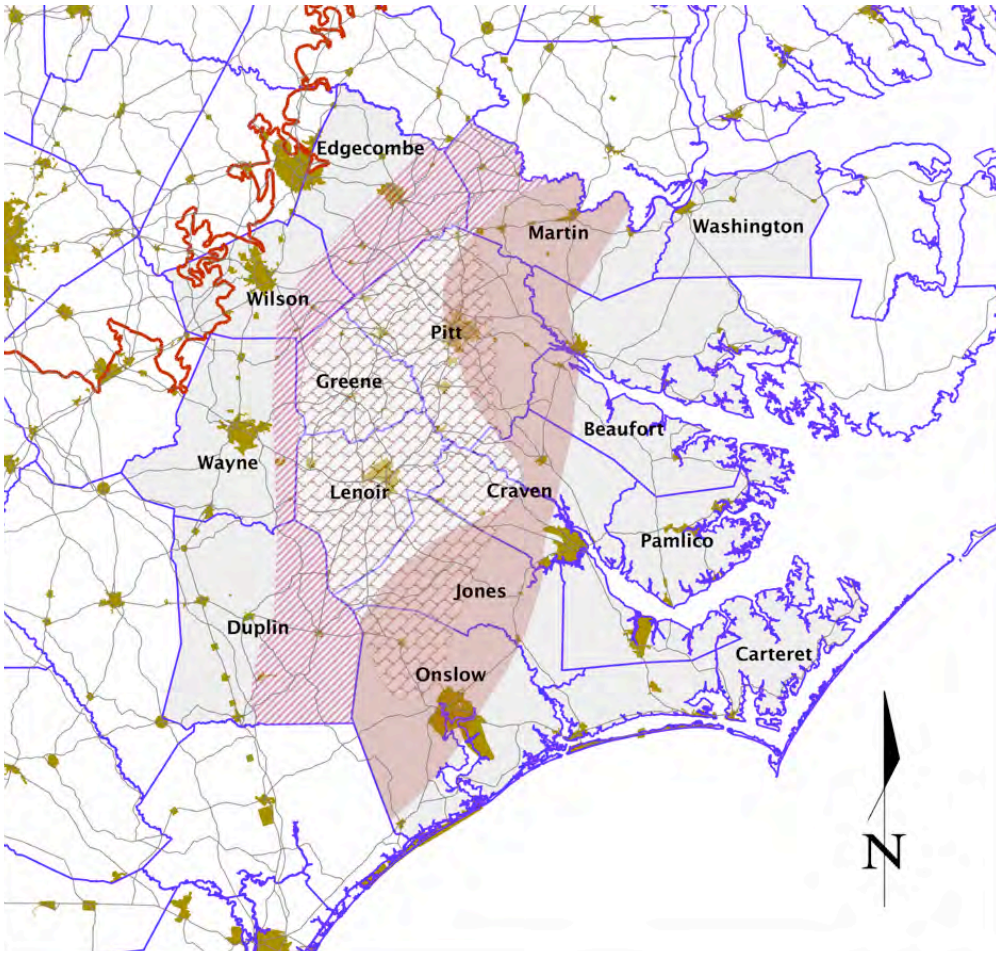


DRAFT
Central Coastal Plain Capacity Use Area
Assessment Report



February 2013
Ground Water Management Branch
Division of Water Resources
North Carolina Department of Environment and Natural Resources

Introduction

15A NCAC 2E .0503 (7) of the Central Coastal Plain Capacity Use Area (CCPCUA) rules requires that the Division of Water Resources (DWR) produce an analysis of central coastal plain aquifer conditions as set forth below:

"The CCPCUA Cretaceous Aquifer Zones map shall be updated, if necessary, in the sixth, eleventh, and sixteenth years following the effective date of this Rule to account for aquifer water level responses to phased withdrawal reductions. The map update shall be based on the following conditions:

- (a) Rate of decline in water levels in the aquifers;
- (b) Rate of increase in water levels in the aquifers;
- (c) Stabilization of water levels in the aquifers;
- (d) Chloride concentrations in the aquifers.

This aquifer information shall be analyzed on a regional scale and used to develop updated assessments of aquifer conditions in the CCPCUA. The Environmental Management Commission (EMC) may adjust the aquifer zones and the water use reduction percentages for each zone based on the assessment of conditions. The EMC shall adopt the updated map and reduction percentage changes after public hearing."

The CCPCUA rules require assessments to be produced in 2008, 2013, and 2018 which correspond with the beginning of each of three phases of water withdrawal reduction (see attached rule at end of report). However, the Division of Water Resources staff feel obligated to constantly track aquifer conditions so as to best serve the permit holders in the region and be aware of potential ground water supply issues.

In this 2013 report we have concluded after a thorough review of aquifer conditions that no action need be taken by the Environmental Management Commission to alter either the reduction zone boundaries or rule language in 15A NCAC 2E .0503. However, we do recommend that the EMC endorse the division's new method of permit review which will use a series of criteria to judge each production well and aquifer conditions by individual permit. This enhanced permit application review will allow the division to alter an individual permit holder's reduction requirements.

Ground Water Level & Chloride Concentration Analysis

DWR has invested over two million dollars and many staff hours since 1998 to improve the monitoring well network throughout the state, especially in the central coastal plain area. That investment has enhanced our understanding of the regional aquifer system

that underlies our coastal plain. It also has provided valuable information about how the aquifers are responding to the changing patterns of water withdrawals. Monitoring stations allow us to determine both the extent of the over-drafting situation and the recovery of water levels as investments in alternative water supplies come to fruition.

To those ends, 177 wells have been constructed at 53 monitoring stations since 1998. In combination with existing wells they are positioned to provide a more detailed picture of the cone of depression beneath the coastal plain in each of the major aquifers. Automatic recording equipment is used on over 74% of the network. Chloride concentrations are now measured on a subset of network wells every two or three years to assess that adjusting set of conditions.

DWR provides access to water level and chloride data it collects through its website (www.ncwater.org) at the link entitled "Ground Water Data."

Reporting is required as part of every CCPCUA permit. Daily water withdrawals and monthly static and pumping water levels from every source well or sump are reported to DWR. This information is digitized and made available to the public. DWR also requires chloride concentrations to be submitted annually by select permit holders based on their location. Public access to all this data is available from the main DWR website following the link entitled "Central Coastal Plain Capacity Use Area."

DWR is firmly committed to providing easy access to all the data we collect either through our monitoring well network or permitting system.

Figures 2 & 3 illustrate the distribution of water levels in the two primary Cretaceous aquifers, the Black Creek and Upper Cape Fear. Each map displays ground water levels as color-filled contours referenced to mean sea level. Each map also has county boundaries, the fall line (the line that delineates the coastal plain from the piedmont), the transitional zone between fresh and salt water in the aquifer, points where water level and chloride data were collected (red-filled points indicate chloride concentrations equal to or exceeding 250 mg/l or ppm), and the three Cretaceous aquifer zones as described in 15A NCAC 2E .0503 and portrayed in the CCPCUA Cretaceous Aquifer Zones map (see figure 1).

Figures 4 & 5 include the previously described information and static water level and chloride concentration data from permit holders.

Admittedly, the maps are complex. However, they demonstrate the relationship between the state of our knowledge at the time of rule-making for the CCPCUA (represented by the Cretaceous aquifer zone boundaries) and current conditions. There are many areas showing improved conditions in the CCPCUA. As those aquifer conditions relate to the Cretaceous Zones, the potential for salt water encroachment still

exists. Dewatering, although less likely, is still possible in many areas because available drawdown is limited due to the depth of the aquifers and so many production wells have pump intakes below the aquifer tops. Declining water levels are still occurring in a few places.

Permit holders in the designated declining water level zone can be relieved of future reductions under rule provision .0503 (9). That provision allows a permit holder to use three years of their most current water level data to be relieved of reduction requirements, provided that data do not indicate a downward trend in ground water levels. To date, one permit holder (Guilford Mills Inc. in Duplin County) has already used this provision to be exempted from further reductions.

Estimating Ground Water Level Improvements

Individual hydrographs of wells in the DWR network delineate how ground water levels have changed over time. Every one of the network wells is available for visual analysis on the DWR web site. Figure 6 shows eight examples of individual hydrographs. Several hydrographs show rising water levels associated with the reduction of water use from the Cretaceous aquifers. Water levels began to rise after 2008. Other hydrographs show water levels continuing to decline or show a delayed reaction even after regional withdrawals have been reduced.

