

North Carolina Ground Water Resources Monitoring Well Network 2013 Annual Report



Topsail Beach Station



Chicod Station



Godley Station

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Environment and Natural Resources
Division of Water Resources
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1.0 Introduction

The State of North Carolina (the State) relies on ground water for approximately 50 percent of its drinking (potable) water use. In addition, the State has thousands of agricultural and industrial ground water users. The North Carolina Department of Environment and Natural Resources (DENR), Division of Water Resources (DWR) has monitored and maintained a statewide network of monitoring wells to assess North Carolina's ground water supply since 1998. The operation of this monitoring well network is an essential part of DWR's mission to ensure that the State has an adequate water supply for its citizens. Information (data) collected quarterly from this well network include the following:

- Evaluating climatic influences on the State's ground water supply, including effects of drought and recharge-discharge relationships;
- Monitoring human-induced effects on the State's ground water supply, particularly in the regional aquifer systems of the Coastal Plain physiographic province. These effects include local and regional water level declines as well as migration of the fresh water-salt water interface within various aquifers;
- Providing supporting data for enforcement and creation of current and future ground water usage regulations, such as the Central Coastal Plain Capacity Use Area rules; and
- Providing high quality ground water data to local governments, ground water professionals, and the general public to use in making informed decisions in ground water related issues.

Data collected from the network are available to the public through DWR's Internet website, www.ncwater.org. These data include ground water levels, chloride measurements, well construction information, borehole log construction (lithological and geophysical), ground water monitoring station locations, and geophysical/lithological data collection from non-DWR well sites.

2.0 Purpose and Scope

The 2013 Annual Report summarizes field activities and conclusions derived from activities performed during the July 1, 2012 through June 30, 2013 fiscal year (FY). These activities include water level and water quality data statistics, monitoring well installations including new installations and acquired wells, monitoring equipment usage and evaluations, and site surveys.

3.0 Background

The Division of Water Quality (DWQ) and its predecessor agencies initially operated the statewide Ground Water Resource Monitoring Program. DWQ installed the original network wells in the 1960s. DWQ actively monitored the network through the early 1990s, collecting a portion of the ground water data currently contained within the network database. The program was transferred to DWR in 1998. DWR has expanded the active monitoring network by approximately thirty percent (210 monitoring wells) by either installation or acquisition of new monitoring wells since the 1998 transfer.

The U.S. Geological Survey (USGS) has also contributed to the monitoring of the State’s ground water resources under a cooperative agreement between the State of North Carolina and the Federal government. The cooperative well network consists of 13 monitoring wells, many of which are also part of the DWR statewide network.



4.0 DWR Statewide Monitoring Well Network Overview

4.1 Description

The monitoring well network currently consists of 614 wells at 208 monitoring stations (sites), divided into five regions, comprising 62 counties (Figure 1). There are 31 wells located in the Piedmont and Mountain physiographic provinces (Piedmont and Mountain) and 583 wells located in the Coastal Plain physiographic province (Coastal Plain). The Coastal Plain relies more heavily on ground water supplies than either the Piedmont or Mountains. Subsequently, ground water monitoring and research has been more concentrated in the Coastal Plain. In the past few years, more resources have been invested in monitoring the Piedmont and Mountain ground water conditions to better understand the impact of drought cycles on ground water supplies and their contribution to surface water flow. There are 46 wells within the monitoring well network used to assess drought conditions (Figure 2).

Chicod, Pitt County



Boiling Springs, Brunswick County

Of the 208 monitoring stations, 68 are on State or Federal property, 50 are located on property owned by local governments, 88 are located on private property through agreements with landowners and 2 stations are located on properties where landowner indicates that the land property ownership may change. In the past, some wells have been abandoned at the landowner’s request due to changes in land use or ownership. Due to the high cost of well construction combined with the fact that the wells are most valuable when they are monitored continuously over a period of decades, every attempt is made to put new stations in secure, stable locations. A scale has been developed to rank new and existing well sites for potential well abandonment due to



Beaver Creek, Jones County

land-use issues in the future (Table 1). It is preferred that new wells be installed at sites with a susceptibility rating of 1 or 2.

4.2 Monitoring

The statewide monitoring network is divided into five regions (Figure 1). One staff member is responsible for each region. Staff member responsibilities include visiting the wells quarterly to collect water level data, collecting data from drought wells monthly, performing routine site maintenance, keeping automatic data recorders in working order and keeping sites accessible and esthetically pleasing. Additional site activities (i.e. recorder removal/replacement, weed/grass maintenance, video-logging, etc.) are conducted on an as-needed basis.

Depth to ground water level measurements are collected from the network in two different ways. Manual water levels are measured using electronic water level indicators. Hourly water level measurements are collected using one of three types of automatic water level recorders (shaft encoder, vented, or unvented submersible pressure transducers). Hourly water level data are extremely valuable in assessing aquifer recharge, impacts of large storms on ground water conditions, and delineation of aquifer boundaries. DWR typically publishes only the manual water level readings and daily water level data from recorders on the website. However, hourly data is available upon request for specific wells. Table 2 summarizes site and recorder distribution by region.



**Setting up to Video-log at Densons Creek Park,
Montgomery County**

In addition to the recorders mentioned above, Solinst Telemetry System (STS) recording units have been installed in two wells that are included in the Drought Indicator Well network. They consist of one pressure transducer, one barometer, and are powered by a twelve volt battery. Data is collected by a controller unit which stores hourly readings. The readings are sent to the home station (DWR web page server) every reporting interval (currently 6 hours) via cell phone modem. DWR intends to use the STS system on the Drought Indicator Well network to take the place of monthly visits. Subsequently, they will be serviced every quarter or semi-annually depending on battery life. DWR intends to add ten STS units this fiscal year.



Manual water level collection.



Electronic water level recorder (Hobo connected to Shuttle)

4.3 Chloride Sampling

Triennial chloride samples are collected from select wells in the Coastal Plain. The samples are analyzed using the Quantab field method. Field results are used to monitor the migration of the fresh water-salt water interface in the Coastal Plain aquifers. Additional chloride samples are collected for field analyses when new monitoring wells are installed and as needed for special projects. The next chloride sampling event will occur September/October 2014. Section 5.2 summarizes the 2012 chloride sampling event.

