



Laurel Springs Station



Cove City Station

**North Carolina
Ground Water Resources
Monitoring Well Network
2014 Annual Report**



Halls Station

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Division of Water Resources

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 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 2014 Annual Report summarizes field activities and conclusions derived from activities performed during the July 1, 2013 through June 30, 2014 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 twenty-eight percent (223 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 627 wells at 212 monitoring stations (sites), divided into five regions, comprising 63 counties (Figure 1). There are 38 wells located in the Piedmont and Mountain physiographic provinces (Piedmont and Mountain) and 589 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 were 41 DWR wells within the monitoring well network used to assess drought conditions in fiscal year 2013. In April 2014, the East Bend Station Well (F61F3) was abandoned. From March 2014 through June 30, 2014, there were 40 DWR drought wells in the monitoring well network. (Figure 2).

Of the 212 monitoring stations, 71 are on State or Federal property, 49 are located on property owned by local governments, 89 are located on private property through agreements with landowners and 3 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,



Windsor Station, Bertie County



DH Conley, Pitt County



Boardman, Robeson County

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 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 if needed, 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 vented or unvented submersible 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. Manual water level readings and daily automatic recorder water level data are typically published on the DWR website. However, hourly data is available upon request for specific wells. Table 2 summarizes site and recorder distribution by region.



Manual Water Level Collection

In addition to the recorders mentioned above, Solinst Telemetry System (STS) recording units have been installed in eight 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 that stores hourly readings. The readings are sent to the home station (DWR web page server) every reporting interval (currently 3 hours) via cell phone modem. DWR uses 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. The STS data is especially helpful in keeping the Drought Indicator well water levels up to date (www.ncwater.org/?page=345).

Seven STS systems were installed in the FY 2013-2014 at the following stations:

- Bryson City, Swain County, O97W2 (02/18/2014);
- Columbus, Polk County, R8211 (02/19/2014);
- Rowland, Robeson County, Z47R5 (04/24/32014);
- Clarendon, Columbus County, DD42N1 (04/24/2014);
- Manteo Airport, Dare County, I4W5 (06/04/2014);
- Topsail Beach, Pender County, BB28J5 (06/12/2014); and
- NC Zoo, Randolph County, M53L1 (06/19/2014);

DWR intends to add at least four STS units in FY 2014-2015.



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 interfaces 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 2015. Section 5.2 summarizes the 2012 chloride sampling event.



Quantab® Chloride Titrators

5.0 Well Network Statistics

5.1 Ground Water Data Collection

Depth to ground water was measured in 627 wells in the 2013- 2014 FY. [Table 3](#) contains DWR monitoring well network statistics from January 1, 2005 through June 30, 2014. 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 2013 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 2014 data was collected through June 2014.

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 continued 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

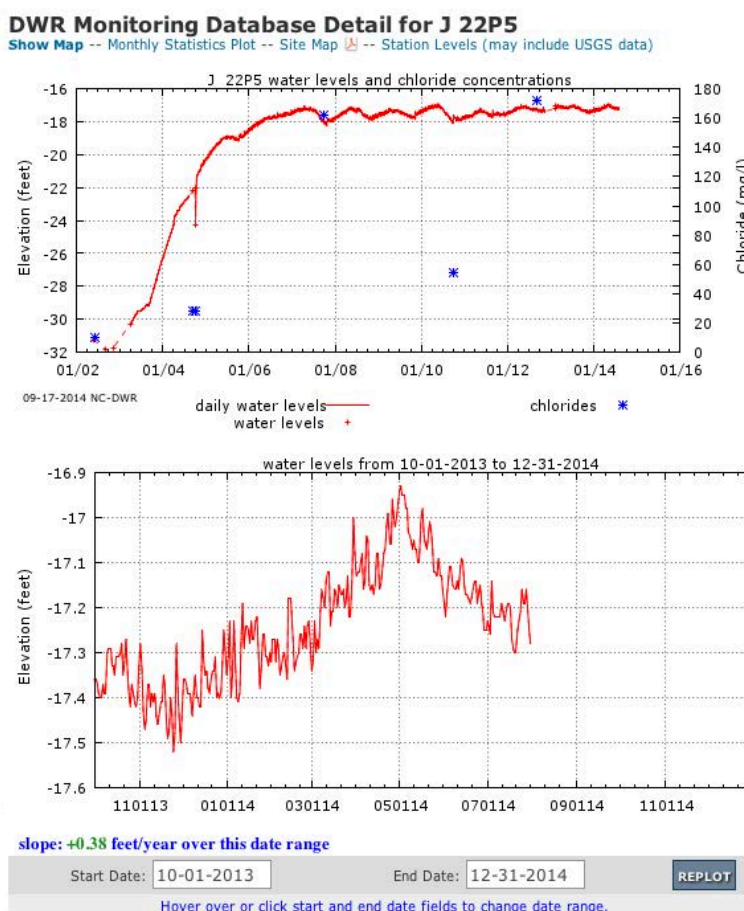
A chloride sampling event was performed in September and October 2012. Ground water from 245 wells within the network was sampled for chlorides using Quantab® chloride titrators. Field data were collected for pH, conductivity, and salinity using YSI® portable probes.