One method that is employed to visualize the changes in water levels in map form is presented in figures 7 and 8. Two potentiometric surfaces from different dates are developed and the change in water levels between those two dates is displayed in a map view. Specifically, figures 7 and 8 illustrate the rebound in water levels in the Black Creek and Upper Cape Fear aquifers between November 2007 and November of 2012. A highlight of these maps is the broad area of increase in ground water levels as much as 35-40 feet, and is centered in Lenoir and Craven counties.

Permit Holder Suggested Changes to Reduction Zone Boundaries

Item Number	Proposed Boundary Change	Analysis
1	Expansion of the Declining Water Level Zone and Contraction of the Dewatering zone near the Duplin, Lenoir, Wayne, Wilson, & Greene County	Pump intakes and pumping water levels below the aquifer tops indicate the need to maintain zone boundaries as they are currently located.

1. The Division of Water Resources (DWR) received letters from the Town of La Grange (September 21, 2012), Greene County and the Town of Farmville

(November 26, 2012) regarding the implementation of the CCPCUA Rules. The letters requested that their water systems be designated as being in the “Declining Water Zone” instead of the “Dewatering Zone” when the 2013 CCPCUA Assessment is finalized.

The letters also stated that the boundary between the dewatering and declining water level zones west of Kinston is based on a political boundary. This is incorrect. That boundary, like all other reduction zone boundaries, was based on the water level decline rates observed at DWR monitoring wells, the location of production wells as was known in 2000, the locations of salt water occurrences in the aquifers, and the results of a survey DWR completed with water supply operators in 1998-1999, which gathered production well static water levels. Those static water levels were compared to the tops of the aquifers and the levels falling below the tops were mapped. This is what formed the basis of the dewatering zone.

Furthermore, the letters stated that water levels have rebounded significantly as a result of the 25% reduction, which occurred in 2008. However, it should be stressed that some permit holders have undertaken extensive efforts toward CCPCUA compliance and several nearby communities have reduced their Cretaceous aquifer demands by approximately 90%. Therefore, a 25% reduction was not sufficient to reverse the declining water level trend in this area. In fact, it appears that a 90% reduction is precipitating much of the current water level recovery.

The pumping water levels as well as pump intakes in some of these systems' wells are still below the tops of the aquifers. This would indicate that some level of dewatering is being generated by these wells. If the boundary line is shifted, then DWR would be placing production wells that are currently dewatering the aquifer outside of the dewatering zone.

Criteria Driven Permit Review

Although we have recommended that the CCPCUA .0503 rule not be adjusted, we do think it is necessary to amend our permitting framework to reflect a more customer service oriented approach for our permit holders. DWR needs to be able to offer individual systems an alternate reduction plan or a stable annual withdrawal limit depending on their situation. We believe this can be accomplished using provision 15A NCAC 02E .0502 (p) which is written as follows:

"Where an applicant or a permit holder can demonstrate that compliance with water withdrawal limits established under Section .0500 of this Subchapter is not

possible because of construction schedules, requirements of other laws, or other reasons beyond the control of the applicant or permit holder, and where the applicant or permit holder has made good faith efforts to conserve water and to plan the development of other water sources, the Director may issue a temporary permit with an alternative schedule to attain compliance with provisions of Section .0500 of this Subchapter, as authorized in G.S. 143-215.15(c)(ii)."

This provision is not limited by Cretaceous reduction zones and gives the Director flexibility to work with individual permit holders without changing the overall reduction plan. DWR has used this provision in the past to make allowances for scheduling delays associated with use of alternative water sources. Permit holders proving economic hardship may also be candidates for an alternate schedule to achieve reductions.

To use .0502 (p) in this amended permit review process, DWR has developed a set of requirements that should be achieved by each reduction zone well before the Director could allow any alternate permit language other than the standard, reduction schedule permit language. The list of requirements is as follows:

- Present day static ground water levels must be at least 50% of the distance between the top of the aquifer and land surface (a water level that should relate to the operability of the well or available drawdown) [.0502 (c)], see figure 9,
- Static water level trends must be level or upward trending over the previous 3 years from present day [.0502 (c)], see figure 10,
- Pump intakes must be above the top of the shallowest Cretaceous aquifer screened by the well [.0502 (c) & (j)], see figure 11,
- Present day pumping water levels must be above the top of the shallowest Cretaceous aquifer screened by the well [.0502 (c) & (j)], see figure 12, and
- If applicable, chloride concentrations obtained from monitoring wells (not production wells) are fresh (< 250 mg/l) for 3 previous years from present day and do not trend toward higher concentrations [.0502 (c), (i) & (l)].

Permit renewals for permit holders within reduction zones will include this new analysis. Figures 9-12 show the status of reduction wells given the first four criteria. The fifth criterium is difficult to visualize in this type of map and could involve construction and measurement of monitoring wells by permit holders. Permit holders may submit an application to modify their permit before the slated expiration date if all their reduction zone wells meet these requirements. If subsequent monitoring reports reveal problems,

then DWR will re-open that permit and make appropriate adjustments.

It is paramount that permit holders continue to report water levels, water withdrawals, and chloride data. The proposed, new criteria driven permitting process will give each permit holder hard measuring points so that they know where they stand with future reductions. Our overall picture of the aquifer will improve with permit holders understanding the importance of their data and that they may be able to make use of more Cretaceous aquifer water than the reduction zones and schedule allow. DWR is determined to be only as restrictive as necessary to ensure the sustainable use of these aquifers. These new criteria and use of provision .0502 (p) will strengthen the permitting program while creating more flexibility.

Conclusions

Based on analysis of water level and chloride concentration conditions in the CCPCUA that were gathered through January 2013, we recommend that the EMC not adjust either the CCPCUA reduction zone boundaries or reduction percentages. Although water levels many areas have risen and aquifer dewatering is less of a concern, salt water encroachment is still problematic. DWR hopes that the EMC will concur with allowing the Director to make use of rule provision .0502 (p) which, taken with the list of requirements to be met by each reduction well, will give the division more flexibility to manage the CCPCUA area beyond the broad brush approach of the Cretaceous reduction zones.

Although the CCPCUA rules require assessments to be produced in 2008, 2013, and 2018, the Division of Water Resources staff will continue to constantly track aquifer conditions so as to best serve the permit holders in the region and also be aware of potential ground water supply issues. Another formal assessment will be conducted in 2018.

Figure 1.

