

South Carolina DNR's Groundwater Monitoring Network

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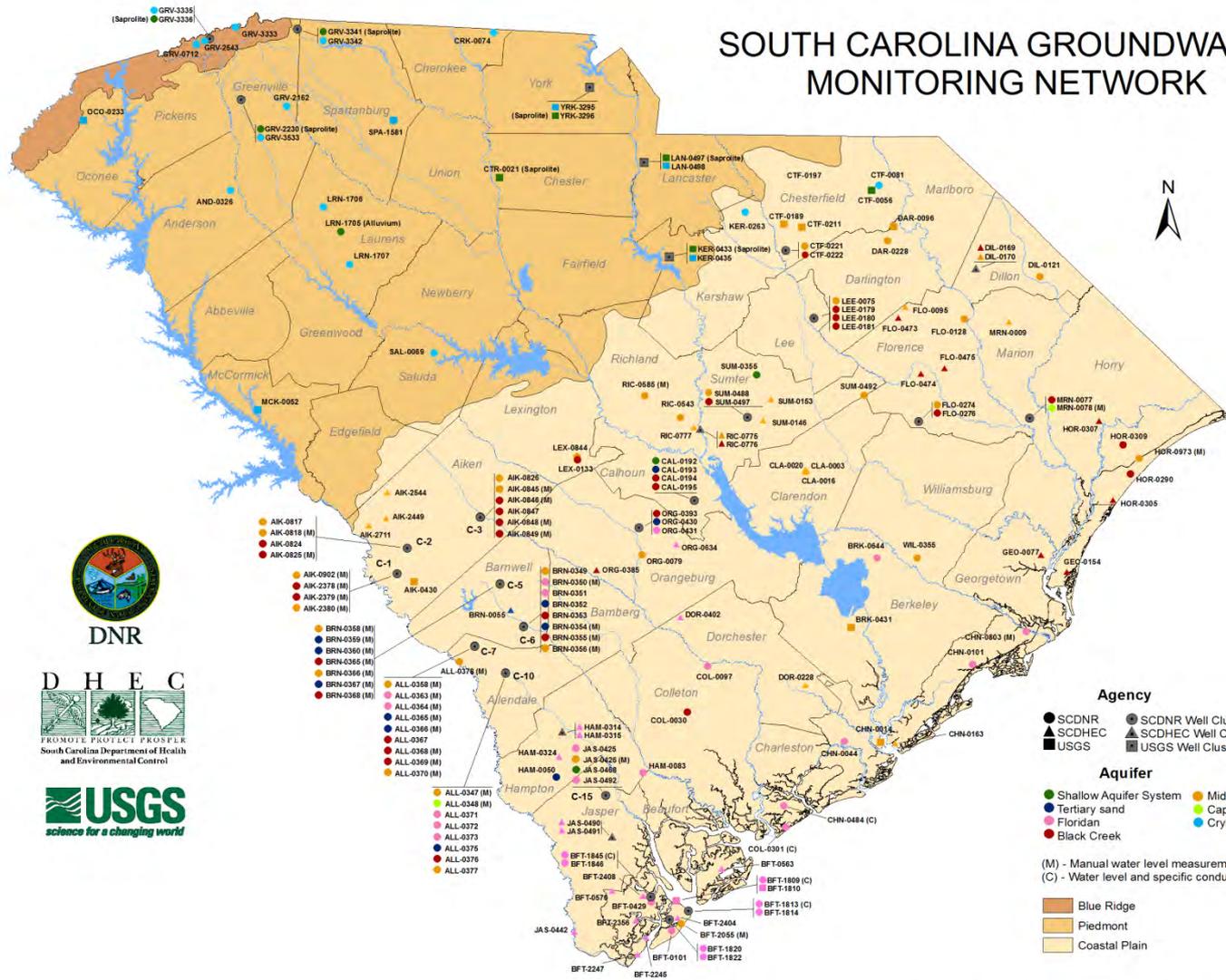
South Carolina Ground-Water Monitoring Network

- Collaborative effort between 3 agencies:
 - South Carolina Department of Natural Resources (SCDNR) - 122 wells
 - South Carolina Department of Health and Environmental Control (SCDHEC) - 41 wells
 - United States Geologic Survey (USGS) - 18 wells

“The goal of this cooperative effort is to develop and maintain a statewide ground-water monitoring network that provides scientifically defensible information for use in planning, managing, and developing South Carolina’s ground-water resources in a responsible and sustainable manner for all current and future users.”



SOUTH CAROLINA GROUNDWATER MONITORING NETWORK



DNR



- Agency**
- SCDNR
 - ▲ SCDHEC
 - USGS
 - SCDNR Well Cluster
 - ▲ SCDHEC Well Cluster
 - USGS Well Cluster
- Aquifer**
- Shallow Aquifer System
 - Tertiary sand
 - Cape Fear
 - Floridan
 - Black Creek
 - Middendorf
 - Crystalline rock
- (M) - Manual water level measurement
(C) - Water level and specific conductance measurement
- Blue Ridge
Piedmont
Coastal Plain

Map prepared by the Land, Water & Conservation Division of the South Carolina Department of Natural Resources-February, 2014.

Purpose of the Monitoring Network

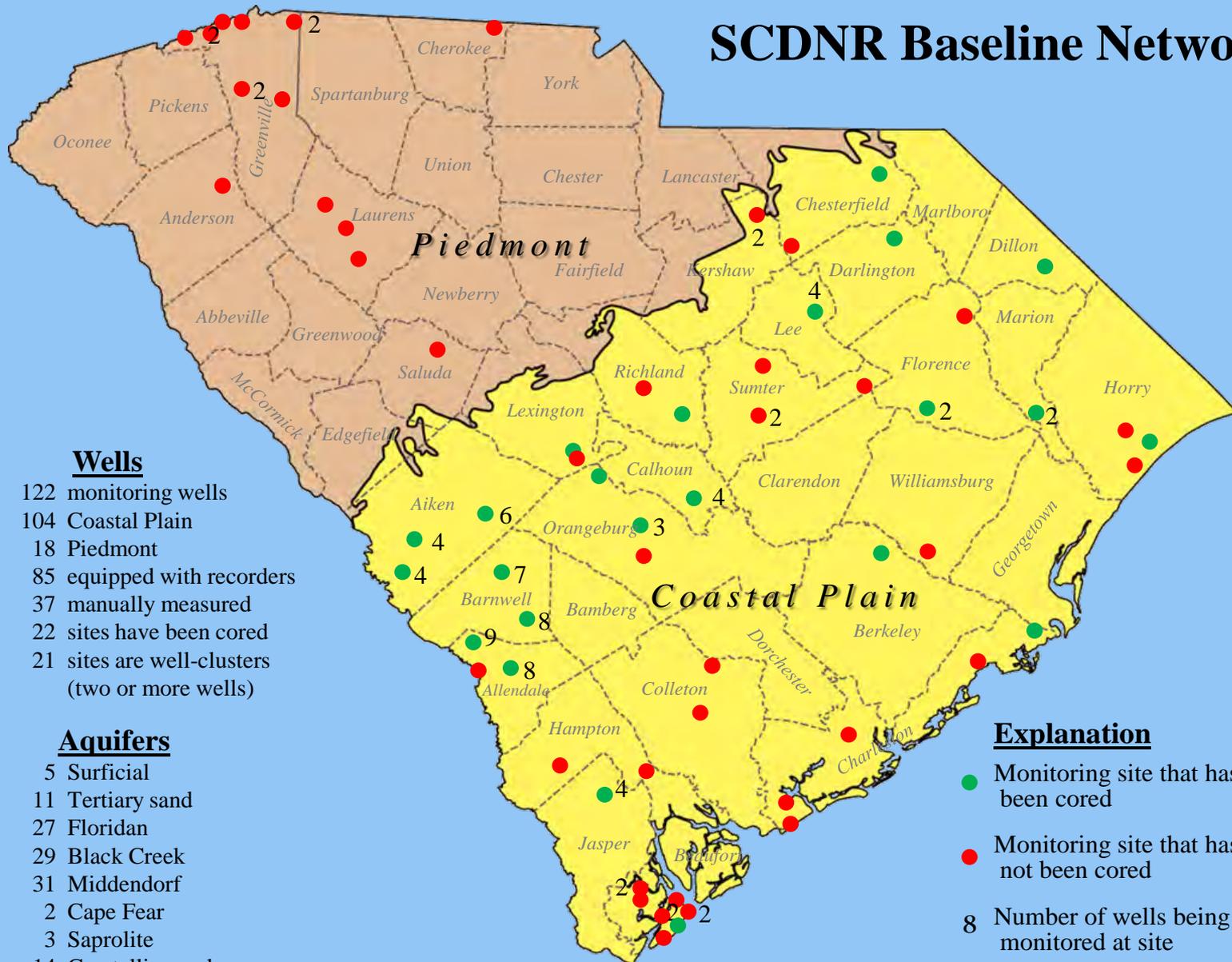
- Establish a long-term groundwater dataset to support:
 - Groundwater management and permitting
 - Drought assessments
 - Identification of long-term trends
 - Groundwater flow modeling
 - Water-level (potentiometric) mapping
 - Evaluation of groundwater availability

SCDNR Baseline Groundwater Monitoring Network

- 122 wells – most owned by SCDNR.
- 86 wells – Equipped with automatic data recorders (ADRs) which record hourly water levels.
- 36 wells – Periodic measurements made every 2-3 months.
- Periods of Record:
 - range from several months to over 50 years.
 - 10-15 years is typical.



