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Recharge Variability and Simulated Hydraulic Head

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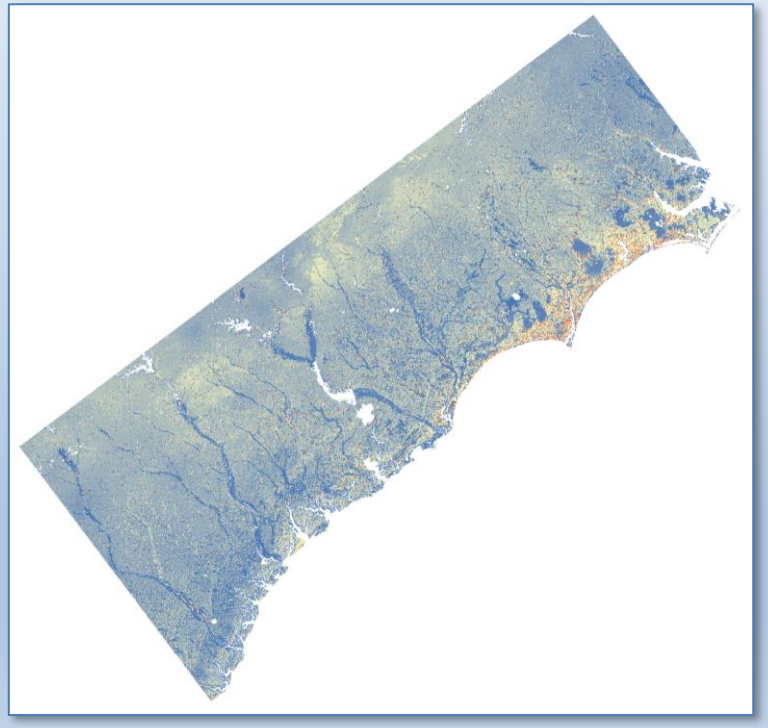

Simulated average annual recharge – 1998
Nardi, M.R., and LaMotte., A.E., 2021

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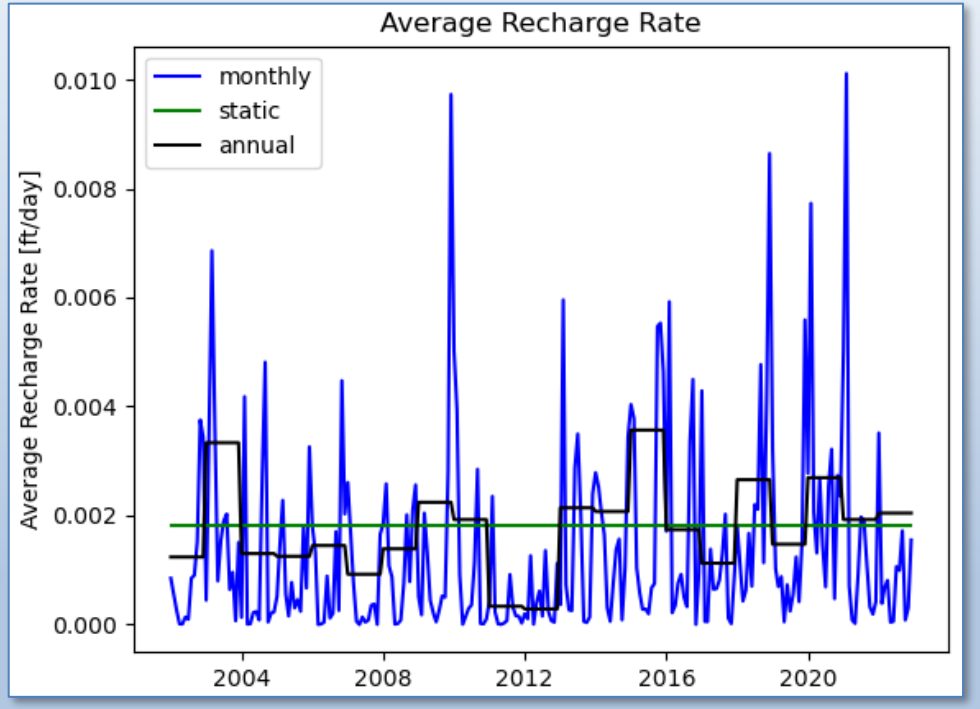
Presentation Overview

- Why are we evaluating recharge scenarios?
- Brief description of recharge scenarios
- POT Maps 101
- Simulation Results
  - Pot Maps
  - Time series hydraulic head profiles
- Summary

Why Evaluate Recharge Scenarios

Model simplifying assumptions for recharge vary in order to shorten run times.

How do those assumptions impact simulation results?