CCPCUA Cretaceous Aquifer Zones

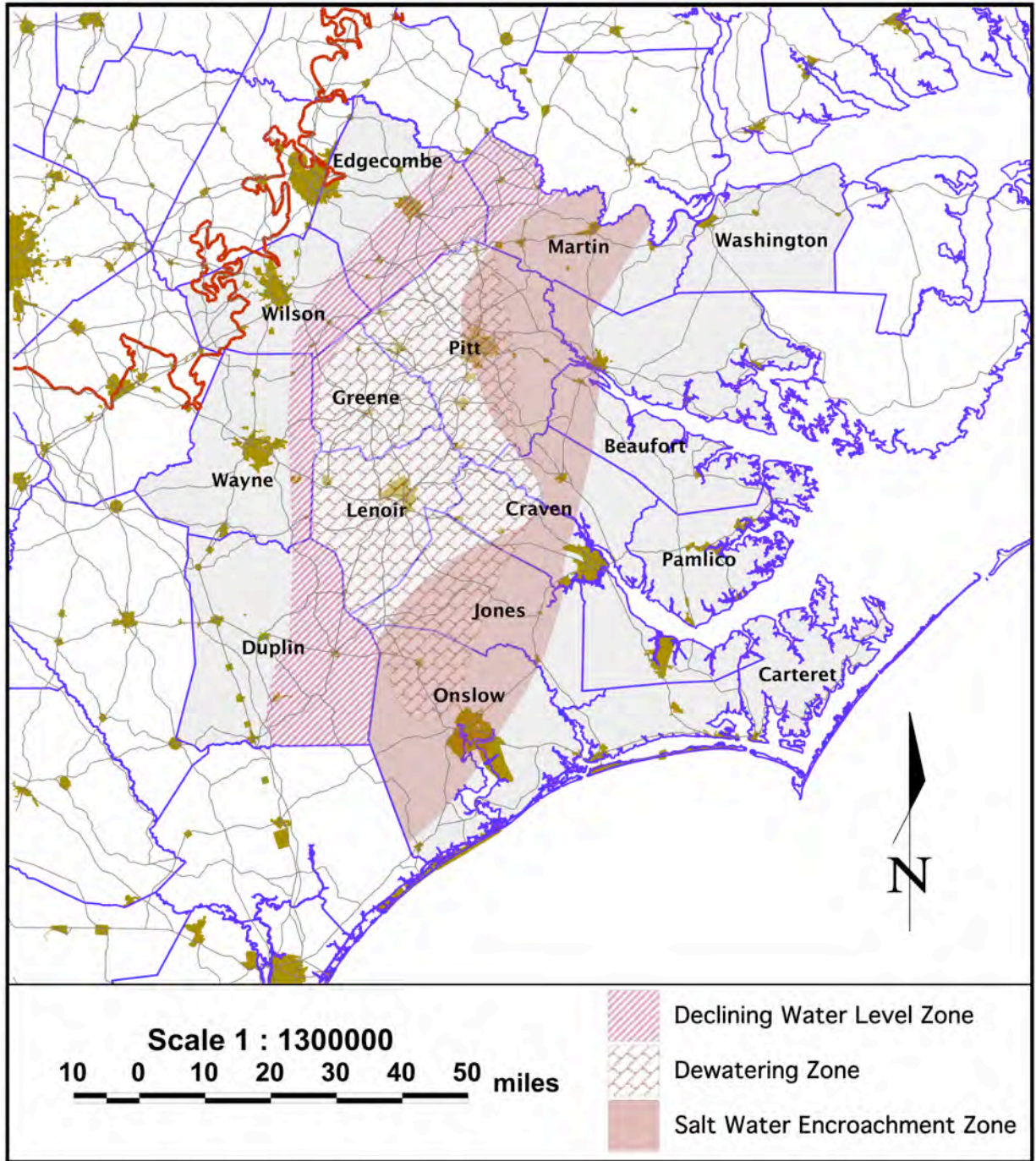


Figure 2.

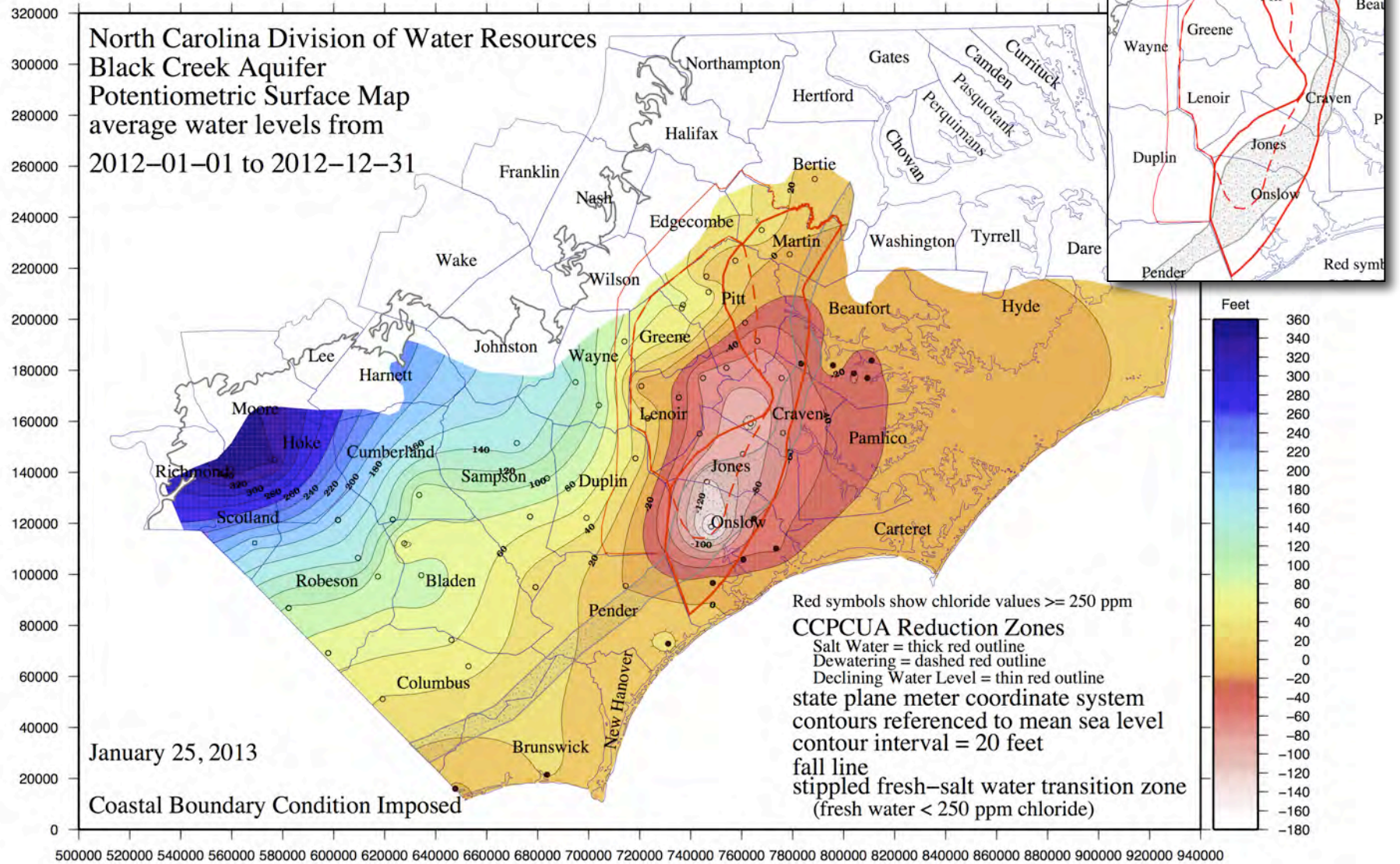


Figure 3.

