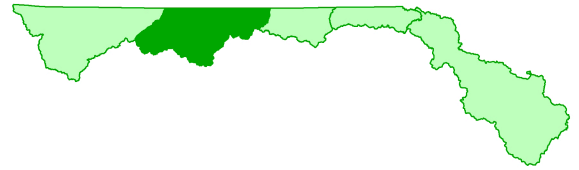


LOWER DAN RIVER SUBBASIN



HUC 03010104

Includes: Dan River, Country Line Creek, Lake Roxboro, Hyco River, Hyco Lake, Marlowe Creek, Mayo Reservoir & Aarons Creek

SUBBASIN WATER QUALITY OVERVIEW

The Lower Dan River Subbasin is the second western most subbasin and runs along the North Carolina/Virginia state line. The subbasin contains two impaired streams: Dan River is Impaired for fecal coliform bacteria and turbidity; and Marlowe Creek is Impaired for biological integrity as well as zinc in the downstream segment.

During this assessment cycle (2004-2009), the subbasin experienced a moderate drought in 2005 and 2006 as well as a prolonged drought between 2007 and 2008. Monitoring the biological community during this time showed a small percent improved. There were no major ambient monitoring violations; however, there were a few elevated levels for turbidity and fecal coliform bacteria.

SUBBASIN AT A GLANCE

COUNTIES:

Rockingham, Caswell, Person, & Granville

MUNICIPALITIES:

Reidsville, Yanceyville, Milton, & Roxboro

ECOREGIONS:

Northern Inner Piedmont, Southern Outer Piedmont, & Northern Outer Piedmont

PERMITTED FACILITIES:

NPDES Dischargers:	67
Major	3
Minor	8
General	56
NPDES Non-Dischargers:	26
Stormwater:	12
General	11
Individual	1
Animal Operations:	11

POPULATION:

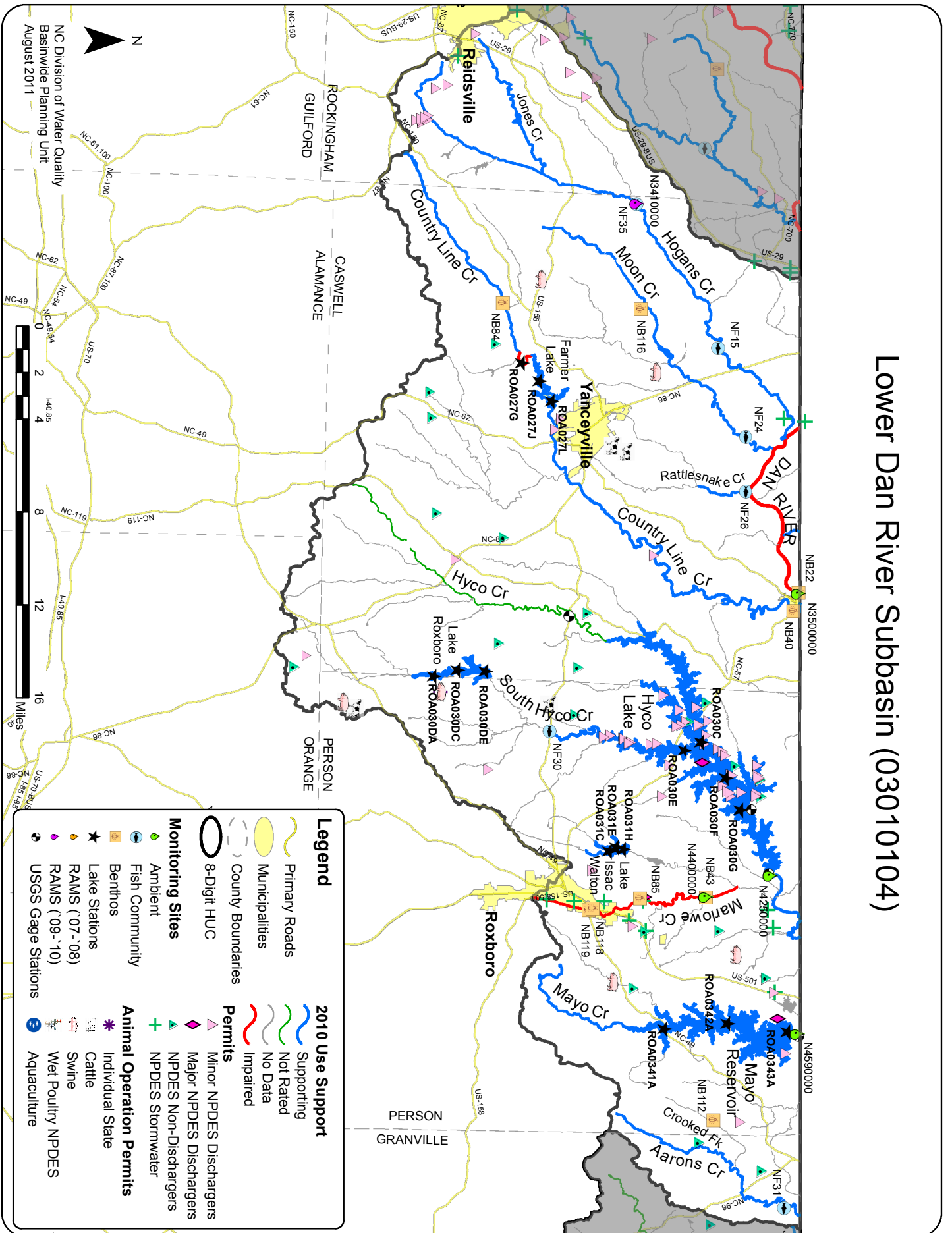
2010 Census.....50,017

2006 LAND COVER:

Open Water.....	2.2%
Developed.....	4.7%
Forest	61.8%
Agriculture.....	19.5%
Wetlands	1.3%
Barren Land	0.2%
Shrub/Grassland	10.3%

Lower Dan River Subbasin (03010104)

FIGURE 2-1: LOWER DAN RIVER SUBBASIN (03010104)

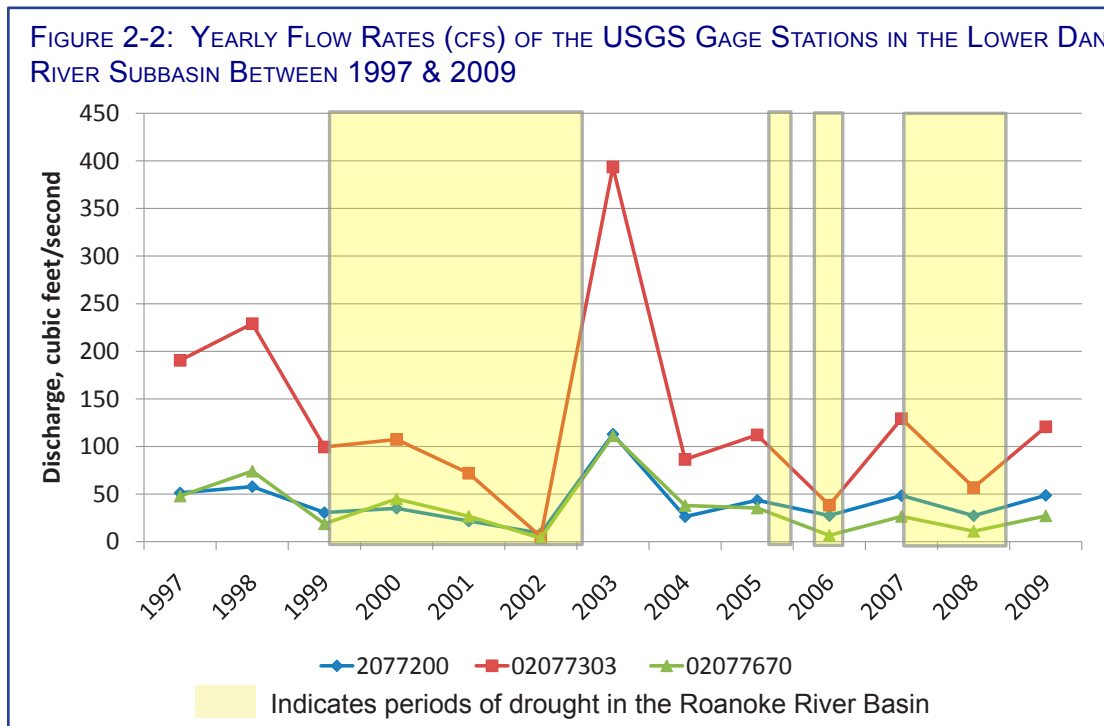


WATER QUALITY DATA SUMMARY FOR THIS SUBBASIN

Monitoring stream flow, aquatic biology and chemical/physical parameters is a large part of the basinwide planning process. More detailed information about DWQ monitoring and the effects each parameter has on water quality is discussed in Chapters 2 and 3 of the [Supplemental Guide to North Carolina's Basinwide Planning](#) document.

STREAM FLOW

The basin experienced prolonged droughts from 1998-2002 and again from 2007-2008, with moderate droughts in 2005 and 2006 (Figure 2-2). More detail about flows in the Roanoke River Basin can be found in the [2010 Roanoke River Basinwide Assessment Report](#) produced by DWQ-Environmental Science Section.



From Left to Right:

- 2077200: Hyco Creek (Leasburg)
- 2077303: Hyco River (McGehees)
- 2077670: Mayo Creek (Bethel Hill)

BIOLOGICAL DATA

Biological samples were collected during the spring and summer months of 2009 by the DWQ-Environmental Sciences Section as part of the five year basinwide sampling cycle, in addition to special studies. Overall, 12 biological sampling sites were monitored within the Lower Dan River Subbasin. The ratings for each of the sampling stations can be seen in [Appendix 2-B](#).

Benthic Macroinvertebrate Sampling

Each benthic station monitored during the current cycle is shown in Figure 2-3 and color coded based on the current rating. Each of the sites are discussed in more detail in the watershed section below. Figure 2-5 is a comparison of benthic site ratings sampled during the last two basinwide cycles to indicate if there are any overall shifts in ratings. Of the two existing sites, one declined and one improved.

BENTHIC SAMPLING SUMMARY	
💧 Total Stations Monitored	6
💧 Total Samples Taken	6
💧 Number of New Stations	4

FIGURE 2-3: BENTHIC STATIONS COLOR CODED BY CURRENT RATING IN THE LOWER DAN RIVER SUBBASIN

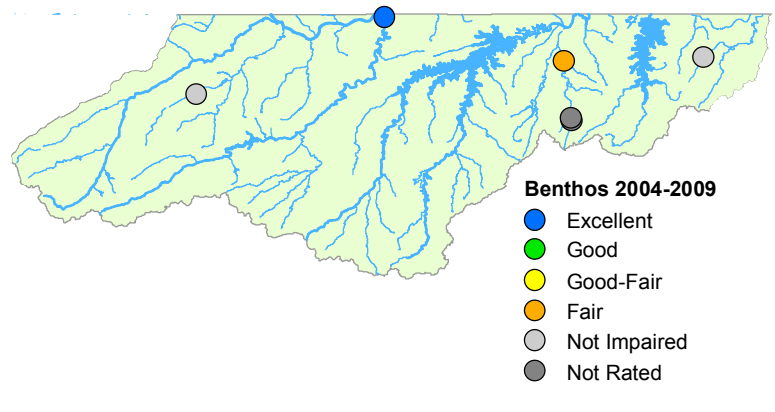


FIGURE 2-4: CURRENT BENTHIC SITE RATINGS

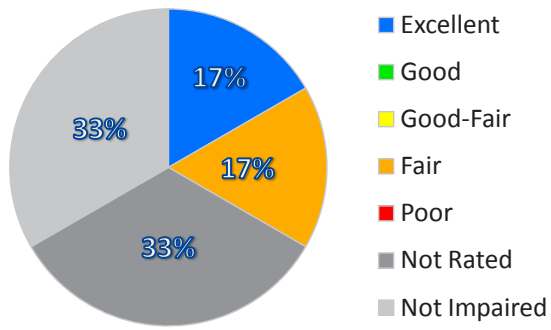
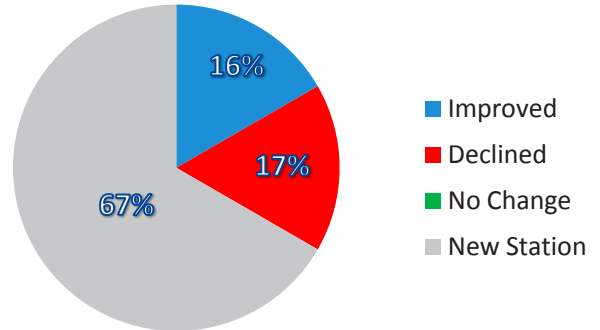


