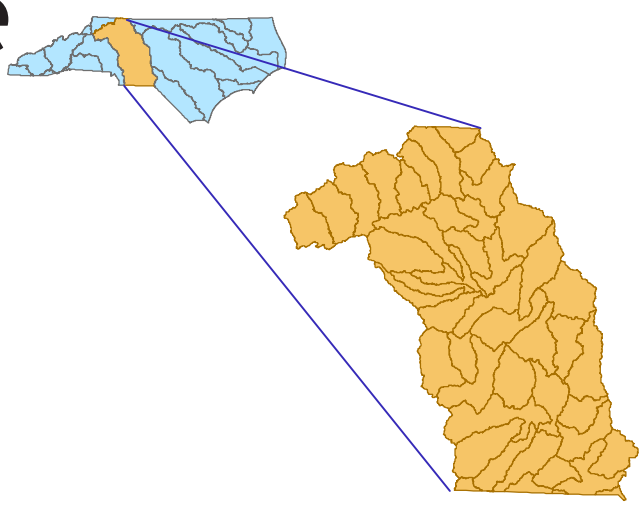
Yadkin - Pee Dee River Basin Plan 2008 Summary

Hydrologic Unit Code 030401



GENERAL DESCRIPTION

The Yadkin-Pee Dee River basin is the second largest basin in North Carolina and covers approximately 7,213 square miles, spanning 21 counties. Originating on the eastern slopes of the Blue Ridge Mountains in Caldwell and Wilkes counties, the Yadkin River flows northeasterly for about 100 miles and then turns southeast until joined by the Uwharrie River to form the Pee Dee River. The Pee Dee River continues its southeast course through North and South Carolina to Winyah Bay at the Atlantic Ocean.

Increasing nutrient enrichment, urbanization, and wastewater are the primary impacts to water quality in this basin. Most of these impacts are focused in the counties of Forsyth, Rowan, Iredell, Cabarrus, Davidson, and Union. Land conversion from forest and agricultural practices to suburban uses is occurring nearly everywhere throughout this basin. Only protected natural areas and steep mountainous terrain are not impacted by these changes.

Despite these areas of concern, there are still streams in largely forested and comparatively undeveloped catchments with very good water quality. Most of these waters are found in northern Wilkes, western Surry, and portions of Montgomery County (Uwharrie National Forest). In fact, of the 51 streams and rivers classified Outstanding Resource Waters (ORW) in the Yadkin-Pee Dee River basin, 73% are located in these counties.

The Yadkin-Pee Dee River basin experienced moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges.

CURRENT STATUS

There are 94 impaired assessment units in the Yadkin Pee-Dee River (Figure 1/Table 1). Impaired waterbodies are those streams/lakes not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) or those not meeting the narrative standards for either benthic macroinvertebrate community criteria or fish community criteria. Most of the stream impairments (26%) are based on poor biological integrity measured by aquatic macroinvertebrates and fish communities, followed by turbidity violations (19%), low dissolved oxygen levels (6%) and elevated fecal coliform bacteria (4%). In lakes and reservoirs, chlorophyll *a* exceeds the standards in 36% of the total acres sampled, followed closely by high pH levels (35%) and turbidity in 17% of the samples.

BASIN AT A GLANCE

COUNTIES

Alexander, Alleghany, Anson, Ashe, Cabarrus, Caldwell, Davidson, Davie, Forsyth, Guilford, Iredell, Mecklenburg, Montgomery, Randolph, Richmond, Rowan, Scotland, Stanly, Stokes, Surry, Union, Watauga, Wilkes, Yadkin

PERMITTED FACILITIES

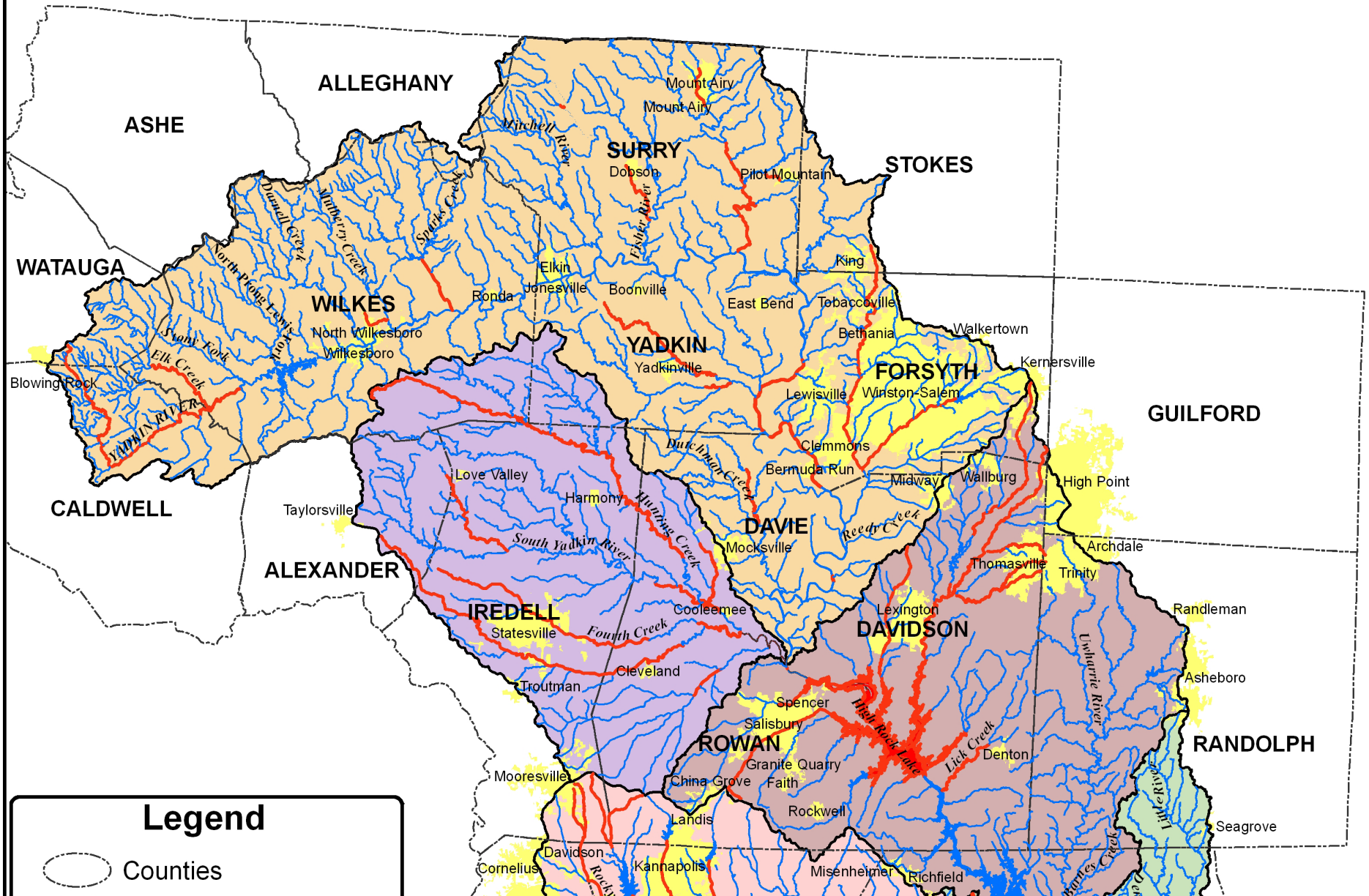
NPDES WWTP	
Major:	40
Minor:	193
NPDES Nondischarge:	80
NPDES Stormwater	
General:	647
Individual:	37
Phase II	21
Animal Operations:	347

AQUATIC LIFE SUMMARY

	Rivers & Streams (Miles)	Lakes & Reservoirs (Acres)
Monitored	2,320 39%	32,263 92%
Supporting	1,284 55%	12,796 40%
Not Rated	123 5%	8,004 25%
Impaired	912 39%	11,463 36%
No Data	3,626 61%	2,731 8%
Total length or area	5,946	34,994

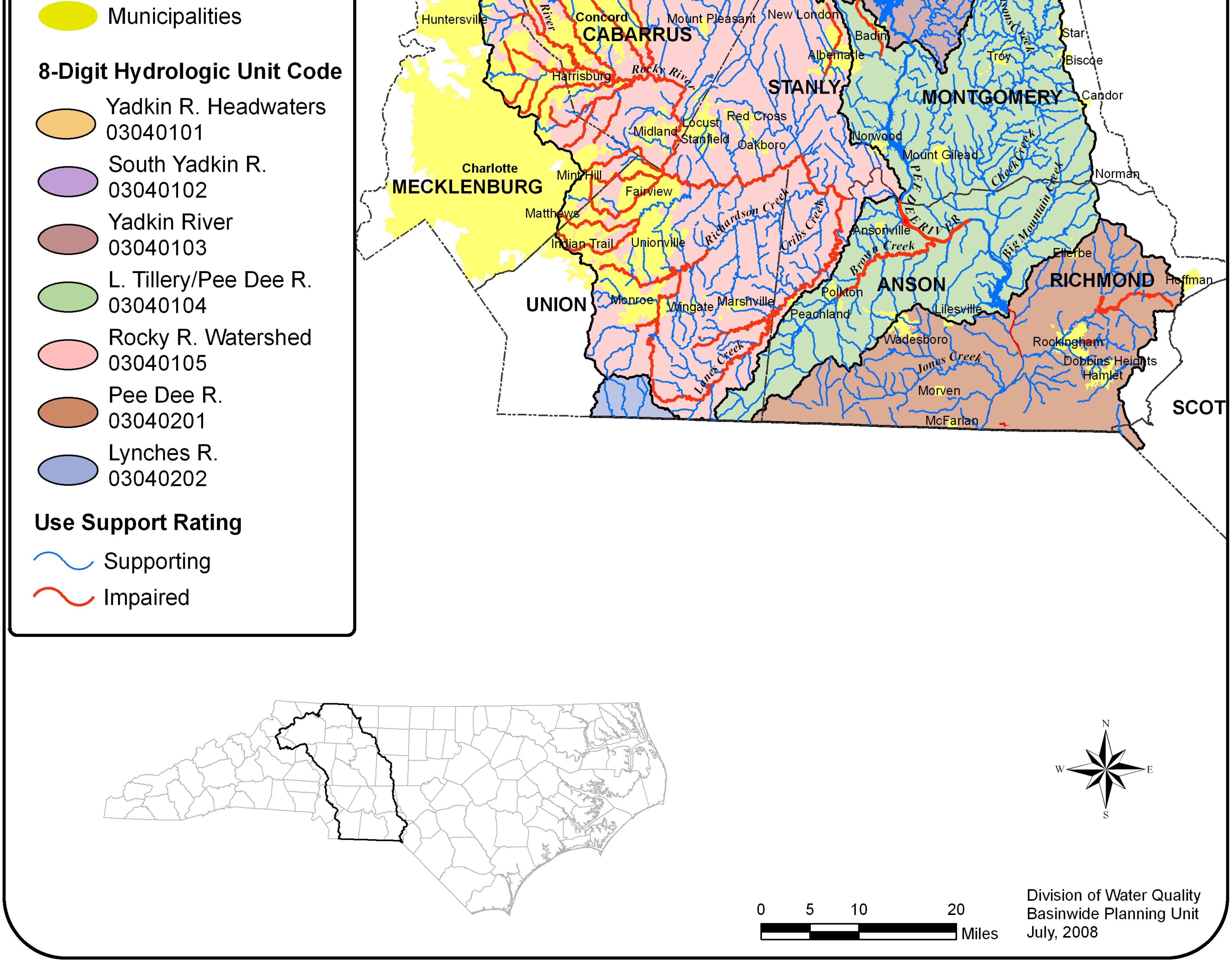
Figure 1

Yadkin - Pee Dee River Basin



Legend

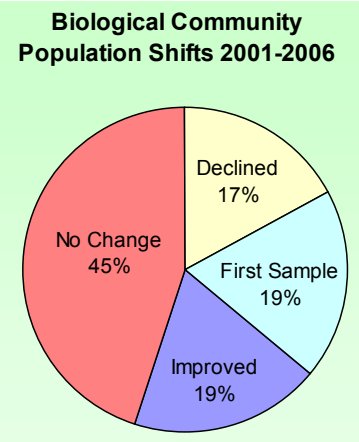
- Counties


Municipalities
8-Digit Hydrologic Unit Code
Yadkin R. Headwaters 03040101
South Yadkin R. 03040102
Yadkin River 03040103
L. Tillery/Pee Dee R. 03040104
Rocky R. Watershed 03040105
Pee Dee R. 03040201
Lynches R. 03040202
Use Support Rating
Supporting
Impaired
MECKLENBURG
CABARRUS
STANLY
MONTGOMERY
UNION
ANSON
RICHMOND
SCOT
Charlotte
Huntersville
Concord
Mount Pleasant
New London
Badin
Star
Biscoe
Troy
Candor
Albemarle
Harrisburg
Locust
Red Cross
Midland
Stanfield
Oakboro
Norwood
Mount Gilead
Norman
Mint Hill
Fairview
Matthews
Indian Trail
Unionville
Ansonville
Monroe
Wingate
Marshville
Polkton
Peachland
Lilesville
Wadesboro
Ellerbe
Hoffman
Rockingham
Dobbins Heights
Hamlet
Morven
McFarlan
Rocky River
Richardson Creek
Cribs Creek
Brown Creek
Lanes Creek
Jones Creek
Cheek Creek
Big Mountain Creek
PEE DEE RIVER
0 5 10 20 Miles
N
S
E
W
Division of Water Quality
Basinwide Planning Unit
July, 2008

BIOLOGICAL SAMPLING

The basinwide biological (fish and benthic community) sampling effort in the Yadkin-Pee Dee River basin increased by 12 percent between samples collected in 2001 and samples collected in 2006; however, this increased effort did not significantly impact the ratio of supporting and impaired streams. Nineteen percent of the waters sampled between 2001 and 2006 showed an improvement in biological communities (Figure 2). There was a 17 percent decline in benthic and fish populations between 2001 and 2006. Most declines were noted in areas along the urbanizing I-85 and I-40 corridors, particularly in western Cabarrus County.

FIGURE 2.



AMBIENT SAMPLING

Problem areas were scattered throughout the basin. See 8-digit hydrologic unit code (HUC) subbasin sections to get specifics on individual streams and lakes.

The majority of North Carolina, including the Yadkin-Pee Dee River basin, experienced drought in 2002, and significant rains in 2003. These dramatic changes in flow appear to account for fluctuations for many parameters, including temperature, specific conductance, dissolved oxygen, pH, turbidity, and fecal coliform. Comparisons of the six hydrologic units (HU) within the Yadkin-Pee Dee River basin yielded the following:

·Physical Parameters; all HUs:

- Temperature: The majority of variation in temperature is caused by seasonal and daily variation in solar radiation and air temperature. A slight increase in surface water temperature was detected in the South Yadkin HU. There were no discernible trends in the other five HUs.
- Specific Conductance: Conductance peaked in 2002 during the drought. Similarly it reached its lowest point during 2003 and the end of the drought. Downward trends in conductivity values in the Yadkin River Headwaters, the Rocky River, and the Pee Dee River reflect the end of the drought and resultant dilution due to increased runoff and rainfall.
- Dissolved Oxygen: Dissolved Oxygen was at its lowest during the 2002 drought. Increasing concentrations in the Yadkin River Headwaters, the Rocky River, and the Pee Dee River reflect the end of the drought.
- pH: The ending of the drought in 2003 caused a steep decline in pH values throughout the basin.
- Turbidity concentrations appear to be decreasing in the South Yadkin and High Rock Lake HUs and increasing in the Rocky River HU. Turbidity concentrations were low during the 2002 drought, rose in 2003, and have since stayed relatively even.
- Fecal Coliform bacteria levels peaked during the 2003 rains, and has decreased since then. Significant downward trends are present in the Yadkin River Headwaters, the South Yadkin River, the High Rock Lake, and the Lake Tillery HUs.

·Nutrients in Yadkin River Headwaters & South Yadkin River 8-digit HUs:

- Ammonia concentrations appeared to decrease slightly and do not appear to be related to the drought.
- Total Kjeldahl Nitrogen concentrations appeared to be decreasing and do not appear to be related to the drought.
- Total Nitrate and Nitrite concentrations peaked during the drought and were beginning to decrease after the drought ended.
- Total Phosphorus concentrations appeared to decrease. Concentrations were slightly higher during the drought.
- Nutrients in Lake Tillery HU: Total Nitrate and Nitrite concentrations appeared to increase slightly.
- Nutrients in Rocky River HU: Total Phosphorus concentrations tended to be higher than in the rest of the HUs.

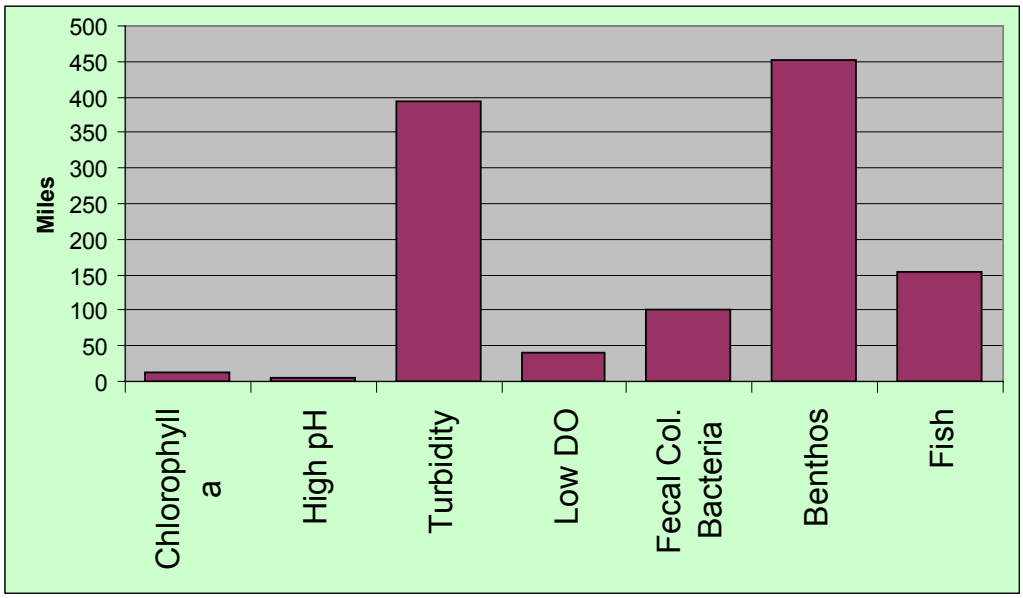
SIGNIFICANT ISSUES

WATER QUALITY STRESSORS & SOURCES

Rivers and Streams

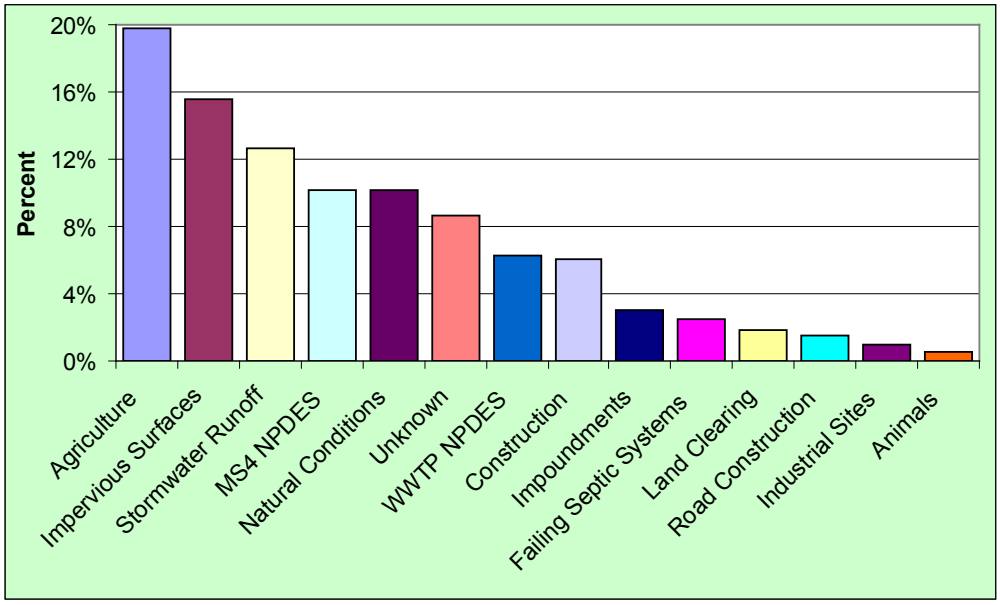
Stressors are indicators or parameters that may cause water quality degradation. Twenty-six percent of stream impairments are based on poor biological integrity measured by aquatic macroinvertebrates and fish communities, turbidity violations account for 19 percent, low dissolved oxygen levels six percent and elevated fecal coliform bacteria four percent. Stream miles impaired by these parameters are indicated in Figure 3.

FIGURE 3. STREAM MONITORED PARAMETERS



When evaluating water quality stressors, DWQ evaluates and identifies the source of the stressor as specifically as possible depending on the amount of information available for that particular watershed. ***Sources*** are most often associated with the predominant land use where the altered hydrology is able to easily deliver the water quality stressor to the waterbody. Factors that contribute to habitat degradation include increased impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Sources identified as contributing to water quality degradation in the Yadkin- Pee Dee River basin are found in Figure 4.

FIGURE 4. IDENTIFIED SOURCES CONTRIBUTING TO WATER QUALITY DEGRADATION IN STREAMS



Lakes and Reservoirs

For lakes and reservoirs in the Yadkin-Pee Dee River basin, nutrient overenrichment is the largest stressor as evidenced by the high percentage of waters impacted by high chlorophyll a levels and high pH (Figure 5). Turbidity and temperature were the next most common stressors to these lake and reservoir systems. Stormwater is the predominant stressor source for lakes and reservoirs in the Yadkin- Pee Dee River basin (Figure 6). Stormwater is the flow of water that results from precipitation and usually occurs immediately following a rainfall. Common stormwater pollutants include sediment, nutrients, organic matter, bacteria, oil and grease, and toxic substances (i.e., metals, pesticides, herbicides, hydrocarbons). Stormwater can also impact the temperature of a surface waterbody, which can affect the water's ability to support healthy aquatic communities.

Figure 5. Lake Impaired Parameters

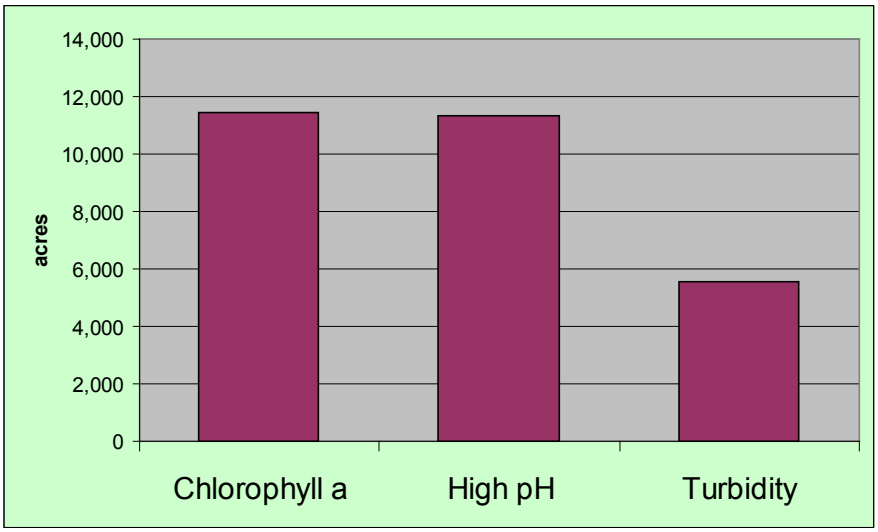
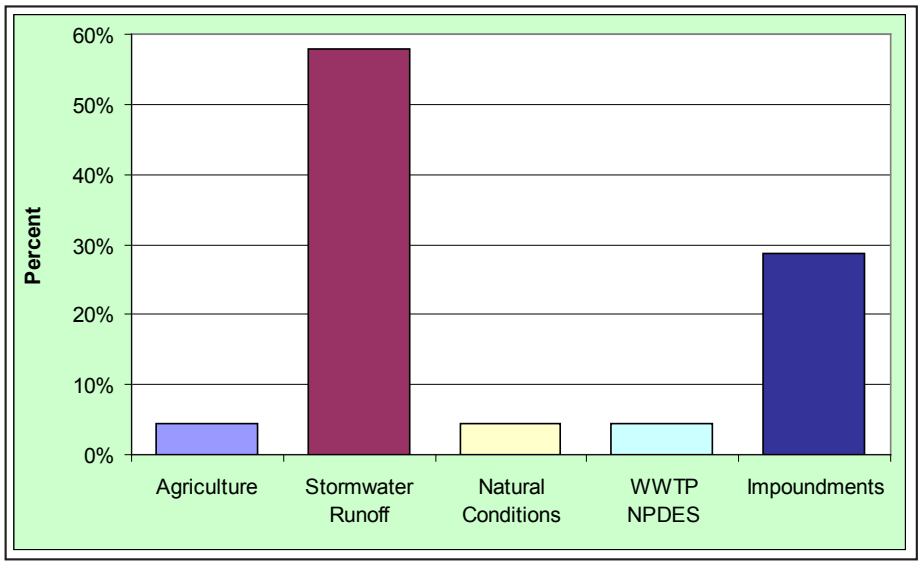


Figure 6. Identified Sources Contributing to Water Quality Degradation in Lakes



Nutrients

Nutrients are significantly impacting lakes throughout the basin as evidenced by algal productivity. Most impoundments in the piedmont are sensitive to nutrient inputs and are unable to effectively assimilate the nutrient loads exported from developed and agricultural areas, as well as wastewater discharges. Most of the lakes sampled by DWQ during this assessment cycle showed evidence of nutrient overenrichment (Table 1). Nutrient overenrichment can result in algal blooms that deplete oxygen, kill fish and create taste and odor problems in drinking water. A detailed sampling report of these Lakes and Reservoirs is available from DWQ's Environmental Sciences Section: *http://h2o.enr.state.nc.us/esb/Basinwide/YadkinLakes2006v7.pdf*.

Table 1. Impoundments with Indications of Nutrient Overenrichment

Waterbody	
High Rock Lake	Lake Fisher
Salem Lake	Lake Concord
Lake Thom-a-lex	Lake Lee
Tuckertown Reservoir	Lake Monroe
Back Creek Lake	Lake Twitty
Bunch lake	City Pond (Wadesboro Lake)

Fecal Coliform

Fecal coliform concentrations peaked during the 2003 rains and have since decreased. Significant decreases are present in the Yadkin River headwaters, South Yadkin River, High Rock Lake, and Lake Tillery HUs. Concentrations appear to be increasing in the Rocky River HU. While fecal coliform concentrations appear to be decreasing in many HUs, many samples in all HUs were well above the 400 colonies/ml maximum limit.

Turbidity

The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the Yadkin River headwaters. It appears, however, violations are highest in the Yadkin River mainstem, agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where land use is predominantly forest. This observation exemplifies the utility of ***stream buffers and natural areas.***

Figure 7 depicts the distribution of fecal coliform and turbidity standards violations within the Yadkin-Pee Dee River basin. For the most part, elevated concentrations of one are associated with elevated concentrations of the other and are found in some of the more developed areas of the basin.

Figure 8 shows the percent of samples per year that exceeded 50 NTUs for all ambient stations in the entire Yadkin- Pee Dee Basin between 1997-2007. High rainfall events in 2003 clearly result in increased turbidity impairments.

See: ***Yadkin Ambient Monitoring System Report*** and ***Yadkin Basinwide Assessments*** for detailed sample results and discussion.

Figure 7. Water Quality Violations

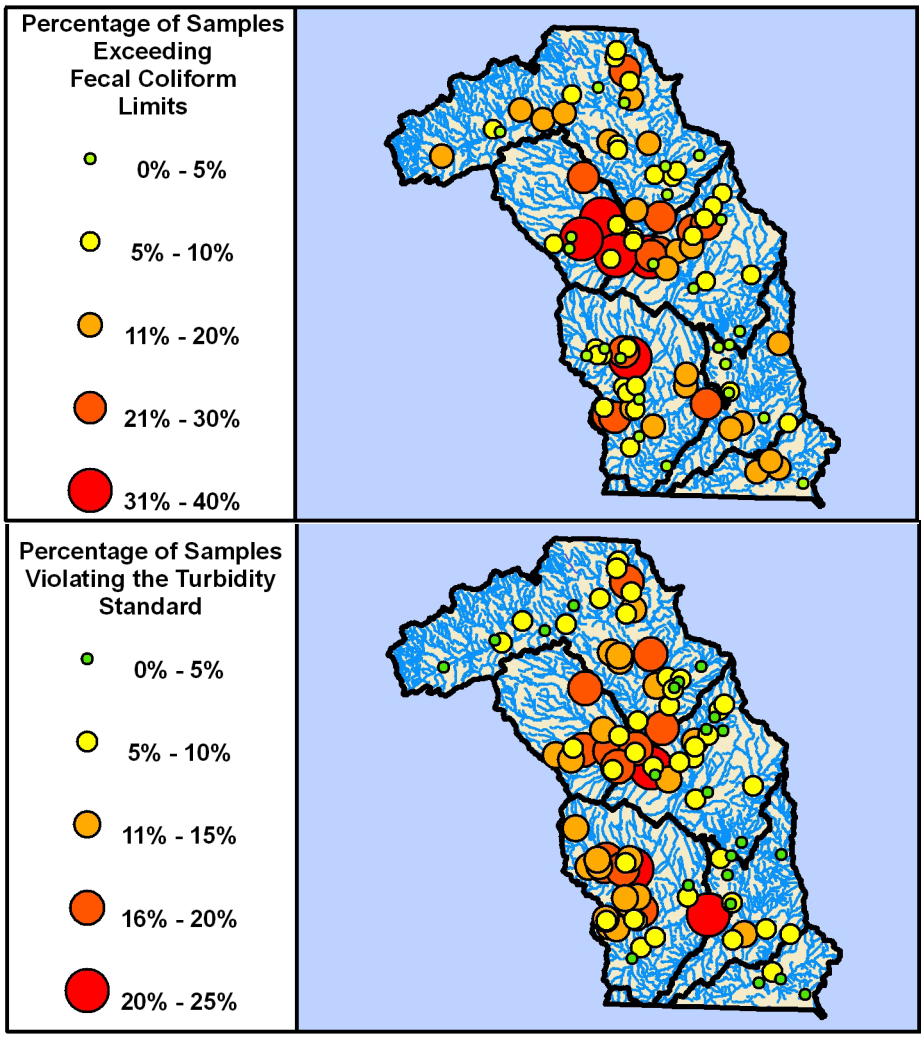
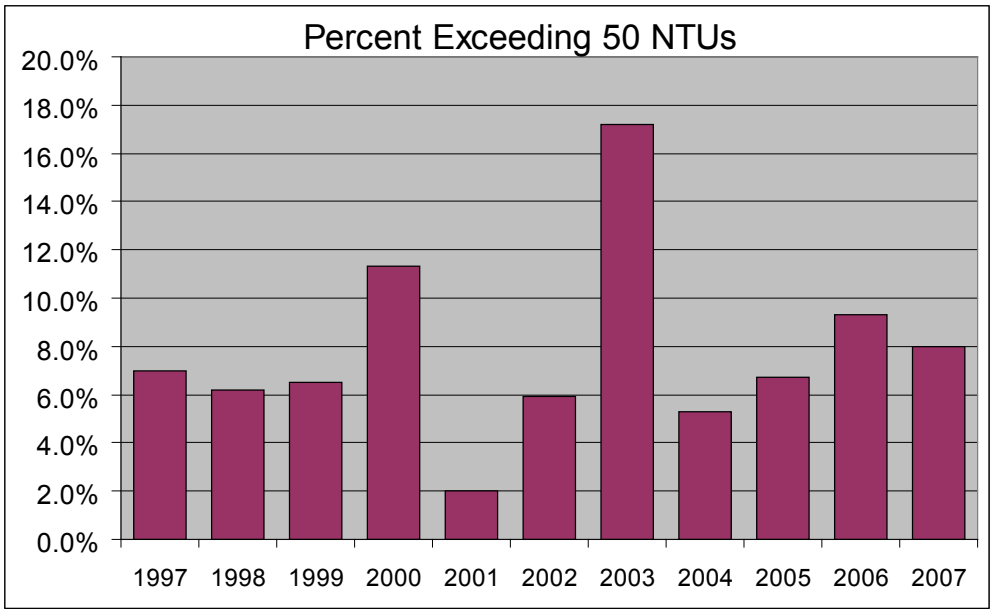


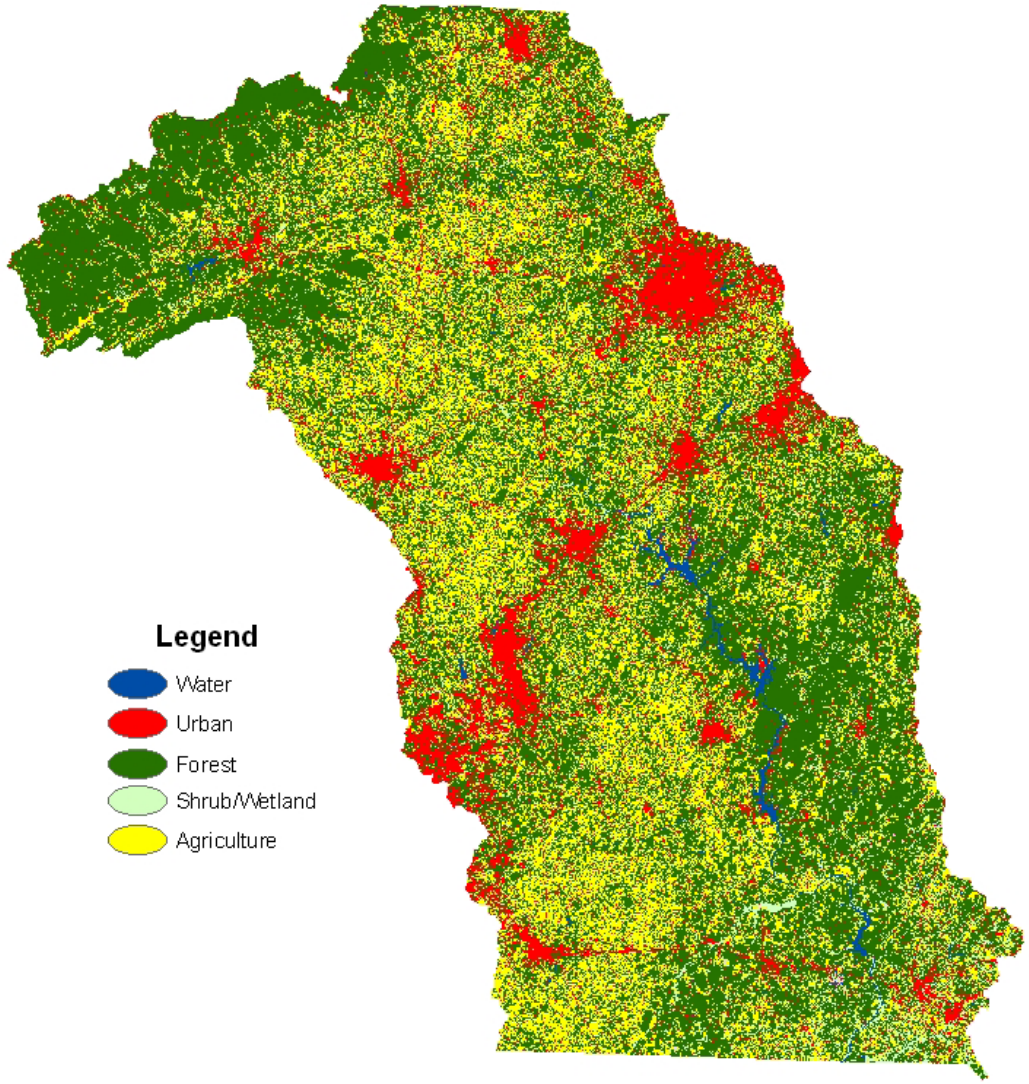
Figure 8. Turbidity Comparison



POPULATION AND LAND USE

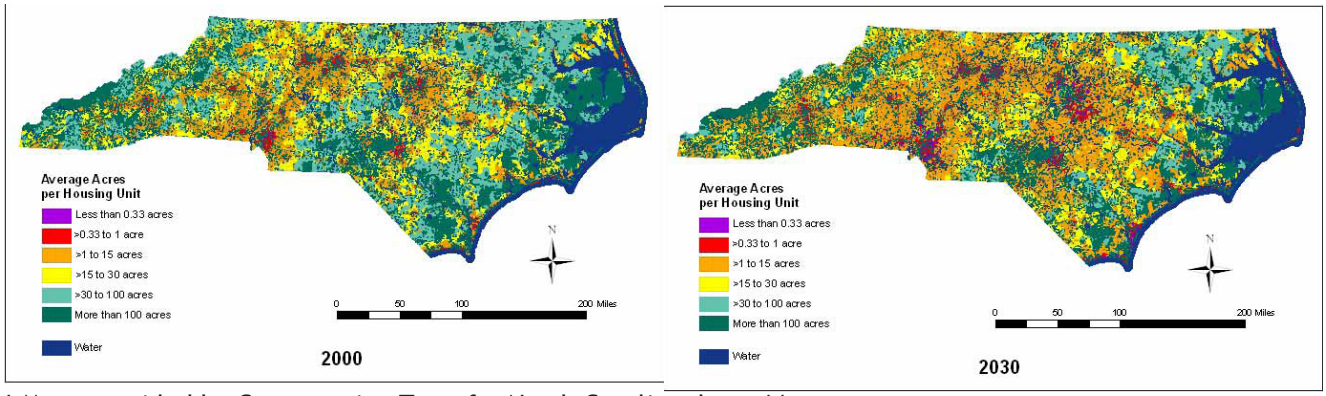
Population distribution and land use patterns are highly variable in the Yadkin-Pee Dee River Basin. Land use varies from generally undisturbed in the western highlands to decidedly urban in the central portion of the watershed along the I-85 and I-40 corridors. The population distribution closely follows this pattern (Figure 9 & Figure 10).

Figure 9. Land Cover



* USGS 2003, National Land Cover Database Zone 60 Land Cover Layer

Figure 10. NC Housing Density Comparison 2000 vs. 2030



* Maps provided by Conservation Trust for North Carolina http://www.ctnc.org

HIGH QUALITY WATERSHEDS AT A CROSSROADS

Stream degradation in this river basin closely follows population density and land use patterns. Degradation is more common in agriculture areas than in forested headwaters and most concentrated in urban areas. However, this pattern may be changing as new development pressure, in the form of secluded resort communities and low-density second home developments, increases in the forested headwaters. Many of these developments are sited in designated High Quality and Outstanding Resource Watersheds ***(HQW/ORW)***.

One of the largest residential/resort communities in North Carolina is currently under construction in the Elk Creek ORW. Because ORW watersheds usually occur in historically rural and undisturbed areas, the long-term ability of the management strategies to maintain ORW status in the face of these new developments remains untested.

Research suggests that streams begin to degrade when watershed imperviousness reaches ten percent of the total land area. The ORW management strategy, however, allows for much higher densities provided the development treats the first inch of rainfall. The management strategy also requires enhanced sediment and erosion control and, in some cases, a 30-foot stream buffer. The management strategy does not restrict the number of developments or homes that may be constructed in a watershed. It is unclear if these restrictions are sufficient to maintain excellent water quality as development and cumulative imperviousness increases. New research that accurately projects development scenarios and their impact on water quality is needed in the short term.

INTERSECTING WATER QUALITY WITH WATER QUANTITY

Recent droughts in North Carolina have raised significant concern about long term water availability for human uses. Efforts are underway to study and update North Carolina's water supply laws and raise local water supply resistance to future droughts. These efforts will lead to inevitable alterations in stream flow, and thus directly impact water quality. Impacts to water quality and biological integrity must be fully examined in these planning efforts.

The Rocky River Watershed (HUC 03040105), in the southwestern portion of the basin, is one of the first regions in North Carolina forced to find the difficult balance between clean and reliable drinking water, healthy streams, and rapid urbanization. From Mooresville in the north to Monroe in the south, most of the suburban communities around Charlotte depend in some way on the ecological services provided by the Rocky River and are facing strong development pressure.