SCDNR Baseline Network



Wells

- 122 monitoring wells
- 104 Coastal Plain
- 18 Piedmont
- 85 equipped with recorders
- 37 manually measured
- 22 sites have been cored
- 21 sites are well-clusters (two or more wells)

Aquifers

- 5 Surficial
- 11 Tertiary sand
- 27 Floridan
- 29 Black Creek
- 31 Middendorf
- 2 Cape Fear
- 3 Saprolite
- 14 Crystalline rock

Explanation

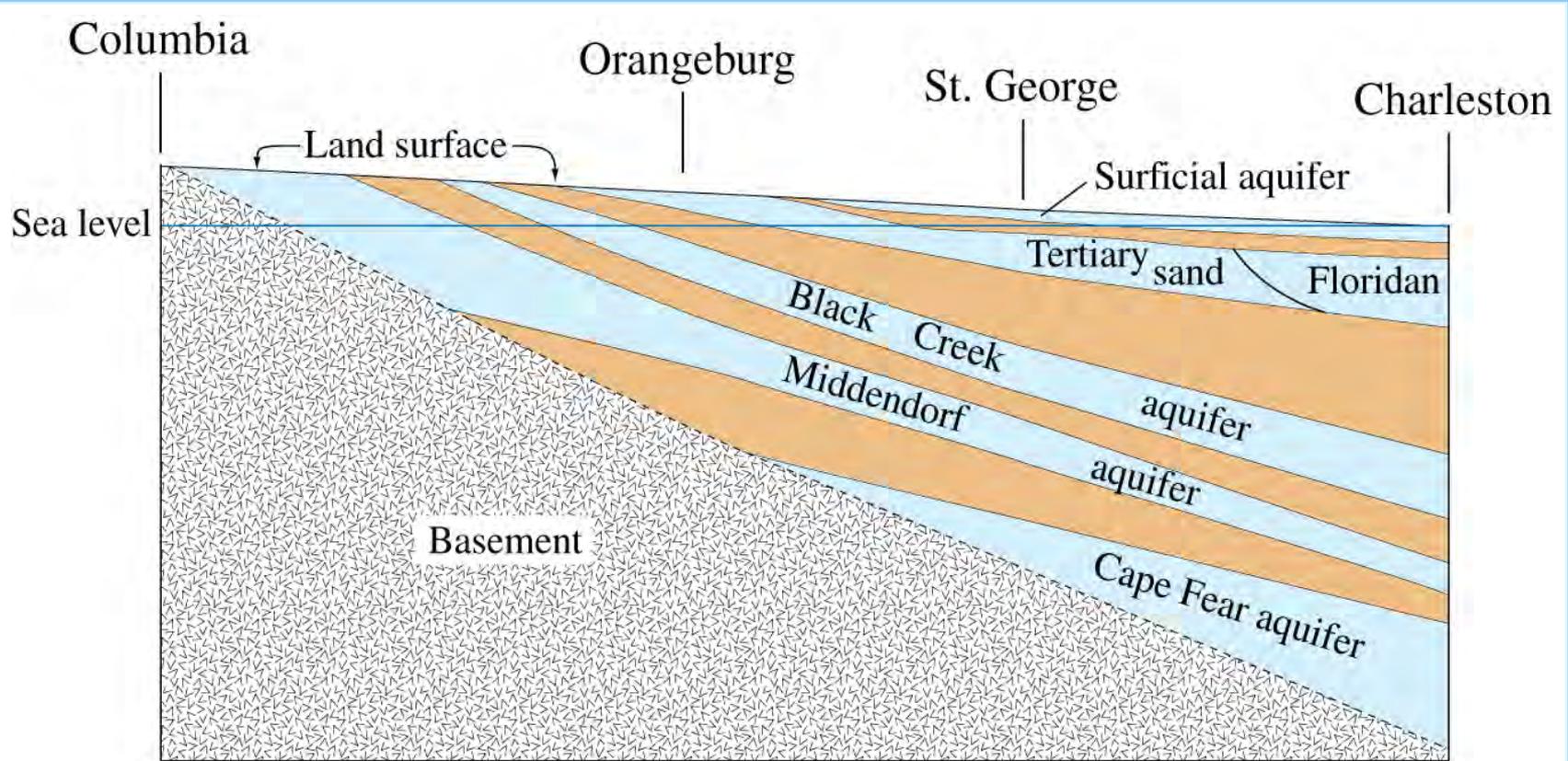
- Monitoring site that has been cored
- Monitoring site that has not been cored
- 8 Number of wells being monitored at site

Methods

- Field visits are taken every 2-3 months:
 - Manual measurements are recorded.
 - ADRs (predominantly of the pressure transducer variety) are downloaded.
 - ADRs are calibrated, fixed or replaced as needed.
- Manual and downloaded hourly data are checked for quality assurance and quality control and entered into SCDNR database.
- Daily average water levels are computed from hourly data and converted to depths below land surface.



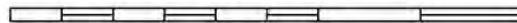
Principal Coastal Plain Aquifers



Vertical axis not to scale

 Aquifer  Confining unit  Crystalline rock

0 10 20 30 40 50 miles

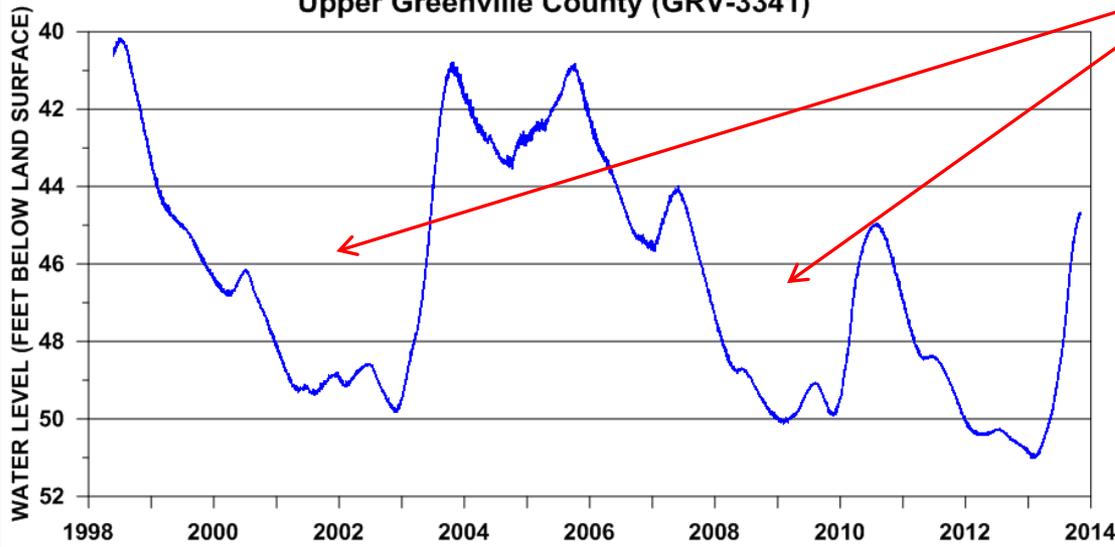


Interpreting Groundwater Behavior Can Be Challenging:

- Some sites have inadequate periods of record from which to evaluate long-term trends.
- Can be difficult to distinguish between the impacts of drought and impacts of pumping.
- Limited spatial distribution of wells.
- Incomplete groundwater use data (historically and currently).
- Incomplete data on where wells are screened.

