal coliform bacteria excursions was apparent, the source was listed as natural conditions, but because of the potential for human health concerns the use support determination was still listed as partial or nonattainment of recreational uses as the frequency of excursions dictated.

Table 19. Estuaries Use Support Summary (Square Miles)

Use	Size Assessed	Size Fully Supported	Size Partially Supported	Size Not Supported	Percent Fully Supported
Aquatic Life	221.11	150.28	31.84	38.99	68%
Recreation	221.11	208.07	9.85	3.19	94%
Shellfish Harvesting*	892.20	626.10	149.74	116.36	70%

*Shellfish Harvesting areas include intertidal and subtidal habitats. Size Partially Supported is represented by Restricted and Conditional shellfish classifications. Size Not Supported is represented by administrative closures (Prohibited shellfish classification). Aquatic Life and Recreational area includes only open water areas.

Table 20. Summary of Fully Supporting and Impaired Estuaries (Not including Fish/Shellfish Consumption Use)

Degree of Use Support	Size (Square Miles)
Size Fully Supporting All Assessed Uses	144.20
Size Impaired for One or More Uses	76.91
Total Assessed	221.11

Table 21. Total Sizes of Estuaries Impaired by Various Cause Categories (Square Miles)

Cause Category	Size of Waters by Contribution to Impairment
Metals (Combined)	12.29
Copper	8.57
Nickel	0.65
Zinc	3.72
PH	10.59
Turbidity	17.76
Dissolved Oxygen	39.01
Fecal Coliform Bacteria	13.04

Table 22. Total Sizes of Estuaries Impaired by Various Source Categories* (Square Miles)

Potential Sources by Category	Size of Waters by Contribution to Impairment
Industrial Point Sources	13.92
Municipal Point Sources	0.54
Collection System Failures	0.06
Intensive Animal Feeding Operations	0.14
Urban Runoff	0.37
Land Disposal	1.56
Habitat Modification	0.06
Natural Sources	8.23
Unknown Sources	56.27

*Potential Sources range from specific activities in the immediate vicinity of the monitoring site to general activities within the watershed, (see Assessment Methodology.)

Comparison of Traditional and Probability-Based Assessment Results

Data from a total of 60 randomly located estuary sites are summarized for the probability-based assessment conclusions, 30 sampled in 2001 and 30 sampled in 2002. Since the size estimates between the traditional approach and the random design are based on different size/resource representation approaches, using the absolute sizes doesn't provide a meaningful comparison. Therefore the numbers were converted to the percentage of square miles assessed in each category for the traditional §305(b) approach by dividing the size in each category by the total number of square miles assessed for the appropriate use. For the probability-based approach it represents the percentage of total combined tide creek and open water habitat area in the State, weighted by habitat stratum as per the design discussed previously.

For the traditional §305(b) approach, square miles impaired for individual pollutants (causes) were divided by the total square miles assessed to get the percentage of estuary square miles assessed that were impaired.

Note that some of the causes noted in the traditional §305(b) assessment did not cause impairments at any of the random sites, so there is no percent impaired for the probability-based estimates in this comparison, e.g. nickel, fecal coliform bacteria, etc.

Table 23. Comparison of Traditional and Probability-Based Assessment Results for Estuaries

Indicator	Category	Percent of Square Miles Assessed - Traditional §305(b)	Probability-Based Estimated Percent of Total Resource	Lower 95 Percent Confidence Interval	Upper 95 Percent Confidence Interval
Aquatic Life Use	Fully Supporting	68.0%	75.3%	64.5%	86.0%
	Partially Supporting	14.4%	3.0%	0.0%	7.7%
	Not Supporting	17.6%	21.7%	10.8%	32.7%
Recreational Use	Fully Supporting	94.1%	100.0%	100.0%	100.0%
	Partially Supporting	4.5%			
	Not Supporting	1.4%			
Support of All Assessed Uses	Fully Supporting All	65.2%	75.3%	64.5%	86.0%
	Impaired for One or More	34.8%	24.7%	14.0%	35.5%
Percent of Estuaries Impaired by Various Cause Categories					
Turbidity		8.0%	14.4%	5.7%	23.0%
Dissolved Oxygen		17.6%	9.3%	2.7%	15.9%
pH		4.8%	0%		
Copper		3.9%	4.4%	0.0%	9.7%
Nickel		0.3%	0%		
Zinc		1.7%	0.3%	0.0%	0.9%
Fecal Coliform Bacteria		5.9%	0%		

The Lower and Upper 95 Percent Confidence Intervals for the probability-based estimates signify that it is 95% certain that the true percentage is between the upper and lower confidence limits. As more probability-based sites are monitored the 95% confidence interval will become a tighter fit. It is reassuring that many of the estimates derived by the traditional approach also fall close to or within the 95% confidence interval estimates based on the probability-based approach. . The fact that nickel was detected as a cause of impairment for such a small percentage of miles assessed

under the traditional §305(b) approach and at none of the probability-based sites suggests that it is not a widespread pollutant problem. This example demonstrates one of the advantages of the probability approach towards characterizing general conditions without over-emphasizing small scale, local pollution issues. It also provides evidence of the need to retain resources for targeted monitoring of specific known or suspected problems.

6. Wetlands Assessment

A. Summary Statistics

Table 24. Extent of Wetlands, by Type

Wetland Type	Historical Extent in Acreage	1980's Reported Acreage	1994 Reported Acreage	Most Recent Acreage
Saturated Bottomland Forest	6,414,000	4,659,000	1,804,884	1,804,884
Nonforested Wetlands/Marsh			485,314	485,314

SCDHEC and S.C. Department of Natural Resources (SCDNR) have derived land use/land cover data from SPOT satellite imagery from December 1988 to March 1990. This data provides the best statistics to date for wetlands statewide, but are only for two major wetland types. SCDHEC and SCDNR are working together to provide a more detailed land use/land cover map for South Carolina using Landsat Thematic Mapper satellite imagery to identify seven classes of wetlands that include: low marsh, high marsh, fresh marsh, deciduous wetland forest, coniferous wetland forest, bottomland hardwoods and scrub/shrub. This approach was determined to be the easiest way to attain statewide wetlands data for use in a GIS since the more detailed National Wetlands Inventory mapping is not complete for the state.