With the growing population come additional demands for drinking water supply and wastewater assimilative capacity. Solutions for one of these will directly impact the other. For example, the stream flow volume altered by new interbasin transfers will alter the calculations used to derive wastewater discharge permit limits. In another possible scenario, access to additional water withdrawals by an upstream community may be restricted because downstream discharges require a certain flow to remain in permit compliance. The complexity of this system requires close coordination between DWQ and the Divisions of Water Resources (DWR) and Environmental Health (DEH) if a sustainable solution is to be derived.

COORDINATING STREAM RESTORATION AND PROTECTION EFFORTS

Sixty-three waterbodies in the Yadkin-Pee Dee River basin are impaired (Appendix A) and more streams are added during each new assessment. Population growth and associated land use changes, higher water consumption, greater wastewater production, and stormwater runoff are major contributors to these impairments. The protection and restoration of streams is a multi-agency effort, requiring various levels of resources and expertise. North Carolina has shown great leadership by dedicating funding for water quality protection and restoration through several trust funds. Additionally, a broad network of local governments, conservation trusts, and other nonprofit organizations support stream protection and restoration at the local level. Despite these accomplishments, many water quality improvement efforts lack adequate resources resulting in management that may be under-coordinated and inefficient.

Tighter coordination between organizations involved in restoration and protection of surface waters will lead to expeditious and cost-effective projects. Specifically, common program goals and watersheds with the potential to meet these goals should be identified. These watersheds should be prioritized and a concerted effort to focus each organization's technical specialties should be undertaken. By focusing resources and spreading the burden between organizations restoration projects will proceed more efficiently. DWQ has initiated an effort to bring the state organizations together for the purpose of identifying common goals and mandates. Encouragement from DENR

management and partnerships with local organizations will go a long way towards advancing this effort and lead to new restoration synergy.

Currently, multiple state and local agencies are actively involved in restoration efforts in Ararat River and Grants, Coddle, Goose and Crooked Creeks' watersheds. Specific information regarding each of these efforts is detailed in its own ***subbasin/watershed report***. As information and resources become available these reports will be updated to assist in coordination and tracking activities.

TOTAL MAXIMUM DAILY LOADS (TMDL)

A ***Total Maximum Daily Load*** (TMDL) is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. This includes an allocation of that amount to the pollutant's sources and a margin of safety. A TMDL includes a detailed water quality assessment that can provide the scientific foundation for a restoration implementation plan. However, under the Federal Clean Water Act there is no requirement to develop an implementation plan. Therefore, a TMDL by itself can only identify controls to point sources since the allocation estimates are used for development of discharger permit limits. DWQ is supporting local development and implementation of management strategies to address nonpoint sources in these watersheds.

TMDLs have been completed in the basin for the waters listed in Table 2. A management strategy including rules is under development for Goose Creek. More information on Goose Creek is available at ***http://h2o.enr.state.nc.us/csu/GooseCreek.html***.

High Rock Lake TMDL

DWQ has initiated a TMDL development process for High Rock Lake due to violations of the turbidity and chlorophyll a standards. Turbidity and sedimentation are significant water quality issues in the Yadkin River Headwaters. The sediment generated in the Yadkin River Headwaters contributes directly to the water quality impairment observed in High Rock Lake. In addition to sediment, runoff from the landscape delivers substantial nutrients to High Rock Lake that lead to chlorophyll a violations. Residents and government agencies in the Yadkin River Headwaters are active in the TMDL development process for the lake and will be working together to implement point and nonpoint source pollution reduction strategies.

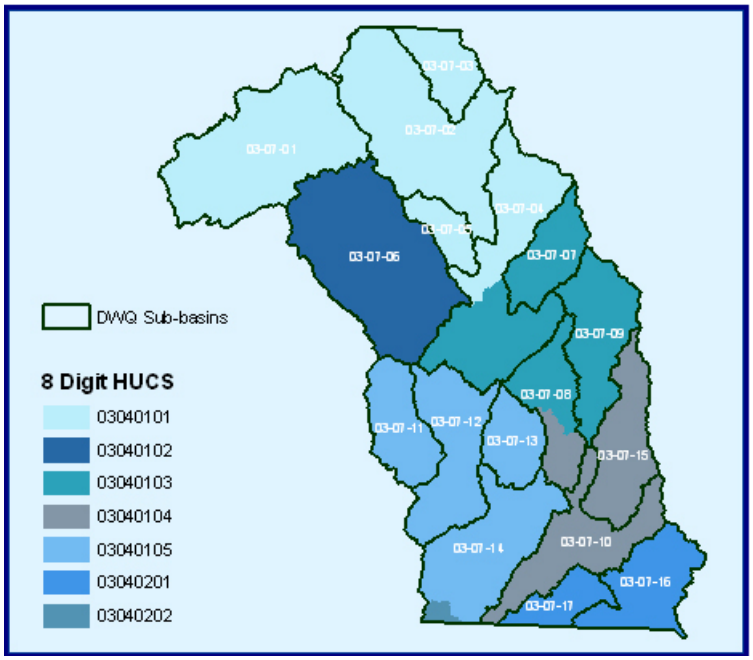
Table 2: Finalized TMDLs in the Yadkin – Pee Dee River Basin

Waterbody	Pollutant	Link	Final TMDL Date
Elk Creek	Fecal Coliform	*Final TMDL*	Feb. 20, 2008
McKee and Clear Creeks	Fecal Coliform	*Final TMDL*	Aug. 1, 2003
Rocky River	Fecal Coliform	*Final TMDL*	Sept. 19, 2002
Grants Creek	Fecal Coliform	*Final TMDL*	Sept. 27, 2002
Fourth Creek	Fecal Coliform	*Final TMDL*	Dec. 19, 2001
Rich Fork and Hamby Creeks	Fecal Coliform	*Final TMDL*	Apr. 28, 2004
Fourth Creek	Turbidity	*Final TMDL*	Nov. 22, 2004
Goose Creek	Fecal Coliform	*Final TMDL*	July 8, 2005
Grants Creek	Turbidity	*Final TMDL*	Sept. 25, 2006
Salem Creek	Fecal Coliform	*Final TMDL*	Sept. 25, 2006

RIVER BASIN HYDROLOGIC UNITS

The Yadkin River basin covers over 7,000 square miles. Many management strategies a more appropriate to smaller land areas. Therefore the basin is divided into smaller watersheds based on major drainages. Under the federal system, the Yadkin River basin is made up of hydrologic areas referred to as cataloging units (USGS 8-digit hydrologic units). Cataloging units ar further divided into smaller watershed units (10 and 12-digit hydrologic units or local watersheds) that are used for smaller scale planning. Historically, DWQ has used its own 6-digit watershed numbering system but is migrating to the federal system for consistency. A comparative map of the different systems is show in Figure 11.

Figure 11. Yadkin-Pee Dee River Basin Hydrologic Divisions



RECOMMENDATIONS

WATER QUALITY STRESSORS: HABITAT DEGRADATION, TURBIDITY, FECAL COLIFORM & NUTRIENTS

- Encourage and support implementation of Best Management Practices, Sediment & Erosion Control Local Programs and Local Stormwater Control Ordinances.
- Support research to determine the contribution of human accelerated erosion sources vs. natural processes.
- Develop watershed restoration plans for through federal, state and local stakeholder initiatives.
- Collect sufficient samples at locations with elevated fecal coliform bacteria counts prioritized such that those sites classified for organized swimming (B) are addressed first to allow complete use support determinations.
- Use High Rock Lake restoration efforts and research to direct nutrient management strategies in the upper basin.

HIGH QUALITY WATERS

- Conduct a comprehensive review of the North Carolina's High Quality Waters management strategy to determine how it is working and where it needs to be adjusted.
- Support new research that accurately projects development scenarios and their impact on water quality.

COORDINATED EFFORTS

- Evaluate the need for basinwide sediment, buffer and stormwater management programs with appropriate agency partners.
- In partnership with Division of Water Resources, assess water supply and assimilative capacity in the Rocky River watershed with the goal of deriving a sustainable solution to the area's water supply and wastewater concerns.
- Continue support of the Yadkin-Pee Dee River Basin Association's monitoring efforts.
- Continue support of the restoration projects within the basin and pursue opportunities to develop partnerships and restoration activities in other impaired watersheds.

11

Appendix A. Impaired Waterbodies in Yadkin Pee-Dee River Basin because of Standard Violations or Exceeded Biological Criteria

AU Number	HUC (Watershed Boundary #)	Name	Class	Parameter of Interest
12-(1)	03040101	Yadkin River	C;Tr	Turbidity
12-(80.7)	03040101	Yadkin River	WS-IV	Turbidity
12-(86.7)	03040101	Yadkin River	WS-IV	Turbidity
12-(97.5)	03040101	Yadkin River	WS-IV;CA	Turbidity
12-102-13-(2)	03040101	Cedar Creek	C	Fish
12-24-(10)	03040101	Elk Creek	B;ORW	Recreation- Fecal Coliform Bacteria
12-42-9	03040101	Long Creek	C	Benthos
12-46	03040101	Roaring River	B	Recreation- Fecal Coliform Bacteria
12-63-14	03040101	Cody Creek	C	Turbidity
12-63-5-(3)	03040101	Endicott Creek (Branch)	WS-II; Tr,HQW	Benthos
12-72-(18)	03040101	Ararat River	WS-IV	Turbidity
12-72-(4.5)b	03040101	Ararat River	C	Turbidity
12-72-14-5b	03040101	Heatherly Creek	C	Benthos
12-72-8-(3)	03040101	Lovills Creek (Lovell Creek)	C	Benthos
12-84-1-(0.5)	03040101	North Deep Creek	C	Turbidity
12-84-2-(5.5)	03040101	South Deep Creek	WS-IV	Turbidity
12-94-(0.5)a	03040101	Muddy Creek	C	Benthos
12-94-(0.5)b	03040101	Muddy Creek	C	Benthos
12-94-12-(4)	03040101	Salem Creek (Middle Fork Muddy Creek)	C	Benthos, Recreation- Fecal Coliform Bacteria
12-108-(14.5)	03040102	South Yadkin River	WS-IV	Turbidity
12-108-(19.5)b	03040102	South Yadkin River	C	Turbidity
12-108-16-(0.5)	03040102	Hunting Creek	WS-III	Turbidity
12-108-18-(3)	03040102	Bear Creek	WS-IV	Fish
12-108-20-4a	03040102	Third Creek	C	Turbidity
12-108-20-4b	03040102	Third Creek	C	Fish, Turbidity
12-108-20a1	03040102	Fourth Creek	C	Fish
12-108-20a3	03040102	Fourth Creek	C	Turbidity, Benthos, Fish, Recreation- Fecal C. Bacteria
12-108-20c	03040102	Fourth Creek	C	Fish
12-108-21b	03040102	Second Creek (North Second Creek)	C	Turbidity
12-108-9-(0.6)	03040102	Snow Creek	WS-IV	Fish
12-(108.5)b	03040103	Yadkin River (upper portion of High Rock Lake below normal operating level)	WS-V	Turbidity, High pH, Chlorophyll a
12-(114)	03040103	Yadkin River (including lower portion of High Rock Lake)	WS-IV,B	Chlorophyll a, High pH
12-(124.5)a	03040103	Yadkin River (including lower portion of High Rock Lake)	WS-IV,B;CA	Chlorophyll a, High pH
12-110b	03040103	Grants Creek	C	Turbidity, Recreation- Fecal Coliform Bacteria
12-113	03040103	Swearing Creek	C	Fish
12-115-3	03040103	Town Creek	C	Benthos, Fish
12-117-(3)	03040103	Second Creek Arm of High Rock Lake	WS-IV,B	Chlorophyll a, High pH
12-118.5a	03040103	Abbotts Creek Arm of High Rock Lake	WS-V,B	Chlorophyll a
12-118.5b	03040103	Abbotts Creek Arm of High Rock Lake	WS-V,B	Chlorophyll a, Turbidity, High pH
12-119-(1)	03040103	Abbotts Creek	WS-III	Fish
12-119-(6)a	03040103	Abbotts Creek	C	Turbidity, Benthos
12-119-(6)b	03040103	Abbotts Creek	C	Benthos
12-119-7-3	03040103	Hunts Fork	C	Benthos
12-119-7-4	03040103	Hamby Creek	C	Benthos
12-119-7-4-1	03040103	North Hamby Creek	C	Benthos

AU Number	HUC (Watershed Boundary #)	Name	Class	Parameter of Interest
12-119-7a	03040103	Rich Fork	C	Recreation- Fecal Coliform Bacteria
12-119-7b	03040103	Rich Fork	C	Fish
12-126-(3)	03040103	Lick Creek	WS-IV	Benthos
12-126-(4)	03040103	Lick Creek	WS-IV;CA	Benthos
13-(15.5)b	03040104	Pee Dee River	WS-V,B	Turbidity
13-(34)a	03040104	Pee Dee River	C	Mercury
13-20b	03040104	Brown Creek	C	Low DO, Benthos
13-5-1-(1)	03040104	Little Mountain Creek	C	Benthos
13-5-1-(2)	03040104	Little Mountain Creek	WS-IV	Benthos
13-17-17	03040105	Clear Creek	C	Turbidity
13-17-18-3	03040105	Duck Creek	C	Benthos
13-17-18a	03040105	Goose Creek	C	Recreation- Fecal Coliform Bacteria
13-17-18b	03040105	Goose Creek	C	Benthos, Recreation- Fecal Coliform Bacteria
13-17-2	03040105	Dye Creek (Branch)	C	Benthos
13-17-20-1	03040105	North Fork Crooked Creek	C	Turbidity, Benthos
13-17-20-2a	03040105	South Fork Crooked Creek	C	Fish, Benthos
13-17-20-2b	03040105	South Fork Crooked Creek	C	Benthos
13-17-31-1	03040105	Little Long Creek	C	Benthos
13-17-36-(3.5)	03040105	Richardson Creek (Lake Lee)	WS-IV;CA	Chlorophyll a
13-17-36-(5)a1a	03040105	Richardson Creek	C	Turbidity, Benthos
13-17-36-(5)a1b	03040105	Richardson Creek	C	Benthos
13-17-36-4-(0.5)	03040105	Little Richardson Creek (Lake Monroe)	WS-IV	Chlorophyll a
13-17-36-4-(2)	03040105	Little Richardson Creek (Lake Monroe)	WS-IV;CA	Chlorophyll a
13-17-36-9-(1)	03040105	Stewarts Creek	WS-III	Benthos
13-17-36-9-(4.5)	03040105	Stewarts Creek (Lake Twitty/L. Stewart)	WS-III;CA	Chlorophyll a
13-17-4	03040105	Clarke Creek	C	Fish
13-17-40-(1)	03040105	Lanes Creek	WS-V	Benthos
13-17-40-(12)	03040105	Lanes Creek	C	Benthos
13-17-40-11	03040105	Beaverdam Creek	WS-V	Low DO
13-17-5-2	03040105	Clarks Creek	C	Benthos
13-17-5-3	03040105	Doby Creek	C	Benthos
13-17-5-4	03040105	Toby Creek	C	Benthos
13-17-5-5	03040105	Stony Creek	C	Benthos
13-17-5b	03040105	Mallard Creek	C	Turbidity, Benthos
13-17-6-(0.5)	03040105	Coddle Creek	WS-II; HQW	Fish
13-17-6-(5.5)	03040105	Coddle Creek	C	Turbidity, Benthos
13-17-6-1	03040105	East Fork Coddle Creek	WS-II; HQW	Benthos
13-17-7	03040105	Back Creek	C	Benthos
13-17-8	03040105	Reedy Creek	C	Benthos
13-17-8-4	03040105	McKee Creek	C	Benthos, Recreation- Fecal Coliform Bacteria
13-17-8-5a	03040105	Caldwell Creek	C	Benthos
13-17-9-(2)	03040105	Irish Buffalo Creek	C	Benthos
13-17-9-4-(1.5)	03040105	Cold Water Creek	C	Benthos, Turbidity
13-17a	03040105	Rocky River	C	Turbidity, Benthos, Recreation- Fecal Coliform Bacteria
13-17b	03040105	Rocky River	C	Turbidity, Benthos
13-17c	03040105	Rocky River	C	Turbidity
13-17d	03040105	Rocky River	C	Turbidity
13-39-(1)	03040201	Hitchcock Creek (McKinney Lake, Ledbetter Lake)	WS-III	Mercury
13-45-(2)b	03040201	Marks Creek (Boyds Lake, City Lake, Everetts Lake)	C	Benthos

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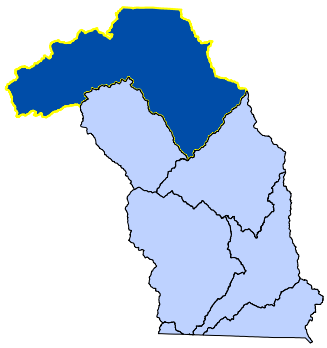
Yadkin River Headwaters



Subbasin HUC: 03040101
Yadkin River Headwaters to the Confluence with South Yadkin River

Water Quality Overview

Water quality in this HUC is relatively good compared to other subbasins in the greater Yadkin-Pee Dee River basin. This is based, in part, on the relatively undeveloped nature of the watershed and low population density. Seventy four percent of the monitored streams support aquatic life, while 24 percent are impaired. Most water quality impairments and impacts are associated with imperious surfaces and stormwater systems, along with agriculture, NPDES permits and mining.

General Description

The Yadkin River Headwaters contains the Yadkin River from its mountainous headwaters to the confluence with the South Yadkin River. Streams and rivers on its western boundary drain the high elevation areas of the Blue Ridge Mountains, where elevations are generally 1200-4500 feet, stream gradients are high, and landuse is predominantly forest. The major mountain tributaries include Buffalo, Elk, and Stony Creeks, North and South Prong Lewis Forks, Reddies River, Mulberry Creek, and Roaring River, most of which flow south into the Northern Inner Piedmont ecoregion before reaching the Yadkin River. Many of the mountain streams are classified as trout streams, and in terms of their fish communities, are considered mountain cold water, and foothills cool water systems. The mountainous section of the Mitchell River watershed above its confluence with the South Fork Mitchell River in western Surry County is classified as an Outstanding Resource Watershed (ORW).

Flowing out of the mountains in a northeast direction, the Yadkin River then flows through the Town of Elkin along the Surry and Yadkin County line, before changing direction to the south at the intersection of Surry, Stokes, Forsyth, and Yadkin Counties. Watersheds to the east of the Blue Ridge are primarily located within the Piedmont and usually have rocky substrates. Streams in the southeast portion of the hydrologic unit (around Winston-Salem) have sandier substrates. W. Kerr Scott Reservoir is the first of the Yadkin River chain of lakes, and is the only major impoundment located in this hydrologic unit. The Yadkin River Headwaters is the largest watershed draining to High Rock Lake.

The southeastern portion of this hydrologic unit includes the urban and suburban area in and around the City of Winston-Salem, one of the largest cities in North Carolina. The Muddy Creek watershed is the largest Yadkin River tributary in this area, and receives runoff from most of the Winston-Salem metro area. Many streams in Winston-Salem are affected by urban runoff and/or by the city's numerous permitted dischargers, many of which are small residential (i.e. package) plants. Large dischargers in the Muddy Creek drainage include the Winston-Salem Archie Elledge WWTP (Salem Creek, 30 MGD), and Winston-Salem Muddy Creek WWTP (Yadkin River, 21 MGD). The major tributaries to Muddy Creek in Winston-Salem include Salem, and South Fork Muddy Creeks. Salem Creek drains a heavily urbanized portion of Winston-Salem.

Watershed at a Glance

Counties

Alexander, Alleghany, Ashe, Caldwell, Davidson, Davie, Forsyth, Iredell, Stokes, Surry, Watauga, Wilkes, Yadkin

Municipalities

Arlington, Bethania, Blowing Rock, Boonville, Clemmons, Dobson, East Bend, Elkin, Jonesville, Kernersville, King, Lewisville, Mocksville, Mount Airy, North Wilkesboro, Pilot Mountain, Ronda, Rural Hall, Tobaccoville, Wilkesboro, Winston-Salem, Yadkinville

Permitted Facilities

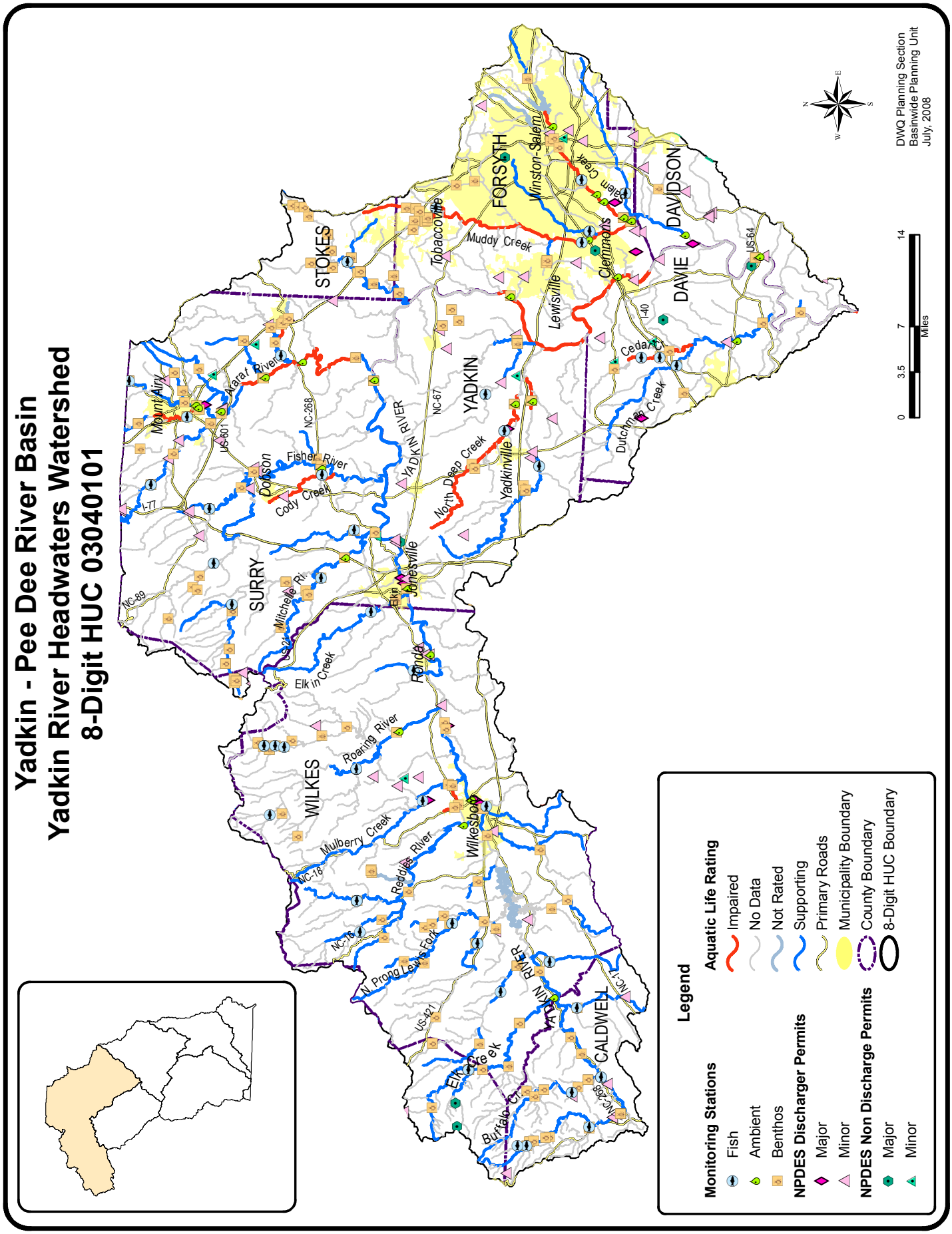
NPDES WWTP:	
Major	10
Minor	76
NPDES Nondischarge:	17
NPDES Stormwater:	
General	181
Individual	10
Phase II	5
Animal Operations:	97

Waterbody summary

Total Streams:.....2,183.1 mi
.....1,157.4 ac

Total No Data:.....1,474.6 mi
Total Monitored:.....707.9 mi
Total Supporting:.....524 mi
Total Impaired:.....166.5 mi
Total Not Rated:.....17.4 mi
.....1,157.4 ac

Figure 1-1. Yadkin River Headwaters HUC 03040101



How to Read this Document

This document was written to correspond with our new *Online Geographic Document Distribution* tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add *http://web.ceo.ncsu.edu/basinplans/dwq.kml* to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The *Use Support* report provides information on how and why water quality ratings are determined and DWQ's "*Redbook*" describes in detail water quality standards for each waterbody *classification*. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality *Plans*"

Figure 1-1. shows monitoring station locations and impaired streams for the Yadkin River Headwaters subbasin.
Appendix A provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C provides summaries of biological and fish assessment monitoring sites.

Current Status and Significant Issues

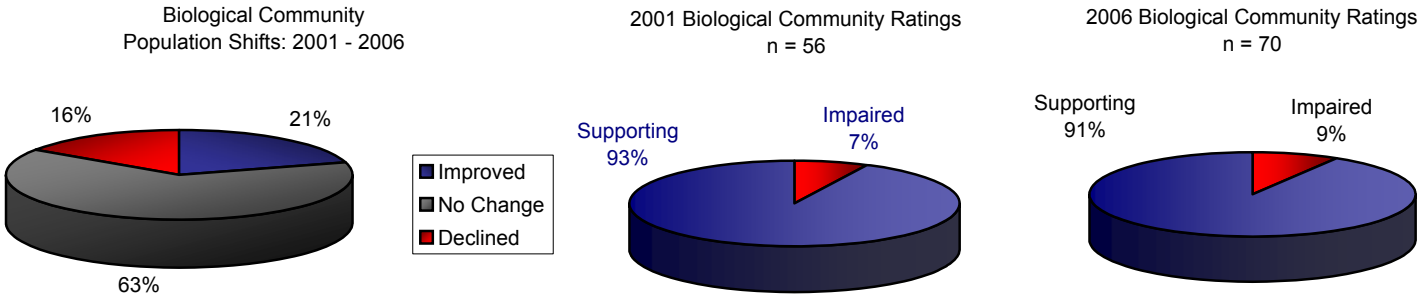
General Biological Health

Overall, the basinwide sampling effort in the Yadkin River Headwaters increased by 20 percent. Despite this substantial increase in effort the ratio of Supporting and Impaired stream segments remains roughly the same.

There were 40 benthic macroinvertebrate sites sampled in the Yadkin River Headwater hydrologic unit. Seven of the 36 benthic macroinvertebrate sites previously sampled in the last basinwide cycle had an improvement in bioclassification. Seven of the 36 benthic basinwide sites declined by one bioclassification.

In addition, there were 30 fish community sites sampled in the Yadkin River Headwaters. Four of the 20 fish community sites previously sampled in the last basinwide cycle improved by one bioclassification and two declined by one bioclassification.

Figure 1-2. Biological Health Summary



The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

Habitat Degradation

Approximately 240 miles of streams in the Yadkin River Headwaters are impaired or impacted by habitat degradation. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in the Yadkin River Headwaters make streams highly vulnerable to these stressors.

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMP***s, ordinance/rule changes at the local, state, and federal levels, volunteer activism, and education programs. Figure 1-3 illustrates a general process for ***developing watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. Organizations have begun this process in a few watersheds in the Yadkin River Headwaters. Similar efforts on all streams listed in Table 1-1 are necessary. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 1-3. Watershed Planning

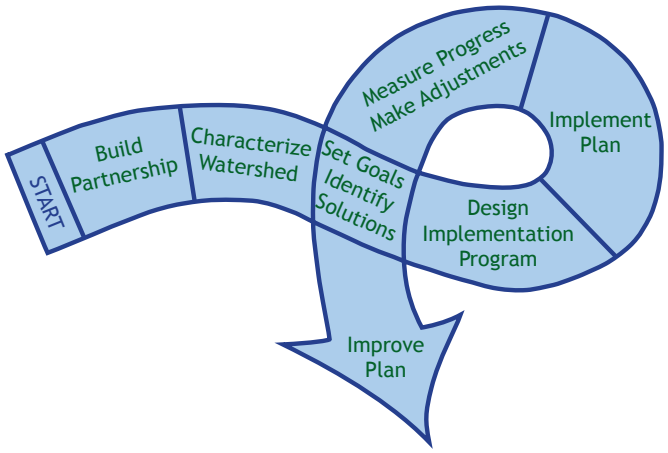


Figure 1-4. Habitat Degradation Potential Sources

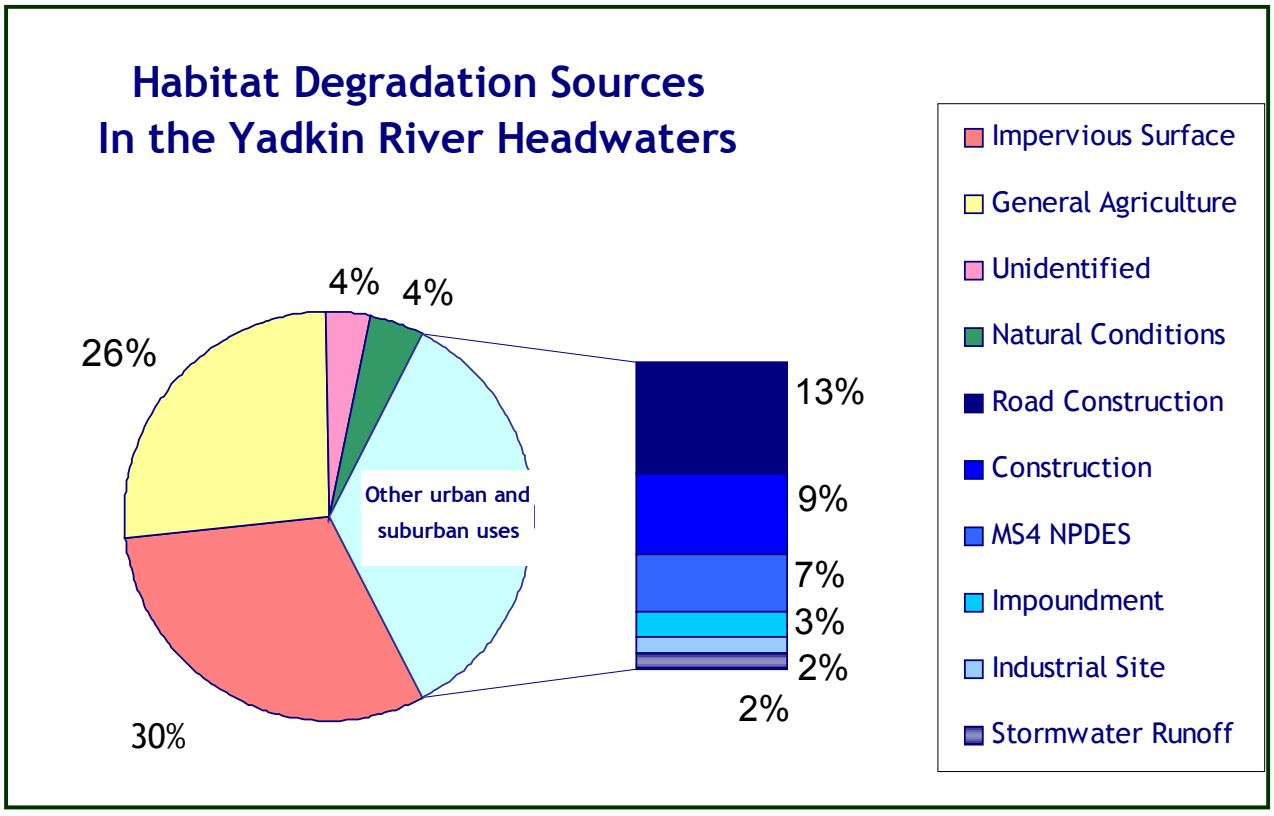


Table 1-1. Streams Impaired or Impacted by Habitat Degradation in Yadkin River Headwaters

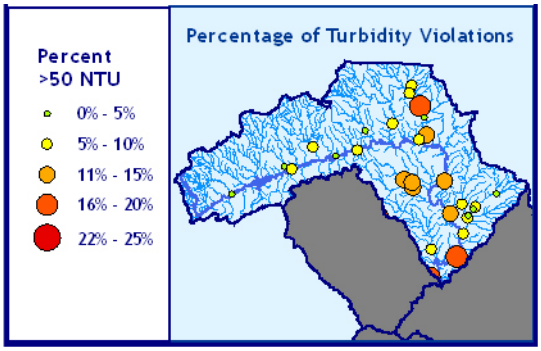
AU Number	Name	Subbasin	Length or Area	Class.	Impaired	Impacted	Potential Source
12-(1)	YADKIN RIVER	03-07-01	35.0 Miles	C; Tr	X	-	Road Construction
12-(53)	YADKIN RIVER	03-07-02	24.7 Miles	C	-	X	Impervious Surface
12-102-(2)a	Dutchman Creek	03-07-05	25.5 Miles	C	-	X	Agriculture, Impervious Surface
12-102-(2)b	Dutchman Creek	03-07-05	7.5 Miles	C	-	X	Impervious Surface, Agriculture, Natural Conditions, Impervious Surface
12-102-13-(2)	Cedar Creek	03-07-05	7.0 Miles	C	X	-	Impoundment, Industrial Site
12-31-3-(2)	Naked Creek	03-07-01	0.9 Miles	WS-IV	-	X	Agriculture
12-35	Fish Dam Creek (Fishtrap Creek)	03-07-01	4.2 Miles	WS-IV	-	X	Impervious Surface, Agriculture
12-39	Moravian Creek (Yellow Jacket Lake)	03-07-01	11.4 Miles	C	-	X	Agriculture
12-42-9	Long Creek	03-07-01	3.1 Miles	C	X	-	Impervious Surface
12-54-(4.5)	Elkin Creek (River)	03-07-02	1.8 Miles	C	-	X	Impervious Surface, Agriculture
12-62-15	Snow Creek	03-07-02	9.6 Miles	C	-	X	Agriculture
12-63-10-(2)	Little Fisher River	03-07-02	8.9 Miles	C	-	X	Agriculture
12-63-5-(3)	Endicott Creek (Branch)	03-07-02	0.5 Miles	WS-II; Tr, HQW	X	-	Agriculture
12-72-(4.5)b	Ararat River	03-07-03	13.7 Miles	C	X	-	Stormwater Runoff, Impervious Surface
12-72-13	Flat Shoal Creek	03-07-03	8.2 Miles	C	-	X	Impervious Surface, Natural Conditions
12-72-6	Faulkner Creek	03-07-03	6.1 Miles	C	-	X	Impervious Surface
12-72-8-(1)	Lovills Creek (Lovell Creek)	03-07-03	2.5 Miles	WS-IV	-	X	Impervious Surface, MS4 NPDES
12-72-8-(3)	Lovills Creek (Lovell Creek)	03-07-03	4.2 Miles	C	X	-	Stormwater Runoff, Impervious Surface
12-72-9-(4)	Stewarts Creek	03-07-03	3.3 Miles	WS-IV	-	X	Impoundment
12-77	Little Yadkin River	03-07-02	12.5 Miles	WS-IV	-	X	Road Construction, Construction, Impervious Surface
12-77-3	Danbury Creek	03-07-02	4.3 Miles	WS-IV	-	X	Impervious Surface
12-83-(1.5)	Forbush Creek	03-07-02	4.9 Miles	WS-IV	-	X	Agriculture
12-83-2-(0.7)	Logan Creek	03-07-02	2.6 Miles	WS-IV	-	X	Stormwater Runoff
12-94-10	Silas Creek	03-07-04	10.1 Miles	C	-	X	Construction, MS4 NPDES, Impervious Surface
12-94-12-(4)	Salem Creek (Middle Fork Muddy Creek)	03-07-04	12.0 Miles	C	X	-	Construction, MS4 NPDES, Impervious Surface, WWTP NPDES, Agriculture, Failing Septic Systems
12-94-13	South Fork Muddy Creek	03-07-04	14.3 Miles	C	-	X	Impervious Surface, Agriculture

Ambient Water Quality

Turbidity

Turbidity violations are common throughout the Yadkin River Headwaters (Figure 1-5). Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), damage fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at many of the biological sample sites in the Yadkin River Headwaters.

Figure 1-5. Turbidity Violations



Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the Yadkin River Headwaters. It appears, however, violations are highest in the Yadkin River mainstem, agricultural areas, and transitional suburban areas. Violations are lowest in the upper watershed where landuse is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***.

It is likely that a combination of human caused land disturbances and natural erosion are causing the majority of turbidity violations in this watershed, with human causes the leading contributor. To appropriately address turbidity and sediment problems in the Yadkin River Headwaters, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. All reasonable efforts to reduce or eliminate human sources of erosion should be implemented immediately. These efforts can be organized by developing watershed restoration plans based on the process outlined in Figure 1-3. Plans are needed for each watershed listed below.

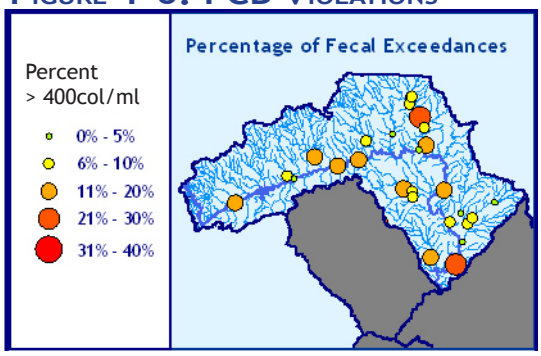
Table 1-2. Streams Impaired or Impacted by Turbidity Violations in Yadkin River Headwaters

AU Number	Name	Subbasin	Miles	Classification	Impaired	Impacted	Source
12-(80.7)	YADKIN RIVER	03-07-02	9.4	WS-IV	X	-	Stormwater Runoff
12-(86.7)	YADKIN RIVER	03-07-02	10.0	WS-IV	X	-	Stormwater Runoff
12-(97.5)	YADKIN RIVER	03-07-04	0.5	WS-IV;CA	X	-	Stormwater Runoff
12-102-(2)b	Dutchman Creek	03-07-05	7.5	C	-	X	Impervious Surface, Agriculture/Pasture
12-63-(9)	Fisher River	03-07-02	21.2	C	-	X	Land Clearing, Impervious Surface, Agriculture/Pasture
12-63-14	Cody Creek	03-07-02	7.0	C	X	-	Impervious Surface
12-72-(4.5)a	Ararat River	03-07-03	14.2	C	-	X	Impervious Surface
12-72-(4.5)b	Ararat River	03-07-03	13.7	C	X	-	Impervious Surface
1 2 - 8 4 - 1 - (0.5)	North Deep Creek	03-07-02	17.3	C	X	-	Impervious Surface, Agriculture/Pasture
1 2 - 8 4 - 2 - (5.5)	South Deep Creek	03-07-02	2.8	WS-IV	X	-	Impervious Surface, Agriculture/Pasture
12-94-(0.5)c	Muddy Creek	03-07-04	4.8	C	-	X	Stormwater Runoff
12-94-12-(4)	Salem Creek (Middle Fork Muddy Creek)	03-07-04	12.0	C	X	-	Unknown

Fecal Coliform Bacteria

Fecal coliform bacteria concentrations often exceeded 400 colonies/100ml in the Yadkin River Headwaters (Figure 1-6). The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Figure 1-6. FCB Violations



An analysis of all ambient water quality stations in the Yadkin River Headwaters shows a downward trend in fecal coliform bacteria concentrations from 2002-2006. Rainfall, which influences bacteria concentrations, did not appear to be driving this trend. Therefore, the decrease is likely due to implementation of agricultural BMPs and sewer infrastructure improvements. However, concentrations remain elevated and further work remains to be done. Additional funds will be necessary to continue implementing these improvements.