5.0 2012-2013 Well Network Statistics

5.1 Ground Water Data Collection

Depth to ground water was measured in 614 wells in the July 1, 2012 through June 30, 2013 fiscal year. [Table 3](#) contains DWR monitoring well network statistics from January 1, 2005 through June 30, 2013. Statistics may vary in comparison to previous years due to additional data entry in the DWR database as older field books are scanned and unrecorded data entered.

Figure 3 compares the number of wells monitored to the water level data collected from the network from 1967 to present. Hourly water level data is not included in this graph. Calendar year 2012 represents the most water level data collected in any single year since starting the monitoring well network operation. This is due to the gradual increase in the number of wells monitored and the increased use of automatic data recorders. The 2013 data was collected through June 2013.

Archived water level recorder charts obtained from DWQ with records dating from the 1960s through 1980s continue to be digitized and data recorded into the DWR online database. Additional digitized information recorded in the database includes, but is not limited to, well construction records, well development, chloride sampling events, memorandums of agreement, and field notes.

5.2 Triennial Chloride Sampling

A chloride sampling event was performed in September and October 2012. Ground water from 245 wells within the network was sampled for chlorides using Quantab® chloride titrators. Field data were collected for pH, conductivity, and salinity using YSI® portable probes.



Quantab® Chloride Titrators



Chloride Sampling Equipment

The intention of the triennial chloride sampling is to assess the position of the fresh water-salt water interface within each of the major coastal plain aquifers. Current results are compared to results of previous sampling events to evaluate potential landward migration of the fresh water-salt water interface due to aquifer overuse. Chloride sampling results are posted in the database and the DWR website. The following graph illustrates the typical database detail of parameters for a well hydrograph.

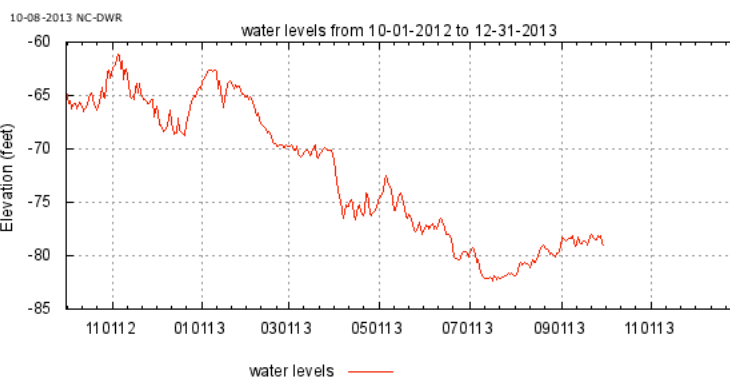
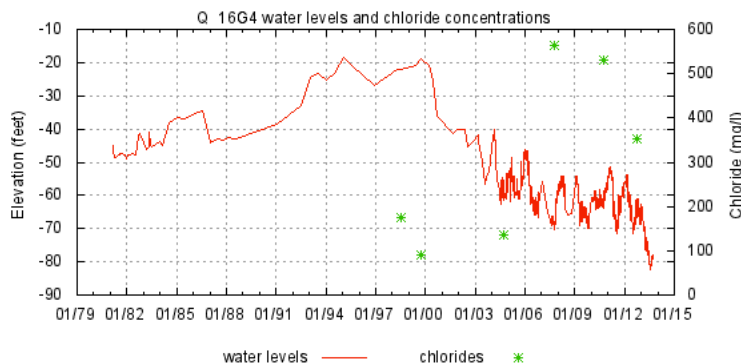
Field	Data
County	Beaufort
Quad link to framework	Q 16G4
Name link to logs	Godley
Latitude	35.315752
Longitude	-76.727595
Location Accuracy	GPS
Netname (link to USGS data)	
USGS ID	351856076434104
Aquifer	Castle Hayne
Land Surface NED elevation is not available	10.63
Date Constructed	02/23/1981
Measuring Point (feet above land surface)	1.20
Depth	500.00
Diameter	4.00
Yield	60.00
Exists?	y
Recorder Box?	y
Top of Screen	406.00
Bottom of Screen	500.00
Number of Water Levels (date * feet below land surface * elevation) 02/23/1981 to 09/30/2013	2,891 ** 999.99 feet below land surface value indicates dry well -222.22 feet above land surface value indicates a flowing well
Number of Chlorides (date * chlormgm * spcond_uS/cm * salin_ppt * pH * comments) 02/23/1981 to 09/21/2012	7 ** -1 values equal no data ** a negative # other than -1 equals below detection limit of #

output files are tab-delimited text
 NED = National Elevation Dataset, 1/9 arc second value
 (~3 X 3 meter grid)

[return to well table](#)

DWR Monitoring Database Detail for Q 16G4

[Show Map](#) -- [Monthly Statistics Plot](#) -- [Site Map](#) -- [Station Levels](#) (may include USGS data)



slope: -20.61 feet/year over this date range

Start Date: End Date:

Hover over or click start and end date fields to change date range.

Sampling results indicate that there continues to be concern for salt-water encroachment, especially near larger pumping centers located near the fresh water-salt water interface (250 parts per million (ppm) chloride is considered salt water). The September 2012 chloride field sampling results associated with wells near larger pumping centers illustrate these types of issues:

- Chloride concentrations from September 2012 in the lower Castle Hayne aquifer well Q16G4 at the Godley Station continue to indicate salt water intrusion with levels of 352 ppm which exceed the 250 ppm threshold for salt water. This station is located near PCS Phosphate Inc. at Aurora, NC in Beaufort County.
- Chloride concentrations from the Peedee aquifer well Y25Q4 at the Folkstone Station show a decrease in chlorides from 296 ppm in July 2011 to 227 ppm on September 12, 2012. Since previous samples indicated salt water intrusion, this well will continue to be sampled in the future. This station is located near the ONWASA Dixon well field in Onslow County.

- Chloride concentrations from the Upper Cape Fear aquifer well J22P5 at the Gold Point Station increased from 54 ppm in October 2010 to 172 ppm in September 2012. This station is located near the town of Robersonville in Martin County.
- Chloride concentrations from the Yorktown Aquifer well H4U2 increased from 160 ppm in September 2010 to 227 ppm in September 2012. This station is located at the Wright Memorial Station in Dare County.