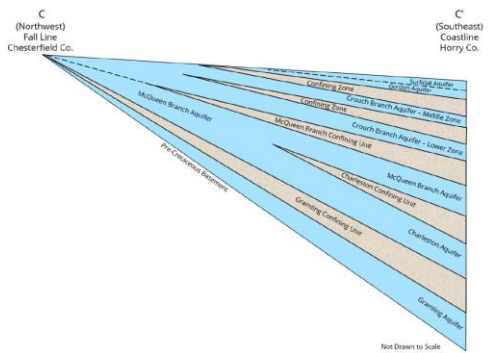


Why Evaluate Recharge Scenarios

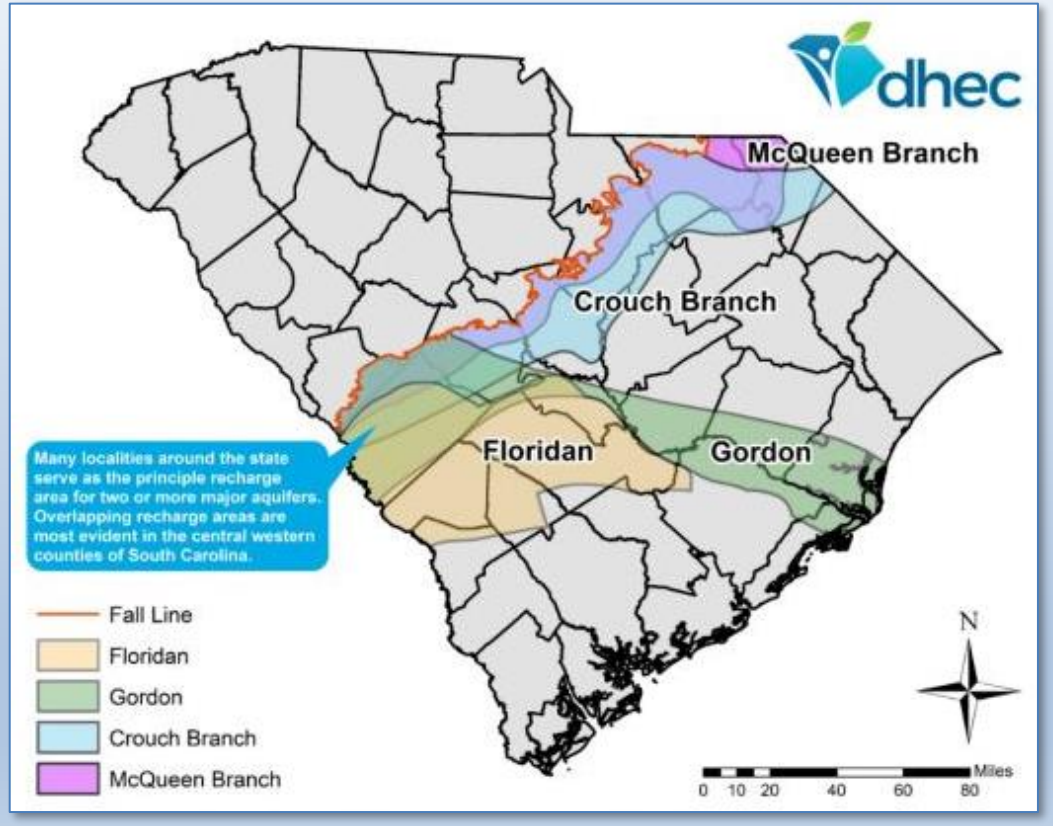
Aquifer Recharge Areas in SC →

Aquifers are recharged near the Fall Line, and the groundwater moves slowly toward the coast.

Groundwater is roughly 20,000 years old near the coast.(Degnan et al., 2000)



SCDHEC, Pee Dee Capacity Use Area: 2020 Groundwater Evaluation Report, February 2020, modified from USGS Professional Paper 1773.



SCDHEC, Pee Dee Capacity Use Area: 2020 Groundwater Evaluation Report, February 2020

