



# **Groundwater Resources of the Lower Savannah-Salkehatchie Basin – Part 2**

## **Lower Savannah-Salkehatchie River Basin Council**

### **Meeting #9, September 5<sup>th</sup>, 2024**

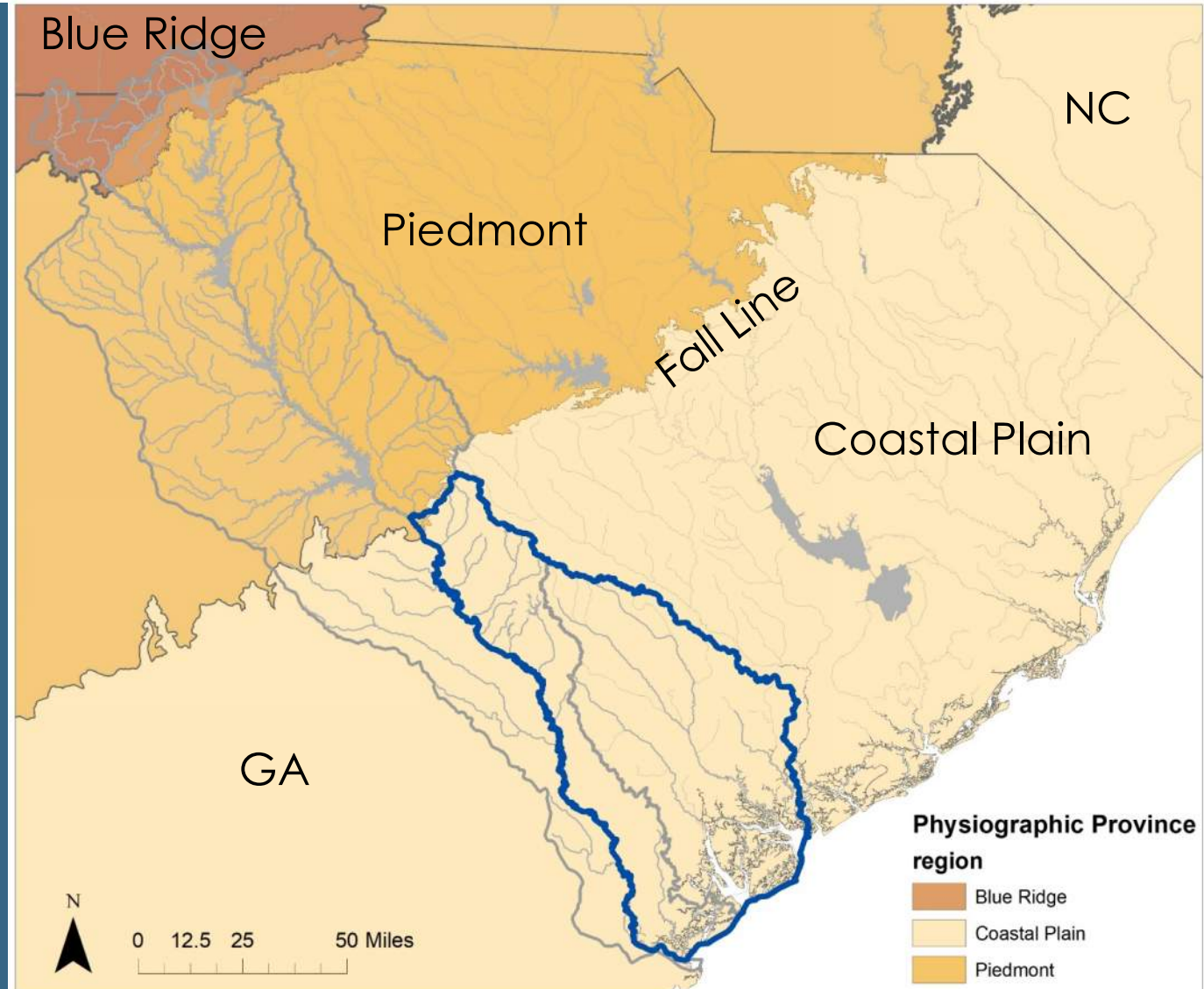
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Hydrologist  
South Carolina Department of Environmental Services



# Physiographic Provinces



- Blue Ridge and Piedmont
  - Elevation ranges from 3,300 (Blue Ridge) to 1,000 ft at the foothills (Piedmont) to 450 ft near the Fall Line
  - Underlain by metamorphic and igneous bedrock
    - Groundwater wells tap crystalline rock fractures and saprolite
- Coastal Plain
  - Elevation ranges from 450 ft at Fall Line to near Sea level at the coast
    - Sediments thicken from zero at the Fall line to 4,000 feet in Beaufort County
  - Encompasses nearly 2/3 of the state and characterized as a wedge of sand, clay, silt, and limestone
  - Permeable sand and limestone form the State's most important aquifers
    - Aquifers store an abundant volume of water representing a vital resource throughout the Coastal Plain

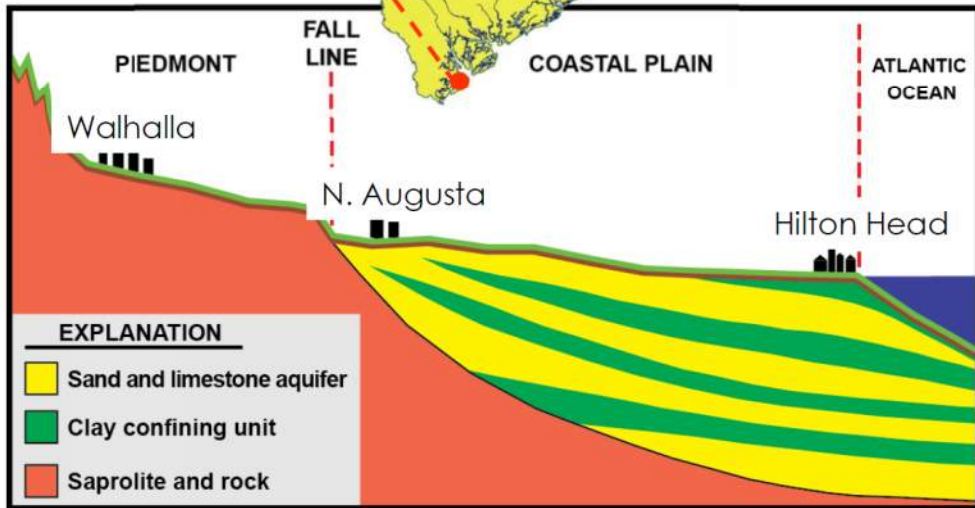
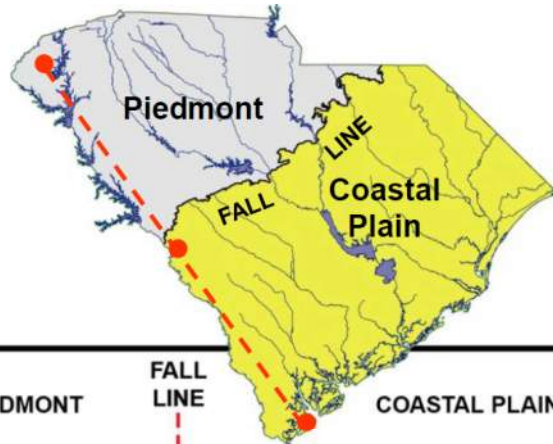


# SC Hydrogeologic Framework Along Dip



450 Feet, elevation  
Fall Line (Aiken County)

10 Feet, elevation  
Coastline (Beaufort County)



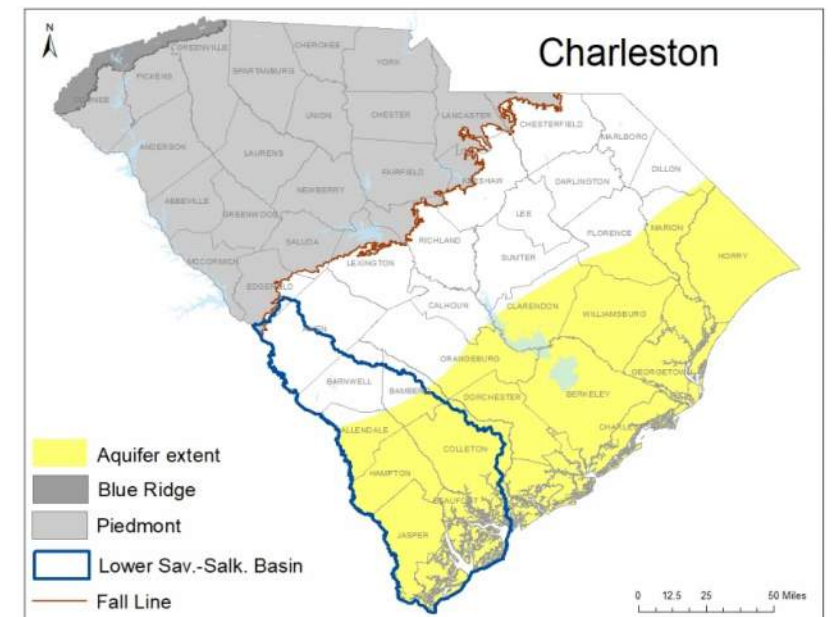
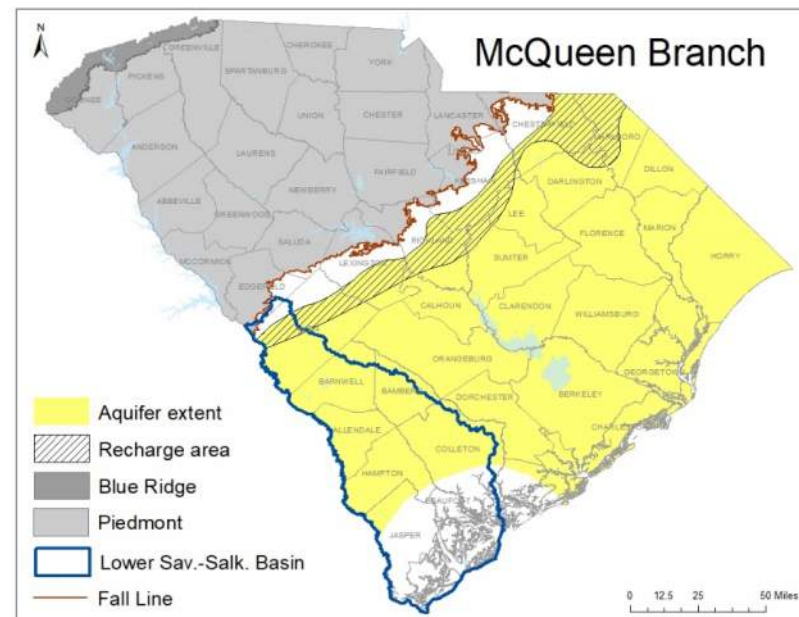
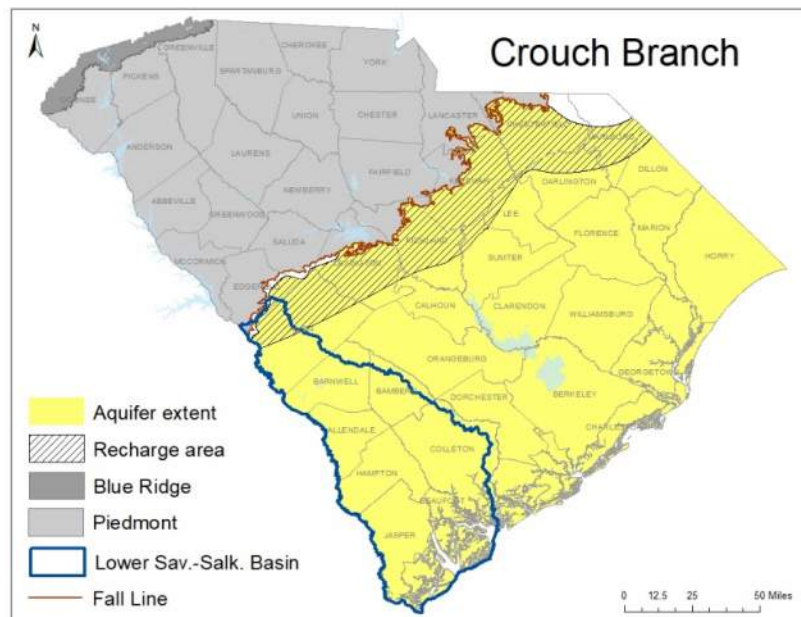
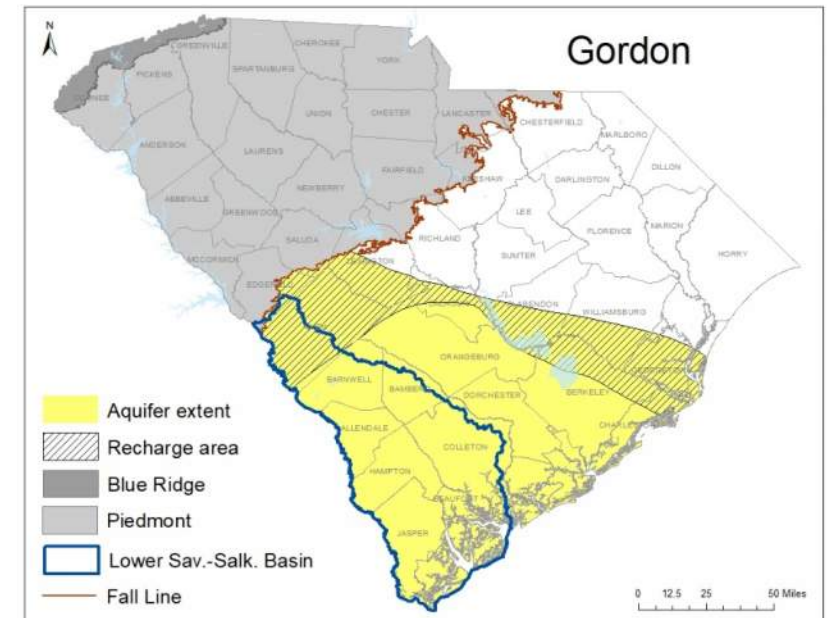
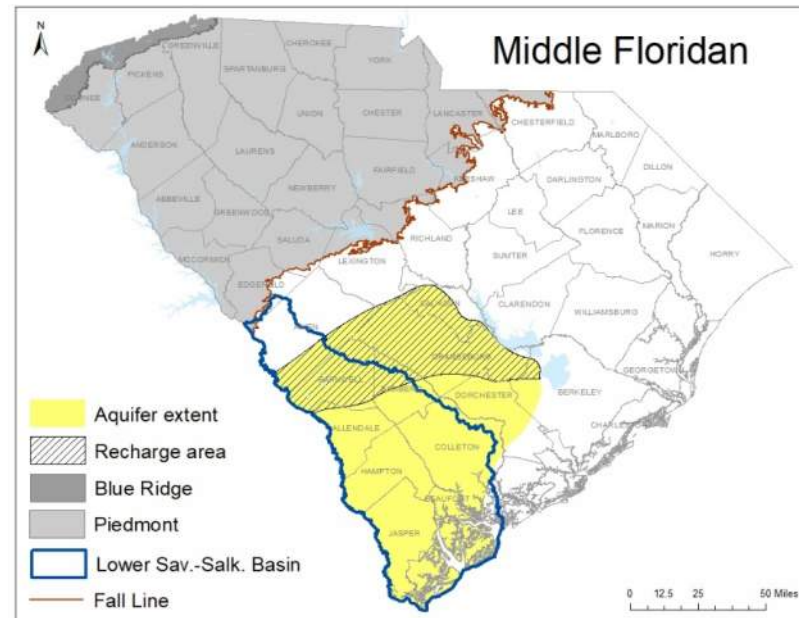
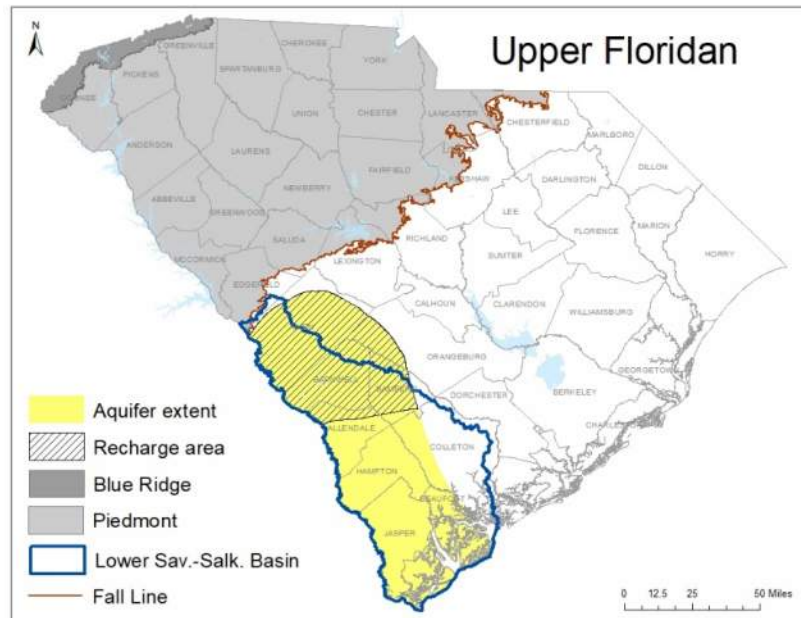
Limestone/Sand Aquifer  
Clay Confining unit