FIGURE 2-5: CHANGE IN BENTHIC SITE RATINGS

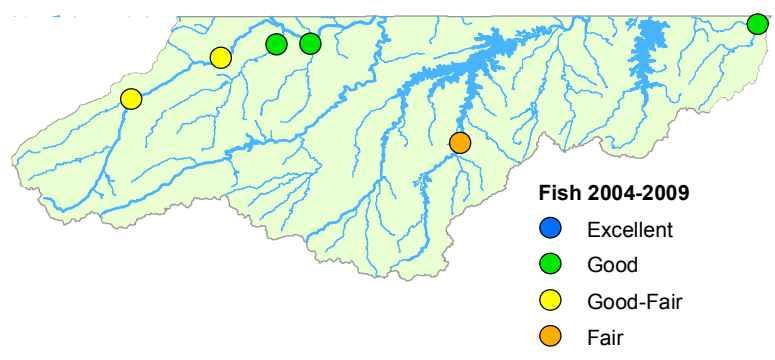


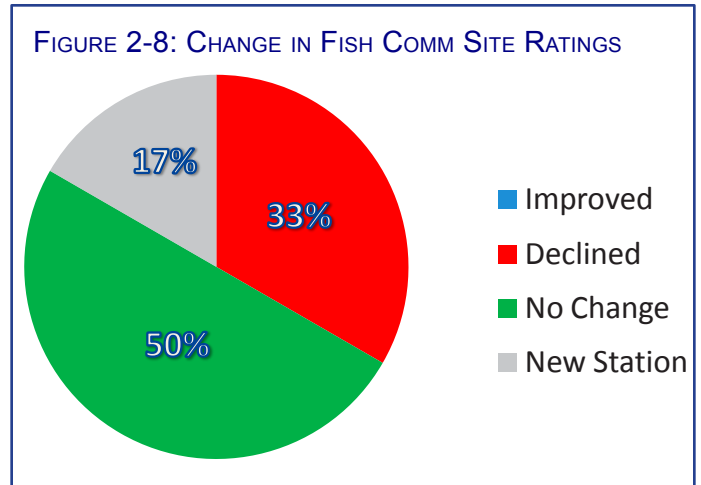
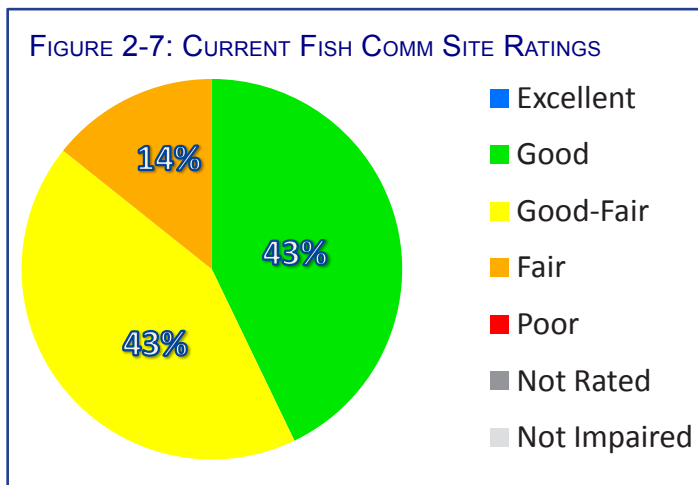
Fish Community Sampling

Each fish community station monitored during the current cycle is shown in Figure 2-6 and color coded based on the current rating. Each of the sites are discussed in more detail in the watershed section below. Figure 2-7 shows the percentages of each rating given during this sampling cycle within this subbasin. Figure 2-8 is a comparison of fish community site ratings sampled during the last two cycles to determine if there are any overall watershed shifts in ratings. Overall, the community is relatively stable.

FISH COM. SAMPLING SUMMARY	
🌊 Total Stations Monitored	6
🌊 Total Samples Taken	7
🌊 Number of New Stations	1

FIGURE 2-6: FISH COMMUNITY STATIONS COLOR CODED BY CURRENT RATING IN THE LOWER DAN RIVER SUBBASIN





For more information about biological data in this subbasin, see the [2010 Roanoke River Basinwide Assessment Report](#). Detailed data sheets for each sampling site can be found in [Appendix 2-B](#).

Fish Kills/Spill Events

Mayo Creek:

A site visit, conducted on 30 March 2004 by DWQ staff, resulted in the observation of approximately 60 dead common carp in various stages of decay within 500 meters of the reservoir spillway. There were also approximately 200 live carp congregating in the shallow areas and around spillway. Approximately 50% of the live carp had sores on top of their head and body. Many carp were very lethargic and unresponsive, as was a bluehead chub. Live carp were in spawning condition, but no spawning activity was observed. Four specimens were sent to Warm Springs Fish Health Center, Georgia, for analysis. There are no known causes.

Bowes Branch:

The La. Pacific Corporation plant near Roxboro experienced a serious fire within the production facility. A subsequent fish kill occurred in the company's fire pond. During the fire, large quantities of water were pulled from the pond to spray on the fire. Runoff was at times about 3 to 4 inches deep running from the building to the stormwater system, thereby returning to the pond. The fire began at 2:41 AM on June 13, 2006, and the use of water ended about 4:30 PM. Production units that burned included mixers in which the chemicals methyl diisocyanate, paraformaldehyde, and paraffin wax were being applied to wood. Some undetermined quantity of these materials returned to the pond with the recycling firewater. There was heavy rain from the remnants of tropical depression Alberto most of the day of June 14, as well. Dead fish were observed and reported at about 7:35 AM on June 15. The pond was also observed at that time to have a reddish material floating along one edge where the wind had moved it. A total of 290 fish were observed killed the first day: 113 bass, 50 carp, and 127 sunfish. None was observed to be diseased, malformed, or otherwise abnormal. The next day, another 50 were gathered, 20 bass and 30 sunfish. About half were "fresh" enough to have expired overnight.

AMBIENT DATA

The ambient data are used to develop use support ratings every two years, which are then reported to the EPA via the Integrated Report (IR). The IR is a collection of all monitored waterbodies in North Carolina and their water quality ratings. The most current IR is the 2010 version and is based on data collected between 2004 and 2008. The ambient data reported in this basin plan were collected between 2005 and 2009 and will be used for the 2012 IR. If a waterbody receives an Impaired rating, it is then placed on the 303(d) Impaired Waters List. The Roanoke River Basin portion of the 2010 IR can be found in [Appendix 2-A](#) and the full 2010 IR can be found on the [Modeling & TMDL Unit's](#) website.

Four Ambient Monitoring System (AMS) stations are located in the Lower Dan River subbasin (see Figure 2-1 for the station locations). During the current sampling cycle (January 2005 and December 2009), samples were collected for all parameters on a monthly basis except metals which were sampled quarterly until May

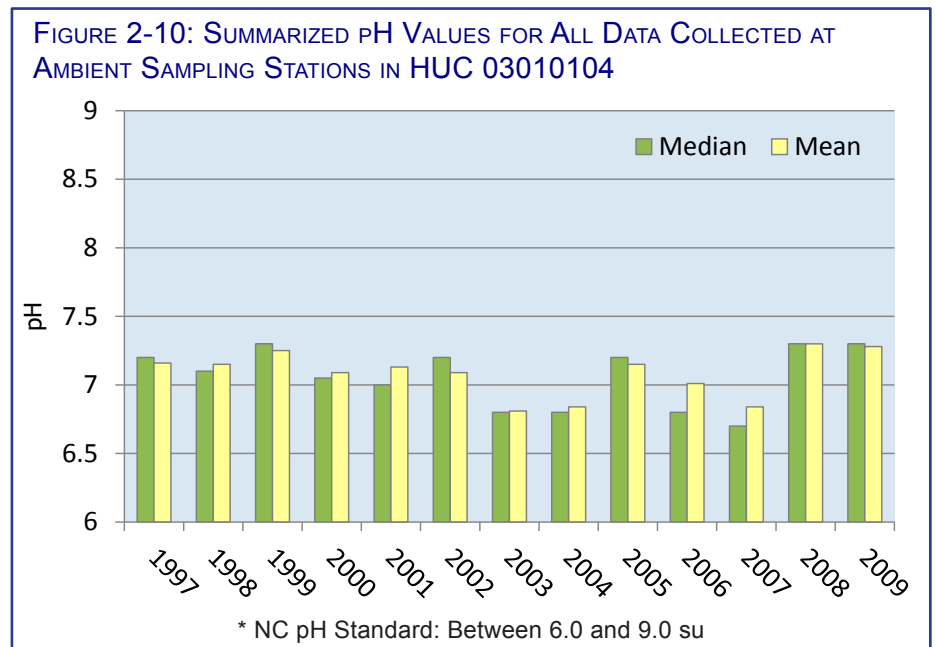
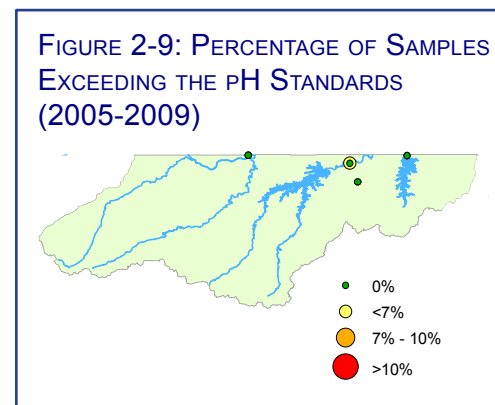
2007 when metals sampling was suspended. For more information about the ambient monitoring, parameters, how data are used for use support assessment and other information, see Chapter 2 of the [Supplemental Guide to North Carolina's Basinwide Planning](#).

Long Term Ambient Monitoring

The following discussion of ambient monitoring parameters of concern include graphs showing the median and mean concentration values for each ambient station in this subbasin by specific parameter over a 13 year period (1997-2009). The geometric mean is a type of mean or average, which indicates the central tendency or typical value of a set of numbers. The graphs are not intended to provide statistically significant trend information, but rather an idea of how changes in land use or climate conditions can affect parameter readings over the long term. The difference between median and mean results indicate the presence of outliers in the data set. Box and whisker plots of individual ambient stations were completed by parameter for data between 2005 and 2009 by DWQ's Environmental Sciences Section (ESS) and can be found in the [Roanoke River Basin Ambient Monitoring System Report](#).

pH

Figure 2-10 shows the mean and median pH levels for all samples taken over the course of 13 years in the Lower Dan River Subbasin. Station N4250000 had two percent of samples exceeding the low pH standard of 6.0 as shown by the yellow dot in Figure 2-9. The pH levels in this subbasin remain mostly stable throughout this time frame.



Turbidity

Two of the four AMS stations in the Lower Dan River subbasin exceeded the state's turbidity standard in 5 to 16 percent of samples, as seen in Figure 2-11 indicated by yellow and red dots. Possible sources of the elevated turbidity levels are discussed in the 10-digit watershed section. Figure 2-12 shows the mean and median turbidity levels for all samples taken over the course of 13 years in the Lower Dan River subbasin. The yearly averages are well below the state standard of 50 NTUs.

While some erosion is a natural phenomenon, human land use practices may accelerate the process to unhealthy levels for aquatic life. Construction sites, mining operations, agricultural operations, logging operations and excessive stormwater flow off impervious surfaces are all potential sources. Turbidity exceedances demonstrate the importance of [protecting and conserving stream buffers and natural areas](#).

FIGURE 2-11: PERCENTAGE OF SAMPLES EXCEEDING THE TURBIDITY STANDARD (2005-2009)

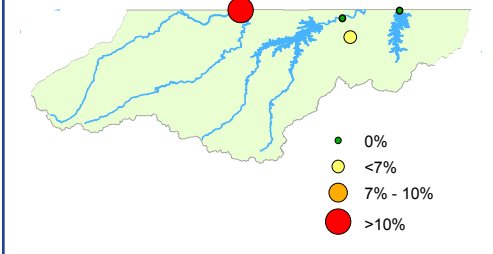
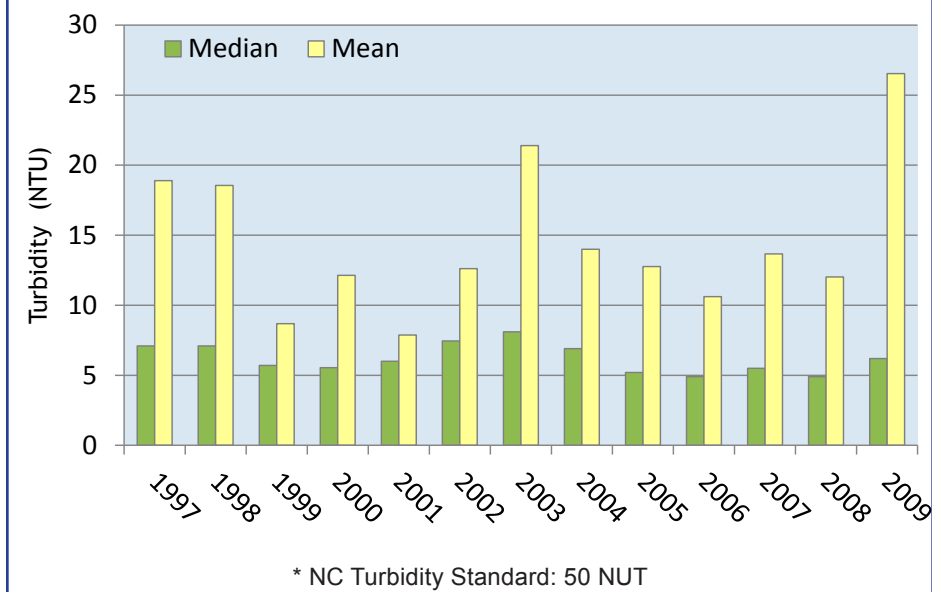


FIGURE 2-12: SUMMARIZED TURBIDITY VALUES FOR ALL DATA COLLECTED AT AMBIENT SAMPLING STATIONS IN HUC 03010104



Dissolved Oxygen (DO)

As seen in Figure 2-13, none of the four sites recorded DO standard exceedance during this monitoring cycle. Figure 2-14 shows the mean and median of DO levels for all samples taken over the course of 13 years in the Lower Dan River subbasin. These averages are well within the normal DO range.