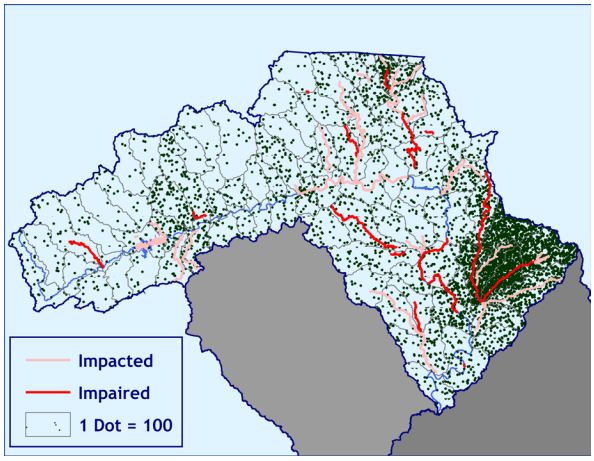
Table 3. Streams Impaired or Impacted by Fecal Coliform Concentration Violations

AU Number	Name	Subbasin	Miles	Classification.	Impaired	Impacted	Potential Source
12-24-(10)	Elk Creek	03-07-01	9.1	B;ORW	X	-	Agriculture
12-54-(0.5)	Elkin Creek	03-07-02	16.3	WS-II;HQW	X	-	Unknown
12-72-10	Rutledge Creek	03-07-03	9.4	C	X	-	Unknown
12-94-(0.5)c	Muddy Creek	03-07-04	4.8	C	-	X	Stormwater Runoff
12-94-12-(4)	Salem Creek (Middle Fork Muddy Creek)	03-07-04	12.0	C	X	-	Construction, MS4 NPDES, Impervious Surface, WWTP NPDES, Agriculture, Failing Septic Systems

See: *Yadkin Ambient Monitoring System Report* /Appendix B and *Yadkin Basinwide Assessments* /Appendix C for detailed sample results and discussion.

Population and Land Use

Figure 1-7. Population Density in 2000

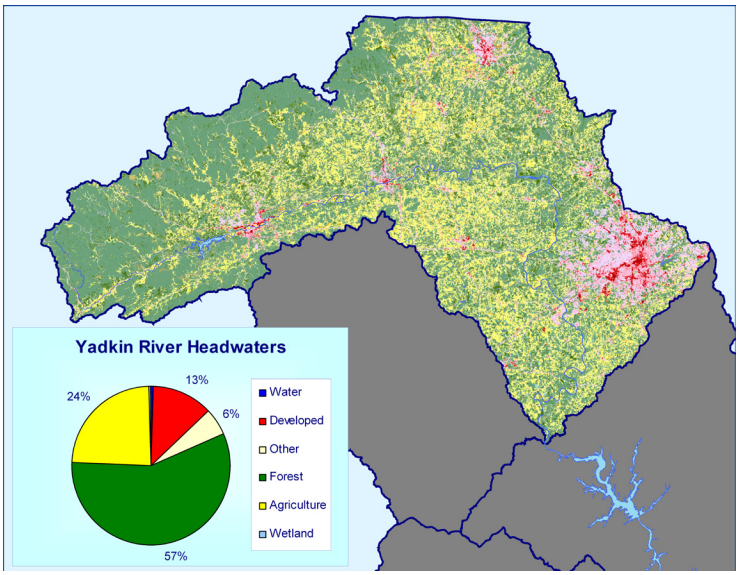


Population distribution and land use patterns are highly variable in the Yadkin River Headwaters. Land use varies from generally undisturbed in the western highlands to decidedly urban in the eastern portion of the watershed around the Winston-Salem metro area. The population distribution closely follows this pattern. The highest population densities are located around Winston-Salem and Mt. Airy. The agricultural regions in the central and western parts of the watershed have much lower population densities.

Stream impacts closely follow the population density and land use patterns. They are more common in agriculture areas than in the forested headwaters and most concentrated in the urban centers. However, this pattern may be changing as new development pressure increases in the forested headwaters. This new pressure comes primarily in the form of secluded resort communities and low-density second home developments. Many of these developments are sited in designated High Quality and Outstanding Resource Watersheds (*HQW/ORW*)

where management strategies are in place to reduce the impact of new development. Because HQW/ ORW watersheds usually occur in historically rural and undisturbed areas, the long-term ability of the management strategies to maintain HQW and ORW status in the face of new development is very difficult to predict. For example, research suggests that streams begin to degrade when watershed imperviousness reaches 10 percent of the total land area (Center for Watershed Protection, 2003). DWQ's own data indicates degradation may begin at even lower levels of imperviousness. The HQW management strategy, however, allows for much higher densities provided the development treats the first inch of rainfall. The management strategy also requires enhanced sediment and erosion control and, in some cases, a 30-foot stream buffer. The management strategy does not restrict the number of developments that may be constructed in a watershed. Therefore, it is unclear if these restrictions are sufficient to maintain excellent water quality if development pressure remains high. New research that accurately projects development scenarios and their impact on water quality is desperately needed in the short term. These trends demonstrate the importance of ***protecting and conserving stream buffers and natural areas***. Protection is especially important given the new develop.

Figure 1-8. Land Use



TMDLs

A TMDL or ***Total Maximum Daily Load*** is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

A TMDL provides a detailed water quality assessment that provides the scientific foundation for an implementation plan. An implementation plan outlines the steps necessary to reduce pollutant loads in a certain body of water to restore and maintain human uses or aquatic life. Plan implementation is usually voluntary. The following TMDL has been completed in the Yadkin River Headwaters and should be adopted by all residents and local governments within the watershed.

Table 1-4. Finalized TMDLs in the Yadkin River Headwaters

Waterbody	Pollutant	Link	Final TMDL Date
Salem Creek	Fecal Coliform	***Final TMDL***	Sept. 25, 2006

High Rock Lake TMDL

Although it is not located within this hydrologic unit, the Yadkin River Headwaters is the largest watershed draining to ***High Rock Lake***. High Rock Lake is impaired due to violations of the turbidity and chlorophyll *a* standards. Therefore, DWQ has initiated a TMDL development process for the lake. As discussed above, turbidity and sedimentation are a significant water quality issue in the Yadkin River Headwaters. The sediment generated in the Yadkin River Headwaters contributes directly to the water quality impairment observed in High Rock Lake. In addition to sediment, runoff from the Yadkin River Headwaters delivers substantial nutrients to High Rock Lake that lead to chlorophyll *a* violations. Residents and government agencies in the Yadkin River Headwaters should be active in the TMDL development process for the lake and continue implementing nonpoint source pollution reduction strategies.

Local Initiatives

Cooperative Conservation Partner Initiative

The Cooperative Conservation Partnership Initiative (***CCPI***) is a voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds of special significance. See the ***Rapid Watershed Assessment*** completed in the Yadkin River Headwaters.

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs through stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 5 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining 70 percent is made available through a competitive grants process.

319 grant funds have been used in combination with other funding sources in the Yadkin River Headwaters to implement successful restoration projects. One example is the ***Agriculture Sediment Initiative for Yadkin-Pee Dee and Cape Fear Basins.*** Table 1-5, includes a list of all the 319 projects implemented in the Yadkin River Headwaters.

Table 1-5. 319 Projects in the Yadkin River Headwaters

Fiscal Year	Contract Number	Name	Description	Agency	Funding
2000	EW05032	Ag Sediment Initiative Rockingham, Clay, & Surry Counties		DSWC	$157,810
2000	EW01070	Ag Sediment Initiative Rockingham, Clay, & Surry Counties		DSWC	$125,984
2001	EW02027	Restoration of Mountain Wetlands and the Upper Yadkin Training Center	Wetlands & Hydrologic Modification	NCSU	$20,000
2001	EW03047	Ag Sediment Initiative Yadkin PeeDee, Cape Fear River Basins		DSWC	$367,900
2002	EW03006	Demo at Dupont & Rendezvous Mountain Educational State Forest	Forestry, Education	NC DENR, DFR	$86,000

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Yadkin River Headwaters. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 1-6 shows the number of projects implemented and in the Yadkin River Headwaters and the dollar amount invested. Table 1-7 shows the water quality benefits realized from that investment.

Table 1-6. ACSP Project Expenditures in the Yadkin River Headwaters

	Erosion Reduction/Nutrient Loss Reduction in Fields		Stream Protection from Animals		Proper Animal Waste Management	
12-digit hydrologic unit	Total Implemented	Cost	Total Implemented	Cost	Total Implemented	Cost
030401010100	34.2 ac.	$8,465	381 units	$31,295	5 units	$52,950
030401010101					1 unit	$3,725
030401010200			5 units	$14,618	3 units	$10,904
030401010300					8 units	$73,524
030401010400					2 units	$28,454
030401010500					2 units	$8,992
030401010600	0.10 ac.	$50	10 units	$19,243	13 units	$109,778

	Erosion Reduction/Nutrient Loss Reduction in Fields		Stream Protection from Animals		Proper Animal Waste Management	
12-digit hydrologic unit	Total Implemented	Cost	Total Implemented	Cost	Total Implemented	Cost
030401010700	29.5 ac.	$6,638	455 units	$45,130	8 units	$54,310
030401010800	133.55 ac.	$99,396	20 units	$45,846	3 units	$35,826
030401010900	111.31 ac.	$14,241	72.3 units	$189,196	3 units	$48,965
030401011000	36.15 ac.	$4,182	30.2 units	$63,752	1 unit	$19,344
030401011100	100.18 ac.	$17,626	192.82 units	$496,030	6 units	$62,008
030401011200	135.29 ac.	$21,040	2 units	$6,738	2 units	$4,475
030401011300	83.78 ac.	$11,741	17 units	$43,395	4 units	$35,736
030401011400	16 ac.	$3,600	6 units	$19,217	2 units	$4,209
030401011500	146.88 ac.	$42,819	4 units	$13,155		
030401011600	4.83 ac.	$1,087				
030401011700	163.7 ac.	$36,743	12.07 units	$23,630	4 units	$12,102
030401011800	155.25 ac.	$17,948				
030401011900	9 ac.	$1,577	1 unit	$2,658		
030401012000	132.52 ac.	$16,324			4 units	$55,959
TOTAL		$303,477		$1,013,903		$621,261

Table 1-7. NC ASCP Water Quality Benefits

	Water Quality Benefits				
12-digit hydrologic unit	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401010100	465	2,736	1,368	74,763	83,830
030401010101				5,405	8,681
030401010200	14			67,723	94,907
030401010300				106,606	173,710
030401010400				93,717	75,933
030401010500				34,056	54,692
030401010600	8			335,740	359,092
030401010700	1,817	1,475	4,959	234,923	269,616
030401010800	3,122	54,795	1,964	14,128	5,191
030401010900	2,576	10,371	691	2,080	1,120
030401011000	827	3,572	132	69,648	
030401011100	3,623	10,422	995	33,419	34,215
030401011200	3,589	3,804	2,092		
030401011300	757	1,173	180	19,008	5,244
030401011400	445	3,300	198		
030401011500	3,975	4,008	489		
030401011600	12	242	15		
030401011700	3,248	5,975	2,234	3,290	647
030401011800	759	28,789	149		
030401011900	138	450	600		
030401012000	1,245	135,835	245	17,065	20,768
TOTAL	26,619	266,946	16,312	1,111,571	1,187,646

Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made significant investment in the Yadkin River Headwaters. Figure 1-9 shows the distribution of projects to date in the watershed and Table 1-8, includes a list of projects and their cost. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations.

Figure 1-9 demonstrates how the CWMTF has partnered with conservation groups and clustered projects into specific watersheds in order to leverage additional funds and increase the benefits to water quality and conservation. Two examples are the Mitchell and Ararat River projects.

Figure 1-9. CWMTF Projects

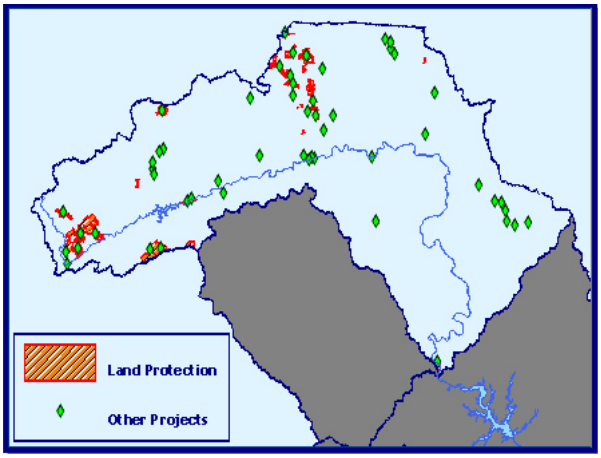


Table 1-8. CWMTF Projects In The Yadkin River Headwaters (9/1/2001-8/31/2006)*

Project Number	Application Name	Proposed Project Description	Amount Funded
2001A-002	Blue Ridge Rural Land Trust - Jenkins Tract Land Cons Easement	Provide funds to cover transactional costs of acquiring a donated permanent conservation easement on 1200 acres along Osborne Creek.	$103,000
2001A-510	North Wilkesboro- Elim Discharge & Reroute Waste/ Mulberry Ck	Eliminate existing package WWTP discharging to Mulberry Ck & install gravity sewer from area now served by package plant to the Mulberry Ck Pump Station and then to Town's 2.0 MGD WWTP which discharges into the Yadkin River. 100 ft CE.	$200,000
2001A-806	Surry Soil & Water Conservation District - Restoration Monitoring & Watershed Study	Conduct monitoring to measure the benefits of previously funded stream restoration and BMP projects in Mitchell River watershed. Continues five years of previous TSS monitoring and stream restoration parameters (physical and biological).	$434,000
2001B-003	Blue Ridge Rural Land Trust - Acquisition/ Reddies River	Provide funds to cover transactional and stewardship costs on one donated conservation easement to protect 75 acres along the North Fork of Reddies River.	$18,000
2001B-044	Piedmont Land Conservancy-Acquisition/ Upper and South Fork Mitchell Rivers	Acquire through fee simple purchase 83 acres on the Upper and South Fork Mitchell Rivers. Includes education and outreach.	$216,000
2002A-008	Elkin, Town of - Acq/ Big Elkin Creek	Acquire 65 acres through fee simple purchase along Big Elkin Creek. An additional 20 acres will be protected through a permanent conservation easement. Project will protect a total of 85 acres.	$259,000
2002A-023	NC Div Forest Resources - Acq & Restoration/ Purlear Creek	Acquire 98 acres through fee simple purchase along Purlear Creek. CWMTF would fund purchase of 62% of the tract.	$600,000
2002A-026	Piedmont Land Conservancy-Acq/ Upper Mitchell R. Winebarger Tract	Acquire 298 acres through fee simple purchase and acquire conservation easements on an additional 118 acres along the South Fork and Upper Mitchell Rivers. Project to protect a total of 416 acres.	$1,408,000
2002A-031	Yadkin River Greenway Council - Acq/ Wilkesboro Greenway	Acquire donated permanent conservation easements on 12.7 acres along the Yadkin River as part of a greenway system. Funds are also provided to plant a woody vegetated buffer along the river and to monitor erosion rates.	$74,000
2002A-405	Surry Soil & Water Conservation District - Stream Restoration/ S. Fork Mitchell R. Phase II	Restore 7,000 linear feet of the South Fork Mitchell River using natural channel design and 2,000 feet of buffer. Monitor results for five years.	$1,137,000

Project Number	Application Name	Proposed Project Description	Amount Funded
2002A-407	Wilkes Soil & Water Conservation District- Warrior Creek Ag. BMPs	Construct six animal waste/feed dry-stack structures in Warrior, Purlear and Little Bugaboo Creek watersheds. Project is part of a larger stream restoration and livestock exclusion project. Includes donated conservation easements on 48 acres.	$150,000
2002A-503	Elkin, Town of - Chatham WWTP Upgrade & Consolidation	Upgrade Elkin's WWTP to serve as a regional plant for Elkin, Ronda and East Wilkes High School. Eliminate approximate 200 failing septic tanks in Ronda. Includes a donated easement on 20 riparian acres (potentially 47 acres) along the Yadkin River.	$1,000,000
2002A-707	Mount Airy - Stormwater/ Lovills Creek	Fund design and permitting of improvements to Tumbling Rock Reservoir to treat stormwater drainage in Lovills Creek, a tributary of the Ararat River. The City will donate 21 acres adjacent to the reservoir as a greenway.	$81,000
2002B-001	Blue Ridge Rural Land Trust - Acq./Brushy Mts., Moravian Cr	Acquire permanent conservation easements on 122 riparian acres along Moravian and Big Warrior Cks. An additional 1,298 acres will be protected through donation or other funding sources. A total of 1,420 acres will be protected.	$276,000
2002B-405	NC Div Parks & Recreation - Restoration/Stone Mt. State Park, Big Sandy Cr.	Restore 4,225 feet of Big Sandy Creek and tributaries in Stone Mountain State Park. Match includes land acquisition in the watershed.	$290,000
2002B-406	Pilot View RC&D, Inc. - Restoration/Tom's Cr.	Restore 900 linear ft and plant buffers along 1200 ft of Toms Creek, a tributary of Ararat River. Accept donation of an additional 300 feet of buffer along the stream (98 ac) and purchase 116 acre tract with federal funds.	$192,000
2002B-407	Pilot View RC&D, Inc. - Restoration/Yadkin Farmland Project	Restore a total of 5,700 linear feet of stream in Surry County on Toms, Pauls and Ramey Creeks. Match provided by EQIP funds and donated permanent conservation easements. Monitor water quality results.	$314,000
2002B-804	Pilot View RC&D, Inc. - Planning/Upper Yadkin Sediment	Fund a 5-year planning and water quality monitoring program for bedload and suspended sediment in the Upper Yadkin & Dan River basins, using the Mitchell River as a reference site. Use to validate stream restoration methods used in the Yadkin Basin.	$295,000
2002M-003	NC Div Forest Resources - Benton Tract Mini-Grant/ Purlear Ck	Minigrant to pay for preacquisition costs for approxmately 100 acres that border Purlear Creek.	$25,000
2003A-035	NC Wildlife Resources Commission- Acq./ Mingo Tribal Tract, Joes Creek	Acquire 5,621 acres through fee simple purchase along Layton and Buffalo Creeks and Green Rock Branch.	$13,500,000
2003D-004	Blue Ridge Rural Land Trust - Donated Minigrant, Johnston Tract/ Cales and Bussels Creeks	Minigrant to pay for transactional costs for a donated easement on 96 acres along the Cales and Bussels Creeks.	$25,000
2004A-002	Caldwell County - Acq./ Donahue Creek	Protect a total of 400 acres along Donahue Creek through fee simple purchase, including 168 riparian acres.	$685,000
2004A-020	NC Wildlife Resources Commission - Acq./ Long Ridge Tract, Buffalo Creek	Protect through fee simple purchase 965 acres along Buffalo and Rockhouse Creeks and Lowder Mill Branch. Property will be managed as part of the Game Lands Program.	$2,776,000
2004A-411	NC Div Forest Resources - Rest./ Purlear Creek, Phase II	Design, permit & construct natural channel stream restoration project along 4,000 linear feet of Purlear Creek. Of the restored stream, 3,000 linear feet are located within Redezvous Mountain Educational State Forest. Monitor water quality.	$508,000

Project Number	Application Name	Proposed Project Description	Amount Funded
2004A-413	Surry Soil & Water Conservation District - Rest./ Snow Creek Watershed	Design, permit & construct natural channel stream restoration project along 10,353 linear feet of Snow Creek. Monitor results. Includes funds to install livestock exclusion systems.	$850,000
2004B-049	Piedmont Land Conservancy- Acq/ Ellis Tract, Mill Creek	Protect through fee simple purchase 75 riparian acres on the headwaters of Mill Creek, an Outstanding Resources Water and wild trout stream with significant endangered aquatic species habitat. Tract is adjacent to Mitchell River Game Lands.	$270,000
2004B-517	Wilkes County School Board - WW/ C.C. Wright Elementary School, Cub Creek	Decommission existing sand filtration system at elementary school and connect to a new sewer line by installing 1,100 LF of collection lines and 7 manholes. Will eliminate discharge to Cub Creek.	$45,000
2004B-706	Pilot View RC&D, Inc. - Storm & Rest/ Upper Silas Creek	Design, permit & construct natural channel stream restoration project along 3,808 linear feet of stream in Upper Silas Creek watershed. Construct 3 stormwater BMPs (2 wet ponds and 1 extended wetland detention pond) in the watershed. Monitor results.	$1,603,000
2004B-809	Pilot View RC&D, Inc. - Plan/ Bath Creek Restoration	Investigate the feasibility of "daylighting" a section of Bath Creek in downtown Winston-Salem. Explore options that would open the stream segment to the surface and reestablish vegetation, habitat and a natural channel configuration.	$59,000
2004B-811	Pilot View RC&D, Inc. - Plan/ Monarcas Creek Restoration	Evaluate and prepare preliminary designs for a natural channel restoration project of approximately 4,200 linear feet of Monarcas Creek. Wake Forest University will conduct an archaeological survey of the project area.	$134,000
2005A-001	Blue Ridge Rural Land Trust - Acq/ Minton and Church Tracts, Lewis Fork and Reddies Creeks	Protect through easements 209 acres along South Prong Lewis Fork. CWMTF funds to purchase a permanent conservation easement on 34.3 riparian acres and landowner to donate a permanent agricultural and timber management easement on 175 acres of upland.	$157,000
2005A-402	Pilot View RC&D, Inc. - Rest/ Shoals Restoration Project, Ararat River	Design, permit and construct a natural channel stream restoration project on 4,830 LF of the Ararat River, including 3,600 LF of restoration and 1,230 LF of enhancement. Project includes purchase of 77 acres with the potential for a greenway.	$488,000
2005B-007	Conservation Trust for North Carolina - Acq/ Cumberland Knob Tract, Roaring Fork	Protect through fee simple purchase 201 acres, including 138 riparian acres, along Roaring Fork. The property is adjacent to the Blue Ridge Parkway and will transferred to the National Park Service. CWMTF funds to purchase the riparian portion.	$512,000
2005B-030	NC Wildlife Resources Commission - Acq/ Bernhardt Tract, Walnut Branch	Protect through fee simple purchase 245 acres of the Bernhardt tract along Walnut Branch. Tract is adjacent to and will become part of the Buffalo Cove Game Land.	$364,000
2005B-040	Piedmont Land Conservancy - Acq/ Harris Tract, Mill Creek	Protect through fee simple purchase and a permanent conservation easement 262 acres along headwater tributaries to Mill Creek. Includes 233 riparian acres. Mill Creek is an Outstanding Resource Waters with rare aquatic species.	$199,000
2005B-406	Pilot View RC&D, Inc - Rest/ Mill Creek Restoration	Design, permit & construct natural channel stream restoration & stabilization project on 3,600 LF of Mill Ck. Restore over 6.5 ac of wetlands, renovate 3.2 ac of a shallow lake for stormwater benefits, & restore 2.3 ac of riparian buffer.	$292,000

Project Number	Application Name	Proposed Project Description	Amount Funded
2005B-407	Resource Institute, Inc. - Rest/ Mount Airy, Ararat River Restoration	Design, permit & construct a natural channel stream restoration & enhancement project on 15,000 LF of the Ararat River. Easements to become part of a greenway system & will provide a canoe launch area.	$1,847,000
2005B-412	Surry Soil & Water Conservation District - Rest/ Fisher River Restoration Project	Design, permit and construct a natural channel stream restoration project on 16,900 linear feet of Cody and Ramey Creeks and the Fisher River. Project compliments other restoration projects in the area.	$976,000
2006A-042	Surry SWC District- Acq./ Surry County Greenway, Yadkin Tributaries	Protect through at least three donated conservation easements 270 acres along the South Mitchell River and tributaries. CWMTF funds to be used to cover transactional costs and to support the District in acquiring and processing easements.	$81,000
2006A-409	Resource Institute, Inc.- Rest/ Ararat River Restoration Sites	Design, permit and construct natural channel design stream restoration project on 11,500 linear feet of the Ararat River, Toms Creek and Lovils Creek, a 303(d)-listed stream.	$910,000
2006A-417	Winston-Salem, City of- Rest/ Reynolds, Silas, Monarcas & Muddy Creek Restoration	Fund a one-time relocation of utilities along stream reaches with the highest potential for sewer line failure due to streambank erosion. Applicant will revamp its methodology for bank stabilization to more environmentally friendly procedures.	$192,000
2006A-509	Elkin, Town of- WW/ Regionalization with Jonesville, Ronda, Yadkin River	Upgrade Elkin WWTP (1.8 to 2.5 MGD) as a regional facility for Elkin, Jonesville, Ronda and Wilkes High School. Eliminate Jonesville and High School discharges. Connect unsewered community of Ronda.	$2,000,000
2006A-807	Elkin and Jonesville, Towns of- Plan/WW/Storm/ GIS Mapping, Elkin Creek	Fund GIS mapping of the Towns' stormwater and sewer systems by locating lines, manholes and catch basins. The Towns will use this information to develop programs to eliminate sources of pollution to both surface and groundwaters.	$70,000
2006A-812	Mount Airy, City of - Plan/ Storm/ Stormwater Management Initiative, Ararat River	Fund stormwater planning for the Ararat River watershed, including a map and inventory of the stormwater conveyance system, study of bacterial loading to determine needed measures, identification of BMP sites, and design of two demonstration projects.	$95,000
2006A-814	Northwest Piedmont Council of Governments - Plan/ Acq/ Yadkin River Corridor Planning	Develop a riparian corridor plan for the 34-mile section of the Yadkin River through Surry County, including mapping and parcel assessments.	$50,000

*This list does not include: - regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.

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Appendix A

Use Support Ratings for All Monitored Waterbodies in Yadkin River Headwaters Subbasin

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-72-(1)	**Ararat River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From N.C.-Va. State Line to the mouth of Johnson Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV;Tr	03-07-03	2.5 FW Miles								
12-72-(18)	**Ararat River**			Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
From a point 0.1 mile upstream of Surry County SR 2080 to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
WS-IV	03-07-03	2.0 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-72-(4.5)a	**Ararat River**		**Turbidity** Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Town of Mount Airy proposed water supply intake to Stoney Creek 12-72-12				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
C	03-07-03	14.2 FW Miles								
12-72-(4.5)b	**Ararat River**		**Habitat Degradation** **Turbidity** Coastal Stormwater Outfalls Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Stoney Creek 12-72-12 to a point 0.1 mile upstream of Surry County SR 2080				Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
C	03-07-03	13.7 FW Miles		Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
12-25	**Beaver Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
C;Tr	03-07-01	9.9 FW Miles								
12-48-(0.7)	**Big Bugaboo Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From a point 0.3 mile upstream of Wilkes County SR 1931 to Yadkin River										
WS-IV	03-07-01	5.2 FW Miles								
12-29-1	**Big Warrior Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From source to Warrior Creek										
C	03-07-01	6.5 FW Miles								
12-19	**Buffalo Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C;Tr	03-07-01	14.9 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-102-13-(2)	**Cedar Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	2008	5
From Davie County SR 1410 to Dutchman Creek			Impoundment							
C	03-07-05	7.0 FW Miles	Industrial Site							
12-62-8	**Christian Creek (North Fork Mitchell River)**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Mitchell River										
B;Tr,ORW	03-07-02	5.5 FW Miles								
12-63-14	**Cody Creek**		**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From source to Fisher River			Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-02	7.0 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-41	**Cub Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2001		1
From source to Yadkin River										
C	03-07-01	10.8 FW Miles								
12-77-3	**Danbury Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to Little Yadkin River			Impervious Surface							
WS-IV	03-07-02	4.3 FW Miles								
12-102-(2)a	**Dutchman Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Davie County SR 1002 to Elisha Creek			General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-05	25.5 FW Miles	Impervious Surface							
12-102-(2)b	**Dutchman Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Elisha Creek to a point 0.9 mile upstream of mouth			General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-05	7.5 FW Miles	Impervious Surface	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Natural Conditions							
			Turbidity							
			General Agriculture/Pasture							
			Impervious Surface							
12-24-(1)	**Elk Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Dugger Creek										
B;Tr,ORW	03-07-01	13.5 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-24-(10) From Dugger Creek to Yadkin River B;ORW	**Elk Creek** 03-07-01	9.1 FW Miles	**Fecal Coliform Bacteria** General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	2004	5
12-54-(0.5) From source to Long Branch WS-II;HQW	**Elkin Creek (River)** 03-07-02	16.3 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
12-54-(4.5) From Elkin Water Supply Intake to Yadkin River C	**Elkin Creek (River)** 03-07-02	1.8 FW Miles	**Habitat Degradation** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-63-5-(3) From dam at Raven Knob Lake to Fisher River WS-II;Tr,HQW	**Endicott Creek (Branch)** 03-07-02	0.5 FW Miles	**Habitat Degradation** General Agriculture/Pasture	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1991	1998	5
12-72-6 From source to Ararat River C	**Faulkner Creek** 03-07-03	6.1 FW Miles	**Habitat Degradation** Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-35 From source to Yadkin River WS-IV	**Fish Dam Creek (Fishtrap Creek)** 03-07-01	4.2 FW Miles	**Habitat Degradation** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
12-63-(7) From Burris Creek to a point 1.0 mile upstream of the Town of Dobson water supply intake WS-II;HQW	**Fisher River** 03-07-02	6.3 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
12-63-(9) From Town of Dobson water supply intake to Yadkin River C	**Fisher River** 03-07-02	21.2 FW Miles	**Turbidity** General Agriculture/Pasture Impervious Surface Land Clearing	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-72-13 From source to Ararat River C	**Flat Shoal Creek** 03-07-03	8.2 FW Miles	**Habitat Degradation** Impervious Surface Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-83-(1.5)	**Forbush Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From a point 0.4 mile upstream of Yadkin County SR 1600 to Yadkin River			General Agriculture/Pasture							
WS-IV	03-07-02	4.9 FW Miles								
12-94-12-6-1	**Frazier Creek (Winston Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
From source to Brushy Fork										
C	03-07-04	4.6 FW Miles								
12-72-14-5a	**Heatherly Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2004		3a
From source to NC 268										
C	03-07-03	2.0 FW Miles								
12-72-14-5b	**Heatherly Creek**			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1994	1998	5
From NC 268 to Toms Creek										
C	03-07-03	1.4 FW Miles								
12-94-12-2-(0.3)	**Kerners Mill Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to a point 0.1 mile downstream of I-40										
WS-III	03-07-04	4.6 FW Miles								
12-23	**Kings Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Yadkin River										
C;Tr	03-07-01	8.2 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-24-8	**Laurel Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Elk Creek										
C;Tr,ORW	03-07-01	3.4 FW Miles								
12-26-3	**Left Prong Stony Fork**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From source to Stony Fork										
C;Tr	03-07-01	7.3 FW Miles								
12-63-13	**Little Beaver Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to Fisher River										
C	03-07-02	4.4 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-63-10-(2)	**Little Fisher River**	**Habitat Degradation** General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Surry County SR 1615 to Fisher River			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-02 8.9 FW Miles								
12-31-1-5	**Little Fork Creek**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to North Prong Lewis Fork									
C	03-07-01 4.5 FW Miles								
12-29-2-(2)	**Little Warrior Creek**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From a point 0.3 mile upstream of mouth to Warrior Creek									
WS-IV	03-07-01 0.3 FW Miles								
12-77	**Little Yadkin River**	**Habitat Degradation** Construction Impervious Surface Road Construction	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Yadkin River			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV	03-07-02 12.5 FW Miles								
12-83-2-(0.7)	**Logan Creek**	**Habitat Degradation** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From a point 0.4 mile upstream of mouth of Loney Creek to Forbush Creek									
WS-IV	03-07-02 2.6 FW Miles								
12-42-9	**Long Creek**	**Habitat Degradation** Impervious Surface	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1990	1998	5
From source to Mulberry Creek									
C	03-07-01 3.1 FW Miles								
12-72-8-(1)	**Lovills Creek (Lovell Creek)**	**Habitat Degradation** Impervious Surface MS4 NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From N.C.-Va. State Line to a point 0.5 mile upstream of Town of Mount Airy Water Supply Dam									
WS-IV	03-07-03 2.5 FW Miles								
12-72-8-(3)	**Lovills Creek (Lovell Creek)**	**Habitat Degradation** Impervious Surface Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Town of Mount Airy Water Supply Dam to Ararat River			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
C	03-07-03 4.2 FW Miles								
12-40-2	**Middle Fork Reddies River**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to Reddies River									
WS-II;Tr,HQW	03-07-01 7.9 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-46-2-(6)	**Middle Prong Roaring River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Wilkes County SR 1736 to Roaring River										
C	03-07-01	3.1 FW Miles								
12-62-(1)	**Mitchell River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to mouth of Christian Creek (North Fork Mitchell River)										
B;Tr,ORW	03-07-02	8.5 FW Miles								
12-62-(12.5)	**Mitchell River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From South Fork Mitchell River to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-02	6.9 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-39	**Moravian Creek (Yellow Jacket Lake)**		**Habitat Degradation** General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Yadkin River										
C	03-07-01	11.4 FW Miles								
12-94-(0.5)a	**Muddy Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Mill Creek #3				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	5
C	03-07-04	10.3 FW Miles								
12-94-(0.5)b	**Muddy Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Mill Creek #3 to SR 2995				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2004	5
C	03-07-04	15.2 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-94-(0.5)c	**Muddy Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From SR 2995 to a point 0.8 mile upstream of mouth			**Turbidity** Stormwater Runoff	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
C	03-07-04	4.8 FW Miles								
12-42	**Mulberry Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-01	19.7 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-31-3-(2)	**Naked Creek**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From a point 0.7 mile upstream of mouth to Lewis Fork		General Agriculture/Pasture							
WS-IV	03-07-01 0.9 FW Miles								
12-84-1-(0.5)	**North Deep Creek**	**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From source to a point 1.0 mile downstream of Yadkin County SR 1515		General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-02 17.3 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-40-4	**North Fork Reddies River**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Reddies River									
WS-II;Tr,HQW	03-07-01 11.2 FW Miles								
12-31-1-(1)	**North Prong Lewis Fork**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From source to Wilkes County SR 1300									
C;Tr	03-07-01 7.3 FW Miles								
12-31-1-(4)	**North Prong Lewis Fork**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Wilkes County SR 1300 to a point 1.0 mile upstream of Purlear Creek			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-01 4.7 FW Miles								
12-31-1-(7.5)	**North Prong Lewis Fork**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From a point 1.0 mile upstream of mouth of Purlear Creek to Lewis Fork									
WS-IV	03-07-01 3.9 FW Miles								
12-31-1-8-(1)	**Purlear Creek**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to a point 2.0 mile upstream of mouth									
C	03-07-01 2.9 FW Miles								
12-40-(1)	**Reddies River**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to a point 0.4 mile downstream of Hoopers Branch			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-II;HQW	03-07-01 14.3 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-94-9b	**Reynolds Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Sequoia WWTP to Muddy Creek										
C	03-07-04	2.9 FW Miles								
12-46	**Roaring River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
B	03-07-01	5.9 FW Miles		Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	2008	5
12-72-10	**Rutledge Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Ararat River										
C	03-07-03	9.4 FW Miles								
12-94-12-(4)	**Salem Creek (Middle Fork Muddy Creek)**		**Fecal Coliform Bacteria** Failing Septic Systems General Agriculture/Pasture MS4 NPDES WWTP NPDES **Habitat Degradation** Construction Impervious Surface MS4 NPDES **Nutrient Impacts** MS4 NPDES WWTP NPDES **Turbidity**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Winston-Salem Water Supply Dam (Salem Lake) to Muddy Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
C	03-07-04	12.0 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
				Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
12-94-12-(1)	**Salem Creek (Middle Fork Muddy Creek, Salem Lake)**		**Nutrient Impacts** Stormwater Runoff	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
From source to Winston-Salem Water Supply Dam (Salem Lake)				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
WS-III;CA	03-07-04	275.3 FW Acres								
12-94-10	**Silas Creek**		**Habitat Degradation** Construction Impervious Surface MS4 NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Muddy Creek										
C	03-07-04	10.1 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-62-15	**Snow Creek**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Mitchell River		General Agriculture/Pasture							
C	03-07-02 9.6 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-84-2-(1)	**South Deep Creek**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to a point 0.6 mile upstream of U.S. Hwy. 601									
WS-III	03-07-02 18.5 FW Miles								
12-84-2-(5.5)	**South Deep Creek**	**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From a point 0.6 mile upstream of Yadkin County SR 1710 to Deep Creek		General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV	03-07-02 2.8 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-62-13	**South Fork Mitchell River**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Mitchell River									
C	03-07-02 17.7 FW Miles								
12-94-13	**South Fork Muddy Creek**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Muddy Creek		General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-04 14.3 FW Miles								
12-40-3	**South Fork Reddies River**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From source to Reddies River									
WS-II;Tr,HQW	03-07-01 7.5 FW Miles								
12-31-2-(6)	**South Prong Lewis Fork**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Wilkes County SR 1155 to a point 1.1 mile upstream of mouth			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
C	03-07-01 5.8 FW Miles								
12-72-9-(1)	**Stewarts Creek**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From N.C.-Va. State Line to Surry County SR 1622									
WS-IV;Tr	03-07-03 5.0 FW Miles								
12-72-9-(4)	**Stewarts Creek**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From Surry County SR 1622 to a point 0.7 mile downstream of mouth of Pauls Creek		Impoundment							
WS-IV	03-07-03 3.3 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-72-9-(8)	**Stewarts Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Town of Mount Airy water supply intake to Ararat River										
C	03-07-03	6.8 FW Miles								
12-26-(7)	**Stony Fork**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Wilkes County SR 1168 to Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-01	5.9 FW Miles								
12-104	**Tanyard Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Yadkin River										
WS-IV	03-07-04	1.5 FW Miles								
12-72-14-(4)	**Toms Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Town of Pilot Mountain water supply intake (Located 0.2 mile upstream of U.S. Hwy. 52) to Ararat River										
C	03-07-03	5.7 FW Miles								
12-37-(2)	**Tucker Hole Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From a point 0.5 mile upstream of mouth to Yadkin River										
WS-IV;Tr,CA	03-07-01	0.4 FW Miles								
12-40-6	**Tumbling Shoals Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2004		3a
From source to Reddies River										
WS-II;HQW	03-07-01	4.1 FW Miles								
12-(1)ut21	**UT to Yadkin River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Yadkin River										
	03-07-01	3.0 FW Miles								
12-(1)	**YADKIN RIVER**		**Habitat Degradation** Road Construction	Aquatic Life	Impaired	Standard Violation	Turbidity	2000	2004	5
From source to mouth in W. Kerr Scott Reservoir at Elevation 1030				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C;Tr	03-07-01	35.0 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-(38)	**YADKIN RIVER**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Moravian Creek to a point 1.0 mile upstream of Roaring River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-01	11.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-(47.5)	**YADKIN RIVER**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.2 mile upstream of Big Bugaboo Creek to a point 0.9 mile upstream of mouth of Elkin Creek (River)			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV	03-07-01 9.7 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-(53)	**YADKIN RIVER**	**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.3 mile upstream of the mouth to Elkin Creek (River) to a point 0.3 mile upstream of Ararat River		Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-02 24.7 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-(80.7)	**YADKIN RIVER**	**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
From a point 0.3 mile upstream of Bashavia Creek to mouth of Hauser Cr.		Stormwater Runoff	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV	03-07-02 9.4 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-(86.7)	**YADKIN RIVER**	**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Davie County water supply intake to a point 0.5 mile upstream of Carters Creek		Stormwater Runoff	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV	03-07-02 10.0 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-(97.5)	**YADKIN RIVER**	**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From a point 0.5 mile upstream of U.S. Hwy. 64 to a point 0.3 mile downstream of U.S. Hwy. 64 (Davidson County water supply intake)		Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV;CA	03-07-04 0.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-(27.5)	**YADKIN RIVER (W. Kerr Scott Reservoir below Elevation 1030)**	**Chlorophyll a**	Aquatic Life	Not Rated	Data Inconclusive	High Water Temperature	2006		3a
From a point 3.2 mile downstream of Stony Fork to W. Kerr Scott Dam		General Agriculture/Pasture General Agriculture/Pasture WWTP NPDES	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
WS-IV,B;Tr	03-07-01 882.1 FW Acres								

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040101 – YADKIN RIVER HEADWATERS

Description

The Yadkin River Headwaters 8 digit HUC 03040101 contains the Yadkin River subbasins 1, 2, 3, 4 (in part), and 5 (Figure 2). Streams and rivers on the western boundary of the HUC drain the high elevation areas of the Blue Ridge Mountains. Watersheds to the east of the Blue Ridge are primarily located within the Piedmont ecoregions. Streams of the Northern Inner Piedmont generally have rocky substrates, while Southern Outer Piedmont watersheds in the southeast portion of the HUC (around Winston-Salem) have sandier substrates. W. Kerr Scott Reservoir is the first of the Yadkin River chain of lakes, and is the only major impoundment located in this HUC.