not drawn to scale

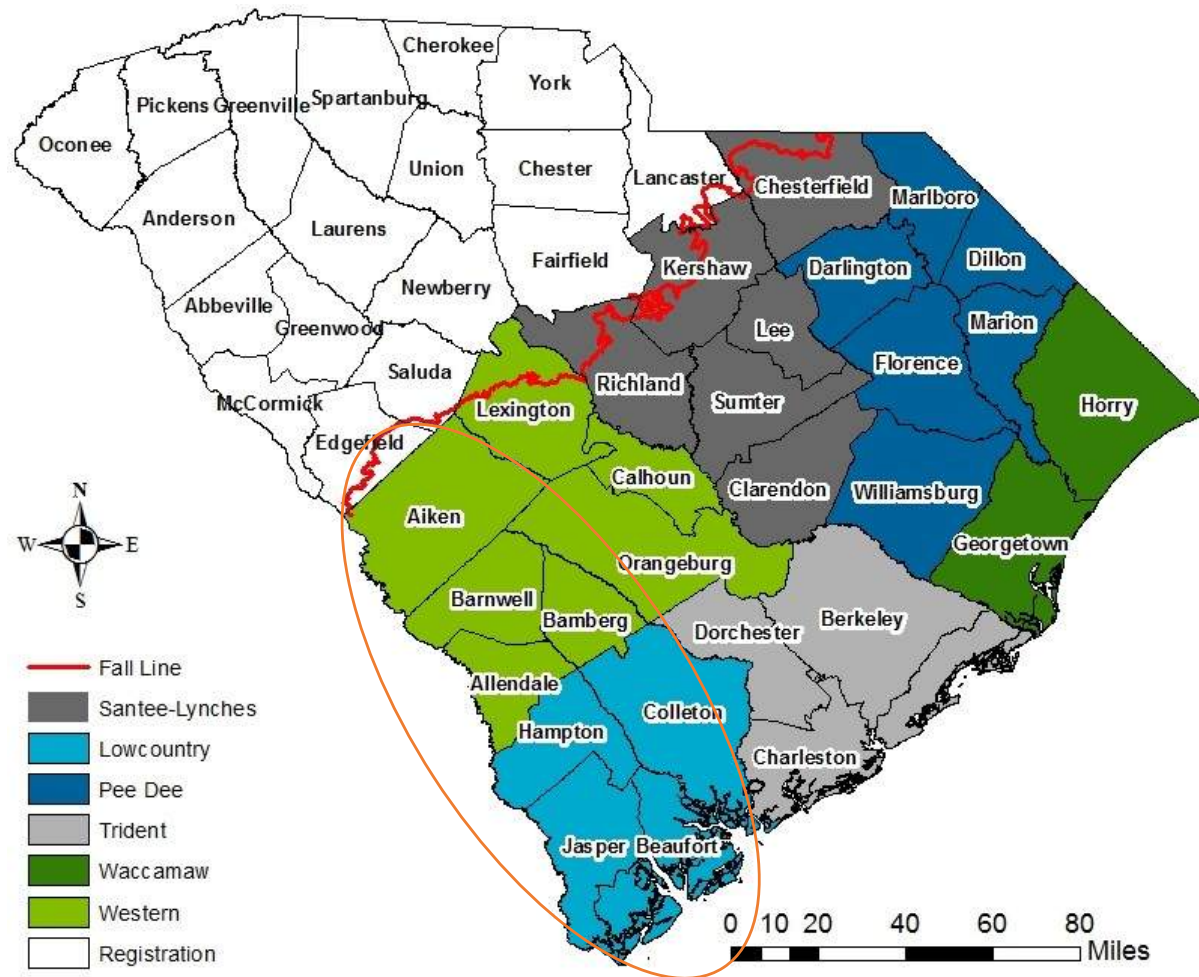
Limestone  
Limestone/Sand  
Sand  
Sand  
Sand  
Sand  
Sand/Clay

-4000 Feet

# Coastal Plain Aquifer Extents and Recharge Areas



# Capacity Use Areas in Lower Savannah-Salkehatchie Basins



## Capacity Use Area

A groundwater withdrawer of greater than three million gallons during any one month from a single well or from multiple wells under common ownership within a one-mile radius from any one existing or proposed well (Groundwater Use and Reporting Act, 2000).

Any user who uses 3 million gallons or more in any month of the year, in these areas, is required to apply for a permit.

## **Lowcountry Area (1981)**

Beaufort, Colleton, and Jasper Counties

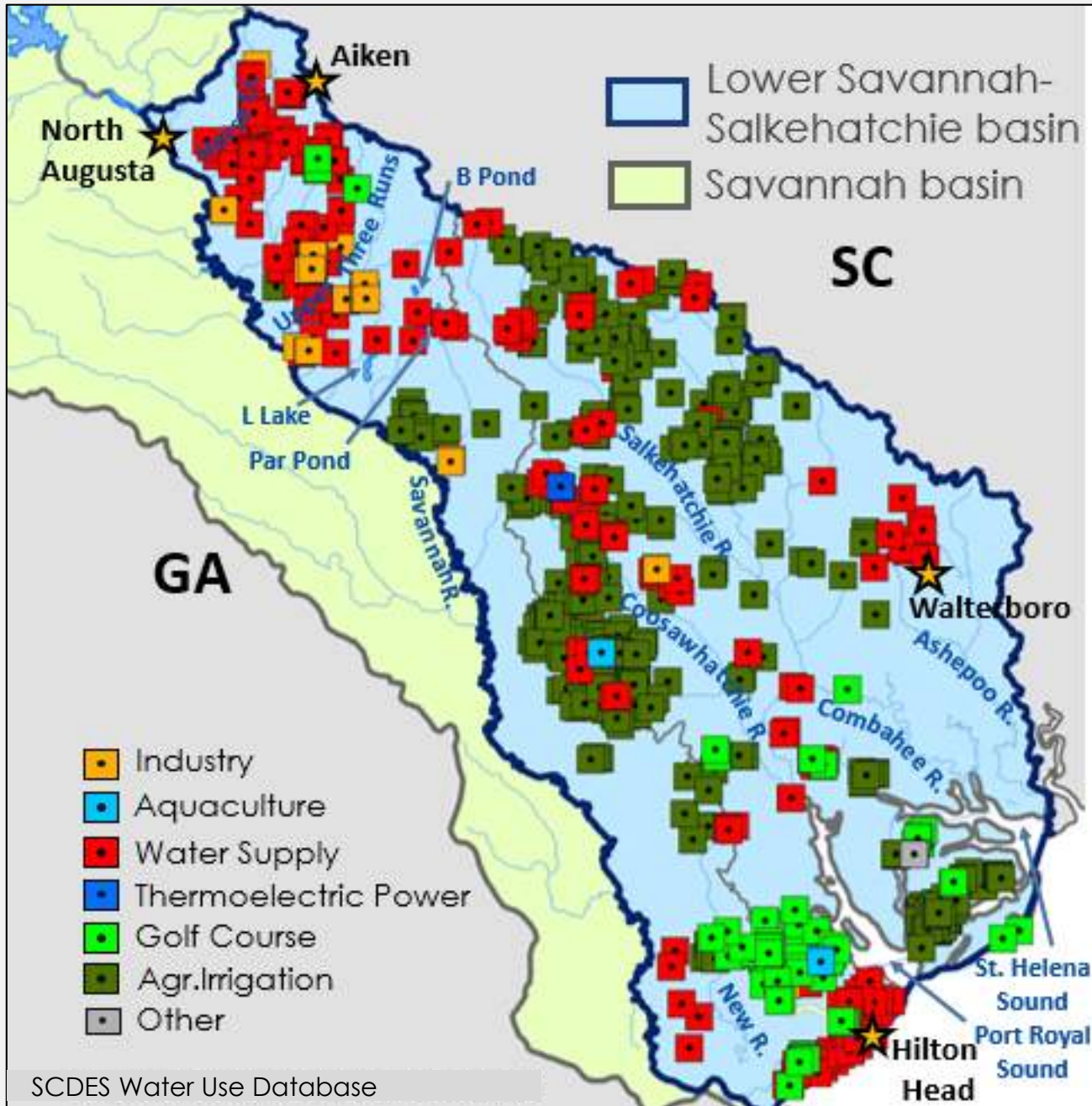
## **Western Area (2018)**

Aiken, Allendale, Bamberg, Barnwell, Calhoun, Lexington, and Orangeburg Counties

## Groundwater Management Plans

Examine water use in the Capacity Use Areas to ensure sustainable and beneficial use of the groundwater resource.

# Reported SC Water Withdrawals (2023 Groundwater)



SCDES Water Use Database

Including Energy

SW : 68% 154 MGD  
GW: 32% 68 MGD



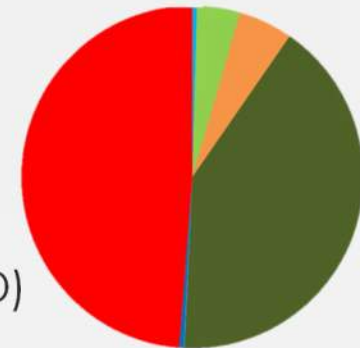
Excluding Energy

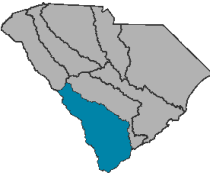
SW : 47% 65 MGD  
GW: 52% 72 MGD



Groundwater Including Energy

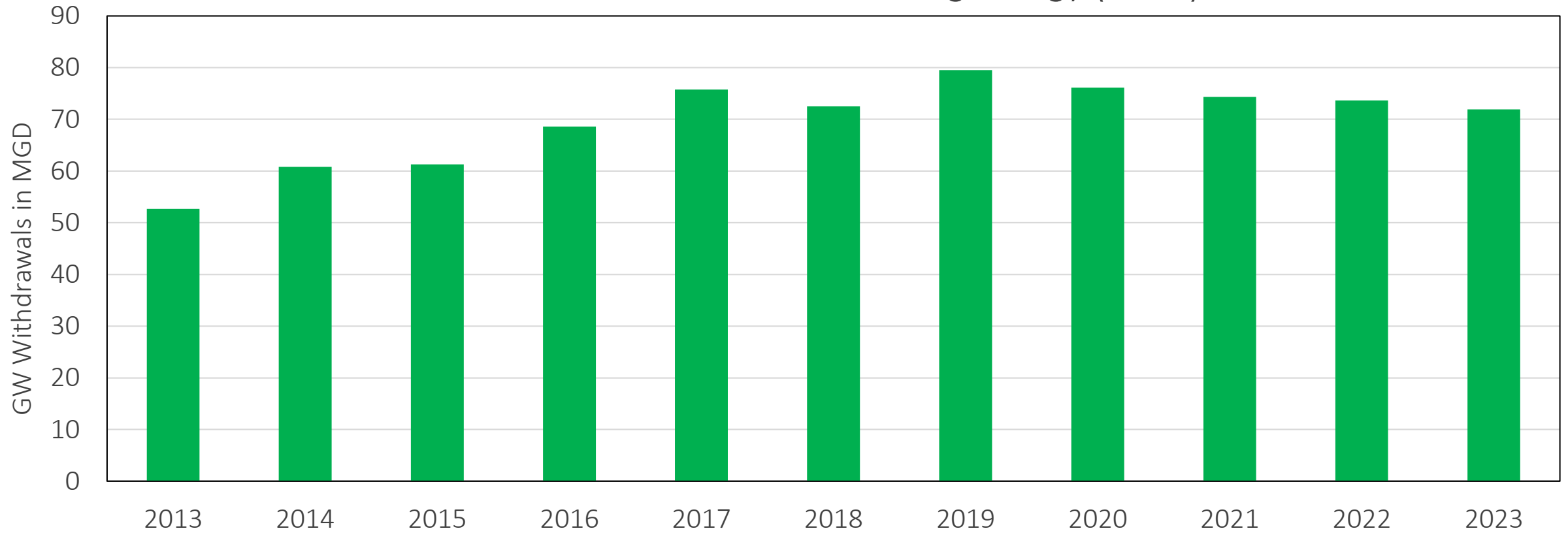
- Water Supply (49%, 35 MGD)
- Agr. Irrigation (41%, 30 MGD)
- Industry (5%, 4 MGD)
- Golf Course (4%, 3 MGD)
- Thermoelectric Power (<1%, 0.3 MGD)
- Aquaculture (<1%, 0.3 MGD)
- Other (<1%, 0.07 MGD)