Table 4 summarizes the chloride field analysis to date for specific wells. Chloride sampling will take place again in September and October 2014.

5.3 Well Installation and Development

From October 2012 through May 2013, the following monitoring wells were installed:

- Ivanhoe Station, Ivanhoe, Duplin County, one well, Y34P9;
- New Hanover Correctional Institute Station, Wilmington, New Hanover County, one well, CC31U1; and
- Eagle Point Station, Wilmington, New Hanover County, four wells, CC29L1, CC29L2, CC29L3, and CC29L4.

The wells were installed using 4-inch PVC riser and 10 or 20 feet of 4 to 4.5-inch stainless steel continuous wire wrap V-slot screen (wells greater than 70 feet) or 4 inch .020 slot PVC screen (wells less than 70 feet). The wells were constructed of a gravel pack extending from the bottom of the screen to a minimum of five feet, but no more than ten feet, above the screen. A minimum of ten feet of bentonite overlies the top of the gravel pack in order to provide a sufficient bentonite seal in the well. Table 5 summarizes the monitoring well construction information.



Slotted Screen with Tail Pipe



Gravel Pack Installation



Pressure grouting using bentonite grout

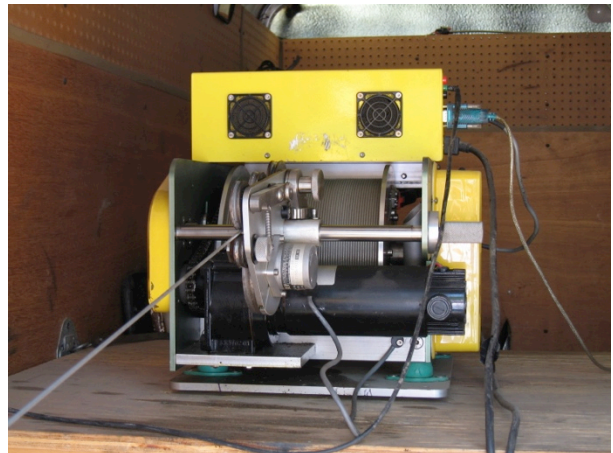
A pilot hole was not advanced prior to installing the well at the Ivanhoe station since this station had a pilot hole drilled in previous years and geophysical logging was conducted at that time. The New Hanover Correctional Institute station well was a shallow well and split-spoon sampling was advanced every five feet for lithologic identification purposes prior to well installation. A pilot hole was drilled at the Eagle Point station prior to installing the four station monitor wells. Geophysical and lithologic log interpretation enabled the DWR staff to assess well screen intervals and the number of wells to be installed. Borehole advancement and well installation included well development. The Eagle Point Station chloride measurement collection will take place in October 2013.



Collecting drill cuttings for lithologic interpretation



Samples for lithologic interpretation



Geophysical Logger

Development removes fine-grained sediments from the vicinity of the well screen and ensures proper hydraulic connection with the aquifer. In addition, field data were collected for pH, conductivity, salinity, and temperature in thirty minute or hourly intervals. Field data exhibiting overall consistency was used to assist in the decision to stop well development. The following monitoring wells were developed, by pumping, from July 2012 through May 2013:

- Farmville Marlboro Rd. Station, Farmville, Pitt County, wells M27U13, M27U14, M27U15, M27U16, and M27U17 (July 2012);
- Southside Ferry Station, Beaufort County, wells P16O2, P16O3, P16O4 (October 2012);
- New Hanover Correctional Institute Station, Wilmington, New Hanover County, well CC31U1 (November 2012);
- Ivanhoe Station, Ivanhoe, Duplin County, well Y34P9 (March 2013);
- General Timber Station, Sanford, Chatham County, well N46H1 (March 2013); and
- Clarendon Station, North of Tabor City, Columbus County, well DD42N2 (April 2013).



Development



5.4 Well Maintenance

The well network requires continual maintenance to keep active monitoring stations usable. Many of the wells exceed 30 years in age and are constructed of materials that are susceptible to corrosion, especially in acidic or saline ground water conditions. Some older wells were constructed with outdated, less than desirable construction practices including backfilling boreholes with cuttings instead of neat cement or bentonite grout. Boreholes backfilled with cuttings form an inadequate seal and allow other aquifers to influence the water level and water quality in that well. Another outdated practice included well construction using telescoped casing. Telescoped casing uses a reducer to trim the well to a smaller diameter casing at depth apparently to save money during well construction. Telescoped wells are very susceptible to blockage at the depth of the reducer. Approximately 152 wells in the network were constructed with reducers. DWR has implemented a long-term program for replacing damaged or unsuitably constructed wells with new, properly constructed wells.

In addition to replacing monitoring wells, DWR was able to repair one well in order to make it usable. The following well was repaired between July 2012 and June 2013:

- Southside Ferry, Beaufort County, P1603, replaced outer casing;

Installation of new and replacement monitoring wells occupies a large portion of DWR's resources. [Table 5](#) lists the new wells installed during the 2013-2014 fiscal year. The new wells are included on [Figure 1](#).

5.5 Automatic Water Level Recorders

Automatic water level recorders play an integral role in the DWR monitoring program. They allow for economical collection of near-continuous data at remote well stations. Four primary recorders are utilized and are included [Table 6](#). DWR is currently experimenting with the Solinst Telemetry System (STS) on two wells.



Hobo including barometer, shuttle and water level indicator



Sutron including card reader, 12-volt battery and voltage meter



Global Water WL16 including iPAQ, field book and calculator



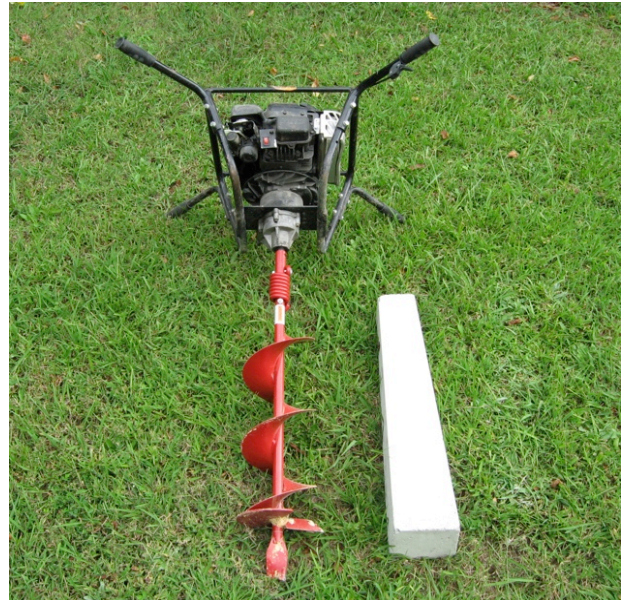
Solinst Telemetry System



Solinst Telemetry System. Cell phone antenna is housed in a PVC pipe projecting downward from shelter base.