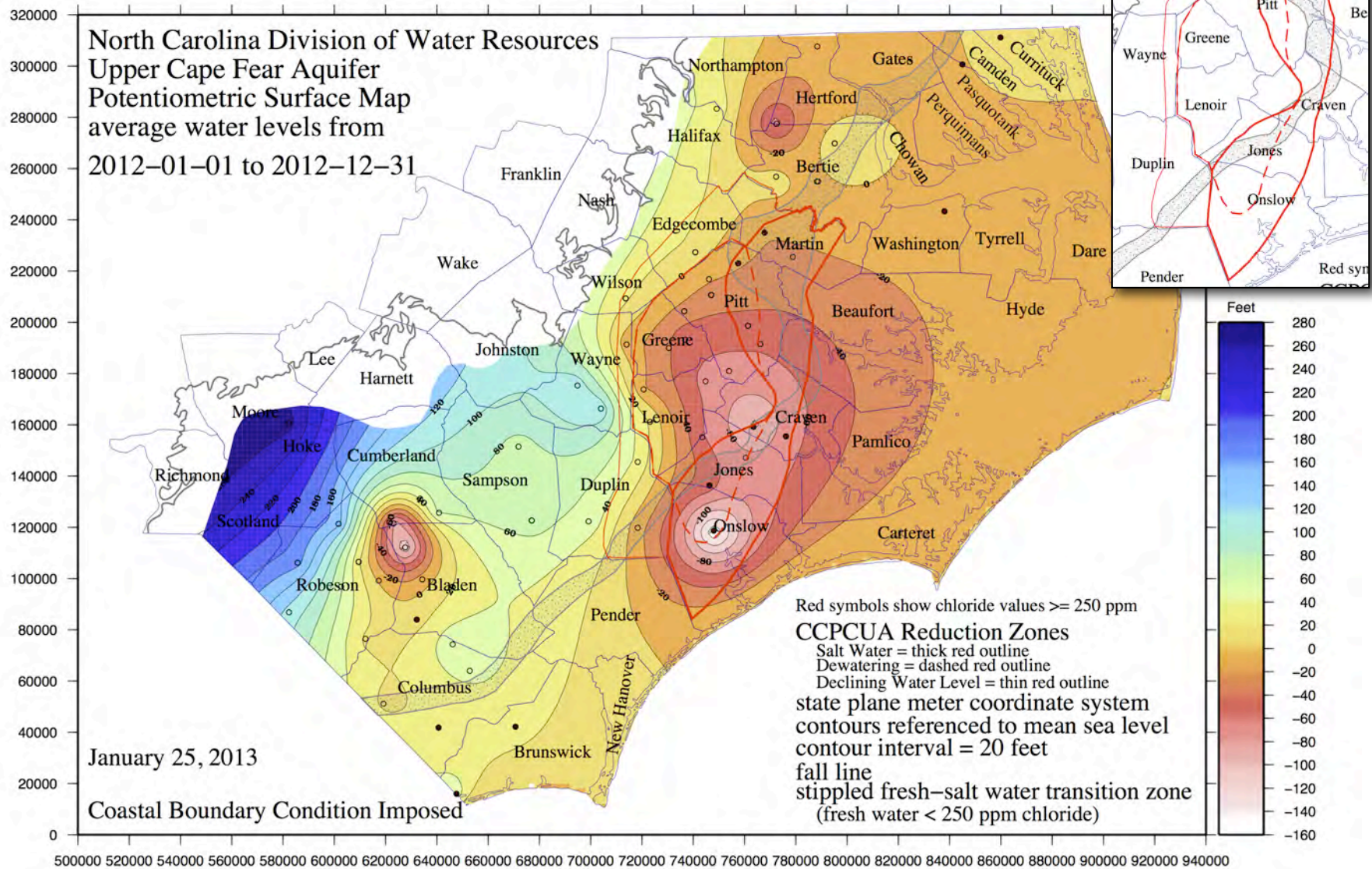


Figure 4.

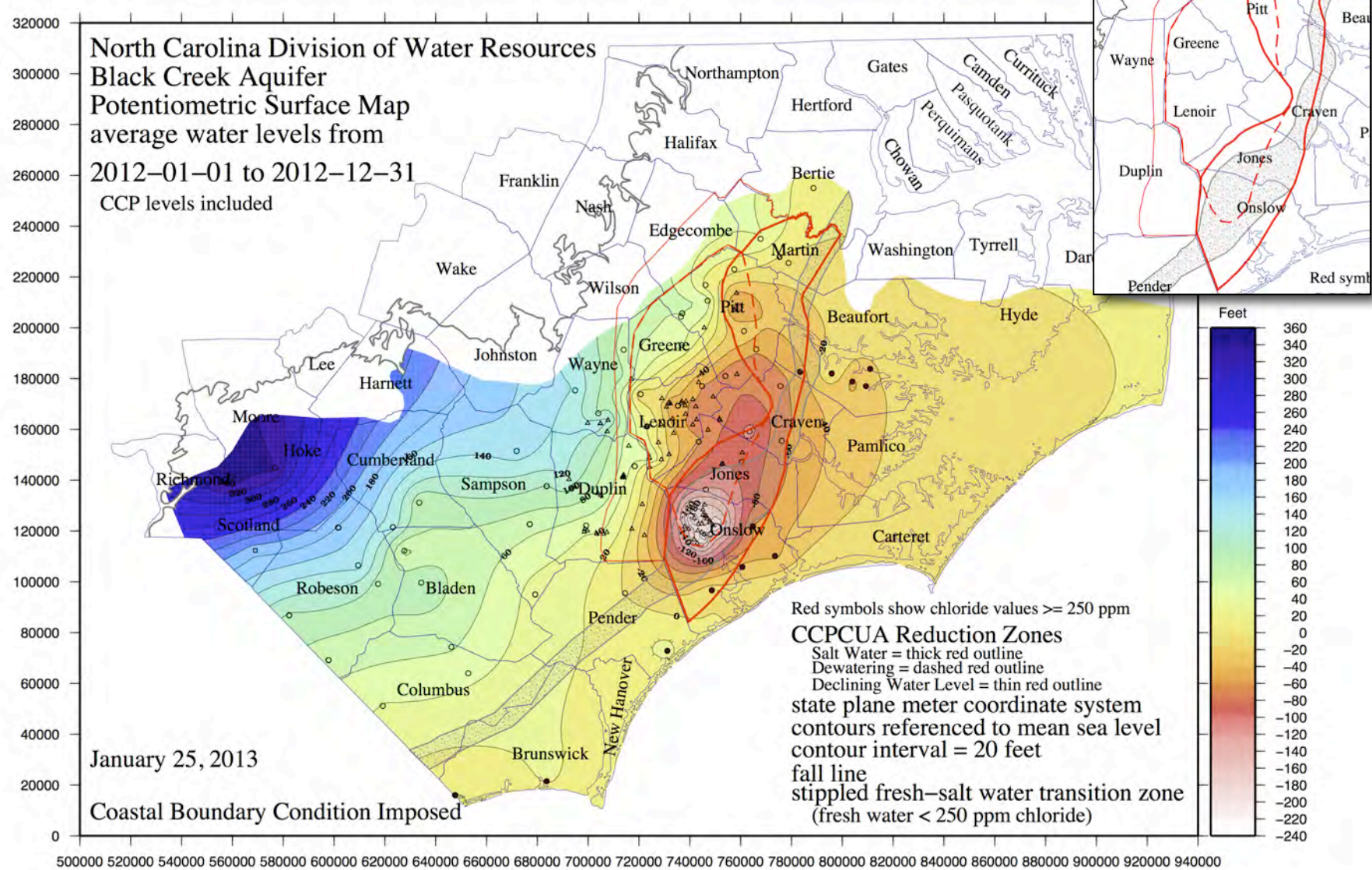


Figure 5.

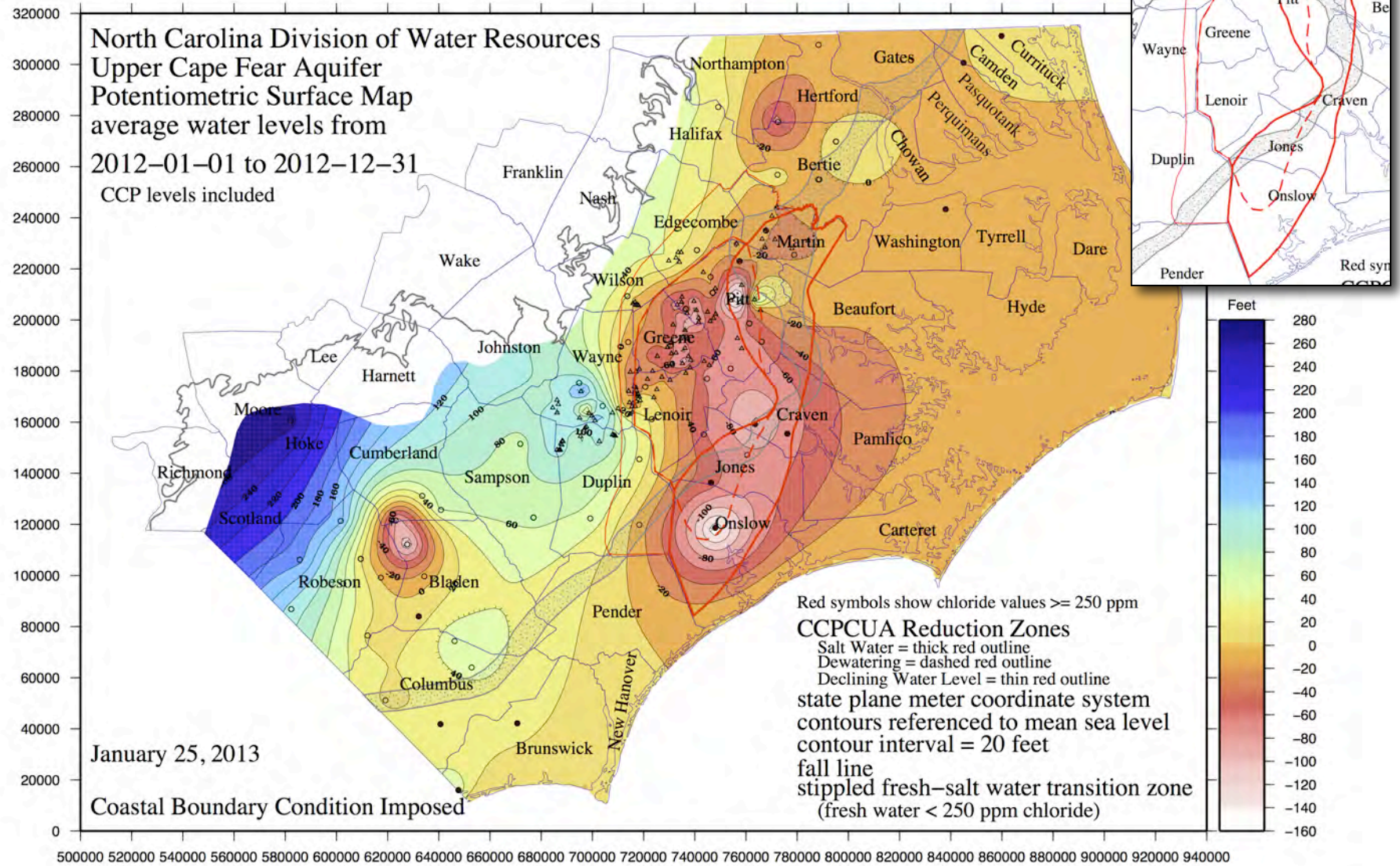


Figure 6 (a-d).