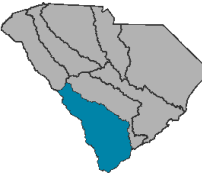


# Reported Groundwater Withdrawals (2013 – 2023)

Groundwater Withdrawals Including Energy (MGD)



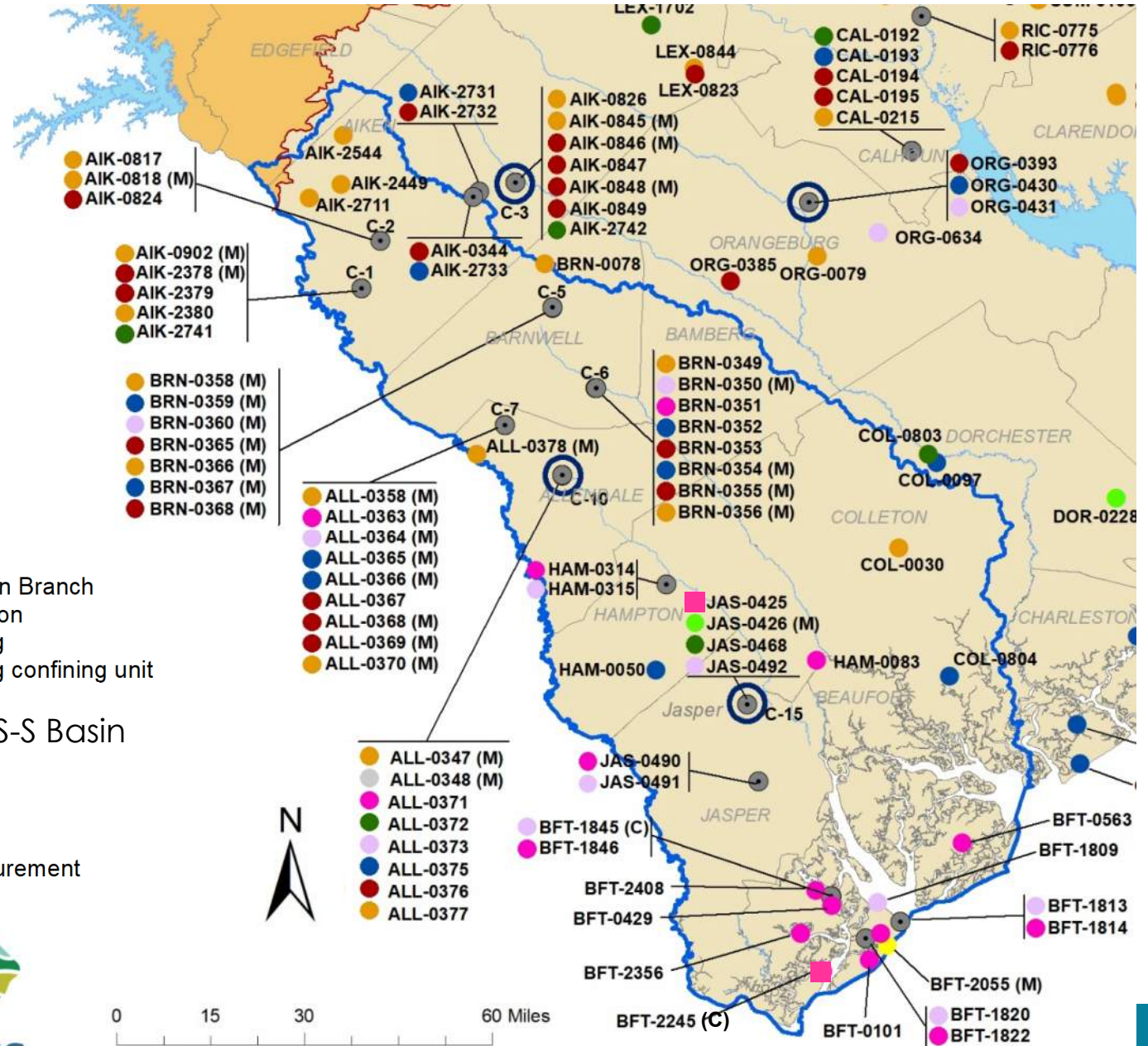
# Groundwater Monitoring Network



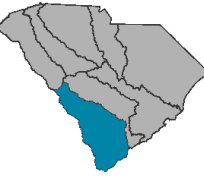
- 75 well sites actively monitored completed in 9 aquifers
- Period of record ranges from 4 to 69 years



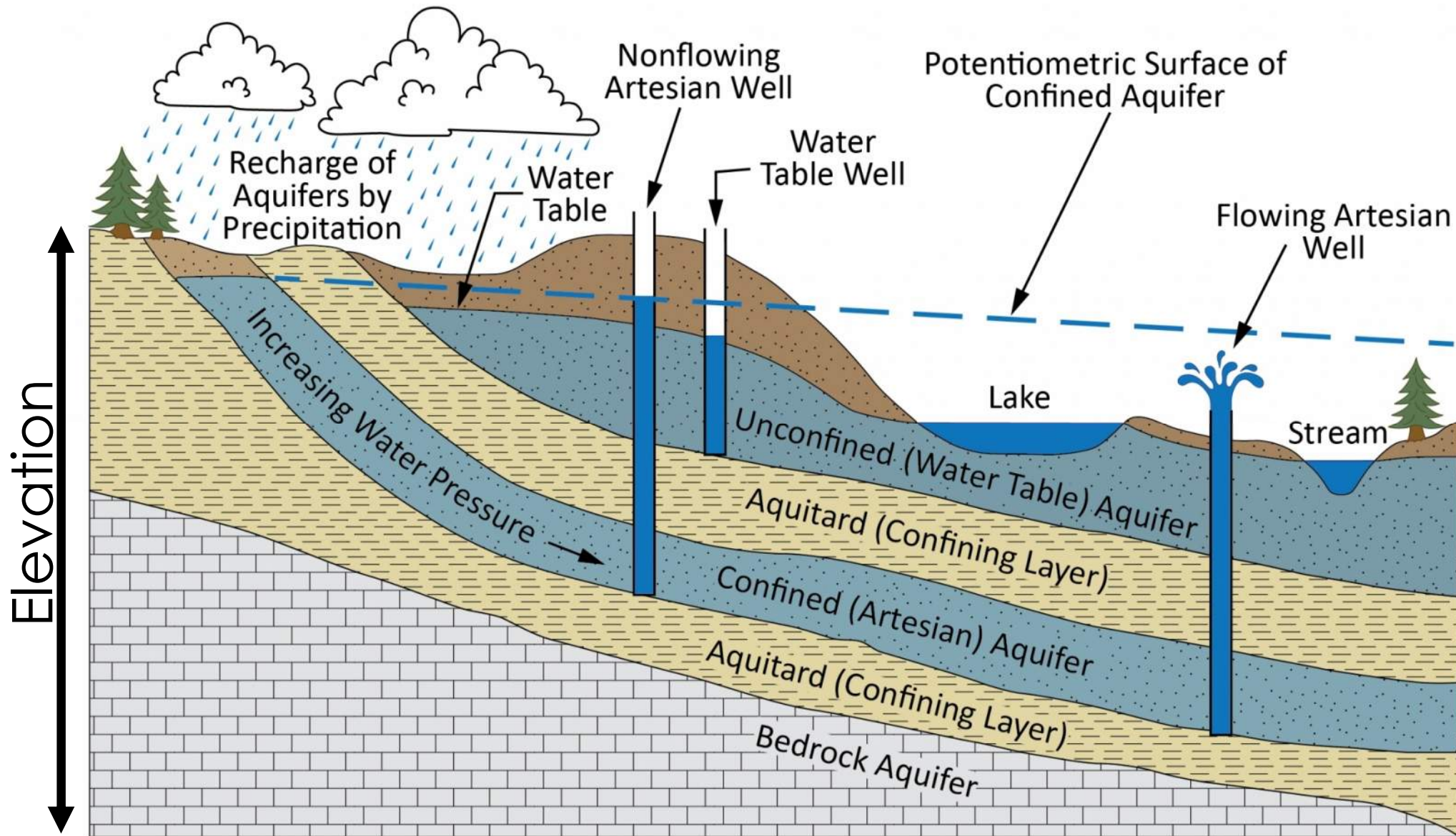
- Aquifer**
- Surficial aquifer system
  - Gordon
  - Upper Floridan
  - Middle Floridan
  - Crouch Branch
  - McQueen Branch
  - Charleston
  - Gramling
  - Gramling confining unit
- Agency**
- SCDNR
  - USGS
  - Cluster site
- (M) Manual water level measurement  
(C) Water level and conductivity measurement  
(T) Telemetry Site
- LS-S Basin

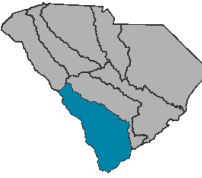






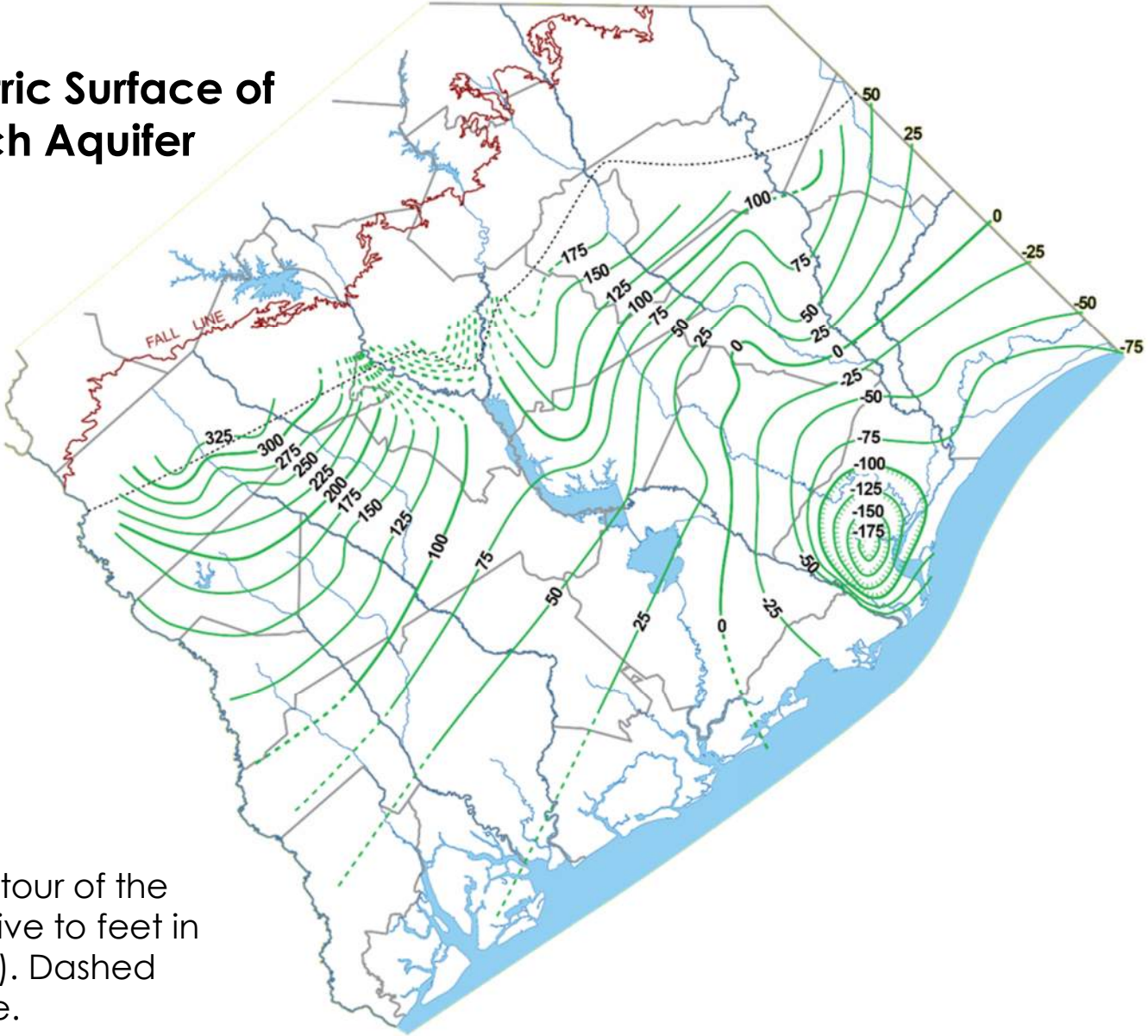
# Water-Level Measurements of an Aquifer