FIGURE 2-13: PERCENTAGE OF SAMPLES EXCEEDING THE DO STANDARD (2005-2009)

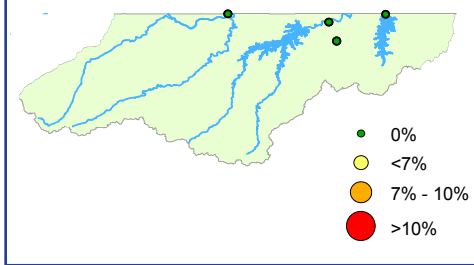
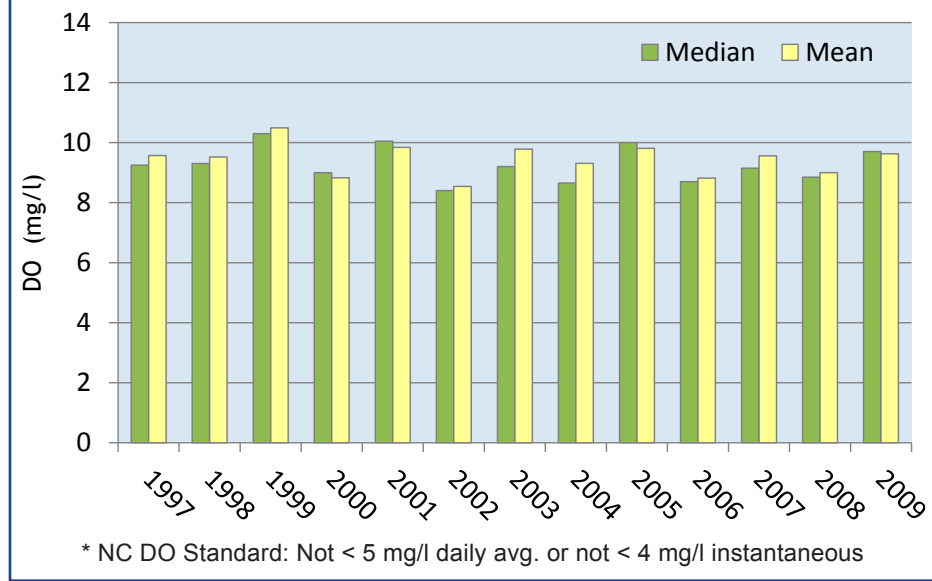


FIGURE 2-14: SUMMARIZED DO VALUES FOR ALL DATA COLLECTED AT AMBIENT SAMPLING STATIONS IN HUC 03010104



Fecal Coliform Bacteria

Fecal coliform bacteria (FCB) occurs in water as a result of nonpoint sources such as animal waste from wildlife, farm animals and/or pets, as well as from sanitary sewer overflows (SSOs). The FCB standard for freshwater streams is not to exceed the geometric mean of 200 colonies/100 ml, or 400 colonies/100 ml in 20% of the samples where five samples have been taken in a span of 30 days (5-in-30). Only results from a 5-in-30 study are used to indicate whether the stream is Impaired or Supporting. Waters with a use classification of B (primary recreational waters) receive priority for 5-in-30 studies. Other waters are studied as resources permit.

As seen in Figure 2-15, two of the four sites had between 6.9% and 20% of samples over 400 colonies/100 ml. Possible sources of elevated levels of FCB are discussed in the subwatershed sections. Figure 2-16 shows the yearly geometric mean (calculated average) for all samples taken over the course of 13 years in the Lower Dan River subbasin. The highest yearly geometric mean was recorded in 2001 (56 colonies/100 ml). The figure also includes the yearly average stream flow, as seen in Figure 2-2, to show how flow can be closely linked to FCB levels.

FIGURE 2-15: PERCENTAGE OF SAMPLES WITH ELEVATED FCB LEVELS (2005-2009)

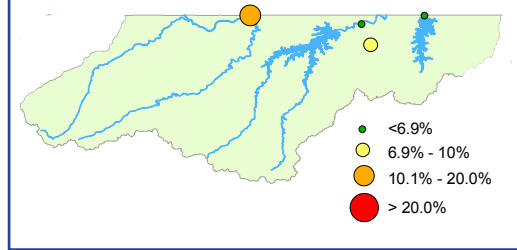
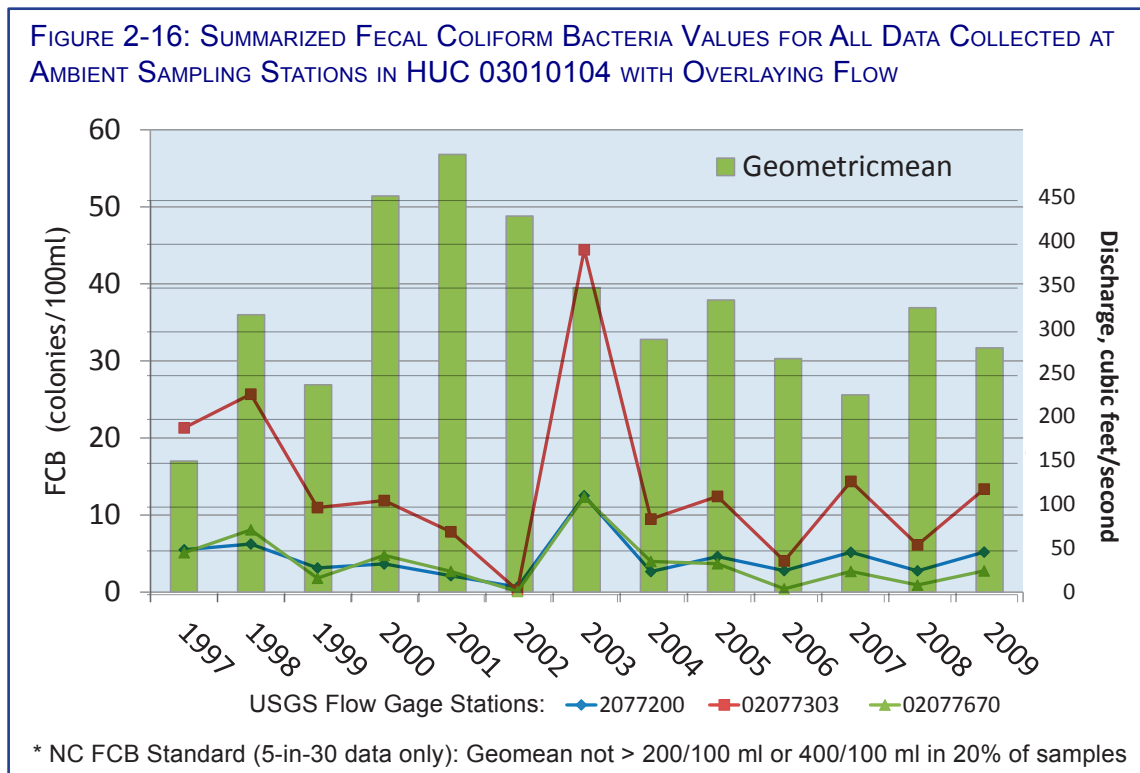


FIGURE 2-16: SUMMARIZED FECAL COLIFORM BACTERIA VALUES FOR ALL DATA COLLECTED AT AMBIENT SAMPLING STATIONS IN HUC 03010104 WITH OVERLAYING FLOW



Additional information about possible causes of parameters discussed above for particular stations, see the stream write ups below. For more information regarding any of the parameters listed above, see Section 3.3 of the [Supplemental Guide to North Carolina's Basinwide Planning](#). For additional information about ambient monitoring data collected in this river basin, see the [Roanoke River Basin Ambient Monitoring System Report](#).

UNDERSTANDING THE DATA

Biological & Ambient Ratings Converted to Use Support Categories

Biological (benthic and fish community) samples are given a bioclassification/rating based on the data collected at the site by DWQs Environmental Sciences Section (ESS). These bioclassifications include Excellent, Good, Good-Fair, Not Impaired, Not Rated, Fair and Poor. For specific methodology defining how these rating are given see [Benthic Standard Operating Procedures](#) (SOP) or the [Fish Community SOP](#). Once a rating is given, it is then translated into a Use Support Category (see Figure 2-17).

Ambient monitoring data are analyzed based on the percent of samples exceeding the state standard for individual parameters for each site within a five year period. In general, if a standard is exceeded in greater than 10.0% of samples taken for a particular parameter, that stream segment is Impaired for that parameter. The fecal coliform bacteria parameter is exception to the rule. See the Fecal Coliform Bacteria section in the Ambient Data portion below.

FIGURE 2-17: USE SUPPORT CATEGORIES FOR BIOLOGICAL RATINGS

Biological Ratings	Aquatic Life Use Support
Excellent	Supporting (Categories 1-2)
Good	
Good-Fair	
Not Impaired	Not Rated (Category 3)
Not Rated	
Fair	Impaired (Categories 4-5)
Poor	

FIGURE 2-18: CATEGORY NUMBER TO USE SUPPORT RATING

CATEGORY #	USE SUPPORT RATING
1	Supporting
2	
3	Not Rated
4	Impaired
5	

Each biological parameter (benthic and fish community) and each ambient parameter is assigned a Use Support Category based on its rating or percent exceedance. A detailed description of each category can be found on the first page of [Appendix 2-A](#). Each monitored stream segment is given an overall category number which reflects the highest individual parameter category. Figure 2-18 shows how the category number is translated into the use support rating.

Example

Stream A had a benthic sample that rated Good-Fair and 12% of turbidity samples taken at the ambient station were exceeding the standard. The benthic sample would be given an individual category number of 1 (Figure 2-17) and the turbidity parameter would be given a category number of 5 since >10% of samples exceeded the standard. Therefore, stream A's overall category number would be a 5, indicating the stream has a use support rating of Impaired.

RECOMMENDATIONS & ACTION PLANS AT THE SUBBASIN SCALE

DWQ PRIORITY SUMMARY

Table 2-1 is a list of waters in the Middle Roanoke River Subbasin that DWQ has prioritized for restoration/protection. The order of priority is not based solely on the severity of the stream's impairment or impacts but rather by the need for particular actions to be taken. A stream that is currently supporting its designated uses may be prioritized higher within this table than a stream that is currently impaired. This is based on a more holistic evaluation of the drainage area which includes monitoring results, current and needed restoration/protection efforts, land use and other activities that could potentially impact water quality in the area. Some supporting streams may have a more urgent need for protections than an impaired stream with restoration needs already being implemented.

The table also lists potential stressors and sources that may be impacting a stream including in-field observations, monitoring data, historical evidence and permit or other violations. Additional study may be needed to determine exact source(s) of the impact. The last column includes a list of recommended actions.

TABLE 2-1: NOTABLE WATERS IN THE LOWER DAN RIVER SUBBASIN (NOT RANKED)

STREAM NAME	AU#	CLASS.	POTENTIAL STRESSOR(S)	POTENTIAL SOURCE(S)	QUALITATIVE STATUS	ACTIONS NEEDED
Country Line Cr (Farmer Lake)	22-56-(3.5)a, (3.5b) &(3.7)	WS-II; HQW,CA	Low DO, Nutrients, Turbidity	--	Impaired	SS
Hyco Lake	22-58-(0.5)	WS-V;B	Chlorophyll a, Low pH, Low DO	--	Supporting	SS
Marlowe Cr	22-58-12-6a & b	C	Habitat Degradation, Copper ,Zinc	Urban Runoff	Impaired	SC, E, RBR
Mayo Cr (Mayo Reservoir)	22-58-15-(0.5)	WS-V	TSS	--	Supporting	SS

Class.: Classification (e.g., C, B, WS-I, WS-II, WS-III, WS-IV, WS-V, Tr, HQW, ORW, SW, UWL)

Stressor: Chemical parameters or physical conditions that at certain levels prevent waterbodies from meeting the standards for their designated use (e.g., low/high DO, nutrients, toxicity, habitat degradation, etc.). Fecal Coliform Bacteria (FCB),

Source: The cause of the stressor. (Volume & Velocity: when a stream receives stormwater runoff at a much higher volume and velocity than it would naturally receive due to ditching, impervious surfaces, etc.)

Status: Impaired, Impacted, Supporting, Improving (For current Use Support Assessment see the Integrated Report.)

Actions Needed: Agriculture BMPs (**Ag**), Best Management Practices (**BMPs**), Daylight Stream (**DS**), Education (**E**), Forestry BMPs (**F**), Local Ordinance (**LO**), Monitoring (**M**), Nutrient Mgmt Controls (**NMC**), Protection (**P**), Restoration (**R**), Riparian Buffer Restoration (**RBR**), Stormwater Controls (**SC**), Sediment and Erosion Control BMPs (**SEC BMPs**), Species Protection Plan (**SPP**), Stressor Study (**SS**), .

STATUS & RECOMMENDATIONS FOR MONITORED WATERS

UNDERSTANDING THIS SECTION

In this Section, more detailed information about stream health, special studies, aquatic life stressors and sources and other additional information is provided by each 10-digit Hydrological Unit Code (HUC). Waterbodies discussed in this Chapter include all monitored streams, whether monitored by DWQ or local agencies with approved methods. Use Support information on all monitored streams within this watershed can be seen on the map in Figure 2-1, and a Use Support list of all monitored waters in this basin can be found in the [Use Support Chapter](#).

Use Support & Monitoring Box:

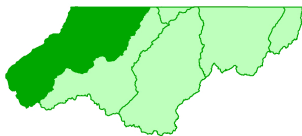
Each waterbody discussed in the Status & Recommendations for Monitored Waters within this Watershed section has a corresponding Use Support and Monitoring Box (Table 2-2). The top row indicates the 2010 Use Support and the length of that stream or stream segment. The next two rows indicate the overall Integrated Report category which further defines the Use Support for both the 2008 and the 2010 reports. These first three rows are consistent for all boxes in this Plan. The rows following are based on what type of monitoring stations are found on that stream or stream segment and may include benthic, fish community and/or ambient monitoring data. If one of these three types of monitoring sites is not shown, then that stream is not sampled for that type of data. The first column indicates the type of sampling in bold (e.g., **Benthos**) with the site ID below in parenthesis (e.g., CB79). The latest monitoring result/rating of that site is listed in the next column followed by the year that sample was taken. If there is more than one benthic site, for example, on that stream, the second site ID and site rating will be listed below the first. The last row in the sample box in Table 2-2 is the AMS data. The data window for all AMS sites listed in the boxes in this Plan is between 2004-2008. Only parameters exceeding the given standard are listed in the second column with the percent of exceedance listed beside each parameter.

Please note any fecal coliform bacteria (FCB) listing in the last row (as seen in Table 2-2) only indicates elevated levels and a study of five samples in 30 days (5-in-30) must be conducted before a stream becomes Impaired for FCB.