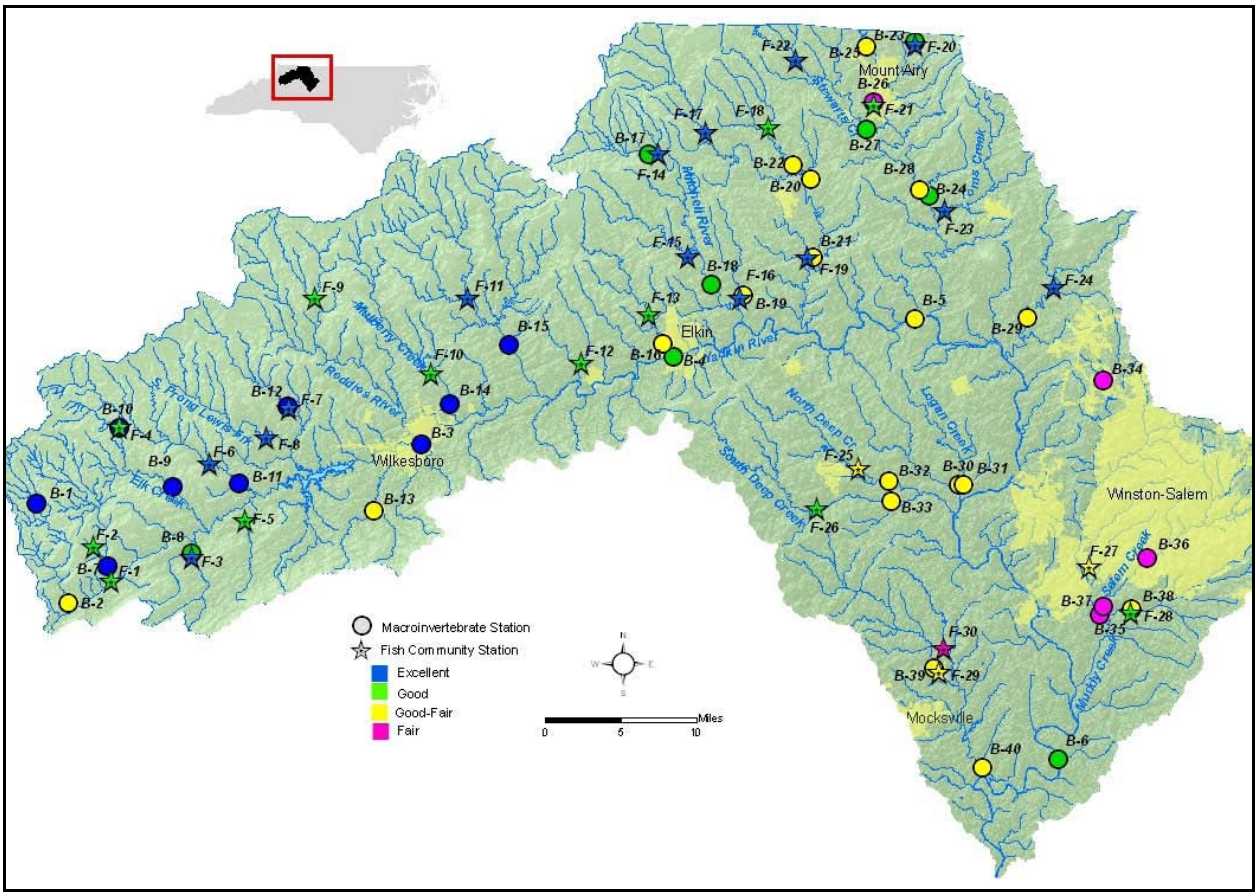


Figure 2. Sampling sites in HUC 03040101 in the Yadkin River Basin. Monitoring sites are listed in Table 1.

Subbasin 01 includes the mountainous headwater reaches of the Yadkin River basin in Watauga, Caldwell and Wilkes Counties. Streams occurring along the northern edge of this subbasin are primarily located within the Southern Crystalline Ridges and Mountain ecoregion where elevations are generally 1200-4500 feet (Griffith *et al*. 2002), stream gradients are high, and landuse is predominantly forest. The major mountain tributaries include Buffalo, Elk, and Stony Creeks, North and South Prong Lewis Forks, Reddies River, Mulberry Creek, and Roaring River, most of which flow south into the Northern Inner Piedmont ecoregion before reaching the Yadkin river. Many of the mountain streams are classified as trout streams, and in terms of their fish communities, are considered mountain cold water, and foothills cool water systems. The Eastern Blue Ridge Foothills ecoregion also occurs along the southern edge of subbasin 01 and includes the Kings and Beaver Creek watersheds. W. Kerr Scott Reservoir is located in this subbasin.

The cities of Wilkesboro and North Wilkesboro are located in subbasin 01, both of which have wastewater treatment plants that discharge to the Yadkin River (4.9 MGD and 2.0 MGD, respectively). The other major discharger is the Louisiana Pacific Corporation ABTCO plant that discharges 1.0 MGD to the Yadkin River, approximately eight river-miles downstream of North Wilkesboro.

Flowing out of its mountainous escarpment in a northeast direction, the Yadkin River then flows through the town of Elkin into subbasin 02 along the Surry and Yadkin County line, before changing direction to the south at the intersection of Surry, Stokes, Forsyth, and Yadkin Counties. The river continues south through this subbasin until just below I-40 in Davie County. Subbasin 02 is located primarily within the Northern Inner Piedmont where elevations and gradients are generally higher and more mountain-like than in other Piedmont ecoregions. The smaller, southern part of the subbasin is located within the Southern Inner Piedmont ecoregion, where streams are characterized by slower flows and sandy substrates. The major tributaries to the Yadkin River in this part of the HUC include the Mitchell, Fisher and Little Yadkin Rivers, Forbush Creek, and Deep Creek. The mountainous section of the Mitchell River watershed above its confluence with the South Fork Mitchell River in western Surry County is classified as ORW.

Landuse in this subbasin is largely forest or used for pasture. The largest residential community in this subbasin is Elkin; others smaller communities include Yadkinville, Dobson, Lewisville, and Clemmons. The three largest NPDES facilities in this subbasin are Chatham Manufacturing Incorporated, which discharges 4.0 MGD into the Yadkin River at Elkin, the Elkin WWTP, which discharges 1.8 MGD into the Yadkin River, and Yadkinville WWTP, which discharges 1.0 MGD into North Deep Creek.

Subbasin 03 lies within the Northern Inner Piedmont ecoregion and originates in the mountains of Virginia. Flowing south, the Ararat River watershed and all of its tributaries drain this entire subbasin before emptying into the Yadkin River to the east of Elkin. The Ararat's main tributaries include Stewarts, Lovills and Flat Shoals Creeks. This watershed is known to have moderate to swift flows throughout the year, with turbidity problems following rainfall events. Outside of the cities of Mt Airy and Pilot Mountain, landuse in this subbasin is mostly forest and pasture. The Mt Airy and Pilot Mountain wastewater treatment plants discharge 7MGD and 1.5 MGD of effluent to the Ararat River, respectively.

The upper portion of Yadkin subbasin 04, approximately bisected north to south by NC 150, includes most of the city of Winston-Salem, one of the largest urban areas in North Carolina. The Muddy Creek watershed is the largest Yadkin River tributary in this subbasin, and receives runoff from almost the entire Winston-Salem vicinity. The major tributaries to Muddy Creek in Winston-Salem include Salem, and South Fork Muddy Creeks. Salem Creek drains a heavily urbanized portion of Winston-Salem. South of Winston-Salem, land use in this lowest part of the HUC is still primarily forest and pasture.

Many streams in Winston-Salem are affected by urban runoff and/or by the city's numerous permitted dischargers, many of which are small residential (i.e. package) plants. Large dischargers in the Muddy Creek drainage include the Winston-Salem Archie Elledge WWTP (Salem Creek, 30 MGD), and Winston-Salem Muddy Creek WWTP (Yadkin River, 21 MGD).

Dutchmans Creek and all of its tributaries, including Cedar Creek (subbasin 05) lies mainly within the Southern Outer Piedmont ecoregion in Davie County. The headwater reaches of Dutchmans Creek originate in small sections of the Northern Inner Piedmont and Triassic Basins ecoregions, along the borders of Yadkin and Iredell Counties. Outside of the town of Mocksville, this area is rural, with the predominant land use in forest and pasture. The Mocksville Town WWTP is the largest permitted NPDES facility in this area, and discharges 0.68 MGD to Dutchmans Creek.

Overview of Water Quality

Overall, there were 40 benthic macroinvertebrate sites sampled in the Yadkin River Headwater HUC (Table 1). Seven of the 36 benthic macroinvertebrate sites previously sampled in the last basinwide cycle had an improvement in bioclassification. The Yadkin River at NC18/268 was the only benthic site that improved by two bioclassifications. Seven of the 36 benthic basinwide sites also declined by one bioclassification.

Table 1. Waterbodies monitored in HUC 03040101 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	Yadkin R	Caldwell	NC 268, Patterson	Good-Fair	Good-Fair
B-2	Yadkin R	Caldwell	SR 1372	Good	Excellent
B-3	Yadkin R	Wilkes	NC 18/268	Good-Fair	Excellent
B-4	Yadkin R	Yadkin	US 21	Good	Good
B-5	Yadkin R	Surry	SR 1003	Good	Good-Fair
B-6	Yadkin R	Davidson	SR 1447	Good	Good
B-7	Buffalo Cr	Caldwell	SR 1505	Excellent	Excellent
B-8	Kings Cr	Caldwell	SR 1552	---	Good
B-9	Elk Cr	Wilkes	SR 1175	Good	Excellent
B-10	Laurel Cr	Watauga	SR 1508	---	Excellent
B-11	Stony Fk	Wilkes	SR 1135	Excellent (2002)	Excellent
B-12	N Pr Lewis Fk	Wilkes	Near SR 1300	Excellent (2002)	Excellent
B-13	Moravian Cr	Wilkes	NC 18	Good-Fair	Good-Fair
B-14	Mulberry Cr	Wilkes	NC 268	Excellent	Excellent
B-15	Roaring R	Wilkes	SR 1990	Good	Excellent
B-16	Elkin Cr	Surry	NC 268	Good-Fair	Good-Fair
B-17	Mitchell R	Surry	SR 1330	Good	Good
B-18	Mitchell R	Surry	SR 1001	Excellent	Good
B-19	Snow Cr	Surry	SR 1121	Good-Fair	Good-Fair
B-20	Fisher R	Surry	US 601	Good	Good-Fair
B-21	Fisher R	Surry	NC 268	Good	Good-Fair
B-22	L Fisher R	Surry	SR 1480	Good-Fair	Good-Fair
B-23	Ararat R	Surry	NC 104	Good-Fair	Good
B-24	Ararat R	Surry	SR 2019	Good-Fair	Good
B-25	Lovills Cr	Surry	SR 1700	Good-Fair	Good-Fair
B-26	Lovills Cr	Surry	SR 1371	Fair	Fair
B-27	Stewarts Cr	Surry	SR 2258	Good	Good
B-28	Flat Shoal Cr	Surry	SR 2017	---	Good-Fair
B-29	L Yadkin R	Stokes	SR 1102	---	Good-Fair
B-30	Forbush Cr	Yadkin	SR 1570	Good-Fair	Good-Fair
B-31	Logan Cr	Yadkin	SR 1571	Good	Good-Fair
B-32	N Deep	Yadkin	SR 1510	Good-Fair	Good-Fair
B-33	S Deep Cr	Yadkin	SR 1710	Good-Fair	Good-Fair
B-34	Muddy Cr	Forsyth	SR 1898	Good-Fair	Fair
B-35	Muddy Cr	Forsyth	SR 2995	Good-Fair	Fair
B-36	Salem Cr	Forsyth	SR 2902	Fair	Fair
B-37	Salem Cr	Forsyth	SR 2991	Fair	Fair
B-38	S Fk Muddy Cr	Forsyth	SR 2902	Good-Fair	Good-Fair
B-39	Dutchmans Cr	Davie	US 158	Good-Fair	Good-Fair
B-40	Dutchmans Cr	Davie	NC 801	Fair	Good-Fair

Table 1 (continued).

Map #[1]	Waterbody	County	Location	2001	2006
F-1	Yadkin R	Caldwell	NC 268	Good	Good
F-2	Buffalo Cr	Caldwell	SR 1594	Excellent (1999)	Good
F-3	Kings Cr	Caldwell	SR 1552	---	Excellent
F-4	Laurel Cr	Watauga	SR 1508	Good (1999)	Good
F-5	Beaver Cr	Wilkes	SR 1131	Good	Good
F-6	Stony Fk	Wilkes	SR 1170	---	Excellent
F-7	N Prong Lewis Fk	Wilkes	SR 1304	Excellent	Excellent
F-8	S Prong Lewis Fk	Wilkes	SR 1154	Good	Excellent
F-9	N Fk Reddies R	Wilkes	SR 1567	Excellent	Good
F-10	Mulberry Cr	Wilkes	SR 1002	---	Good
F-11	M Prong Roaring R	Wilkes	SR 1002	Excellent	Excellent
F-12	Big Bugaboo Cr	Wilkes	SR 1924	---	Good
F-13	Elkin Cr	Wilkes	SR 2044	---	Good
F-14	Mitchell R	Surry	SR 1330	Good (1999)	Excellent
F-15	S Fk Mitchell R	Surry	SR 1301	---	Excellent
F-16	Snow Cr	Surry	SR 1121	---	Excellent
F-17	Fisher R	Surry	SR 1331	Excellent	Excellent
F-18	Little Fisher R	Surry	SR 1480	Good	Good
F-19	Cody Cr	Surry	US 268	Good (1996)	Excellent
F-20	Ararat R	Surry	NC 104	---	Excellent
F-21	Lovills Cr	Surry	SR 1371	---	Good
F-22	Stewarts Cr	Surry	SR 1622	Excellent	Excellent
F-23	Toms Cr	Surry	SR 2024	Excellent	Excellent
F-24	Little Yadkin R	Stokes	SR 1236	Excellent	Excellent
F-25	N Deep Cr	Yadkin	SR 1605	Good-Fair	Good-Fair
F-26	S Deep Cr	Yadkin	SR 1152	Good	Good
F-27	Silas Cr	Forsyth	SR 1137	Good-Fair (2002)[2]	Good-Fair
F-28	S Fk Muddy Cr	Forsyth	SR 2902	Good-Fair	Good
F-29	Dutchmans Cr	Davie	US 158	Good-Fair	Good-Fair
F-30	Cedar Cr	Davie	off SR 1410	---	Fair (2004)

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.
[2]Basinwide site that was resampled as a special study.

In addition, there were 30 fish community sites sampled in the Yadkin River Headwater 8-digit HUC. Four of the 20 fish community sites previously sampled in the last basinwide cycle improved by one bioclassification and two declined by one bioclassification (Table 1).

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

The upper part of the Yadkin River Headwaters HUC generally has Good or Excellent water quality, as indicated by the basinwide sites (benthic and fish) sampled west of Elkin (Figure 2). Two of the benthic sites in the uppermost part of the HUC (Yadkin River at SR 1372, and Elk Creek at SR 1175) have been showing trends of stable or improving water quality since the 1980's, and had ratings of Good in 2001 that increased to Excellent in 2006. A new benthic site in the upper Elk Creek watershed (Laurel Creek at SR 1508, an established fish community site) was also rated Excellent for its benthic community and Good for fish community. The Yadkin River at NC 268 in Patterson is an exception in this part of the watershed, receiving two consecutive Good-Fair benthic ratings, which may be attributed to runoff from road projects along NC 321. Buffalo Creek received its third Excellent rating for benthic macroinvertebrates at SR 1505, but slipped from its previous fish community rating of Excellent to Good at SR 1594 (further upstream).

The Kings Creek watershed was sampled for the first time in 2006 at SR 1552 for both benthic macroinvertebrates and fish, and received ratings of Good and Excellent, respectively. The Stony Fork and North Prong Lewis Fork tributaries continue to be rated Excellent for both their benthic and fish

communities, and have shown very few discernable water quality stressors. The South Prong Lewis Fork fish community site at SR 1154 also improved in rating from Good to Excellent.

A few miles southwest of Wilkesboro, the benthic site at NC 18 on Moravian Creek has produced three consecutive Good-Fair ratings, and may be showing subtle signs of declining water quality in that agricultural watershed. The benthic site in Wilkesboro (Yadkin River at NC 18/268) has fluctuated between Good-Fair and Good since 1984, and is the only biological monitoring station in the Yadkin River Headwater HUC that improved two whole ratings in 2006; rising to Excellent.

The biological assessments of the Mulberry Creek watershed indicate good water quality. The creek was sampled for the first time for fish in 2006 at SR 1002 and received a rating of Good. Further downstream at NC 268, the stream has been rated Excellent for its benthic community on three occasions, and shows no signs of water quality stressors. The Roaring River at SR 1990 moved from Good to Excellent, and has been showing trends of stable or improving water quality since first sampled in 1983. The Middle Prong Roaring River fish community site rated Excellent for the second time in a row, after an initial 1996 rating of Good in this rural mountain watershed. The fish community of Big Bugaboo Creek just outside of Rhonda at SR 1924 was sampled for the first time in 2006, and earned a rating of Good.

Bound by Elkin and Jonesville, the Yadkin River at US 21 has been sampled for benthic macroinvertebrates on three occasions since 1996. This urban river site has maintained a rating of Good since the 2001 assessment, and has shown slight improvement over a ten-year period. The Elkin Creek tributary just upstream of this site has been sampled for its benthic community at NC 268 and further upstream for fish at SR 2044. The lower site has maintained a Good-Fair rating over three basinwide cycles and continues to show its urban influences. The new fish community site located about three miles upstream at SR 2044 is classified as WS-II; HQW, and was rated Good in 2006.
Streams in the northernmost areas of the Yadkin River Headwater HUC and especially the northwest corner of Surry County are typified by rural montane characteristics, and in general, exhibit good water quality. The upper Mitchell River watershed in western Surry County, much of which is classified as ORW (above the South Fork Mitchell confluence), has benefited from extensive restoration and conservation efforts. There are four biological monitoring stations located throughout the Mitchell River watershed.

The upper Mitchell River site at SR 1330 retained its third consecutive Good rating for benthos in 2006, and improved to a rating of Excellent based on the fish community. In fact, water quality (as indicated by the fish community) has shown a steady improvement over three assessments, from Good-Fair in 1996 to Excellent in 2006, and can be attributed to the ongoing conservation and habitat restoration efforts. Further downstream at the SR 1003 crossing, the 2006 benthic assessment of the Mitchell River indicated a return to a previous rating of Good (1987 and 1996) after one Excellent rating in 2001 based on low flows and the lack of nonpoint pollution inputs. The fish community of South Fork Mitchell River was sampled for the first time in 2006 at SR 1301, and was rated Excellent.

Snow Creek is a tributary to the lower Mitchell River that was rated Good-Fair for benthos at SR 1121 in 2001 and 2006 (a decline from a Good rating in 1996). This site however, which drains a primarily forested and agricultural watershed, was rated Excellent for fish in 2006.

The upper Fisher River watershed drains the rural extreme northwest corner of Surry County. The 2006 fish community site located at SR 1331 retained its water quality rating of Excellent, and is showing no discernable signs of stressors. However, the water quality ratings at two benthos sites further downstream (US 601 and NC 268) declined from Good in 2001 to Good-Fair in 2006 based on low flow and sedimentation (upstream residential construction), respectively. Originating in Virginia, the Little Fisher River retained its water quality ratings of Good (as indicated by the fish community) and Good-Fair (as indicated by benthic macroinvertebrates), but was noted as having an increased amount of interstitial sediment than in 2001. Although not sampled since the 1996 basinwide cycle, the fish community of Cody Creek (a tributary to the Little Fisher River) showed a slight water quality improvement, with an increase in rating from Good to Excellent.

The Yadkin River at SR 1003 (just before its turn to the south) has been sampled for benthic macroinvertebrates on three occasions, fluctuating between ratings of Good-Fair and Good since 1996. In 2006 the rating returned to Good-Fair, as the benthic community at this 1,228 square mile site is showing trends towards increasingly tolerant organisms.

Originating in the mountains of Virginia, the Ararat River watershed located in the northeast corner of the Yadkin River Headwaters HUC, comprises the entire Yadkin River subbasin 03, and is almost completely contained within Surry County. At the uppermost monitoring site on the Ararat River (NC 104), nearly the entire drainage flows from Virginia. In 2006, this site was rated Good based on the benthic community (an improvement from the two previous Good-Fair ratings) and Excellent based on the first fish community assessment. Further downstream at SR 2019, the benthic community has shown consistent improvements in water quality since the 1996 assessment (rated Fair). Since then, the site has earned a Good-Fair rating in 2001, then improved to a rating of Good for benthos in 2006, which was likely due to the loss of the textile industry in Mt Airy. All biological monitoring efforts indicate that water quality is improving in this watershed.

Stewarts Creek is a main tributary that drains the western side of the watershed. The fish community site in the upper part of this catchment (SR 1622) was rated Excellent for the third time in 2006, and the benthos site draining western Mt Airy (located just above the Ararat River confluence at SR 2258) earned a second rating of Good. The aquatic biotas at these sites are very stable and there appears to be no discernable water quality stressors in this watershed. There are three monitoring sites on Lovills Creek, which runs through the center of Mt Airy. The benthos site just below the Virginia line (SR 1700) has been rated Good-Fair on three occasions and continues to indicate no specific stressors in that upper part of the catchment. The Lovills Creek site at SR 1371 in southwest Mt Airy has been rated Fair in three consecutive benthos assessments, yet the first fish community sample in 2006 indicated Good water quality, mostly as a result of the extreme number of fish that were collected. In fact, the abundance of aquatic vegetation at this site (due to an open canopy and non-point nutrients) may be enhancing the fish community.

Flat Shoal Creek was sampled for the first time for benthos at SR 2017 in 2006, and earned a rating of Good-Fair. However, the influence of the Ararat River (site 250 feet above the Ararat River confluence) during high flow events may cause this site to be somewhat unrepresentative of the watershed as a whole. The fish community of Toms Creek, the next major downstream tributary to the Ararat River draining Pilot Mountain, was sampled at SR 2024 in 2001 and 2006 and has received its second consecutive rating of Excellent, with no apparent water quality issues.

In general, the areas that lie to the east and southeast of the town of Elkin in the Yadkin River Headwater HUC are dominated by Piedmont topographies. The Little Yadkin River watershed drains the southwest corner of Stokes County and maintained its third Excellent rating (as indicated by the fish community) at SR 1236. Further southwest at the SR 1102 crossing, the Little Yadkin River was rated Good-Fair following its first benthic macroinvertebrate assessment. This rating is reflective of the various land uses in the watershed including agriculture, commercial and residential. Situated between Winston-Salem and Yadkinville, the largely agricultural watershed of Forbush Creek has maintained its water quality rating of Good-Fair at SR 1570 since 1996, and is supporting a stable benthic community that may be showing a slight trend towards more tolerant species. Logan Creek is a tributary to Forbush Creek that has fluctuated between ratings of Good-Fair (1996 and 2006) and Good (2001). The drop in the 2006 rating may not be related to a decline in water quality in this agricultural watershed, but rather may reflect recent high flows that scoured the benthic population. The North Deep Creek watershed has maintained its water quality rating of Good-Fair for both benthos and fish community monitoring sites since it was first sampled in 1993. Water quality in the South Deep Creek watershed (drains the south side of Yadkinville) has also remained stable since 1996, with three ratings of Good (as indicated by the fish community at SR 1152), and three ratings of Good-Fair further downstream (as indicated by benthos at SR 1710).

In general, water quality in and around the Winston-Salem metropolitan area appears to be unchanged since the last basinwide assessment. The benthic site in the upper Muddy Creek watershed (at SR 1898) dropped by one bioclassification to Fair, likely because of a decline in habitat quality (erosion and

sedimentation). Although the monitoring site located further downstream on Muddy Creek at SR 2995 (below its confluence with Salem Creek) also declined by one rating to Fair, the benthic community at this location appears to indicate fairly stable stream conditions. Water Quality in Silas Creek also appears to be unchanged since the last monitoring cycle. This urban site was rated Good-Fair for the second time since 2002, based on its fish community. Both of the benthic sites in the heavily urbanized watershed of Salem Creek also retained their ratings of Fair and indicate stable water quality conditions. As indicated by the increase in the fish community rating at the SR 2902 crossing from Good-Fair to Good, water quality in the South Fork Muddy Creek watershed seems to be improving slightly. Possible reasons include the loss of industrial dischargers, as well as sewer collection system upgrades in Kernersville. However, the benthic macroinvertebrates sampled at this same location indicated no changes in water quality. Despite its location below the Muddy and Salem Creek catchments (about 10 miles downstream from the Muddy Creek confluence), the Yadkin River site at SR 1447 (this crossing is listed as SR 1147 in the 2001 Basinwide Assessment Report) maintained its fifth rating of Good for benthos since 1985. In part, good habitat qualities have been attributed to the stable benthic community at this location.

The US 158 monitoring site in the upper Dutchmans Creek watershed earned its second Good-Fair rating for both benthic macroinvertebrates and the fish community in 2006. As in 2001, low flows at this sandy low gradient site exposed some functional instream habitats (i.e. root mats), which may be affecting these ratings. Further downstream below Mocksville at the NC 810 crossing, the benthic rating for Cedar Creek improved slightly from Fair to Good-Fair because of slight improvements in habitat quality. However, both of these monitoring sites continue to suffer from the same habitat issues including sedimentation from easily eroded banks and instream habitat exposures that occur during periods of drought. The fish community of Cedar Creek (a tributary to Dutchmans Creek) has been sampled on three occasions since 1996, with the most recent sample resulting in a decline in rating from Good in 2001 to Fair in 2006. This stream is also a low flow affected stream that suffers from poor instream habitats during periods of drought.

River and Stream Assessment

Specific site summaries of the 40 benthic macroinvertebrate and 30 fish community samples may be found at this link: **03040101**.

SPECIAL STUDIES

Benthic Macroinvertebrate Monitoring of Stewarts Creek, Surry County

Stewarts Creek at NC 89 was re-sampled in order to determine if it should be placed on the 303d list, as an earlier 2001 sample resulted in a Fair bioclassification (BAU Memorandum B-021001). The 2002 resample produced a Good-Fair rating. A temporary cofferdam upstream of the sampling location during the 2001 sample restricted flow to the riffle area, and thereby lowered EPT richness and the bioclassification. The dam was removed after the 2001 sample, thereby restoring the riffle and the stream's bioclassification.

Benthic Macroinvertebrate Monitoring of Heatherly Creek, Surry County

Two sites on Heatherly Creek (at NC 268 and US 52) were sampled as part of an upstream/downstream study on the effects of the 1996 removal of the Pilot Mountain WWTP discharge on Heatherly Creek (BAU Memorandum B-040823). This facility used to discharge upstream of the US 52 location. The 2004 samples declined from the 2001 samples. The 2001 samples were collected during drought conditions, and were therefore receiving less polluted runoff from the upstream Town of Mt. Airy. In 2004, normal flows returned and the increased pollutant inputs lowered the bioclassifications from 2001 levels.

Benthic Macroinvertebrate Monitoring of Faulkner Creek, Surry County

Faulkner Creek was sampled at three locations (SR 1742, SR 1756, SR 1827) in order to determine if the stream should remain on the 303d list (BAU Memorandum B-020719). It was determined that the section of Faulkner Creek below SR 1742 should remain listed on the 303d list, as it received a Not Rated bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1372	06/05/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-(1)	360514	813556

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr	9.2	3	0.3

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

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

Water Quality Parameters

Temperature (°C)	17.1
Dissolved Oxygen (mg/L)	9.2
Specific Conductance (µS/cm)	44
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	3
Right Bank Stability (7)	7
Light Penetration (10)	3
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	84

Site Photograph

Substrate mostly cobble, boulder, gravel; some bedrock, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/05/06	9939	-	43	-	2.67	Excellent
07/27/01	8525	-	33	-	3.50	Good

Taxonomic Analysis

The number of Trichoptera taxa doubled, from six in 2001 to 12 in 2006; four taxa not present in 2001 were common or abundant in 2006: *Lepidostoma* , *Dolophilodes* , *Polycentropus* , and *Rhyacophila fuscula* . The mayfly community differed somewhat between the two sampling events, and had a net addition of two taxa in 2006. The stonefly community was very similar in 2001 and 2006; the most notable addition was *Isoperla holochlora* , which was absent in 2001 and abundant in 2006.

Data Analysis

The site is 5.5 miles SE of Blowing Rock NC; the drainage area includes the watersheds of Ooten, Bailey Camp and Dennis Creeks. It was suggested in the prior BAU report that water quality in the catchment has been improving since 1988 when sampling occurred near the mouth of Dennis Creek and about 1 mile downstream of the present site on Yadkin River; both sites received ratings of Good-Fair in that year. The Excellent classification in 2006 provides support for the trend towards better water quality in the upper Yadkin River watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	NC 268, Patterson	06/06/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-(1)	355930	813329

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Eastern Blue Ridge Foothills	C; Tr	28.6	10	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	50	30	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Omni Supply	NC0006254	0.45
Caldwell County Schools	NC0041181	0.008

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	51
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	73

Site Photograph

Substrate mostly bedrock, boulder, sand; some cobble, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9940	112	33	5.32	4.22	Good-Fair
08/30/01	8619	69	24	5.53	4.69	Good-Fair
07/22/96	7107	102	41	4.55	3.75	Good
07/10/90	5373	87	38	4.89	3.92	Good
08/04/87	4181	87	37	5.24	4.39	Good
08/06/85	3544	76	24	6.03	4.27	Good-Fair

Taxonomic Analysis

EPT richness was much lower in 2001 than 1996, but increased in 2006. Trichoptera richness took a particularly hard hit between 1996 and 2001, from 16 taxa down to seven; in 2006 the number was still low with eight caddisfly taxa collected. Between 1987 and 1996 there were six or seven hydropsychid taxa present at each sampling event; in two were present in 2001 and three in 2006. *Polycentropus* were either common or abundant prior to 2001, but rare in both 2001 and 2006.

Data Analysis

The site is located next to a USGS gauging station on Yadkin River near Patterson. Good-Fair ratings at the site in both 2001 and 2006 may be the result of road projects on NC 321; better erosion control in 2006 may be resulting in better values over 2001 for EPT richness and NCBI.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Yadkin R	**NC 268 (Legerwood)**	**08/02/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360048	813030	12-(1)	Eastern Blue Ridge Foothills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	85.2	1150	11	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	35	---	65	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Patterson School (100% domestic, 1 mile above site)	NC0043125	0.025

Water Quality Parameters

Temperature (°C)	24.5
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	60
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**67**

Site Photograph

Substrate gravel, cobble, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/02/06	2006-106	22	48	Good
06/18/01	2001-60	20	48	Good
05/23/96	96-61	22	48	Good

Most Abundant Species Bluehead Chub

Exotic Species Central Stoneroller, Warpaint Shiner

Species Change Since Last Cycle **Gains** -- Gizzard Shad, Rosyside Dace, Whitefin Shiner. **Losses** -- Striped Jumprock

Data Analysis

Watershed -- drains the extreme western headwater portion of the Yadkin River in northeast Caldwell County, including the municipalities of Patterson and Legerwood. **Habitats** -- runs, riffles, car snags (old bank stabilization), woody snags, no true pools; narrow riparian zones; low flow. **2006** -- moderate abundances, but good diversity of fish community; total of 24 species collected with Smallmouth Bass and Flat Bullhead counted (young-of-year representation only). **1996-2006** -- 26 species have been collected from this site; stable darter populations with same three species; Redbreast Sunfish is the one consistent sunfish present; declining number of sucker species in three assessments (5,4,3, respectively); same four intolerant species collected; no trout collected in 1996, 2001, or 2006: identical NCIBI scores and ratings over a ten year period.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	**NC 18/268**	**06/08/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-(38)	360909	810845

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	500	30	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	80	10	0

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

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	41
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	0
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	59

Site Photograph

Substrate mostly cobble with some gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/08/06	9950	114	46	4.61	3.69	Excellent
07/25/01	8516	94	32	5.31	4.41	Good-Fair
07/24/96	7116	72	39	5.03	4.01	Good
06/07/93	6181	73	34	5.50	4.47	Good-Fair
08/10/89	5047	75	35	4.76	4.22	Good

Taxonomic Analysis

In 2006 the site had the highest number of EPT taxa than for any prior sampling event, with the next greatest number of 39 EPT taxa occurring in 1996. In fact, each of the three orders were higher in 2006 than for any previous year; seasonality does not account for the high numbers of those taxa seen. Four taxa were either common or abundant in 2006 and unrecorded for previous years: *Agnetina* , *Ceraclea ancylus* , *Neophylax fuscus* , and *Neophylax oligius* . The decrease in NCBI and EPT BI between 2001 and 2006 is due in large part to several taxa intolerant to the presence of stressors that were either common or abundant in 2006 and absent in 2001: *Drunella tubercalata* , *Serratella deficiens* , *Serratella molita* , *Agnetina* , *Pteronarcys* , *Ceraclea ancylus* , *Neophylax fuscus* , and *Neophylax oligius* .

Data Analysis

The site was sampled about 300 feet downstream of the NC 18/268 bridge at Wilksboro NC. The site has been sampled ten times since 1984. On seven of those occasions the site received a rating of Good-Fair, and at three other times a rating of Good. Only after the most recent sampling event in 2006 has the site received a classification of Excellent. In addition to having the highest number of EPT taxa in 2006, the site in 2006 also had the lowest NCBI and EPT BI values. The sedimentation and large amounts of filamentous algae noted in 2001 were not seen in 2006 and are likely significant for the results from the benthic data seen in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	**US 21**	**08/07/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-(53)	361427	805057

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	828.2	50	1

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	70	20	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Louisiana Pacific Corp - ABTCO (approcimately 15.5 miles upstream)	NC0005266	1
North Wilkesboro WWTP (approximately 22.5 miles upstream)	NC0020761	2
Wilkesboro WWTP (approximately 23.6 miles upstream)	NC0021717	4.9

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	57
pH (s.u.)	6.2
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	52

Site Photograph

Substrate Gravel, rubble, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10006	82	35	4.9	3.9	Good
08/06/01	8562	65	30	4.7	3.8	Good
07/23/96	7094	56	23	5.4	4.4	Good-Fair

Taxonomic Analysis

Total taxa collected in 2006 increased relative to 2001, mostly due to more midge species, though the sensitivity of the overall community decreased slightly. Trichopteran taxa collected in 2006 including *Brachycentrus, Ceraclea,* and *Micrasema* indicate that species absent in 2001 may have been the result of droughts and decreased habitat available that year. Amphipod and isopod species collected in 2006 may support the assumption that additional organic leaf litter along the edges of the river provided better habitat during this period.

Data Analysis

This relatively urban site, bounded by the towns of Elkin ad Jonesville has had biological results that suggest relatively stable water quality conditions and even improvement on a ten-year scale. At the head of subbasin 2, the drainage immediately upstream of this wide site is predominately rural once it passes Wilkesboro 22 miles upstream. The site offers fairly homogenous gravel/sand habitat with little riparian canopy and few pools.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1003	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-(53)	361655	803351

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	1227.8	70	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10	30	

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

Water Quality Parameters

Temperature (°C)	26.3
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	60
pH (s.u.)	6.9
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	53

Site Photograph

Substrate Gravel, boulder, sand, bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10013	78	29	5.3	4.2	Good-Fair
08/07/01	8569	65	30	4.5	3.8	Good
07/27/96	7078	62	30	5.4	4.6	Good-Fair

Taxonomic Analysis

Total taxa at this site increased relative to the previous (2001) sampling event, mostly by a large increase in chironomid taxa. At the same time, the biotic index of the site increased from 4.54 to 5.25, helping to reduce the site's bioclassification from Good in 2001 to the current Good-Fair rating. The relative abundance of tolerant organisms like *Larsia, Argia, Plauditus dubius* and the absence/paucity of sensitive taxa previously present like *Protoptila* and *Promoresia elegans* helped foment this change.

Data Analysis

This site is located between the confluences of the Fisher and Ararat rivers and receives 1228 square miles of drainage at this point. The River is wide and flowing over a short, exposed area of riffle/bedrock. Though benthos results seem relatively stable over time, hovering in the Good to Good-Fair range, the current rating shows a trend toward a more tolerant community of organisms.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
YADKIN R	SR 1447	08/09/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	4	03040101	12-(97.5)	355140	802315

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	2160.6	50	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	10	40	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Winston-Salem Muddy Creek WWTP	NC0050342	21.0

Water Quality Parameters

Temperature (°C)	28.2
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	118
pH (s.u.)	6.5
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	5
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	70

Site Photograph

Substrate cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10045	85	33	5.4	4.3	Good
09/12/01	8631	67	29	5.5	4.6	Good
07/09/90	5368	64	27	5.5	4.6	Good
08/05/86	3898	67	26	5.8	4.8	Good
09/09/85	3670	60	23	5.7	4.5	Good

Taxonomic Analysis

The number of EPT species collected has risen slightly every collection year since 1985 to the current number of 33 taxa. Additionally, the BI has decreased slightly over the same period. This site on the Yadkin River was not sampled in 1996 due to high flows. Three intolerant species were abundant in 2006, a mayfly (*Heptagenia*) and two caddisflies (*Brachycentrus numerosu*s and *Protoptila*). Of note is the fact that more relatively intolerant taxa were abundant than tolerent taxa. As in 2001, three stonefly species were present though were rare.

Data Analysis

This site is approximately 10 miles downstream from the confluence with Muddy Creek and the outfall to the Muddy Creek WWTP. The large urban area of Winston-Salem drains into the Yadkin via Muddy Creek and therefore has the potential to affect water quality, particularly during low flows. Water quality, however, has remained good since 1985 indicating substantial dilution effect of water received from upstream of Muddy Creek. Another contributing factor to the high EPT count is the high amount of favorable habitat available for colonization.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Buffalo Cr	**SR 1594**	**08/03/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360246	813149	12-19	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	29.8	1230	13	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	---	---	5 (camp lawns)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	35
pH (s.u.)	7.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**91**

Site Photograph

Substrate cobble, boulder, bedrock shelves

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-108	13	52	Good
06/08/99	99-42	15	56	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Smallmouth Bass, Central Stoneroller, Warpaint Shiner, Brown Trout

Species Change Since Last Cycle **Losses** -- White Sucker, Sandbar Shiner, Piedmont Darter **Gains** -- Brown Trout

Data Analysis

Watershed -- drains the extreme northeast corner of Caldwell County, and the extreme southeast corner of Watauga County; site location is at Camp Carolwood. **Habitats** -- high quality; runs, riffles, plunge pools; good riparian; low flow. **2006** -- 16 species collected including three that were only represented by young-of-year fish (White Sucker, Piedmont Darter, and Creek Chub); 77% of species with multiple age groups. **1999-2006** -- total of 17 species collected from this site; slight drop in NCIBI score and rating from 1999 special study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BUFFALO CR	**SR 1505**	**06/06/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-19	360143	813045

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr	32.2	12	0.5

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

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

Water Quality Parameters

Temperature (°C)	17.8
Dissolved Oxygen (mg/L)	9.6
Specific Conductance (µS/cm)	29
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Site Photograph

Substrate bedrock and a mix of boulder, cobble, sand and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9942	-	48	-	3.36	Excellent
08/30/01	8620	-	43	-	3.88	Excellent
07/22/96	7108	-	40	-	3.65	Excellent

Taxonomic Analysis

EPT richness increased in both 2001 and 2006. In 2006 the increase occurred in spite of the fewest number of recorded caddisfly taxa for the site; both mayfly and stonefly richness were higher in 2006 than for the two prior sampling events. Seasonality is playing a role in increased mayfly and stonefly richness; five taxa identified by the BAU as winter seasonal (*Dannella simplex* , *Drunella walkeri* , *Eurylophella verisimilis* , *Haploperla brevis* , and *Isoperla transmarina*) were present in the June sample in 2006 and absent in later season samples in 1996 and 2001. Three taxa were abundant in 2006 though unrecorded in prior samples: *Drunella cornutella* , *Maccaffertium ithaca* , and *Dolophilodes* . Though either common or abundant in 1996 and 2001, no *Micrasema* were identified from the site in 2006.