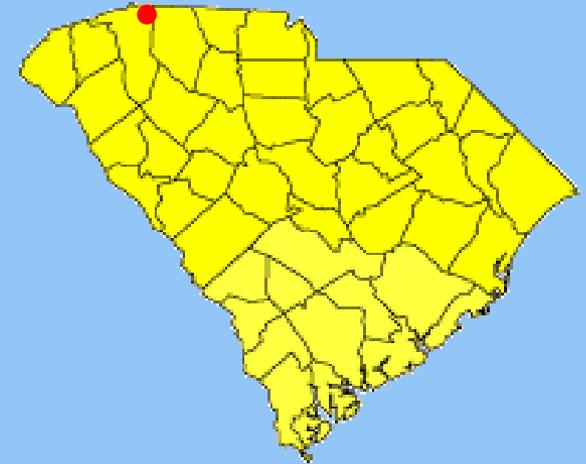
Crystalline Rock/Saprolite Aquifer System

Daily Average Water Levels
Upper Greenville County (GRV-3341)

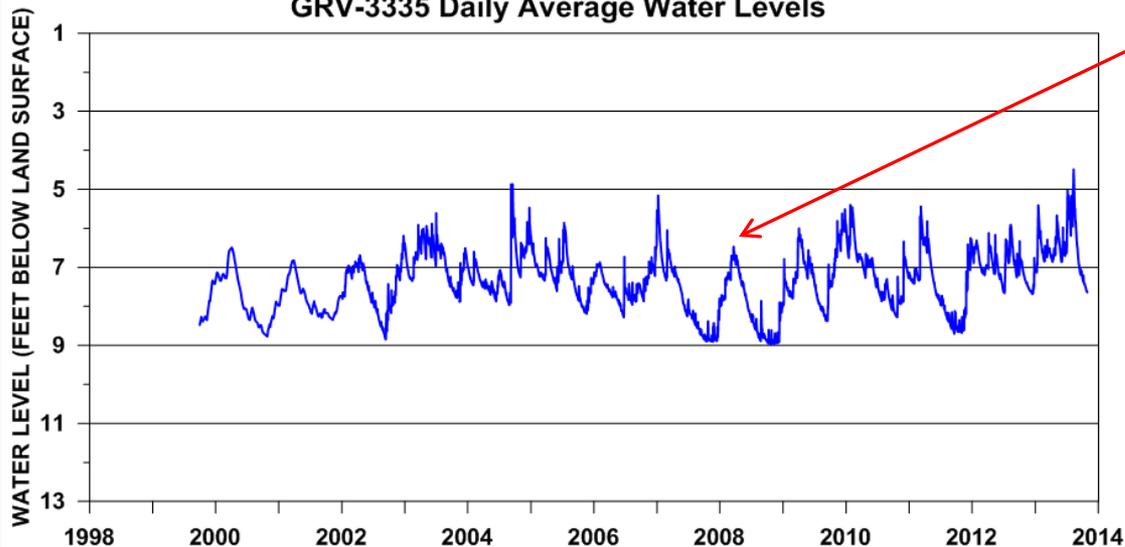


Aquifer: saprolite Depth: 80 ft.
Elevation: 1030 ft. Screen: 70-80 ft.

- Strong drought signature
- Typically recovers from drought

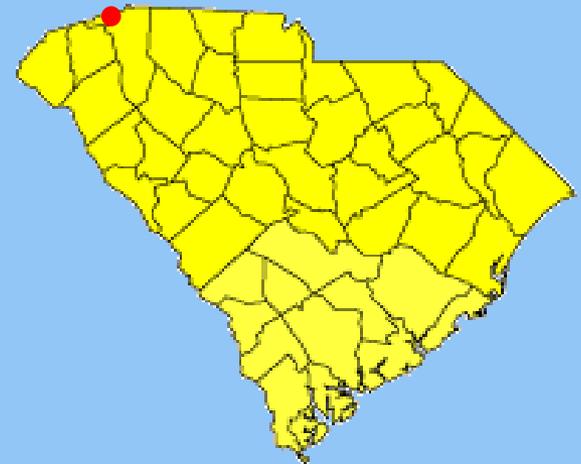


GRV-3335 Daily Average Water Levels

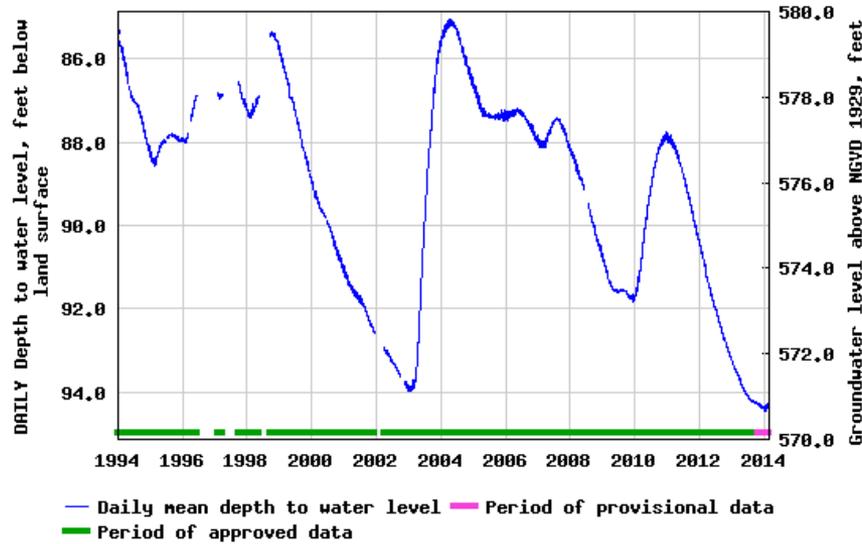


Aquifer: Crystalline Rock Depth: 110 ft.
Elevation: 1352 ft. Screen: Open Hole

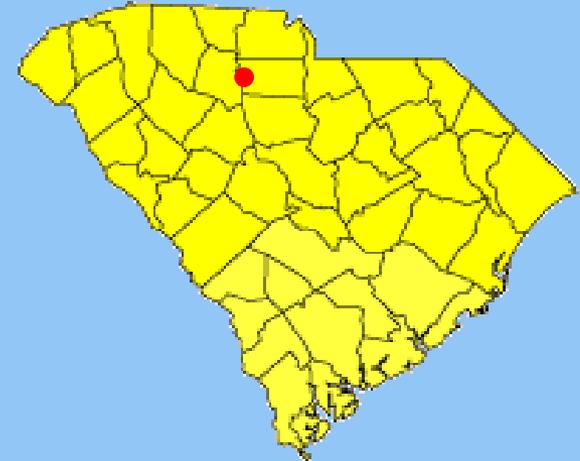
- Weak drought signature



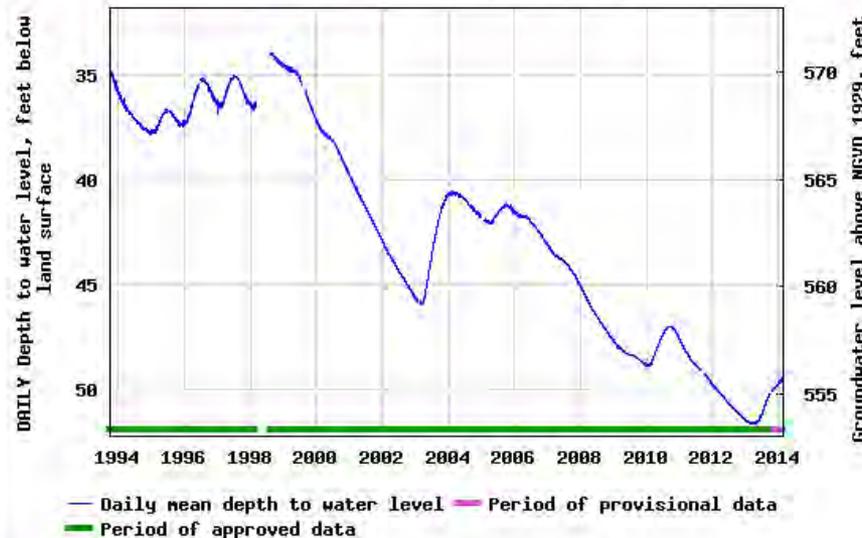
USGS 344000081250011 CTR- 21



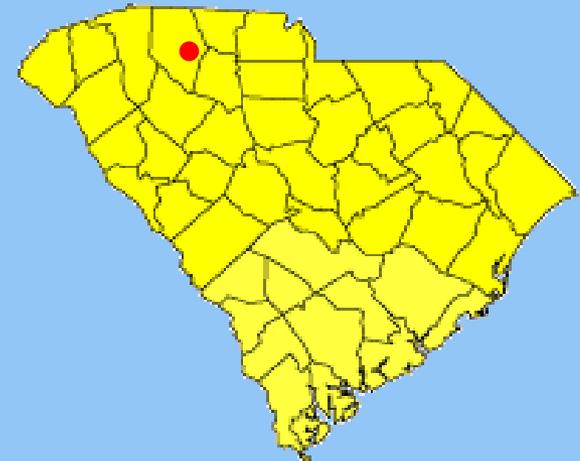
- Strong recovery after 1998-2002 and 2007-2008 droughts, but no recovery after 2012 drought