Description of Recharge Scenarios

Model Used: MODFLOW 6, monthly stress periods, no inset basement mesh refinement

Scenario 1 – Average Annual Recharge, Spatial Variation

Scenario 2 – Average Monthly Recharge, Spatial Variation

Scenario 3 – Average Recharge (1900 to 2022), Constant, No Spatial Variation

POT Maps 101

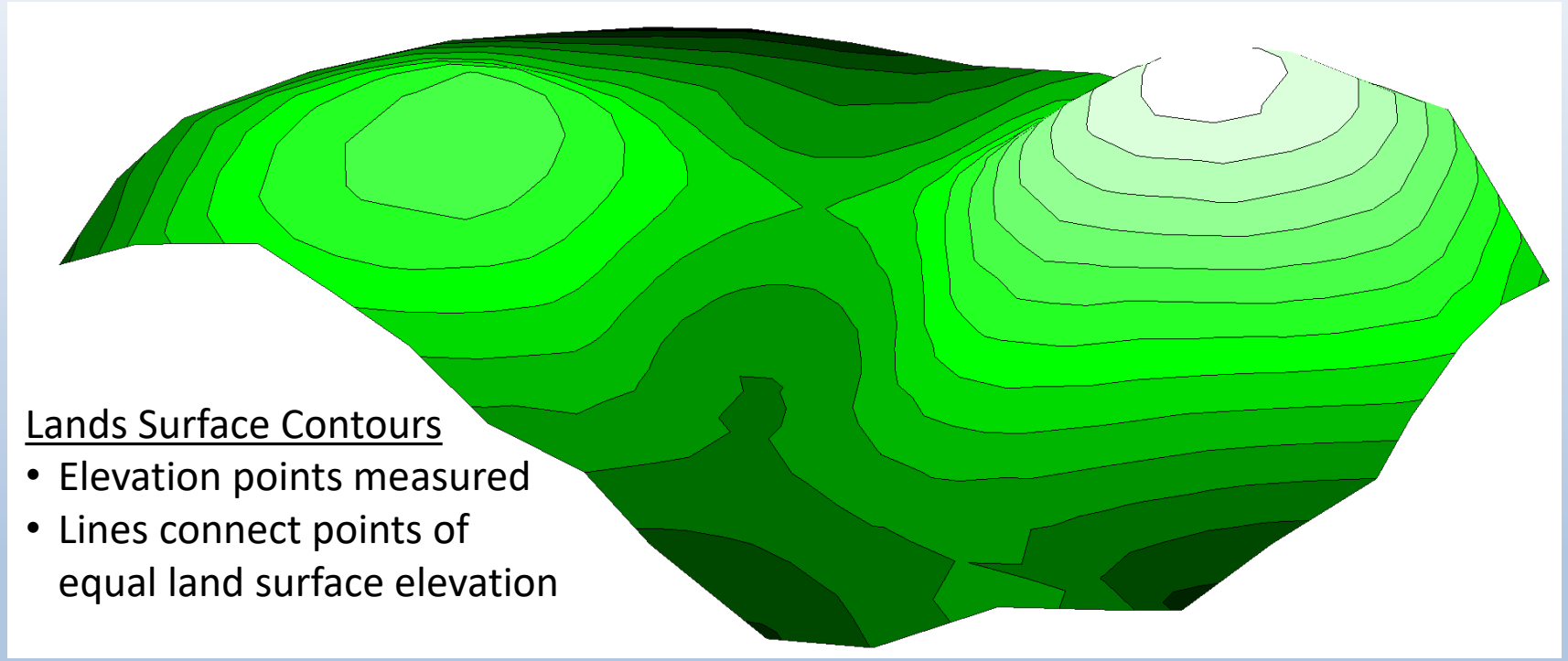
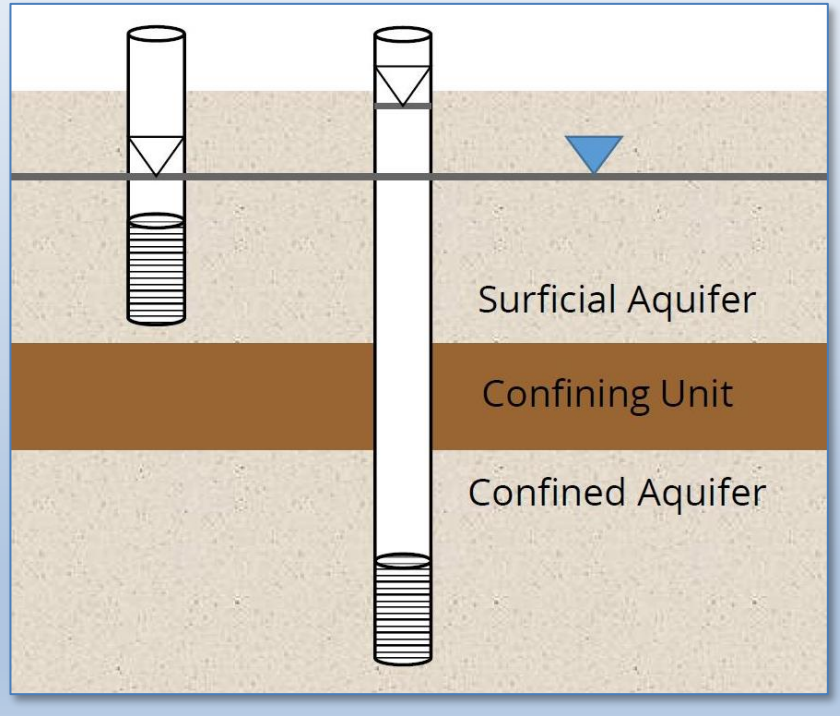