Data Analysis

The site is eight miles north of Lenoir NC, one mile south of the summit of Winding Stairs Mountain, about one mile above the confluence of Buffalo Creek and Yadkin River, and about 450 feet below a small impoundment. The highest EPT richness and the lowest EPT BI were recorded for the site in 2006. No water quality problems are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
KINGS CR	SR 1552	06/07/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CALDWELL	1	03040101	12-23	360234	812453

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C; Tr	25.8	12	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	0	80	0

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

Water Quality Parameters

Temperature (°C)	15.5
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	51
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	4
Total Habitat Score (100)	57

Site Photograph

Substrate mostly sand and silt with a small amount of gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9946	-	28	-	4.19	Good

Taxonomic Analysis

The presence of *Brachycercus* spp. and *Caenis* spp. (both common) is a benthic reflection of the silt and sand substrate. A species of *Pteronarcys* was abundant suggesting stability of water quality and habitat at the site. Other abundant taxa were: *Baetis intercalaris*, *Plauditus dubius* group, *Serratella deficiens*, *Serratella serrata*, *Maccaffertium modestum*, *Isonychia*, *Perlesta*, *Ceratopsyche bronta*, *Ceratopsyche sparna*, *Cheumatopsyche*, and *Neophylax oligius*.

Data Analysis

The site is about 11 miles NE of Lenoir NC and one stream mile above the confluence with Yadkin River. The drainage area captures much of the region between Brushy Mountains and Yadkin River in Caldwell County. This is the first year for a benthic collection on the stream. Though the site classified as Good, one taxon fewer would have resulted in a classification of Good-Fair. Habitat homogeneity resulting from a dominance of silt and sand as the bottom substrate is very likely depressing richness at the site. The EPT BI was relatively high; of the ten EPT samples collected in Yadkin River subbasin 01 in 2006, only the basinwide site at Moravian Creek was higher.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Kings Cr	**SR 1552**	**06/23/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Caldwell	1	03040101	360235	812453	12-23	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	27.6	1075	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	---	50	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	58
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	**65**

Site Photograph

Substrate gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-95	21	54	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Central Stoneroller, Warpaint Shiner, Brown Trout

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains the northeast corner of Caldwell County. **Habitats** -- borderline between Piedmont and Mountains (Eastern Blue Ridge Foothills); snags, gravel riffles, undercuts, few side snag pools; riprap on left to stabilize banks leading to corn fields; tires in stream throughout sample reach, trash dump at upper end. **2006** -- first fish community sample at this location; good abundance (n=599) and diversity with three darter species, two sunfish, one bass, and one trout species, three sucker species, and two intolerant species; slightly skewed trophic structure towards Omnivores+Herbivores (Bluehead Chub = 41% of sample); large suckers collected with high biomass.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ELK CR	**SR 1175**	**06/07/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-24-(10)	360623	812617

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	B; ORW	43.2	18	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	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
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	36
pH (s.u.)	6.9
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	13
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Site Photograph

Substrate mix of boulder, cobble, gravel, sand, and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9948	135	62	4.26	3.53	Excellent
08/29/01	8618	100	43	4.64	3.68	Good
07/22/96	7109	85	42	4.68	3.90	Good
07/29/88	4643	96	47	4.52	3.52	Excellent
08/06/85	3545	107	44	4.73	3.73	Good

Taxonomic Analysis

The highest number of EPT taxa in Yadkin River basin in 2006 were collected at the site, far exceeding the next highest number of 53 EPT taxa collected at three other sites. Seasonality is playing only a small role in the high number of EPT taxa collected in 2006; three taxa identified as winter seasonal (*Eurylophella aestiva* , *Isoperla transmarina* , and *Apatania*) were collected in the early June sample in 2006 and not collected previously in later season samples. Several EPT taxa were identified from the site for the first time in 2006 and were either common or abundant: *Heterocloeon curiosum* , *Plauditus dubius* group, *Procloeon* , *Drunella tuberculata* , *Eurylophella aestiva* , *Serratella serrata, Apatania* , and *Paranyctiophylax nephophilus* .

Data Analysis

The site is 14.5 miles NNE of Lenoir NC, about 4.5 stream miles above the confluence with Yadkin River, and between Elk and County Line Ridges. High numbers of EPT taxa and specimens collected places the site into the Excellent category for 2006; the NCBI is somewhat high for the category, indicating a relatively tolerant community considering the Excellent classification. However, the highest number of EPT taxa and the lowest NCBI value were recorded for the site in 2006, possibly indicating an improvement in water quality.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LAUREL CR	**SR 1508**	**06/07/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WATAUGA	1	03040101	12-24-8	360941	813013

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Crystalline Ridges and Mountains	C; Tr, ORW	8.3	7	0.4

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

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

Water Quality Parameters

Temperature (°C)	16.9
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	26
pH (s.u.)	6.9
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	96

Site Photograph

Substrate relatively even mix of boulder, cobble, gravel, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/07/06	9947	-	47	-	2.82	Excellent

Taxonomic Analysis

Several taxa uncommonly collected in North Carolina were present at the site: *Habrophlebia vibrans*, *Rhithrogena exilis*, *R. uhari*, *Acroneuria carolinensis*, and *Apatania*. In addition, one stonefly rarely collected in the state was present: *Acroneuria evoluta*. Abundant taxa were: *Baetis flavistriga*, *Baetis intercalaris*, *Drunella cornutella*, *Epeorus rubidus*, *Leucrocuta*, *Maccaffertium ithaca*, *Paraleptophlebia*, *Leuctra*, *Tallaperla*, *Acroneuria abnormis*, *Perlesta*, *Isoperla holochlora*, and *Neophylax oligius*.

Data Analysis

The site is about 10 miles ESE of Boone NC and about 450 feet above the confluence with Elk Creek. A portion of the drainage area coincides with a portion of the proposed 6000-acre Laurelmor Resort. Laurel Creek and all of its tributaries are classified as Outstanding Resource Waters. Good habitat diversity was reflected by the high number of EPT taxa collected. The site had been sampled once before, in December 1987, at which time it received a classification of Excellent. EPT richness was slightly higher in summer 2006 than winter 1987 (47 versus 45), contrary to the expectations of higher diversity in winter. In neither year did the benthic macroinvertebrate community show indications of impact at the site. The site supports a diverse and pollution-intolerant assemblage of macroinvertebrate species.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Laurel Cr	**SR 1508**	**08/03/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Watauga	1	03040101	360942	813012	12-24-8	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr,ORW	7.8	1430	10	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	---	---	15 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	30
pH (s.u.)	5.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**92**

Site Photograph

Substrate cobble, boulder, gravel, sand, silt, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-109	13	48	Good
05/05/99	99-31	13	52	Good
10/01/98	98-80	14	54	Excellent
05/23/96	96-62	14	54	Excellent

Most Abundant Species Central Stoneroller

Exotic Species Rock Bass, Smallmouth Bass, Central Stoneroller, Warpaint Shiner, Brown Trout

Species Change Since Last Cycle **Gains** -- Notchlip Redhorse, Warpaint Shiner **Losses** -- White Sucker, Striped Jumprock

Data Analysis

Watershed -- drains the rural area of eastern-central Watauga County; watershed is part of the Powderhorn Development; three small impoundments in the upstream watershed. **Habitats --** runs, riffles, pools; *Rhododendron* and Hemlock-lined; water was clear, but became very silty during sampling. **2006** -- fewer fish than all previous samples (n=128 vs. 494 in 1999, 737 in 1998, and 280 in 1996); Redlip Shiner numbers very low (n=5 vs. 88 in 1999, 259 in 1998, and 125 in 1996); much higher percentage of piscivores collected (~15%) including large specimens of Smallmouth Bass, Rock Bass, and Brown Trout; fewer Stonerollers than in 1999; Warpaint Shiner is new. **1996-2006** -- consistently high habitat scores; fluctuation of trophic structure over ten year period; steady drop in NCIBI score since the 1998 assessment; stream appears to be siltier than in past assessments; the three upstream impoundments have no minimum flow requirements which may reduce flow in this watershed during periods of drought.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaver Cr	**SR 1131**	**06/22/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360428	812110	12-25	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,Tr	17.4	---	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	---	60	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	23.0
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	57
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	**50**

Site Photograph

Substrate sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-94	18	52	Good
06/18/01	2001-61	19	50	Good
05/21/96	96-56	14	50	Good

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Central Stoneroller

Species Change Since Last Cycle **Losses** -- Brown Trout, **Gains** -- none.

Data Analysis

Watershed -- drains the southernmost tip of Wilkes County and a small section of northeast Caldwell County; a tributary to W. Scott Kerr Reservoir. **Habitats** -- lots of deadfalls, sandy shallow runs; severe erosion along left bank, corn field above left bank. **2006** -- good diversity with two darter species, four sunfish and one bass species, three sucker species, and one intolerant species; the trophic structure was slightly skewed towards Omnivores+Herbivores (Bluehead Chub = 33% of sample). **1996-2006** -- there are 20 species known from this site; excluding the one Brown Trout collected in 2001 and the one Common Carp collected in 1996, the list of collected species has not changed; consistently low habitat scores (49-50 total score), but stable NCIBI metrics and the same water quality rating over a ten year period.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stony Fk	**SR 1170**	**06/23/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360741	812343	12-26-(7)	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.8	1150	11	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	45	---	50	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	37
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	16
Left Bank Stability (7)	4
Right Bank Stability (7)	1
Light Penetration (10)	5
Left Riparian Score (5)	3
Right Riparian Score (5)	0
Total Habitat Score (100)	**66**

Site Photograph

Substrate	cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-96	18	54	Excellent

Most Abundant Species	Bluehead Chub	**Exotic Species**	Striped Jumprock, Rock Bass, Smallmouth Bass, Central Stoneroller, Brown Trout

Species Change Since Last Cycle	N/A, new site in 2006

Data Analysis

Watershed -- drains a portion of the western tip of Wilkes County and the extreme eastern corner of Watauga County; a tributary to W. Kerr Scott Reservoir. **Habitats** -- fast runs, good gradient riffles; severe bank erosion from cattle, especially on the right bank; 50-75 animals were in the stream (see picture) and the adjacent woods prior to sampling; specific conductance was not elevated due to wastes in and near the stream, perhaps because of good flow; the extremely rocky substrates and gradient may be offsetting the affects of instream erosion from cattle. **2006** -- first fish community sample at this site; good numbers (n = 484) and diversity of fish with two darter species, four sunfish, bass and trout species, three sucker species, and four intolerant species; White Sucker only represented by young-of-year.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
STONY FK	**SR 1135**	**06/06/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-26-(7)	360638	812136

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	33.8	15	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	79	0	30	0

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

Water Quality Parameters

Temperature (°C)	20.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	32
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	6
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	6
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	62

Site Photograph

Substrate mostly bedrock, sand, boulder; some cobble, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9944	-	42	-	3.74	Excellent
06/11/02	8776	-	41	-	3.38	Excellent
07/26/01	8523	-	44	-	3.66	Excellent
07/22/96	7110	-	37	-	3.62	Excellent

Taxonomic Analysis

Three taxa were collected for the first time in 2006 and were either common or abundant in the sample: *Plauditus cestus* , *Ephemerella catawba* , and *Isoperla holochlora* . Otherwise the EPT community has been quite stable over the most recent three sampling events. Other abundant taxa in 2006 were: *Baetis intercalaris* , *Baetis pluto* , *Heterocloeon curiosum* , *Plauditus dubius* group, *Caenis* , *Serratella deficiens* , *Serratella molita* , *Stenacron pallidum* , *Isonychia* , *Ephoron leukon* , *Acroneuria abnormis* , *Perlesta* , *Ceratopsyche sparna* , *Cheumatopsyche* , and *Psychomyia nomada* .

Data Analysis

The site is 7.7 miles WSW of Kerr Scott Dam and 1.6 miles from the confluence with Yadkin River. The site supports a diverse and intolerant benthic community. The biological data do not indicate the presence of stressors, and water quality appears to be stable.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N PRONG LEWIS FORK	NR SR 1300	06/06/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-31-1-(4)	361110	811818

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	23.8	18	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	30	30	0

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

Water Quality Parameters

Temperature (°C)	18.8
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	25
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph

Substrate 1/3 sand, 1/3 bedrock, even distribution among other classes

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/06/06	9943	-	38	-	3.32	Excellent
06/10/02	8772	-	42	-	3.45	Excellent
07/25/01	8518	-	35	-	3.58	Good
07/23/96	7114	-	33	-	3.25	Good

Taxonomic Analysis

Greater mayfly diversity, and to a lesser extent greater stonefly diversity, has resulted in high EPT richness in 2001 and 2006. Three mayfly species were common in 2006 though unreported from earlier collections: *Drunella cornutella*, *Ephemerella dorothea*, and *Eurylophella aestiva*. Seasonality is a factor for higher EPT richness values in 2002 and especially in 2006 (samples were collected in the first half of June in both years) than in 1996 and 2001 (collected in the last half of July). Seven of the taxa recorded at the site are identified as winter seasonal by the BAU (*Dannella simplex*, *Drunella walkeri, Ephemerella catawba, E. dorothea, Eurylophella aestiva, Eu. verisimilis, Epeorus dispar*); six of those taxa were only collected in the June samples (and four of those were only collected in 2006). There are also seven summer seasonal taxa recorded for the site (*Baetis flavistriga*, *Baetis intercalaris*, *Heterocloeon curiosum*, *Serratella deficiens*, *Ephoron leukon*, *Oecetis*, *Triaenodes ignitus*); overall those summer taxa do not show any relationship between June and July sampling events at the site.

Data Analysis

The site is about 9 miles W of North Wilksboro NC and about 5.5 miles NW of Kerr Scott dam. The benthic community at the site appears to be stable, with most differences between sampling events due to seasonality. No stressors are indicated by the benthic data.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Prong Lewis Fk	**SR 1304**	**08/03/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361100	811812	12-31-1-(4)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.7	1190	9	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	---	15	25 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	24.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	30
pH (s.u.)	5.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	7
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**71**

Site Photograph

Substrate cobble, boulder, bedrock, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/03/06	2006-110	15	56	Excellent
06/19/01	2001-64	17	56	Excellent
05/21/96	96-55	15	48	Good

Most Abundant Species Redlip Shiner

Exotic Species Striped Jumprock, Smallmouth Bass, Central Stoneroller, Brown Trout

Species Change Since Last Cycle **Losses** -- Brassy Jumprock, Redbreast Sunfish, Bluegill. **Gains** -- Brown Trout

Data Analysis

Watershed -- drains part of the northwest region of Wilkes County; a tributary to W. Kerr Scott Reservoir. **Habitats** -- pools, riffles, lower half of reach is sandy. **2006** -- diverse assemblage of fish including three darter species, one bass and one trout species, three sucker species, and three intolerant species; stream continues to have very low percentage of tolerant fish (3%). **1996-2006** -- 19 species have been collected from this site; this stream continues to support a well balanced community of fish with the same NCIBI score and Excellent rating since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Prong Lewis Fk	**SR 1154**	**08/04/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	360918	811948	12-31-2-(7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	32.3	1150	11	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	98	---	---	2 (Kudzu slope)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	35
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**80**

Site Photograph

Substrate cobble, boulder, bedrock, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-111	22	54	Excellent
06/19/01	2001-63	17	48	Good
05/21/96	96-54	16	50	Good

Most Abundant Species Redlip Shiner

Exotic Species Striped Jumprock, Smallmouth Bass, Central Stoneroller

Species Change Since Last Cycle **Gains** -- Brassy Jumprock, Smallmouth Bass, Spottail Shiner, Snail Bullhead, Flat Bullhead. **Losses** -- none.

Data Analysis

Watershed -- drains a portion of rural northwest Wilkes County; a tributary to W. Scott Kerr Reservoir. **Habitats** -- riffles, runs, chutes, sand in channel in mid reach; not as silty compared to 2001 sample when US 421 was being widened. **2006** -- low flow; fewer fish than 2001 (734 vs 1009), but a gain of five species (plus all previously collected species); a balanced and diverse community including three darter species, one sunfish and one bass species, four sucker species, and five intolerant species; Brown Trout represented by young-of-year only. **1996-2006** -- stream has always had a very low percentage of piscivores (<1%); the trophic structure has shifted to a more balanced community of fish since 2001 (Insectivores and Omnivores+Herbivores both equaled ~50% in 2001; in 2006, Insectivores = 70% and Omnivores+Herbivores = 30%). This trophic shift is the main reason for a higher NCIBI score and rating in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MORAVIAN CR	**NC 18**	**06/05/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-39	360517	811201

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	18.3	5	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	0	80	0

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

Water Quality Parameters

Temperature (°C)	16.6
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	48
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	7
Pool Variety (10)	0
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	63

Site Photograph

Substrate mostly sand, some gravel, small amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/05/06	9937	-	24	-	4.69	Good-Fair
07/26/01	8522	-	25	-	4.97	Good-Fair
07/23/96	7115	-	27	-	4.26	Good-Fair

Taxonomic Analysis

The decline in the number of EPT taxa at the site over the three sampling events is driven by the loss of Plecoptera, which is generally the most sensitive group of the three to the presence of environmental stressors; stoneflies have decreased from five taxa in 1996, to two in 2001, and to one in 2006. The remaining stonefly in 2006, *Perlesta* , is the most tolerant of those taxa found in prior sampling events. Such characteristics of the benthic fauna at the site would suport an argument for a trend towards declining water quality. However, the most tolerant taxon recorded from the site, *Hydropsyche betteni* , was abundant in 1996, common in 2001, and not collected in 2006. Secondly, an intolerant caddisfly, *Neophylax oligius* , has been identified in increasing numbers from no record in 1996, common in 2001, and abundant in 2006. Lastly, an intolerant mayfly, *Serratella serrata,* was abundant in 2006 yet uncollected in either of the two prior sampling events.

Data Analysis

The site is about 4.5 miles SSW of Wilkesboro NC and 3.5 miles SSE of Kerr Scott Dam. The site had the highest EPT BI value for the ten sites collected in Yadkin River subbasin 01 in 2006 using EPT methods. The paucity of large rocky substrate for macroinvertebrate colonization is likely limiting the benthic community. Declining EPT and especially Plecoptera richness over the three sampling events may be reflecting declining water quality at the site, though EPT BI values and characteristics of the mayfly and caddisfly communities do not provide evidence for such a trend.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Fk Reddies R	**SR 1567**	**08/04/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361723	811631	12-40-4	Southern Crystalline Ridges and Mountains

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,Tr, HQW	12.7	1293	7	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	---	10	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	33
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**84**

Site Photograph

Substrate cobble, boulder, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-112	11	50	Good
06/19/01	2001-65	17	56	Excellent
05/05/99	99-33	14	58	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Rock Bass, Smallmouth Bass, Central Stoneroller

Species Change Since Last Cycle

Losses -- Northern Hogsucker, Highback Chub, Western Blacknose Dace, Rainbow Trout, Brown Trout, Brook Trout. **Gains** -- none.

Data Analysis

Watershed -- drains part of northwest-central Wilkes County. **Habitats** -- runs, riffles, chutes, good side roots; low flow, but evidence of previous high water. **2006** -- fewer fish collected than in 2001 (426 vs. 718, respectively) including six less species; good trophic structure; lower NCIBI score and loss of one bioclassification. **1999-2006** -- 18 species have been collected from this site; consistently high quality habitat scores and stable trophic structure in all monitoring cycles; lower abundances in 2006 may be flow related.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mulberry Cr	**SR 1002**	**06/23/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361309	810810	12-42	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	39	---	12	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	---	50	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	44
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	8
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	**66**

Site Photograph

Substrate cobble, bedrock, some gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/06	2006-97	22	52	Good

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Rock Bass, Smallmouth Bass

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains rural north-central Wilkes County, above North Wilkesboro. **Habitats** -- snag pools, bedrock shelves and riffles; fairly open canopy due to width of stream; cattle with access to upper part of sample reach; barbed wire across stream. **2006** -- first fish community sample at this location; lots of fish (n=713); very diverse community with three darter species, one sunfish and two bass species, four sucker species, and six intolerant species (including three cyprinids - Thicklip Chub, Fieryblack Shiner, and Highback Chub); slightly skewed trophic structure towards Omniviores+Herbivores (Bluehead Chub = 48% of sample); large specimens and biomass of all sucker species, and Smallmouth Bass.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MULBERRY CR	**NC 268**	**06/09/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-42	361128	810649

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	45.7	20	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	50	40	0

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

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	50
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	10
Bottom Substrate (15)	7
Pool Variety (10)	8
Riffle Habitat (16)	8
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	57

Site Photograph

Substrate mostly sand/silt; cobble riffle; some bedrock, trace boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/09/06	9953	-	47	-	3.37	Excellent
07/25/01	8515	-	41	-	4.12	Excellent
07/24/96	7117	-	37	-	3.07	Excellent

Taxonomic Analysis

The increase in EPT richness in 2006 is driven by a large increase in the number of mayfly taxa collected; 17 and 18 Ephemeroptera taxa were collected in 1996 and 2001, while the number collected in 2006 jumped to 26. Seasonality is playing a small role in the increase in mayfly taxa in 2006; three species are identified as winter seasonal by the BAU (*Ephemerella catawba* , *Eurylophella aestiva* , and *Eu. minimella*) and were only collected in the June sample in 2006 (the other two collections were made in late July). Several taxa collected for the first time at the site in 2006 were either common (*Plauditus dubius* group, *Eurylophella aestiva* , *Serratella serrata* , *Hydropsyche scalaris*) or abundant (*Ephoron leukon* , *Apatania*). The absence of wetted root mats in 2006 explains the absence of *Oecetis persimilis* and *Triaenodes ignitus* , both of which were seen in the prior two collections.

Data Analysis

The site is 2.5 miles NE of downtown North Wilksboro NC and 1.9 stream miles above the confluence with Yadkin River. Macroinvertebrate habitat at the site was mostly restricted to a single riffle that was quite productive in terms of taxa richness. The highest number of EPT taxa for the three sampling events at the site occurred in 2006 despite active bridge construction above the site. No water quality problems are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROARING R	**SR 1990**	**06/08/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	1	03040101	12-46	361459	810239

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	B	128.3	25	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	0

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

Water Quality Parameters

Temperature (°C)	21.5
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	36
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	75

Site Photograph

Substrate mostly cobble/sand, lesser amounts gravel, boulder, bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/08/06	9951	120	50	4.12	3.23	Excellent
07/25/01	8513	89	42	4.48	3.45	Good
07/24/96	7118	98	48	4.68	3.43	Excellent
07/29/88	4644	92	43	4.77	3.54	Good
08/08/85	3549	87	36	4.81	3.29	Good
08/10/83	3134	66	35	3.94	3.35	Good

Taxonomic Analysis

Several EPT taxa either common or abundant in 2006 were not previously identified from the site: *Plauditus dubius* group, *Brachycercus*, *Eurylophella aestiva*, *Perlesta*, *Apatania*, *Hydropsyche scalaris*, and *Rhyacophila formosa*. Seasonality is not an issue with regard to the high number of EPT collected in 2006. Other abundant EPT taxa at the site were: *Baetis intercalaris*, *Caenis*, *Epeorus rubidus*, *Leucrocuta*, *Maccaffertium modestum*, *Stenacron pallidum*, *Isonychia*, *Ephoron leukon*, *Acroneuria abnormis*, *Ceratopsyche sparna*, *Cheumatopsyche*, and *Neophylax fuscus*. Two uncommon oligochaetes were collected for the first time from the site in 2006: *Ripistes parasita* and *Vejdovskyella comata*.

Data Analysis

The site is eight miles NE of North Wilksboro NC and 4 stream miles from the confluence with Yadkin River. The lowest NCBI value since 1983 and the highest EPT richness ever recorded for the site occurred in 2006, pushing the bioclassification back into the Excellent category. There seems to be a trend towards improving water quality at the site since 1983, though the results from 2001 are anomalous in that regard.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
M Prong Roaring R	**SR 1002**	**08/04/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361736	810542	12-46-2-(6)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	57.3	1070	11	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	---	25	25 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

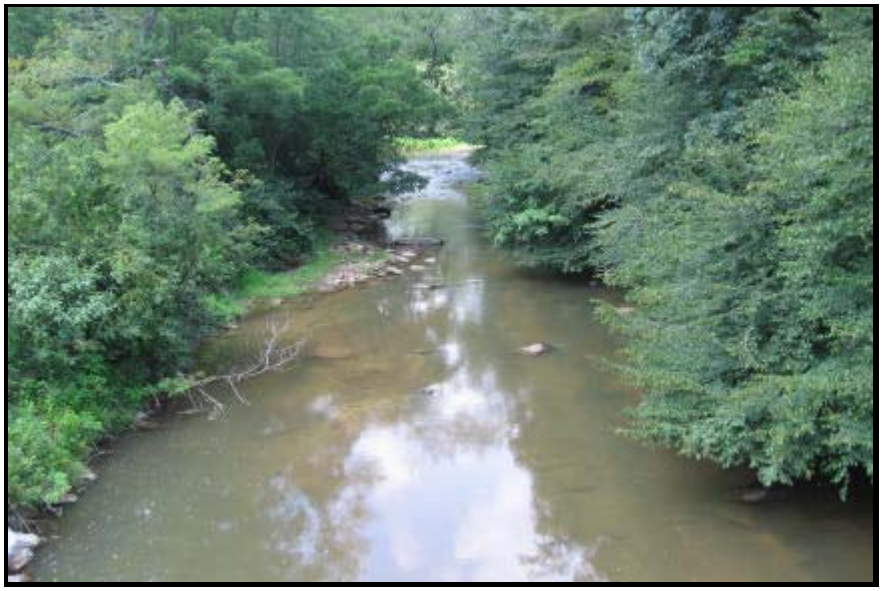
Temperature (°C)	25.1
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	37
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**84**

Site Photograph



Substrate cobble, boulder, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
08/04/06	2006-113	19	58	Excellent
06/20/01	2001-66	20	56	Excellent
05/22/96	96-60	15	50	Good

Most Abundant Species Redlip Shiner

Exotic Species Striped Jumprock, Rock Bass, Smallmouth Bass

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, V-lip Redhorse, Brassy Jumprock, Creek Chub **Gains** -- Rosyside Dace, Flat Bullhead

Data Analysis

Watershed -- drains the rural area of northeast Wilkes County to the northernmost tip of the county. **Habitats** -- pools, runs, good riffles, same as in 2001; side pools, snags, some eroded banks. **2006** -- good abundance (304 total) and high diversity with three darter species, two bass and one sunfish species, two sucker species, and six intolerant species; **1996-2006** -- 23 species have been collected from this site; this rural mountain stream continues to support a rich assemblage of fish and earns a high NCIBI score.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Big Bugaboo Cr	**SR 1924**	**06/22/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	1	03040101	361357	805730	12-48-(0.7)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	16.7	---	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	---	20	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	42
pH (s.u.)	6.0

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**85**

Site Photograph

Substrate cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-92	17	52	Good

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Green Sunfish, Central Stoneroller

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains part of northeast Wilkes County, just northwest of the town of Ronda. **Habitats** -- high quality habitats; high gradient stream with boulder riffles, plunge pools, and bedrock shelves; open canopy at beginning of sample reach (powerline right of way); water very easily sited. **2006** -- first fish community sample at this site; very abundant fish (n = 1189) and biomass; moderate to high diversity with two darter species, three sunfish and one bass species, two sucker species, and two intolerant species; Bluehead Chub = 43% and Redlip Shiner = 26% of the sample. High end of Good water quality rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Elkin Cr	**SR 2044**	**06/22/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	2	03040101	361651	805246	12-54-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,HQW	25.6	---	13	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	---	55	5 (lawn)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.6
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	42
pH (s.u.)	6.0

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**87**

Site Photograph

Substrate bedrock, gravel, cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-91	14	48	Good

Most Abundant Species Bluehead Chub

Exotic Species Fathead Minnow

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains the extreme northeast corner of Wilkes County. **Habitats** -- high quality; shelves, pools, riffles; very rocky; old mill site; silts settled out on rocks; good riparian, *Rhododendron* on left. **2006** -- new fish community monitoring site; lots of fish (n= 860); moderate diversity with three darter species, two species of sunfish, suckers, and intolerants; trophic structure is slightly skewed with a relatively even percentage of Omnivores+Herbivores and Insectivores; Bluehead Chub = 44%, and Redlip Shiner = 38% of sample; no piscivores present.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ELKIN CR	**NC 268**	**08/07/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-54-(4.5)	361512	805146

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35.9	8	0.2

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

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

Water Quality Parameters

Temperature (°C)	24.1
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	60
pH (s.u.)	6.3
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	63

Site Photograph

Substrate gravel, sand silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10007	NA	24	NA	4	Good-Fair
08/06/01	8561	NA	20	NA	3.8	Good-Fair
07/22/96	7081	NA	24	NA	3.6	Good-Fair

Taxonomic Analysis

EPT taxa at the site have increased and decreased in the past ten years with the previous report (2001) being the low. The current EPT taxa total was increased by relative addition of 4 caddisfly taxa with mayfly and stonefly taxa remaining constant. The EPT biotic index increased from 3.75 in 2001 to 3.96 in 2006; a modest change toward more tolerant species.

Data Analysis

Situated on the northwest corner of Elkin, this partly urban site drains a mostly rural area. The site is located adjacent to the Elkin water treatment plant and has local hiking trails along the right bank. Silty sand and gravel substrate suggest sediment loading from upstream. The amount of litter in the stream suggests its proximity to urban and residential areas. Water quality (as indicated by macroinvertebrate sampling) has apparently remained fairly consistent for the past ten years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MITCHELL R	**SR 1330**	**08/08/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-(1)	362605	805258

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	B Tr ORW	19.8	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	20	50	

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)	8
Specific Conductance (µS/cm)	27
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph

Substrate Rubble, boulder, gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10009	97	29	4.6	3.5	Good
08/06/01	8563	90	40	4.2	3.1	Good
07/23/96	7091	79	38	3.9	3.1	Good
02/07/91	5544	NA	41	NA	1.9	Excellent
10/25/89	5124	NA	34	NA	2.6	Good

Taxonomic Analysis

Declines in mayfly, stonefly and caddisfly taxa are accompanied by a large increase in chironomid taxa. While total taxa increased from 90 to 97 species between 2001 and 2006, the biotic index of the community now present indicates a loss of more pollution-sensitive species.

Data Analysis

This site, located in a largely agricultural and residential watershed, is downstream of Devotion and the undeveloped Reynolds property. Declines in water quality (as indicated by macroinvertebrate analysis) have been noted in the past, concurrent with the development of the Old Beau golf resort which was found responsible for sediment impacts to the stream. An apparent continued decline in the benthic community is implied by this round of sampling.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mitchell R	**SR 1330**	**06/21/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362607	805221	12-62-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
B,Tr,ORW	29.1	1200	13	0.4	Yes

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	28
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**87**

Site Photograph

Substrate cobble, bedrock, boulder, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-89	18	60	Excellent
05/26/99	99-38	15	52	Good
05/16/96	96-51	15	46	Good-Fair

Most Abundant Species Redlip Shiner

Exotic Species Rock Bass, Smallmouth Bass, Brown Trout

Species Change Since Last Cycle **Gains** -- White Sucker, Brassy Jumprock, Largemouth Bass, Brown Trout. **Losses** -- none.

Data Analysis

Watershed -- drains western-central Surry County, including the community of Devotion. **Habitats** -- pool (lower 1/3 of site), bedrock boulders, riffles, plunge pools. **2006** -- three more species than in 1999; Redlip Shiner = 32% and Bluehead Chub = 26% of sample; unusual fish assemblage with cold, cool, and warm water species present; two large stocked Brook Trout collected; Rainbow Trout only represented by young-of-year; site is upstream of a Knapp Mill's Dam that was breached in the spring of 2006. **1996-2006** -- a total of 20 species have been collected here over a ten year period; this site shows a steady improvement of NCIBI score and bioclassification, which is likely related to ongoing conservation and restoration efforts in this watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MITCHELL R	**SR 1001**	**08/08/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-(12)	361841	804824

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C; ORW	76.8	10	1

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	20	30	

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

Water Quality Parameters

Temperature (°C)	23.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	37
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	80

Site Photograph

Substrate Boulder, rubble, gravel, sand

Sample Date	Sample ID	78	EPT	BI	EPT BI	Bioclassification
08/08/06	10008	104	38	4.4	3.6	Good
08/06/01	8564	95	43	4.2	3.1	Excellent
07/27/96	7090	82	45	4.5	3.7	Good
07/01/87	4113	78	38	4.7	3.6	Good

Taxonomic Analysis

Reversing gains observed in 2001, mayfly and caddisfly taxa reduced sharply in 2006 samples. Total taxa observed increased due largely to an increase in dipteran taxa, particularly chironomid taxa. The overall biotic index for the site increased from 3.1 to almost 3.6 indicating the community shifted toward more tolerant organisms.

Data Analysis

The lower Mitchell River watershed, bounded by the US 21 and I-77 corridors west and east, respectively, drains residential and agricultural areas in a region with continued development. This site is located with the USGS gage # 02112360 (Mitchell River near State Road, NC). If, as subscribed by the 2001 report, this site enjoyed improved water quality due to drought conditions of that period, these improvements were not helpful to the site prior to the 2006 sampling event and the community reverted (in terms of tolerance) to 1996 conditions of community tolerance, though still increasing overall diversity.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Mitchell R	**SR 1301**	**06/21/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362012	805005	12-62-13	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	24.2	---	10	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	45	---	50	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

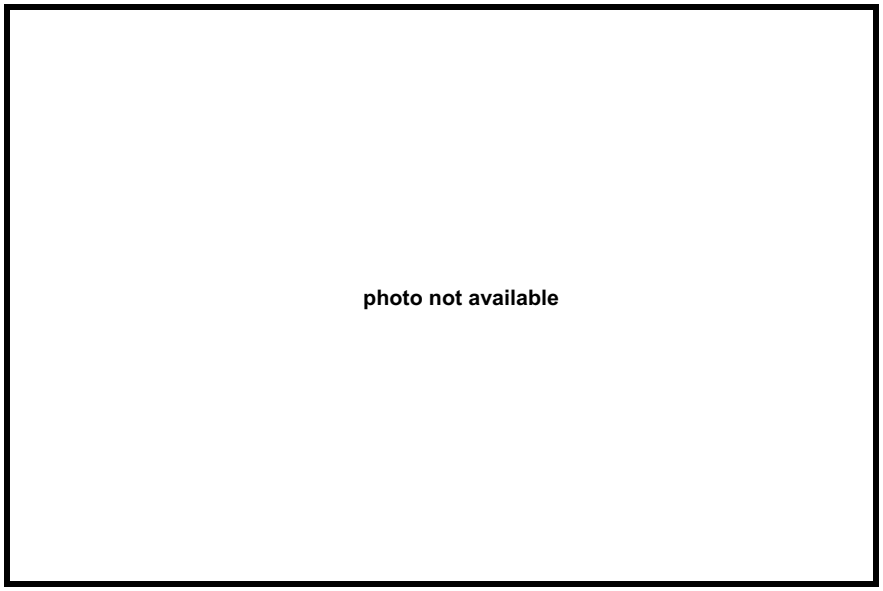
Temperature (°C)	21.9
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	37
pH (s.u.)	6.2

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	5
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**58**

Site Photograph



Substrate sand, bedrock, cobble, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-90	19	60	Excellent

Most Abundant Species	Rosyside Dace	**Exotic Species**	Striped Jumprock, Rock Bass, Green Sunfish, Smallmouth Bass

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains the extreme west-central side of Surry County. **Habitats** -- bedrock shelf pools, sandy runs of uniform shallow depth, snags, undercuts; lower half of sample reach had better instream habitats; water easily silted. **2006** -- first fish community monitoring sample at this site; high diversity with three species of darter, six species of sunfish and bass, three sucker species, and four intolerant species; maximum NCIBI score and rating may be related to the extensive stream restoration and conservation efforts in this watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SNOW CR	**SR 1121**	**08/07/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-62-15	361805	804604

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	17.3	6	0.2

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

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	59
pH (s.u.)	6.1
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	65

Site Photograph

Substrate Sand, silt, gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10005	NA	25	NA	4.4	Good-Fair
08/06/01	8565	NA	24	NA	4	Good-Fair
07/23/96	7080	NA	31	NA	3.6	Good
07/01/87	4114	67	27	5.1	4.3	Good-Fair

Taxonomic Analysis

Though total taxa were similar between 2001 and 2006, The mayfly *Epeorus* was not present in the 2006 sample and the more tolerant mayflies *Caenis, Hexagenia* and *Isonychia* were present in the latter sample. The biotic index of the site rose in 2006 compared to 2001 indicating an overall more tolerant community present. Those minor differences existed, Trichoptera and Plecoptera taxa recorded remained fairly similar between 2001 and 2006 EPT samples.

Data Analysis

A silt line was noted in riparian trees 1.5 meters above the water level indicating that this site may be subject to high-flow spate events following heavy rainfall. Note was made of a muddy-silt bottom at the site. Along with a decline in mayfly taxa (*Epeorus*) that tend to inhabit cleaner, faster moving water, these facts may indicate that the site may be experiencing greater siltation than previously encountered. A decline from a Good bioclassification to Good-Fair in the last basinwide assessment cycle may be continuing at this site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Snow Cr	**SR 1121**	**06/07/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	361805	804605	12-62-15	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	17.2	---	12	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	---	15	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	18.7
Dissolved Oxygen (mg/L)	9.1
Specific Conductance (µS/cm)	57
pH (s.u.)	5.6

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**79**

Site Photograph

Substrate	gravel, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-81	19	56	Excellent

Most Abundant Species	Bluehead Chub	**Exotic Species**	Striped Jumprock, Smallmouth Bass

Species Change Since Last Cycle	N/A, new site in 2006

Data Analysis

Watershed -- drains part of south-western Surry County. **Habitats** -- low flow; bedrock shelves with riffles, plunge and snag pools; old mill site. **2006** -- first fish community sample at this location; lots of fish collected (722 individuals); high diversity with three darter species, four sunfish species, four sucker species, and three intolerant species collected; trophic structure was slightly skewed towards a high percentage of Omnivores+Herbivores; 79% of species represented by multiple age classes.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Fisher R	**SR 1331**	**06/21/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362722	804900	12-63-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-II,Tr,HQW	36.9	1185	13	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	---	75	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	21.0
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	39
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**83**

Site Photograph

Substrate cobble, bouler, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/21/06	2006-88	23	56	Excellent
06/20/01	2001-68	18	60	Excellent

Most Abundant Species Redlip Shiner

Exotic Species Rock Bass, Smallmouth Bass, Spotted Bass, Mountain Redbelly Dace

Species Change Since Last Cycle

Gains -- Brassy Jumprock, Rock Bass, Pumpkinseed, Spotted Bass, Spottail Shiner, Mountain Redbelly Dace, Flat Bullhead **Losses** -- Thicklip Chub, Fieryblack Shiner

Data Analysis

Watershed -- drains the extreme northwest corner of Surry County. **Habitats** -- runs, side snags, undercuts, woody debris, short and shallow riffles. **2006** -- lots of fish (n = 766, 325 more than in 2001); increase in diversity with three species of darters, seven species of bass and sunfish, three sucker species, and four intolerant species; large schools of Redlip Shiner colonizing Bluehead Chub nests. **2001-2006** -- 25 species known from this site; trout never collected here; slightly lower NCIBI score in 2006, but same Excellent rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FISHER R	**US 601**	**08/08/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-(7)	362451	804126

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-II HQW	105.6	7	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	20	60	

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

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	53
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	61

Site Photograph

Substrate Rubble, boulder, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10011	NA	27	NA	4.7	Good-Fair
08/08/01	8572	NA	30	NA	3.2	Good
07/23/96	7092	NA	30	NA	3.6	Good

Taxonomic Analysis

Compared to 2001 samples, the loss of sensitive mayflies *Epeorus rubidus* , *Ephoron leukon, Serratella serratoides,* and caddisflies *Hydropsyche scalaris, Brachycentrus nigrosoma* and *Ceraclea ancylus* raised this site's EPT biotic index from 3.19 to 4.7. Along with a decline in EPT taxa from 30 in 2001 to 27 in 2006, the site's bioclassification downgraded from Good to Good-Fair.