# Potentiometric Water-Level of an Aquifer

## 2016 Potentiometric Surface of the Crouch Branch Aquifer

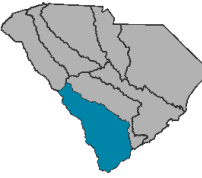


### EXPLANATION

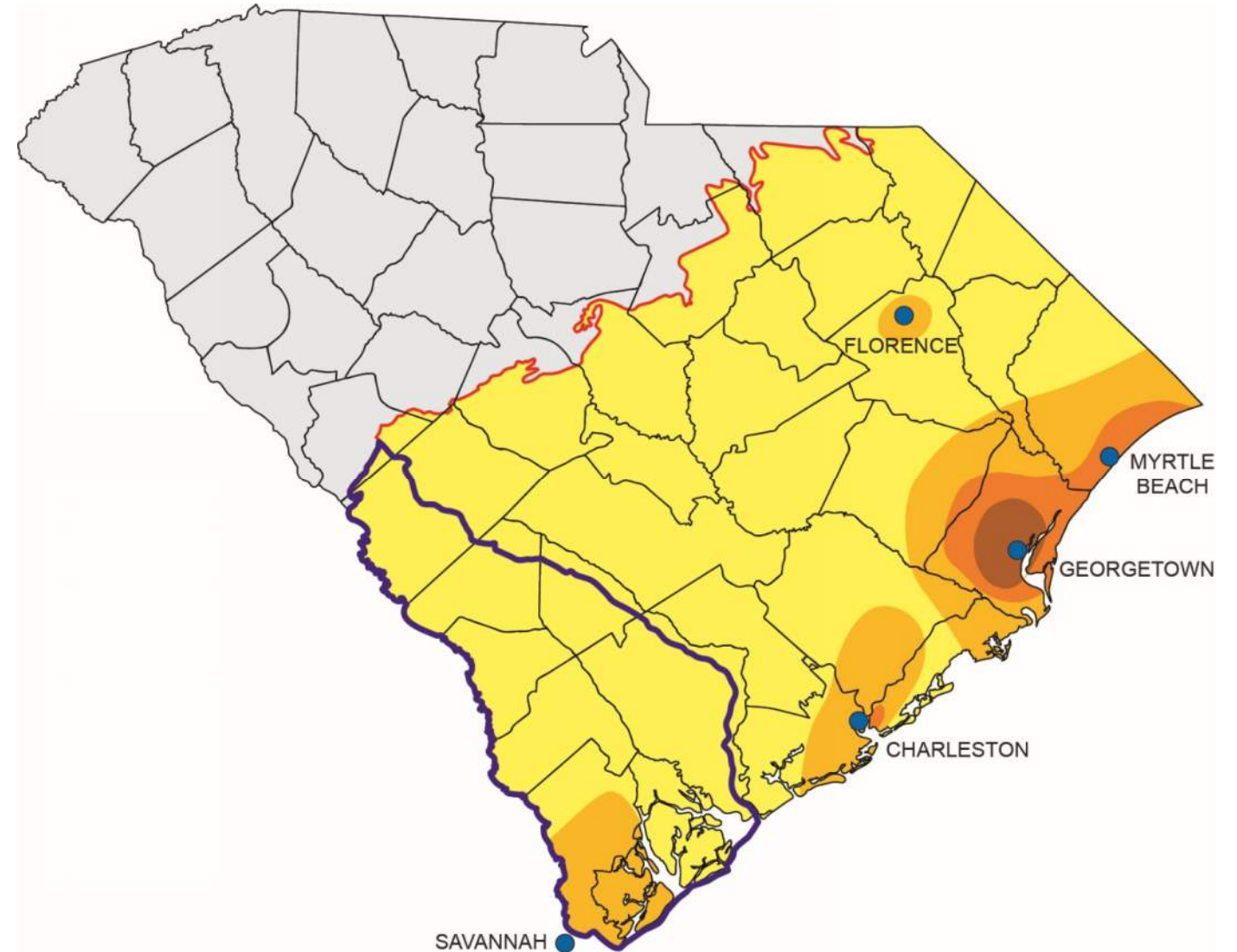
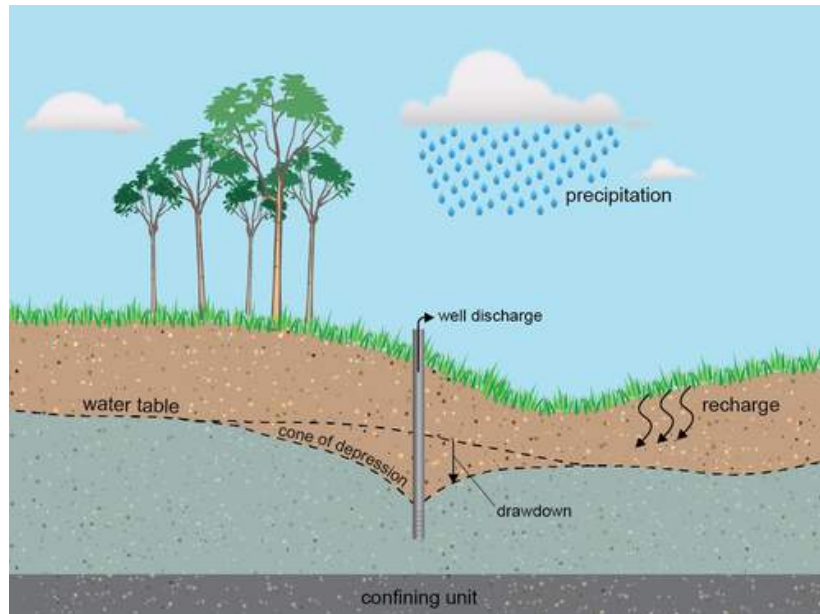
— 100 —

Potentiometric contour of the aquifer in feet relative to feet in elevation (NAVD88). Dashed where approximate.

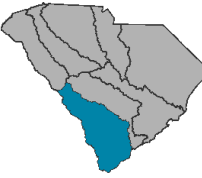
- The potentiometric surface is the level, in feet of elevation to which water rises as measured in tightly cased wells open to specific aquifers.
- Changes in groundwater storage and direction of flow gradients are represented by potentiometric water-level contours.



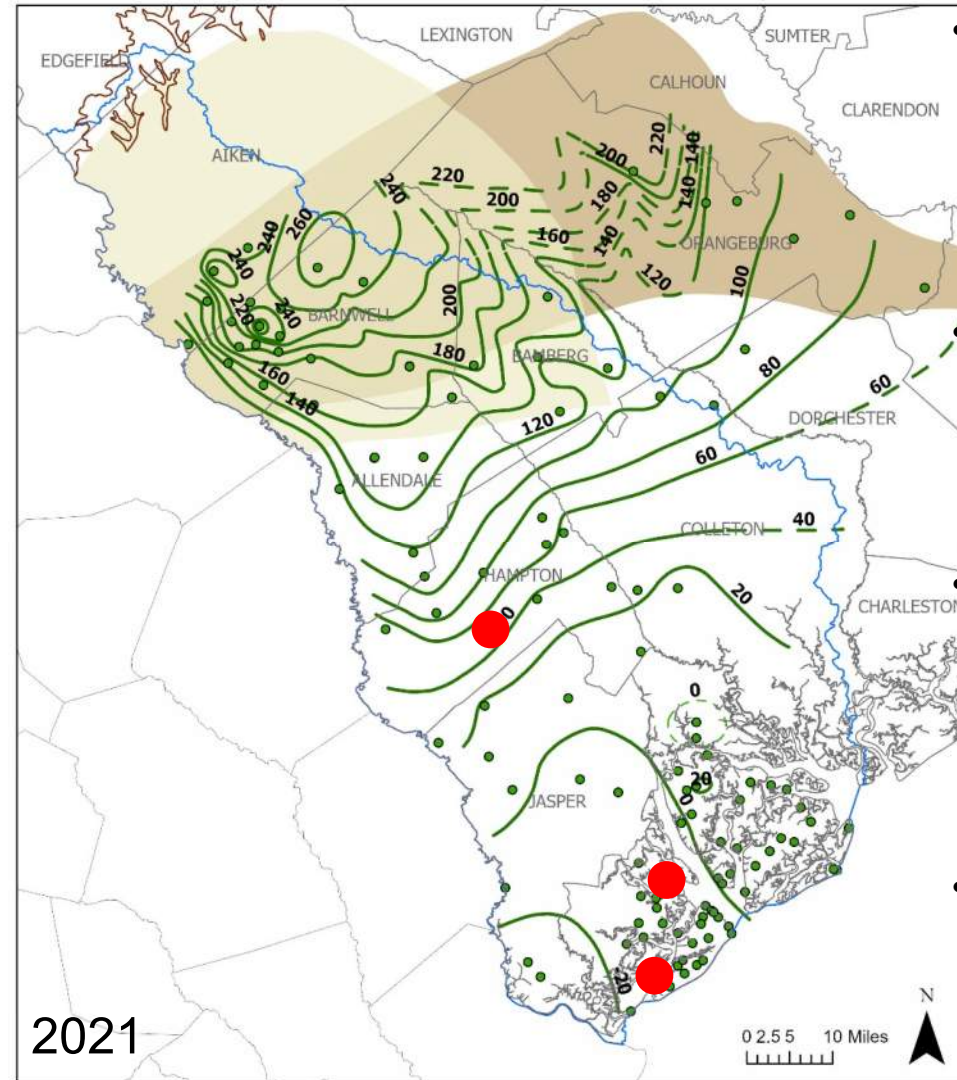
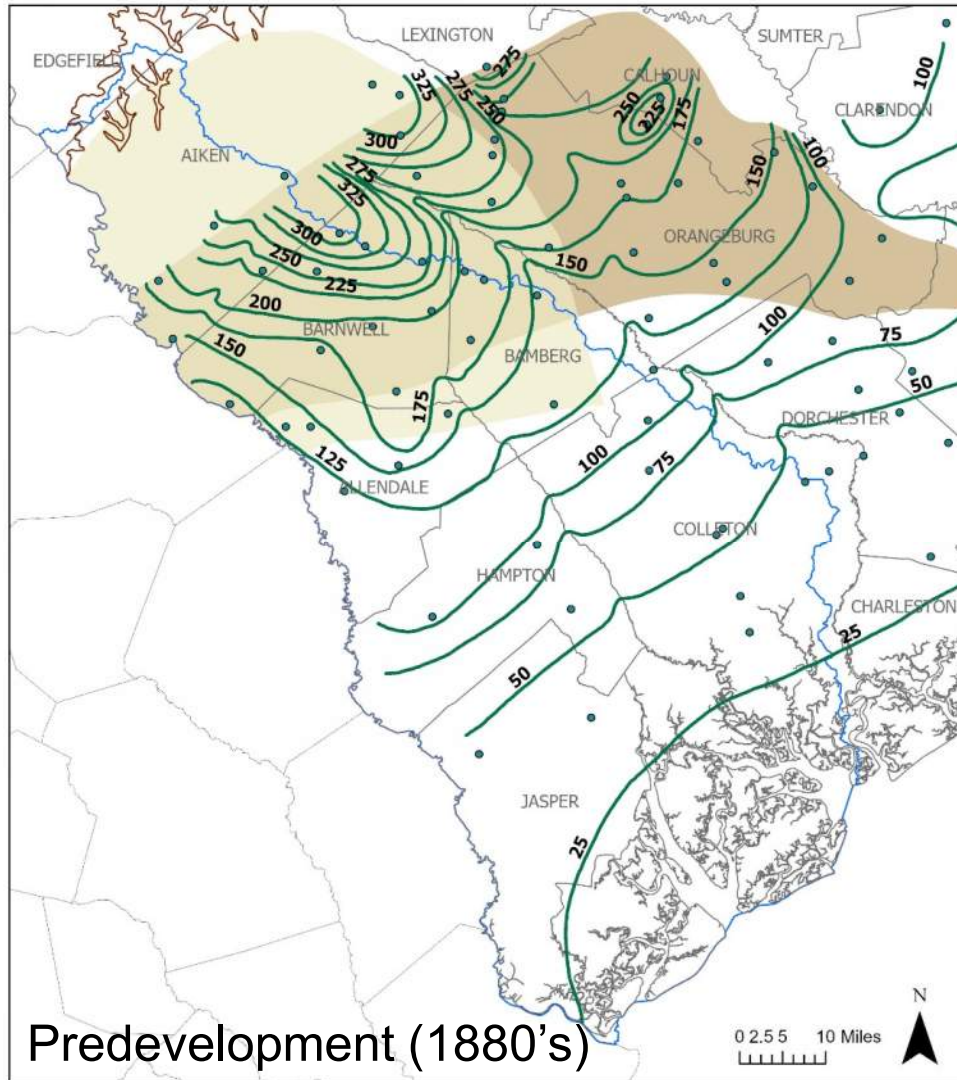
# Cones of Depression in South Carolina



Long-term pumping can result in “cones of depression”, which are areas where groundwater levels have declined. The greatest declines are centered at the pumping wells, but the zone of influence can spread out for tens of miles.



# Upper and Middle Floridan Aquifer



Upper and Middle Floridan aquifers mapped together due to minor head differences.

Primarily used for agriculture and water supply; golf course irrigation secondary.