5.6 Site Surveys

Concrete survey monuments continue to be installed at each of the 208 monitoring well stations within the network. Once installation is complete, the monuments will be surveyed using Survey Grade Global Positioning System (GPS) to calculate the most accurate horizontal and vertical location data possible. Twelve monuments were installed by end of this fiscal year, with a total of 202 monuments installed to date. Surveying of the monuments will take place once monument installation at each well station is complete.



Gas auger and monument



Monument Installed



Top of monument - survey point

6.0 Planned Activities for FY 2013-2014

6.1 New Well Installation

Monitoring well network expansion efforts for FY 2013-2014 will be focused on Beaufort, Bladen, Chowan, Columbus, Duplin, Edgecombe, Onslow, Pender, Pitt, Sampson, Scotland, Washington, and Wayne Counties. In addition, some wells throughout the network that cannot be used due to bad construction, screening in multiple aquifers, etc., may be abandoned during this upcoming fiscal year. Table 7 summarizes the possible upcoming expansion of the network in FY 2013-2014.

6.2 Well Abandonment

The following wells were abandoned during FY 2012-2013: Rowland, Robeson County, Z47R8 and Croatan, Craven County, U19O4, U19O6, U19O7, U19O8, and U19O9.

7.0 Central Coastal Plain Capacity Use Area

On August 1, 2002, the Central Coastal Plain Capacity Use Area (CCPCUA) rules came into effect. As stated in 15A NCAC 2E .0501, “[t]he intent of this Section [the CCPCUA rules] is to protect the long term productivity of aquifers within the designated area and to allow the use of ground water for beneficial uses at rates which do not exceed the recharge rate of the aquifers...” The goal of the DWR is to regulate water withdrawals in the Central Coastal Plain (CCP) under the authority of the Environmental Management Commission (EMC). The following summarizes how these withdrawals are regulated:

- Permits are required for ground water users who withdraw greater than 100,000 gallons of water per day.
- Annual registration and reporting of withdrawals is required for surface and ground water withdrawals greater than 10,000 gallons per day.

The counties included in the CCPCUA are Beaufort, Carteret, Craven, Duplin, Edgecombe, Greene, Jones, Lenoir, Martin, Onslow, Pamlico, Pitt, Washington, Wayne, and Wilson (Figure 4). DWR collects depth to water level measurements and chloride sampling event data from monitor wells within the well network and permitted wells to assess aquifer conditions. 15A NCAC 2E .0503 requires that DWR gather this information together in 2013 and determine if CCPCUA rule changes are necessary. Based on the results of data assessment, DWR does not recommend rule changes, but is recommending the use of temporary permits under rule .0502. This may give certain permit holders a stable withdrawal rate which is higher than indicated by their reduction schedule and reduction zone (see Figure 4), provided that all well construction and reporting criteria are met as specified in the 2nd Draft of the CCPCUA Assessment Report. The final report is expected to be presented to the EMC in November 2013. Reports referencing the CCPCUA rules can be viewed by visiting the DWR website, www.ncwater.org.

8.0 Summary and Conclusions

The NCDENR, DWR, has maintained and monitored a statewide network of ground water monitoring wells used to assess North Carolina's ground water supply since 1998.

Data collected from the network are available to the public through DWR's Internet website, www.ncwater.org. These data include, but are not limited to, ground water levels, chloride measurements, well construction information, borehole log construction (lithological and geophysical), ground water monitoring station locations, and geophysical/lithological data collected from other (non-DWR) well sites.

The well network consists of 614 monitoring wells at 208 individual stations. From July 2012 through June 2013, ground water level data were collected from 614 wells within the network. These data include manual measurements taken quarterly from wells, plus hourly water levels collected using automatic data recorders from 491 wells.

The addition of the STS system on the drought monitoring network wells will replace monthly site visits and provide positive economic impacts. DWR intends to add ten STS units this fiscal year.

A total of six monitor wells have been installed at three different stations during the FY 2012-2013. One monitoring well was installed at Ivanhoe (Duplin County), one monitoring well was installed at New Hanover Correctional Institute (New Hanover County), and four wells were installed at Eagle Point (New Hanover County). Borehole advancement and well installation included, but was not limited to, well development and collection of chloride measurements.

A total of six wells were abandoned at two different stations: well Z47R8 at the Rowland Station, Robeson County and wells U19O4, U19O6, U19O7, U19O8, and U19O9 at the Croatan Station, Craven County.

Archived water level recorder charts obtained from the DWQ with records dating from the 1960s through 1980s continue to be digitized and data recorded into the DWR online database. Survey monuments continue to be installed at each of the well stations with plans to survey each monument using Survey Grade GPS.

The triennial chloride sampling was performed on 245 wells in September/October 2012. One additional sample was collected from the new well installation at Ivanhoe in March 2013. Sampling results indicated that there continues to be concern for saltwater encroachment especially near larger pumping centers located near the fresh-salt water interface. Chloride sampling will occur again in September/October 2014.

DWR has tentative plans to expand the monitoring well network by installing up to ten wells at two sites in FY 2013/2014. In addition several wells in the network may be scheduled for abandonment, replacement, and repair.

Fifteen counties in the Central Coastal Plain are governed by the Central Coastal Plain Capacity Use Area rules. Data collected from the monitoring well network and permitted withdrawal wells are being used to assess aquifer conditions and determine whether or not changes to the rules are warranted. Based on the results of data assessment, DWR does not recommend rule changes, but is recommending the use of temporary permits under rule .0502. The assessment document will be presented to the EMC in November 2013.