Data Analysis

Infrequent riffles and silty pools characterize the substrate of this site that had little organic habitat. Due to flow conditions that existed, many root mats were out of the water. The surrounding watershed, dominated by agricultural, pastoral, and sparse rural residential uses generally retains a good wooded buffer along the riparian zone of the river. Macroinvertebrate analysis indicates a slight decline in water quality compared to previous sampling.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FISHER R	**NC 268**	**08/09/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-(9)	362022	804107

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	124.6	15	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	20	50	

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

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	68
pH (s.u.)	7
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph

Substrate Bedrock, boulder, rubble, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10012	93	28	5.4	4.5	Good-Fair
08/08/01	8571	88	39	5.1	3.9	Good
07/22/96	7079	84	36	5.1	4	Good

Taxonomic Analysis

A decline in sensitive mayfly taxa (including the complete absence of taxa abundant in 2001- *Ephoron, Leucrocuta, Stenacron)* and the absence of the previously abundant caddisfly *Symphitopsyche morosa* accompany an increase in chironomid, mollusk and dragonfly taxa in 2006 samples.

Data Analysis

Co-located with USGS Gage # 02113000 (Fisher River nr. Copeland, NC) this is the most downstream benthos site on the Fisher River, draining 125 square miles at this point. This site had heavy silt between riffles with silty periphyton covering rocks in areas of all but swiftest flow. A residential site under current construction just upstream of the site on the left bank was contributing silt runoff to the stream. Benthos results observed could imply the effects of additional embedding of silt on the habitat quality of this site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L FISHER R	**SR 1480**	**08/08/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	2	03040101	12-63-10 (2)	362538	804243

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	36.2	5	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	40	50	

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	63
pH (s.u.)	6.7
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	65

Site Photograph

Substrate Rubble, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10010	NA	25	NA	4.4	Good-Fair
08/07/01	8566	NA	22	NA	4.9	Good-Fair
07/23/96	7093	NA	29	NA	4.2	Good

Taxonomic Analysis

Slight increases in stonefly and caddisfly taxa in this 2006 EPT sample are offset by a slight decline in mayfly relative to 2001 sampling. The 2006 biotic index indicated a slightly more sensitive community present than in 2001.

Data Analysis

The Little Fisher River flows into North Carolina from Virginia and through north-central Surry County before discharging to the Fisher River. The watershed has mostly agricultural and residential uses. Steep banks along this reach are eroding in the bends of the stream. The substrate was noted as very silty. Macroinvertebrate data suggest improvement in community diversity and sensitivity since the 2001 sampling event but have not achieved values equivalent to 1996 results.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Fisher R	**SR 1480**	**06/20/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362743	804432	12-63-10-(2)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.3	---	10	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	---	80	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	22.8
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	50
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	4
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	1
Total Habitat Score (100)	**60**

Site Photograph

Substrate cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-87	17	52	Good
06/20/01	2001-67	19	50	Good
05/16/96	96-50	15	46	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species Striped Jumprock, Smallmouth Bass, Mountain Redbelly Dace, Rainbow Trout

Species Change Since Last Cycle **Losses** -- Satinfin Shiner, Thicklip Chub, Fieryblack Shiner, Flat Bullhead **Gains** -- Mountain Redbelly Dace, Rainbow Trout

Data Analysis

Watershed -- drains rural north-central Surry County up to the NC-VA state line; site is below NCWRC Hatchery Supported Trout Waters. **Habitats** -- deadfalls, undercuts, snags, short riffles; the riparian zone including the right bank was recently altered via the adjacent field (soil and vegetation was pushed over the bank edge), causing sediment to enter the stream; water clear but easily silted; more sediment than 2001. **2006** -- Lots of fish (n = 735) with three darter species, three sucker species, and four intolerant species (one less than 2001); Bluehead Chub = 36% and Redlip Shiner = 33% of sample; only one individual of one sunfish species (Redbreast) collected. **1996-2006** -- slight improvement in NCIBI score; stable water quality rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cody Cr	**US 268**	**06/07/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	2	03040101	362017	804135	12-63-14	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	10.8	---	7	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.9
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	62
pH (s.u.)	6.3

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	7
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**71**

Site Photograph

Substrate gravel, sand, bedrock shelves

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-80	19	56	Excellent
05/16/96	96-49	18	52	Good

Most Abundant Species Bluehead Chub

Exotic Species Central Stoneroller, Fathead Minnow

Species Change Since Last Cycle

Gains -- Largemouth Bass, Central Stoneroller, Golden Shiner, Fathead Minnow **Losses** -- Notchlip Redhorse, Brassy Jumprock, Green Sunfish

Data Analysis

Watershed -- drains part of central Surry County, including the south side of Dobson. **Habitats** -- sandy runs with rocky ledges, overhanging bushes, a few snag pools and shallow plunge pools at the upper end of the site. **2006** -- good abundance (518 individuals); well balanced community of fish including three darter species, three sunfish species, one sucker species (two less than 1996), and two intolerant species. **1996-2006** -- an additional 211 fish were collected in 2006; the NCIBI metrics for this site have increased slightly and the bioclassification has improved to the highest rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ARARAT R	**NC 104**	**07/24/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-(1)	363313	803408

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV; Tr	36.2	12	0.3

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

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

Water Quality Parameters

Temperature (°C)	20.9
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	59
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	5
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	79

Site Photograph

Substrate mostly gravel, cobble, sand; some boulder and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10025	-	29	-	3.88	Good
07/23/01	8507	-	25	-	4.04	Good-Fair
07/25/96	7123	-	26	-	3.96	Good-Fair

Taxonomic Analysis

Plecoptera are primarily responsible for the increased EPT in 2006 over prior sampling events. Six stonefly taxa were collected in 2006; two and four taxa were collected 1996 and 2001 respectively. New taxa records for the site in 2006 were: *Heterocloeon anoka*, *Ephemerella subvaria*, *Maccaffertium ithaca*, *Rhithrogena uhari*, *Acroneuria arenosa*, *Paragnetina immarginata*, *Malirekus hastatus*, and *Ceratopsyche bronta*.

Data Analysis

The site is located about 4.3 miles NNE of Mount Airy NC and 1000 feet south of the Virginia border. Almost the entire drainage area is in Virginia. Sampling results from 1996, 2001, and 2006 show a relatively stable benthic community with little change in EPT BI values. The increase in the number of EPT taxa--and particularly stonefly taxa--might indicate slighty better conditions at the site in 2006 than during the prior two sampling events, though an increase in specific conductance over the three events (35, 52, and 59 µmhos/cm for 1996, 2001, and 2006 respectively) does not provide support.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Ararat R	**NC 104**	**06/20/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	363313	803408	12-72-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, Tr	36.2	---	12	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	35	---	65	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

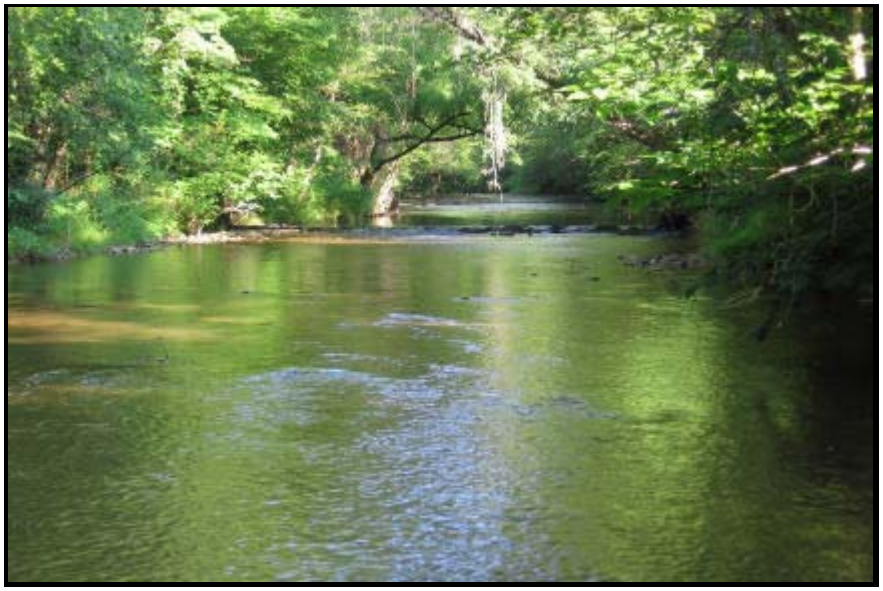
Temperature (°C)	19.1
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	53
pH (s.u.)	6.2

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**73**

Site Photograph



Substrate cobble, gravel, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-85	19	54	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish, Mountain Redbelly Dace

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- flows from Patrick County in southwest Virginia; downstream the river flows south and drains the east side of Mount Airy. **Habitats** -- riffles, snags, bedrock shelves. **2006** -- new fish community monitoring site; lots of fish collected (total of 899); high diversity with three darter species, two sunfish species, three sucker species, and two intolerant species, but no piscivores and no trout.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ARARAT R	SR 2026	07/25/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-(4.5)	362416	803343

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	231	30	0.5

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Mount Airy WWTP	NC0021121	7.0

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	146
pH (s.u.)	7.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	6
Left Bank Stability (7)	1
Right Bank Stability (7)	5
Light Penetration (10)	4
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	65

Site Photograph

Substrate mostly cobble, sand, gravel; some boulder, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10031	95	41	4.99	4.23	Good
07/23/01	8506	77	28	5.57	4.62	Good-Fair
08/28/96	7181	69	20	5.81	4.81	Fair
07/12/90	5378	59	17	6.17	5.43	Fair
07/26/88	4661	62	16	6.36	5.68	Fair
09/24/86	3919	50	11	6.56	5.46	Fair

Taxonomic Analysis

Since the sampling event in September 1986, richness in each of the orders Ephemeroptera, Plecoptera, and Trichoptera have increased. The increase in richness for each order was especially significant between the 2001 and 2006 collections (14 to 22 for mayflies, two to four for stoneflies, 12 to 15 for caddisflies). Of the six most pollution-intolerant EPT taxa recorded for the site, five were recorded for the first time in 2006: *Serratella molita* , *Brachycentrus numerosus* , *Paralepthophlebia* , *Paranyctiophylax* , and *Goera* . The most tolerant taxon recorded for the site, *Hydropsyche betteni* , has declined from abundant in 1986 and 1988 to common in 1990 and has not been collected from the site during the three most recent sampling events.

Data Analysis

The site is 7 miles SSE of Mt Airy NC and about 5 miles WNW of Pilot Mountain NC. Since the sampling event in September 1986 all indications from the benthic data show consistent improvements in water quality at the site. EPT richness has increased from the low of 11 taxa in 1986 to 41 in 2006; the NCBI has decreased in value from 6.56 to 4.99 over the same period. Accordingly, the resultant bioclassification has improved from Fair in 1986 to Good in 2006. The greatest difference occurred between the sampling events in 2001 and 2006 with an increase of 13 EPT taxa collected and the addition of several particularly intolerant taxa in 2006. From 1997 to 2006 there has been a reduction in the discharge from Mount Airy WWTP, from a monthly average of 6.1 MGD in April 1997 to 2.9 MGD in July 2006 (with a spike to 6.3 MGD in March 2000). A loss of textile production in Mount Airy is responsible for the reduced discharge from the WWTP.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOVILLS CR	**SR 1700**	**07/24/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-8-(1)	363233	803735

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	26.8	13	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	8.8
Specific Conductance (µS/cm)	55
pH (s.u.)	7.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	4
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph

Substrate good mix of sand through bedrock classes; some silt present

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10027	-	23	-	4.46	Good-Fair
07/24/01	8508	-	26	-	4.18	Good-Fair
07/25/96	7122	-	22	-	4.75	Good-Fair

Taxonomic Analysis

Twelve Ephemeroptera, three Plecoptera, and eight Trichoptera taxa were collected from the site in 2006. Abundant taxa were: *Acentrella* , *Baetis intercalaris* , *Heterocloeon anoka* , *Maccaffertium modestum* , *Stenacron pallidum* , *Isonychia* , *Leuctra* , *Cheumatopsyche* , and *Hydropsyche venularis* .

Data Analysis

The site is three miles NNW of downtown Mount Airy NC and one mile south of the Virginia border. Most of the drainage area for the site is in Virginia. EPT richness fell and the EPT BI value increased between 2001 and 2006, though both values are still slightly better than those attained in 1996. No specific stressors are indicated by the benthic community.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOVILLS CR	**SR 1371**	**07/24/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-8-(3)	362919	803701

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35	8	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	0	90	10	0

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

Water Quality Parameters

Temperature (°C)	27.4
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	68
pH (s.u.)	9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	9
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	0
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	55

Site Photograph

Substrate nearly even mix of sand, gravel, cobble; some bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	10026	73	19	5.63	4.88	Fair
07/24/01	8509	67	14	6.38	4.72	Fair
07/25/96	7121	63	16	6.42	5.06	Fair

Taxonomic Analysis

Twelve Ephemeroptera and seven Trichoptera taxa were collected in 2006; Plecoptera have never been collected from the site. Abundant EPT in 2006 were: *Heterocloeon anoka*, *Maccaffertium modestum*, *Isonychia*, *Cheumatopsyche*, *Hydropsyche venularis*, *Macronychus glabratus*, *Promoresia elegans*, *Simulium*, *Cricotopus bicinctus*, *Cricotopus vierriensis* group, Lumbriculidae, and Acari. Baetidae, a ubiquitous family of mayflies, were not identified from the site in 2001; seven baetid taxa were present in 2006.

Data Analysis

The site is located near US 52 southwest of downtown Mount Airy NC. An increase in the number of EPT taxa collected and a decrease in the NCBI value in 2006 may be indicating slightly better water quality over 1996 and 2001. The benthic fauna do not indicate a particular stressor as a problem.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lovills Cr	**SR 1371**	**06/19/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	362919	803700	12-72-8-(3)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9.7	---	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	10	90	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	28.4
Dissolved Oxygen (mg/L)	9.5
Specific Conductance (µS/cm)	74
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	7
Riffle Habitat (16)	15
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	0
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	**52**

Site Photograph

Substrate cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-84	16	48	Good

Most Abundant Species	Redlip Shiner	**Exotic Species**	Central Stoneroller

Species Change Since Last Cycle	N/A, new site in 2006

Data Analysis

Watershed -- drains the west side of Mount Airy in northern Surry County; stream runs through town. **Habitats** -- riffles (with *Podostemum*), runs, pools; excessive periphyton; banks stabilized with pavers near bridge crossing; open canopy, grasses, no trees. **2006** -- first fish community sample at this location; extreme number of fish (2073) and biomass; three darter species, one sunfish species, two sucker species, and two intolerant species collected; Redlip Shiner = 40% of total, and Bluehead Chub = 31%.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stewarts Cr	**SR 1622**	**06/20/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	363138	804239	12-72-9-1	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV;Tr	24.2	---	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	---	60	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	42
pH (s.u.)	5.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**89**

Site Photograph

Substrate gravel, cobble, sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/20/06	2006-86	20	54	Excellent
06/21/01	2001-69	17	54	Excellent
05/17/96	96-52	19	54	Excellent

Most Abundant Species Redlip Shiner

Exotic Species Central Stoneroller, Warpaint Shiner

Species Change Since Last Cycle

Gains -- Bluegill, Spottail Shiner, Sandbar Shiner, Mountain Redbelly Dace. **Losses** -- Smallmouth Bass, Fieryblack Shiner

Data Analysis

Watershed -- drains the extreme upper north-central region of Surry County and a small portion of south Carroll County, Virginia. **Habitats** -- runs, riffles, side woody debris; *Fissidens moss*. **2006** -- abundant fish (906 total) including three darter species, two sunfish species, three sucker species, and two intolerant species; three more species collected than in 2001, yet two less intolerants. **1996-2006** -- total of 22 species collected from this site; very consistent metrics among three samples, and identical NCIBI scores and ratings.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
STEWARTS CR	**SR 2258**	**07/25/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-9-(1)	362744	803731

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV; Tr	78.6	15	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	80	0	0

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

Water Quality Parameters

Temperature (°C)	22.5
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	72
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	14
Pool Variety (10)	10
Riffle Habitat (16)	6
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	73

Site Photograph

Substrate gravel, sand, cobble; some silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10028	110	37	5.35	4.56	Good
07/24/01	8511	78	34	5.31	4.48	Good
07/25/96	7120	81	27	5.61	4.78	Good-Fair

Taxonomic Analysis

The greatest number of EPT taxa for a sampling event occurred in 2006. The increase in EPT richness in 2006 over 2001 was due to Plecoptera; one stonefly taxon was collected in 2001 and four in 2006. Abundant EPT taxa in 2006 included: *Baetis intercalaris*, *Serratella deficiens*, *Maccaffertium ithaca*, *Isonychia*, *Ceratopsyche bronta*, *C. sparna*, *Cheumatopsyche*, and *Hydropsyche venularis*.

Data Analysis

The site is about 3 miles SSW of downtown Mount Airy and 2.3 stream miles from the confluence with Ararat River. NCBI and EPT BI values suggest similar water quality conditions between 2001 and 2006; more significant differences are seen between 1996 and 2001 (as reflected in the improved classification of Good in 2001 from Good-Fair in 1996).

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FLAT SHOAL	**SR 2017**	**07/25/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
SURRY	3	03040101	12-72-13	362420	803338

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	9	5	0.3

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

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

Water Quality Parameters

Temperature (°C)	21.7
Dissolved Oxygen (mg/L)	8
Specific Conductance (µS/cm)	52
pH (s.u.)	6.1
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	10
Riffle Habitat (16)	5
Left Bank Stability (7)	3
Right Bank Stability (7)	1
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	61

Site Photograph

Substrate mostly sand, gravel; some silt, cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	10030	-	25	-	3.30	Good-Fair

Taxonomic Analysis

Thirteen Ephemeroptera, three Plecoptera, and nine Trichoptera taxa were collected from the site. Abundant taxa were: *Baetis pluto* , *Serratella deficiens* , *Maccaffertium modestum* , *Leuctra* , *Chimarra* , and *Neophylax oligius* .

Data Analysis

The site is 7 miles SSE of Mt Airy NC, about 5 miles WNW of the city of Pilot Mountain NC, and about 250 from the confluence with Ararat River. The site was sampled for benthic invertebrates for the first time in 2006. The former basinwide site was upstream at SR 1827 and had a small drainage area; presently the BAU does not have criteria to rate such streams. Though the site at SR 2017 has the advantage of a possessing a large enough drainage area so that a rating can be assessed, the hydrology of the stream at the site is influenced by high flow events in nearby Ararat River and therefore is not representative of the stream as a whole. During the next cycle consideration for a basinwide site should be given to the next upstream road crossing or to the original site if small-stream criteria have been developed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Toms Cr	**SR 2024**	**06/19/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Surry	3	03040101	362308	803150	12-72-14-(4)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	37.7	---	14	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	---	5	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.1
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	65
pH (s.u.)	5.9

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**80**

Site Photograph

Substrate gravel, cobble, bedrock, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-83	22	58	Excellent
06/21/01	2001-70	23	56	Excellent

Most Abundant Species Redlip Shiner

Exotic Species Northern Hogsucker, Green Sunfish, Spotted Bass, Central Stoneroller

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, Warmouth, Thicklip Chub, Snail Bullhead **Gains** -- Spotted Bass, Creek Chub, Flat Bullhead

Data Analysis

Watershed -- drains part of the eastern edge of Surry County including the town of Pilot Mountain and a small section of Stokes County. **Habitats** -- pools, riffles, cobble, flat rocks; mountain-like; good riparian including Rhododendron and Mountain Laurel. **2006** -- lots of fish (834 total); very diverse, well balanced community of fish including three darter species, five sunfish species, three sucker species, and two intolerant species; approaching a maximum NCIBI score. **2001-2006** -- This watershed continues to support a diverse community of fish (26 species collected here) and has earned two consecutive Excellent bioclassifications.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Yadkin R	**SR 1236**	**06/19/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stokes	2	03040101	361847	802402	12-77	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.3	---	14	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	---	10	5 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	71
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	8
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**78**

Site Photograph

Substrate gravel, cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/19/06	2006-82	17	54	Excellent
06/21/01	2001-71	22	54	Excellent
05/17/96	96-53	21	54	Excellent

Most Abundant Species Redlip Shiner

Exotic Species Mountain Redbelly Dace

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, Green Sunfish, Largemouth Bass, Goldfish, Thicklip Chub, Fieryblack Shiner, Flat Bullhead **Gains** -- Bluegill, Mountain Redbelly Dace

Data Analysis

Watershed -- drains the rural southwest corner of Stokes County. **Habitats** -- gravel and cobble riffles, woody debris, tires; open canopy at upper end of reach. **2006** -- lots of fish (1002); well balanced community, but five fewer species collected since 2001 including two intolerants (Thicklip Chub and Fieryblack Shiner). **1996-2006** -- 25 fish species have been collected at this site; slight increase in specific conductance over three cycles from 43 to 71 µS/cm; third cycle with identical NCIBI score and Excellent bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L YADKIN R	SR 1102	08/09/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STOKES	2	03040101	12-77	361704	802549

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	48.9	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	10	20	

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

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	73
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	53

Site Photograph

Substrate Sand with little gravel and silt.

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10014	102	33	5.4	4.5	Good-Fair

Taxonomic Analysis

A fairly diverse, though relatively tolerant community of macroinvertebrates was identified at this site. Edge habitat (snags, undercut banks, root mats) provided diverse taxa despite a predominately sand substrate across the stream channel. Leptocerid caddisflies and coleopterans were well represented among taxa taking advantage of the organic habitat.

Data Analysis

This site was moved to this location for the first time in this sampling trip of 2006. At this point, the Little Yadkin River drains approximately 49 square miles, much of it in the US 52 corridor with agricultural, commercial, and residential land uses. Previous sampling, labeled as Little Yadkin River at SR 1236 had actually been collected from Danbury Creek at SR 1236, upstream of the confluence of Danbury Creek and West Prong where the Little Yadkin River is formed. The current site at SR 1102 is approximately 6 river miles downstream of this location.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FORBUSH CR	**SR 1570**	**08/10/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-83-(1.5)	360725	803034

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	26.9	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10	30	

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	72
pH (s.u.)	7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	55

Site Photograph

Substrate Rubble, sand, boulder, gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10017	NA	22	NA	4.8	Good-Fair
08/08/01	8573	NA	22	NA	4.2	Good-Fair
07/24/96	7099	NA	23	NA	4	Good-Fair

Taxonomic Analysis

Taxa richness was identical at this site in 2006 and 2001 samples though a few more tolerant species in 2006 raised the EPT biotic index slightly. The lack of the caddisfly genera *Oecetis, Triaenodes* and *Brachycentrus* in 2006 samples may be an indication that woody habitat available at higher flow may have been absent during this sampling event due to low flows.

Data Analysis

Forbush Creek, just north of North Deep Creek and US 421 drains an agricultural area though increasing development from the south along the highway corridor probably influences the area. The site has steep and highly eroded banks with a rubble/sand substrate. A large corn field abuts the stream on the right bank. The benthic community appears fairly consistent over time though a slight trend toward more tolerant species was observed during the 2006 sampling event.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LOGAN CR	**SR 1571**	**08/11/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-83-2-(0.7)	360726	803015

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	26.3	5	0.3

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

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	89
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	5
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	51

Site Photograph

Substrate Sand, gravel, silt, rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10018	NA	21	NA	5.1	Good-Fair
08/09/01	8576	NA	31	NA	4.8	Good
07/24/96	7098	NA	27	NA	4.7	Good-Fair

Taxonomic Analysis

EPT taxa declined sharply in 2006 sampling compared to 2001. Trichoptera and Plecoptera taxa dropped by half while the EPT biotic index declined only slightly. This fact may suggest that declines may have been habitat, rather than water quality related.

Data Analysis

The Logan Creek site is surrounded by open agricultural fields. The immediate watershed has a fairly broad floodplain, making the land ideal for this use. At the time of sampling, the stream was heavily laden with woody debris piles, suggesting recent high flows that may have scoured benthos populations and created the drop in taxa richness observed. Some riparian logging activities were also obvious at the site. Previous sampling had indicated a relatively stable community.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Deep Cr	**SR 1605**	**06/07/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Yadkin	2	03040101	360811	803744	12-84-1-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.8	---	10	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	---	30	30 (overhead powerline)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.8
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	75
pH (s.u.)	5.9

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	1
Right Bank Stability (7)	1
Light Penetration (10)	5
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	**38**

Site Photograph

Substrate sand, clay

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/07/06	2006-79	16	42	Good-Fair
06/21/01	2001-72	13	44	Good-Fair
05/15/96	96-46	13	44	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle **Gains** -- Highback Chub, Golden Shiner, Margined Madtom, Fantail Darter **Losses** -- Fieryblack Shiner

Data Analysis

Watershed -- drains eastern and northern Yadkinville and southern Booneville, in central Yadkin County. **Habitats** -- sandy runs, side snag pools, few root wads and undercuts; areas with severe vertical bank erosion; power line right of way and ATV access; no canopy in upper 1/3 of site. **2006** -- good diversity, with 16 species collected; first collection of Fantail Darter at this site. **1996-2006** -- 17 fish species are known from this site; little change in the fish community, with an almost identical NCIBI score, and the same rating; consistently very low habitat scores over three assessments.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N DEEP CR	**SR 1510**	**08/11/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-84-1-(0.5)	360733	803532

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	42	10	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100			

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Yadkinville WWTP	NC0020338	1.0

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	91
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph

Substrate Boulder, rubble, gravel, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10015	75	26	5.3	4.8	Good-Fair
08/09/01	8575	76	26	5.4	4.6	Good-Fair
07/25/96	7100	57	24	5.3	4.9	Good-Fair
04/12/93	6155	53	25	4.9	4.4	Good-Fair

Taxonomic Analysis

Taxonomic results for 2006 are very similar to 2001 data. EPT abundance has increased from 137 to 146, spurred by an increase in several baetid mayfly taxa. The stream maintains a fairly diverse, if somewhat tolerant community of macroinvertebrates. A jump in taxa between 1996 and 2001 appears to have been maintained fairly consistently since then. Blackfly larvae and the relatively sensitive mayfly *Serratella deficiens* are taxa that have reappeared in abundance.

Data Analysis

Located several miles downstream of the Yadkinville WWTP, this site is located in a forested drainage and is situated in Shore-Styers Mill Site park. A waterfall just upstream of the site provides good physical aeration when flowing. The substrate has a good mix of rock sizes provided common riffles and the riparian vegetation provides both good canopy and runoff buffer.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Deep Cr	**SR 1152**	**06/06/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Yadkin	2	03040101	360550	804035	12-84-2-(1)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	50.6	---	10	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	20.7
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	68
pH (s.u.)	6.7

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**55**

Site Photograph

Substrate sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-78	17	52	Good
06/22/01	2001-73	19	52	Good
05/15/96	96-47	17	48	Good

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle

Gains -- Warmouth, Fieryblack Shiner, Fantail Darter, Eastern Mosquitofish **Losses** -- White Sucker, Green Sunfish, Whitefin Shiner, Spottail Shiner, Snail Bullhead, Flat Bullhead

Data Analysis

Watershed -- drains the southwest side of Yadkin County, west of Yadkinville. **Habitats** -- good pools (favored by sucker species), coarse woody debris, large bedrock outcrop on left side. **2006** -- good species diversity including four darter species, three sucker species, and three intolerant species (Fieryblack Shiner, Highback Chub, Piedmont Darter). **1996-2006** -- 25 species have been collected here; this site has sustained a stable and diverse fish community, and a rating of Good since 1996.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S DEEP CR	SR 1710	08/09/01	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
YADKIN	2	03040101	12-84-2-(5.5)	360624	803518

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	63.5	10	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	70	10	20	

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

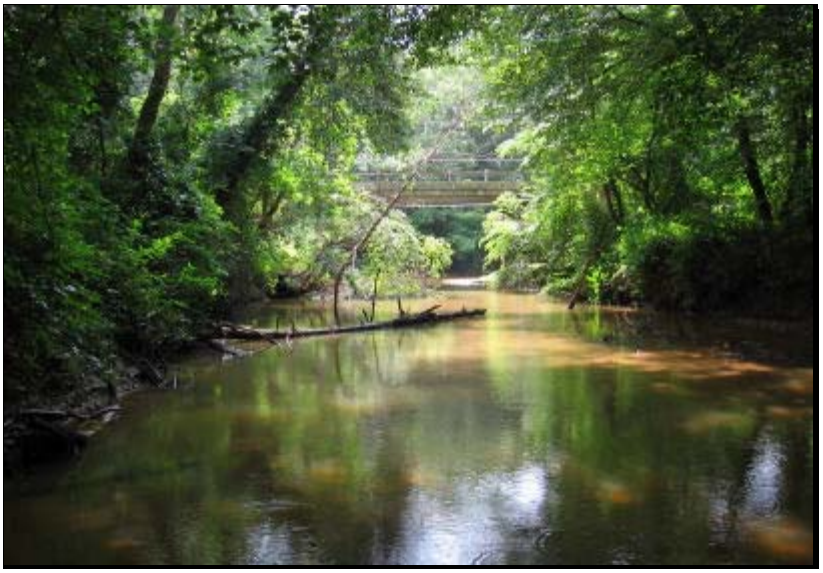
Water Quality Parameters

Temperature (°C)	23
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	68
pH (s.u.)	7.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	52

Site Photograph



Substrate Sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10016	75	24	4.9	3.9	Good-Fair
08/09/01	8574	65	19	5.3	4.4	Good-Fair
07/26/96	7101	56	26	4.8	4.4	Good-Fair

Taxonomic Analysis

The 2006 sampling event at this site realized a gain in mayfly, stonefly and caddisfly taxa, all contributing to a decrease in the biotic index (overall and EPT); an indication that a less tolerant benthic community currently inhabits the site. Overall, 10 taxa were gained in this most current survey.

Data Analysis

South Deep Creek drains the southwest corner of Yadkin County before joining North Deep Creek 3 miles downstream of this site. The sandy/silty substrate here is likely contributed in some part by the steep, badly eroded banks. Evidence of flash flows of 5 feet stage were present, though flow was low at the time of sampling with many root mats out of the water. Stream-edge woody debris and remaining root mats provided much of the habitat for the benthic community observed, qualifying the site for a Good-Fair bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MUDDY CR	**SR 1898**	**08/07/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-(0.5)	361331	802022

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	7.3	3	0.2

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

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

Water Quality Parameters

Temperature (°C)	24
Dissolved Oxygen (mg/L)	6.9
Specific Conductance (µS/cm)	65
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	63

Site Photograph

Substrate mostly sand with some gravel and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/07/06	10038	---	14	---	5.9	Fair
08/06/01	8500	---	19	---	5.1	Good-Fair
08/05/96	7103	---	18	---	5.0	Good-Fair

Taxonomic Analysis

Benthic sampling in 2006 resulted in the lowest number of EPT ever collected at this site. Taxa collected in 2001 that were absent in 2006 included two intolerant caddisflies, *Neophylax oligius* and *Pycnopsyche* as well as three mayflies, *Baetisca carolina* , *Hexagenia,* and *Stenacron interpunctatu* m. Taxa never before collected included the mayfly *Plauditus,* and the caddisfly *Polycentropus.* The increase in the EPT BI indicates an overall more tolerant EPT community.

Data Analysis

Upstream of Winston-Salem, this segment of Muddy Creek primarily drains agricultural land, though the immediate landuse at the site was forest and residential. The reduction of the rating from Good-Fair in 2001 to Fair in 2006 appears to be associated with poorer habitat (73 in 2001). Sediment loading from agriculture and erosion has possibly impacted the macroinvertebrate community as higher sediment homogeneity was observed in 2006 than in previous years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
MUDDY CR	**SR 2995**	**09/28/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-(0.5)	360001	802025

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	224.2	17	0.5

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

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

Water Quality Parameters

Temperature (°C)	19.3
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	420
pH (s.u.)	7.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	52

Site Photograph

Substrate mostly sand with some bedrock, boulder and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/28/06	10071	58	12	6.3	5.4	Fair
08/07/01	8462	50	14	6.5	5.8	Good-Fair
08/06/96	7125	51	18	6.4	5.6	Good-Fair
07/31/85	3572	53	17	6.6	5.2	Fair

Taxonomic Analysis

The loss of two EPT taxa and a reduced EPT abundance (from 80 in 2001 to 70 in 2006) at this site reduced the bioclassification to Fair for 2006. Previously abundant taxa not collected in 2006 included only the mayfly *Stenacron interpunctatum.* Of note, two intolerant stoneflies, *Acroneuria abnormis* and *Paragnetina fumosa* have been present since 1985. The midge (Chironomidae) community was more diverse than in past years with a higher number of tolerant species, five of which were abundant (*Conchapelopia* gr. and *Polypedilum illinoense* gr., *P. flavum* , *Rheocrocopus robacki* and *Rheotanytarsus*)

Data Analysis

This site is below the confluence of Muddy and Salem Creeks. The high specific conductance measured (420) is a result of urban runoff from southwestern Winston-Salem and the W-S Archie-Elledge WWTP that discharges into Salem Creek. Although the biotic index is lower than the 2001 BI, the stream still rated Fair due a low EPT richness and EPT abundance. However, this site only missed a Good-Fair rating by one abundance value (EPT N =70) indicating that stream conditions have not changed much since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Silas Cr	**SR 1137**	**06/05/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Forsyth	4	03040101	360244	802115	12-94-10	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.9	---	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	10	30	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	18.3
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	127
pH (s.u.)	6.2

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**49**

Site Photograph

Substrate sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-72	13	44	Good-Fair
04/24/02	2002-31	12	44	Good-Fair
04/30/01	2001-28	12	40	Fair

Most Abundant Species Bluehead Chub

Exotic Species Rosefin Shiner

Species Change Since Last Cycle **Gains** -- Warmouth, Speckled Killifish, Tessellated Darter **Losses** -- Bluegill, Highback Chub

Data Analysis

Watershed -- drains a section of central Winston-Salem in southwest Forsyth County. **Habitats** -- shallow sandy runs, side snags, undercuts, coarse woody debris. **2006** -- good species diversity, yet lowest number of fish collected at this site (total = 154); first time Tessellated Darter collected here; Highback Chub (intolerant) is missing (collected in the 2002 303(d) sample). **2001-2006** -- among three assessments, there have been 18 fish species collected from this urban site; the Bluehead Chub has always been the most abundant fish; after an improvement in 2002, the fish community rating has remained stable.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SALEM CR	**SR 2902**	**08/08/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-12-(4)	360318	801708

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	59.4	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	50	0	0

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

Water Quality Parameters

Temperature (°C)	25.6
Dissolved Oxygen (mg/L)	7
Specific Conductance (µS/cm)	178
pH (s.u.)	6.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Site Photograph

Substrate Mostly sand, some gravel and cobble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10042	58	16	6.6	6.0	Fair
08/06/01	8501	45	9	6.9	6.3	Fair
08/05/96	7104	53	11	7.2	6.0	Fair
09/27/82	2870	31	4	7.9	7.1	Poor

Taxonomic Analysis

A total of 16 EPT taxa were collected in 2006, seven of which have never before been collected at this site. Of these new taxa, only two were abundant, the very tolerant mayflies *Paracloeodes fleeki* and *P. minutus*. The remaining five new taxa were rare to common and included two relatively intolerant caddisflies (*Diplectrona modesta* and *Polycentropus*), one moderately tolerant caddisfly (*Triaenodes ignitus*), one moderately tolerant mayfly (*Tricorythodes*) and one tolerant caddisfly (*Hydroptila*). Macroinvertebrate taxa tolerant of organic loading were abundant particularly the midges *Dicrotendipes neomodestus* and *Polypedilum illinoense* gr. In addition to the increase in EPT, the biotic index has consistently decreased every sampling year.

Data Analysis

This portion of Salem Creek drains much of Winston-Salem and though many small dischargers exist upstream none are within a mile of the sampling site. This stream has maintained a Fair bioclassification every year except 1982 when it was rated Poor. The habitat improved in 2006 (score 60) since 2001 (score 39), most likely contributing to the increase in EPT taxa. Also, excessive periphyton growth was observed in both 2001 and 2006, further evidence of high nutrient loadings in this stream. Salem Creek at SR 2902 appears to be improving though more monitoring is needed to verify this trend.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SALEM CR	**SR 2991**	**08/09/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-12-(4)	360030	802009

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	69.3	15	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	20	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Winston-Salem Archie Elledge WWTP	NC0037843	30

Water Quality Parameters

Temperature (°C)	29.1
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	500
pH (s.u.)	7.1
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	4
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	45

Site Photograph

Substrate Sand with some bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10044	51	11	6.6	6.3	Fair
08/06/01	8544	42	10	7.1	6.4	Fair
08/05/96	7105	43	8	7.2	5.9	Fair
09/27/82	2871	22	0	8.4	---	Poor

Taxonomic Analysis

EPT richness has remained stable since 1996 although EPT N has increased steadily since 1982 (0 in 1982, 30 in 1996, 50 in 2001 and 58 in 2006). In addition, the biotic index has decreased every year. Absent from previous years, the heptageniid mayflies *Maccaffertium modestum* and *Stenacron interpunctatum* were collected but were rare. Tolerant taxa were found in abundance and included mayflies (*Baetis intercalaris* and *Pseudocloeon propinquum*) and hydropsychid caddisflies (*Cheumatopsyche, Hydropsyche betteni and H. venularis*). Organic waste indicator chironomid taxa, *Polypedilum illinoense* gr. and *P. flavum,* were also abundant.

Data Analysis

This site is downstream of Winston-Salem Archie Elledge WWTP but upstream of the confluence with Muddy Creek. Salem Creek has rated Fair since 1996. The high specific conductance is typical of a stream below a WWTP and relects the high volume of treated waste that is discharged. The low EPT and the current BI of 6.65 reflect substantially degraded water quality attributable in large part to the high degree of urbanization and poor habitat. It appears discharge from the WWTP may further degrade water quality as evidenced by the higher EPT richness (16) and abundance (85) seen at the Salem Creek site (SR 2902) above the WWTP.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S FK MUDDY CR	**SR 2902**	**08/08/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
FORSYTH	4	03040101	12-94-13	360023	801810

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont		42.3	10	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	30	20	30

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	5.5
Specific Conductance (µS/cm)	111
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	5
Riffle Habitat (16)	3
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	2
Total Habitat Score (100)	53

Site Photograph

Substrate Mostly sand with some gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/08/06	10043	61	17	6.0	5.3	Good-Fair
08/06/01	8545	---	17	---	5.5	Good-Fair
08/05/96	7124	---	14	---	4.8	Good-Fair

Taxonomic Analysis

The number of EPT taxa remained constant at 17, however, the site was sampled with a more exhaustive method than in previous years. The majority of abundant taxa at the site were tolerant species (the mayflies *Baetis intercalaris, Pseudocloeon propinquum* , *Maccaffertium modestum* and the caddisfly *Cheumatopsyche*) though two fairly intolerent caddisfly taxa (*Nectopsyche exquisita* and *Triaenodes ignitus*) were also abundant. The number of stonefly species decreased from 3 in 2001 to 1 in 2006 (*Paragnetina fumosa*).

Data Analysis

A major tributary to Muddy Creek, the South Fork Muddy Creek drains the southestern portion of Winston-Salem. The stream has consistently rated Good-Fair since it was first monitored in 1996. This stream has more agricultural and less urban inputs than Salem Creek nearby and as a consequence has a higher bioclassification. The Biotic index indicates fairly degraded water quality which is primarily due to urban and agricultural runoff as no permitted dischargers exist on this stream. Though no direct camparisons can be made to previous data, it is clear that water quality at this site has not worsened since 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Muddy Cr	**SR 2902**	**06/05/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Forsyth	4	03040101	360022	801807	12-94-13	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	42.9	---	9	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	---	---	5 (old sand dipping operation)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	95
pH (s.u.)	6.5

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**52**

Site Photograph

Substrate sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-71	19	52	Good
04/30/01	2001-31	13	42	Good-Fair

Most Abundant Species Satinfin Shiner

Exotic Species Rosefin Shiner, Channel Catfish

Species Change Since Last Cycle

Gains -- White Sucker, Pumpkinseed, Bluegill, Largemouth Bass, Gizzard Shad, Eastern Silvery Minnow, Rosefin Shiner, Bluehead Chub, Channel Catfish, Piedmont Darter, Eastern Mosquitofish. **Losses** -- Green Sunfish, Redlip Shiner, Flat Bullhead, Margined Madtom.