B. Extent of Wetlands Resources

To date, South Carolina has not conducted an assessment of wetland acreage changes over time. The Water Quality Certification, Standards, and Wetlands Programs Section has developed a computer tracking system into that all Section 10 and Section 404/401 projects are entered. This tracking system includes information on project location (latitude/longitude, basin, and watershed unit), purpose, types of impacts, acreage of wetland and non-wetland impacts, mitigation requirements and location (latitude/longitude, basin, and watershed unit) and remediation requirements. Information regarding projects from the years of 1983 to the present has been entered into this tracking system and is currently being verified. Once this data has been verified, statistics on the location and types of wetland impacts in South Carolina will be available. Currently, maps of compensatory mitigation sites (1990 to present) are being digitized and entered into GIS for future analyses.

C. Integrity of Wetlands Resources

There is no specific legislation authorizing a statewide wetlands protection program. The primary mechanisms for wetlands protection in the state are federal and state regulatory programs for the discharge of dredged or fill material into waters of the state and for activities in the critical areas of the coastal zone.

Section 404 Permit Program - Section 404 of the Clean Water Act requires a permit for the discharge of dredged or fill material into navigable waters, including wetlands, throughout the United States. Certain activities, such as normal agriculture, silviculture and ranching activities, are exempt from such permit requirements. The United States Army Corps of Engineers (ACE) administers the Section 404 permitting program, but the EPA exercises final authority. The Agency can prohibit the use of a disposal area if the discharge will have an adverse impact on municipal water supplies, shellfish beds, fishing areas, wildlife, or recreational areas. No permit can be issued without a Section 401 Certification from SCDHEC's Division of Water Quality, and in coastal areas, a determination of consistency with the Coastal Zone Management Program (CZM) from SCDHEC's Office of Ocean and Coastal Resource Management (OCRM) is required. Other state and federal natural resource agencies, such as DNR, U. S. Fish and Wildlife Service, and National Marine Fisheries Service, provide input to decisions of the federal permitting agency and the state certifying agencies on proposed activities.

Section 404 permit authority can be delegated to states but South Carolina has elected not to assume that authority. In 1986, SCDHEC completed a study to determine the feasibility of assuming the Section 404 program. The study concluded that although SCDHEC had the legal authority and the technical expertise, it was not advisable to assume that authority because of the limited area of the jurisdiction involved. Perhaps more importantly, there would be no new funding from EPA to support assumption.

Section 401 Water Quality Certification - Section 401 of the Clean Water Act requires any applicant for a federal permit or license involved in an activity that may result in a discharge to navigable waters to receive certification from the state that the discharge will not cause violations of the state's water quality standards. Consequently, 401 Certification is required for all activities requiring a Section 404 permit from the ACE. This mechanism provides a State position on wetlands alterations.

The Division of Water Quality evaluated 605 projects that required a §401 Water Quality Certification in FYs 2000 through 2002. Approximately 23% of these projects involved impacts to wetlands. SCDHEC routinely requires compensation for wetland impacts at greater than a one to one basis. This compensation may be in the form of preservation, lineation, enhancement, or restoration and may not strictly meet the State and Federal “no net loss” goals.

SCDHEC administers certification programs using as guidance the South Carolina Pollution Control Act. S. C. Regulation 61-101, *Water Quality Certification*, guides the administration and

technical review for the §401 Certification Program that determines if the standards of S. C. Regulation 61-68 will be met.

The S. C. Pollution Control Act provides authority for regulation of wetlands since it defines waters of the State as:

"lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Atlantic Ocean within the territorial limits of the State and all other bodies of surface or underground water, natural or artificial, public or private, inland or coastal, fresh or salt, that are wholly or partially within or bordering the State or within its jurisdiction."

This definition does not specifically list wetlands, but wetlands are included through the generic use of the word "marshes" as well as within the broad inclusion of the phrase "all other bodies of surface or underground water." Therefore, all water pollution control programs administered by SCDHEC apply to activities in wetlands.

During review of applications for §401 Certification, SCDHEC, with authority from S.C. Regulation 61-101, evaluates whether or not there are feasible alternatives to the activity that reduce adverse consequences on water quality and classified water uses, if the activity is water dependent, and the intended purpose of the activity. Certification is denied if the activity will adversely affect existing or designated uses. Certification is granted if water quality standards, that includes protection of existing uses, will not be violated. The federal permit cannot be issued if certification is denied.

Water Quality Certification, Nationwide Permits (NWP) - SCDHEC sent a Notice of Proposed Decision for the 2002 NWPs on February 28, 2002 to the ACE. SCDHEC proposed to deny NWPs: 15, 16, 17, 21, 34, and 35. In regard to NWP 17, SCDHEC currently reviews all applications for FERC licenses. The following NWPs were proposed for issuance with conditions: 3, 7, 12, 13, 14, 18, 19, 20, 22, 23, 27, 29, 30, 31, 32, 33, and 36 through 44. The most shared condition states that proposed impacts will not exceed 0.10 ac or 50 linear ft. of special aquatic sites including wetlands, or if exceeded a mitigation plan will be required; and, depending on the NWP some allowed impacts are capped at 0.25 ac or 100 linear ft. of stream. In March of 2000, the ACE proposed to replace NWP 26 with several “activity specific” NWPs and NWP 26 was placed on reserve. To take advantage of a NWP permit, the applicant must submit a wetlands delineation and, in some cases, a pre-construction notification to the ACE.

Wetlands losses can cause significant adverse, but avoidable, cumulative environmental impacts. Wetlands losses may lead to increased costs to the public for flood control and drinking water treatment. Moreover, wetlands are especially important in providing storm water filtration to maintain surface and ground water quality. Protection of wetlands is imperative if South Carolina is to achieve the goals of the Clean Water Act to restore and maintain the chemical, physical, and biological integrity of its waters.

D. Development of Water Quality Standards for Wetlands

S.C. Regulation 61-68 provides that waters not classified by name assume the classification of the waterbody to that they are adjacent. Wetlands contiguous to a stream or lake assume the classification of the waterbody to that they are contiguous. The standards allow variation from specific numeric standards if those variations are due to natural conditions. SCDHEC is continuing to evaluate the development of water quality classifications and standards specifically applicable to wetlands.

With funding from the EPA, SCDHEC developed classifications and standards for wetlands. The intent was that the system would augment the State's existing water quality classifications and standards to ensure greater protection of the State's wetlands through Clean Water Act programs.

Before proceeding with regulation development for the proposed classifications and standards for wetlands, there is the need to gain general agreement regarding wetlands protection policy and mechanisms in the State. Consensus-building among Federal, State, and local regulators with developers, farmers, forestry industry, and environmental groups would ensure acceptance of a clearly defined South Carolina wetlands protection policy. In 1993, SCDHEC received additional funding from EPA to further determine wetlands protection mechanisms and encourage consensus-building through education.