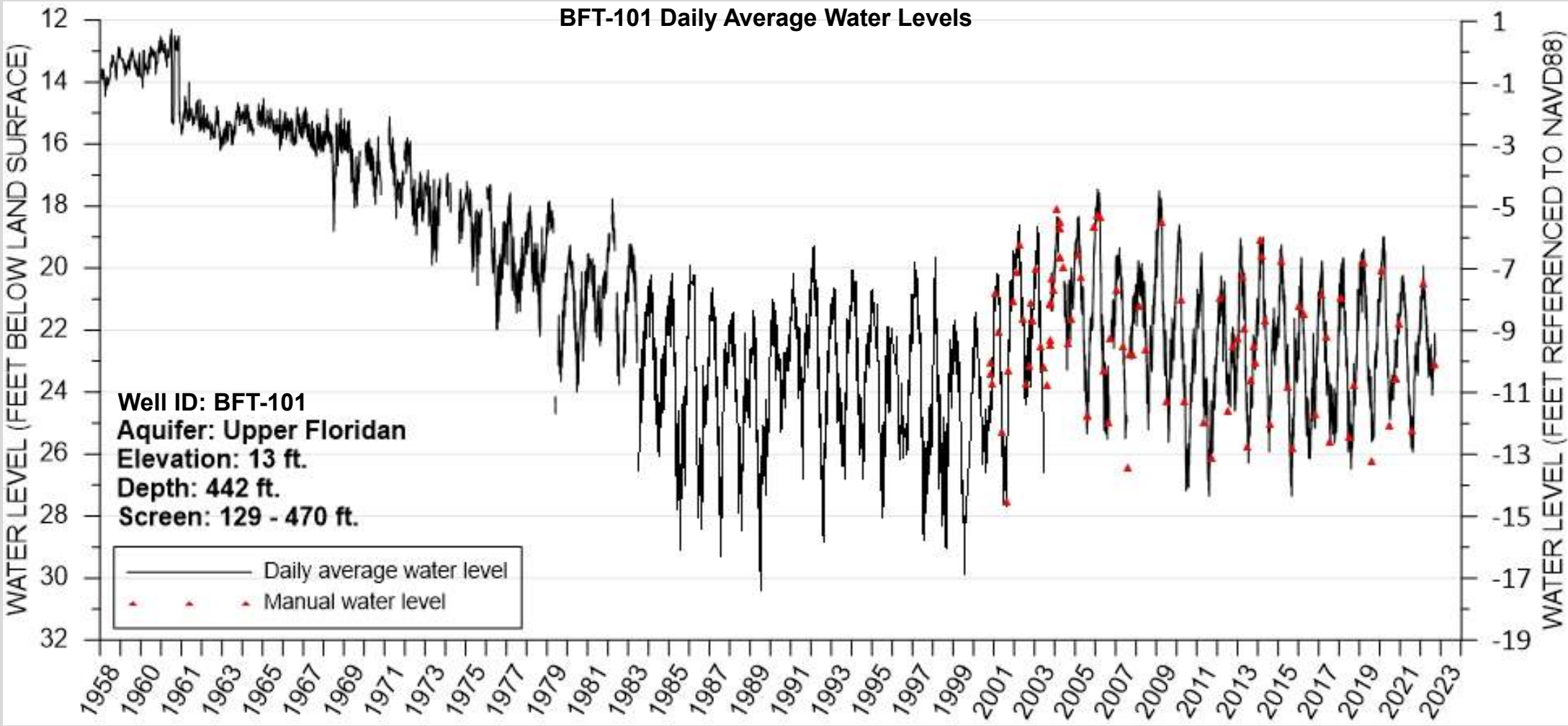
Pumping centers at Hilton Head and Savannah, GA have shifted gradient from SE to SW.

Water level declines since predevelopment between 25 and 45 feet at the coast, saltwater intrusion at Hilton Head is an ongoing problem.

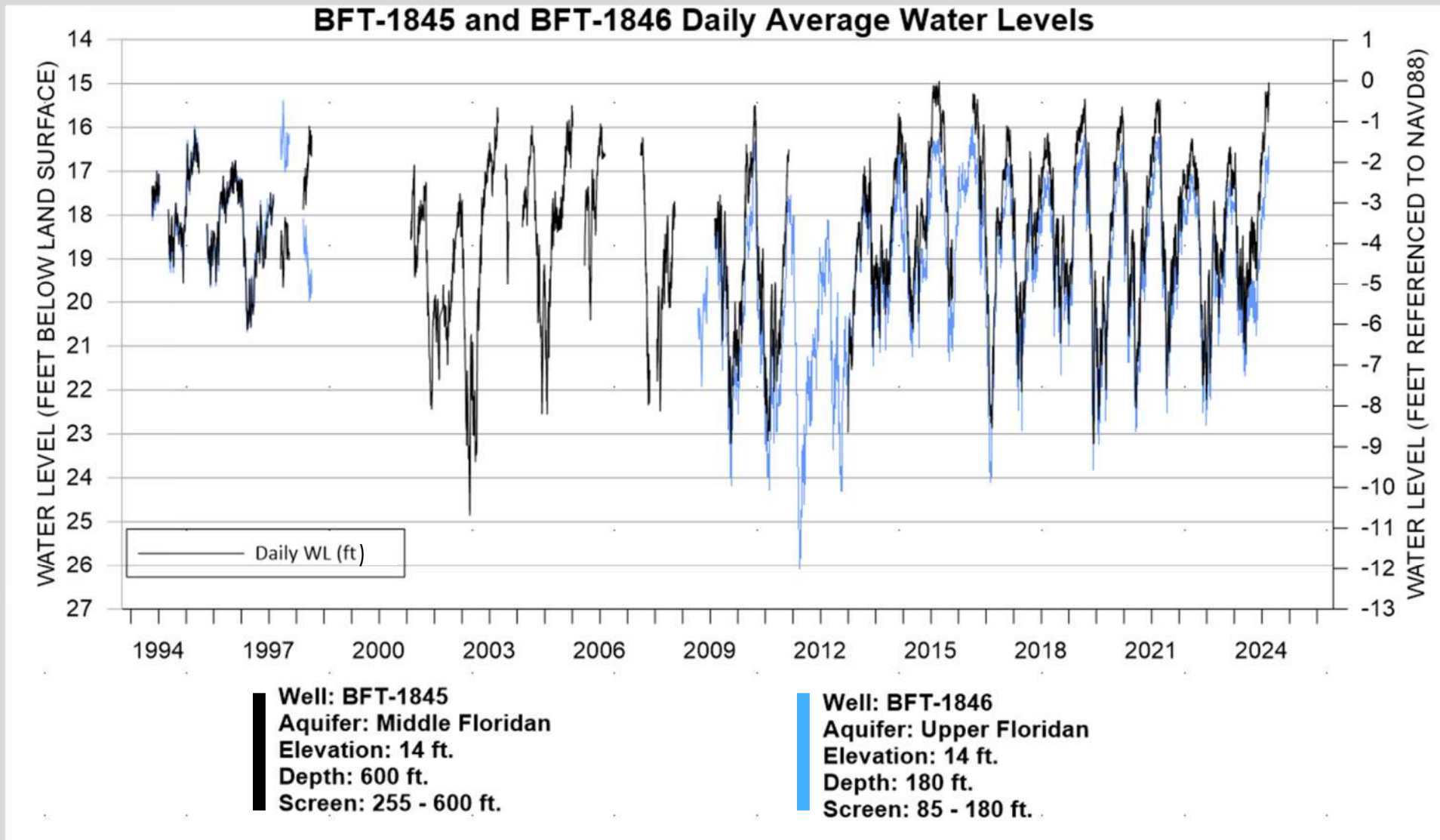
- ext\_upper\_floridan\_rech
- ext\_middle\_floridan\_rech
- floridanPreDev (feet, in elevation)
- wellsPreDev

- ext\_upper\_floridan\_rech
- ext\_middle\_floridan\_rech
- Floridan 2021 (feet, in elevation)
- Wells 2021

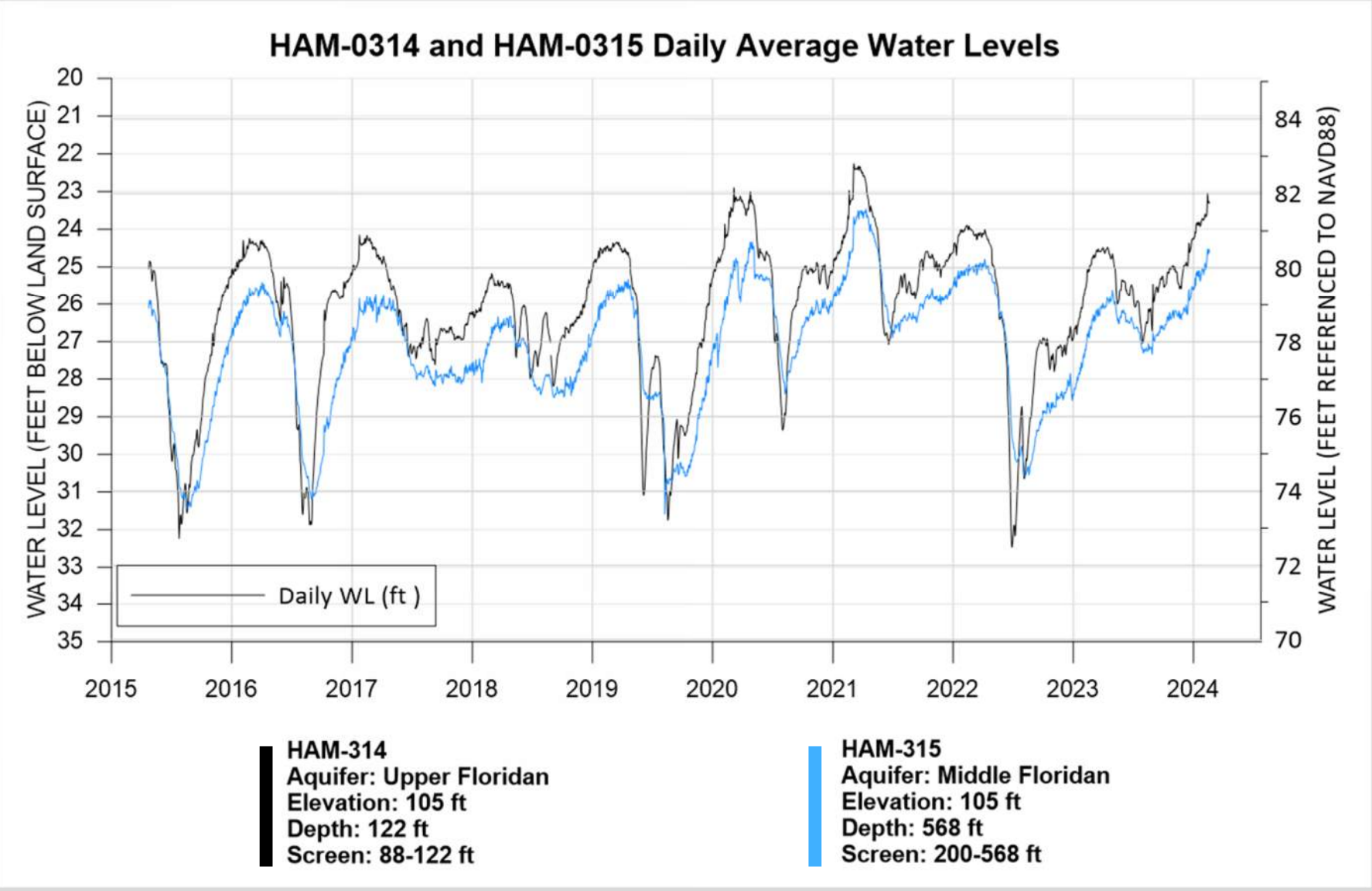
# Example: Upper Floridan Aquifer in Beaufort County