Data Analysis

Watershed -- drains the southeastern side of Winston-Salem and a portion of northern Davidson County. **Habitats** -- entrenched; shallow sandy runs, woody debris, side snags; site is just above an old sand dipping operation. **2006** -- high percentage of Insectivores collected (81%). Conductivity reading of 95 µS/cm continues to reflect the urban and agricultural nature of this watershed. **2001-2006** -- 65 fewer fish were collected in 2006; the change in community structure between these monitoring cycles includes a total of 15 fish species (gain of 11, and loss of four); 23 species are known from this site; substantial improvement in the NCIBI score, and an increase in one bioclassification.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	US 158	08/10/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	5	03040101	12-102-(2)	355648	803209

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	57.6	3	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	10	40	

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	141
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	49

Site Photograph

Substrate Sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10019	77	19	6	5.5	Good-Fair
08/07/01	8568	72	20	6.4	5.5	Good-Fair
07/24/96	7096	69	24	5.6	4.8	Good

Taxonomic Analysis

Total taxa encountered at this site in 2006 increased due to higher chironomid richness. EPT taxa remained nearly constant with a slight increase in odonates. The overall biotic index showed a slight improvement toward less tolerant organisms.

Data Analysis

Dutchmans Creek bisects Davie County. This site lies south of the I-40 corridor and is the most upstream benthos sampling location on the stream. The site has a low gradient with sandy, silty substrate. Low flow conditions existing during the sampling event had root mats exposed and only a central channel of flow remaining. These conditions seem to maintain a fairly consistent, if relatively tolerant macroinvertebrate community at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Dutchmans Cr	**US 158**	**06/05/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	5	03040101	355649	803208	12-102-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	57.6	---	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	---	---	10 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	140
pH (s.u.)	6.0

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**61**

Site Photograph

Substrate sand, gravel, boulders

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-73	20	46	Good-Fair
05/04/01	2001-42	17	44	Good-Fair
05/13/96	96-40	12	38	Fair

Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish, Redear Sunfish, Spotted Bass, Threadfin Shad, Channel Catfish

Species Change Since Last Cycle

Gains -- White Sucker, Green Sunfish, Redear Sunfish, Spotted Bass, Threadfin Shad, Eastern Silvery Minnow, Flat Bullhead. **Losses** -- Creek Chubsucker, Red Shiner, Highback Chub, Redlip Shiner.

Data Analysis

Watershed -- drains the northwest quadrant of Davie County and a small area along the southern edge of Yadkin County. **Habitats** -- boulder and snag pools, sand bars, side snags. **2006** -- high number of species collected (n=20) including two darter species, five sunfish species, two bass species, and three sucker species. **1996-2006** -- a steady increase in species diversity and NCIBI Score since 1996; 26 species are known from this site; the trophic structure has shifted from a majority of Omnivores+Herbivores (Bluehead chubs = 40% of the sample in 2001) to a majority of Insectivores (76%) in 2006 (collectively, Redbreast Sunfish and Bluegill make up ~51% of sample); the percentage of piscivores has also increased slightly over these monitoring cycles. Stable NCIBI score and rating since 2001.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	**NC 801**	**08/10/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	5	03040101	12-102-(2)	355107	802834

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	124.5	10	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	20	10	70	

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

Water Quality Parameters

Temperature (°C)	24.5
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	171
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	0
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	3
Light Penetration (10)	8
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	41

Site Photograph

Substrate Sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10020	90	23	6.3	5.5	Good-Fair
08/07/01	8567	77	17	6.5	5.2	Fair
07/24/96	7095	84	30	6.2	4.7	Good

Taxonomic Analysis

Both total and EPT taxa at this site appear to have recovered somewhat since the drought conditions experienced in 2001 though the population now appears somewhat more tolerant with the biotic index climbing to 5.48. EPT abundance however lags below levels observed during 1996 sampling with only 3 mayfly and 1 caddisfly taxa abundant (>9 individuals). Chironomid taxa increased from 24 in 1001 to 31 in 2006.

Data Analysis

This site on Dutchmans Creek is located in the southeastern corner of Davie County near the bottom of the Dutchmans Creek watershed and well downstream of Mocksville and the Mocksville WWTP. A sandy low-gradient stream, it provides relatively poor habitat (habitat score of 41 out of 100) for macroinvertebrates and many of the taxa found are located in stream-edge woody habitat (snags, roots mats). The paucity of this habitat encountered in 2001 is slightly improved, though not ideal in 2006 with many root mats still out of the water due to low flows. Stream banks here are steep, sandy and eroded.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cedar Cr	**off SR 1410**	**07/26/04**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	5	03040101	355756	803130	12-102-13-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.1	--	5	0.2	No

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

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

Water Quality Parameters

Temperature (°C)	22.4
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	260
pH (s.u.)	6.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**50**

Site Photograph

Substrate Gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/26/04	2004-134	8	40	Fair
05/04/01	2001-43	11	50	Good
05/13/96	96-41	11	46	Good-Fair

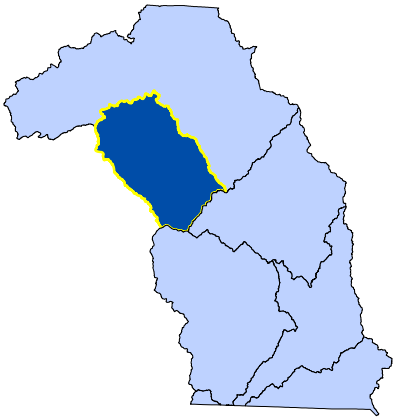
Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle **Losses** -- Red Shiner, Highback Chub, Creek Chub, and Creek Chubsucker. **Gains** -- Flat Bullhead.

Data Analysis

Watershed -- drains north-central Davie County; no municipalities in watershed; site is ~3.7 miles below Cedar Creek S&W Dam # 8 (there is no minimum flow requirement below the dam) and ~1.8 miles below site sampled in 1996 and 2001 (difference in drainage areas between the two sites is 1.2 square miles); on Vulcan quarry property, upstream from any quarry runoff, access to stream at the Pinebrook Science Center. **Habitat** -- gravely runs; no riffles; side roots and snags; very shallow and narrow. **2004** -- low flow; specific conductance was elevated; number of fish decreased from 437 in 2001 to 153 in 2004; lower than expected total species diversity; suckers and intolerant species absent. **1996 - 2004** -- specific conductance has steadily increased from 197 to 222 to 260 µS/cm; 15 species are known from the site, including the nonindigenous Red Shiner; the percentage of tolerant fish (primarily Redbreast Sunfish) very high (66 - 86%); Redbreast Sunfish consistently the dominant species; sampled as part of a NCSU Urban Fish Study. A low flow- and reservoir-affected stream.



South Yadkin River

Subbasin HUC 03040102

Includes the South Yadkin River and Tributaries

Water Quality Overview

Of the monitored streams in the South Yadkin River subbasin, 47 percent are supporting for their designated uses; however, 53 percent are impaired. Of the monitored waters habitat degradation is the largest stressor to meeting Aquatic Life standards, with 51 percent of the streams impacted or impaired because of habitat degradation. Overall, benthic macroinvertebrate samples indicate an improvement in bioclassification since the 2001 samples. Turbidity violations also contribute to impairments in the Aquatic Life category, with 39 percent of monitored streams listed as impaired. Fecal coliform is the parameter of interest in the Recreation Use Support category, this bacteria accounts for 37 miles of impaired streams.

Watershed at a Glance

Counties

Alexander, Davie, Iredell, Rowan

Municipalities

Taylorsville, Harmony, Mocksville, Statesville, Troutman, Cleveland, Mooresville

Permitted Facilities

NPDES WWTP:	
Major	5
Minor	24
NPDES Nondischarge:	8
NPDES Stormwater:	
General	791
Individual	3
Phase II	0
Animal Operations:	94

Stream Summary

Total Streams:.....686 mi

Total Monitored:.....296 mi

Total Supporting:.....139 mi
Total Impaired:.....157 mi
Total Not Rated:.....0 mi
Total No Data.....390 mi

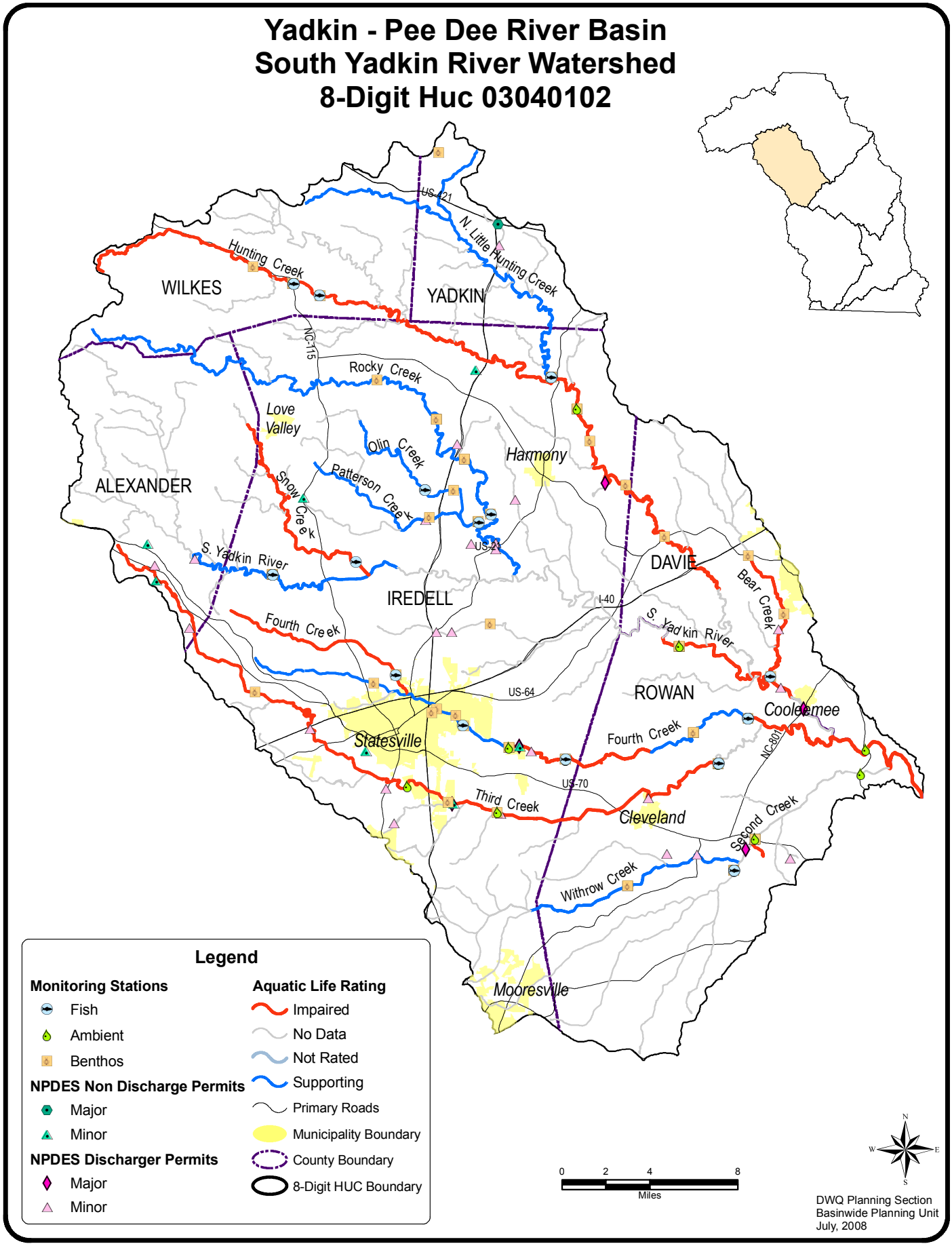
General Description

The South Yadkin River, hydrologic unit 03040102, consists of the South Yadkin River watershed and its major tributaries: Hunting, Rocky, Fourth, Third, and Second Creeks. The tributary streams constitute large watersheds in Iredell, Davie, and Rowan counties. Except for a very small portion of the headwater sections of Rocky, Hunting and North Hunting Creeks (in Wilkes and Yadkin counties), which are located in the Eastern Blue Ridge Foothills ecoregion, the majority of the subbasin is located in the Southern Outer Piedmont and Northern Inner Piedmont ecoregions. The watershed includes the I-40 and US 70 corridors from Salisbury westward. The largest metropolitan area in this subbasin is Statesville. Land use is mainly forest and agriculture.

Third Creek and Fourth Creek are two of the largest streams in the watershed and originate upstream of Statesville, in an area of agricultural land use. The streams flow east southeastward across Iredell County through the city and receive urban runoff from several small tributaries. Downstream of the city, the catchment is a combination of forest, agricultural and residential land use. The city of Statesville is permitted to discharge treated wastewater up to 6.0 MGD in Fourth Creek and 4.0 MGD in Third Creek.

There are over 25 major and minor dischargers in this hydrologic unit. Several have permitted flows greater than one million gallons per day (MGD). Most facilities with permitted flows greater than 1 MGD discharge to the South Yadkin River, Hunting, Second, Third, and Fourth Creeks. All streams in the South Yadkin River hydrologic unit flow into High Rock Lake.

Figure 2-1. South Yadkin River HUC 03040102



How to Read this Document

This document was written to correspond with our new ***Online Geographic Document Distribution*** tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add ***http://web.ceo.ncsu.edu/basinplans/dwq.kml*** to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The ***Use Support*** report provides information on how and why water quality ratings are determined and DWQ's "***Redbook***" describes in detail water quality standards for each waterbody ***classification***. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality ***Plans***"

Figure 2-1. shows monitoring station locations and impaired streams for the South Yadkin River subbasin.
Appendix 2-A provides descriptions of Use Support ratings for all monitored waterbodies in the subbasin
Appendix 2-B. provides a summary of each ambient data monitoring station.
Appendix 2-C provides summaries of biological and fish assessment monitoring sites.

Current Status and Significant Issues

General Biological Health

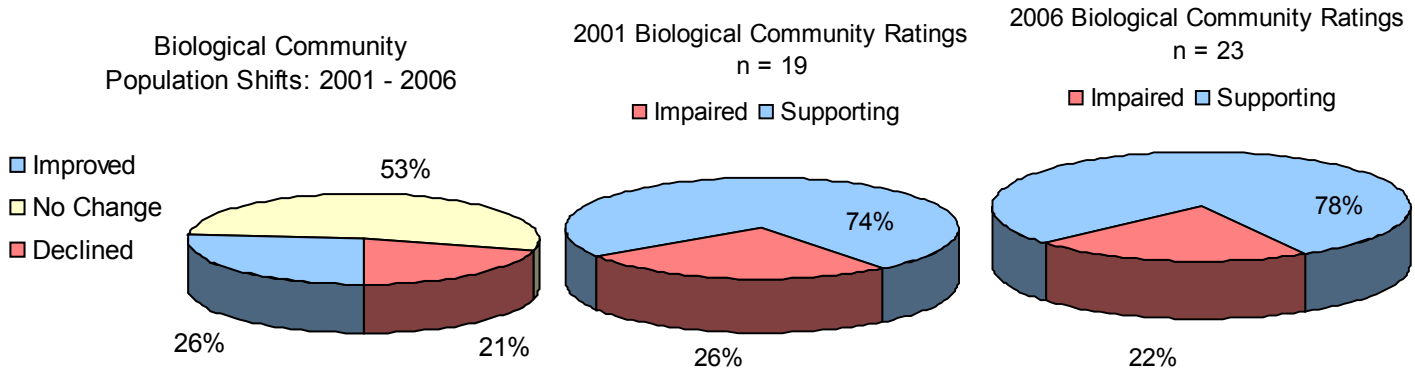
Many of the streams in this subbasin have moderate to severe bank erosion and are suffering from shifting sandy substrates, channelization, and sedimentation. During benthos sampling most of the streams were turbid to slightly turbid.

Twelve sites were sampled for benthic macroinvertebrates 2006. All the streams sampled for benthos were classified using Piedmont criteria, except for Hunting Creek at NC 115 (mountain ecoregion). Among these, four sites (Patterson Creek, Fourth Creek, North Second Creek at SR 1526, and North Second Creek at US 70) showed improved bioclassifications compared with 2001 sampling, six sites retained the same bioclassification as 2001, and two sites (Hunting Creek at SR 2115 and North Little Hunting Creek) showed degraded bioclassifications compared to 2001. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. One site, Olin Creek, showed an improved bioclassification, four sites retained their 2001 classification, and two sites (Hunting Creek at NC 115 and North Little Hunting Creek) showed degraded classification compared to 2001. Four additional fish sites were added as basinwide sites: Snow Creek, Rocky Creek, Patterson Creek, and Bear Creek.

The watersheds in the northern half of the watershed (north of Statesville) all have Good or Excellent water quality based on benthic macroinvertebrates. The fish communities generally supported the benthos findings with the exception of South Yadkin River and North Little Hunting Creek. The number of fish and the number of fish species

Figure 2-2. Biological Health Summary



collected at these two sites decreased and the number of tolerant fish species collected increased. Conversely, the benthos data showed an increase in the number of intolerant macroinvertebrate species.

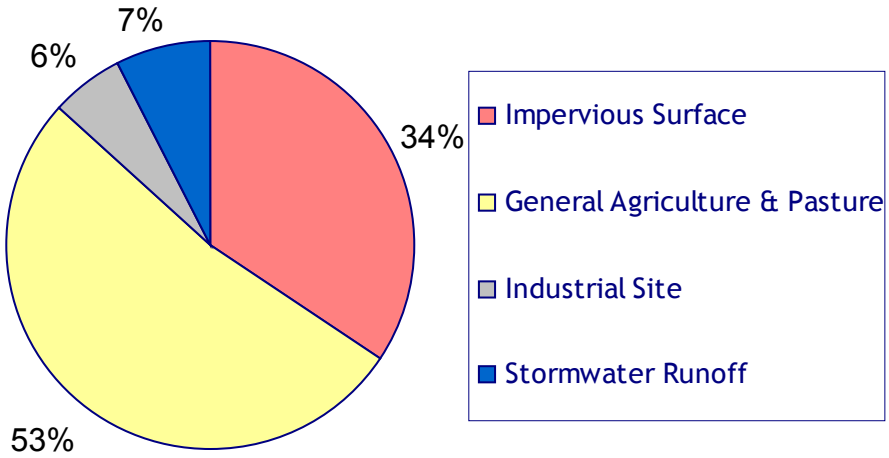
The watersheds in the southern half of the watershed (Third Creek, Fourth Creek, North Second Creek, and Withrow Creek) support more degraded benthic and fish communities than the upper South Yadkin River watershed. The fish community reflected less species diversity than the benthic community, especially in Fourth and Third Creeks, which were rated Poor by the fish but Good or Excellent by the benthos. This may be explained by the lack of good instream habitats in these very sandy streams.

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

Habitat Degradation

The severe bank erosion, shifting sandy substrates, channelization, and sedimentation described above, point to an overall pattern of habitat degradation in the watershed. This habitat degradation is reflected in many impaired streams. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities Naturally erodible soils in the watershed make streams highly vulnerable to these stressors. Figure 2-3 shows the potential sources contributing to habitat degradation in this subbasin.

Figure 2-3. Potential Sources Contributing to Habitat Degradation



Many tools are available to address habitat degradation including; ***urban stormwater BMPs***, ***agricultural BMPs***, ordinance/rule changes at the local, state, and federal levels, volunteer activism, and education programs. New and existing development should employ ***stormwater BMPs*** wherever practical. Figure 2-4. illustrates a general process for ***developing watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 2-4. Watershed Planning

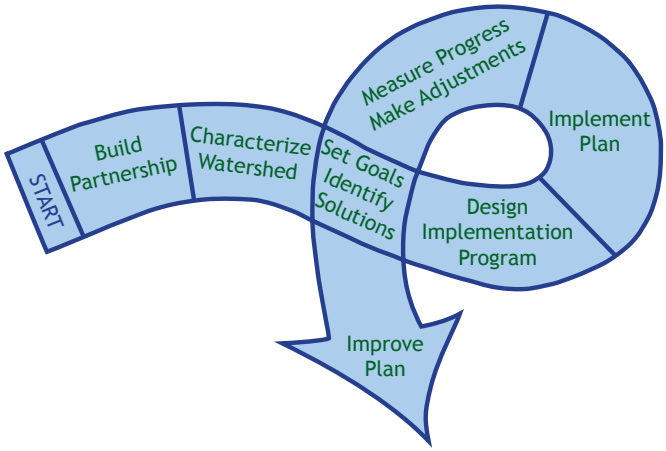


Table 2-1. Streams Impaired or Impacted by Habitat Degradation in the South Yadkin River

AU Number	Name	Subbasin	Miles	Classification	Impaired	Impacted	Potential Source
12-108-(5.5)	South Yadkin River	03-07-06	14.6	WS-IV	-	X	Agriculture, Impervious Surface
12-108-11-3-3	Olin Creek	03-07-06	9.7	C	-	X	Agriculture
12-108-16-6	North Little Hunting Creek	03-07-06	23.8	WS-III	-	X	Agriculture
12-108-18-(3)	Bear Creek	03-07-06	8.6	WS-IV	X	-	Agriculture, Impervious Surface
12-108-20-3	Morrison Creek	03-07-06	7.8	C	-	X	Agriculture, Impervious Surface
12-108-20-4a	Third Creek	03-07-06	16.8	C	X	-	Impervious Surface, Agriculture
12-108-20-4b	Third Creek	03-07-06	22.1	C	X	-	Agriculture, MS4 NPDES, Impervious Surface
12-108-20a1	Fourth Creek	03-07-06	10.2	C	X	-	Agriculture, Impervious Surface, Industrial Site
12-108-20a3	Fourth Creek	03-07-06	7.8	C	X	-	WWTP NPDES, Stormwater Runoff, MS4 NPDES
12-108-20c	Fourth Creek	03-07-06	5.5	C	X	-	Stormwater Runoff
12-108-21-3	Withrow Creek	03-07-06	11.2	C	-	X	Agriculture
12-108-9-(0.6)	Snow Creek	03-07-06	12.5	WS-IV	X	-	Agriculture

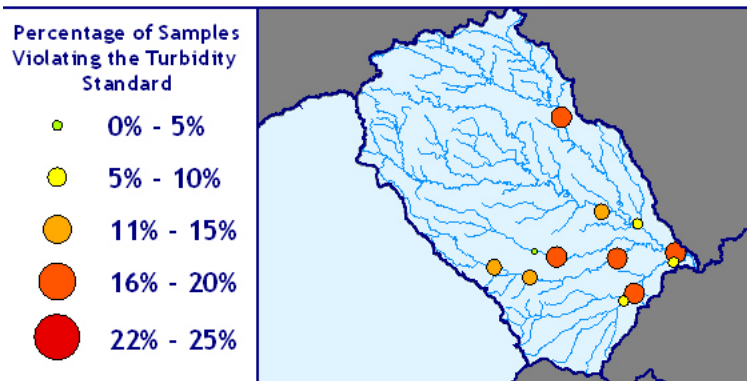
Ambient Water Quality

Turbidity

Turbidity violations are common in the South Yadkin River watershed (Figure 2-5). Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and/silt were noted in the stream substrate at many of the biological sample sites in the South Yadkin River subbasin.

Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices can accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the South Yadkin River watershed. It appears, however, violations are highest in the agricultural areas. Violations are lowest in the upper watershed where land use is predominantly forest.

Figure 2-5. Turbidity Violations



It is likely that a combination of human caused land disturbances and natural erosion are causing the majority of turbidity violations in this watershed, human causes being the leading contributor. To appropriately address turbidity and sediment problems in the South Yadkin River watershed, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. All reasonable efforts to reduce or eliminate human source of erosion should be implemented immediately. A ***turbidity TMDL*** has been completed for Fourth Creek, a major tributary to the South Yadkin River.

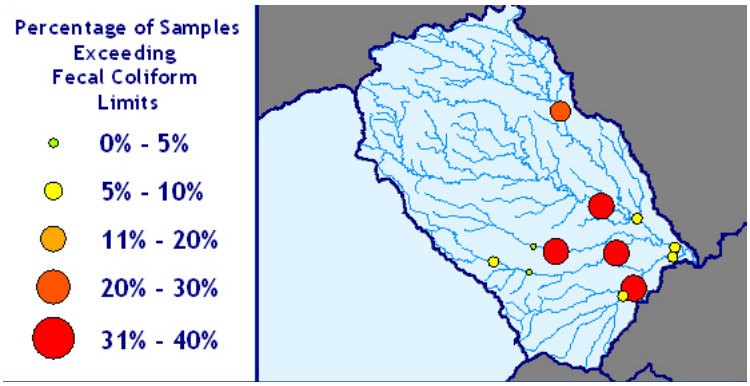
Table 2-2. Monitored Streams Impaired or Impacted by Turbidity in the South Yadkin River

AU Number	Name	Subbasin	Miles	Classification	Impaired	Impacted	Potential Sources
12-108-(14.5)	South Yadkin River	03-07-06	9.5	WS-IV	X	-	Unknown
12-108-(19.5)b	South Yadkin River	03-07-06	5.3	C	X	-	Stormwater Runoff
12-108-16-(0.5)	Hunting Creek	03-07-06	49.3	WS-III	X	-	Agriculture, Mining
12-108-20-4a	Third Creek	03-07-06	16.8	C	X	-	Impervious Surface, Agriculture
12-108-20-4b	Third Creek	03-07-06	22.1	C	X	-	Agriculture, MS4 NPDES, Impervious Surface
12-108-20a3	Fourth Creek	03-07-06	7.8	C	X	-	WWTP NPDES, Stormwater Runoff, MS4 NPDES
12-108-21b	Second Creek (North Second Creek)	03-07-06	3.4	C	X	-	Unknown

Fecal Coliform Bacteria

Fecal Coliform concentrations often exceeded 400 colonies/100ml in the South Yadkin River Watershed (Figure 1-6). The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Figure 2-6. FCB Violations



An analysis of all ambient water quality stations in the South Yadkin River watershed shows a downward trend in fecal coliform bacteria concentrations from 2002-2006. Rainfall, which influences bacteria concentrations, did not appear to be driving this trend. Therefore, the decrease is likely due to implementation of agricultural BMPs and sewer infrastructure improvements. However, concentrations remain elevated and further work remains to be done. Additional funds will be necessary to continue implementing these improvements. A ***fecal coliform TMDL*** has been completed for Fourth Creek, a major tributary to the South Yadkin River.

Table 2-3. Monitored Streams Impaired or Impacted by Fecal in the South Yadkin River

Assessment Unit	Name	Subbasin	Classification	Miles	Impaired	Impacted	Source
12-108-(14.5)	South Yadkin River	03-07-06	WS-IV	9.5	X	-	Agriculture

Assessment Unit	Name	Subbasin	Classification	Miles	Impaired	Impacted	Source
12-108-20-4b	Third Creek	03-07-06	C	22.1	X	-	Agriculture, MS4 NPDES
12-108-20a2	Fourth Creek	03-07-06	C	5.8	-	X	Unknown

Other Water Quality Concerns

Low pH readings were recorded in Hunting Creek. Two general stormwater permits have been issued for a quarry and asphalt paving operation in the stream headwaters, but no data exists linking the industrial facilities to the pH readings. Further investigation is needed.

Table 2-4. Other Stressors Impacting Monitored Streams

Assessment Unit	Name	Subbasin	Classification	Miles	Impaired	Stressor	Source
12-108-16-(0.5)	Hunting Creek	03-07-06	WS-III	49.3	X	Low pH	Unknown

See: ***Yadkin Ambient Monitoring System Report*** and ***Yadkin Basinwide Assessments*** for more information regarding specific monitoring sites.

Population and Land Use

Water quality is generally best in the forested and sparsely populated area in the northwestern portion of the watershed. Impervious surfaces and the highest population densities are located in the area in and around Statesville. The most significant impacts to water quality occur in this portion of the basin and demonstrate the negative affect urban and suburban development can have on aquatic resources. These impacts are reversible and avoidable by effectively implementing ***watershed restoration plans*** and adopting ***land use ordinances*** that protect aquatic resources.

Agricultural land uses in the remainder of the watershed appear to have less impact than the Statesville area, major exceptions being Hunting and Snow Creeks. Agricultural BMPs are a priority in these watersheds. The ***North Carolina's Agriculture Cost Share Program*** is an effective program to use for BMP implementation.

Because much of the land in this hydrologic unit is forest and agriculture, DWQ believes land conservation accompanied with stream restoration projects can be very successful. Stream restoration projects can easily exceed $500,000 per mile. Protection and conservation projects many cost one tenth of that. (Haupt, 2002 and Weinkam, 2001) DWQ strongly encourages conservation in this watershed. Many programs and organizations can assist with these projects. Additionally, there are significant tax incentives landowners can take advantage of. Many of these programs allow and encourage owners to maintain control and exclusive use or their land. Some provide opportunities to ensure farmland remains productive and is not converted into commercial development and subdivisions. ***Local land trusts*** can help landowners explore conservation options and identify potential funding sources.

Figure 2-7. Population Dot-Density Map

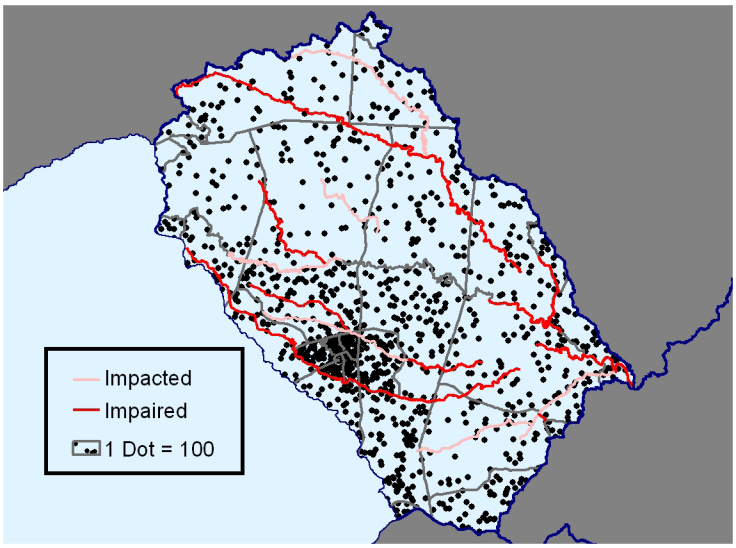
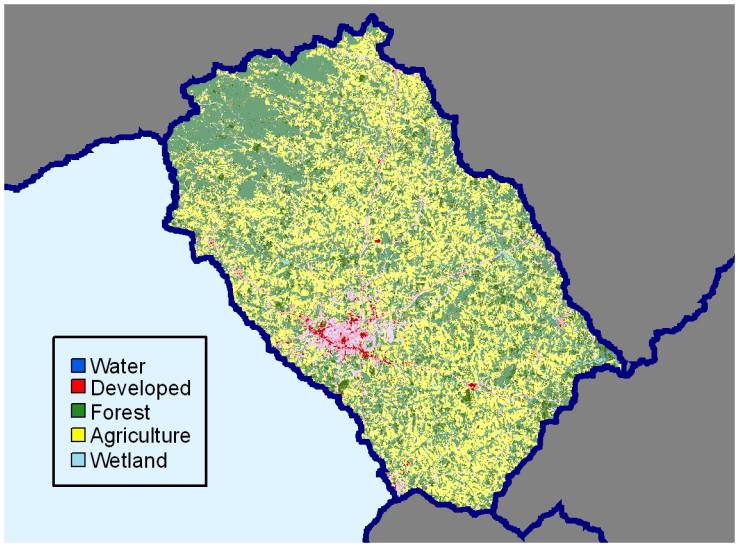


Figure 2-8. Land cover



Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made several investments in the South Yadkin River Watershed. Figure 2-9 shows the distribution of projects to date in the watershed and Table 2-5, includes a list of recent projects and their cost. These projects include several land acquisitions. As discussed above, DWQ encourages further investment in the upper reaches of this watershed.

Figure 2-9. CWMTF Projects

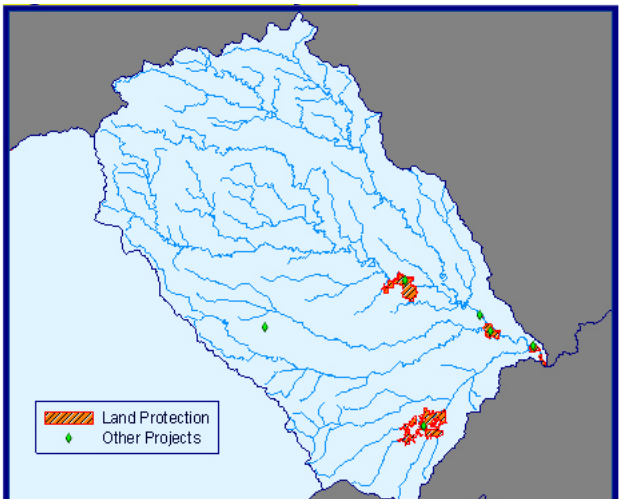


Table 2-5. CWMTF Funded Projects In The South Yadkin River Watershed (9/1/01-8/31/06).

Project Number	Application Name	Proposed Project Description	Amount Funded
2001B-011	LandTrust for Central North Carolina- Acquisition/ South Yadkin River tributaries	Provide funds to acquire the riparian, floodplain, & wetland portions of 6 tracts (up to 1200 ac) through fee simple purchase along the South Yadkin River, Third & Fourth Creeks, & Yadkin River. Total of 1900 ac to be protected with all funding sources.	$1,913,000
2004B-018	LandTrust for Central North Carolina- Acq/ Adams Tract, South Yadkin	Protect through conservation easements 2,289 acres along the South Yadkin River. CWMTF and Farmland Preservation Program funds to purchase easement on 604 acres and landowner to donate permanent conservation easements on additional 1,750 acres.	$465,000
2005A-022	NC Wildlife Resources Commission - Acq/ Kannapolis Tract, Second and Sloan Creeks	Protect through fee simple purchase 2,842 acres, 96% of which are riparian, along Second and Sloan Creeks (WS II). The tract will become part of the Game Lands program.	$2,522,000

This list does not include:
regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.

TMDLs

A TMDL or Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

A TMDL provides a detailed water quality assessment that provides the scientific foundation for an implementation plan. An implementation plan outlines the steps necessary to reduce pollutant loads in a certain body of water to restore and maintain human uses or aquatic life. Plan implementation is usually voluntary. The following TMDLs have been completed in the South Yadkin River watershed and should be adopted by all residents and local governments within the watershed.

Table 2-6. Finalized TMDL's in the South Yadkin River Watershed

Waterbody	Pollutant	Link	Final TMDL Date
Fourth Creek	Fecal Coliform	*Final TMDL*	Dec. 19, 2001
Fourth Creek	Turbidity	*Final TMDL*	Nov. 22, 2004

High Rock Lake TMDL

Although it is not located within this hydrologic unit, all streams in the South Yadkin River watershed drain to High Rock Lake. High Rock Lake is impaired due to violations of the turbidity and chlorophyll *a* standards. Therefore, DWQ has initiated a TMDL development process for the lake. As discussed above, turbidity and sedimentation are a significant water quality issue in the South Yadkin River watershed. The sediment generated in this watershed contributes directly to the water quality impairment observed in High Rock Lake. In addition to sediment, runoff from the South Yadkin River watershed delivers substantial nutrients to High Rock Lake that lead to chlorophyll *a* violations. Residents and government agencies in the Yadkin River headwaters should be active in the TMDL development process for the lake and continue implementing nonpoint source pollution reduction strategies.

Local Initiatives

Cooperative Conservation Partner Initiative

The Cooperative Conservation Partnership Initiative (***CCPI***) is a voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds of special significance. See the ***Rapid Watershed Assessment*** completed in the South Yadkin River subbasin for more information.

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 3 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining seventy percent is made available through a competitive grants process.

Table 2-7. 319 Project in the South Yadkin River Watershed

Fiscal Year	Contract Number	Name	Description	Agency	Funding
2003	EW04007	Fourth Creek TMDL Implementation Project, Phase I	TMDL Implementation	Carolina Land and Lakes, Inc.	$200,000

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the South Yadkin River subbasin. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 2-8 shows the number of projects implemented and in the South Yadkin River Hydrologic Unit and the dollar amount invested. Table 2-9 shows the water quality benefits realized from that investment.

Table 2-8. ACSP Project Expenditures In the South Yadkin River

	Erosion Reduction/ Nutrient Loss Reduction in Fields			Sediment/Nutrient Delivery Reduction from Fields			Stream Protection from Animals			Proper Animal Waste Management		
12-digit HU	Total Implemented		Cost	Total Implemented		Cost	Total Implemented		Cost	Total Implemented		Cost
030401020100	52.2 ac.		$9,530	3.79 ac.		$5,221	34 units	11,035 LF	$88,923	11 units		$118,812
030401020101							2 units	2,576 LF	$8,573	1 unit		$24,750
030401020200	208.22 ac.		$31,812	187.1 ac.		$3,648	32 units	16,121 LF	$101,610	11 units		$87,590
030401020300					1 unit	$78	36 units	29,550 LF	$51,218	3 units		$15,627
030401020400	1.25 ac.		$2,216				14 units	8,038 LF	$39,265	3 units		$13,729
030401020500				4.25 ac.	2 units	$10,410	15 units	7,148 LF	$43,857	2 units		$1,463
Total			$43,558			$19,357			$333,446			$261,971

Table 2-9. NC ASCP Water Quality Benefits

	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401020100	396	22,709	18,391	183,320	205,233
030401020101					
030401020200	5,964	28,492	3,358	132,437	123,164
030401020300	106	3,865	2,323	17,274	3,442
030401020400	1,027	3,844	2,320	1,192,282	
030401020500	146	13,725	310	6,240	3,770
Total	**7,638**	**72,635**	**26,702**	**1,531,553**	**335,609**

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

Costs in the North Carolina Wetlands Restoration Program. Paper presented at the conference *Setting the Agenda for Water Resources Research*. April 9, 2002. Raleigh, NC.

Weinkam, C., R. Shea, C. Shea, C. Lein and D. Harper. 2001. *Urban Stream Restoration Programs of Two Counties in the Baltimore-Washington DC Area*. Paper Presented at the *Fourth Annual North Carolina Stream Restoration Conference, Stream Repair and Restoration: A Focus on the Urban Environment*. October 16-19, 2001. Raleigh, NC.