Image created using Aquaveo's GMS Software version 10.7. www.aquaveo.com

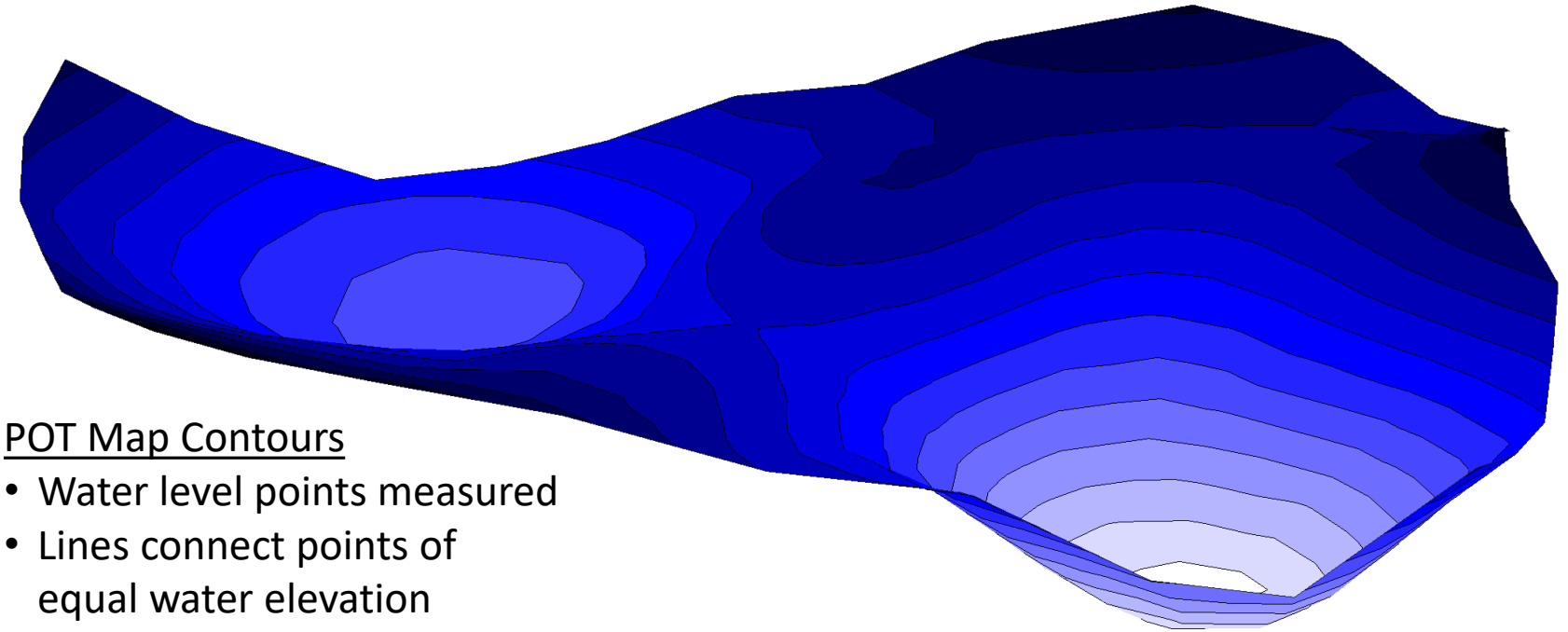
POT Maps 101

Water Levels: Confined versus Unconfined Aquifers

- Water Table (free surface of the groundwater)
- Potentiometric Surface (pressure surface of groundwater in a confined aquifer)
- Groundwater flows from high to low water levels (hydraulic head)



POT Maps 101



POT Map Contours

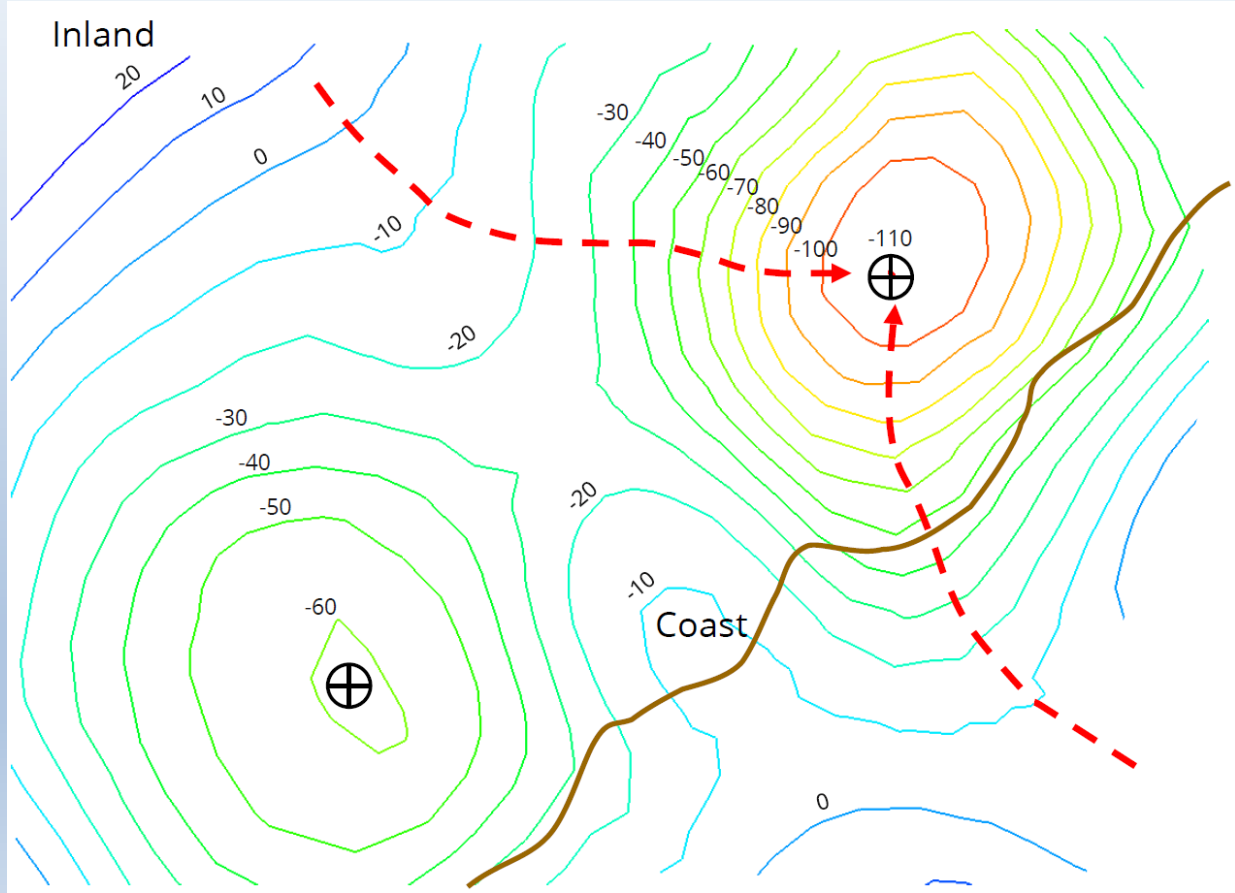
- Water level points measured
- Lines connect points of equal water elevation