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.

Ground Water Level Database Detail

Field	Data
County	Martin
Quad link to framework	J 22P5
Name link to logs	Gold Point
Latitude	35.856521
Longitude	-77.248202
Location Accuracy	GPS
Netname (link to USGS data)	
USGS ID	
Aquifer	Upper Cape Fear
Land Surface NED elevation = 73.00 feet	72.00
Date Constructed	04/02/2002
Measuring Point (feet above land surface)	2.76
Depth	447.00
Diameter	4.00
Yield	1.00
Exists?	y
Recorder Box?	y
Top of Screen	432.00
Bottom of Screen	442.00
Number of Water Levels {date * feet below land surface * elevation} 05/24/2002 to 07/31/2014	4,054 ** 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 * chlorgpm * spcond_uS/cm * salin_ppt * pH * comments} 06/10/2002 to 09/06/2012	6 ** -1 values equal no data ** a negative number other than -1 equals below detection limit of abs(number)
output files are tab-delimited text NED = National Elevation Dataset, 1/3 arc second value (~10 X 10 meter grid)	

[return to well table](#)



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 type 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 2015.

5.3 Well Installation and Development

From March 2014 through May 2015, the following monitoring wells were installed using the mud rotary drilling method:

- D Canal Road Station, Hyde County, five well, L15T1, L15T2, L15T3, L15T4, L15T5; and
- Nakina Station, Columbus County, three wells, EE39O1, EE39O2, and EE39O3.

A pilot hole was advanced at the D Canal Road Station, Hyde County, using the mud rotary drilling method. Samples of the drill cuttings were collected at ten foot intervals in order to assess the borehole lithology. In addition, a borehole geophysical log was obtained by lowering a probe into the borehole once the borehole was completed. The geophysical log makes a detailed record of the geologic formations in the borehole. Geophysical and lithologic log interpretation enabled the DWR staff to assess well screen intervals and the number of wells to be installed.

A pilot hole was not advanced prior to installing the wells at the Nakina station. This station had a pilot hole advanced in previous years and geophysical logging was conducted at that time.



Well Installation Using Mud Rotary Drilling



Collecting drill cuttings for lithologic interpretation



Drill Cutting Samples



Geophysical Logger

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 overlay 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. These wells are also include in Figure 1.



Stainless Steel Slotted Screen with Tail Pipe



Installing Gravel Pack



Pressure grouting using bentonite grout

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 November 2013 through June 2014:

- Eagle Point Station, Wilmington, New Hanover County, wells CC29L1, CC29L2, CC29L3, CC29L4 (November 2013);
- Thrower Wells Station, Rockingham, Richmond County, wells U52R1, U52R2 (April 2014); and
- Nakina Station, Columbus County, wells EE39O1, EE39O2, EE39O3 (June 2014).

Borehole advancement and well installation included well development. DWR staff will conduct additional well development in September 2014 at the D Canal Road station. Chloride measurement collection will take place subsequent to DWR well development. Chloride samples were collected from the newly constructed wells at the Nakina station in June 2014.



Development Sampling Equipment



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.

5.5 Acquired Network Wells

DWR acquired the following five existing wells and included them into monitoring well network:

- Throver Wells, Rockingham, Richmond County, wells U52R1 and U52R2 (07/23/2013);
- Grassy Ridge Well, Pilot Mountain State Park, Surry County, well E61C1 (01/16/2014);
- East Bend VFD, East Bend, Yadkin County, well F62J1 (02/06/2014); and
- Pilot Mountain Well #1, Pilot Mountain State Park, Surry County, well D61X1 (04/02/2014).