Figure 6a. Chicod Station, Pitt County

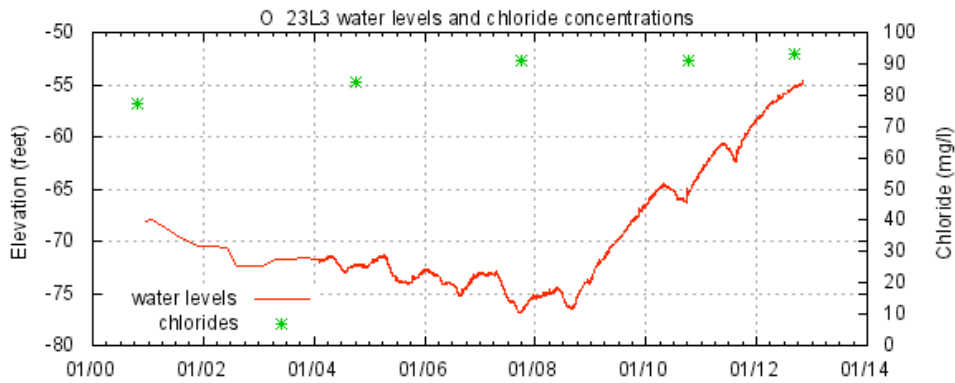


Figure 6b. North Pitt High School Station, Pitt County

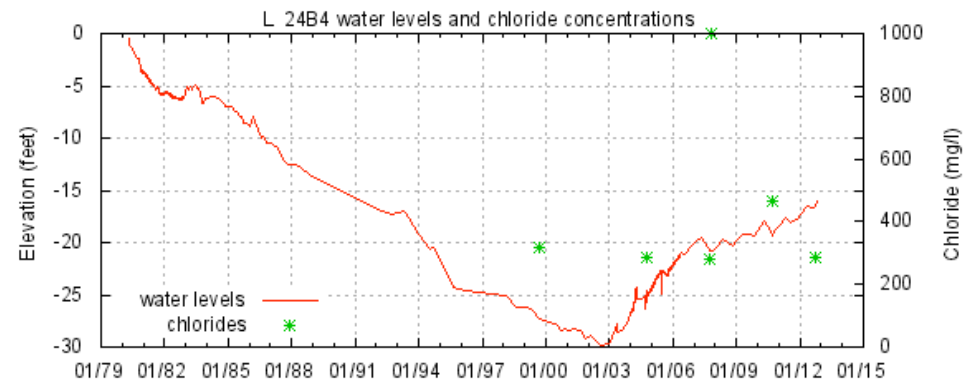


Figure 6c. Chinquapin Station, Duplin County

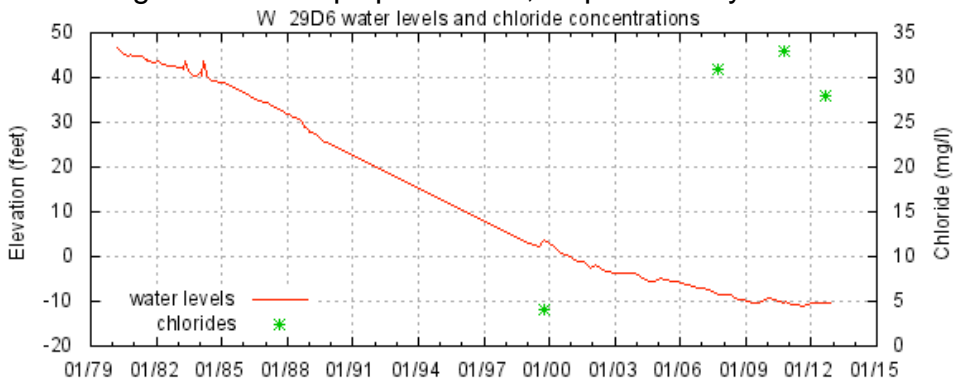


Figure 6d. Pink Hill Station, Duplin County

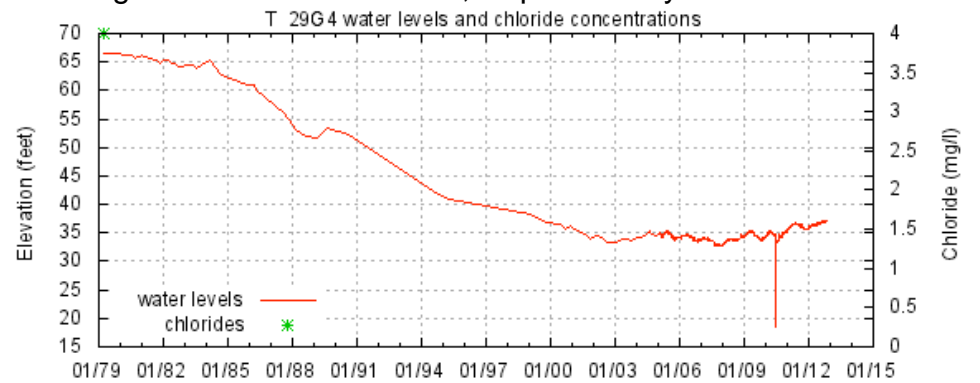


Figure 6 (e-h).