Image created using Aquaveo's GMS Software version 10.7. www.aquaveo.com

POT Maps 101

Example POT Map:

- Brown line designates coastline.
- Red dashed arrows indicate groundwater flow paths to pumping center.
- More closely spaced lines indicate steeper ‘surface’.



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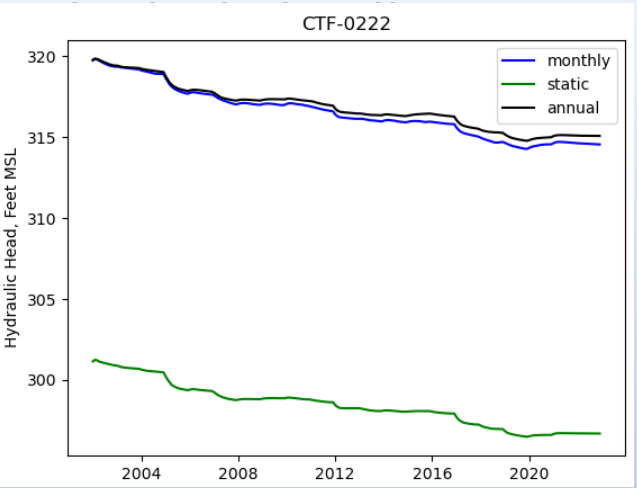
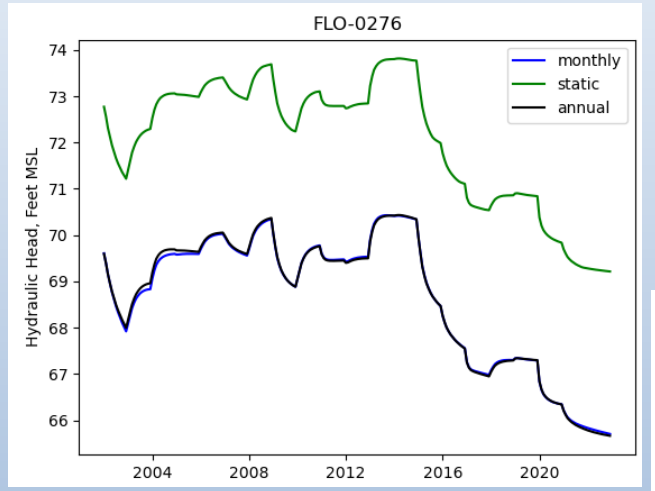
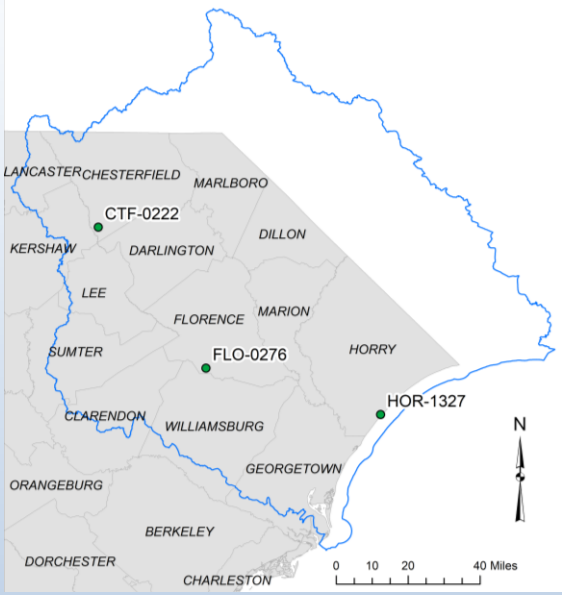
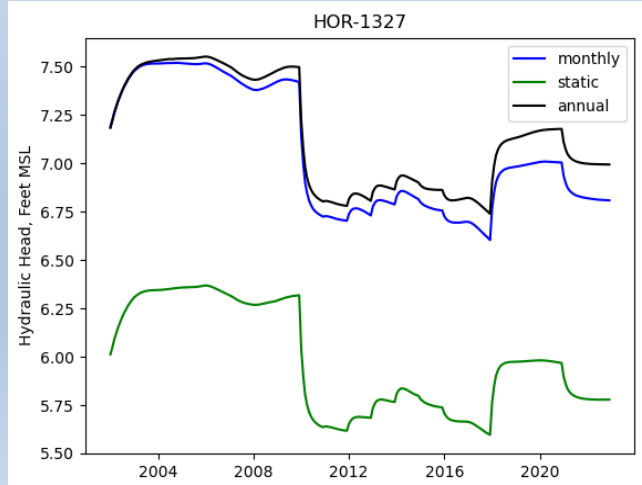
Time-Series Hydraulic Head