Table 5 includes the detailed information of the acquired monitoring wells. These wells are also included in Figure 1.

5.6 Automatic Water Level Recorders

Automatic water level recorders play an integral role in the DWR monitoring program. Hourly water level measurements are collected using vented or unvented submersible transducers. They allow for economical collection of near-continuous data at remote well stations. Four primary recorders (Global Water WL15 and WL16, Hobo U20 and barometer, Solinst Telemetry System) are utilized and are included in [Table 6](#).



Hobo Including barometer, shuttle, and water level indicator

Solinst Telemetry System (STS) recording units have been installed in eight 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 that stores hourly readings. The readings are sent to the home station (DWR web page server) every reporting interval (currently 3 hours) via cell phone modem.



Global Water WL 16 including iPAQ, field book and calculator



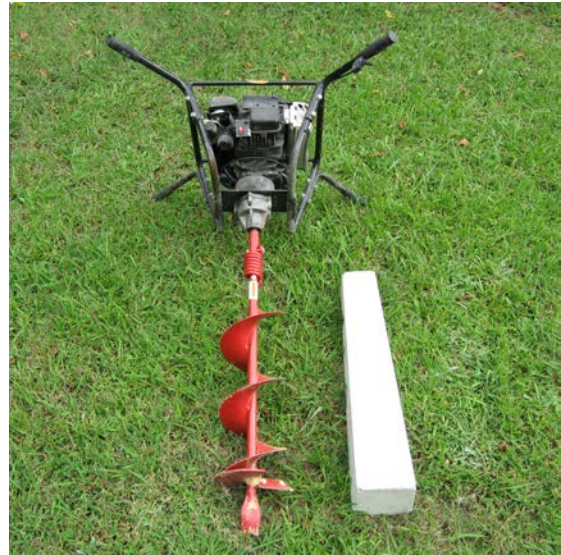
Solinst Telemetry System



STS Final Installation Complete with Solar Panel

5.7 Site Surveys

Concrete survey monuments continue to be installed at each of the 212 monitoring well stations within the network. Monuments have been installed at 196 stations and five of those stations have more than one monument. Ten of the stations are on hold pending the results of the extremely involved process associated with monitoring wells stations located on military bases. Six stations are scheduled to have monuments installed in FY 2014-2015. 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.



Auger and Monument



Monument Installed



Top of monument - survey point

6.0 Planned Activities for FY 2014-2015

6.1 New Well Installation

Monitoring well network expansion efforts for FY 2014-2015 will be focused on Bladen, Duplin, Pender, 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 2014-2015.

6.2 Well Abandonment

Monitoring well F61F3, East Bend Station, Yadkin County was abandoned in April 2014.

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 2013 CCPCUA Assessment Report.

The final CCPCUA Assessment Report was presented to the EMC in November 2013. Based on analysis of water level and chloride concentration conditions in the CCPCUA that were gathered through January 2013, and a thorough review of aquifer conditions, DWR concluded that no action needs to be taken by the EMC to alter either the reduction zone boundaries or rule

language in 15A NCAC 2E .0503. However, DWR does 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.

Although the CCPCUA rules require assessments to be produced in 2008, 2013, and 2018, the DWR 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. 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 627 monitoring wells at 212 individual stations. From July 2013 through June 2014, ground water level data were collected from 627 wells within the network. These data include manual measurements taken quarterly from wells, plus hourly water levels collected using automatic data recorders from 498 wells.

Eight STS systems have been installed as of FY 2013-2014 on drought monitoring network wells. The addition of the STS systems will replace monthly site visits and provide positive economic impacts. DWR intends to add four STS units in the 2014-2015 fiscal year.

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. Three additional samples were collected, one from each of the new wells installed at Nakina. 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 2015.

Eight monitor wells have been installed at two different stations during the FY 2013-2014. Five monitoring wells were installed at D Canal Road (Hyde County), and three wells were installed at Nakina (Columbus County). Borehole advancement and well installation included, but not limited to, well development and collection of chloride measurements.

Five wells were acquired and added to the monitoring well network in FY 2013-2014: Thrower Wells (2 wells), Richmond County; Grassy Ridge Well, Surry County; East Bend VFD, Yadkin County; and Pilot Mountain Well #1, Surry County.

One well was abandoned (F61F3, East Bend, Yadkin County) in April 2014.