FIGURES

Figure 1: North Carolina Division of Water Resources Monitoring Stations August 2013

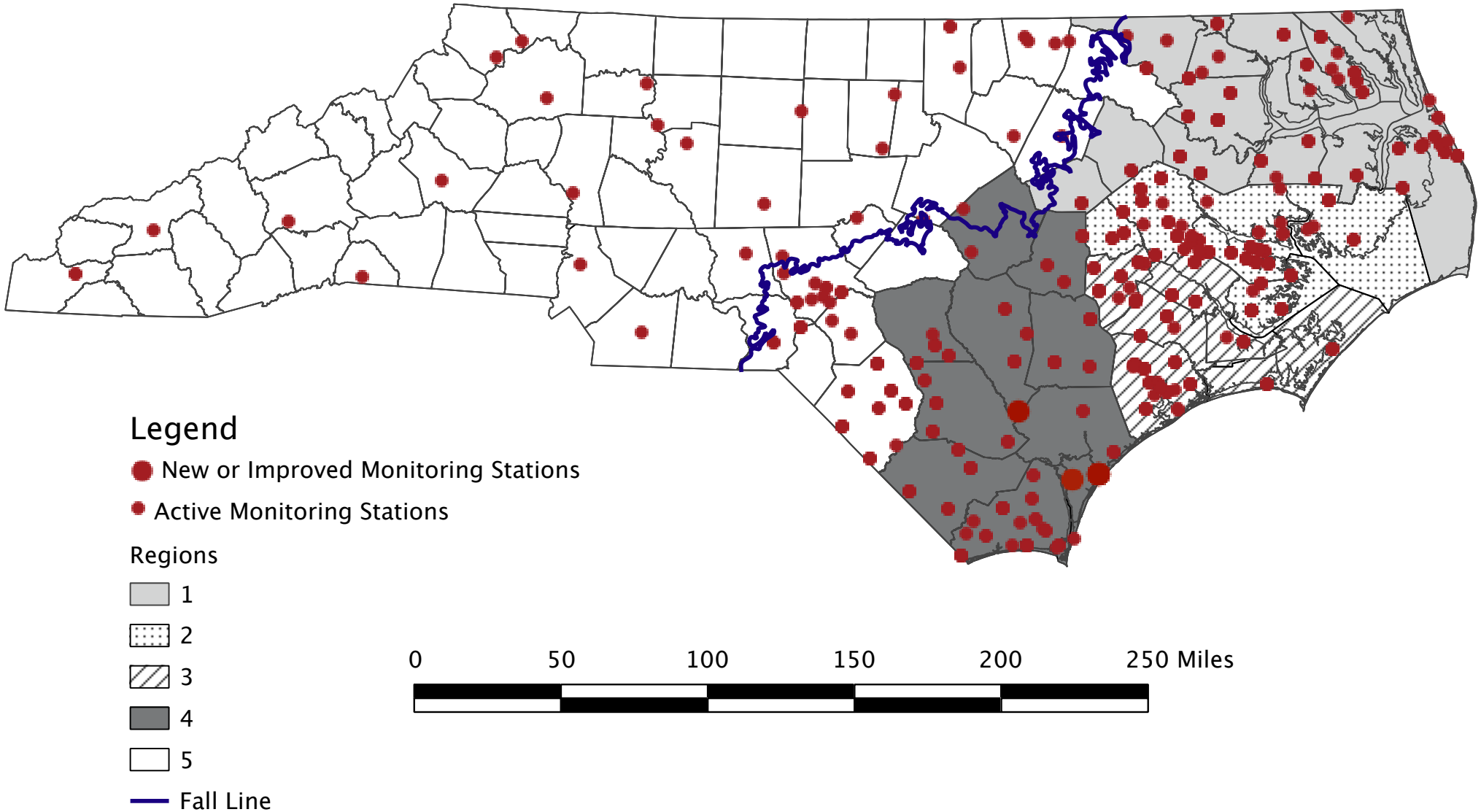


Figure 2: Drought Indicator Wells