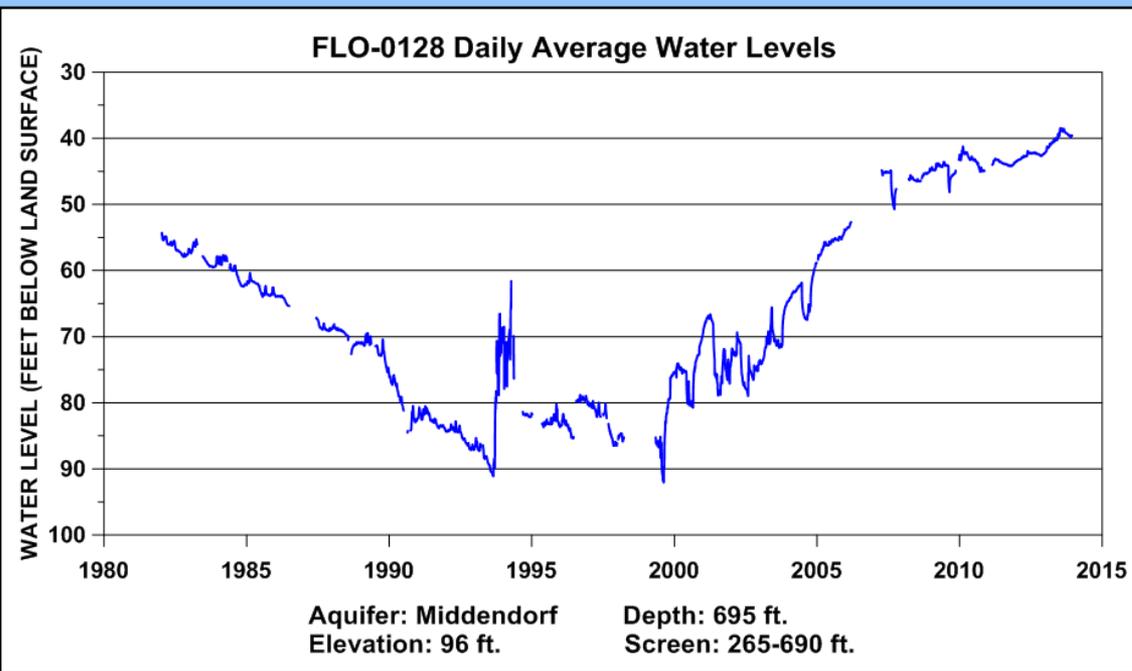
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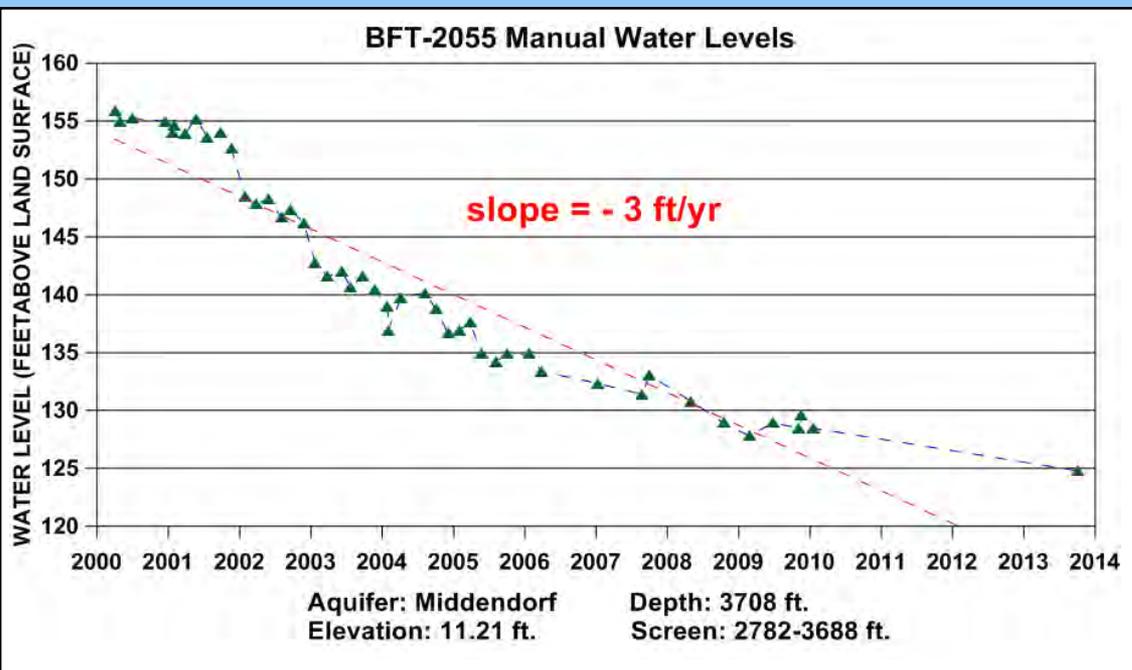
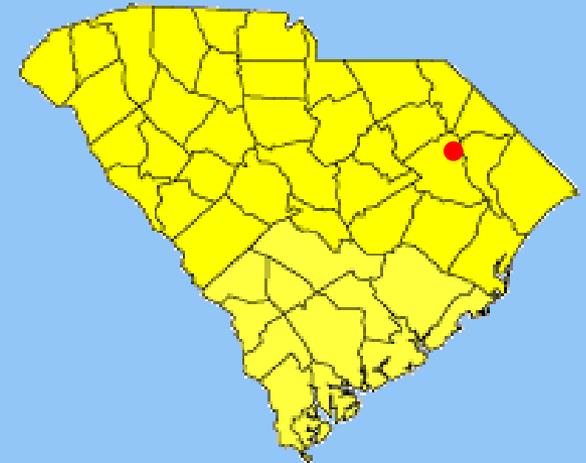
- Weak recovery after 1998-2002 and 2007-2008 droughts and overall downward trend



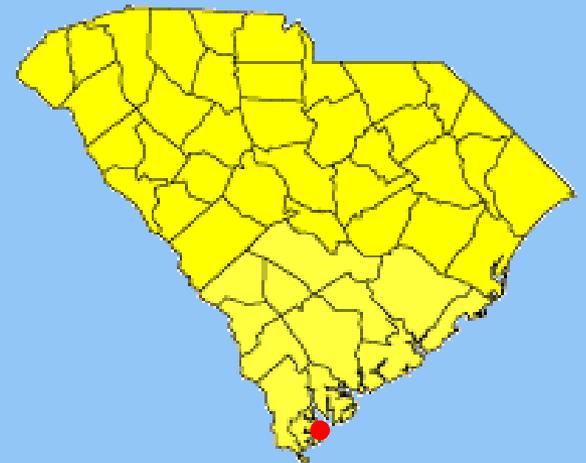
Middendorf Aquifer



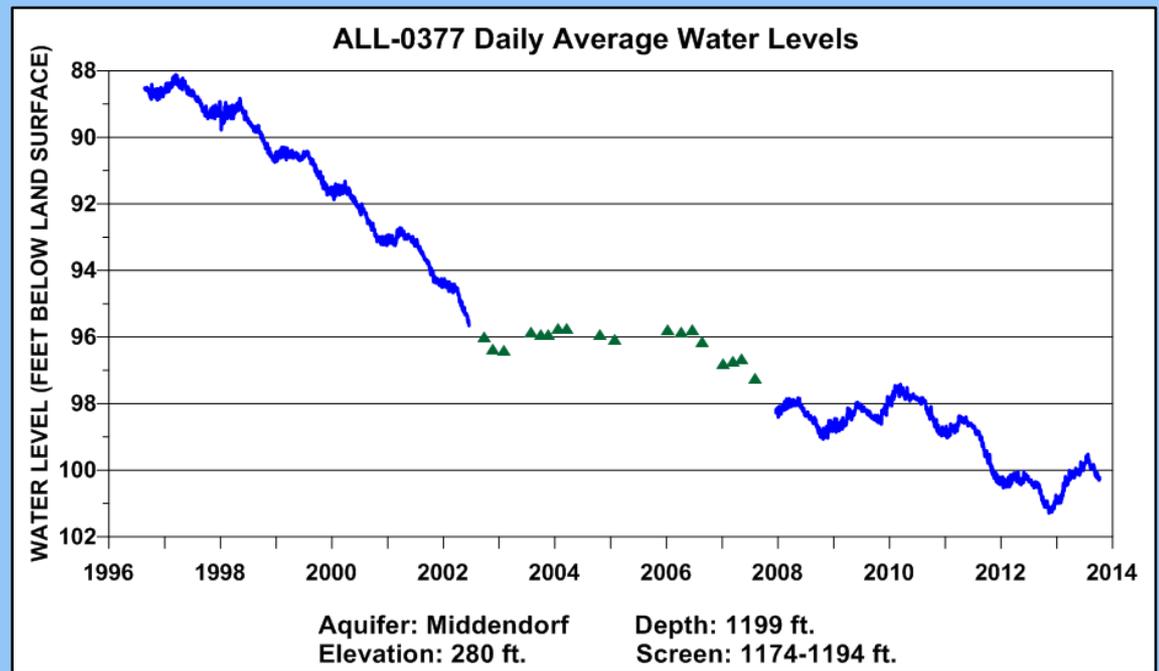
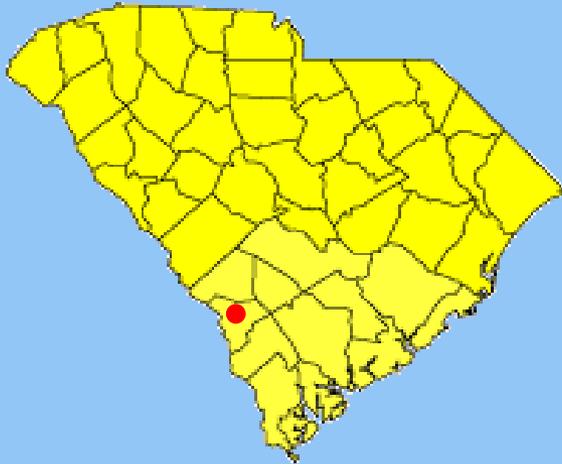
- Significant recovery after City of Florence supplemented ground-water supply with Pee Dee River