E. Additional Protection Activities

SCDHEC also uses antidegradation rules in S.C. Regulation 61-68 to evaluate applications for Water Quality Certification. The basic tenet of antidegradation is:

"existing uses and the level of water quality necessary to protect existing uses in all segments of a water body must be maintained"

Strict application of this water quality standard is impossible if there is to be any fill in wetlands. Therefore, the federal government determined that some fill in wetlands may be allowed pursuant to Section 404 of the Clean Water Act. S.C. Regulation 61-68 provided for this by adding a provision that states,

"Discharge of fill into waters of the State is not allowed unless the activity is consistent with Department regulations and will result in enhancement of classified uses with no significant degradation to the aquatic ecosystem or water quality".

Fill may only be allowed if it does not cause or contribute to significant degradation of the aquatic environment that can be determined by whether or not the activity will cause adverse effects on:

1. Human health or welfare;

2. Life stages of aquatic life or wildlife dependent upon the aquatic ecosystem;

3. Ecosystem diversity, productivity, and stability;

4. Recreational, aesthetic, and economic values.

7. Public Health - Aquatic Life Concerns

A. Sizes of Water Affected by Toxicants

Toxic pollutants in South Carolina's surface waters were assessed for this report through the evaluation of data collected statewide at SCDHEC monitoring stations. Monthly ammonia data from 621 SCDHEC monitoring sites and quarterly metals data from 604 SCDHEC monitoring sites statewide were evaluated for this assessment.

SCDHEC also annually collects sediment samples for toxics analyses at approximately 160 monitoring sites. There are no State standards for sediment.

Table 25. Total Size Affected by Toxicants

Waterbody Type	Size Monitored for Toxicants	Size with Elevated Levels of Toxicants
Rivers (miles)	13,450.02	1,343.32
Lakes (acres)	226,845.72	12,619.02
Estuaries (square miles)	196.76	12.29

B. Public Health: Aquatic Life Impacts

Pollution Caused Fish Kills/Abnormalities

During 2002 there were a total of 99 investigations of fish kills conducted by SCDHEC and in 2003, 73 investigations. Dissolved oxygen depletion, weather conditions, and other natural causes accounted for approximately 66 % of all fish kills in 2002 and 67% in 2003. In 2003 nearly 58% of the kills occurred in privately owned ponds or lagoons. In approximately 20% of the fish kills reported, the cause could not be determined. Approximately 14% of the fish kills investigated in 2003 were from unnatural causes. Unnatural causes ranged from fish being cough and dumped back into lakes and streams to the runoff of pesticides and pollution.

Most investigations were conducted a day or more after the initial occurrence of the fish kill. Late reporting of fish kills to DHEC investigators hinders accurate determination of the cause of the fish kill.

The *Pfiesteria* program continues to be an important program in the state of South Carolina. Funding has been cut but SC DHEC continues to be prepared for possible *Pfiesteria* events in

2004. The coastal districts maintain trained personal to investigate *Pfiesteria* related kills. For the 2003 FY no fish kills can be linked to *Pfiesteria*. In 2003 the presence of *Pfiesteria Shumwayae* and *P. cryptoperidiniopsis* were detected in coastal waters. *Pfiesteria piscicida* the form of *Pfiesteria* knows to kill fish has not been detected in SC in its toxic stage following any fish kill in SC during the 2003 FY.

There are no waters in the State that routinely experience fish kills or fish abnormalities due to pollutions or toxics. When fish kills do occur that can be attributed to other than natural causes, enforcement action is taken. The action usually takes the form of an administrative order and includes penalties commensurate with the violation. Schedules for corrective actions are included in the order along with appropriate assessment of monetary damage of the fish killed.

In May 31, 2001 SC DHEC implemented a "Field Manual for the Investigation of Fish Kills" to be used by all districts. This manual is the official guide for all districts. It is updated once a year by DHEC's Emergency Response Section.

Fish Consumption Advisories

SCDHEC uses a risk-based approach to evaluate contaminant concentrations in fish tissue and to issue consumption advisories in affected waterbodies. This approach contrasts the average daily exposure dose to the reference dose (RfD). Using these relationships, fish tissue data are interpreted by determining the consumption rates that would not be likely to pose a health threat to adult males and nonpregnant adult females. Because an acceptable RfD for developmental neurotoxicity has not been developed and because scientific studies suggest that exposure before birth may have adverse effects the health of infants, pregnant women, infants, and children are advised to avoid consumption of fish from any waterbody where an advisory has been issued.

Fish consumption advisories are updated annually in March. For background information and the most current advisories, please visit the Bureau of Water homepage at http://www.scdhec.net/eqc/admin/html/fishadv.html or call SCDHEC's Division of Health Hazard Evaluation, toll-free, at (888) 849-7241.

Shellfish Restrictions/Closures

The goal of SCDHEC's Shellfish Sanitation Program (SSP) is to ensure that molluscan shellfish and areas from that they are harvested meet the health and environmental quality standards provided by federal and state regulations, laws, and guidelines. Additionally, SCDHEC promotes and encourages coastal quality management programs consistent with protected uses established through the S.C. Regulation 61-68, *Water Classifications and Standards*. SSP management policy is primarily determined by S. C. Regulation 61-47, *Shellfish*, as well as other State legislation. The National Shellfish Sanitation Program (NSSP) Model Ordinance, developed through participation in the Interstate Shellfish Sanitation Conference (ISSC) and endorsed by all shellfish producing states and the United States Food and Drug Administration (USFDA), is used as primary guidance for shellfish regulation development.

Sanitary surveys are conducted by SCDHEC to assess the quality of the coastal waters. These surveys result in shellfish harvesting classifications described as follows:

Approved: Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations that would render shellfish unsafe for human consumption. Approved area classification shall be determined upon a sanitary survey that includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, nor shall more than ten percent of the samples exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, nor shall the estimated ninetieth percentile exceed an MPN of forty-three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Guidelines.

Conditionally Approved: Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under that harvesting will be allowed shall be adopted by the Department, prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted: Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved area classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more

than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Guidelines.

Prohibited: Growing areas shall be classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities that could render shellfish unfit or unsafe for human consumption.

As a matter of SCDHEC policy, prohibited areas are established adjacent to all point source and/or marinas as a precaution to protect public health. These prohibited areas are not necessarily an indication of lesser water quality or that standards are not being met; rather, they are areas that have the potential for variable water quality.

South Carolina currently has approximately 571,010 estuarine/riverine surface acres classified for the harvest of molluscan shellfish. Of this total, Approved accounts for 70.2% of total acreage, Conditionally Approved - 1.4%, Restricted - 15.4%, and Prohibited - 13.0%.