Figure 6e. Clarks Station, Craven County

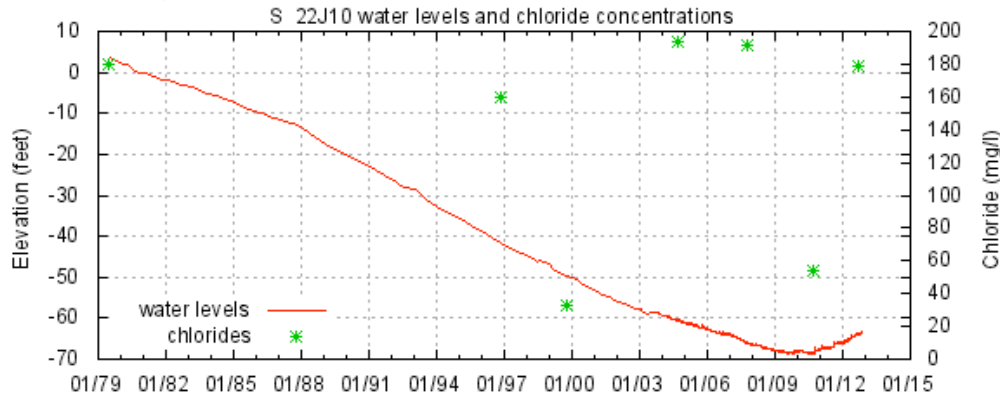


Figure 6f. Savannah School Station, Lenoir County

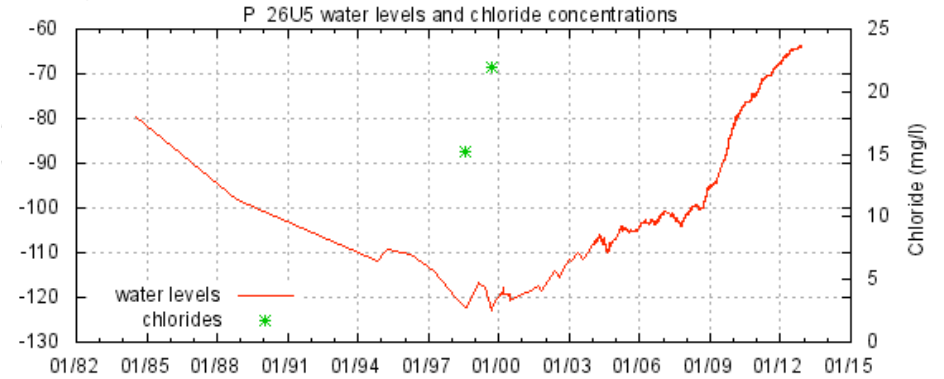


Figure 6g. Kinston Yard Station, Lenoir County

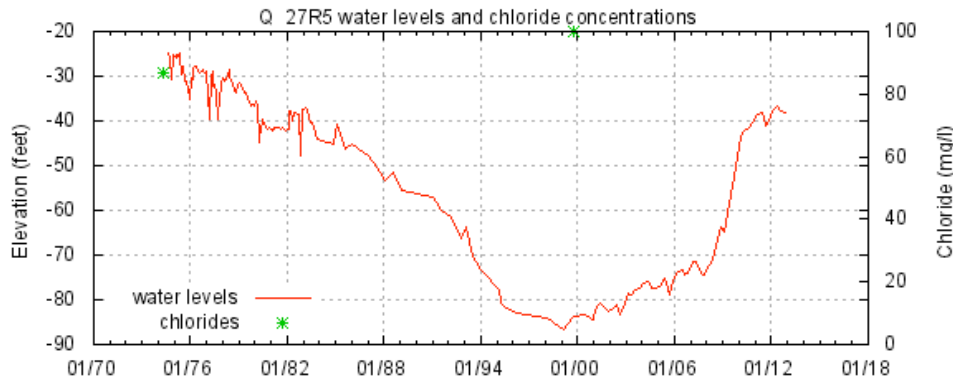


Figure 6h. Comfort Station, Jones County

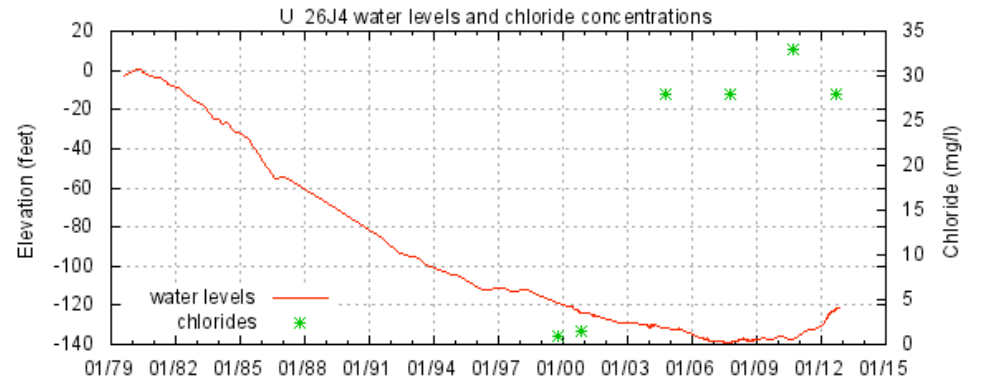


Figure 7. Black Creek Aquifer Rebound (feet)
Nov 2007 through Nov 2012

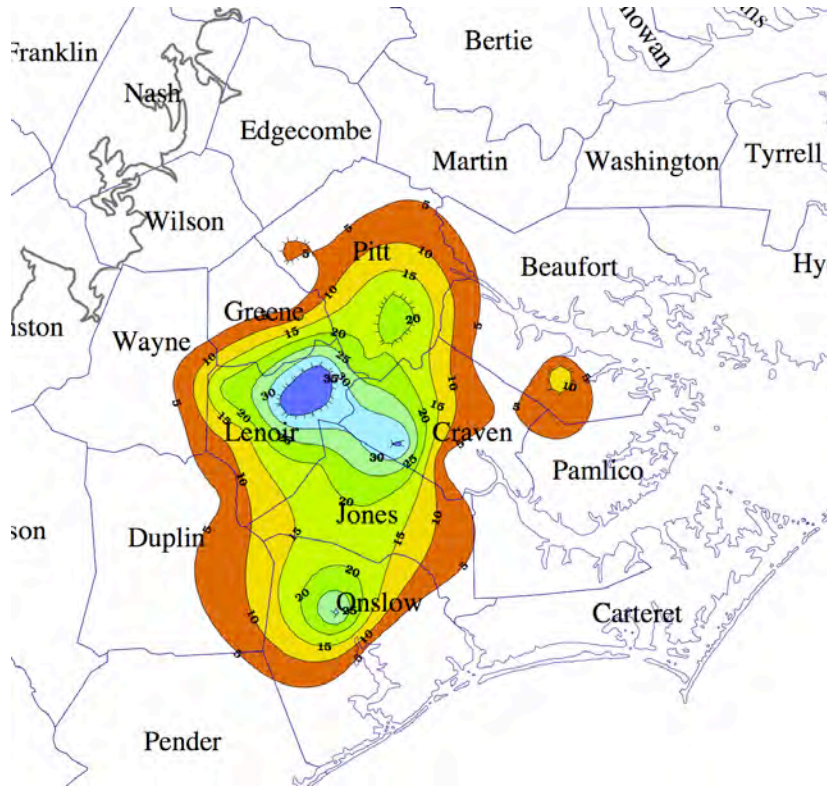
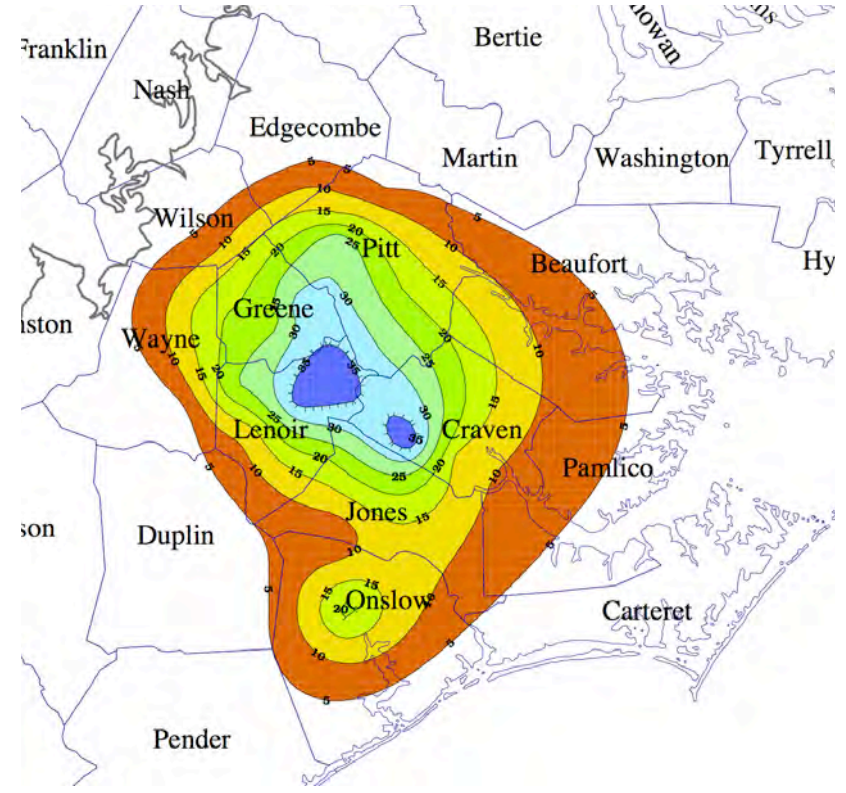


Figure 8. Upper Cape Fear Aquifer Rebound (feet)
Nov 2007 through Nov 2012



Water Levels in Reduction Zone Wells

Static Water Levels Measured in Production Wells as Percentage of Distance between Top of Aquifer and Land Surface