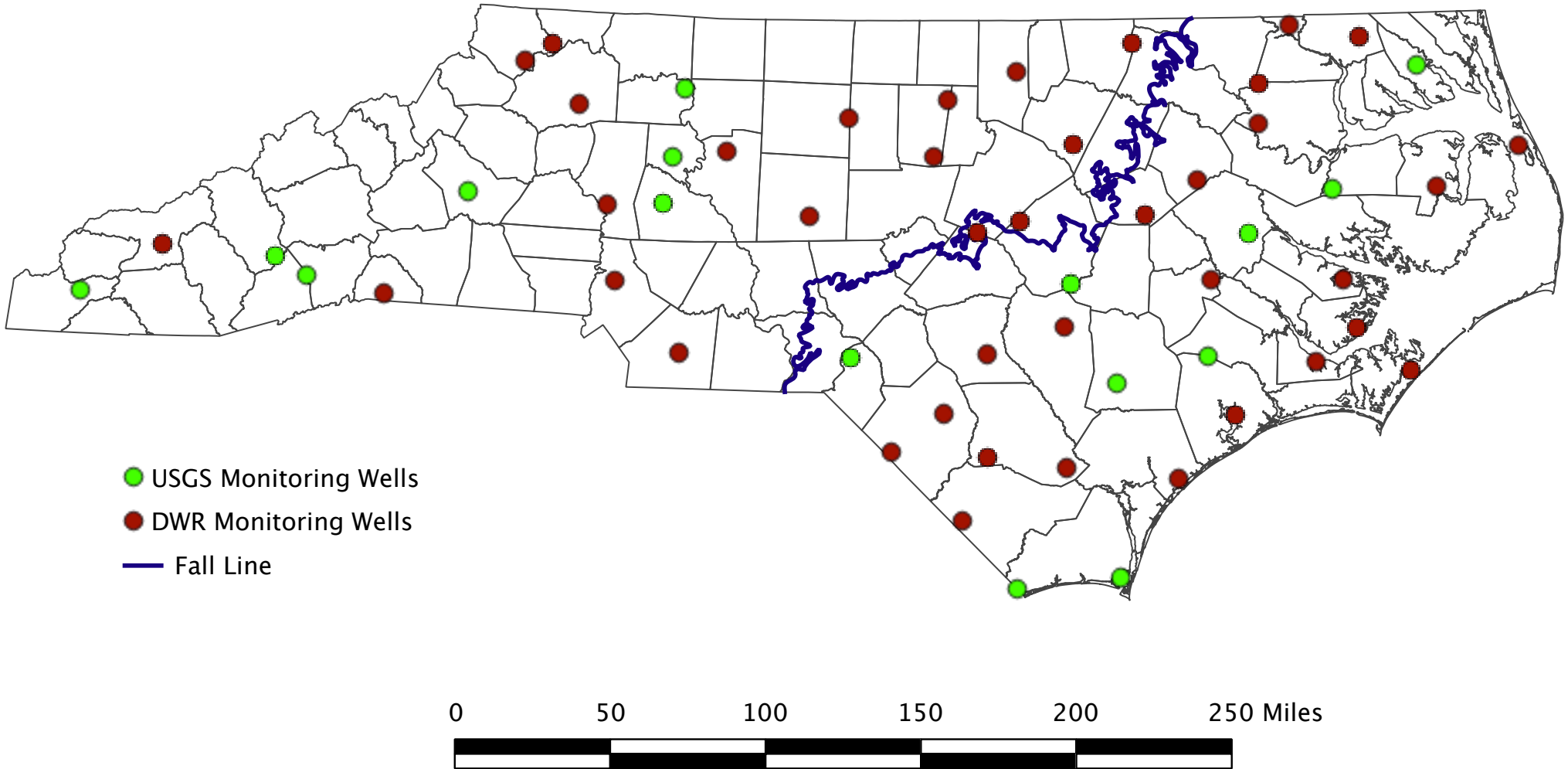
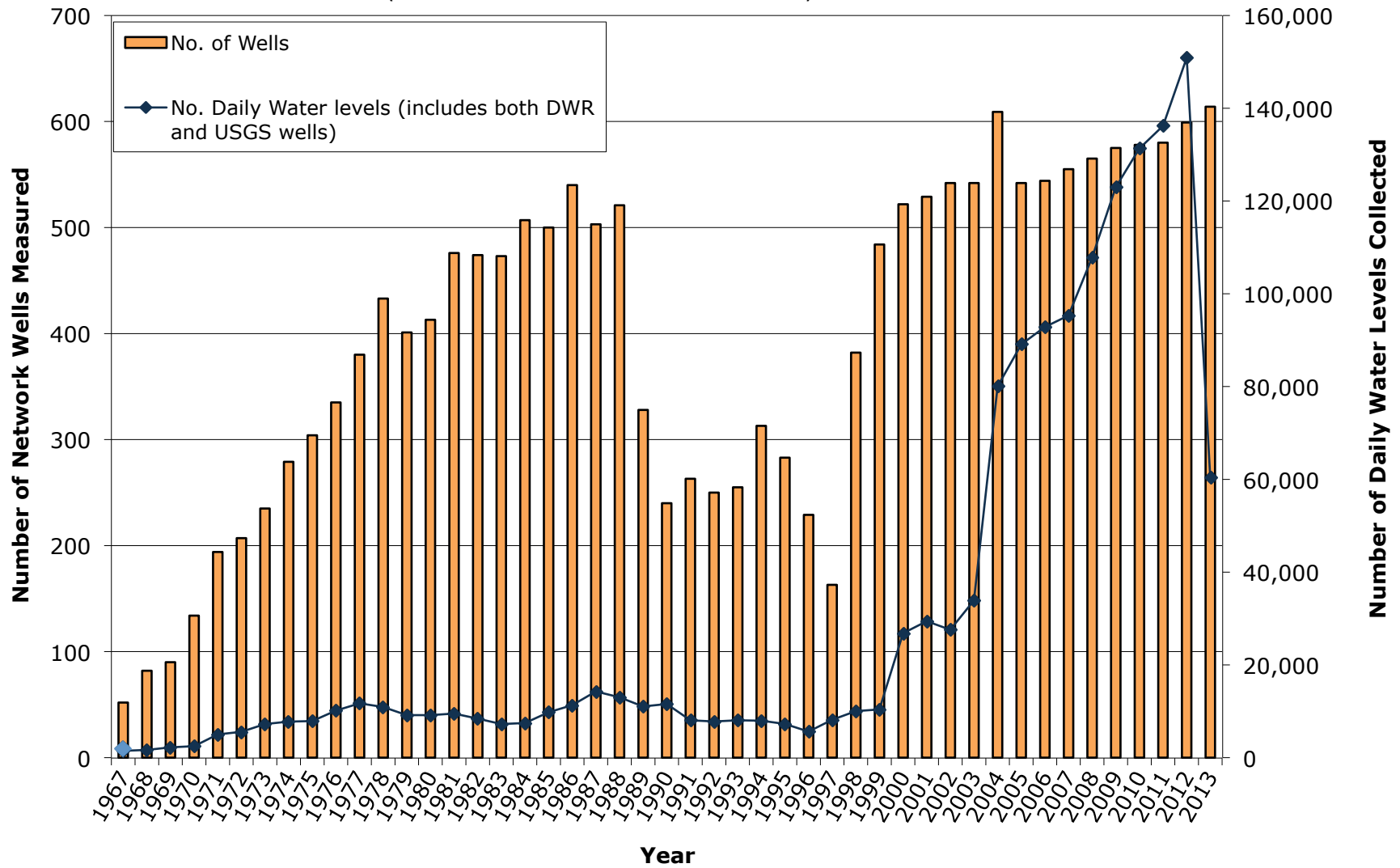


FIGURE 3
 Water Level Data Collected from 1967-2013
 (Plot includes both DWR and USGS Data)