Crouch Branch Aquifer







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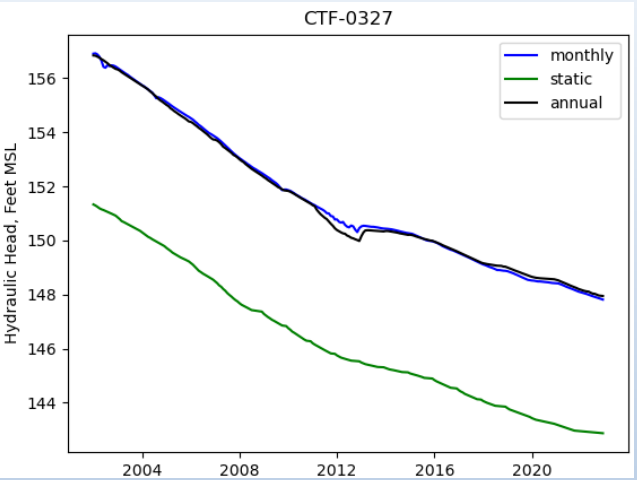
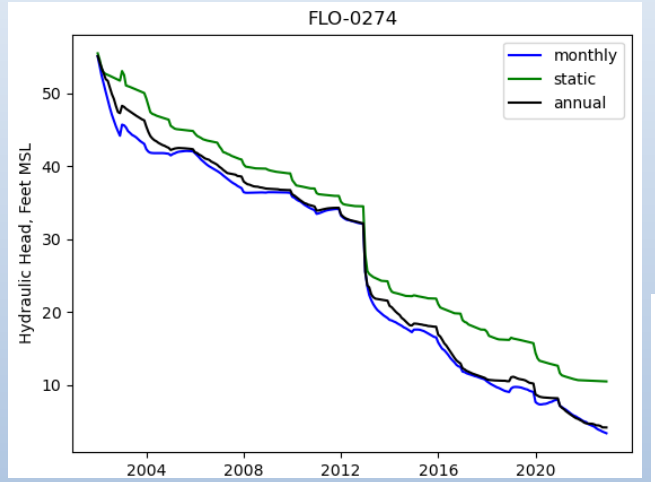
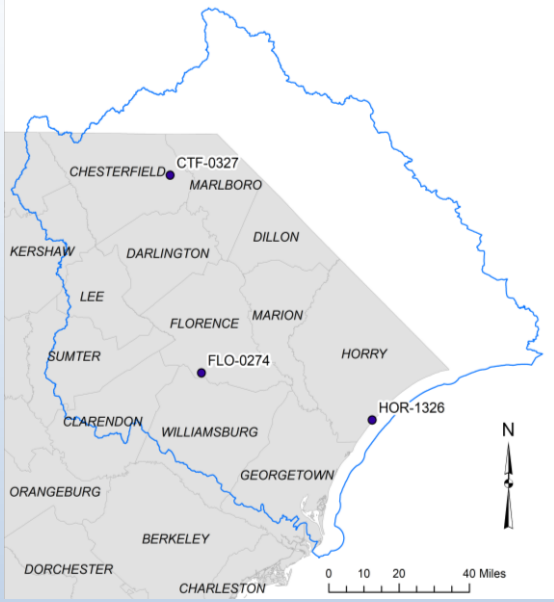
Provisional Results Subject to Final Review