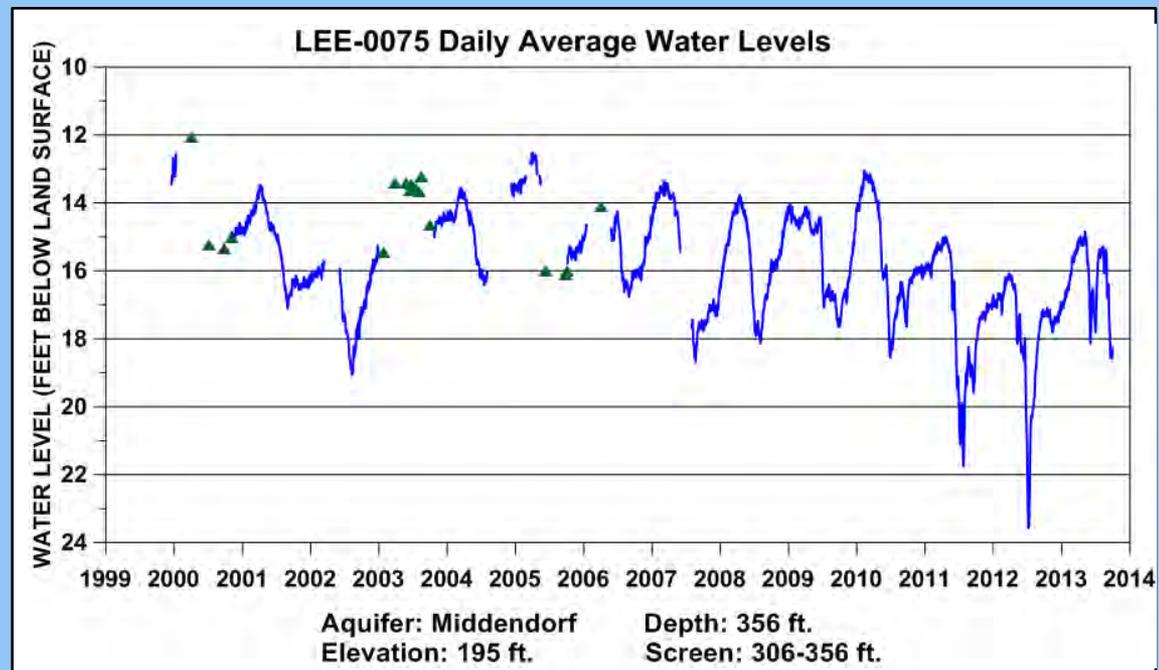
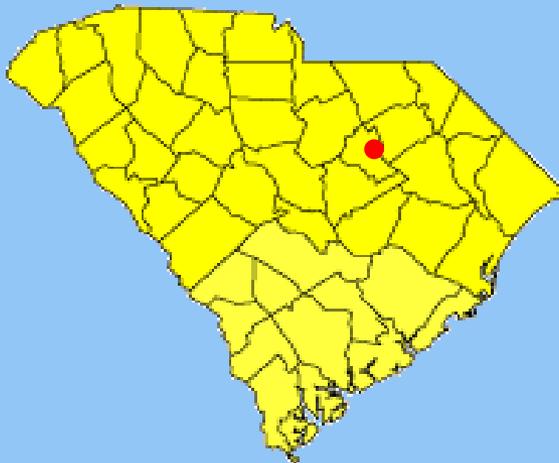
- Decline likely due to pumping on Hilton Head



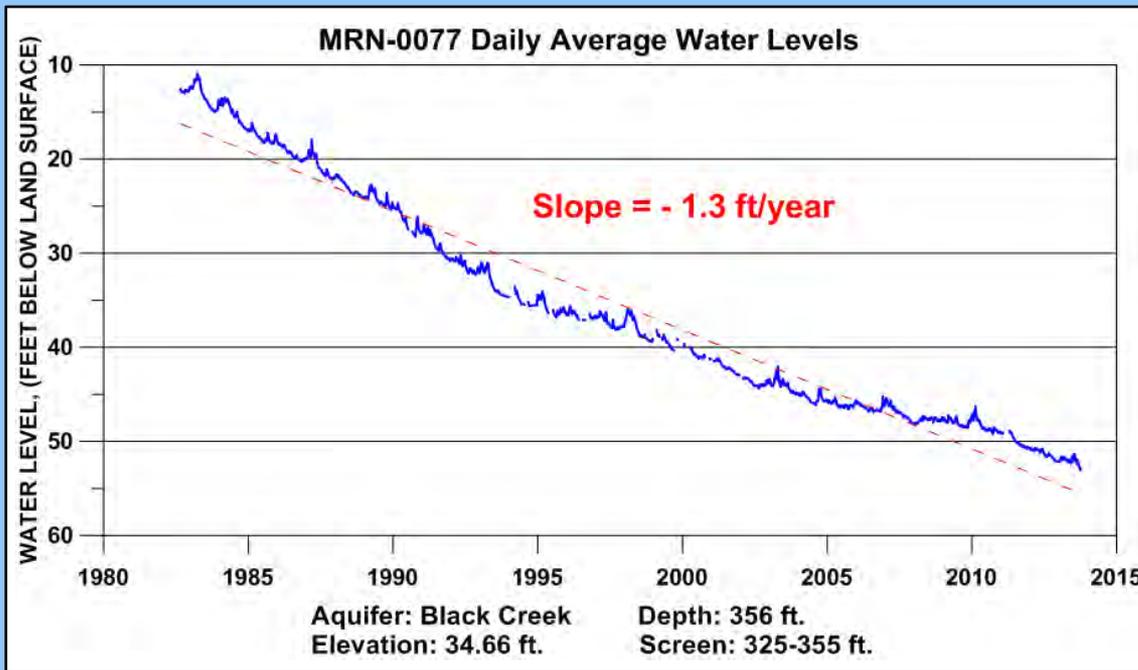
- Little to no recovery after 1998-2002 drought
- Overall downward trends



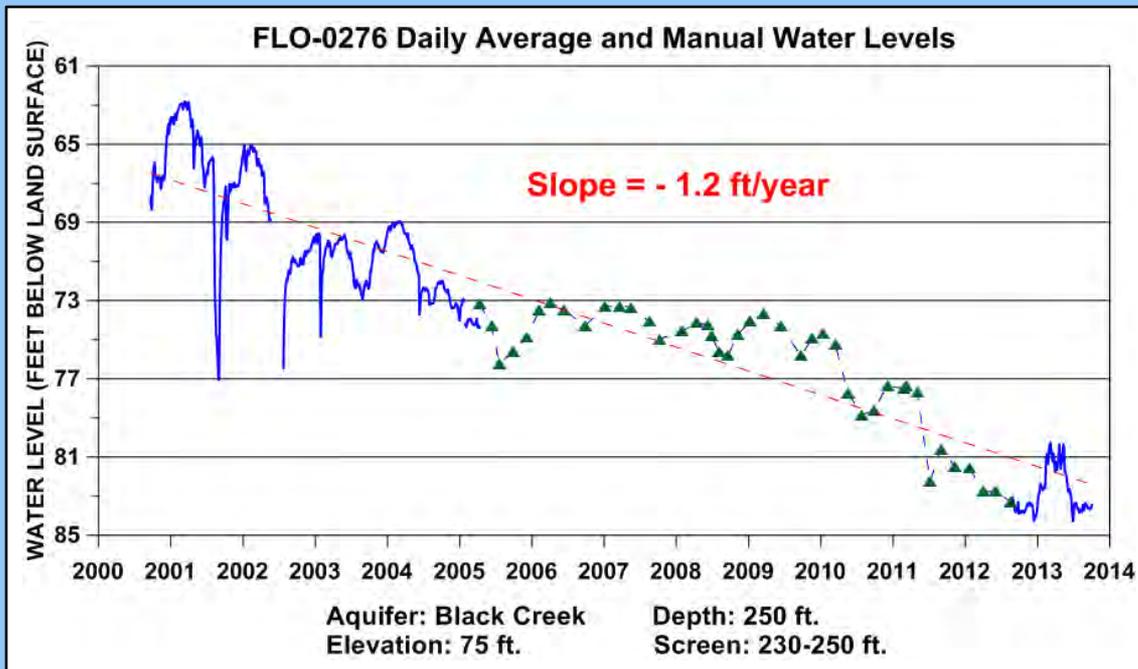
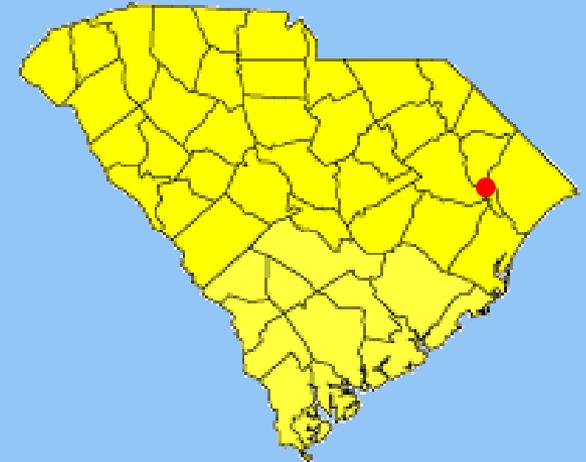
- Smaller downward trends,
- Stronger recovery from drought
- Evidence for recent increased pumping