CCPCUA Cretaceous Aquifer Zones

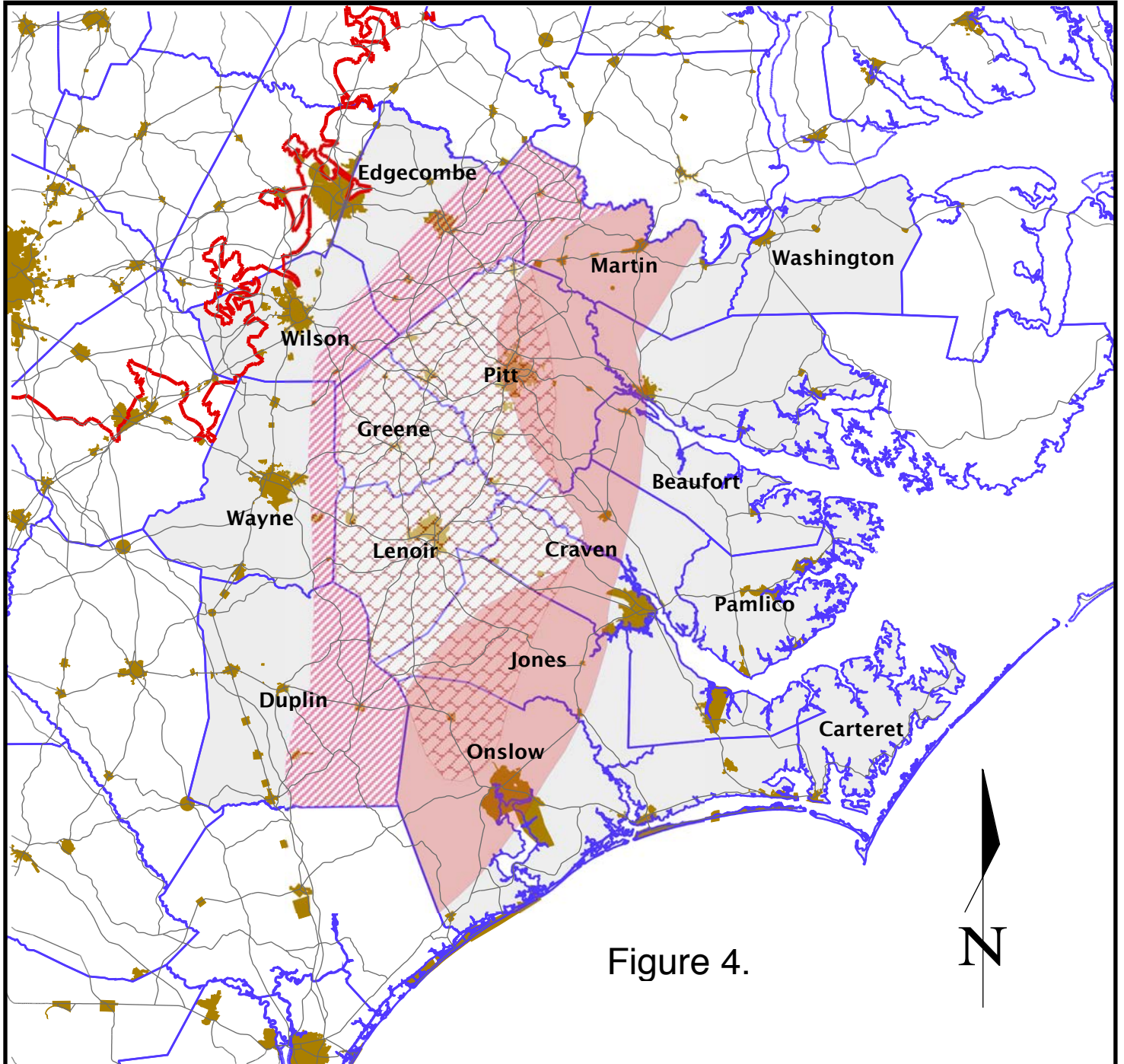





Figure 4.



Scale 1 : 1300000

10 0 10 20 30 40 50 miles

-  Declining Water Level Zone
-  Dewatering Zone
-  Salt Water Encroachment Zone

TABLES

TABLE 1
Site Susceptibility Rating
North Carolina Ground Water Resources Monitoring Well Network
2013 Annual Report

Susceptibility Rating	Description
1	Secure —station is located on State or Federal government property
2	Secure —station is located on local government or school property
3	Moderately secure —station is located on private property, but landowner does not give any indication that land use or property ownership may change
4	Tenuous —station is located on public or private property and landowner is giving indications that land use or property ownership may change
5	Imminent threat —station is on public or private property and landowner desires abandonment of well station.

TABLE 2 Site and Recorder Distribution by Region through 6/30/13 North Carolina Division of Ground Water Resources Monitoring Well Network 2013 Annual Report				
Region	Parameter	Number	% of Region	% of Network
1	Wells	121		19.7
	Sites	40		19.2
	Sutrons	0	0.0	0.0
	WL15s	0	0.0	0.0
	WL16s	25	20.7	4.1
	Hobos	76	62.8	12.4
	All Recorders	101	83.5	16.4
2	Wells	143		23.3
	Sites	39		18.8
	Sutrons	0	0.0	0.0
	WL15s	5	3.5	0.8
	WL16s	9	6.3	1.5
	Hobos	117	81.8	19.1
	All Recorders	131	91.6	21.3
3	Wells	110		17.9
	Sites	30		14.4
	Sutrons	0	0.0	0.0
	WL15s	0	0.0	0.0
	WL16s	13	11.8	2.1
	Hobos	74	67.3	12.1
	All Recorders	87	79.1	14.2
4	Wells	159		25.9
	Sites	48		23.1
	Sutrons	0	0.0	0.0
	WL15s	4	2.5	0.7
	WL16s	21	13.2	3.4
	Hobos	84	52.8	13.7
	All Recorders	109	68.6	17.8
5	Wells	81		13.2
	Sites	50		24.0
	Sutrons	4	4.9	0.7
	WL15s	8	9.9	1.3
	WL16s	10	12.3	1.6
	Hobos	40	49.4	6.5
	All Recorders	62	76.5	10.1

TABLE 3
DWR Monitoring Well Network Statistics (1-1-05) through (6-30-13)
North Carolina Ground Water Resources Monitoring Well Network
2013 Annual Report

Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of monitored wells	542	544	555	565	575	579	591	605	625
Manual water levels (tapedowns)	2,633	2,738	2,618	2,468	2,558	2,911	2,628	2,954	1,596
Daily water levels (automatic recorders)	89,088	92,827	95,329	107,878	122,962	131,317	136,208	150,912	60,452
Total hourly water levels	2,141,368	2,229,355	2,294,909	2,591,447	2,961,371	3,163,187	3,276,496	3,622,891	1,445,008
Chloride Samples	17	22	175	12	17	251	21	274	3
Geophysical & lithologic logs at new stations	2	1	3	1	1	0	2	1	1