# Example: Upper and Middle Floridan aquifer Beaufort County

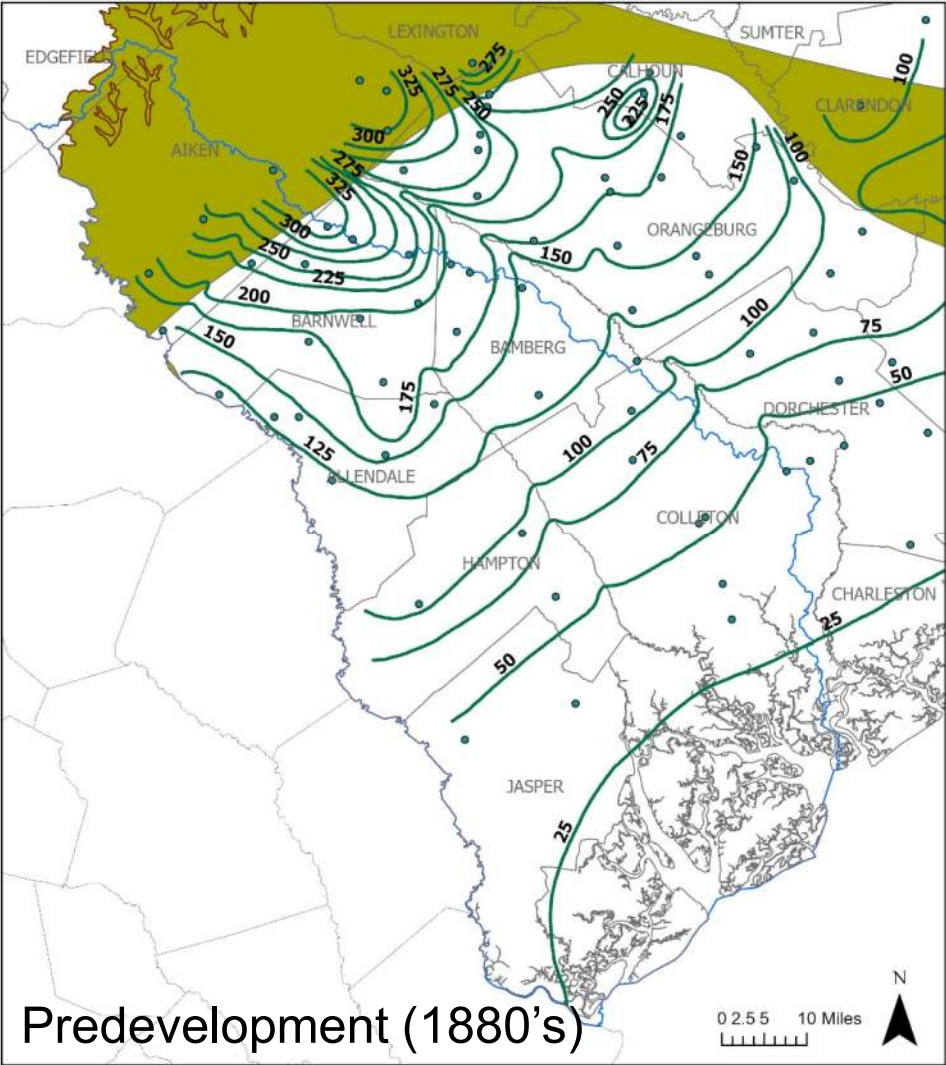


# Example: Upper and Middle Floridan Aquifer Hampton County





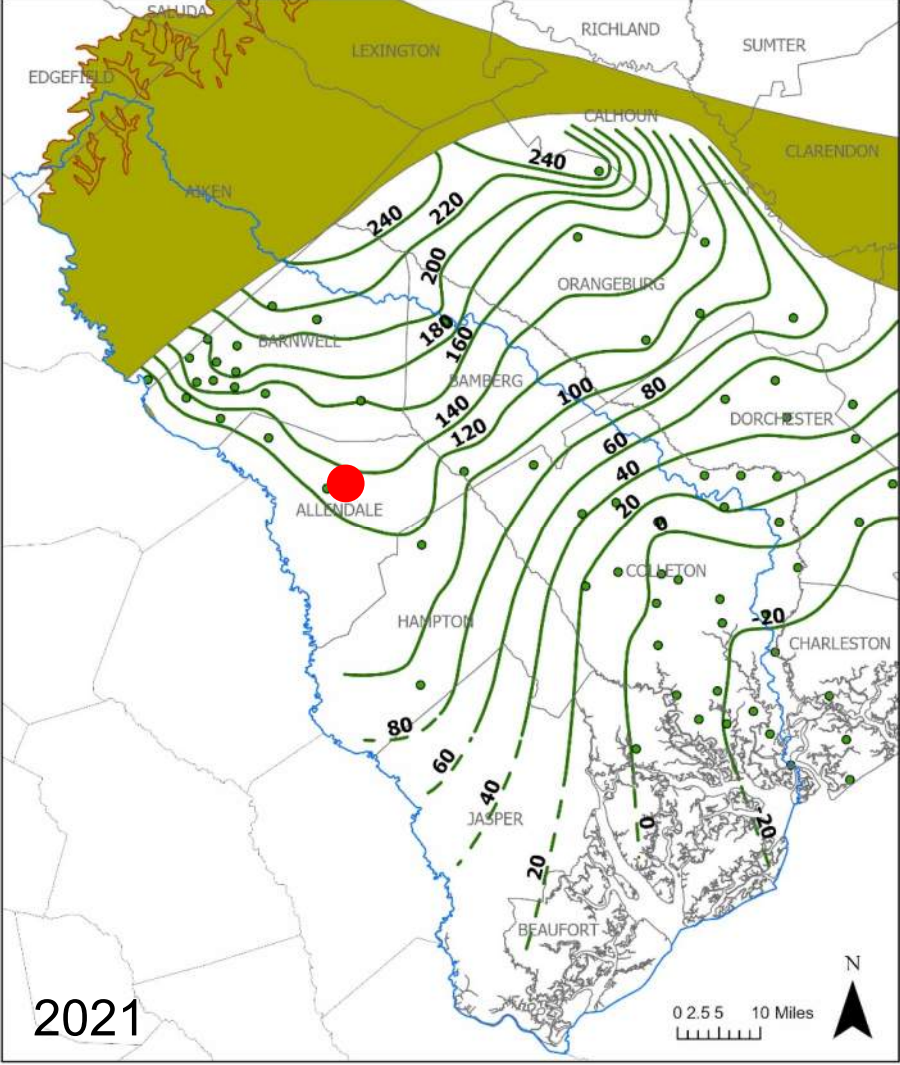
# Gordon Aquifer



ext\_gordan\_recharge

— Flordan/Gordon Predev (feet, in elevation)

• Wells predev



ext\_gordan\_recharge

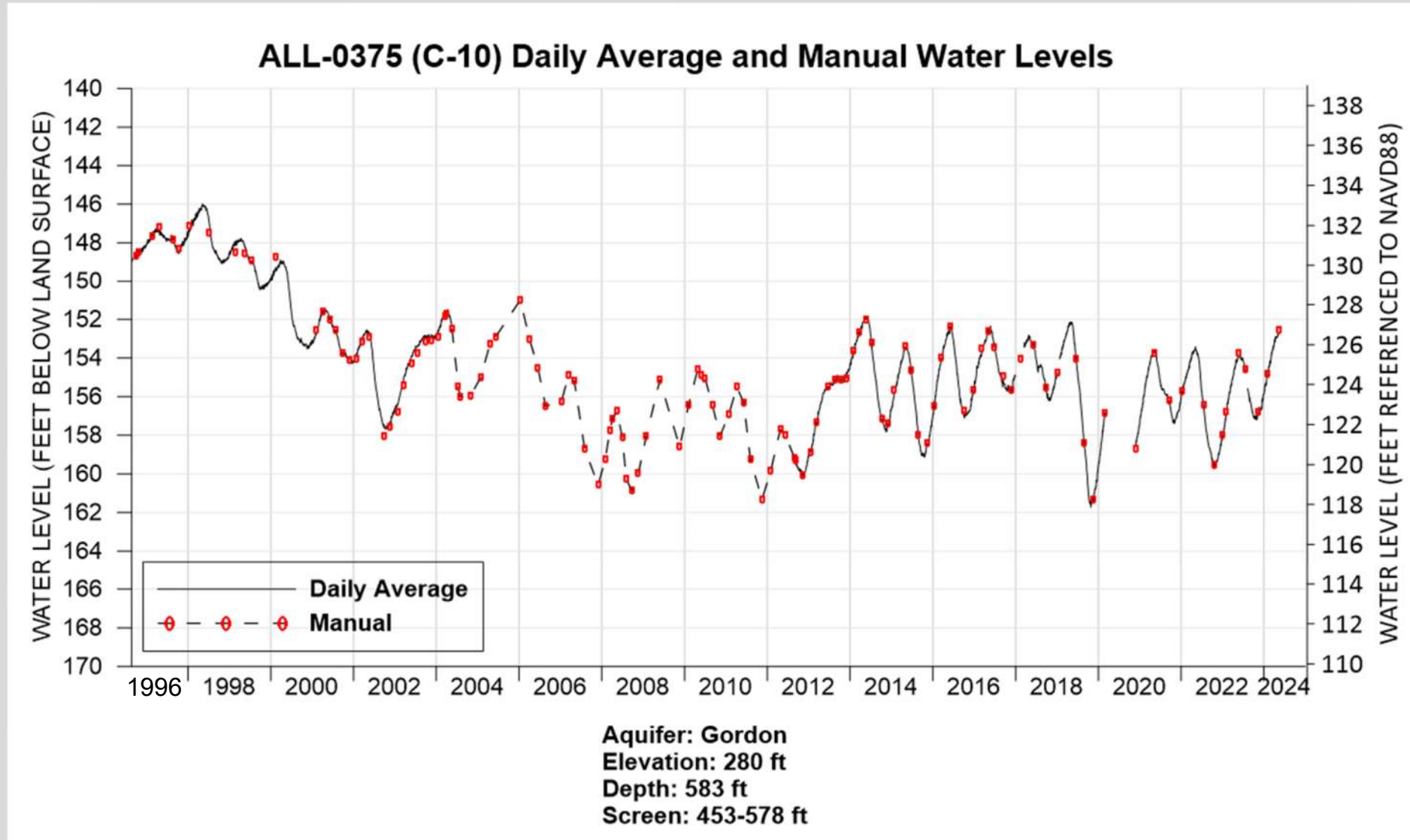
— Gordon 2021 (feet, in elevation)

• Wells 2021

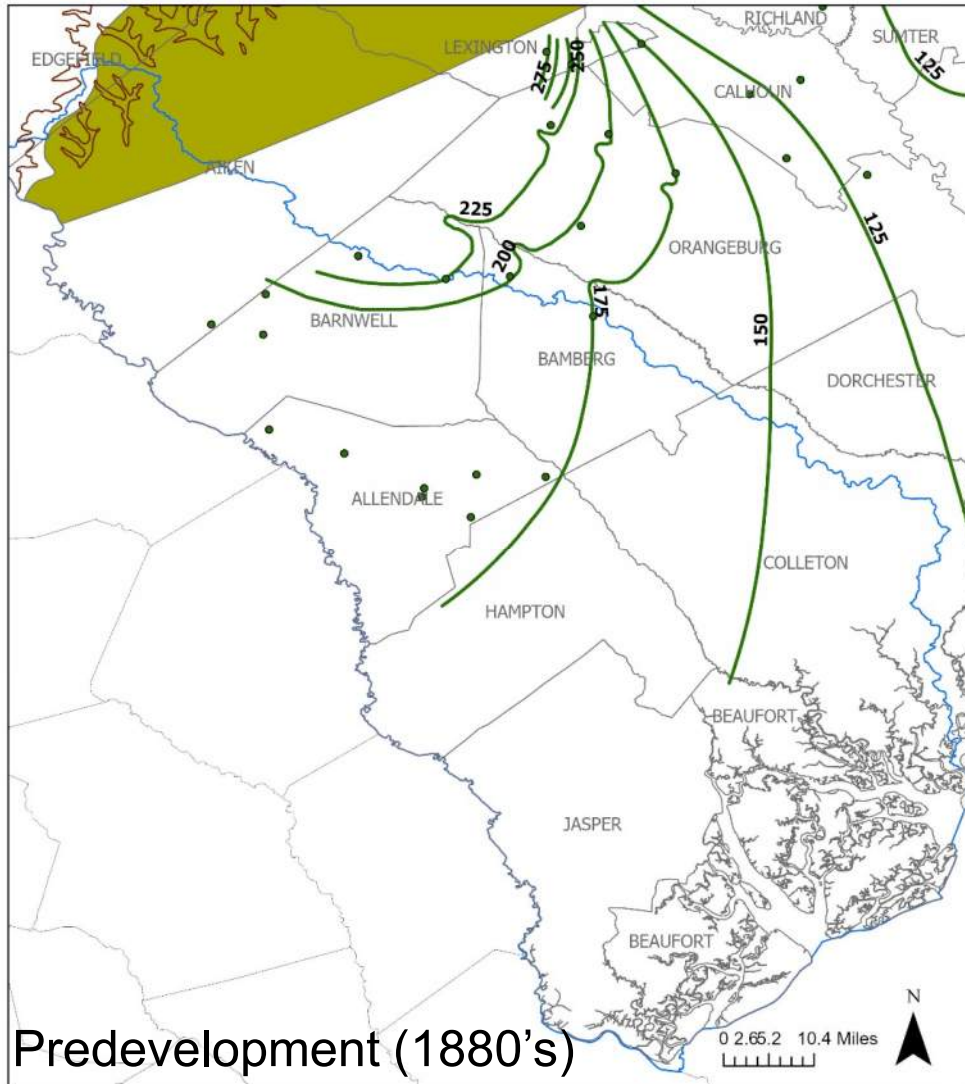
- Gordon Aquifer was previously mapped with the Floridan Aquifer.
- Primarily used for agriculture; water supply, and industry secondary.
- Domestic, rural public supply, fire station use in Colleton County trends brackish towards coast.
- Water level declines since predevelopment between 25 and 45 feet at the coast.



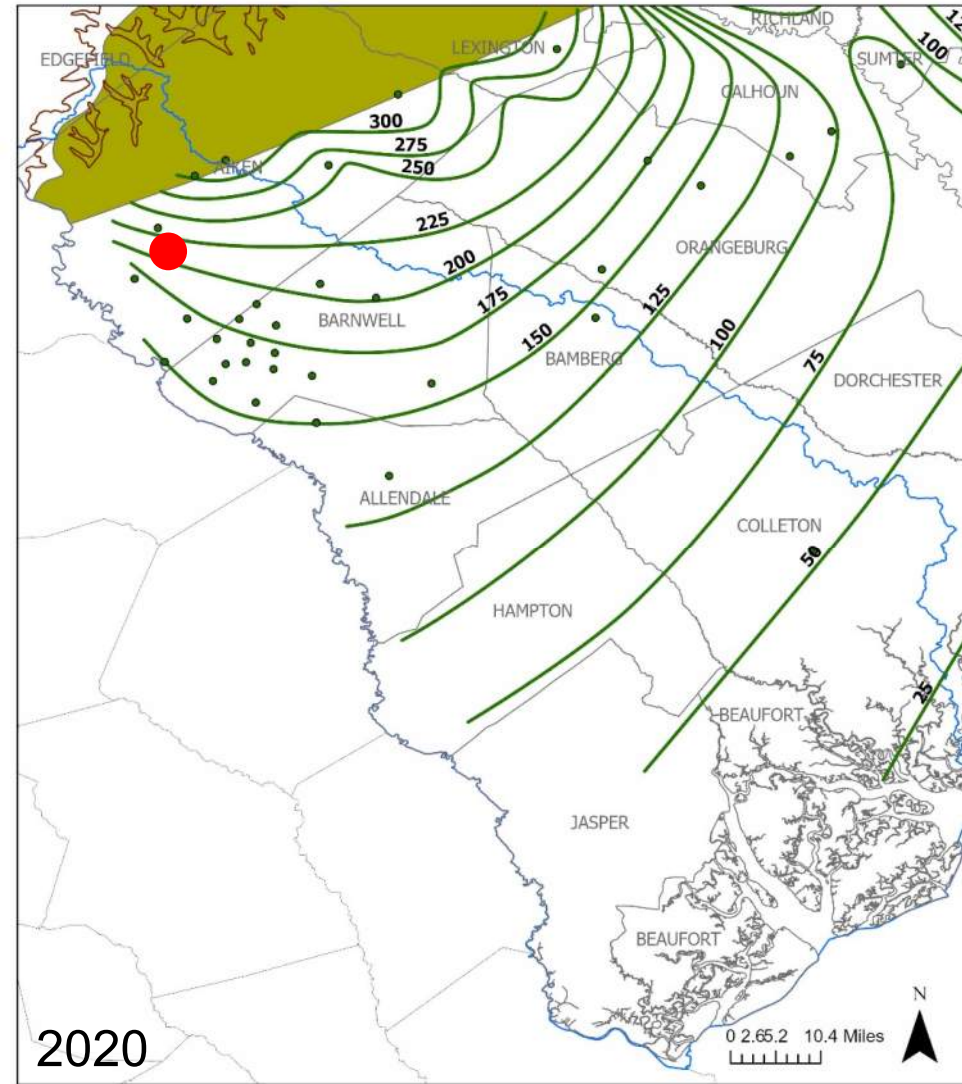
# Example: Gordon Aquifer in Allendale County



# Crouch Branch Aquifer



Predevelopment (1880's)