TABLE 2-2: EXAMPLE OF A USE SUPPORT AND MONITORING BOX

USE SUPPORT: IMPAIRED (14 MI)	
2008 IR Cat.	4a
2010 IR Cat.	4
Benthos (CB79) (CB80)	Fair (2002) Fair (2002)
Fish Com (CF33)	Good-Fair (2002)
AMS (C1750000)	Turbidity - 12% FCB - 48%

HOGANS CREEK-DAN RIVER (0301010401)



Includes: Dan River [AU#: 22-(39)b], Jones Creek [AU#: 22-50-3], Hogans Creek [AU#: 22-50], Moon Creek [AU#: 22-51], Rattlesnake Creek [AU#: 22-52] & Cane Creek [AU#: 22-54]

This watershed contains a mixed land use of agriculture, forest and residential areas. There are 12 minor NPDES permitted facilities and three permitted animal operations located within the watershed. There is one stream (Dan River) on the 2010 Impaired Waters List in this watershed.

Dan River [AU#: 22-(39)b]

This is the last segment of the Dan River within NC and is approximately ten miles from state line to state line. Land cover for this drainage area is mostly agriculture with some forested and residential areas.

USE SUPPORT: IMPAIRED (9.6 MI)	
2008 IR Cat.	5
2010 IR Cat.	5
Benthos (NB22)	Good (1999)
AMS (N3500000)	Turbidity (22.8%) FCB (22.8%)

Water quality status of this segment of the Dan River and other information about the full length of the river is discussed in the Dan River Impairment Summary section in [Chapter 1](#).

COUNTRY LINE CREEK (0301010402)

Includes: Country Line Creek [AU#: 22-56-(1), (3.5)a, (3.5)b & (3.7)]



This watershed contains a mixed land use of agriculture, forest and residential areas. There are three minor NPDES permitted facilities and one permitted swine animal operation located within the watershed. There is one stream (Country Line Creek) on the 2010 Impaired Waters List in this watershed.

Country Line Creek (Farmer Lake) [AU#: 22-56-(3.5)a, (3.5)b & (3.7)]

Farmer Lake is approximately 91 acres in size. The majority of the drainage area is forest, agriculture and some residential. The lake is a water supply reservoir for the City of Yanceyville and is classified as a WS-II, HQW, CA. Only the upstream segment of this lake is on the 2010 Impaired Waters List.

Water Quality Status

Lake station samples were taken in 2007 and 2009 during the summer months on Farmer Lake. Samples showed poor water clarity, thermally stratified waters, low DO levels and high biological productivity. Ammonia and nitrite plus nitrate concentration were low; however, total phosphorus and TKN levels were elevated. Four out of the 34 samples taken between the two years were exceeding the chlorophyll *a* state standard. All exceeding samples were found in the Impaired segment of the lake (ROA027G). Turbidity levels at this station were also exceeding the state standard by 33%. See Figure 2-1 for station locations.

USE SUPPORT: IMPAIRED (90.7 AC)	
2008 IR Cat.	2
2010 IR Cat.	5
Lake Station (ROA027G) (ROA027J) (ROA027L)	Chlorophyll <i>a</i> , Turbidity

Recommendations

A source study in this drainage area could determine the source of nutrients.

HYCO LAKE (0301010405)



Includes: Hyco Creek [AU#: 22-58-1], **South Hyco Creek (Lake Roxboro)** [AU#: 22-58-4-(0.5), (1.7) & (3)], & **Hyco Lake** [AU#: 22-58-(0.5)]

This watershed contains a mixed land use of agriculture, forest and residential areas. There are 39 minor and one major NPDES permitted facilities and four permitted animal operation located within the watershed. There is one stream (Country Line Creek) on the 2010 Impaired Waters List in this watershed.

Hyco Lake [AU#: 22-58-(0.5)]

Hyco Lake is located on the Hyco River approximately three miles south of the North Carolina-Virginia State line in Person and Caswell Counties. Land cover around the lake is a mixture of forest residential and agriculture. The lake was previously on the Impaired Waters List due to a NC DHHS fish consumption advisory-selenium. The advisory was lifted, removing the lake from the Impaired Waters List. This lake is currently supporting all designated uses.

Water Quality Status

There are four lake monitoring stations scattered throughout Hyco Lake. These stations were monitored between May and September 2009. Nutrient levels within the lake have historically measured at low to moderate levels. Results from this cycle indicate the lake remains at low to moderate nutrient and biological productivity levels. However, there is a moderate increase in chlorophyll *a* levels when

USE SUPPORT: SUPPORTING (4,298 AC)	
2008 IR Cat.	5
2010 IR Cat.	2
Lake Stations (ROA030E) (ROA030C) (ROA030F) (ROA030G)	No Exceedances

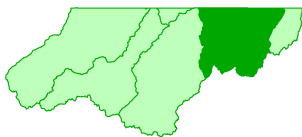
evaluating samples between 1994 - 2009. Long term monitoring results also show a decrease in pH and a steady decrease in DO levels. Specific conductivity averages almost doubled between the current and past sampling cycle.

In 2008, Progress Energy notified the Raleigh Regional Office (RRO) of DWQ that the FGD wastewater settling basin was seeping and at risk of failure. To reduce this risk, Progress Energy dewatered the settling basin into the adjacent ash pond to reduce the hydraulic head in the settling basin. On February 27, 2008, Progress Energy notified RRO staff that an 8 to 12 foot wide berm failure had occurred on the flush pond berm, allowing water from the pond to discharge into the adjacent Ash Pond. According to Progress Energy, at the time of the berm failure, the flush pond only contained start up water and not backwash water from the FGD Bioreactor. The RRO requested Progress Energy to conduct additional sampling of both lake surface water and adjacent ground water in an effort to determine changes or effects of the waste streams as a result of the treatment unit failure, bypass and changes in the treatment capacities of the settling basin. This sampling effort was conducted eight times in March and April. Data from this monitoring effort revealed elevated levels of thallium, selenium, copper, beryllium, silver, mercury and antimony in the effluent stream from outfall 003 in Hyco Lake and from a non-potable well located within 500 feet of the FGD Settling Pond and the FGD Flush Pond.

At the request of the Raleigh Regional Office, staff from DWQ's Intensive Survey Unit collected water and sediment samples on July 21, 2008 from various lake sites near the FGD wastewater treatment system along with two additional sites located upstream and downstream of the facility. Results of this sampling indicated that elevated metals detected by Progress Energy in the spring were now at very low levels or below DWQ laboratory detection levels. Thallium was present in the sediment samples along with vanadium and selenium, however, water samples collected near the bottom of the reservoir at the three sediment sampling sites exhibited concentrations of these metals below the DWQ laboratory's detection levels. Physical measurements taken at each sampling site were similar to those observed in the past with the exception of conductivity values, which were the greatest recorded by DWQ staff since 1983 when this reservoir was first monitored.

For more information about this and additional monitoring see the [Roanoke River Basin Lake and Reservoir Assessment Report](#).

HYCO RIVER (0301010406)



Includes: Hyco River [AU#: 22-58-(9.5)], **Marlowe Creek** [AU#: 22-58-12-6a & b], & **Mayo Creek (Mayo Reservoir)** [AU#: 22-58-15-(0.5)]

This watershed contains a mixed land use of agriculture, forest, urban and residential areas. There are five minor and two major NPDES permitted facilities and two permitted swine animal operation located within the watershed. There is one stream (Marlowe Creek) on the 2010 Impaired Waters List in this watershed.

Marlowe Creek [AU#: 22-58-12-6a & b]

Marlowe Creek is split into two segments and is approximately 11 miles from source to Storys Creek which flows into Hyco River [AU#: 22-58-(9.5)]. The Town of Roxboro is located in the headwaters of Marlowe Creek. Further downstream, the land use is mostly forest and agriculture. Marlowe Creek has been on the Impaired Waters List since 1998.

Water Quality Status

Marlowe Creek was sampled twice for biological health during this cycle. The first sample was taken in 2006 as part of a [Small Stream Biocriteria Development](#) study near the intersection of N. Main Street and NC-49 in Roxboro. The sample showed the creeks aquatic life was severely impacted by the highly urbanized area and had poor habitat (scored a 39 out of 100).

USE SUPPORT: IMPAIRED (11.1 mi)	
2008 IR Cat.	5
2010 IR Cat.	5
Benthos (NB43) (NB85) (NB119)	Fair (2009) Fair (2004) Not Rated (2006)
Fish Com (NF27)	Good-Fair (2004)
AMS (N4400000)	Copper (22.2%) Zinc (44.4%)

The second sample (NB43) was taken further downstream near the confluence of Fishing Creek. This site has been sampled since 1994 when it received a Poor rating. Each sample increased in rating following the 1994 sample up to a Good-Fair in 2004. This water quality improvement was contributed to significant facility upgrades at the Roxboro WWTP. The 2009 sample dropped back to a Fair rating and reflected water quality similar to what was seen in 1999. The WWTP however, had only a few minor permit violations and only failed one toxicity test.

An Ambient Monitoring Station is also located near the confluence of Fishing Creek. DO and turbidity levels have improved as compared to the last cycle (1999-2003). Fecal coliform bacteria levels have also improved. The geometric mean was three time lower than the previous cycle. However, copper and zinc levels remain elevated above the state standards.

Marlowe Creek will remain on the Impaired waters list for both biological impairments as well as for copper and zinc exceedances.

Local Initiatives

The City of Roxboro was designated as a Phase II community as of January 2010 which require additional stormwater BMPs. This will assist in reducing the urban runoff impacting the stream.

Mayo Creek (Mayo Reservoir) [AU#: 22-58-15-(0.5)]

The Mayo Reservoir is roughly 2,613 acres and is owned by Progress Energy. The majority of the drainage area is agriculture, forest and residential.

USE SUPPORT: SUPPORTING (2,613 AC)	
2008 IR Cat.	2
2010 IR Cat.	2
Lake Stations (ROA0343A) (ROA0342A) (ROA0341A)	No Exceedances

Water Quality Status

Surface physical parameters (DO, pH and water temperature) in 2009 were similar to those values observed in this reservoir since it was first monitored by DWQ in 1983. Conductivity values, however, were greater in 2009 (range = 111 to 166 µmhos/cm). Total solids were also greater in 2009 than in previous years (range = 80 to 130 mg/L) while values for turbidity and total solids remained the same. Nutrient levels and chlorophyll *a* levels were all low. The lake was determined to be mesotrophic, or having moderate biological productivity, in 2009.

Progress Energy Mayo Steam Electric Power Plan (NC0038377)

CP&L DBA Progress Energy Carolinas, Inc. operates a steam electric power plant facility and holds an NPDES permit NC0038377 to discharge process control and industrial waste streams to Mayo Lake a Class WS-V water, in the Roanoke River Basin, in Person County.

Progress Energy Carolinas, Inc. installed wet limestone forced oxidation wet scrubbers on all operating units at the Mayo Steam Electric Plant in response to requirements from the State of North Carolina under the Clean Smokestacks legislation. Accordingly, Progress Energy installed a Flue Gas Desulfurization (FGD) wastewater settling pond, a General Electric ABMet bioreactor (a new technology biological treatment system), and a flush pond to treat wastewater generated by the recently added wet scrubbers.

Since installation of FGD settling basin, FGD flush pond and GE ABMet bioreactor Progress Energy Carolinas, Inc. has:

- 💧 upgraded ash handling system to handle all fly ash at the plant as dry ash to reduce pollutant loading to the outfall.
- 💧 installed and uses the addition of a MetClear injection system to aid in the settling of mercury and other constituents in the settling pond.
- 💧 added a pH adjustment system to the inlet of the bioreactor to aid in keeping the pH of the wastewater at an optimum level for maximum treatment efficiency.
- 💧 placed into service secondary hydrocyclones to reduce the amount of suspended solids in the blowdown to the settling pond.

However, effluent sampling results reported by Progress Energy from the NPDES Outfall 002 has revealed effluent limit exceedances. On December 9, 2010, Progress Energy provided DWQ an Application for a Special Order by Consent, whereby a schedule may be developed for additional treatment unit(s) and/or alternative treatment technology construction.

AARONS CREEK-DAN RIVER (0301010407)



Includes: Crooked Fork [AU#: 22-59-1], & Aarons Creek [AU#: 22-59]

This watershed contains a mixed land use of agriculture, forest and residential areas. There are no permitted facilities located within the watershed. There are no streams on the 2010 Impaired Waters List in this watershed.

REFERENCES

References marked with (*) indicates a DWQ special study report. These reports are not currently available online. Contact the DWQ Environmental Science Section at (919) 743-8400 to receive a hardcopy.

North Carolina Department of Environment and Natural Resources (NCDENR). Division of Water Quality (DWQ). August 2004a. *Classifications and Water Quality Standards Applicable to Surface Waters and Wetlands of North Carolina*. North Carolina Administrative Code: 15A NCA 2B. Raleigh, NC. (<http://h2o.enr.state.nc.us/csu/>)

_____. DWQ. Planning Section. Basinwide Planning Unit (BPU). November 2008. *Supplemental Guide to Basinwide Planning: A support document for basinwide water quality plans*. Raleigh, NC. (<http://portal.ncdenr.org/web/wq/ps/bpu/about/supplementalguide>)

_____. DWQ. Environmental Sciences Section (ESS). Ecosystems Unit. September 2010. *Roanoke River Basin Ambient Monitoring Systems Report (January 1, 2005 through December 31, 2009)*. Raleigh, NC. (http://portal.ncdenr.org/c/document_library/get_file?uuid=c9a59811-634c-490b-b566-6a8ebc00554d&groupId=38364)

_____. DWQ. Environmental Sciences Section (ESS). Biological Assessment Unit (BAU). December 2010. *Basinwide Assessment Report: Roanoke River Basin*. Raleigh, NC. (http://portal.ncdenr.org/c/document_library/get_file?uuid=e3dd1d8b-bbc5-42c9-9999-1d99dd4c7455&groupId=38364)

_____. DWQ. ESS. BAU. May 2009. *Small Stream Biocriteria Development*. Raleigh, NC. (<http://www.esb.enr.state.nc.us/documents/SmallStreamsFinal.pdf>)

_____. DWQ. ESS. BAU. March 2010. *Lake & Reservoir Assessments Roanoke River Basin*. Raleigh, NC.

Pate, Travis. 2009. *Watershed Assessment in North Carolina: Building a Watershed Database with Population, Land Cover, and Impervious Cover Information*. Master Theses, University of North Carolina at Chapel Hill.