TABLE 4
Chloride Field Analysis to Date
Wells Q16G4, Y25Q4, J22P5 and R23X9
Ground Water Resources Monitoring Well Network
2013 Annual Report

Station	Date	Chlorides (ppm)
	09/21/2012	352
	10/04/2010	531
Godley Station	10/01/2007	564
Q16G4	09/15/2004	137
	10/07/1999	91
	07/14/1998	174
	02/23/1981	No Reading Available
	09/12/2012	227
	07/09/2011	296
Folkstone Station	09/25/2007	252
Y25Q4	09/14/2004	266
	10/12/1999	35
	08/06/1998	11
	09/25/1982	No Reading Available
	09/06/2012	172
Gold Point Station	10/04/2010	54
J22P5	09/24/2007	162
	09/30/2004	BDL of 28 **
	09/15/2004	BDL of 28
	06/10/2002	10
	09/11/2012	405
Cove City Station	09/20/2010	463
R23X9	10/05/2007	352
	09/13/2004	309
	10/04/2000	30
Chloride Level for Salt Water		250

**Collected after well development

TABLE 5
Well Construction Information
Ivanhoe, Sampson County, New Hanover Correctional Institute, New Hanover County, and Eagle Point, New Hanover County
Ground Water Resources Monitoring Well Network
2013 Annual Report

Well ID	Station Name	Date Installed	Well Diameter (inches)	Well Depth (ft bls)	Screened Interval (x to y ft bls)	Measuring Pt. (MP) (ft)	Aquifer	Water Level (from MP) (ft)
								Measured - 03/20/13
Y34P9	Ivanhoe	11/20/12	4	458	440-450	3.00	Upper Cape Fear	0.74
								Measured – 10/16/12
CC31U1	New Hanover Correctional Institute	10/04/12	4.5	30	15-25	3.06	Surficial	11.22
								Measured – 06/12/2013
CC29L1	Eagle Point	02/12/2013	4	105	90-100	3.19	Castle Hayne	28.25
CC29L2	Eagle Point	04/12/2013	4	450	370-390	2.92	Lower Peedee	29.42
CC29L3	Eagle Point	04/16/2013	4	24	14-24	3.26	Surficial	8.95
CC29L4	Eagle Point	04/30/2013	4	178	162-172	3.83	Peedee	32.89

TABLE 6
Automatic Water Level Recorders
North Carolina Ground Water Resources Monitoring Well Network
2013 Annual Report

Recorder Type	Number in Service*
Sutron Corporation Model 8400A	4
Global Water Instrumentation, Inc. Model WL15	17
Global Water Instrumentation, Inc. Model WL16	79
HOBO U20 Water Level Logger (including separate barometer per station installed)	495 (includes 104 barometers)
Solinst Telemetry System (STS)	2

***As of June 30, 2013**

Note: Due to the large number of recorders employed by DWR, there are, at any given time, a number of units that are being serviced or replaced. These units are not reflected in the above totals.

TABLE 7 FY 2013-2014 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2013 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		100-110	Yorktown
Pocosin Lake Area	Washington	200-210	Upper Castle Hayne
		350-360	Lower Castle Hayne (saltwater)
		500-510	Beaufort
		600	Pilot Hole (penetrate Beaufort Aquifer)
		20-30	Surficial
Vicinity of Walnut Creek	Wayne	45-55	Black Creek or Surficial
		100-110	Black Creek
		220-230	Upper Cape Fear
		350	Pilot Hole (Top of Basement)
		20-30	Surficial
		30-40	Peedee
Vicinity of Faison/Warsaw	Northwestern Duplin	140-150	Black Creek
		265-275	Upper Cape Fear
		400-410	Lower Cape Fear
		448	Pilot Hole (Lower Cape Fear and Peedee Aquifers pinch out in this area)
		20-30	Surficial
Near Macclesfield	Edgecombe	60-70	Yorktown
		120-130	Upper Cape Fear
		260-270	Lower Cape Fear
		292	Pilot Hole (Top of basement)

TABLE 7 (continued) FY 2013-2014 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2013 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		80-90	Yorktown
		220-230	Castle Hayne
Near Valhalla	Chowan	320-330	Beaufort
		450-460	Upper Cape Fear
		850-860	Lower Cape Fear
		1200-1210	Lower Cretaceous Aquifer
		1300	Pilot Hole (Basement estimated to be 1835)
Burgaw	Pender	20-30	Surficial
		630-640	Upper Cape Fear
		20-30	Surficial
		80-90	Yorktown
Between DWR Godley Station and Town of Aurora	Beaufort	250-260	Upper Castle Hayne
		440-450	Lower Castle Hayne
		610-620	Beaufort
		650-660	Peedee
		700	Pilot Hole
		20-30	Surficial
Moore's Creek National Park	Southern Pender	110-120	Peedee
		330-340	Black Creek
		590-600	Upper Cape Fear
		630	Pilot Hole

TABLE 7 (continued) FY 2013-2014 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2013 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
Kelly	Bladen	280-290	Black Creek
		448-458	Upper Cape Fear
Highway 258	Onslow	668-688	Black Creek
		20-30	Surficial
Nakina	Columbus	380-390	Black Creek
		844-854	Lower Cape Fear
		20-30	Surficial
		124-134	Yorktown
Belhaven	Beaufort	244-254	Upper Castle Hayne
		312-322	Lower Castle Hayne
		388-398	Beaufort
		540-550	Pee Dee
		720-730	Black Creek
		900	Pilot Hole (to penetrate Black Creek)
Turkey	Sampson	20-30	Surficial
		318-328	Upper Cape Fear
		432-442	Lower Cape Fear
Vicinity of Salemburg	Sampson	20-30	Surficial
		80-90	Black Creek
		206-216	Upper Cape Fear
		353	Pilot (Top of Basement)
Town of Laurinburg	Scotland	20-30	Surficial
		120-130	Black Creek
		332-342	Upper Black Creek
		360	Pilot (Top of Basement)

TABLE 7 (continued)
FY 2013-2014 Network Expansion
North Carolina Ground Water Resources Monitoring Well Network
2013 Annual Report

Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
		46-56	Yorktown?
River Park North	Pitt	110-120	Pee Dee?
		150-160	Upper Black Creek
		252-262	Lower Black Creek
		380-390	Upper Cape Fear