2020

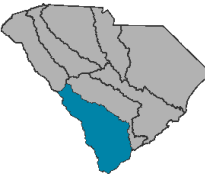
ext\_crouch\_branch\_recharge

- Wells predev
- Contours predev (feet, in elevation)

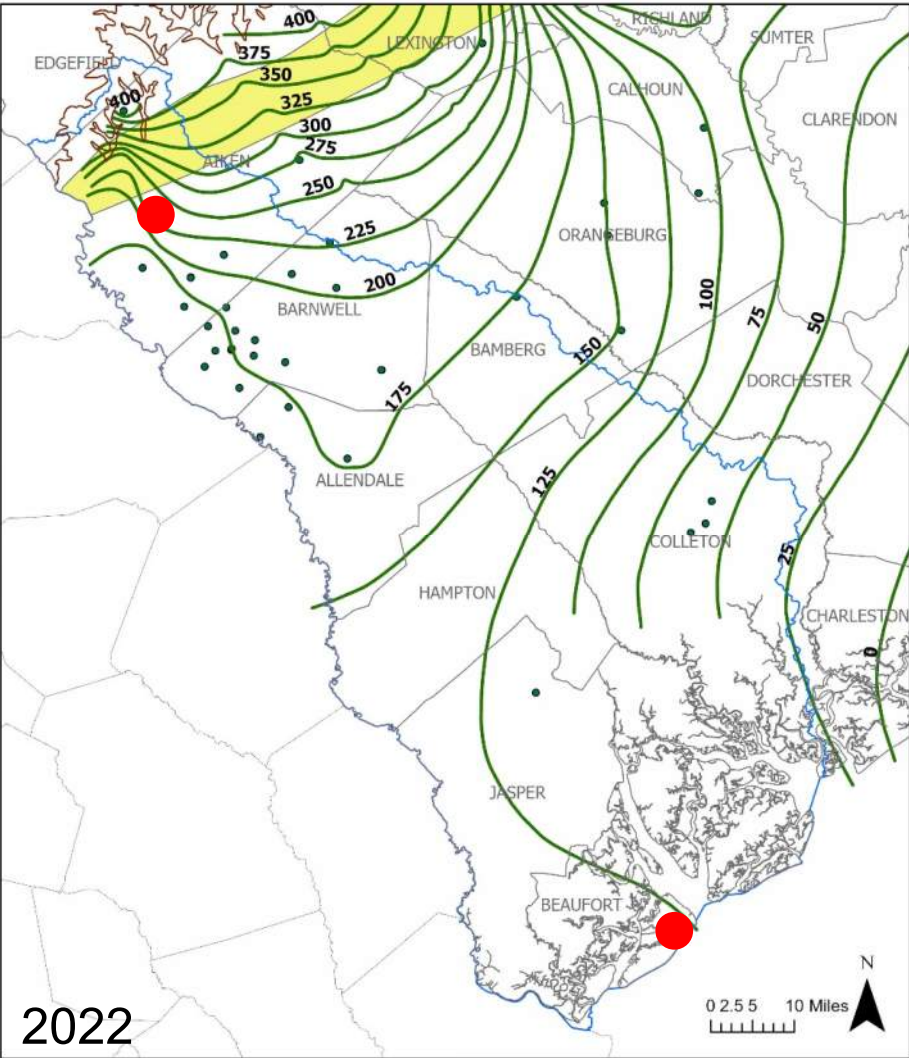
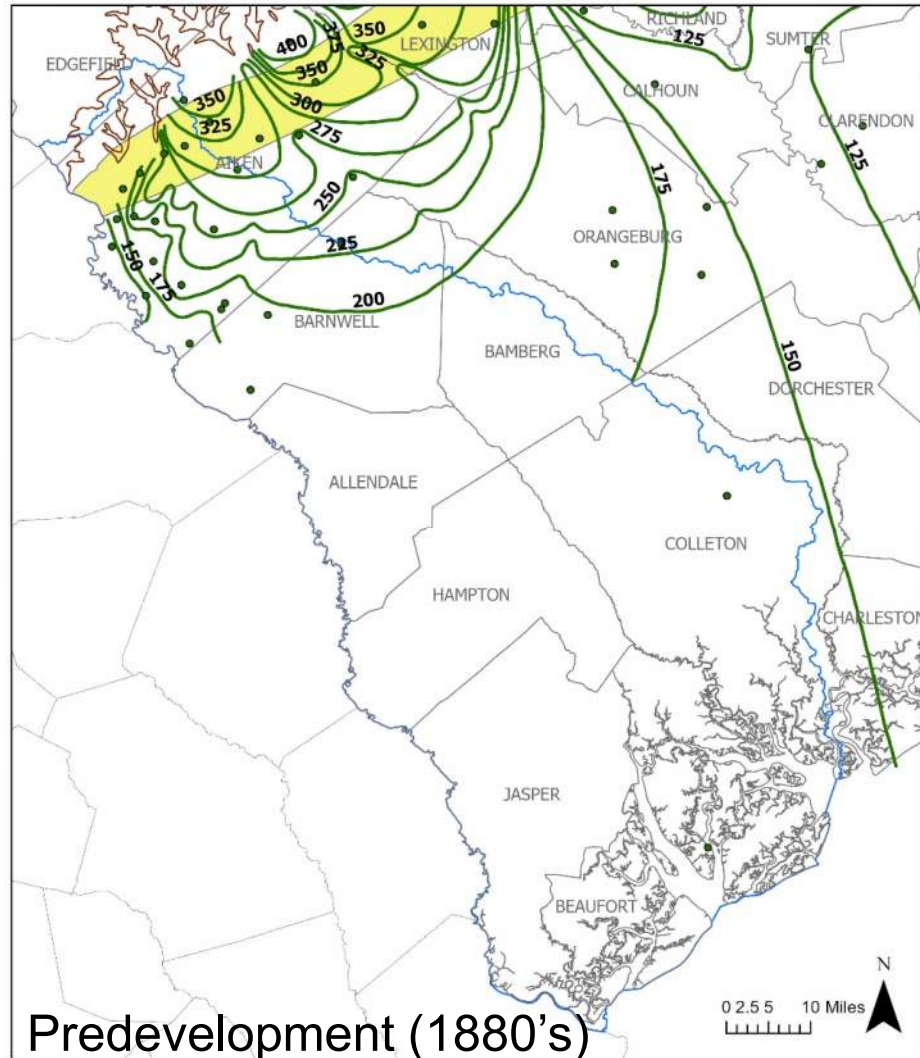
ext\_crouch\_branch\_recharge

- Wells 2020
- Contours 2020 (feet, in elevation)

- Primarily used for agriculture and water supply in LS-S Basins.
- Few wells permitted in the coastal counties due to productive aquifers at shallower depths.
- Minor declines in water level updip, since predevelopment, a general southeastern gradient is present.

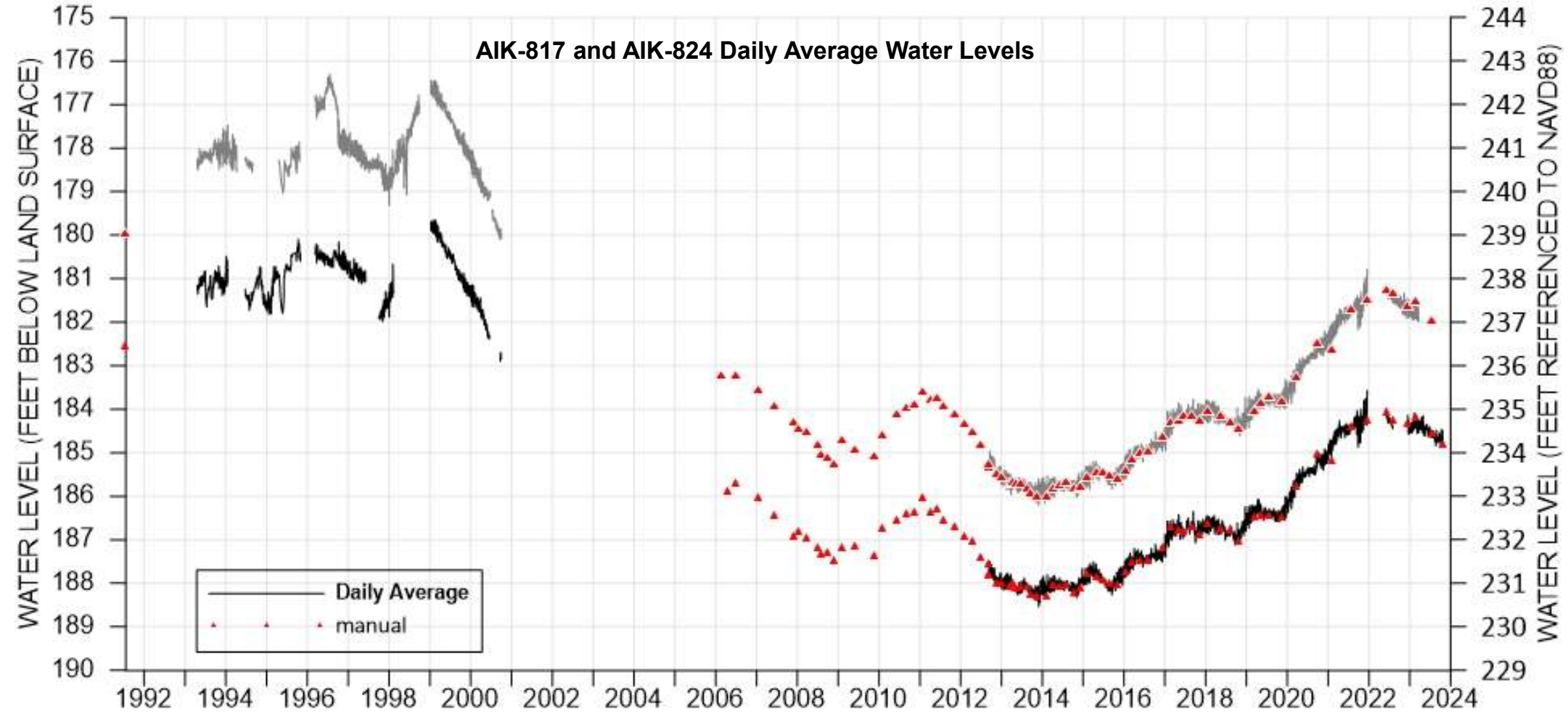


# McQueen Branch/Charleston/Gramling Aquifers



- Primarily used for water supply, industry, and golf in LS-S Basins.
- Few wells permitted in the coastal counties due to productive aquifers at shallower depths, Gramling is used in Hilton Head.
- Minor declines in water level up dip, since predevelopment a general southeastern gradient
- Near surface or flowing conditions near coast.

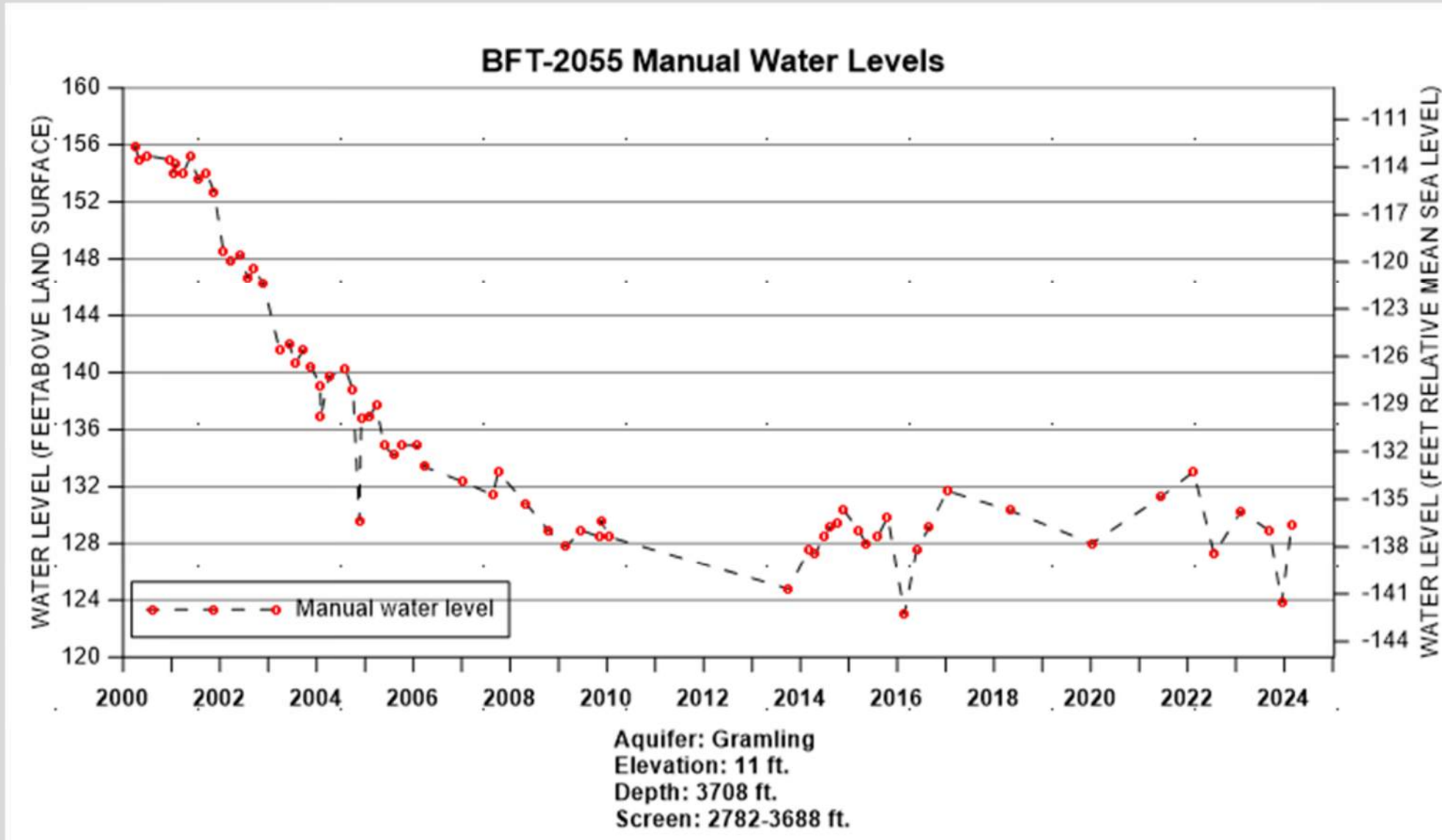
# Example: Well Cluster Site in Aiken County (C-2)