Table 26. Summary of Shellfish Harvesting Status in South Carolina Shellfish Waters

Harvesting Status	Acreage	Percent
Approved	400,706	70.2%
Conditionally Approved	7,860	1.4%
Restricted	87,971	15.4%
Prohibited	74,473	13.0%
Total Assessed	571,010	

Restrictions on Bathing Areas

There are currently fifty-eight (58) Natural Public Swimming Areas permitted for operation by SCDHEC. These areas are tested for Fecal Coliform (FC) bacteria prior to obtaining a yearly operating permit and are tested twice per month during the swimming season. The following swimming areas exceeded acceptable fecal coliform levels as specified in S.C. Regulation 61-50, *Natural Public Swimming Area*. Areas exceeding the specified parameters are closed until

satisfactory sample results are collected. These are all fresh waters. Saltwater areas are addressed in the Ocean Water Quality Monitoring section.

Table 27. Areas of Bathing Restrictions

Natural Area	Frequency
Langley Pond Park	one time 07/01/02
Gem Lakes	recurrent 06/04/02, 09/03/02
Berkeley County Family YMCA – Swim Area A	recurrent 04/17/02, 04/30/02, 05/02/02, 05/21/02, 07/22/02, 07/24/02, 07/26/02
Berkeley County Family YMCA – Swim Area B	recurrent 05/21/02, 06/04/02, 07/22/02, 07/24/02, 07/25/02, 07/26/02
Somerset Point	one time 06/16/03
Paris Mountain State Park	recurrent 08/06/02, 06/03/03
Pleasant Ridge County Park	one time 05/07/03
Look-Up Lodge	recurrent 06/05/03, 06/06/03
Rocks Pond Campground	recurrent 07/08/02, 08/29/02

Ocean Water Quality Monitoring

Ocean water quality is currently monitored at a total of 118 sample sites along the South Carolina coast. Sampling frequency is based on beach Tier level. Tier 1 beaches are high use, high risk beaches. Tier 2 beaches are lower use and/or lower risk beaches. Tier 1 beaches are sampled weekly May 15 through October 15. Sampling is also conducted at Tier 1 beaches following significant rainfall. Tier 2 beaches are sampled twice per month May 15 through October 15. Advisories are issued based on EPA guidelines of 104 Enterococci per 100 ml or greater from two consecutive samples taken within 24 hours. Advisories are issued following a single sampling event if the Enterococcus level exceeds 500 colonies per 100 ml. Precautionary advisories are issued without sampling data based on historical knowledge of the effects of rainfall on specific areas. Advisories are retracted when Enterococcus counts return to below 104 colonies per 100 ml.

Table 28. Areas Affected by Beach Advisories

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
City of North Myrtle Beach	0.076	1	May/2002
City of North Myrtle Beach	0.076	3	June/2002
City of North Myrtle Beach	0.076	4	July/2002
City of North Myrtle Beach	0.076	7	July/2002
City of North Myrtle Beach	0.076	1	July/2002
City of North Myrtle Beach	0.076	1	August/2002
City of North Myrtle Beach	0.076	2	August/2002
City of North Myrtle Beach	0.076	2	August/2002
City of North Myrtle Beach	0.152	4	August/2002
City of North Myrtle Beach	0.076	6	September/2002
City of North Myrtle Beach	0.076	3	September/2002
City of North Myrtle Beach	0.076	1	September/2002
City of North Myrtle Beach	0.076	3	September/2002
City of North Myrtle Beach	0.076	4	September/2002
City of North Myrtle Beach	0.076	3	October/2002
City of North Myrtle Beach	0.076	2	May/2003
City of North Myrtle Beach	0.076	6	June/2003
City of North Myrtle Beach	0.076	5	July/2003
City of North Myrtle Beach	0.076	3	July/2003
City of North Myrtle Beach	0.076	2	July/2003
City of North Myrtle Beach	0.076	3	July/2003
City of North Myrtle Beach	0.076	5	July/2003
City of North Myrtle Beach	0.076	1	August/2003
City of North Myrtle Beach	0.076	6	August/2003
City of North Myrtle Beach	0.076	4	September/2003
City of North Myrtle Beach	0.076	2	October/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
White Point Swash	0.076	1	May/2002
White Point Swash	0.076	4	June/2002
White Point Swash	0.076	2	June/2002
White Point Swash	0.076	1	July/2002
White Point Swash	0.076	4	July/2002
White Point Swash	0.076	1	August/2002
White Point Swash	0.076	2	September/2002
White Point Swash	0.076	2	September/2002
White Point Swash	0.076	2	October/2002
White Point Swash	0.076	1	May/2003
White Point Swash	0.076	1	June/2003
White Point Swash	0.076	4	June/2003
White Point Swash	0.076	6	June/2003
White Point Swash	0.076	5	July/2003
White Point Swash	0.076	3	July/2003
White Point Swash	0.076	4	July/2003
White Point Swash	0.076	2	August/2003
White Point Swash	0.076	1	September/2003
White Point Swash	0.076	2	October/2003
White Point Swash	0.076	3	October/2003
Town of Briarcliffe Acres	1.54	1	May/2002
Town of Briarcliffe Acres	0.076	4	September/2002
Town of Briarcliffe Acres	0.076	2	May/2003
Town of Briarcliffe Acres	0.076	2	May/2003
Town of Briarcliffe Acres	0.076	2	May/2003
Town of Briarcliffe Acres	0.076	1	September/2003
Town of Briarcliffe Acres	0.076	3	October/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Arcadia Beach	2.4	1	May/2002
Arcadia Beach	0.114	1	June/2002
Arcadia Beach	0.038	1	June/2002
Arcadia Beach	0.038	1	June/2002
Arcadia Beach	0.152	2	July/2002
Arcadia Beach	0.038	1	July/2002
Arcadia Beach	0.038	1	July/2002
Arcadia Beach	0.038	1	July/2002
Arcadia Beach	0.114	1	August/2002
Arcadia Beach	0.038	7	August/2002
Arcadia Beach	0.038	1	August/2002
Arcadia Beach	0.038	2	August/2002
Arcadia Beach	0.076	3	May/2003
Arcadia Beach	0.076	1	June/2003
Arcadia Beach	0.076	2	June/2003
Arcadia Beach	0.076	3	June/2003
Arcadia Beach	0.076	2	June/2003
Arcadia Beach	0.076	1	June/2003
Arcadia Beach	0.076	1	July/2003
Arcadia Beach	0.076	1	July/2003
Arcadia Beach	0.076	4	July/2003
Arcadia Beach	0.076	2	July/2003
Arcadia Beach	0.076	4	July/2003
Arcadia Beach	0.076	1	August/2003
Arcadia Beach	0.076	2	August/2003
Arcadia Beach	0.076	2	August/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Arcadia Beach	0.076	4	September/2003
Arcadia Beach	0.076	3	October/2003
City of Myrtle Beach	0.076	1	May/2002
City of Myrtle Beach	0.076	1	June/2002
City of Myrtle Beach	0.152	1	June/2002
City of Myrtle Beach	0.342	1	June/2002
City of Myrtle Beach	0.228	2	June/2002
City of Myrtle Beach	0.038	1	June/2002
City of Myrtle Beach	0.304	2	June/2002
City of Myrtle Beach	0.228	1	July/2002
City of Myrtle Beach	0.152	1	July/2002
City of Myrtle Beach	0.342	4	July/2002
City of Myrtle Beach	0.076	4	July/2002
City of Myrtle Beach	0.304	4	July/2002
City of Myrtle Beach	0.266	1	July/2002
City of Myrtle Beach	0.076	1	August/2002
City of Myrtle Beach	0.076	1	August/2002
City of Myrtle Beach	0.418	1	August/2002
City of Myrtle Beach	0.076	1	August/2002
City of Myrtle Beach	0.304	1	August/2002
City of Myrtle Beach	0.228	1	August/2002
City of Myrtle Beach	0.342	6	August/2002
City of Myrtle Beach	0.418	1	August/2002
City of Myrtle Beach	0.304	3	September/2002
City of Myrtle Beach	0.152	3	September/2002
City of Myrtle Beach	0.076	5	September/2002