APPENDIX 2-A

USE SUPPORT RATINGS FOR ALL MONITORED WATERS IN THE LOWER DAN RIVER SUBBASIN

DRAFT 2010 IR CATEGORY	INTEGRATED REPORTING CATEGORIES FOR INDIVIDUAL ASSESSMENT UNIT/USE SUPPORT CATEGORY/ PARAMETER ASSESSMENTS. A SINGLE AU CAN HAVE MULTIPLE ASSESSMENTS DEPENDING ON DATA AVAILABLE AND CLASSIFIED USES.
1	All designated uses are monitored and supporting
1b	Designated use was impaired, other management strategy in place and no standards violations for the parameter of interest (POI)
1nc	DWQ have made field determination that parameter in exceedance is due to natural conditions
1r	Assessed as supporting watershed is in restoration effort status
1t	No criteria exceeded but approved TMDL for parameter of interest
2	Some designated uses are monitored and supporting none are impaired Overall only
2b	Designated use was impaired other management strategy in place and no standards violations Overall only
2r	Assessed as supporting watershed is in restoration effort status overall only
2t	No criteria exceeded but approved TMDL for POI Overall only
3a	Instream/monitoring data are inconclusive (DI)
3b	No Data available for assessment
3c	No data or information to make assessment
3n1	Chlorophyll a exceeds TL value and SAC is met-draft
3n2	Chlorophyll a exceeds EL value and SAC is not met first priority for further monitoring-draft
3n3	Chlorophyll a exceeds threshold value and SAC is not met first second priority for further monitoring-draft
3n4	Chlorophyll a not available determine need to collect-draft
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4b	Designated use impaired other management strategy expected to address impairment
4c	Designated use impaired by something other than pollutant
4cr	Recreation use impaired no instream monitoring data or screening criteria exceeded
4cs	Shellfish harvesting impaired no instream monitoring data- no longer used
4ct	Designated use impaired but water is subject to approved TMDL or under TMDL development
4s	Impaired Aquatic Life with approved TMDL for Aquatic Life POI or category 5 listing
4t	Designated use impaired approved TMDL
5	Designated use impaired because of biological or ambient water quality standards violations and needing a TMDL
5r	Assessed as impaired watershed is in restoration effort status

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year
Roanoke River Basin		Hogans Creek-Dan River Watershed		0301010401	
Roanoke River Basin		Dan River Subbasin		03010104	
Roanoke River Basin		Hogans Creek-Dan River Watershed		0301010401	
⊙ 22-54	Cane Creek	From North Carolina-Virginia State Line to Dan River		0.8 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
⊙ 22-(39)b	DAN RIVER (North Carolina portion)	From NC/VA crossing downstream of Wolf Island Creek to last crossing of North Carolina-Virginia State Line		9.6 FW Miles	C
4t	Fecal Coliform (recreation)	Standard Violation	Recreation	2008	2008
5	Turbidity	Standard Violation	Aquatic Life	2008	2008
⊙ 22-50	Hogans Creek	From source to Dan River		29.1 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
⊙ 22-50-3	Jones Creek (Lake Wade)	From source to Hogans Creek		7.6 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
⊙ 22-51	Moon Creek (Wildwood Lake)	From source to Dan River		17.0 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
⊙ 22-52	Rattlesnake Creek	From source to Dan River		2.7 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
Roanoke River Basin		Country Line Creek Watershed		0301010402	
⊙ 22-56-(1)	Country Line Creek	From source to a point 0.5 mile upstream of mouth of Nats Fork		10.5 FW Miles	WS-II;HQW
1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2004	
⊙ 22-56-(3.7)	Country Line Creek	From dam at Farmer Lake to Dan River		24.5 FW Miles	C
1	Ecological/biological Integrity Benthos	Good Bioclassification	Aquatic Life	2004	
⊙ 22-56-(3.5)a	Country Line Creek (Farmers Lake)	Upper reservoir- From a point 0.5 mile upstream of mouth Nats Fork to dam at Farmer Lake (Town of Yanceyville water supply intake located 1.8 mile upstream of N.C. Hwy. 62)		90.7 FW Acres	WS-II;HQW,CA
5	Chlorophyll a	Standard Violation	Aquatic Life	2008	2010
5	Turbidity	Standard Violation	Aquatic Life	2008	2010
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year
Roanoke River Basin		Country Line Creek Watershed		0301010402	
⊙ 22-56-(3.5)b	Country Line Creek (Farmers Lake)	Lower reservoir-From a point 0.5 mile upstream of mouth Nats Fork to dam at Farmer Lake (Town of Yanceyville water supply intake located 1.8 mile upstream of N.C. Hwy. 62)	271.1	FW Acres	WS-II;HQW,CA
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Water Supply	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
Roanoke River Basin		Hyco Lake Watershed		0301010405	
⊙ 22-58-1	Hyco Creek (North Hyco Creek)	From source to Hyco Lake, Hyco River	16.8	FW Miles	C
3a	Ecological/biological Integrity FishCom	Not Rated Bioclassification	Aquatic Life	2004	
⊙ 22-58-(0.5)	Hyco River, including Hyco Lake below elevation 410	From source in Hyco Lake to dam of Hyco Lake, including tributary arms below elevation 410	4,297.9	FW Acres	WS-V,B
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
⊙ 22-58-4-(3)	South Hyco Creek	From a point 0.6 mile downstream of Double Creek to Hyco Lake, Hyco River (City of Roxboro water supply intake)	0.7	FW Miles	WS-II;HQW,CA
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	
⊙ 22-58-4-(1.4)	South Hyco Creek (Lake Roxboro)	From backwaters of Lake Roxboro to dam at Lake Roxboro	493.6	FW Acres	WS-II,B;HQW
3n	Chlorophyll a	Potential Standards Violation	Aquatic Life	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
Roanoke River Basin		Hyco River Watershed		0301010406	
⊙ 22-58-(9.5)	Hyco River	From dam of Hyco Lake to North Carolina-Virginia State Line, including all portions in North Carolina	6.8	FW Miles	C
1	Fecal Coliform (recreation)	No Criteria Exceeded	Recreation	2008	
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
⊙ 22-58-12-6a	Marlowe Creek	From source to Mitchell Creek	6.6	FW Miles	C
5	Ecological/biological Integrity Benthos	Fair Bioclassification	Aquatic Life	2004	1998

NC 2010 Integrated Report

All 13,123 Waters in NC are in Category 5-303(d) List for Mercury due to statewide fish consumption advice for several fish species

AU_Number	AU_Name	AU_Description	LengthArea	AU_Units	Classification
Category	Parameter	Reason for Rating	Use Category	Collection Year	303(d)year
Roanoke River Basin			Hyco River Watershed		0301010406
⊙ 22-58-12-6b	Marlowe Creek	From Mithcell Creek to Storys Creek		4.5 FW Miles	C
5	Copper	Standard Violation	Aquatic Life	2008	2008
1	Ecological/biological Integrity Benthos	Good-Fair Bioclassification	Aquatic Life	2004	
1	Ecological/biological Integrity FishCom	Good-Fair Bioclassification	Aquatic Life	2004	
1	Fecal Coliform (recreation)	No Criteria Exceeded	Recreation	2008	
5	Zinc	Standard Violation	Aquatic Life	2008	2008
⊙ 22-58-15-(3.5)	Mayo Creek (Maho Creek)	From dam of Mayo Reservoir to North Carolina-Virginia State Line		0.5 FW Miles	C
1	Fecal Coliform (recreation)	No Criteria Exceeded	Recreation	2008	
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
⊙ 22-58-15-(0.5)	Mayo Creek (Maho Creek) (Mayo Reservoir)	From source to dam of Mayo Reservoir		2,613.8 FW Acres	WS-V
1	Water Quality Standards Aquatic Life	No Criteria Exceeded	Aquatic Life	2008	
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
⊙ 22-58-12-(1.5)	Storys Creek [Roxboro City Lake (Lake Issac Walton)]	From a point 0.9 mile downstream of N.C. Hwy. 57 to Roxboro City Lake Dam		189.5 FW Acres	WS-II;HQW,CA
1	Water Quality Standards Water Supply	No Criteria Exceeded	Water Supply	2008	
Roanoke River Basin			Aarons Creek-Dan River Watershed		0301010407
⊙ 22-59	Aarons Creek	From source to North Carolina-Virginia State Line		8.6 FW Miles	C
1	Ecological/biological Integrity FishCom	Good Bioclassification	Aquatic Life	2004	

APPENDIX 2-B

BIOLOGICAL SAMPLING SITE DATA SHEETS (BENTHIC MACROINVERTEBRATE & FISH COMMUNITY) FOR THE LOWER DAN RIVER SUBBASIN

Biological Samples Taken During this Assessment Cycle

STATION ID	WATERBODY	COUNTY	SITE LOCATION	SAMPLE RESULTS
Benthic Sample Sites				
NB112	CROOKED FK	PERSON	SR 1558	06 - Not Impaired
NB116	NEGRO CR	CASWELL	SR 1769	06 - Not Impaired
NB118	TANYARD BR	PERSON	US 501	06 - Not Rated
NB119	MARLOWE CR	PERSON	NC 49	06 - Not Rated
NB40	COUNTRY LINE CR	CASWELL	NC 57	09 - Excellent
NB43	MARLOWE CR	PERSON	SR 1322	09 - Fair
Fish Community Sample Sites				
NF15	Hogans Cr	Caswell	SR 1330	09 - Good-Fair
NF24	Moon Cr	Caswell	SR 1511	09 - Good
NF26	Rattlesnake Cr	Caswell	SR 1523	09 - Good
NF30	S Hyco Cr	Person	US 158	09 - Fair
NF31	Aarons Cr	Granville	SR 1400	09 - Good
NF35	Hogans Cr	Caswell	SR 1301	09 - Good-Fair

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOGANS CR	SR 1301	07/06/09	NF35	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	3	03010104	36.439045	-79.515205	22-50	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	65.4	550	8	0.3	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.0
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	122
pH (s.u.)	6.7

Water Clarity	Slightly turbid
---------------	-----------------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	3
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	66

Site Photograph



Substrate	Sand, gravel, block bedrock boulders jutting out from the left bank
-----------	---

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/09	2009-80	15	42	Good-Fair

Most Abundant Species 2009	Satinfish Shiner (25%)	Exotic Species 2009	Bluegill
----------------------------	------------------------	---------------------	----------

Species Change Since Last Cycle	N/A
---------------------------------	-----

Data Analysis

This is the first fish community sample collected from this 2009-2010 Random Ambient Monitoring site. **Watershed** -- drains primarily eastern Rockingham County, including a portion of the Town of Reidsville; two small NPDES facilities located in the headwaters (NC0002828 and NC0077135, total $Q_w = 0.027$ MGD); tributary to the Dan River. **Habitats** -- snags, stick riffles, gravel bars, deadfalls, and shallow runs; high quality bank and riparian characteristics, but stream still exhibits impacts such as poor quality riffles and sandy substrate from nonpoint source erosion. **2009** -- all diversity metrics (total species diversity and diversities of darters, sunfish, and suckers) were lower than expected; intolerant species were also absent; three species (White Sucker, Notchlip Redhorse, and Largemouth Bass) were represented only by young-of-year and were excluded from the sample. Long-term nonpoint source erosion seems to be the primary stressor to this stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
HOGANS CR	SR 1330	07/06/09	NF15	Good-Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	3	03010104	36.49027778	-79.40416667	22-50	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	92.6	410	11	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	60	10	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	20.8
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	118
pH (s.u.)	6.7

Water Clarity	Slightly turbid
---------------	-----------------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	4
Erosion (7)	5
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph



Substrate	Sand, gravel
-----------	--------------

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/06/09	2009-81	18	40	Good-Fair
05/25/04	2004-56	20	52	Good

Most Abundant Species 2009	Swallowtail Shiner (28%)	Exotic Species 2009	Bluegill
-----------------------------------	--------------------------	----------------------------	----------

Species Change Since Last Cycle

Gains --Rosyside Dace, Crescent Shiner, Glassy Darter, Riverweed Darter. **Losses** -- White Sucker, Northern Hogsucker, Notchlip Redhorse, Margined Madtom, Channel Catfish, Green Sunfish, Chainback Darter, Roanoke Darter. All species gained or lost were represented by 1-3 fish/species, except for Crescent Shiner (n=37).

Data Analysis

Watershed -- drains eastern Rockingham and northwestern Caswell counties, including a portion of the Town of Reidsville; two small NPDES facilities located in the headwaters (NC0002828 and NC0077135, total Q_w = 0.027 MGD); tributary to the Dan River. **Habitats** -- gravelly and sandy runs; good snag pools, undercut, *Podostemum* in the riffles, but stream still exhibits substantial nonpoint source erosion. **2009** -- ~ 2 times as many fish were collected in 2009 than in 2004 (336 vs. 178), primarily Swallowtail Shiner, Crescent Shiner, and Satinfish Shiner (53% of all the fish collected); the diversities of sunfish and suckers were much lower than expected; 1 of only 2 sites where suckers were absent, although Notchlip Redhorse were collected they were represented only by young-of-year and were excluded from the sample; combined with a skewed trophic structure the NCIBI score and rating declined; despite having a large drainage area the community may still be suffering from drought impacts and from chronic nonpoint source erosion. **2004 & 2009** -- 26 species known from the site, including 6 species of darters; dominant species is the Swallowtail Shiner.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
MOON CR	SR 1511	05/21/09	NF24	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.5075	-79.3355556	22-51	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	47.2	370	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	45	0	55	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	97
pH (s.u.)	6.5

Water Clarity	Clear
---------------	-------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	5
Erosion (7)	5
Bank Vegetation (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	59

Site Photograph



Substrate	Sand, gravel
-----------	--------------

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/09	2009-42	20	52	Good
04/30/04	2004-32	16	46	Good
09/07/94	94-34	22	44	Good-Fair

Most Abundant Species 2009	Crescent Shiner (21%), Bluehead Chub (18%)	Exotic Species 2009	Green Sunfish, Bluegill, Redear Sunfish
-----------------------------------	--	----------------------------	---

Species Change Since Last Cycle
Gains -- Eastern Silvery Minnow, Crescent Shiner, Redlip Shiner, Mountain Redbelly Dace, Creek Chub, White Sucker, Redear Sunfish, Glassy Darter. **Losses** -- Golden Shiner, Redfin Pickerel, Pumpkinseed, Largemouth Bass. All species gained or lost were represented by 1- 4 fish/species, except for Redlip Shiner, Eastern Silvery Minnow, and Crescent Shiner (n=17, 41, and 130, respectively).