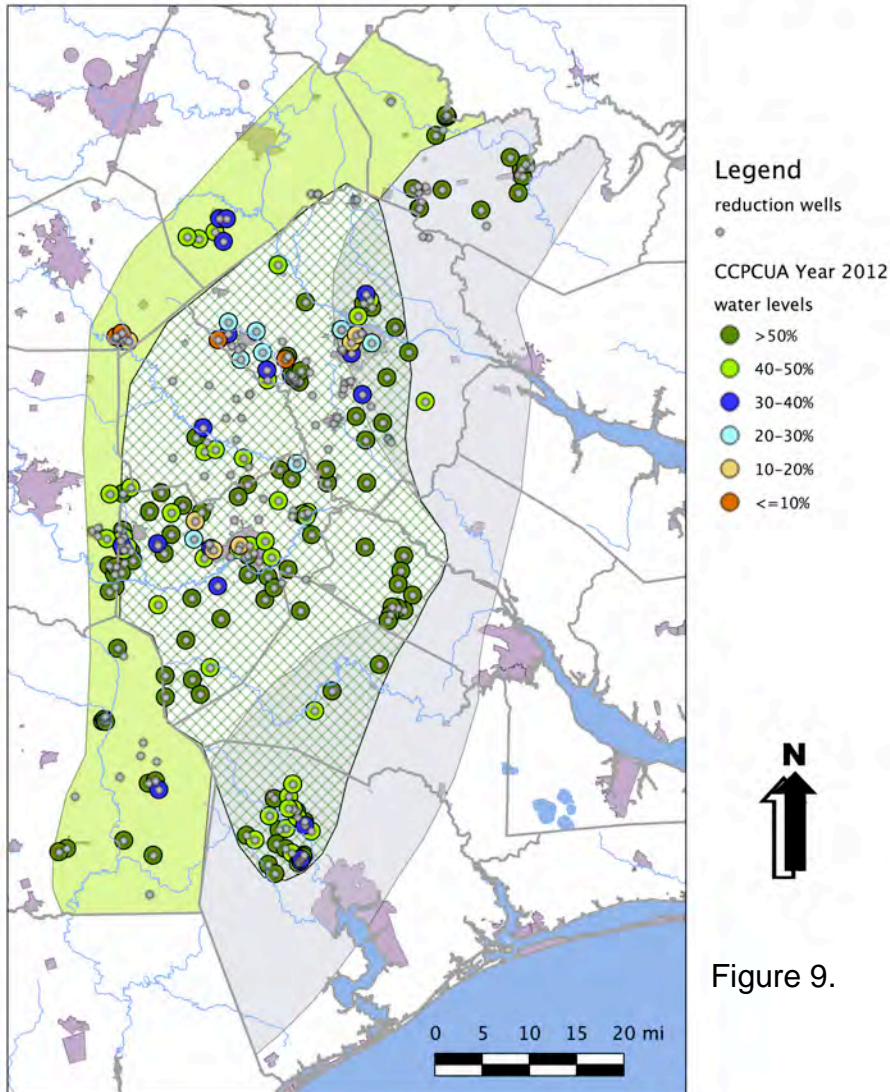


Figure 9.

Reduction Well Static Water Level Trends 2010 - 2012

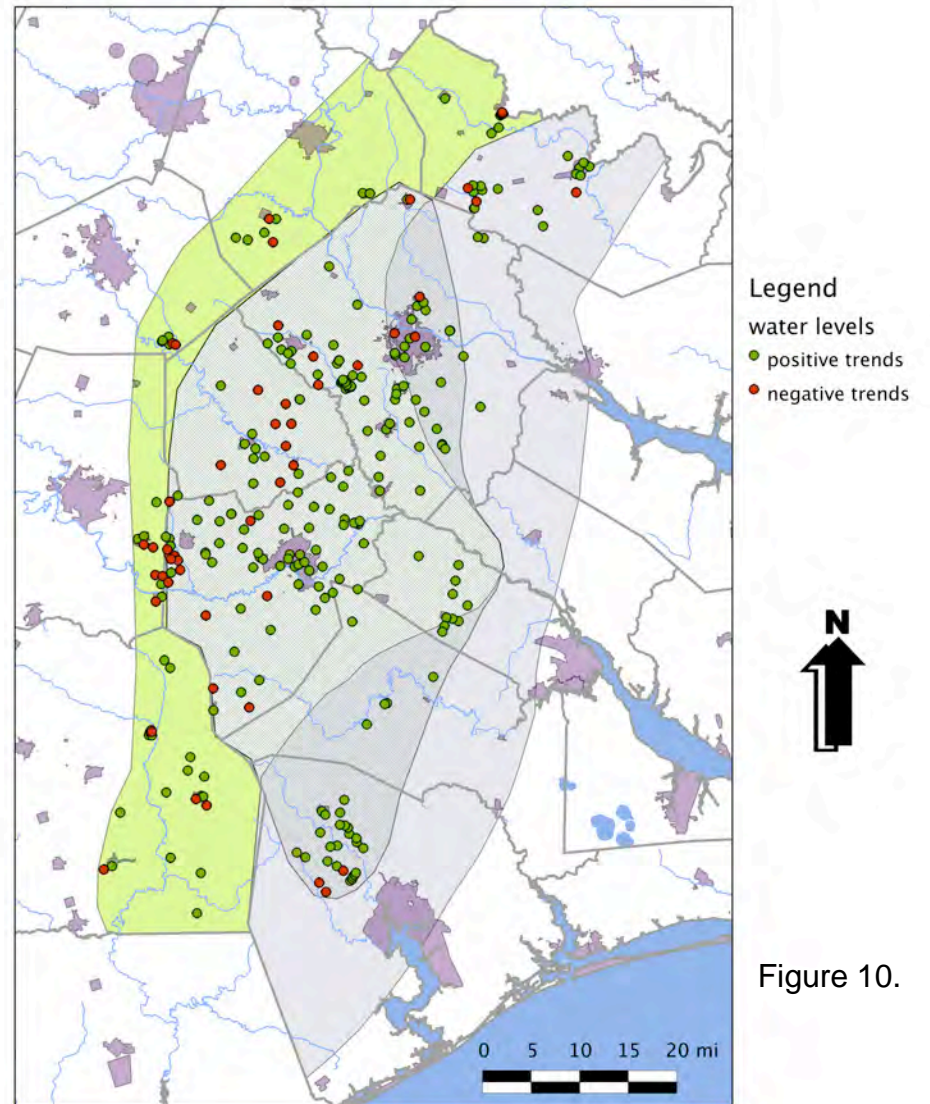


Figure 10.

Current Construction of Reduction Wells

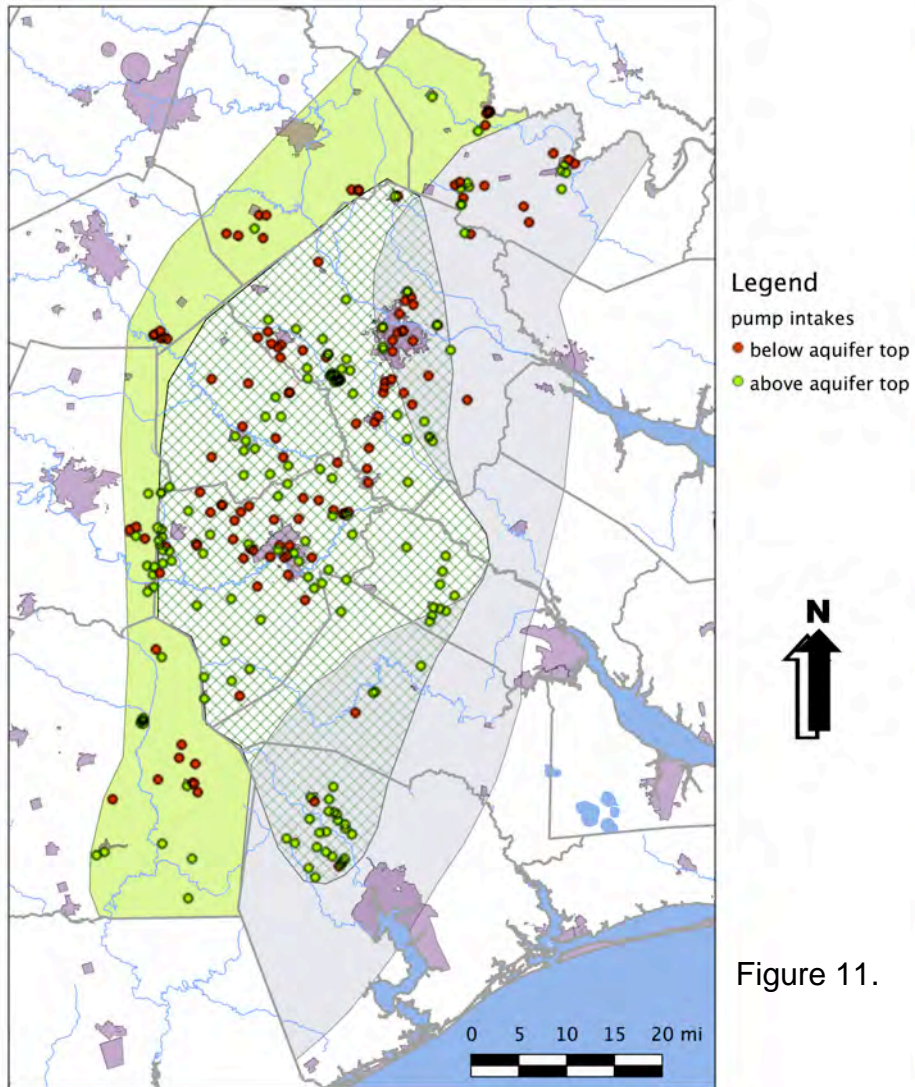


Figure 11.