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
City of Myrtle Beach	0.152	2	September/2002
City of Myrtle Beach	0.038	1	September/2002
City of Myrtle Beach	0.380	2	September/2002
City of Myrtle Beach	0.418	2	September/2002
City of Myrtle Beach	0.304	2	October/2002
City of Myrtle Beach	0.152	1	October/2002
City of Myrtle Beach	0.304	3	October/2002
City of Myrtle Beach	0.076	3	May/2003
City of Myrtle Beach	0.076	2	May/2003
City of Myrtle Beach	0.076	1	May/2003
City of Myrtle Beach	0.076	1	May/2003
City of Myrtle Beach	0.076	1	May/2003
City of Myrtle Beach	0.076	2	May/2003
City of Myrtle Beach	0.076	2	May/2003
City of Myrtle Beach	0.076	2	May/2003
City of Myrtle Beach	0.076	3	May/2003
City of Myrtle Beach	0.076	1	June/2003
City of Myrtle Beach	0.076	8	June/2003
City of Myrtle Beach	0.076	6	June/2003
City of Myrtle Beach	0.076	2	June/2003
City of Myrtle Beach	0.076	4	June/2003
City of Myrtle Beach	0.076	7	June/2003
City of Myrtle Beach	0.076	2	June/2003
City of Myrtle Beach	0.076	2	June/2003
City of Myrtle Beach	0.076	4	June/2003
City of Myrtle Beach	0.076	8	June/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
City of Myrtle Beach	0.076	1	June/2003
City of Myrtle Beach	0.076	7	June/2003
City of Myrtle Beach	0.076	2	June/2003
City of Myrtle Beach	0.076	2	June/2003
City of Myrtle Beach	0.076	4	July/2003
City of Myrtle Beach	0.076	3	July/2003
City of Myrtle Beach	0.076	3	July/2003
City of Myrtle Beach	0.076	1	July/2003
City of Myrtle Beach	0.076	4	July/2003
City of Myrtle Beach	0.076	2	July/2003
City of Myrtle Beach	0.076	3	July/2003
City of Myrtle Beach	0.076	4	July/2003
City of Myrtle Beach	0.076	3	July/2003
City of Myrtle Beach	0.076	4	July/2003
City of Myrtle Beach	0.076	5	July/2003
City of Myrtle Beach	0.076	2	July/2003
City of Myrtle Beach	0.076	5	July/2003
City of Myrtle Beach	0.076	5	August/2003
City of Myrtle Beach	0.076	2	August/2003
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	2	August/2003
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	2	August/2003
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	3	August/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	3	August/2003
City of Myrtle Beach	0.076	4	August/2003
City of Myrtle Beach	0.076	1	August/2003
City of Myrtle Beach	0.076	2	August/2003
City of Myrtle Beach	0.076	4	September/2003
City of Myrtle Beach	0.076	3	September/2003
City of Myrtle Beach	0.076	3	September/2003
City of Myrtle Beach	0.076	1	September/2003
City of Myrtle Beach	0.076	5	September/2003
City of Myrtle Beach	0.076	1	September/2003
City of Myrtle Beach	0.076	3	October/2003
City of Myrtle Beach	0.076	1	October/2003
City of Myrtle Beach	0.076	3	October/2003
City of Myrtle Beach	0.076	3	October/2003
City of Myrtle Beach	0.076	1	October/2003
City of Myrtle Beach	0.076	8	October/2003
SC State Park	0.076	3	June/2002
SC State Park	0.076	1	July/2002
SC State Park	0.076	4	July/2002
SC State Park	0.076	4	July/2002
SC State Park	0.076	2	August/2002
SC State Park	0.076	13	August/2002
SC State Park	0.076	8	Sept-Oct/2002
SC State Park	0.076	7	October/2002
SC State Park	0.076	5	May/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
SC State Park	0.076	4	May/2003
SC State Park	0.076	1	June/2003
SC State Park	0.076	8	June/2003
SC State Park	0.076	6	June/2003
SC State Park	0.076	2	June/2003
SC State Park	0.076	3	June/2003
SC State Park	0.076	2	June/2003
SC State Park	0.076	9	June/2003
SC State Park	0.076	5	June/2003
SC State Park	0.076	4	July/2003
SC State Park	0.076	9	July/2003
SC State Park	0.076	4	July/2003
SC State Park	0.076	2	July/2003
SC State Park	0.076	2	July/2003
SC State Park	0.076	4	July/2003
SC State Park	0.076	2	July/2003
SC State Park	0.076	4	July/2003
SC State Park	0.076	2	August/2003
SC State Park	0.076	3	August/2003
SC State Park	0.076	1	August/2003
SC State Park	0.076	1	August/2003
SC State Park	0.076	2	August/2003
SC State Park	0.076	3	September/2003
SC State Park	0.076	6	October/2003
SC State Park	0.076	4	October/2003
Town of Surfside Beach	0.158	1	July/2002