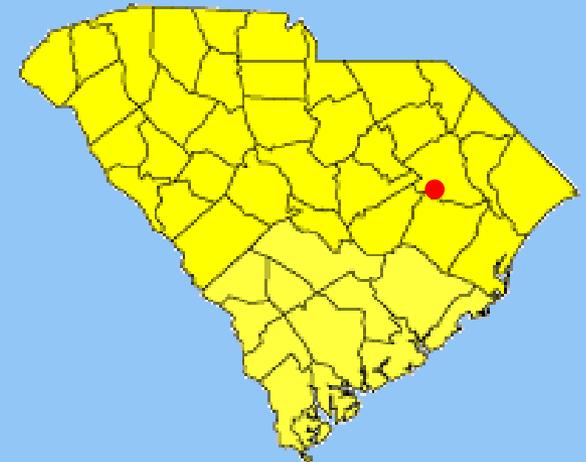
Black Creek Aquifer

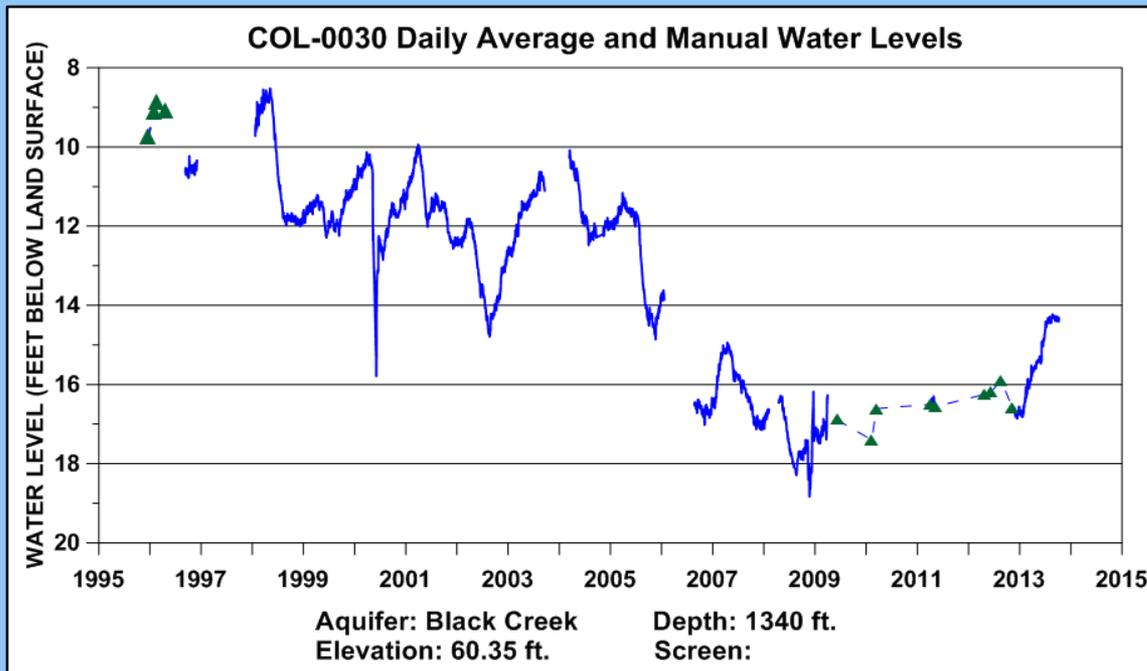


- **Industrial and Municipal Pumping in southeastern Florence County**

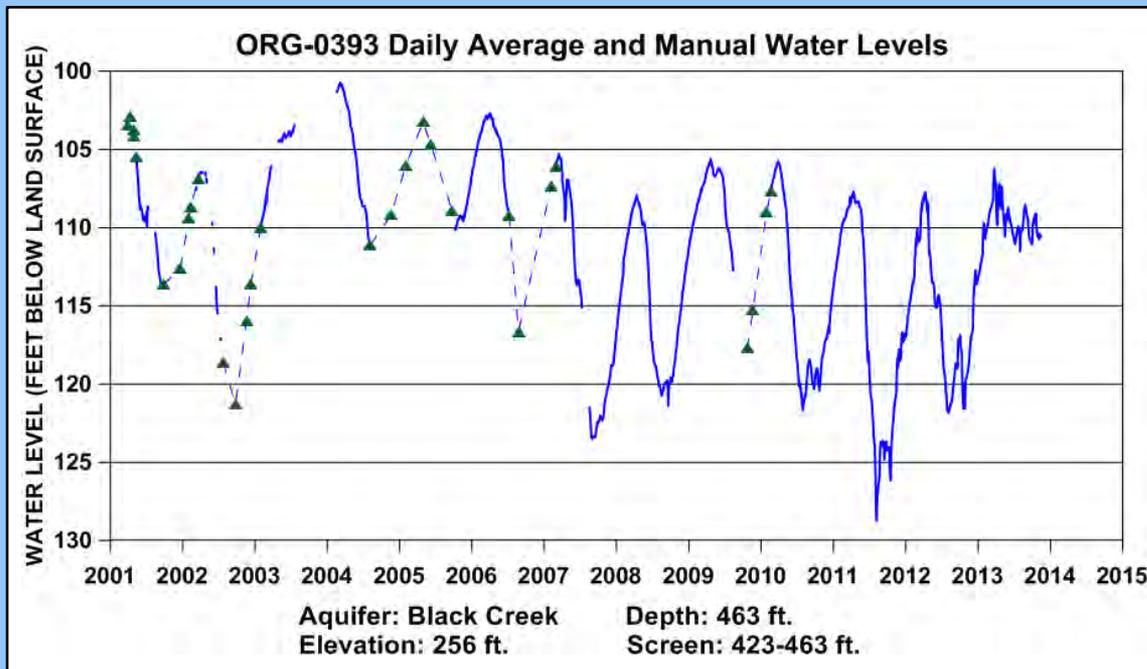
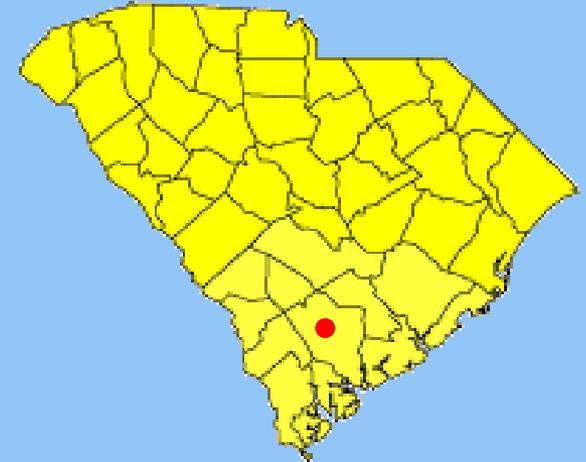