Pumping Water Levels in Reduction Wells
CCPCUA 2012

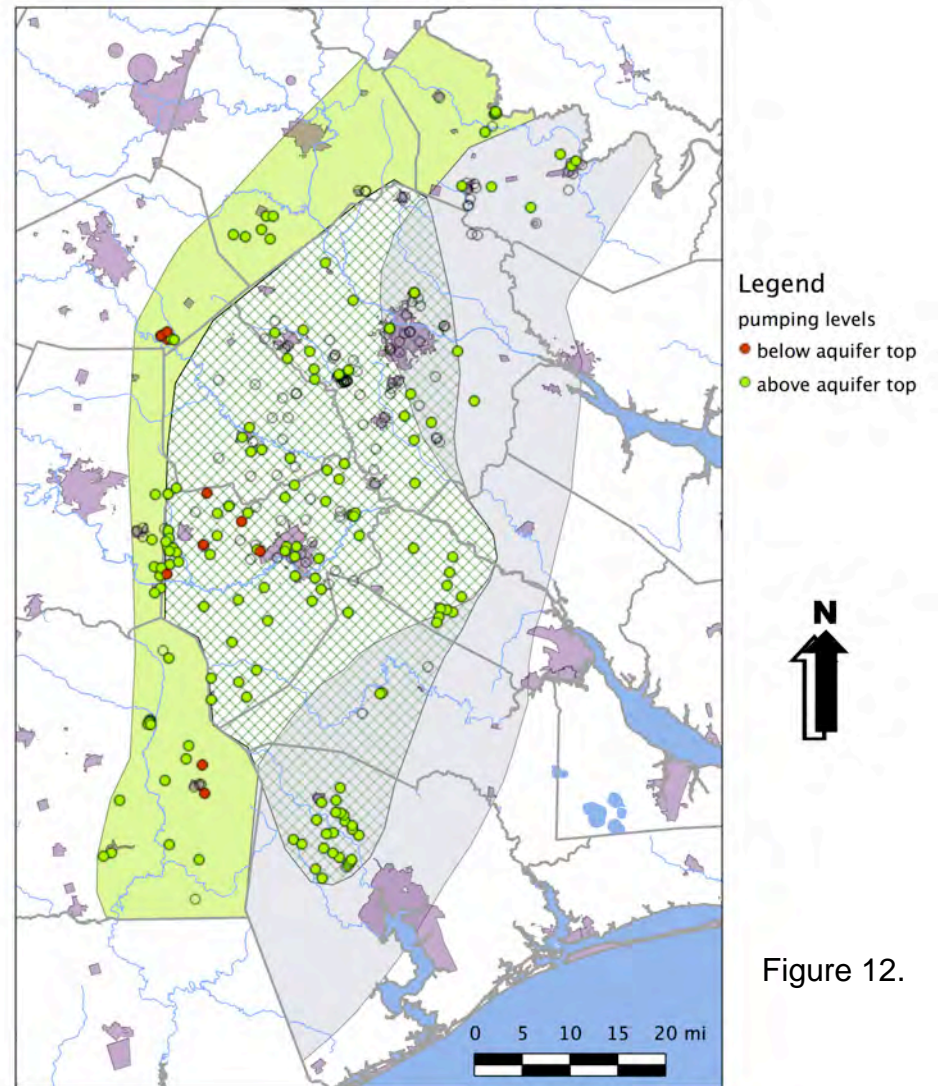


Figure 12.

15A NCAC 02E .0503 PRESCRIBED WATER USE REDUCTIONS IN CRETACEOUS AQUIFER ZONES

Cretaceous aquifer water use shall be reduced in prescribed areas over a 16 year period, starting from approved base rates on the effective date of this Rule. The Cretaceous aquifer system zones and the three phases of water use reductions are listed as follows:

(1) Cretaceous aquifer system zones are regions established in the fresh water portion of the Cretaceous aquifer system that delimit zones of salt water encroachment, dewatering and declining water levels. These zones are designated on the paper and digital map entitled "Central Coastal Plain Capacity Use Area Cretaceous Aquifer Zones" (CCPCUA) on file in the Office of the Secretary of State one week prior to the effective date of these Rules.

(2) The reductions specified in Rule .0503 of this Section do not apply to intermittent users.

(3) If a permittee implements an aquifer storage and recovery program (ASR), reduction requirements will be based on the total net withdrawals. The reductions specified in Rule .0503 of this Section do not apply if the volume of water injected into the aquifer is greater than the withdrawal volume. If the withdrawal volume is greater than the injected volume, reductions specified in Rule .0503 of this Section apply to the difference between the withdrawal volume and the injected volume.

(4) The reductions specified in Rule .0503 of this Section shall not reduce permitted water use rates below 100,001 gallons per day.

(5) Phase definitions:

(a) Phase I: The six year period extending into the future from the effective date of this Rule.

(b) Phase II: The five year period extending into the future from six years after the effective date of this Rule to 11 years after the effective date of this Rule.

(c) Phase III: The five year period extending into the future from 11 years after the effective date of this Rule to 16 years after the effective date of this Rule.

(6) Phase reductions:

(a) Phase I:

(i) At the end of the Phase I, permittees who are located in the dewatering zone will be required to reduce annual water use from Cretaceous aquifers by 25% from their approved base rate.

(ii) At the end of the Phase I, permittees who are located in the salt water encroachment zone will be required to reduce annual water use from Cretaceous aquifers by 25% from their approved base rate.

(iii) At the end of the Phase I, permittees who are located in the declining water level zone will be required to reduce annual water use from Cretaceous aquifers by 10% from their approved base rate.

(iv) At the end of the Phase I, permittees who are located in the Cretaceous zone, but outside of the salt water encroachment, dewatering, or declining water level zones will be required not to exceed annual water use from Cretaceous aquifers as established by their approved base rate.

(b) Phase II:

(i) At the end of the Phase II, permittees who are located in the dewatering zone will be required to reduce annual water use from Cretaceous aquifers by 50% from their approved base rate.

(ii) At the end of the Phase II, permittees who are located in the salt water encroachment zone will be required to reduce annual water use from Cretaceous aquifers by 50% from their approved base rate.

(iii) At the end of the Phase II, permittees who are located in the declining water level zone will be required to reduce annual water use from Cretaceous aquifers by 20% from their approved base rate.

(iv) At the end of the Phase II, permittees who are located in the Cretaceous zone, but outside of the salt water encroachment, dewatering, or declining water level zones will be required not to exceed annual water use from Cretaceous aquifers as established by their approved base rate.

(c) Phase III:

(i) At the end of the Phase III, permittees who are located in the dewatering zone will be required to reduce annual water use from Cretaceous aquifers by 75% from their

approved base rate.

- (ii) At the end of the Phase III, permittees who are located in the salt water encroachment zone will be required to reduce annual water use from Cretaceous aquifers by 75% from their approved base rate.
- (iii) At the end of the Phase III, permittees who are located in the declining water level zone will be required to reduce annual water use from Cretaceous aquifers by 30% from their approved base rate.
- (iv) At the end of the Phase III, permittees who are located in the Cretaceous zone, but outside of the salt water encroachment, dewatering, or declining water level zones will be required not to exceed annual water use from Cretaceous aquifers as established by their approved base rate.

(7) The CCPCUA Cretaceous Aquifer Zones map will be updated, if necessary, in the sixth, eleventh, and sixteenth years following the effective date of this Rule to account for aquifer water level responses to phased withdrawal reductions. The map update will be based on the following conditions:

- (a) Rate of decline in water levels in the aquifers;
- (b) Rate of increase in water levels in the aquifers;
- (c) Stabilization of water levels in the aquifers;
- (d) Chloride concentrations in the aquifers.

This aquifer information will be analyzed on a regional scale and used to develop updated assessments of aquifer conditions in the Central Coastal Plain Capacity Use Area. The Environmental Management Commission (EMC) may adjust the aquifer zones and the water use reduction percentages for each zone based on the assessment of conditions. The EMC will adopt the updated map and reduction percentage changes after public hearing.

History Note: Authority G.S. 143-215.15;
Eff. April 1, 2001.