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Town of Surfside Beach	0.237	1	July/2002
Town of Surfside Beach	0.317	2	July/2002
Town of Surfside Beach	0.079	1	August/2002
Town of Surfside Beach	0.237	4	Aug-Sept/2002
Town of Surfside Beach	0.317	1	September/2002
Town of Surfside Beach	0.079	2	September/2002
Town of Surfside Beach	0.396	2	September/2002
Town of Surfside Beach	0.079	4	Sept-Oct/2002
Town of Surfside Beach	0.317	2	October/2002
Town of Surfside Beach	0.079	1	October/2002
Town of Surfside Beach	0.317	2	October/2002
Town of Surfside Beach	0.079	1	October/2002
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	5	May/2003
Town of Surfside Beach	0.079	2	May/2003
Town of Surfside Beach	0.079	4	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	3	May/2003
Town of Surfside Beach	0.079	1	June/2003
Town of Surfside Beach	0.079	7	June/2003
Town of Surfside Beach	0.079	2	June/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Town of Surfside Beach	0.079	2	June/2003
Town of Surfside Beach	0.079	8	June/2003
Town of Surfside Beach	0.079	6	June/2003
Town of Surfside Beach	0.079	1	June/2003
Town of Surfside Beach	0.079	2	June/2003
Town of Surfside Beach	0.079	3	June/2003
Town of Surfside Beach	0.079	1	June/2003
Town of Surfside Beach	0.079	6	June/2003
Town of Surfside Beach	0.079	6	June/2003
Town of Surfside Beach	0.079	1	June/2003
Town of Surfside Beach	0.079	2	June/2003
Town of Surfside Beach	0.079	3	June/2003
Town of Surfside Beach	0.079	5	June/2003
Town of Surfside Beach	0.079	5	June/2003
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	5	July/2003
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	3	July/2003

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	1	July/2003
Town of Surfside Beach	0.079	4	July/2003
Town of Surfside Beach	0.079	2	July/2003
Town of Surfside Beach	0.079	1	July/2003
Town of Surfside Beach	0.079	1	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	1	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	2	August/2003
Town of Surfside Beach	0.079	4	September/2003
Town of Surfside Beach	0.079	1	September/2003
Town of Surfside Beach	0.079	2	September/2003
Town of Surfside Beach	0.079	3	October/2003
Town of Surfside Beach	0.079	8	October/2003
Town of Surfside Beach	0.079	4	October/2003
Town of Surfside Beach	0.079	4	October/2003
Town of Surfside Beach	0.079	4	October/2003
Town of Surfside Beach	0.079	1	October/2003
Town of Surfside Beach	0.079	4	October/2003
Garden City Beach	0.076	1	July/2002

Area Affected	Miles of Beach Affected	Days Posted	Month/Year
Edisto Island	0.077	1	April/2002
Isle of Palms	6.3	7	October/2002
Sullivans Island	2	4	October/2002
Seabrook Island	1	2	June/2002

C. Public Health: Drinking Water

Restrictions in Surface Drinking Water Supplies and Incidents of Waterborne Diseases

There were eight (8) Notices of Violation (NOV) issued to six (6) systems during the period of July 2002 - June 2003 for Treatment Technique and Monitoring and Reporting violations under the Stage 1 Disinfectants/Disinfection Byproducts and Surface Water Treatment Rules. The State reported nine (9) exceedances of the Maximum Contaminant Level (MCL) for four (4) systems for Trihalomethanes (THMs) and fourteen (14) exceedances of the MCL for nine (9) systems for Haloacetic Acids (HAAs). The state reported no incidences of waterbourne disease during the same period.

GROUNDWATER ASSESSMENT

Groundwater is the source of drinking water for more than 40 percent of the population of the State. This resource is also used by agricultural, industrial, and commercial interests. The policy of the State of South Carolina, with respect to groundwater protection, is founded on the belief that there is a direct connection between land use and groundwater quality, and that at least some activities of man will always impact groundwater, regardless of the regulatory safeguards employed. Because it is an expensive and technologically complex task to restore contaminated groundwater to its original pristine state within a reasonable time frame, a justifiable goal of any groundwater protection strategy is to protect the present and future uses of the resource.

SCDHEC maintains a primary long term objective for groundwater protection. As expressed in the S.C. Regulation 61-68, *Water Classifications and Standards*.

"It is the goal of the Department to maintain or restore groundwater quality so it is suitable as a drinking water source without any treatment. Recognizing the technical and economic difficulty in restoring groundwater quality, the Department will emphasize a preventive approach in protecting groundwater."

This goal fulfills the Core Adequacy Criteria #1 of Strategic Activity 1 in the implementation of the Comprehensive State Groundwater Protection Program (CSGWPP).

The groundwater quality data are to be presented in a series of tables and it is recognized that all states do not have all the information requested at this time. Therefore this year's report serves as a template by that future monitoring and reporting can be designed. The data presented were assembled from existing reports: the state wide ambient groundwater quality monitoring network, the groundwater contamination inventory that is updated annually, the volatile organic compound (VOC) monitoring program for public supply wells, and reports from domestic well owners.

1. Overview of Groundwater Contamination Sources

The major sources of contamination impacting groundwater are presented in Table 29. Underground storage tank (UST) releases account for 3425 of the 4172 total instances. The additional nine sources indicated were the next most numerous instances. Another factor indicated was human health and/or environmental risk for those sources for petroleum products and hazardous waste. The size of the population at risk was also indicated for USTs given the large number of releases. The next column on Table 29 indicates the contaminants associated with the highest priority sources. Petroleum compounds, halogenated solvents, metals and nitrates are the contaminants most frequently detected.