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.

DWR continues to collect depth to water level measurements and chloride sampling event data from monitor wells within the well network and permitted withdrawal wells to assess aquifer conditions.

DWR has tentative plans to expand the monitoring well network by installing up to 13 wells at four sites in FY 2014/2015. 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 is being used to assess aquifer conditions and determine whether or not changes to the rule 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.

FIGURES

Figure 1: North Carolina Division of Water Resources Monitoring Stations August 2014

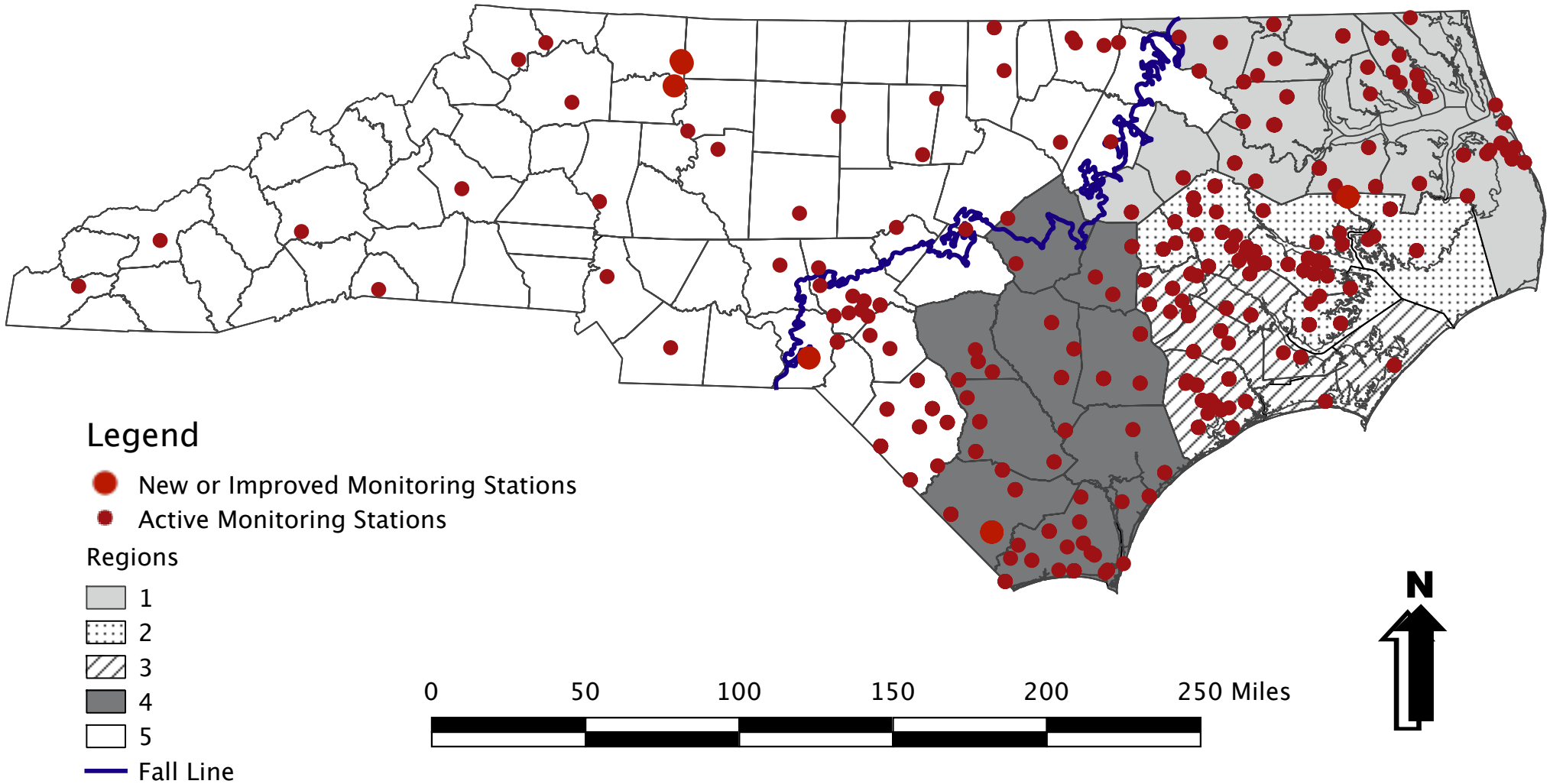


Figure 2: Drought Indicator Wells

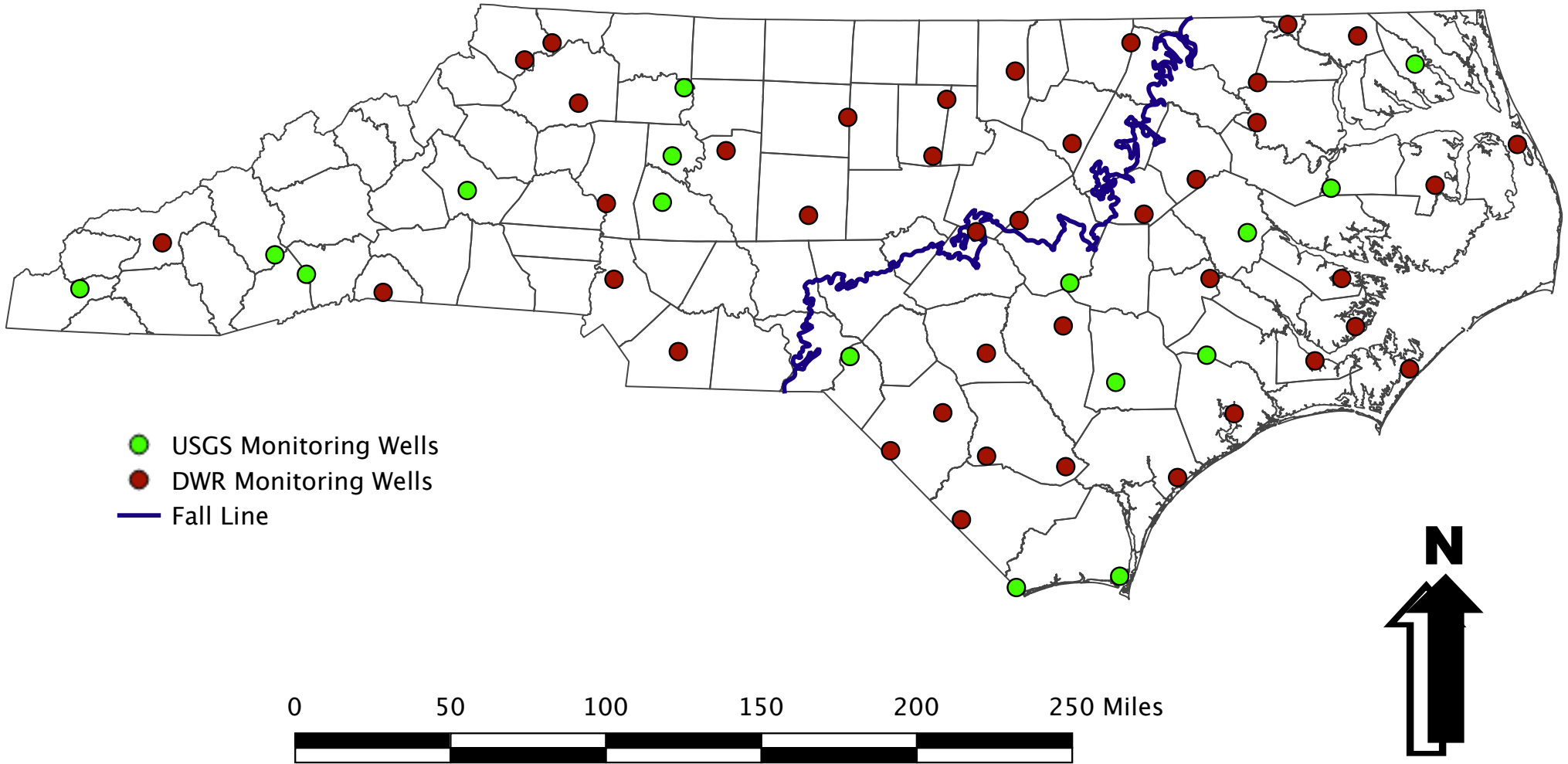
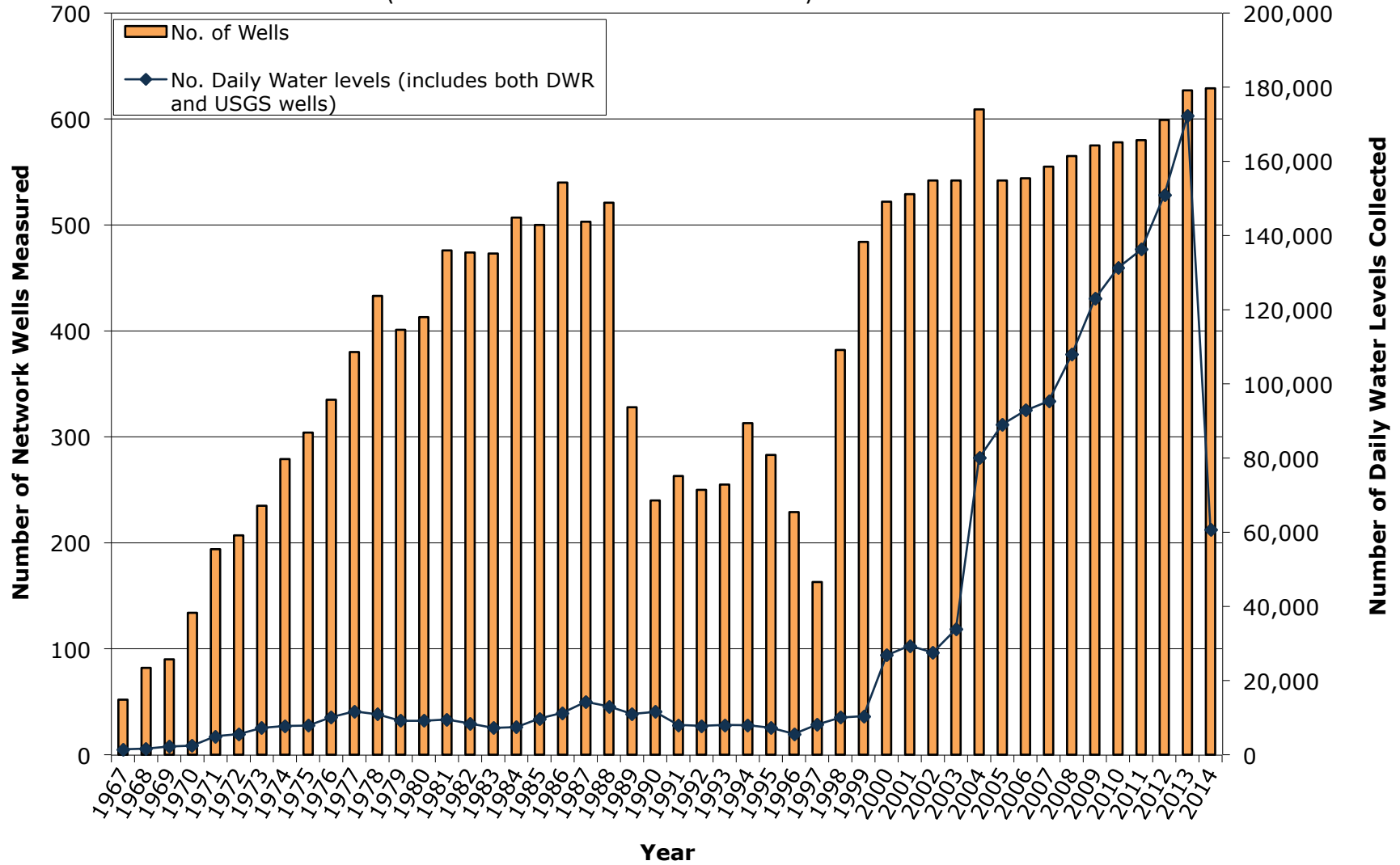