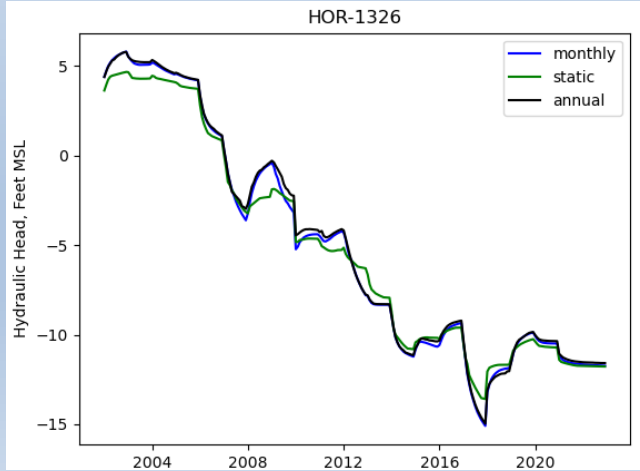
Time-Series Hydraulic Head



McQueen Branch Aquifer







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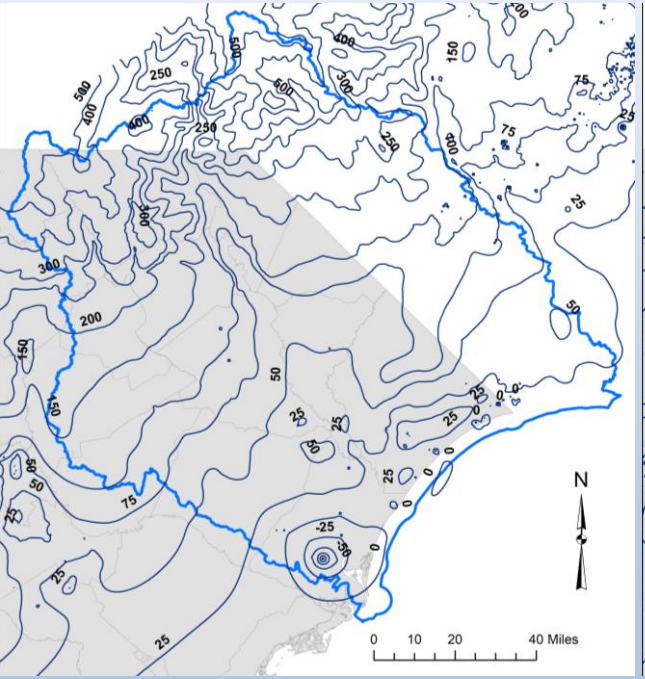
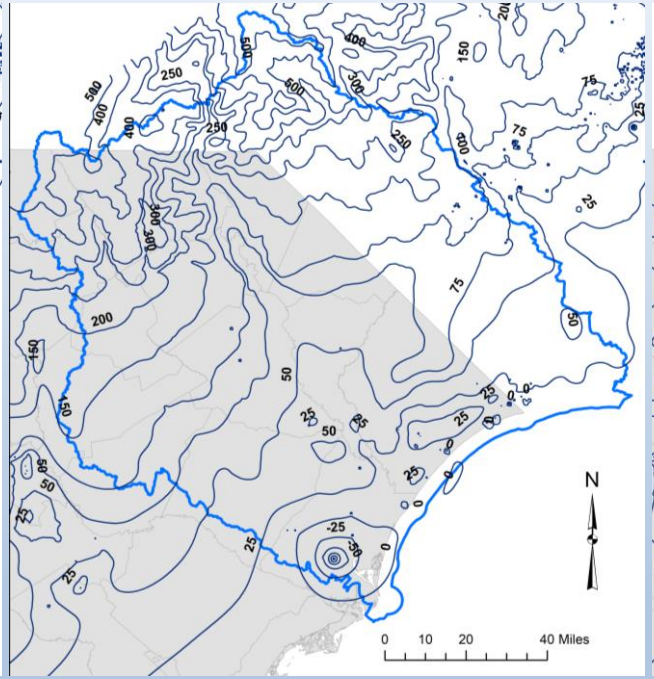
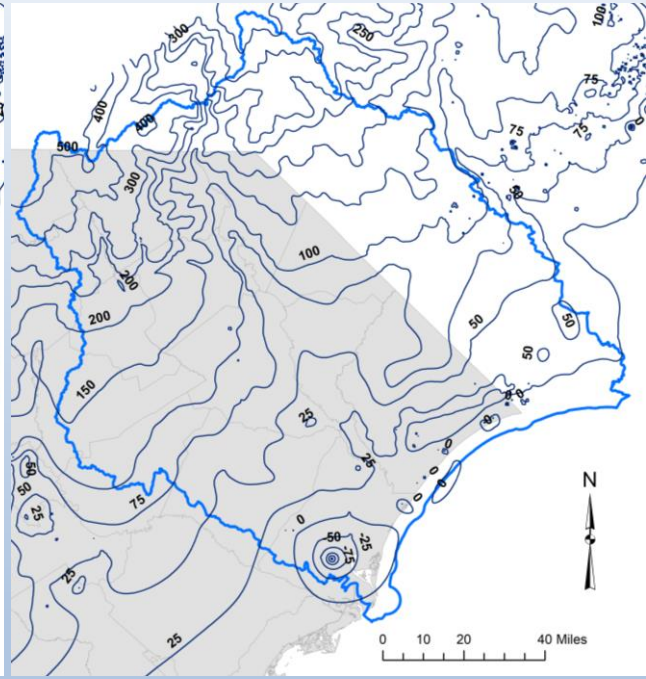
Results: Crouch Branch Pot Maps