Table 29. Major Sources of Groundwater Contamination

Contaminant Source	Ten Highest-Priority Sources (T)	Factors Considered in Selecting a Contaminant Source	Contaminants
Agricultural Activities			
Agricultural chemical facilities			
Animal feedlots			
Drainage wells			
Fertilizer applications			
Irrigation practices			
Pesticide applications			
Storage and Treatment Activities			
Land application	**T**	**D**	**E**
Material stockpiles			
Storage tanks (above ground)	**T**	**D,A**	**D**
Storage tanks (underground)	**T**	**D,A,B**	**D**
Surface impoundments	**T**	**D**	**C,E**
Waste piles			
Waste tailing			
Disposal Activities			
Deep injection wells			
Landfills	**T**	**D**	**C,D,H**
Septic systems			
Shallow injection wells			
Other			
Hazardous waste generators	**T**	**D,A**	**C,H**
Hazardous waste sites	**T**	**D,A**	**C,H**
Industrial facilities	**T**	**D**	**C,E**
Material transfer operations			
Mining and mine drainage	**T**	**A,C**	**A,M** Acid mine drainage

Contaminant Source	Ten Highest-Priority Sources (T)	Factors Considered in Selecting a Contaminant Source	Contaminants
Pipeline and sewer lines			
Salt storage and road salting			
Salt water intrusion Spills	T	D	D
Transportation of materials			
Urban runoff			
Other sources (please specify)			
Other sources (please specify)			

1. Check (**T**) up to 10 contaminant sources identified as highest priority in your State.

2. Specify the factor(s) used to select each of the contaminant sources. Denote the following factors by their corresponding letter (A through G) and list in order of importance. Describe any additional or special factors that are important within your State in the accompanying narrative.

   A. Human health and/or environmental risk (toxicity)
   B. Size of the population at risk
   C. Location of the sources relative to drinking water sources
   D. Number and/or size of contaminant sources
   E. Hydrogeologic sensitivity
   F. State findings, other findings
   G. Other criteria (please add or describe in the narrative)

3. List the contaminants/classes of contaminants considered to be associated with each of the sources that was checked. Contaminants/contaminant classes should be selected based on data indicating that certain chemicals may be originating from an identified source. Denote contaminants/classes of contaminants by their corresponding letter (A through M).

   A. Inorganic pesticides
   B. Organic pesticides
   C. Halogenated solvents
   D. Petroleum compounds
   E. Nitrate
   F. Fluoride
   G. Salinity/brine
   H. Metals
   I. Radionuclides
   J. Bacteria
   K. Protozoa
   L. Viruses
   M. Other (please add or describe in the narrative)

Tables 30, 31, 32 and 33 were designed to report the stress that contaminated sites place on individual aquifers or hydrogeologic settings. The report on each identified aquifer is further subdivided by type of source based on program area, contaminants present, and degree of remediation accomplished thus far. South Carolina's major drinking water aquifers are in the subsurface of the Coastal Plain. The sources and contaminants indicated in Table 29 are generally

present in the near surface, shallowest aquifers. At this point, contamination data is gathered on a site by site basis, rather than by aquifer. Thus, portions of these tables can be completed for the Piedmont saprolite/bedrock and the Coastal Plain water table aquifers only. The number of confirmed groundwater contamination cases that have been identified in the Coastal Plain are 2841 and 1333 has been confirmed in the Piedmont. This number was obtained by counting the sites county by county.

Table 30. Groundwater Contamination Summary

Aquifer Description: Above Fall Line
Aquifer Setting: Saprolite/Bedrock Aquifer
Data Reporting Period: Ending July 2003

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants
NPL	**YES**		**17**	**17**	**C,H**
CERCLIS (non-NPL)	**YES**		**7**	**7**	**C,H**
DOD/DOE	**YES**		**2**	**2**	**D,C,H**
LUST	**YES**		**1164**	**1164**	**D**
RCRA Corrective Action	**YES**		**32**	**32**	**C,H**
Underground Injection	**NO**	**0**	**0**	**0**	
State Sites	**YES**		**34**	**34**	**C,H,A,B,D**
Nonpoint Sources	**YES**		**2**	**2**	**E**
Other (specify)	**YES**		**162**	**162**	**C,D,E,H**
Totals			**1420**	**1420**	

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

List of Contaminants:

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
F. Flouride
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses
M. Other (please add or describe in the narrative)

Table 31. Groundwater Contamination Summary (above fall line)

Source Type	Number of Site Investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL					
CERCLIS (non-NPL)					
DOD/DOE					
LUST					
RCRA Corrective Action					
Underground Injection					
State Sites					
Nonpoint Sources					
Other (specify)					

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Table 32. Groundwater Contamination Summary (2)

Aquifer Description: Below Fall Line
Aquifer Setting: Coastal Plain
Data Reporting Period: Ending July 2001

Source Type	Present in reporting area	Number of sites in area	Number of sites that are listed and/or have confirmed releases	Number with confirmed ground water contamination	Contaminants
NPL	**YES**		**16**	**16**	**C,H**
CERCLIS (non-NPL)	**YES**		**8**	**8**	**C,H**
DOD/DOE	**YES**		**162**	**162**	**C,D,H**
LUST	**YES**		**2261**	**2261**	**D**
RCRA Corrective Action	**YES**		**32**	**32**	**C,H**
Underground Injection	**NO**	**0**	**0**	**0**	
State Sites	**YES**		**34**	**34**	**C,D,A,B,D**
Nonpoint Sources	**YES**		**16**	**16**	**E**
Other (specify)	**YES**		**223**	**223**	**C,D,E,H**
Totals			**2752**	**2752**	

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

List of Contaminants:

A. Inorganic pesticides
B. Organic pesticides
C. Halogenated solvents
D. Petroleum compounds
E. Nitrate
F. Flouride
G. Salinity/brine
H. Metals
I. Radionuclides
J. Bacteria
K. Protozoa
L. Viruses
M. Other (please add or describe in the narrative)

Table 33. Groundwater Contamination Summary (below fall line)

Source Type	Number of Site Investigations (optional)	Number of sites that have been stabilized or have had the source removed (optional)	Number of sites with corrective action plans (optional)	Number of sites with active remediation (optional)	Number of sites with cleanup completed (optional)
NPL					
CERCLIS (non-NPL)					
DOD/DOE					
LUST					
RCRA Corrective Action					
Underground Injection					
State Sites					
Nonpoint Sources					
Other (specify)					

NPL - National Priority List
CERCLIS (non-NPL) - Comprehensive Environmental Response, Compensation, and Liability Information System
DOE - Department of Energy
DOD - Department of Defense
LUST - Leaking Underground Storage Tanks
RCRA - Resource Conservation and Recovery Act

Each source type is listed in each area with the exception of underground injection as waste or contaminant injection, that is not permitted in this state. The "state" sites are state Superfund sites. The "Nonpoint Source" category contains spray irrigation sites only at this time. Pesticide and nitrate monitoring data is gathered by Clemson University, Department of Fertilizer and Pesticide Control. The "other" category includes spills and leaks; pits, ponds and lagoons; landfills; unpermitted disposal; aboveground storage tanks; and septic tanks/tile fields. The "number of sites in the area" is left blank because any number of facilities can be potential sources and that data is not tracked at this time. The number of sites that have confirmed groundwater contamination are listed along with the contaminants (using the contaminant classes from Table 29). The remediation status represented by Tables 31 and 33 is not fully completed because that information is not recorded in that format in all program areas.