**Well ID: AIK-817**  
Aquifer: McQueen Branch  
Elevation: 419 ft  
Depth: 535 ft  
Screen: 520-530 ft

**Well ID: AIK-824**  
Aquifer: Crouch Branch  
Elevation: 418 ft  
Depth: 365 ft  
Screen: 350-360 ft

# Example: Gramling Aquifer on Hilton Head Island

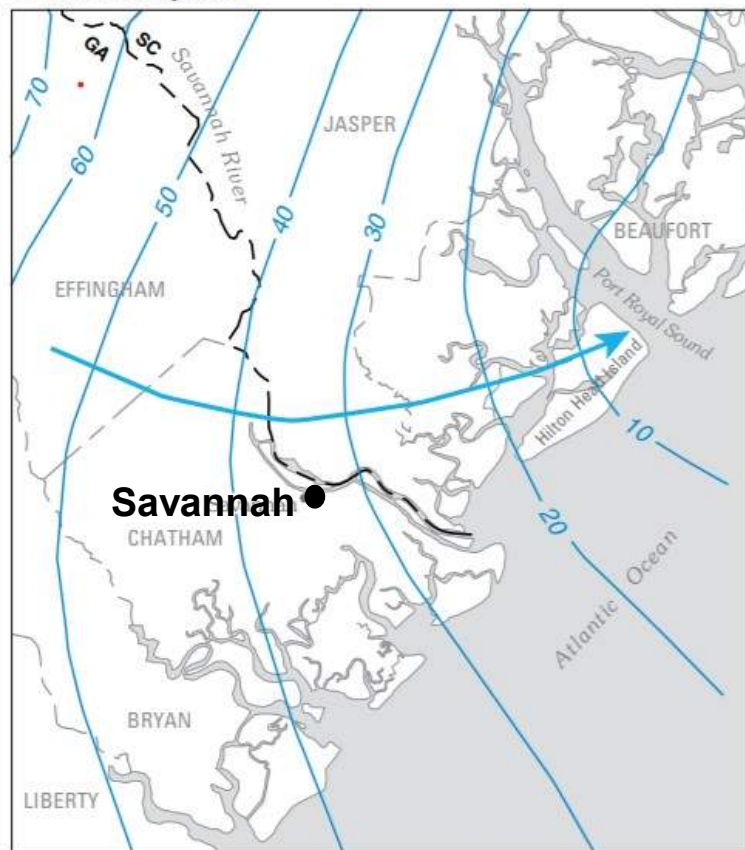


# Cone of Depression in Savannah, GA



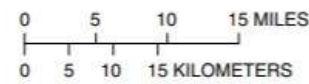
## Upper Floridan Aquifer

A. Predevelopment

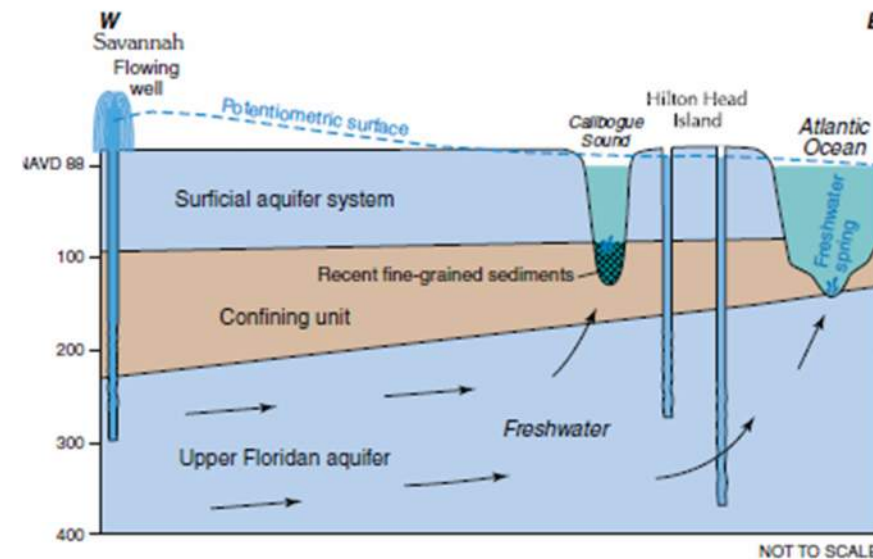


Base from U.S. Geological Survey  
1:100,000 and 1:250,000-scale data

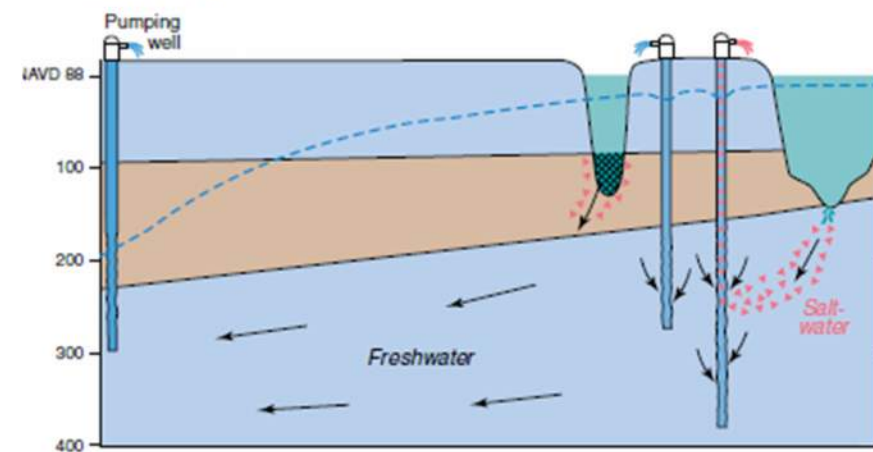
B. May and September 1998



A. Predevelopment

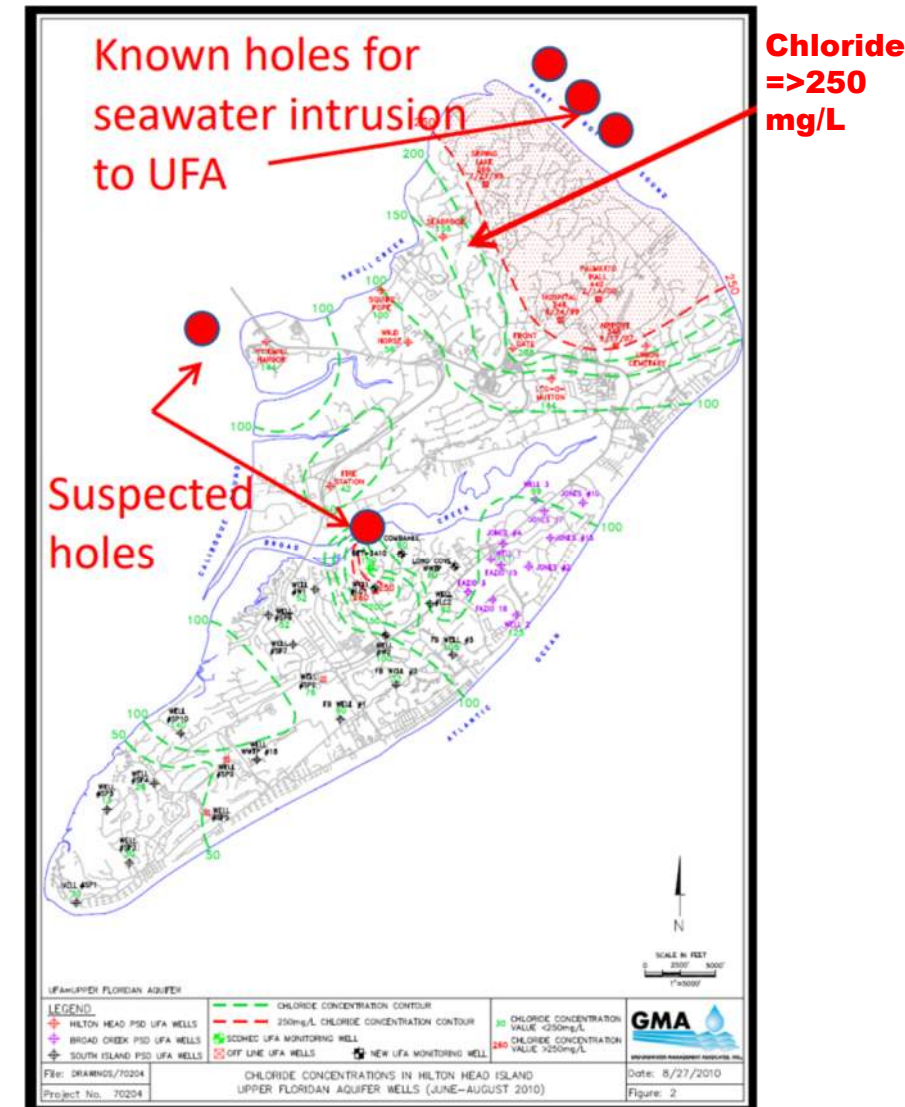


B. Present day

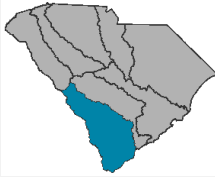


# Saltwater Intrusion at Hilton Head

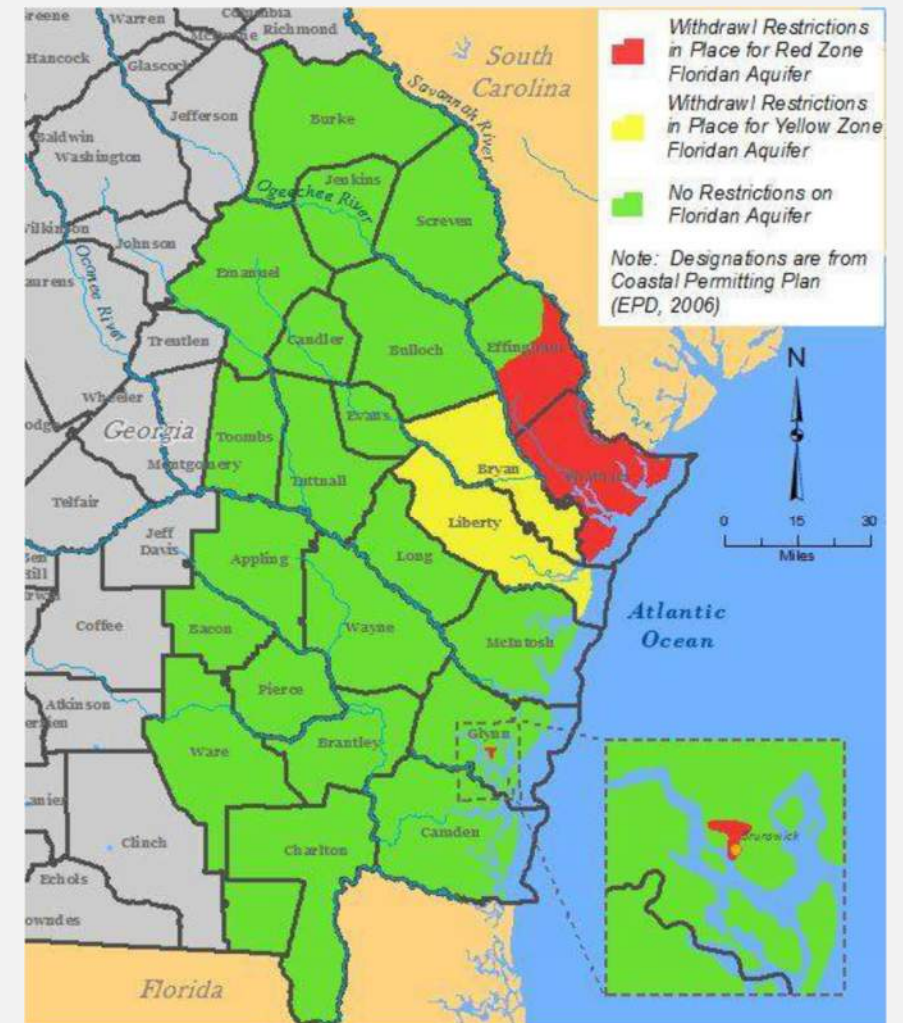
- Hilton Head Island is susceptible to saltwater intrusion due to surface and near surface geology. The thickness of the Upper Floridan confining unit is very thin or absent, leakage of saltwater has occurred in some parts of the island.
- Pumping in both Hilton Head Island and Savannah are factors involved in saltwater intrusion at HHI;
  - reduction in pumping in both pumping centers is required to stop the plume growth, however, plumes will continue to exist and move slowly with the groundwater gradient.
- Hilton Head Public Service District employs several water management strategies to support freshwater supply: these include conjunctive surface water use; aquifer storage and recovery (ASR) and reverse osmosis (RO) of the Middle Floridan Aquifer.



# Coastal Georgia Regional Water Plan



- Coastal Georgia Region includes nine counties, two of which border South Carolina (Effingham and Chatham County).
- Groundwater is mainly from the Floridan aquifer and supplies 65% of the Coastal Georgia Region
- Findings from the 2023 update determined that at a regional level, modeled aquifers have sufficient groundwater to meet forecasted needs over the planning horizon to 2060, but challenges will occur in areas where saltwater intrusion is an issue.
- Historic groundwater withdrawals in both Savannah and Hilton Head areas have contributed toward the inland movement of saltwater plumes in SC. These plumes would continue to exist well into the future even if all groundwater withdrawals were eliminated.



<https://waterplanning.georgia.gov/coastal-georgia-regional-water-plan>



# Summary

- Groundwater supplies over 50% of the Basin's water excluding energy production.
- Groundwater-level data and potentiometric maps illustrate changes in groundwater storage and hydrologic gradients over time in response to climate and water use.
- Saltwater intrusion continues to be an issue at the coast in Hilton Head; reduction in pumping in both SC and GA is required to stop the plume growth.

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