Monthly Varying Recharge Rate



Annual Varying Recharge Rate



Single, Long-term Recharge Rate

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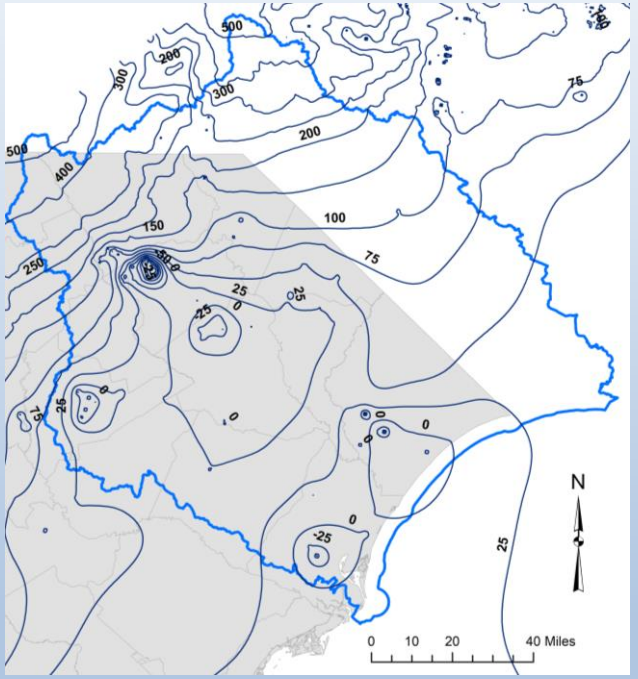
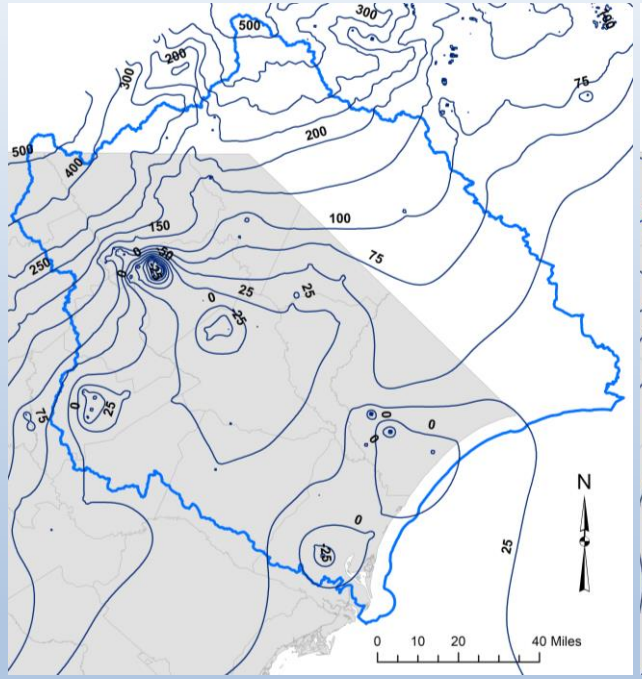
Provisional Results Subject to Final Review

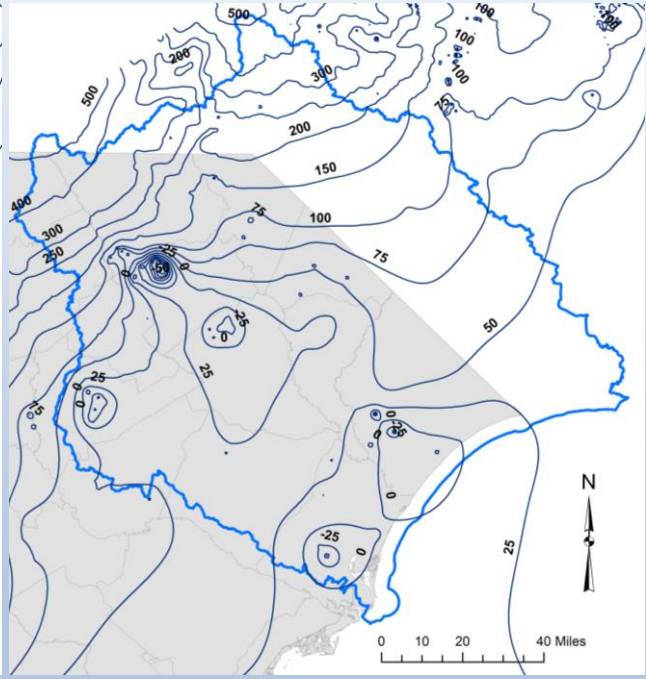
Results: McQueen Branch Pot Maps



Monthly Varying Recharge Rate



Annual Varying Recharge Rate



Single, Long-term Recharge Rate

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Provisional Results Subject to Final Review

Summary

- The maximum change in water level between the three scenarios is 20 ft, and the minimum change is 0 ft.
- Deeper aquifers near the coast are minimally impacted by the recharge scenarios when compared to aquifer locations near the Fall Line.
- Changes to pumping scenarios is expected to have a significantly greater impact on hydraulic head than recharge.

References

Nardi, M.R., and LaMotte., A.E., 2021, Soil-Water Balance model datasets used to estimate groundwater recharge in parts of North Carolina, South Carolina, and Georgia under 2015 conditions and future conditions using three downscaled climate models paired with two land cover scenarios: U.S. Geological Survey data release, https://doi.org/10.5066/P9WEOGCS.

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Questions?

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