Data Analysis

Watershed -- drains northwestern Caswell County; no municipalities with the watershed; tributary to the Dan River, site is ~ 2.2 miles above the creek's confluence with the river. **Habitats** -- sandy runs, woody debris, snags, narrow riparian zones intact along both banks, but stream still exhibits substantial nonpoint source erosion as evident from the low scoring habitat characteristics. **2009** -- 6 times more fish collected in 2009 than in 2004 (627 vs . 104), especially Crescent Shiner (130 vs. 0), Bluehead Chub (112 vs . 11), and Eastern Silvery Minnow (41 vs . 0); no lingering effects from the drought. **1994 - 2009** -- very diverse fish community, 30 species are known from the site, including 12 species of cyprinids, 5 species of sunfish, and 4 species of darters; dominant species are variable and include Eastern Silvery Minnow (1994), Satinfish Shiner and Redbreast Sunfish (2004), and Crescent Shiner and Bluehead Chub (2009); NCIBI score and rating have gradually been improving over the past 15 years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
RATTLESNAKE CR	SR 1523	05/21/09	NF26	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.50777778	-79.29333333	22-52	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.7	350	6	0.2	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	15.1
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	120
pH (s.u.)	6.6

Water Clarity	Clear
---------------	-------

Site Photograph



Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	6
Riffle Habitat (16)	7
Erosion (7)	3
Bank Vegetation (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Substrate	Sand
-----------	------

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/21/09	2009-43	21	46	Good
05/25/04	2004-57	19	48	Good

Most Abundant Species 2009	Satinfin Shiner (46%)	Exotic Species 2009	Red Shiner, Green Sunfish, Bluegill
-----------------------------------	-----------------------	----------------------------	-------------------------------------

Species Change Since Last Cycle

Gains -- Crescent Shiner, Mountain Redbelly Dace, Creek Chub, V-lip Redhorse, Eastern Mosquitofish, Fantail Darter. **Losses** -- Golden Shiner, Channel Catfish, Redfin Pickerel, Warmouth. All species gained or lost were represented by 1-9 fish/species, except for Eastern Mosquitofish and Fantail Darter (n=14 and 17, respectively).

Data Analysis

Watershed -- drains northwestern Caswell County with its headwaters arising in the Town of Yanceyville; tributary to the Dan River, site is ~0.2 miles above the creek's confluence with the river. **Habitats** -- very shallow and sandy runs, a couple of large boulder outcrops in the channel, riparian zones intact providing good shading to the stream; but stream is impacted by very substantial nonpoint source erosion. **2009** -- 5 times more fish collected in 2009 than in 2004 (929 vs. 184), especially Satinfin Shiner, Eastern Silvery Minnow, Swallowtail Shiner, Bluehead Chub, Speckled Killifish, and Rosefin Shiner (86% of all the fish collected); very high percentage of tolerant fish (53%). **2004 & 2009** -- 25 species known from the site, including 12 species of cyprinids and 3 species of darters; dominant species is the Satinfin Shiner; very dynamic community, the close proximity to the river may influence the community (i.e., schooling species such as Eastern Silvery Minnow and Satinfin Shiner migrating back and forth from the creek to the river).

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
COUNTRY LINE CR	NC 57	NB40	08/12/09	Excellent

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CASWELL	4	03010104	36.537778	-79.201111	22-56-(3.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	138.0	395	10	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	70	30	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	23.6
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	126
pH (s.u.)	6.4

Water Clarity	slightly turbid
---------------	-----------------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	7
Bank Erosion (7)	0
Bank Vegetation (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	69

Site Photograph



Substrate The channel substrata consisted of mostly sand and gravel.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/12/09	10808	---	28	---	4.31	Excellent
07/01/04	9400	---	24	---	4.82	Good
08/24/94	6691	---	14	---	4.55	Good-Fair
07/10/90	5337	---	26	---	4.53	Good
07/23/87	4158	---	26	---	5.15	Good

Taxonomic Analysis

Several pollution sensitive EPT taxa were collected at this site in 2009 such as the stoneflies *Paragnetina fumosa*, *Pteronarcys spp.*, and long-lived *Acroneuria abnormis*. Intolerant caddisflies collected included *Brachycentrus numerosus*, *Nyctiophylax moestus*, and *Pycnopsyche spp.* The mayfly *Plauditus cestus* and caddisfly *Ceraclea mentiea* are listed by the North Carolina Natural Heritage Program as Significantly Rare (2006) and were collected from this location in 2009.

Data Analysis

This site received a bioclassification of Excellent in 2009 for the first time since sampling began in 1983. Decreases in EPTBI from 4.82 in 2004 to 4.31 in 2009 in addition to the highest EPT taxa richness (28) on record from this location continue to suggest better water quality. Pollution sensitive macroinvertebrate communities were collected at this site despite evidence of habitat degradation due to increased erosion leading to in-channel sedimentation, scouring, and increased bar development from nonpoint sources.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
S HYCO CR	US 158	05/21/09	NF30	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
PERSON	5	03010104	36.38527778	-79.10777778	22-58-4(-3)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,HQW,CA	56.5	430	8	0.4	No

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	75	0	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	18.7
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.7

Water Clarity

Clear, slightly tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	5
Erosion (7)	2
Bank Vegetation (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	58

Site Photograph



Substrate

Gravel, sand, woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/16/10	2010-48	21	44	Good-Fair
05/21/09	2009-44	15	38	Fair
04/30/04	2004-30	21	52	Good

Most Abundant Species 2009

Swallowtail Shiner (32%)

Exotic Species 2009

Green Sunfish, Bluegill

Species Change Since Last Cycle (2009 vs. 2004)

Gains -- Crescent Shiner, Eastern Mosquitofish, Black Crappie. **Losses** -- Mountain Redbelly Dace, White Sucker, Notchlip Redhorse, V-lip Redhorse, Margined Madtom, Yellow Bullhead, Redfin Pickerel, Speckled Killifish, Yellow Perch. All species gained or lost were represented by 1-6 fish/species, except for Crescent Shiner, V-lip Redhorse, and Eastern Mosquitofish (n=11, 13, and 36, respectively).

Data Analysis

Watershed -- drains northwest Orange, southeastern Caswell, and southwestern Person counties; no municipalities within the watershed; site is ~ 4.5 miles downstream from Roxboro Lake dam and ~ 1.5 miles above the backwaters of Hyco Reservoir, an impoundment of the Hyco River; stream is classified as High Quality Waters based upon its WS-II supplemental classification. **Habitats** -- very low flow; coarse woody debris in the channel, riparian bottomlands, snag debris dams, stream exhibits substantial nonpoint source erosion. **2009** -- 2.3 times more fish collected in 2009 than in 2004 (556 vs. 237), especially Swallowtail Shiner, Satinfin Shiner, Eastern Mosquitofish, and Bluegill (75% of all the fish collected), 1 of 2 sites where suckers were absent; very skewed trophic structure with only 3% omnivores+herbivores; lingering drought impacts. **2004 & 2009** -- despite a large drainage area, only 24 species are known from the site; including just 2 species of darters; dominant species is the Swallowtail Shiner; old weir below the bridge at the old gage may be an impediment to fish movement at low flow; recolonization avenues are limited by the upstream and downstream reservoirs. **Note:** the site was re-sampled in 2010 following a wetter winter and spring flow period and the community was rated Good-Fair.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
MARLOWE CR	SR 1322	NB43	08/12/09	Fair

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
PERSON	5	03010104	36.483333	-78.979444	22-58-12-6b	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	17.8	390	9	0.1

Visible Landuse (%)	Forested/Wetland	Urban	Agriculture	Other (describe)
	60	0	40	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Roxboro WWTP	NC0021024	5.0

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	139
pH (s.u.)	6.5

Water Clarity	turbid
---------------	--------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	10
Bank Erosion (7)	1
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	72

Site Photograph



Substrate This channel was dominated by mostly sand and gravel.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/12/09	10809	59	10	6.25	6.01	Fair
06/30/04	9397	56	13	6.43	5.93	Good-Fair
08/25/99	7988	53	9	6.35	5.74	Fair
08/24/94	6692	33	5	6.91	6.49	Poor

Taxonomic Analysis

This sampling location was dominated by pollution tolerant macroinvertebrates such as the mayflies *Baetis flavistriga* and *Maccaffertium modestum*; and the caddisflies *Cheumatopsyche* spp. and *Hydropsyche betteni*. The root mat-dwelling caddisflies *Oecetis persimilis* and *Tranodes ignitus* were rare at the site. The somewhat tolerant riffle beetle taxa *Macronychus glabratus* was abundant and the intolerant *Psephenus herricki* was rare at this sampling location. Eight odonate taxa were collected in addition to 26 chironomid taxa. *Polypedilum flavum* was the only abundant chironomid taxa collected. No stoneflies were collected at this site in 2009.

Data Analysis

This benthic monitoring station received a bioclassification of Fair in 2009 suggesting a transition back to degraded water quality found in 1999. EPTBI increased slightly and EPT richness decreased from the 2004 sample. In 2009, EPT taxa richness returned to the levels observed in 1999. Chironomid taxa richness (26) was the highest of all other sampling years at this site. Only one chironomid taxa was abundant at the site in 2009. The high chironomid taxa richness could be due to increased drift from the rain event that occurred the night before sampling. Conductivity was lower suggesting improvements from 2004 when levels were between 220 and 340 µS/cm. This stream drains northern portions of urban Roxboro and active row crop agriculture was noted upstream. This site may suffer from several variables including both point and nonpoint source pollution in addition to lack of substrate favorable to many rheophilic EPT taxa.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Station ID	Bioclassification
AARONS CR	SR 1400	05/26/09	NF31	Good

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
GRANVILLE	6	03010104	36.53166667	-78.73916667	22-59	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	27.6	370	8	0.4	Yes

Visible Landuse (%)	Forested/Wetland	Rural Residential	Agriculture	Other (describe)
	100	0	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (°C)	21.1
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	76
pH (s.u.)	6.0

Water Clarity	Clear, easily silted
---------------	----------------------

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	12
Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	88

Site Photograph



Substrate	Cobble, boulder, gravel
-----------	-------------------------

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/26/09	2009-45	16	50	Good
04/28/04	2004-25	15	46	Good

Most Abundant Species 2009	Fantail Darter (30%), Crescent Shiner (28%)	Exotic Species 2009	Green Sunfish, Bluegill, Redear Sunfish
-----------------------------------	---	----------------------------	---

Species Change Since Last Cycle	Gains -- Whitemouth Shiner, Pirate Perch, Redear Sunfish, Carolina Darter, Losses -- Rosyside Dace, Eastern Mosquitofish. All species gained or lost were represented by 1-5 fish/species.
--	--

Data Analysis

Watershed -- drains the extreme northeast corner of Person and the extreme northwest corner of Granville counties; no municipalities in the watershed; **Habitats** -- regional reference site, a typical Carolina Slate Belt-type stream with high quality instream and riparian habitat characteristics; shallow pools and riffles, undercutts, clay banks, blow-out on upper left bank at end of reach. **2009** -- one-half the number of fish collected in 2009 than in 2004 (397 vs. 791), especially Crescent Shiner (111 vs. 321); Carolina Darter [Special Concern] collected for the first time; a slight increase in the overall diversity and diversity of darters increased the NCIBI score, but not the rating; no change in the other metrics, trophic metrics very stable. **2004 & 2009** -- only 19 species known from this site, including 5 species of sunfish and 3 species of darters, but no intolerant species; dominant species is the Crescent Shiner; very possible that the flow in this stream becomes very reduced during dry periods and this may have caused the lower than expected NCIBI score and rating for a reference site.