- **Steady decline over past 10 years likely due to municipal pumping**

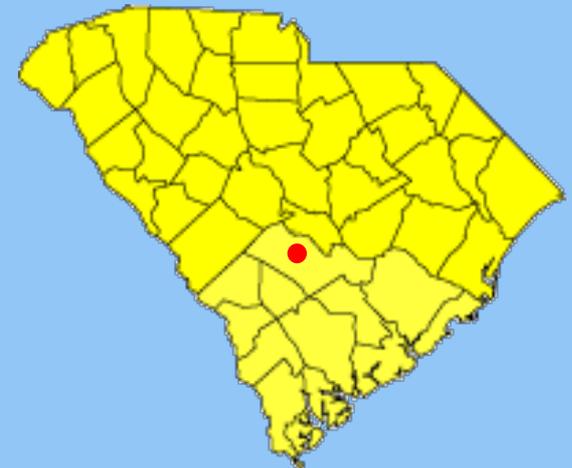




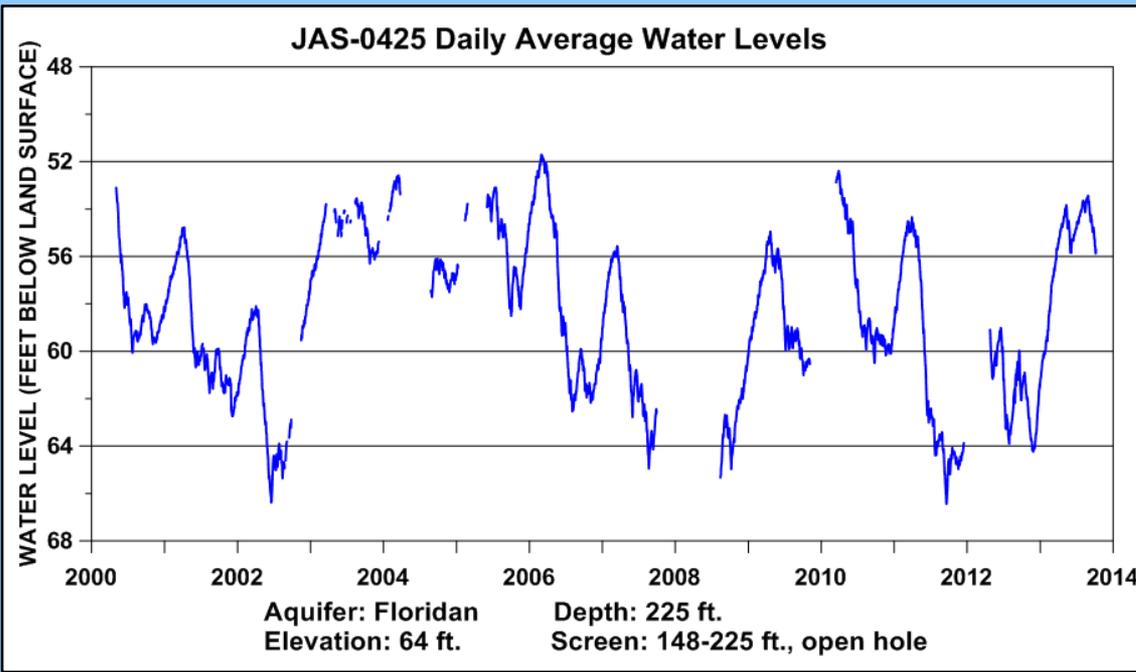
- Decline, in part, due to 2007-2008 drought
- Significant recharge related to 2013 summer rainfall



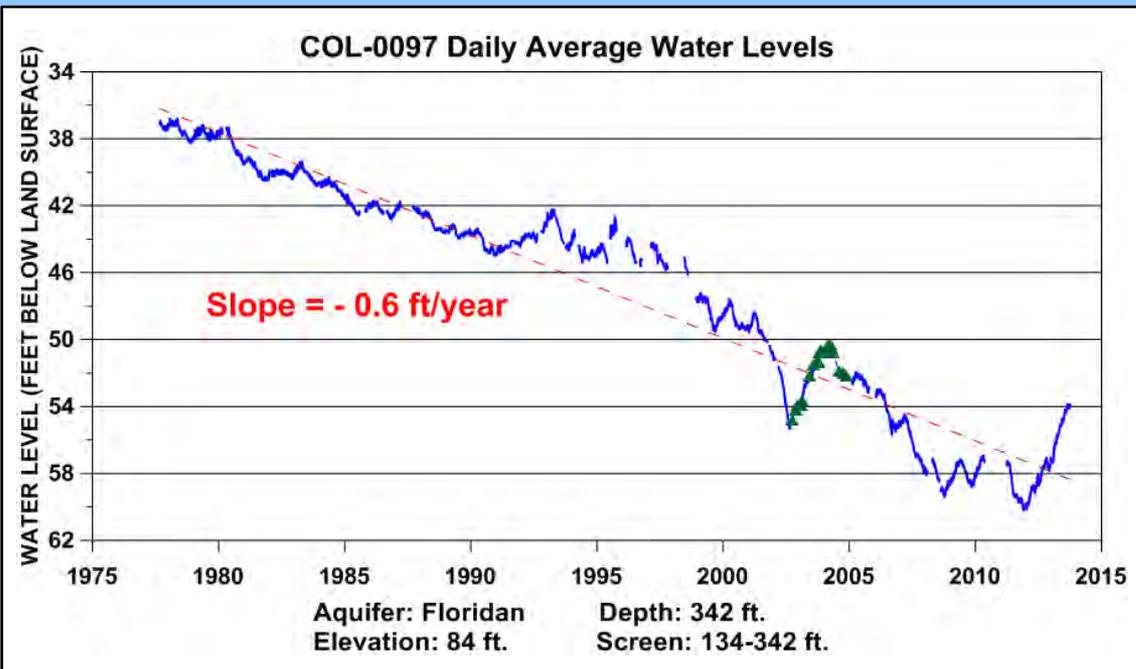
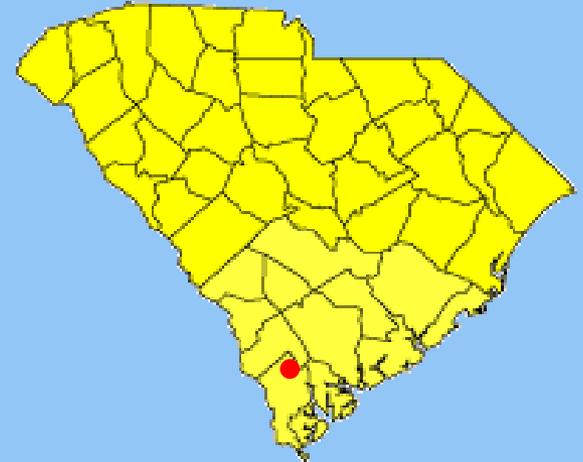
- Strong seasonal signature - likely due to irrigation
- Little to no 2013 seasonal decline