2. Overview of Groundwater Protection Programs

The state's groundwater protection programs are summarized and characterized in Table 34. The Groundwater Working Group, that is comprised of SCDHEC's groundwater program managers, was formed to provide consistency across the programs.

Table 34. Summary of State Groundwater Protection Programs

Programs or Activities	Check (U)	Implementation Status	Responsible State Agency
Active SARA Title III Program	U	**Fully Established**	**SCDHEC/BL&WM/Emergency Response**
Ambient groundwater monitoring system	U	**Fully Established**	**SCDHEC/BOW/GWM**
Aquifer vulnerability assessment	U	**Under Development**	**SCDHEC/BOW/GWM**
Aquifer mapping	U	**Continuing Efforts**	**DNR-SCDHEC/BOW/GWM**
Aquifer characterization	U	**Continuing Efforts**	**DNR-SCDHEC/BOW/GWM**
Comprehensive data management system	U	**Under Development**	**DNR-SCDHEC**
EPA-endorsed Core Comprehensive State Groundwater Protection Program (CSGWPP)	U	**Under Development**	**SCDHEC/BOW/GWM**
Groundwater discharge permits	U	**Fully Established**	**SCDHEC/BOW**
Groundwater Best Management Practices	U	**Under Development**	**SCDHEC/BOW/IAWD**
Groundwater legislation	U	**Continuing Efforts**	**SCDHEC-DNR**
Groundwater classification	U	**Fully Established**	**SCDHEC/BOW**
Groundwater quality standards	U	**Under Revision**	**SCDHEC**
Interagency coordination for groundwater protection initiatives	U	**Under Development**	**SCDHEC-DNR-Clemson Univ.**
Nonpoint source controls	U	**Under Development**	**SCDHEC/BOW**
Pesticide State Management Plan	U	**Under Development**	**SCDHEC/BOW/GWM-Clemson Univ.**
Pollution Prevention Program	U	**Fully Established**	**SCDHEC/BL&WM**
Resource Conservation and Recovery Act (RCRA) Primacy	U	**Fully Established**	**SCDHEC/BL&WM**
State Superfund	U	**Fully Established**	**SCDHEC/BL&WM/CERCLA**
State RCRA Program incorporating more stringent requirements than RCRA primacy		**Not Applicable**	
State septic system requirements	U	**Fully Established**	**SCDHEC/ENV. HEALTH**

Programs or Activities	Check (U)	Implementation Status	Responsible State Agency
Underground storage tank installation requirements	U	**Fully Established**	**SCDHEC/BL&WM/UST Program**
Underground Storage Tank Remediation Fund	U	**Fully Established**	**SCDHEC/BL&WM/UST Program**
Underground Storage Tank Permit Program	U	**Fully Established**	**SCDHEC/BL&WM/UST Program**
Underground Injection Control Program	U	**Fully Established**	**SCDHEC/BOW/GWM**
Vulnerability assessment for drinking water/wellhead protection	U	**Fully Established**	**SCDHEC/BOW/GWM**
Well abandonment regulations	U	**Fully Established**	**SCDHEC/BOW**
Wellhead Protection Program (EPA-approved)	U	**Fully Established**	**SCDHEC/BOW/GWM**
Well installation regulations	U	**Fully Established**	**SCDHEC/BOW**

Implementation of the Comprehensive State Ground-Water Protection Program (CSGWPP) is the major initiative undertaken since the last §305(b) report. The draft Core CSGWPP was completed and submitted to the Region IV EPA, Groundwater 106 Program, comments from EPA have been received. The Source Water Assessment and Protection Plan was approved to EPA Region IV. The Groundwater Contamination Inventory and the Ambient Groundwater Quality Monitoring Report were also completed last quarter.

3. Summary of Groundwater Quality

Aquifer Monitoring Data are presented in Tables 35 and 36. The state's ambient quality monitoring network is designed to develop a baseline for groundwater quality for each of the aquifers within the state. The wells were selected in areas to avoid known or potential contamination in order to test the assumption that variability in water chemistry reflects differences in geologic framework and/or spatial setting. In addition, neither VOCs nor SOCs are included in the analytical parameters. Accordingly, no data from the ambient monitoring network is included in Tables 35 and 36.

Table 35. Aquifer Monitoring Data

Aquifer Description_____
Aquifer Setting _____

County(ies) (optional)
Longitude/Latitude (optional)
Data Reporting Period

			Number of Wells			
Monitoring Data Type	Total No. of Wells Used in the Assessment	Parameter Groups	No detections of Parameters above MDLs of background levels		No detections of parameters above MDLs or background levels and nitrate concentrations range from background levels to less than or equal to 5 mg/l.	
			ND	Number of Wells in Sensitive or Vulnerable Areas (optional)	ND/Nitrate # 5 mg/l	Number of wells in sensitive or vulnerable areas (optional)
Ambient Monitoring Network (optional)		VOC				
		SOC				
		NO3				
		Other				
Raw Water Quality Data from Public Water Supply Wells		VOC				
		SOC				
		NO3				
		Other				
Finished Water Quality Data from Public Water Supply Wells		VOC	1536		43	
		SOC	750		13	
		NO3	4283		2472	
		Other				

Table 36. Aquifer Monitoring Data (2)

Aquifer Description_____ County(ies) (optional)
Aquifer Setting _____ Longitude/Latitude (optional)
Data Reporting Period

Number of Wells				
Parameters are detected at concentrations exceeding the MDL but are less than or equal to the MCLs and/or nitrate ranges from greater than 5 to less than or equal to 10 mg/l	Parameters are detected at concentrations exceeding the MCLs	Removed from Service	Special Treatment	Background parameters exceed MCLs
Finished Water Quality Data from Public Water Supply Wells	VOC			
	SOC			
	NO3			
	Other			

4. Summary of Groundwater/Surface Water Interactions

The Drinking Water Program reports that no Public Water Supply well is under the influence of surface water. Although there are anecdotal reports of groundwater in wells being heavily pumped showing signs of influence by surface water, no instance of groundwater being impacted by surface water has been confirmed.

As groundwater serves to recharge most of the streams in South Carolina, instances where contaminated groundwater impacts surface water are more prevalent. In the Groundwater Contamination Inventory 132 cases of contaminated groundwater discharging from the surficial aquifer to surface water have been noted. A table was not included in this report because contaminant concentration levels in both the aquifer and surface water are not available. It is surmised that, due to dilution, levels in the surface water are very low or not detectable in most cases.

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