APPENDIX 2-C

AMBIENT MONITORING SYSTEMS STATION DATA SHEETS FOR THE LOWER DAN RIVER SUBBASIN

Ambient Monitoring System Station Summaries

NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: DAN RIV AT NC 57 AT VA LINE AT MILTON

Station #: N3500000

Hydrologic Unit Code: 03010104

Latitude: 36.54079

Longitude: -79.21422

Stream class: C

Agency: NCAMBNT

NC stream index: 22-(39)

Time period: 01/12/2005 to 12/03/2009

	# results	# ND	EL	Results not meeting EL			Percentiles						
				#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	57	0	<4	0	0		6	6.6	7.3	9.5	11.4	13	13.9
	57	0	<5	0	0		6	6.6	7.3	9.5	11.4	13	13.9
pH (SU)	57	0	<6	0	0		6.4	7	7.2	7.5	7.7	7.8	8.2
	57	0	>9	0	0		6.4	7	7.2	7.5	7.7	7.8	8.2
Spec. conductance (umhos/cm at 25°C)	56	0	N/A				68	84	102	127	165	258	293
Water Temperature (°C)	57	0	>32	0	0		4.4	7.2	10.6	17.3	25.1	27.2	29.8
Other													
TSS (mg/L)	20	4	N/A				3	5.8	8.9	12	18.2	172	185
Turbidity (NTU)	57	0	>50	13	22.8	99.9	2.5	3.7	5.9	11	35.5	164	240
Metals (ug/L)													
Aluminum, total (Al)	8	0	N/A				120	120	335	515	2480	5100	5100
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	5	>7	0	0		2	2	2	2	4	6	6
Iron, total (Fe)	8	0	>1000	3	37.5		410	410	755	1000	3575	7100	7100
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	6	>50	0	0		10	10	10	10	15	46	46
Fecal Coliform Screening(#/100mL)													
# results:	Geomean:	# > 400:	% > 400:	%Conf:									
57	95	13	22.8	76.2									

Key:

result: number of observations

ND: number of observations reported to be below detection level (non-detect)

EL: Evaluation Level; applicable numeric or narrative water quality standard or action level

Results not meeting EL: number and percentages of observations not meeting evaluation level

%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)

Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries

NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: HYCO RIV BELOW AFTERBAY DAM NR MCGHEES MILL

Station #: N4250000

Hydrologic Unit Code: 03010104

Latitude: 36.52353

Longitude: -78.99600

Stream class: C

Agency: NCAMBNT

NC stream index: 22-58-(9.5)

Time period: 01/10/2005 to 11/16/2009

Field	# results	# ND	EL	Results not meeting EL			Percentiles						
				#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	46	0	<4	0	0		6.3	6.7	7.1	9	10.9	11.8	12.6
	46	0	<5	0	0		6.3	6.7	7.1	9	10.9	11.8	12.6
pH (SU)	48	0	<6	1	2.1		5.9	6.4	6.6	7.1	7.3	7.4	7.8
	48	0	>9	0	0		5.9	6.4	6.6	7.1	7.3	7.4	7.8
Salinity (ppt)	8	0	N/A				0	0	0.1	0.1	0.1	0.1	0.1
Spec. conductance (umhos/cm at 25°C)	47	0	N/A				104	107	110	124	178	255	285
Water Temperature (°C)	48	0	>32	0	0		5.2	7.9	9.5	17.3	23.3	26.1	28.9
Other													
TSS (mg/L)	18	7	N/A				3	3.7	4.7	6.2	6.6	10.2	12
Turbidity (NTU)	47	0	>50	0	0		2.3	3.2	4	4.9	5.9	8.5	9.7
Metals (ug/L)													
Aluminum, total (Al)	8	0	N/A				160	160	160	215	368	410	410
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	6	>7	0	0		2	2	2	2	2	2	2
Iron, total (Fe)	8	0	>1000	0	0		250	250	275	405	520	860	860
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	7	>50	0	0		10	10	10	10	12	17	17
Fecal Coliform Screening(#/100mL)													
# results:	Geomean:	# > 400:	% > 400:	%Conf:									
44	9.1	0	0										

Key:

result: number of observations

ND: number of observations reported to be below detection level (non-detect)

EL: Evaluation Level; applicable numeric or narrative water quality standard or action level

Results not meeting EL: number and percentages of observations not meeting evaluation level

%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)

Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries

NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: MARLOWE CRK AT SR 1322 NR WOODSDALE

Station #: N4400000

Hydrologic Unit Code: 03010104

Latitude: 36.48325

Longitude: -78.97941

Stream class: C

Agency: NCAMBNT

NC stream index: 22-58-12-6

Time period: 01/10/2005 to 11/16/2009

Field	# results	# ND	EL	Results not meeting EL			Percentiles						
				#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	46	0	<4	0	0		6.5	6.9	7.6	9.3	12.1	13.5	14.2
	46	0	<5	0	0		6.5	6.9	7.6	9.3	12.1	13.5	14.2
pH (SU)	48	0	<6	0	0		6.2	6.5	6.8	7.1	7.4	7.7	8.8
	48	0	>9	0	0		6.2	6.5	6.8	7.1	7.4	7.7	8.8
Salinity (ppt)	8	0	N/A				0.1	0.1	0.1	0.1	0.2	0.3	0.3
Spec. conductance (umhos/cm at 25°C)	47	0	N/A				114	156	184	263	405	582	729
Water Temperature (°C)	48	0	>32	0	0		2.2	6.2	9.9	15.1	21.9	23.6	26.3
Other													
TSS (mg/L)	18	8	N/A				2.5	3.7	6.2	7	12.5	22.8	66
Turbidity (NTU)	47	0	>50	2	4.3		1.2	2.4	3.6	4.9	8.8	21	65
Nutrients (mg/L)													
NH3 as N	1	1	N/A				0.02	0.02	0.02	0.02	0.02	0.02	0.02
NO2 + NO3 as N	1	0	N/A				0.87	0.87	0.87	0.87	0.87	0.87	0.87
TKN as N	1	0	N/A				0.53	0.53	0.53	0.53	0.53	0.53	0.53
Total Phosphorus	1	0	N/A				0.3	0.3	0.3	0.3	0.3	0.3	0.3
Metals (ug/L)													
Aluminum, total (Al)	9	0	N/A				100	100	170	360	755	1000	1000
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	1	>7	2	22.2		2	2	4	4	7	16	16
Iron, total (Fe)	9	0	>1000	1	11.1		190	190	415	570	845	2200	2200
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	0	>50	4	44.4		12	12	26	46	57	630	630
Fecal Coliform Screening(#/100mL)													
# results:	Geomean:	# > 400:	% > 400:	%Conf:									
47	81.7	5	10.6										

Key:

result: number of observations

ND: number of observations reported to be below detection level (non-detect)

EL: Evaluation Level; applicable numeric or narrative water quality standard or action level

Results not meeting EL: number and percentages of observations not meeting evaluation level

%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)

Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries

NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: HYCO RIV AT US 501 NR DENNISTON VA

Station #: N4510000

Hydrologic Unit Code: 03010104

Latitude: 36.58805

Longitude: -78.89814

Stream class: III NT

Agency: NCAMBNT

NC stream index:

Time period: 01/10/2005 to 11/16/2009

	# results	# ND	EL	Results not meeting EL			Percentiles						
				#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	46	0	N/A				5.9	6.4	6.9	8.7	10.8	11.7	12.6
pH (SU)	48	0	N/A				6.2	6.2	6.7	7	7.2	7.5	7.9
Salinity (ppt)	8	0	N/A				0.1	0.1	0.1	0.1	0.1	0.1	0.1
Spec. conductance (umhos/cm at 25°C)	47	0	N/A				102	130	144	168	193	234	265
Water Temperature (°C)	48	0	N/A				3.9	5.7	9	15.3	23.6	26	27.2
Other													
TSS (mg/L)	18	10	N/A				2.5	2.5	3.9	6.2	6.9	21.5	35
Turbidity (NTU)	47	0	N/A				1.7	2.8	4.1	6.3	10	27	95
Metals (ug/L)													
Aluminum, total (Al)	9	0	N/A				87	87	109	200	660	1600	1600
Arsenic, total (As)	9	9	N/A				5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	N/A				1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	N/A				10	10	25	25	25	25	25
Copper, total (Cu)	9	3	N/A				2	2	2	2	3	4	4
Iron, total (Fe)	9	0	N/A				99	99	470	580	1095	2300	2300
Lead, total (Pb)	9	9	N/A				10	10	10	10	10	10	10
Manganese, total (Mn)	4	0	N/A				120	120	128	155	160	160	160
Mercury, total (Hg)	8	8	N/A				0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	N/A				10	10	10	10	10	10	10
Zinc, total (Zn)	9	6	N/A				10	10	10	10	16	41	41

Fecal Coliform Screening(#/100mL)

# results:	Geomean:	# > 400:	% > 400: %Conf:
47	61	1	2.1

Key:

result: number of observations

ND: number of observations reported to be below detection level (non-detect)

EL: Evaluation Level; applicable numeric or narrative water quality standard or action level

Results not meeting EL: number and percentages of observations not meeting evaluation level

%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)

Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

Ambient Monitoring System Station Summaries

NCDENR, Division of Water Quality
Basinwide Assessment Report

Location: MAYO CRK AT SR 1501 NR BETHEL HILL

Station #: N4590000

Hydrologic Unit Code: 03010104

Latitude: 36.54021

Longitude: -78.87362

Stream class: C

Agency: NCAMBNT

NC stream index: 22-58-15-(3.5)

Time period: 01/10/2005 to 11/16/2009

Field	# results	# ND	EL	Results not meeting EL			Percentiles						
				#	%	%Conf	Min	10th	25th	50th	75th	90th	Max
Field													
D.O. (mg/L)	46	0	<4	0	0		6.4	7	8.1	9.5	11.1	11.6	12.6
	46	0	<5	0	0		6.4	7	8.1	9.5	11.1	11.6	12.6
pH (SU)	48	0	<6	0	0		6.1	6.4	6.5	7	7.3	7.7	8.4
	48	0	>9	0	0		6.1	6.4	6.5	7	7.3	7.7	8.4
Salinity (ppt)	8	0	N/A				0	0	0	0.05	0.1	0.1	0.1
Spec. conductance (umhos/cm at 25°C)	47	0	N/A				92	97	113	119	128	140	160
Water Temperature (°C)	48	0	>32	0	0		4.7	7.2	9.8	16.3	22.1	24.9	31.6
Other													
TSS (mg/L)	18	14	N/A				2.5	2.5	2.5	6.2	6.2	6.3	7
Turbidity (NTU)	47	10	>50	0	0		1	1	1	1.3	2	2.9	3.9
Metals (ug/L)													
Aluminum, total (Al)	9	3	N/A				50	50	50	58	76	210	210
Arsenic, total (As)	9	9	>10	0	0		5	5	5	5	5	5	5
Cadmium, total (Cd)	9	9	>2	0	0		1	1	2	2	2	2	2
Chromium, total (Cr)	9	9	>50	0	0		10	10	25	25	25	25	25
Copper, total (Cu)	9	7	>7	0	0		2	2	2	2	2	3	3
Iron, total (Fe)	9	3	>1000	0	0		50	50	50	72	102	670	670
Lead, total (Pb)	9	9	>25	0	0		10	10	10	10	10	10	10
Mercury, total (Hg)	8	8	>0.012	0	0		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Nickel, total (Ni)	9	9	>88	0	0		10	10	10	10	10	10	10
Zinc, total (Zn)	9	7	>50	0	0		10	10	10	10	11	14	14
Fecal Coliform Screening(#/100mL)													
# results:	Geomean:	# > 400:	% > 400:	%Conf:									
46	7.6	1	2.2										

Key:

result: number of observations

ND: number of observations reported to be below detection level (non-detect)

EL: Evaluation Level; applicable numeric or narrative water quality standard or action level

Results not meeting EL: number and percentages of observations not meeting evaluation level

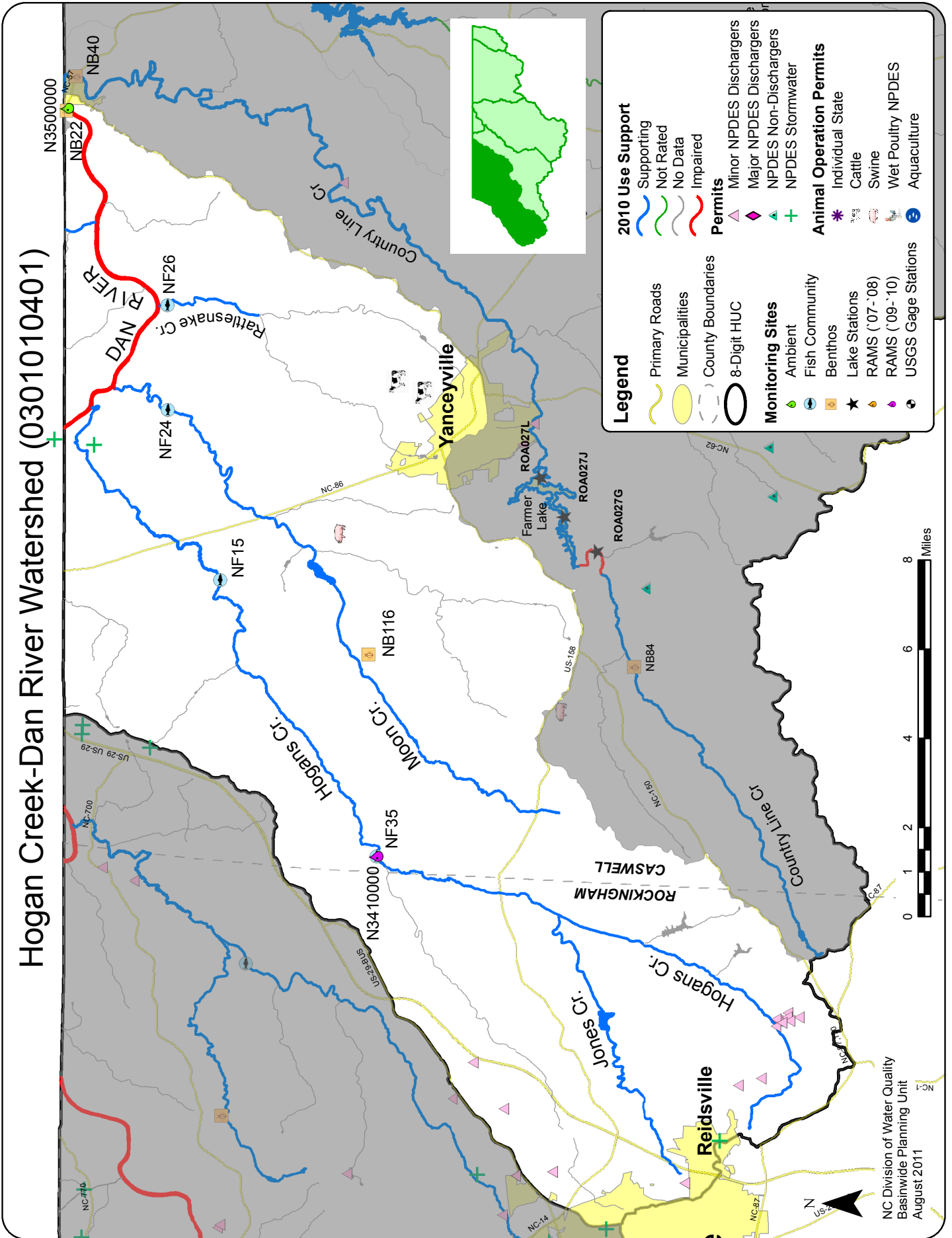
%Conf : States the percent statistical confidence that the actual percentage of exceedances is at least 10% (20% for Fecal Coliform)