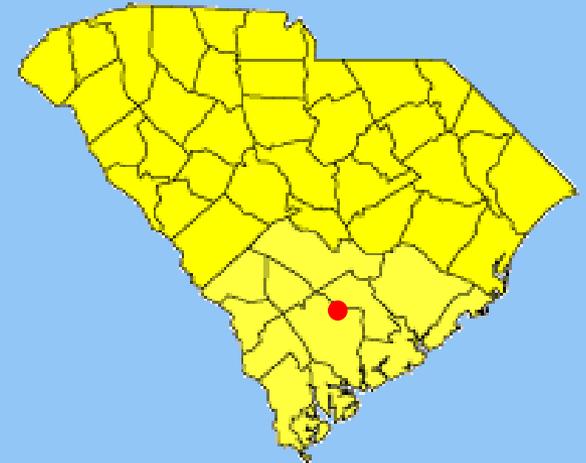
Floridan Aquifer

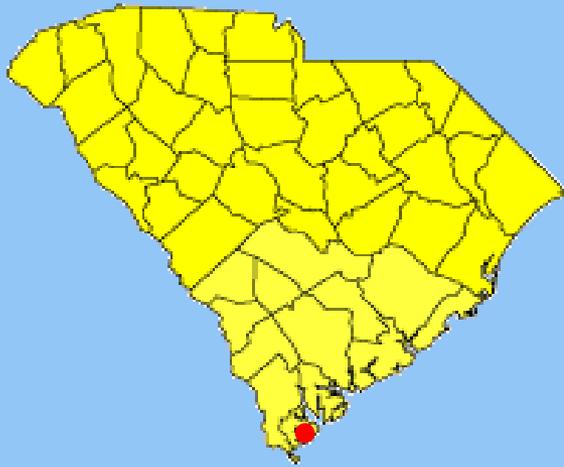


- Recovered well from past droughts
- No long-term decline

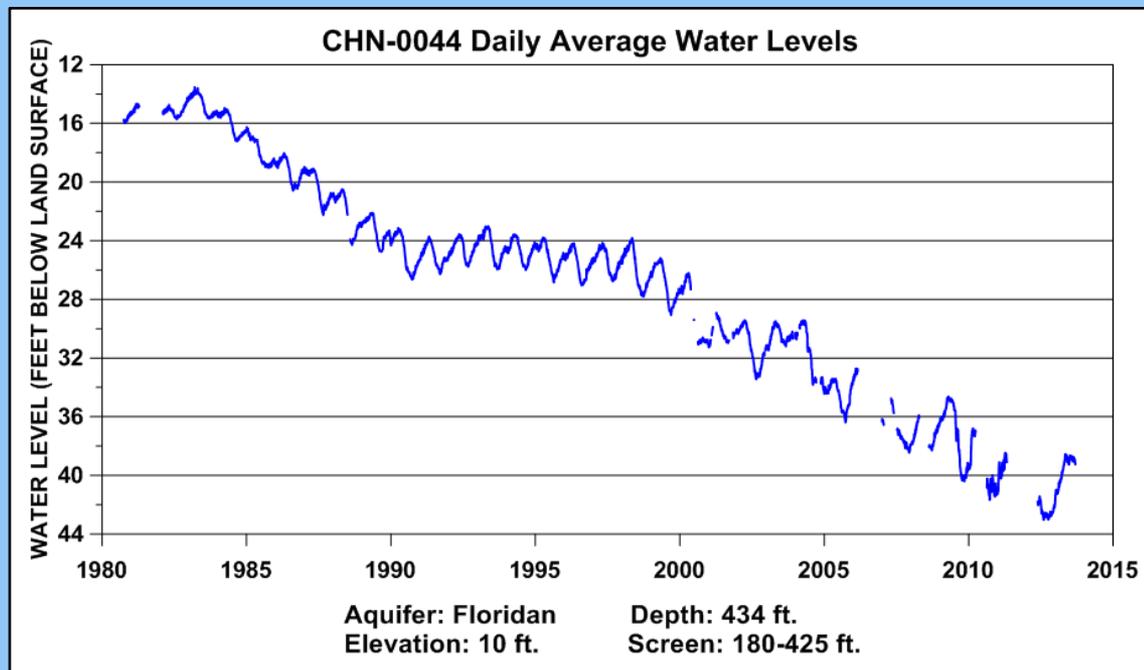
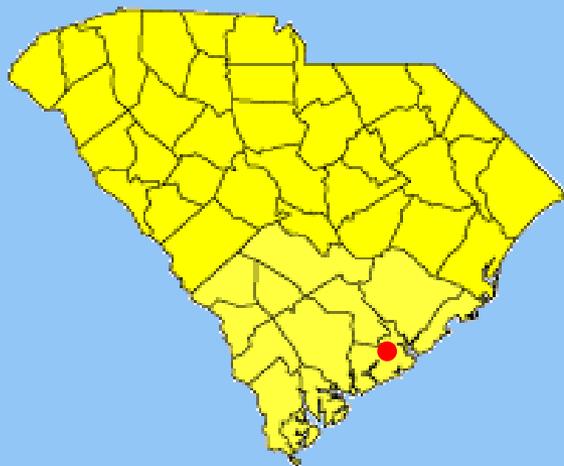
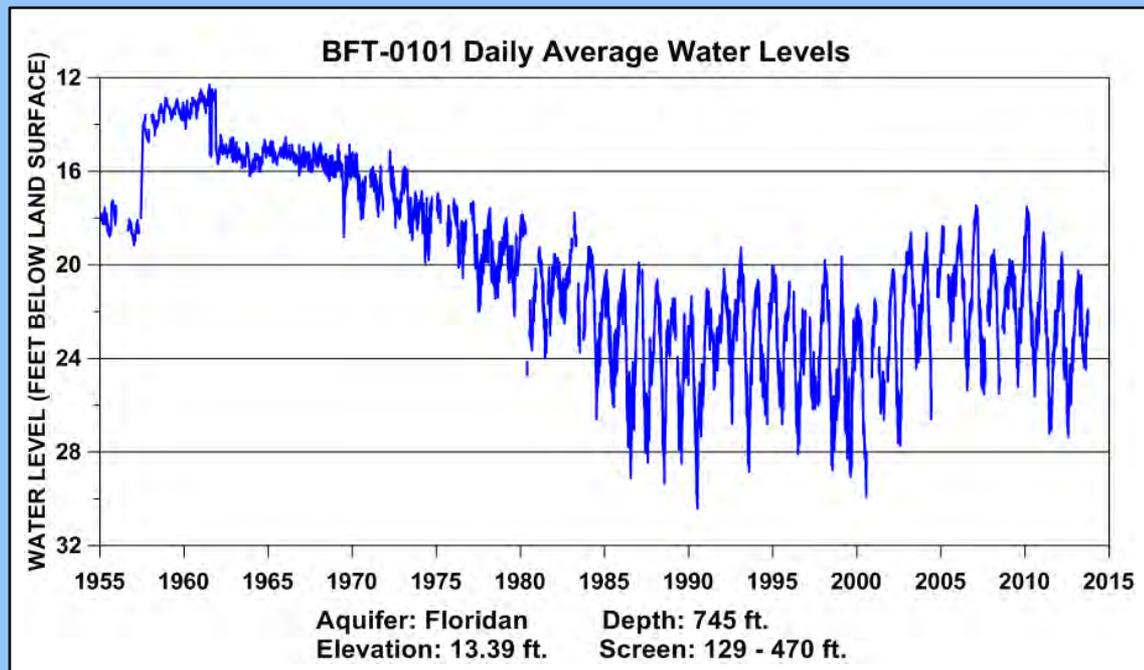


- Long-term downward trend
- Noticeable 2013 summer recharge





Water levels have leveled off after declines during the 1960s, 1970s and 1980s, but have greater seasonal variations



Summary

- Many of our well sites are experiencing downward trends.
 - Declines are generally more severe along the Coastal counties.
 - Largest declines associated with known pumping centers
 - Substantial number of sites had little to no recovery after 1998-2002 drought.
 - Water level behavior likely a function of increased drought frequency and local/regional pumping.
 - Noticeable recharge from 2013 rainfall in the Floridan and Black Creek aquifers in some areas
- Long-term upward trends associated with areas where water users have supplemented water supply with surface water or transitioned from ground water to surface water.

Future Work/Considerations

- Need a detailed study of water withdrawals from each aquifer to better understand ground water trends:
 - *How much of a decline is due to the severe droughts over the last 15 years and how much is due to pumping?*
- Need a better understanding on the significance of water level declines:
 - *When is a decline severe enough to cause concern?*
- Need to *strategically* expand our baseline monitoring network

Recent Drilling Activities



Lee State Park in Lee County – 3 wells

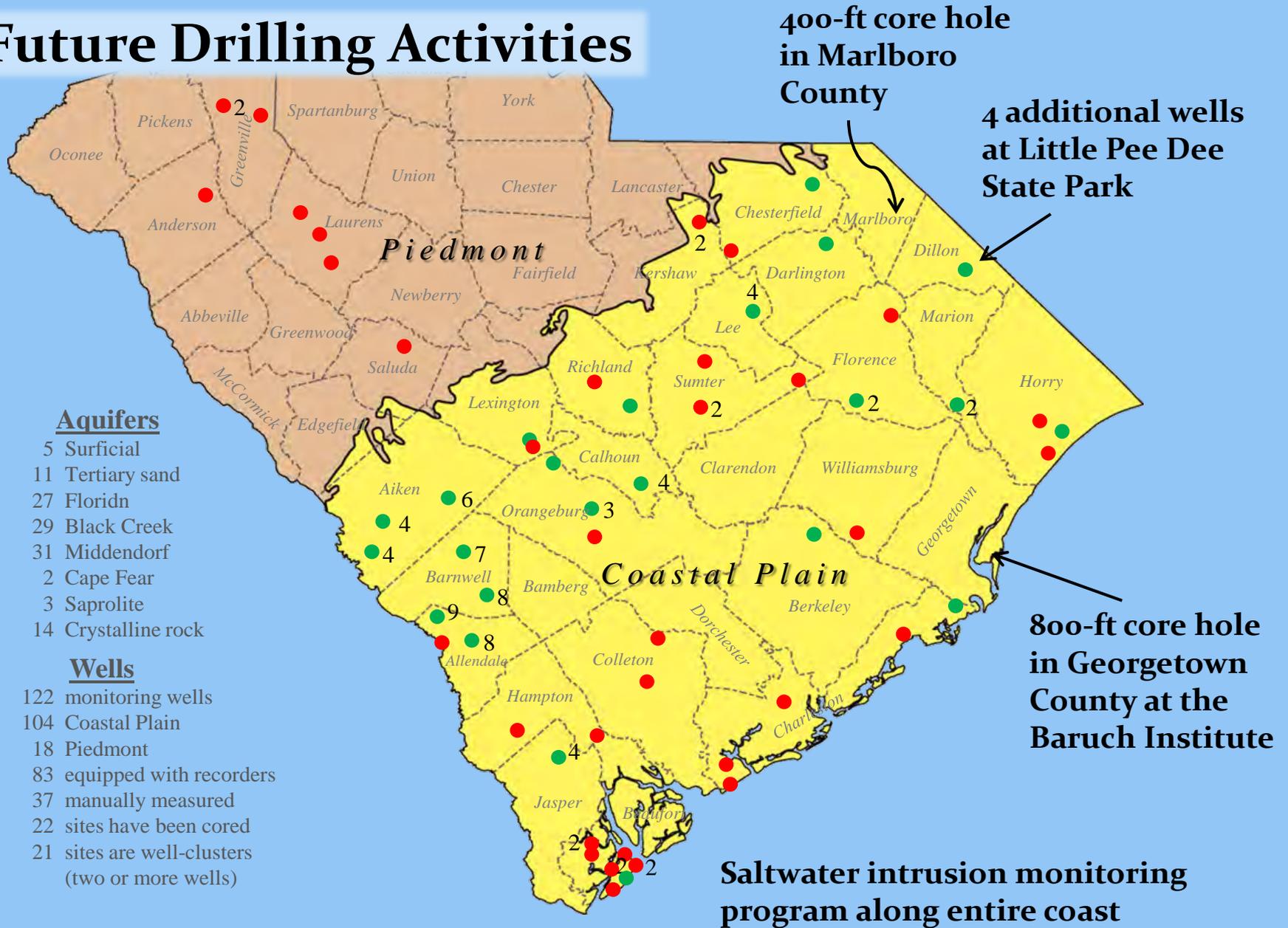
Wee Tee State Forest in Williamsburg County – 1 well

Creston Fire Station in Calhoun County – 4 wells

Continuous core to 1,057 feet at Creston, Calhoun County



Future Drilling Activities



Aquifers

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- 11 Tertiary sand
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- Hydrographs and other information about the network can be found in:
 - *Ground-Water Levels in South Carolina, 2006-2010*
South Carolina Department of Natural Resources
Water Resources Report 50
- Report is available at:
<http://dnr.sc.gov/water/hydro/PubsDNRrep.htm>
- Data are available at:
<http://dnr.sc.gov/water/hydro/groundwater/groundwater.html>
- Contact Information
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 - harders@dnr.sc.gov

End of
presentation.