FIGURE 3

Water Level Data Collected from 1967-2014
(Plot includes both DWR and USGS Data)



CCPCUA Cretaceous Aquifer Zones

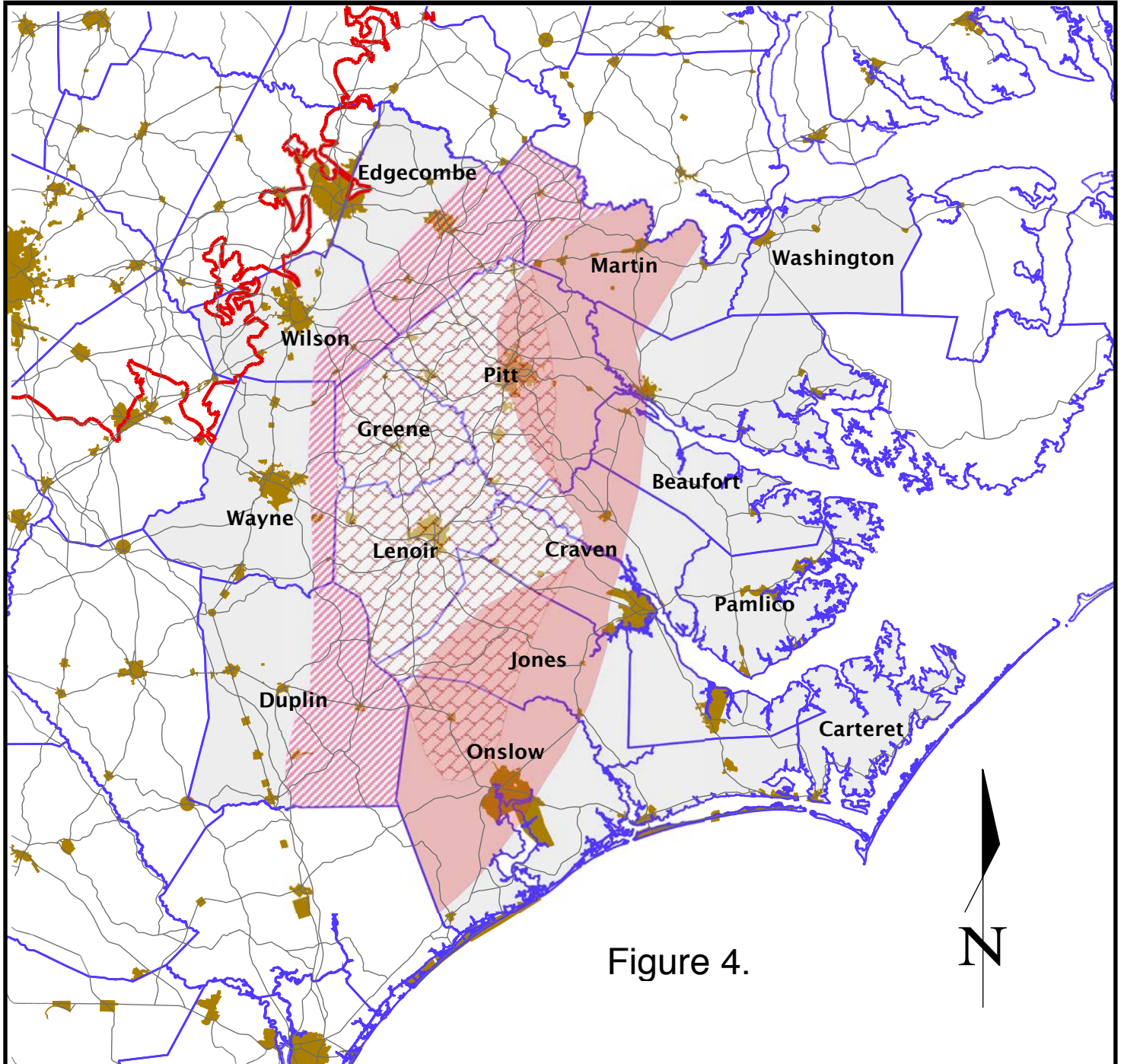





Figure 4.



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
2014 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 6/30/14 North Carolina Division of Ground Water Resources Monitoring Well Network 2014 Annual Report				
Region	Parameter	Number	% of Region	% of Network
1	Wells	121		19.3
	Sites	40		18.9
	WL15s	0	0.0	0.0
	WL16s	16	13.2	2.6
	Hobos	83	68.6	13.2
	All Recorders	99	81.8	15.8
2	Wells	148		23.6
	Sites	40		18.9
	WL15s	1	0.7	0.2
	WL16s	6	4.1	1.0
	Hobos	123	83.1	19.6
	All Recorders	130	87.8	20.7
3	Wells	110		17.5
	Sites	30		14.2
	WL15s	0	0.0	0.0
	WL16s	1	0.9	0.2
	Hobos	86	78.2	13.7
	All Recorders	87	79.1	13.9
4	Wells	163		26.0
	Sites	48		22.6
	WL15s	0	0.0	0.0
	WL16s	13	8.0	2.1
	Hobos	97	59.5	15.5
	All Recorders	110	67.5	17.5
5	Wells	85		13.6
	Sites	53		25.0
	WL15s	6	7.1	1.0
	WL16s	22	25.9	13.5
	Hobos	43	50.6	6.9
	All Recorders	71	83.5	11.3