Stations with less than 10 results for a given parameter were not evaluated for statistical confidence

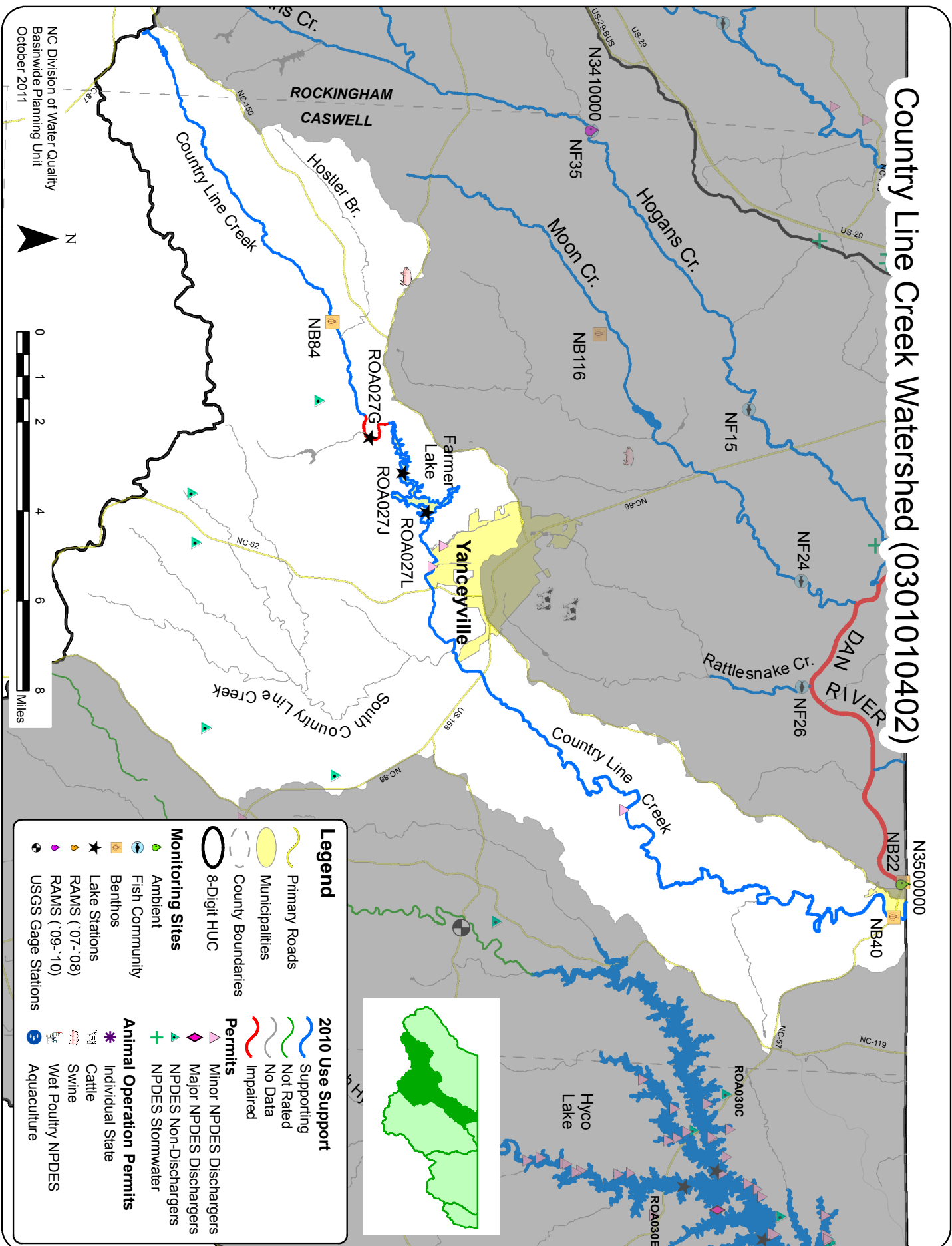
APPENDIX 2-D

10-DIGIT WATERSHED MAPS FOR THE LOWER DAN RIVER SUBBASIN

Hogan Creek-Dan River Watershed (0301010401)



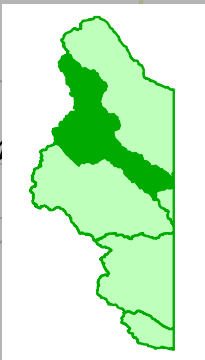
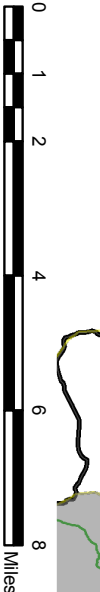
Country Line Creek Watershed (0301010402)



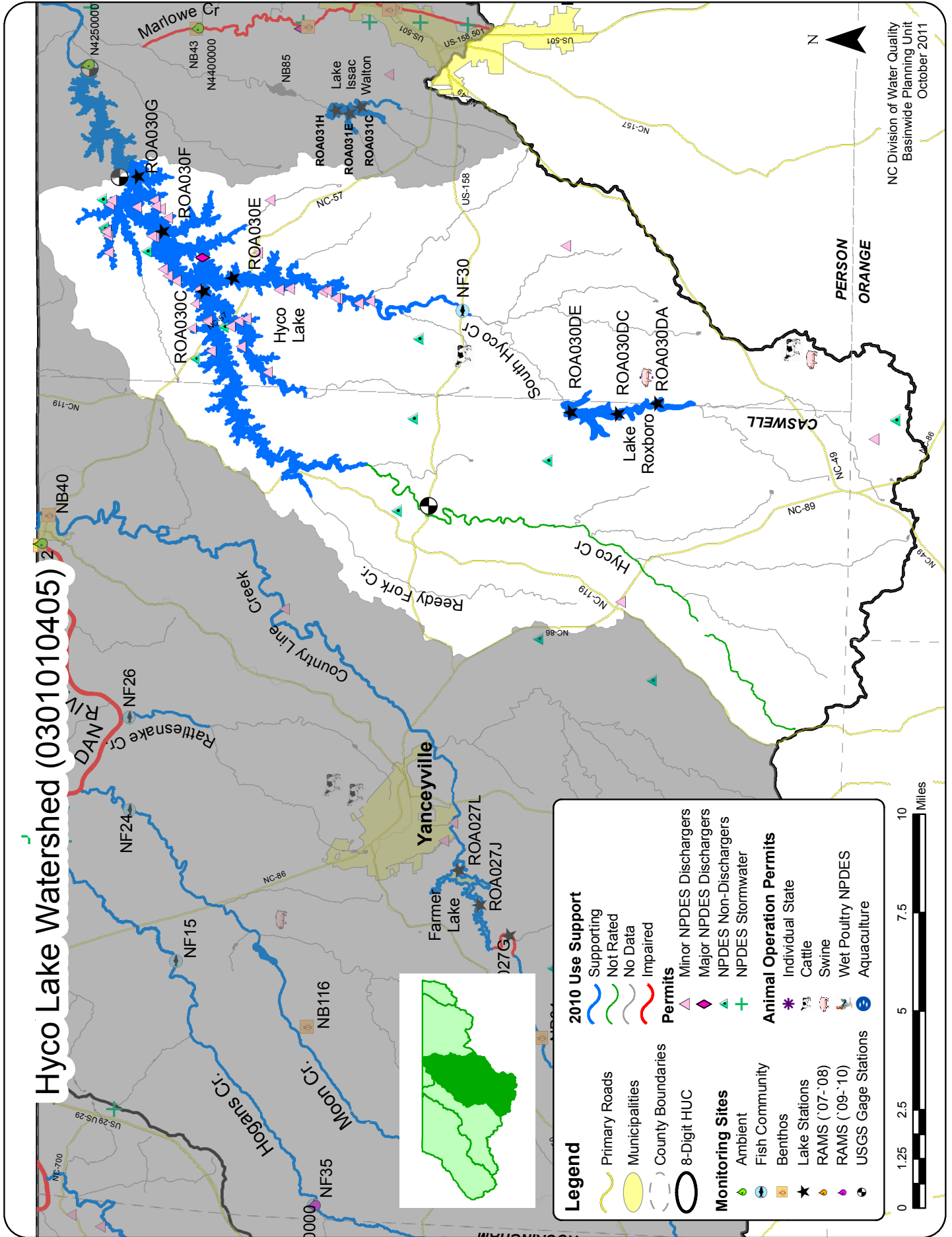
Legend

	Primary Roads		2010 Use Support
	Municipalities		Supporting
	County Boundaries		Not Rated
	8-Digit HUC		No Data
	Ambient		Impaired
	Fish Community		Minor NPDES Dischargers
	Benthos		Major NPDES Dischargers
	Lake Stations		NPDES Non-Dischargers
	RAMS (07-'08)		NPDES Stormwater
	RAMS (09-'10)		Animal Operation Permits
	USGS Gage Stations		Individual State
			Cattle
			Swine
			Wet Poultry NPDES
			Aquaculture

NC Division of Water Quality
 Basinwide Planning Unit
 October 2011



Hycos Lake Watershed (0301010405)



NC Division of Water Quality
 Basinwide Planning Unit
 October 2011

Legend

- Primary Roads
- Municipalities
- County Boundaries
- 8-Digit HUC

Monitoring Sites

- Ambient
- Fish Community
- Benthos
- Lake Stations
- RAMS ('07-'08)
- RAMS ('09-'10)
- USGS Gage Stations

2010 Use Support

- Supporting
- Not Rated
- No Data
- Impaired

Permits

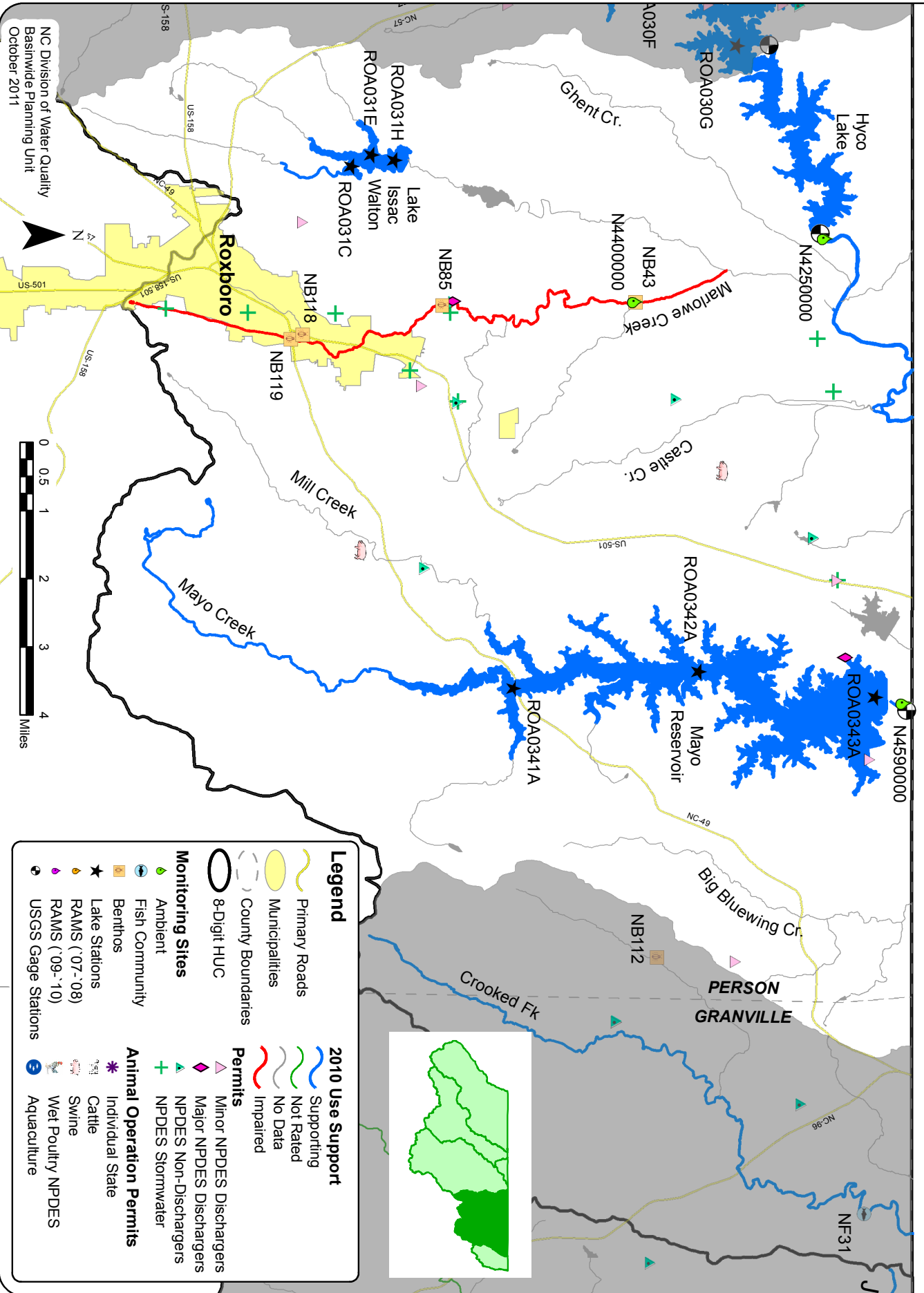
- Minor NPDES Dischargers
- Major NPDES Dischargers
- NPDES Non-Dischargers
- NPDES Stormwater

Animal Operation Permits

- Individual State
- Cattle
- Swine
- Wet Poultry NPDES
- Aquaculture

0 1.25 2.5 5 7.5 10 Miles

Hyco River Watershed (0301010406)



NC Division of Water Quality
 Basinwide Planning Unit
 October 2011



Aarons Creek-Dan River Watershed (0301010407)