TABLE 3
DWR Monitoring Well Network Statistics (01-01-2005 through 06-30-2014)
North Carolina Ground Water Resources Monitoring Well Network
2014 Annual Report

Parameter	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of monitored wells	542	544	556	565	575	579	591	605	627	629
Manual water levels (tapedowns)	2,633	2,738	2,621	2,468	2,558	2,911	2,628	2,954	3,269	1,371
Daily water levels (automatic recorders)	89,088	92,827	95,329	107,878	122,962	131,317	136,208	150,912	172,172	60,655
Total hourly water levels	2,141,368	2,229,355	2,294,909	2,591,447	2,961,371	3,163,188	3,276,496	3,622,891	4,130,467	1,448,633
Chloride Samples	17	22	175	12	17	251	21	274	3	4
Geophysical & lithologic logs at new stations	2	1	3	1	1	0	2	1	1	1

TABLE 4
Chloride Field Analysis to Date
Wells Q16G4, Y25Q4, J22P5 and R23X9
Ground Water Resources Monitoring Well Network
2014 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 for 2013-2014 FY Well Installation
D Canal, Hyde County and Nakina, Columbus County
Ground Water Resources Monitoring Well Network
2014 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 Date Measured (from MP) (ft)
L15T1	D Canal Rd	03/27/2014	4	110	76-86	-	NDY	-
L15T2	D Canal Rd	04/10/2014	4	590	553-563	-	NDY	-
L15T3	D Canal Rd	04/10/2014	4	28	10-20	-	NDY	-
L15T4	D Canal Rd	04/16/2104	4	360	344-354	-	NDY	-
L15T5	D Canal Rd	04/17/2014	4	295	280-290	-	NDY	-
EE39O1	Nakina	05/22/2014	4.5	859	844-854	2.70	Lower Cape Fear	-31.51 (08/06/2014)
EE39O2	Nakina	05/22/2104	4.5	23	8-18	3.40	S	4.79 (07/17/2014)
EE39O3	Nakina	05/30/2014	4.5	375	360-390	3.20	Black Creek	40.03 (07/17/2014)
Wells Construction Information for Wells Acquired in FY 2013-2014								
Well ID	Station Name	Date Acquired	Well Diameter (inches)	Well Depth (ft bls)	Screened Interval (x to y ft bls)	Measuring Pt. (MP) (ft)	Aquifer	Water Level Date Measured (from MP) (ft)
U52R1	Thrower Wells	07/23/2013	24	56	0-0	1.52	Surficial	11.88 (09/10/2013)
U52R2	Thrower Wells	07/23/2013	24	56	0-0	1.35	Surficial	9.96 (09/10/2013)
E61C1	Grassy Ridge Well	01/16/2014	6	183	55-183	2.19	Bedrock	62.67 (01/16/2014)
F62J1	East Bend VFD	02/06/2014	6.25	603	81-603	1.71	Bedrock	30.18 (02/06/2014)
D61X1	Pilot Mountain Well No.1	04/02/2104	6.25	297	40-297	0.41	Bedrock	45.26 (04/02/2014)

NDY – Not Yet Determined

TABLE 6 Automatic Water Level Recorders North Carolina Ground Water Resources Monitoring Well Network 2014 Annual Report	
Recorder Type	Number in Service*
Global Water Instrumentation, Inc. Model WL15	7
Global Water Instrumentation, Inc. Model WL16	59
HOBO U20 Water Level Logger (including separate barometer per station installed)	552 (includes 120 barometers)
Solinst Telemetry System (STS)	8

***As of June 30, 2014**

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 2014-2015 Network Expansion North Carolina Ground Water Resources Monitoring Well Network 2014 Annual Report			
Station Name/Quad	County	Proposed New Well Screens (ft bls)	Aquifer
		20-30	Surficial
Vicinity of Walnut Creek	Wayne	45-55	Black Creek?
		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)
Burgaw Station	Pender	20-30	Surficial
Additional Wells		630-640	Upper Cape Fear
Kelly Station	Bladen	280-290	Black Creek
Additional Wells		448-458	Upper Cape Fear