Haupt, M., J. Jurek, L. Hobbs, J. Guidry, C. Smith and R. Ferrell. 2002. *A Preliminary Analysis of Stream Restoration*

Appendix A

Use Support Ratings for All Monitored Waterbodies in South Yadkin River Subbasin

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-108-18-(3)	**Bear Creek**		**Habitat Degradation** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.2 mile downstream of U.S. Hwy. 64 to South Yadkin River				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	2008	5
WS-IV	03-07-06	8.6 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-108-16-6-1	**Dobbins Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to North Little Hunting Creek										
WS-III	03-07-06	4.5 FW Miles								
12-108-20a1	**Fourth Creek**		**Habitat Degradation** General Agriculture/Pasture Impervious Surface Industrial Site	Aquatic Life	Supporting	No Criteria Exceeded	Turbidity	2006	1998	2t
From source to Morrison				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-06	10.2 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2003	1998	5
				Recreation	Not Rated	No Criteria Exceeded	Fecal Coliform (recreation)	2006	1998	4a
12-108-20a2	**Fourth Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Turbidity	2006	1998	2t
From Morrison Creek to SR2316				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2003		1
C	03-07-06	5.8 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
				Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
				Recreation	Not Rated	No Criteria Exceeded	Fecal Coliform (recreation)	2006	1998	4a
12-108-20a3	**Fourth Creek**		**Habitat Degradation** Stormwater Runoff **Toxic Impacts** WWTP NPDES **Turbidity** MS4 NPDES Stormwater Runoff WWTP NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	1998	4s
From SR2316 to SR1272				Aquatic Life	Impaired	Standard Violation	Turbidity	2006	1998	4a
C	03-07-06	7.8 FW Miles		Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
12-108-20b	**Fourth Creek**		**Habitat Degradation** General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From SR 1972 to SR 1985										
C	03-07-06	6.7 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-108-20c	**Fourth Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2003	1998	5
From SR 1985 to South Yadkin River			Stormwater Runoff							
C	03-07-06	5.5 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
12-108-16-(0.5)	**Hunting Creek**		**Low pH**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From source to a point 1.1 miles upstream of Davie County SR 1147			**Turbidity**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III	03-07-06	49.3 FW Miles	General Agriculture/Pasture	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
12-108-20-3	**Morrison Creek**		**Habitat Degradation**	Aquatic Life	Not Rated	Data Inconclusive	Turbidity		1998	3t
From source to Fourth Creek			General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
C	03-07-06	7.8 FW Miles	Impervious Surface	Recreation	Not Rated	Data Inconclusive	Fecal Coliform (recreation)		1998	3t
12-108-16-6	**North Little Hunting Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Hunting Creek			General Agriculture/Pasture							
WS-III	03-07-06	23.8 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-108-11-3-3	**Olin Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Patterson Creek			General Agriculture/Pasture							
C	03-07-06	9.7 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-108-11-3	**Patterson Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Rocky Creek										
C	03-07-06	10.6 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-108-11	**Rocky Creek (Rocky River)**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to South Yadkin River										
C	03-07-06	42.2 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
12-108-21a	**Second Creek (North Second Creek)**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Withrow Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-06	1.7 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin / Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-108-21b	**Second Creek (North Second Creek)**		Aquatic Life	Impaired	Standard Violation	Turbidity	2006		5
			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Withrow Creek to Beaverdam Creek			Recreation	Not Rated	Data Inconclusive	Fecal Coliform (recreation)	2006		3a
C	03-07-06 3.4 FW Miles								
12-108-21c	**Second Creek (North Second Creek)**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
From Beaverdam Creek to South Yadkin River									
C	03-07-06 5.7 FW Miles								
12-108-9-(0.6)	**Snow Creek**	**Habitat Degradation** General Agriculture/Pasture	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	2008	5
From a point 1.1 miles upstream of Iredell County SR 1614 to South Yadkin River									
WS-IV	03-07-06 12.5 FW Miles								
12-108-(14.5)	**South Yadkin River**	**Fecal Coliform Bacteria** **Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From a point 1.0 mile upstream of Davie County SR 1159 to N.C. Hwy. 801			Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
WS-IV	03-07-06 9.5 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-108-(19.5)b	**South Yadkin River**	**Turbidity** Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
From mouth of Fourth Creek to Yadkin River									
C	03-07-06 5.3 FW Miles								
12-108-(5.5)	**South Yadkin River**	**Habitat Degradation** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Alexander County SR 1456 to a point 0.6 mile downstream of Iredell County SR 1907									
WS-IV	03-07-06 14.6 FW Miles								
12-108-20-4a	**Third Creek**	**Habitat Degradation** General Agriculture/Pasture Impervious Surface **Turbidity** General Agriculture/Pasture Impervious Surface	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to SR 2359			Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
C	03-07-06 16.8 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-108-20-4b	**Third Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	2004	4s
From SR 2359 to SR 1970			General Agriculture/Pasture	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
C	03-07-06	22.1 FW Miles	MS4 NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
			Habitat Degradation	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
			General Agriculture/Pasture							
			Impervious Surface							
			Turbidity							
			General Agriculture/Pasture							
			Impervious Surface							
12-108-21-3	**Withrow Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Second Creek (North Second Creek)			General Agriculture/Pasture							
C	03-07-06	11.2 FW Miles								

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040102 – SOUTH YADKIN RIVER

Description

The South Yadkin River HUC 03040102 (subbasin 06) consists of the South Yadkin River watershed and its major tributaries: Hunting, Rocky, Fourth, Third, and Second Creeks (Figure 3). The tributary streams constitute large watersheds in Iredell, Davie, and Rowan counties. Except for a very small portion of the headwater sections of Rocky, Hunting and North Hunting Creeks (in Wilkes and Yadkin counties), which are located in the Eastern Blue Ridge Foothills ecoregion, the majority of the subbasin is located in the Southern Outer Piedmont and Northern Inner Piedmont ecoregions. The watershed includes the I-40 and US 70 corridors from Salisbury westward. The largest metropolitan area in this subbasin is Statesville. Land use is mainly forest and agriculture.

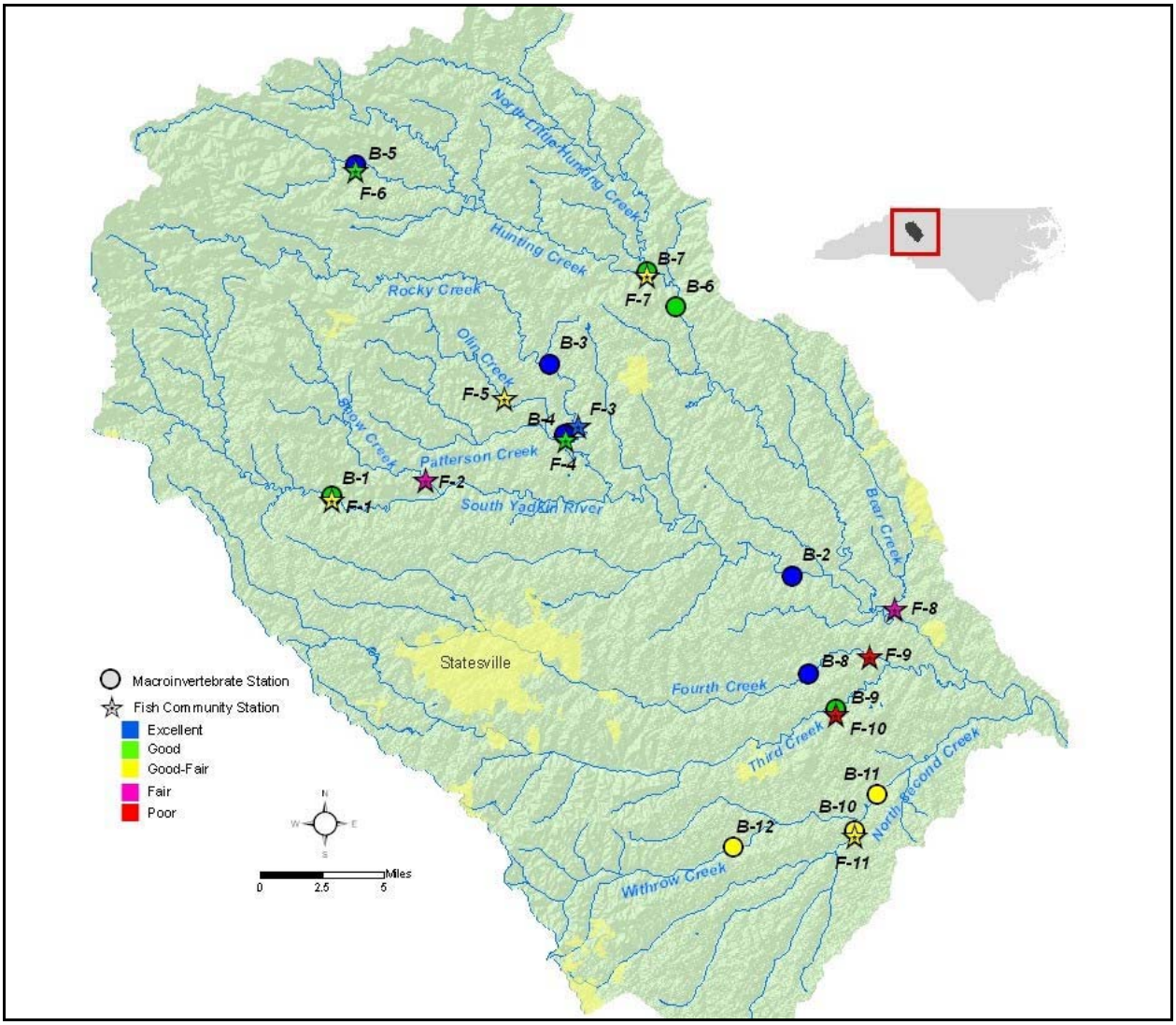


Figure 3. Sampling sites in HUC 03040102 in the Yadkin River basin. Monitoring sites are listed in Table 2.

North Little Hunting, Hunting and Rocky Creeks originate in the foothills of the Brushy Mountains. Hunting and Rocky Creeks flow from southeast Wilkes County south southeastward across the northern third of Iredell County where the land use is mostly forested. North Little Hunting Creek flows southward

from Yadkin County into Iredell County where it joins Hunting Creek in the northeastern corner of Iredell County. Second Creek is on the 303(d) list from its source to the South Yadkin River. Third and Fourth Creeks, which drain much of Statesville, the largest metropolitan area in the subbasin, are 303(d) listed as well. Both Third Creek and Fourth Creek originate above Statesville, in an area of agricultural land use. The streams flow east southeastward across Iredell County through the city of Statesville and receive urban runoff from several small tributaries. Downstream of the city, the catchment is a combination of forest, agricultural and residential land use. The city of Statesville is permitted to discharge up to 6.0 MGD to Fourth Creek and 4.0 MGD to Third Creek.

There are over 25 major and minor dischargers in this HUC of which several have permitted flows > 1 MGD. The facilities that have permitted flows > 1 MGD mainly discharge to the South Yadkin River and Hunting, Second, Third, and Fourth Creeks.

Overview Of Water Quality

Many of the streams in this HUC have moderate to severe bank erosion and are suffering from shifting sandy substrates, channelization, and sedimentation. During benthos sampling most of the streams were slightly turbid to turbid. Table 2 presents the waterbodies monitored in HUC 03040102 for benthos and fish basinwide assessment in 2006. Figure 3 presents the sites monitored for benthos and fish in 2006, depicting the bioclassification for each location.

Table 2. Waterbodies monitored in HUC 03040102 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	South Yadkin R	Iredell	SR 1561	Good	Good
B-2	South Yadkin R	Davie	SR 1159	Excellent	Excellent
B-3	Rocky Cr	Iredell	SR 1884	Excellent	Excellent
B-4	Patterson Cr	Iredell	SR 1890	Good	Excellent
B-5	Hunting Cr	Wilkes	NC 115	Excellent	Excellent
B-6	Hunting Cr	Iredell	SR 2115	Excellent	Good
B-7	North Little Hunting Cr	Iredell	SR 1829	Excellent	Good
B-8	Fourth Cr	Rowan	SR 1003	Good	Excellent
B-9	Third Cr	Rowan	SR 1970	Good	Good
B-10	North Second Cr	Rowan	SR 1526	Fair	Good-Fair
B-11	North Second Cr	Rowan	US 70	Fair	Good-Fair
B-12	Withrow Cr	Rowan	SR 1547	Good-Fair	Good-Fair
F-1	S Yadkin R	Iredell	SR 1561	Good-Fair	Good-Fair
F-2	Snow Cr	Iredell	SR 1905	---	Fair
F-3	Rocky Cr	Iredell	SR 1890	---	Excellent (2004)[2]
F-4	Patterson Cr	Iredell	SR 1890	---	Good (2004)[2]
F-5	Olin Cr	Iredell	SR 1892	Fair (1996)	Good-Fair
F-6	Hunting Cr	Wilkes	NC 115	Excellent	Good
F-7	N Little Hunting Cr	Iredell	SR 1829	Good	Good-Fair
F-8	Bear Cr	Davie	SR 1116	---	Fair (2004)[2]
F-9	Fourth Cr	Iredell	SR 1985	Poor	Poor (2003)
F-10	Third Cr	Rowan	SR 1970	Poor	Poor
F-11	N Second Cr	Rowan	SR 1526	Good-Fair	Good-Fair

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.
[2]special study site that has become a basinwide site.

Twelve sites were sampled for benthic macroinvertebrates in this HUC in 2006. All the streams sampled for benthos were classified using Piedmont criteria, except for Hunting Creek at NC 115 (Mountain ecoregion). Among these, four sites (Patterson Creek, Fourth Creek, North Second Creek at SR 1526, and North Second Creek at US 70) showed improved bioclassifications compared with 2001 sampling, six sites retained the same bioclassification as 2001, and two sites (Hunting Creek at SR 2115 and North Little Hunting Creek) showed degraded bioclassifications compared to 2001. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. One site, Olin Creek, showed an improved bioclassification, four sites retained their 2001 classification, and two sites (Hunting Creek at NC 115 and North Little Hunting Creek) showed degraded classification compared to 2001. Four additional fish sites were added as basinwide sites: Snow Creek, Rocky Creek at SR 1890, Patterson Creek at SR 1890, and Bear Creek.

The watersheds in the northern half of the HUC (north of Statesville) all have Good or Excellent water quality based on benthic macroinvertebrates. The fish communities generally supported the benthos findings with the exception of South Yadkin River and North Little Hunting Creek. The number of fish and the number of fish species collected at these two sites decreased and the number of tolerant fish species collected increased. Conversely, the benthos data showed an increase in the number of intolerant macroinvertebrate species.

The watersheds in the southern half of the HUC (Third Creek, Fourth Creek, North Second Creek, and Withrow Creek) support more tolerant benthic and fish communities than the upper South Yadkin River watershed. The fish community reflected less species diversity than the benthic community, especially in Fourth and Third Creeks, which were rated Poor by the fish but Good or Excellent by the benthos. This may be explained by the lack of good instream habitats in these very sandy streams.

River And Stream Assessment

Fourth Creek was sampled in 2003, which was within the five-year basinwide window. Therefore, the 2003 rating was used to compare with the 2001 rating. Four additional fish sites, of which three were sampled in 2004 and one in 2005, were added to the basinwide schedule and will be sampled as a basinwide site in future assessments.

~~Specific site summaries of the 12 benthic macroinvertebrate and 11 fish community samples may be found at this link: **03040102**.~~

SPECIAL STUDIES

Fish Community Urbanization Study

Rocky Creek at SR 1890 and Patterson Creek at SR 1890 in Iredell County and Bear Creek at SR 1116 in Davie County were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). The fish communities were rated Excellent, Good, and Fair, respectively.

Fourth Creek Fish Community TMDL Study

Four sites on Fourth Creek (at SR 1930, SR 2320, and SR 2308 in Iredell County and at SR 1985 in Rowan County) were sampled by DWQ in 2003 as part of a Total Maximum Daily Load stressor study (Biological Assessment Unit Memorandum 20031006). The study concluded that flows in the creek are extreme – from as little as 1 cfs during droughts to more than 4,000 cfs during the winter of 2003. The stream also has elevated specific conductance, turbidity, and fecal coliform bacteria, and degraded instream and riparian habitats. The sources of these stressors (causes of impairment) are the historic poor landuse practices in the watershed, the current urban landuse practices surrounding the City of Statesville, the erosive soils throughout the watershed, and the wastewater treatment plant. These stressors have resulted in degraded fish communities where the fish communities were sparse and dominated by species indicative of some nutrient enrichment, tolerance to pollution, variable flows, and degraded instream habitats.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S YADKIN R	**SR 1561**	**07/25/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-(5.5)	355311	805924

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	69.3	12	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	0

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

Water Quality Parameters

Temperature (°C)	24.5
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	57
pH (s.u.)	6.4
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	47

Site Photograph

Substrate Sand, Gravel, Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	9988	96	28	5.5	4.5	Good
09/11/01	8621	68	21	5.7	4.9	Good-Fair
07/24/01	8488	77	25	5.8	5.1	Good
08/05/96	7148	70	30	5.0	4.3	Excellent

Taxonomic Analysis

The 2006 sample produced a stonefly community that was comparable to the 1996 community. The intolerant stonefly Leuctra (TV=2.5) was collected for the first time in 2006.

Data Analysis

This site is located in the upper portion of the watershed before the stream receives any influence from major tributaries. In 1996, this site was rated Excellent. Since then, it has rated Good or Good-Fair and a definite decline in the diversity and tolerance of the macroinvertebrate community has occured. This was most evident in the loss of the stonefly community between sampling periods. The overall EPT taxa richness decreased from 30 to 25 in July 2001. It further decreased to 21 two months later when another field crew sampled the site as a Quality Assurance Sample. The 2006 sample produced a slightly higher EPT taxa richness suggesting a slight increase in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Yadkin R	**SR 1561**	**06/06/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355311	805924	12-108-(5.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	69.3	--	13	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	54
pH (s.u.)	5.6

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	1
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**48**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-75	14	42	Good-Fair
05/03/01	2001-39	16	46	Good-Fair
05/14/96	96-45	11	40	Fair

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Notchlip Redhorse, Striped Jumprock, Brassy Jumprock, Flat Bullhead, and Largemouth Bass.
Gains -- Satinfin Shiner, Green Sunfish, and Bluegill.

Data Analysis

Watershed -- drains the northeast quadrant of Alexander County, including the Town of Taylorsville. Habitat -- shallow sandy runs, side snags, some buried woody debris; "holes" missing. **2006** -- high percentage of omnivores+herbivores (61% of all fish were Bluehead Chub); low total species diversity; only one species of sucker collected; first time Green Sunfish collected at the site. **1996 - 2006** -- consistently low total habitat scores; specific conductance ~ 50 µS/cm; total species at site = 20, but the Tessellated Darter has never been collected from the site; increase in the percentage of Bluehead Chub from 31 to 45 to 61%, decrease in the percentage of insectivores from 66 to 55 to 39%; slight decrease in the NCIBI score, but not the rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
S YADKIN R	**SR 1159**	**09/11/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIE	6	03040102	12-108-(14.5)	355040	803934

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-IV	306.5	19	0.7

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

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

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	77
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	4
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	64

Site Photograph

Substrate Boulder, Rubble, Silt, Sand, Gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9995	77	32	5.2	4.6	Excellent
07/24/01	8489	80	32	4.7	3.9	Excellent
08/06/96	7150	60	29	4.5	3.8	Good
07/13/89	4980	73	32	4.7	3.9	Excellent
08/05/86	3899	79	26	5.1	4.1	Good

Taxonomic Analysis

The addition of two tolerant taxa, the mayfly Caenis (TV=7.4) and the oligochaete Branchiura sowerbyi (TV=8.3), which had not previously been collected at this location, may have contributed to the slightly higher Biotic Index. Abundant EPT taxa included *Baetis intercalaris, Caenis, Hexagenia, Isonychia, Stenonema modestum, Acroneuria abnormis, Hydropsyche venularis*, and *Nectopsyche exquisita*.

Data Analysis

This site is located at the Davie/Rowan County line and has consistenly rated Good or Excellent since 1986. It continues to support a diverse and intolerant benthic macroinvertebrate community. However, the Biotic Index did increase slightly from previous collections.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Snow Cr	**SR 1905**	**06/06/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355346	805522	12-108-9-(0.6)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	29.3	--	5	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	0	15	0

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

Water Quality Parameters

Temperature (°C)	15.9
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	73
pH (s.u.)	6.6

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**62**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-76	12	38	Fair

Most Abundant Species Bluehead Chub

Exotic Species Stripped Jumprock

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains rural northwest Iredell and extreme northeast Alexander counties; no municipalities in watershed; site is ~ 1 mi. above mouth. **Habitat** -- sand and gravel substrate; bar development; channel filled with sediment from upstream sediment sources. **2006** -- low diversity; one of a few sites in 2006 without any Tessellated Darter; high percentage of omnivores+herbivores; ~ 60% of all fish were Bluehead Chub.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY CR	SR 1884	07/26/06	Excellent

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-11	355755	805010

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	56.5	12	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	20	50	0

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

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	44
pH (s.u.)	6.4
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	65

Site Photograph

Substrate Sand, Rubble, Gravel, Boulder, Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9990	--	44	--	4.2	Excellent
07/23/01	8485	--	38	--	3.8	Excellent
08/05/96	7146	--	26	--	3.9	Good

Taxonomic Analysis

Although the EPT biotic index increased slightly, only one pollution tolerant mayfly, *Caenis* , went from rare or not collected in 1996 or 2001, repectively, to abundant in 2006. Several intolerant EPT taxa were collected for the first time at this location and included the mayflies *Brachycercus, Epeorus, Ephemera, Ephoron Leukon, Heterocloeon curiosum, Paraleptophlebia, Plauditus dubius* group, *Procloeon* , and *Pseudocloeon dardanum* , the stonefly *Leuctra* , and the caddisflies *Glossosoma* , *Paranyctiophylax celta, Psychomyia flavida* , and *Setodes* .

Data Analysis

This site is located approximately two miles upstream of its confluence with Patterson Creek. In 1996, this site missed an Excellent bioclassification by two taxa (26 EPT taxa found). This site received an Excellent bioclassification in 2001 (39 EPT) and in 2006 (44 EPT).

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Cr	**SR 1890**	**07/26/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355545	804850	12-108-11	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	62.4	--	8	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	23.0
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	46
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**64**

Site Photograph

Substrate Sand, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/26/04	2004-135	19	54	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish and Smallmouth Bass

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- headwaters arise in the Brushy Mountains in southern Wilkes County, flows through northeastern Alexander and northwestern Iredell County; rural, no municipalities in the watershed; tributary to Patterson Creek. **Habitat** -- sandy runs, gravel/boulder/bedrock/shelf riffles, two good plunge pools; bank instability; very similar (habitats, substrate, clarity, and species) to Hunting and North Little Hunting creeks. **2004** -- pH reading was correct and verified; relatively low specific conductance; percentage of tolerant fish was moderate (33 percent) and included the Satinfin Shiner, White Sucker, Flat Bullhead, Redbreast Sunfish, and Green Sunfish; but five intolerant species were also present and included the Thicklip Chub, Fieryblack Shiner, Highback Chub, Smallmouth Bass, and Piedmont Darter; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
PATTERSON CR	**SR 1890**	**07/26/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-11-3	355527	804927

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	C	35.3	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	0

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

Water Quality Parameters

Temperature (°C)	25.5
Dissolved Oxygen (mg/L)	6
Specific Conductance (µS/cm)	61
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	15
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	97

Site Photograph

Substrate Boulder, Rubble, Silt, Bedrock, Gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9991	--	32	--	3.9	Excellent
07/23/01	8486	--	25	--	4.1	Good

Taxonomic Analysis

EPT taxa collected for the first time (at this site) in 2006 included the mayflies *Caenis, Epeorus rubidus, Hexagenia, Leucrocuta*, and *Pseudocloeon propinquum*, the stonefly *Leuctra*, and the caddisflies *Brachycentrus nigrosoma, Hydropsyche rossi, Neophylax oligius, Oecetis persimilis,* and *Rhyacophila fuscula*.

Data Analysis

Patterson Creek is a small tributary to Rocky Creek. It has been sampled on three prior occassions during winter and spring as part of Watershed Assessment Team (WAT) training. This site was added to the basinwide schedule in 2001 and has only been sampled twice as a basinwide site. In 2006, it rated Excellent, up from the Good rating it received in 2001. EPT taxa richness increased from 25 in 2001 to 32 in 2006. Since 2001 was a drought year, this may explain the increase in the number of EPT taxa collected.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Patterson Cr	**SR 1890**	**07/09/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355525	804924	12-108-11-3	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.4	--	7	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	20	5 (rural residential)

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

Water Quality Parameters

Temperature (°C)	20.7
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	68
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	3
Pool Variety (10)	10
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**57**

Site Photograph

Substrate Sand, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/09/04	2004-116	12	52	Good

Most Abundant Species Notchlip Redhorse

Exotic Species None

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- drains rural north-central Iredell County; no municipalities in watershed; a tributary to Rocky Creek, site is ~ 0.5 mile above mouth. **Habitat** -- channel filled with sediment; no riffles; long pools and sandy runs; open canopy. **2004** -- total species diversity and diversity of darters lower than expected; only one species of darter collected (Tessellated Darter); lots of biomass with large suckers (White Sucker, Notchlip Redhorse, and Brassy Jumprock); Rosyside Dace and Creek Chub represented only by young-of-year; sampled as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Olin Cr	**SR 1892**	**06/05/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	355639	805204	12-108-11-3-3	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	9.4	--	4	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	18.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	52
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	4
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**53**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/05/06	2006-74	10	44	Good-Fair
05/14/96	96-44	9	36	Fair

Most Abundant Species Bluehead Chub

Exotic Species Fathead Minnow

Species Change Since Last Cycle **Losses** -- Margined Madtom. **Gains** -- Highback Chub and Fathead Minnow.

Data Analysis

Watershed -- drains rural north-north central Iredell County; rural, no municipalities in watershed; small tributary to Patterson Creek. Habitat -- shallow sandy runs, stick and gravel riffles, snag pools; very turbid when walking in channel. **2006** -- low total species diversity; no suckers; moderately high percentage of omnivores+herbivores. **1996 and 2006** -- slight improvement observed; increase in the total number of fish collected; less dominance by the Bluehead Chub; consistently low total habitat scores and total species diversity; number of species known from site = 11; NCIBI score increased and rating improved to Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HUNTING CR	**NC 115**	**07/25/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
WILKES	6	03040102	12-108-16-(0.5)	360444	805839

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-III	29.8	16	0.3

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

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

Water Quality Parameters

Temperature (°C)	22
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	50
pH (s.u.)	6.3
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	10
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	72

Site Photograph

Substrate Gravel, Sand, Boulder, Rubble, Silt, Bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/25/06	9987	100	43	4.2	3.4	Excellent
07/30/01	8483	--	37	--	3.7	Excellent
06/16/92	5856	84	43	4.0	3.5	Excellent

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris, Epeorus rubidus, Isonychia, Stenonema modestum, Serratella deficiens, Acroneuria abnormis, Leuctra, Paragnetina immarginata, Perlesta, Brachycentrus nigrosoma, Cheumatopsyche, Chimarra, Dolophilodes, Neophylax oligius, Symphitopsyche sparna,* and *Triaenodes ignitus* .

Data Analysis

This site is located in southeastern Wilkes County near the Iredell County line. It has been sampled three times since 1992 and has always rated Excellent. A tributary with a heavy silt load is located just upstream of the bridge. During sampling in 2006, a plume of silt from this tributary was observed (see photo) even though there was no prior rain. Consequently, this heavy silt load has the potential to impact benthic habitats by filling in crevices where macroinvertebrates live and covering food supplies (i.e., algae on rocks).

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hunting Cr	**NC 115**	**06/22/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Wilkes	6	03040102	360444	805839	12-108-16-(0.5)	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	29.8	--	13	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	54
pH (s.u.)	5.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	2
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**56**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/22/06	2006-93	14	52	Good
05/03/01	2001-40	17	58	Excellent
05/15/96	96-48	16	56	Excellent
06/16/92	92-19	12	52	Good

Most Abundant Species Rosyside Dace

Exotic Species Smallmouth Bass

Species Change Since Last Cycle

Losses -- White Sucker, Notchlip Redhorse, V-lip Redhorse, Flat Bullhead, and Piedmont Darter. **Gains** -- Spottail Shiner (new record for creek) and Bluegill.

Data Analysis

Watershed -- drains the rural southeast corner of Wilkes County; stream flows parallel to NC 115 upstream of the sampling site; rural, no municipalities in watershed. Habitat -- eroding banks, shallow channel, seemed to have more silt in the creek than in 2001. **2006** -- number of fish and species, especially suckers and darters, lower than in 2001. **1992 - 2006** -- total habitat scores have varied from 49 to 68; specific conductance has gradually increased from 38 to 48 to 54 µS/cm since 1996; trophically no change; very stable metrics; total number of species known from site = 21; Bluehead Chub consistently the dominant species; NCIBI ratings fluctuate between high Good and high Excellent.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HUNTING CR	**SR 2115**	**09/11/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-16-(12)	360000	804444

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-IV	156.0	20	0.5

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

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

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	58
pH (s.u.)	6.2
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	57

Site Photograph

Substrate Sand, Silt, Rubble, Boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9994	85	34	5.8	4.4	Good
07/23/01	8481	74	31	5.1	4.2	Excellent
07/07/96	7153	66	30	4.7	3.3	Excellent
07/27/88	4665	72	27	5.4	4.1	Good
07/30/85	3609	79	33	4.9	3.7	Excellent

Taxonomic Analysis

Abundant taxa included *Pseudocloeon propinquum, Caenis, Hexagenia, Isonychia, Stenonema modestum, Brachycentrus nigrasoma, Nextopsyche exquisita, Ancyronyx variegatus, Argia, Boyeria vinosa, Macromia, Corydalus cornutus, Ablabesmyia mallochi, Polypedilum flavum,* and *P. illino* .

Data Analysis

This site is located about midway between the headwaters of Hunting Creek and its confluence with the South Yadkin River. The site has rated Excellent or Good since 1985. Although the bioclassification was down in 2006, the EPT taxa richness and total taxa richness was the highest ever recorded at this location. With the exception of 1996, the EPT Biotic Index has gradually increased since 1985 suggesting a slight decline in water quality. However, no major changes in the biological community were observed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N L HUNTING CR	**SR 1829**	**07/26/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
IREDELL	6	03040102	12-108-16-6	360113	804601

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Northern Inner Piedmont	WS-III	54.5	10	0.3

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

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

Water Quality Parameters

Temperature (°C)	22
Dissolved Oxygen (mg/L)	6.1
Specific Conductance (µS/cm)	55
pH (s.u.)	6.4
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	52

Site Photograph

Substrate Sand, Boulder, Rubble, Gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9989	87	30	5.2	4.6	Good
07/23/01	8480	--	31	--	4.1	Excellent
08/05/96	7145	--	28	--	3.7	Excellent

Taxonomic Analysis

EPT taxa that were not collected in 2006 but were common or abundant in 2001 include Heptagenia marginalis, Serratella serratoides, Stenacron pallidum, Polycentropus, and Pycnopsyche. Only one new taxon, *Baetis flavistriga* , a tolerant mayfly (TV=7.0), was collected in 2006.

Data Analysis

North Little Hunting Creek at SR 1829 is the most downstream bridge crossing before its confluence with Hunting Creek.The stream rated Excellent in 1996 and 2001. In 2006, EPT taxa richness decreased and the EPT Biotic Index increased resulting in a Good bioclassification rating.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Little Hunting Cr	**SR 1829**	**06/06/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Iredell	6	03040102	360113	804601	12-108-16-6	Northern Inner Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	54.5	--	9	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	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)	8.5
Specific Conductance (µS/cm)	66
pH (s.u.)	6.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	10
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	4
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**44**

Site Photograph

Substrate Sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/06/06	2006-77	16	44	Good-Fair
05/03/01	2001-41	21	50	Good
05/14/96	96-43	17	44	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species Smallmouth Bass; no exotics in 1996 or 2001.

Species Change Since Last Cycle

Losses -- Rosyside Dace, Whitefin Shiner, Highback Chub, Snail Bullhead, Tessellated Darter, and Piedmont Darter. **Gains** -- Smallmouth Bass (first record for creek; 235 and 236 mm total length).

Data Analysis

Watershed -- includes the southeast corner of Wilkes and southwest corner of Yadkin counties south of US 421; bisected by I-77; part of the catchment is in the Brushy Mountains of Wilkes County; lowermost crossing before confluence with Hunting Creek; rural, no municipalities in watershed. Habitat -- shifting sandy runs, side snags, large deadfalls on the sides, bedrock outcrops on left; extreme fluctuations in flows. **2006** -- decline in number of fish and species, especially darters; high percentage of omnivores+herbivores and tolerant fish; large specimens of Notchlip Redhorse, Smallmouth Bass, and Redbreast Sunfish. **1996 - 2006** -- consistently low total habitat scores (~40); specific conductance has gradually increased from 37 to 56 to 66 µS/cm since 1996; total number of species known from the site = 22; trophically no change, very stable metrics; Bluehead Chub consistently the dominant species (~50%); NCIBI ratings fluctuate between medium Good-Fair and medium Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bear Cr	**SR 1116**	**07/09/04**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davie	6	03040102	354932	803507	12-108-18-(1)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	29.1	--	6	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	0	25 (rural residential)

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

Water Quality Parameters

Temperature (°C)	23.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	150
pH (s.u.)	6.7

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

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

Site Photograph

Substrate Sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/09/04	2004-117	15	40	Fair

Most Abundant Species	Redbreast Sunfish	**Exotic Species**	Green Sunfish

Species Change Since Last Cycle	N/A; new site in 2004.

Data Analysis

Watershed -- drains west-central Davie County, including the western area of the Town of Mocksville; site is ~ 1 mile above confluence with the South Yadkin River. **Habitat** -- sandy runs, snag and tree pools; bank instability. **2004** -- total species diversity and diversity of darters lower than expected; only one species of darter was collected (Tessellated Darter); intolerant species were absent; percentage of tolerant fish was greater than expected (56 percent) and included the Satinfin Shiner, White Sucker, Brown Bullhead, Redbreast Sunfish, and Green Sunfish; lots of biomass with large suckers (White Sucker, Creek Chubsucker; Notchlip Redhorse, and Brassy Jumprock); sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
FOURTH CR	**SR 1003**	**07/26/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-20	354716	803848

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	74.3	22	0.4

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Fourth Creek WWTP	NC0031836	6.0

Water Quality Parameters

Temperature (°C)	25
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	163
pH (s.u.)	7.1
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Site Photograph

Substrate Boulder, Silt, Rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/26/06	9992	--	28	--	4.8	Excellent
09/11/01	8614	--	21	--	5.3	Good
07/24/01	8484	--	20	--	5.3	Good-Fair
08/06/96	7151	--	23	--	5.2	Good

Taxonomic Analysis

Abundant taxa included *Acentrella, Baetis flavistriga, Baetis intercalaris, Stenonema modestum, Cheumatopsyche, Hydropsyche betteini, Leucotrichia pictipes, Nectopsyche exquisita, Psychomyia flavida, Symphitopsyche sparna, and Triaenodes ignitus*. New taxa that had not been previously collected at this site include the mayflies *Baetis pluto* and *Procloeon*, the stoneflies *Neoperla* and *Paragnetina immarginata*, and the caddisflies *Hydropsyche venularis, Hydroptila, Oecetis persimilis*, and *Psychomyia flavida*.

Data Analysis

This site is located approximately 10 miles downstream of the Fourth Creek WWTP. EPT taxa richness and EPT Biotic Index were similar for the 1996 sample and the two 2001 samples suggesting stable water quality. Although the July 2001 sample rated Good-Fair, it was one taxa away from receiving a Good rating and the Biotic Index was identical to the September 2001 sample. In 2006, a significant increase in the number of EPT taxa and a decrease in the EPT Biotic Index occurred suggesting an improvement in water quality. According to the Mooresville Regional Office, Statesville lost some of their industrial wastewater contributors, which may have played a part in the improvement of the creek's overall water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Fourth Cr	**SR 1985**	**07/29/03**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354751	803610	12-108-20	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	80	--	14	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	0	50	25 (rural residential)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Statesville's Fourth Creek WWTP	NC0031836	4

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	7.4
Specific Conductance (µS/cm)	136
pH (s.u.)	7.3

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	0
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**43**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/29/03	2003-42	11	34	Poor
06/03/03	2003-19	8	26	Poor
05/02/01	2001-38	12	28	Poor
04/26/96	96-39	9	32	Poor

Most Abundant Species Bluehead Chub

Exotic Species Red Shiner, Fathead Minnow, Channel Catfish, and Spotted Bass

Species Change Since Last Cycle

Gains -- Fathead Minnow, White Perch, and Spotted Bass. **Losses** -- Eastern Silvery Minnow, Creek Chubsucker, Brown Bullhead, and Largemouth Bass.

Data Analysis

Watershed -- drains central Iredell and northwestern Rowan counties; City of Statesville is in the upper portion of the watershed; 12% of watershed is developed; 41% is cultivated; and 46% is forested. **Habitat** -- no riffles; side snags; good riparian zones and canopy, but eroding and "blown-out" banks; entrenched. **2003** -- few fish and species present, intolerant species absent; poor evidence of recruitment; Eastern Silvery Minnow and Common Carp represented only by young-of-year. **1996 - 2003** -- for a watershed of its size, the fauna is depauperate in the number of species and of individuals; intolerant specie absent; only 19 species are known from the site; of which 10 are tolerant species and 5 are nonindigenous; data were summarized in Biological Assessment Unit Memorandum F-20031006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
THIRD CR	**SR 1970**	**07/27/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-20-4	354603	803733

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	96.6	15	0.3

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Third Creek WWTP	NC0020591	4.0

Water Quality Parameters

Temperature (°C)	23
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	154
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	51

Site Photograph

Substrate Sand, Detritus

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/27/06	9993	70	24	5.5	4.4	Good
07/24/01	8490	52	22	5.2	4.4	Good
08/06/96	7149	56	23	4.9	4.4	Good
07/09/90	5369	62	23	5.6	4.2	Good

Taxonomic Analysis

EPT taxa richness has been nearly identical at this location since sampling commenced in 1990. Although total EPT taxa richness has not changed, there were a few intolerant EPT taxa collected at this location for the first time and included the mayflies *Acentrella parvula*, *Cercobrachys*, and *Pseudocloeon dardanum*.

Data Analysis

This site is located in the lower reach of the watershed approximately ten miles below Third Creek WWTP and five miles above the creek's confluence with Fourth Creek. EPT taxa richness and EPT Biotic Index have been nearly identical since 1990. Overall, these data suggest stable conditions in the Third Creek watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Third Cr	**SR 1970**	**05/11/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354603	803733	12-108-20-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	96.6	--	12	0.5	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Statesville's Third Creek WWTP	NC0020591	4

Water Quality Parameters

Temperature (°C)	17.5
Dissolved Oxygen (mg/L)	7.9
Specific Conductance (µS/cm)	149
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	1
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**56**

Site Photograph

Substrate Sand, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-44	10	32	Poor
05/02/01	2001-37	11	34	Poor
04/25/96	96-38	13	40	Fair

Most Abundant Species Bluehead Chub

Exotic Species Channel catfish, Green Sunfish, Yellow Perch

Species Change Since Last Cycle

Losses -- Common Carp, Satinfin Shiner; Whitefin Shiner; Fieryblack Shiner; Gizzard Shad; Largemouth Bass, and Tessellated Darter. **Gains** -- White Sucker, Notchlip Redhorse, Eastern Mosquitofish, Green Sunfish, Pumpkinseed, Bluegill, and Yellow Perch.

Data Analysis

Watershed -- drains southeast Alexander, central Iredell, including the southern edge of the City of Statesville, and northwest Rowan counties. WWTP with rare violations for dissolved oxygen, cadmium, and total suspended solids from June 2001 to June 2006 (BIMS query 12/14/2006). Habitat -- no riffles, logs in the current, side snags, fast flow; water still turbid three days after rains. **2006** -- fewest fish of any Piedmont/Mountain site; low diversity; no intolerant species; 1 of 3 Piedmont/Mountain sites with no darters; Redlip Shiner has never been collected at the site. **1996 - 2006** -- consistently low total habitat scores (~50); specific conductance variable (144 - 262 µS/cm); consistently very few fish and species, < 130 specimens have been collected in 3 attempts; consistently poor reproduction; total number of species known from site = 21, but none consistently collected except for Bluehead Chub, Channel Catfish, and Redbreast Sunfish.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N SECOND CR	**SR 1526**	**07/24/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21	354149	803642

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	63.3	7	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

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

Water Quality Parameters

Temperature (°C)	24
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	117
pH (s.u.)	6.6
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	2
Instream Habitat (20)	13
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	58

Site Photograph

Substrate Sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9984	--	18	--	5.0	Good-Fair
07/02/02	8856	61	17	6.7	5.4	Fair
07/24/01	8487	--	10	--	6.0	Fair
08/06/96	7152	--	16	--	4.8	Good-Fair

Taxonomic Analysis

The biological community collected in 2006 was almost identical to what was collected in 1996. Three new EPT taxa were collected in 2006: the mayfly, *Pseudocloeon frondale* and the caddisflies, *Lype diversa* and *Oecetis persimilis*.

Data Analysis

This is the most upstream site on North Second Creek. A sand mininig operation was located downstream of the bridge. In 1996, this site rated Good-Fair, it fell to Fair in 2001 and 2002, and increased back to Good-Fair in 2006. The lowest EPT taxa richness and highest EPT Biotic Index scores for this site were recorded in 2001 during the drought. In 2002, EPT richness increased from 10 to 17 and the EPT Biotic Index decreased from 6.0 to 5.4 indicating some improvement in water quality. In 2006, the site rated Good-Fair and had EPT richness and Biotic Index scores similar to that recored in 1996 suggesting that the stream had recovered from the drought.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Second Cr	**SR 1526**	**05/11/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	6	03040102	354149	803642	12-108-21	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	63.3	--	9	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	45	5 -- powerline corridor

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

Water Quality Parameters

Temperature (°C)	17.7
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	123
pH (s.u.)	6.4

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	6
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	**37**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-43	12	46	Good-Fair
05/02/01	2001-36	9	42	Good-Fair
04/25/96	96-37	13	40	Fair

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle **Losses** -- Striped Jumprock. **Gains** -- Eastern Mosquitofish, Green Sunfish, Bluegill, Largemouth Bass.

Data Analysis

Watershed -- drains rural eastern Iredell and western Rowan counties; includes northeast part of the Town of Mooresville. Habitat -- lowest habitat score of any fish site in 2006; one long sandy run with poor instream habitats; good canopy, but deeply entrenched; sand dipping operation below the bridge. **2006** -- two-thirds fewer fish than in 2001 but slight increases in the diversity of sunfish and percentage of insectivores; no species of suckers. **1996 - 2006** -- consistently low total habitat scores (22 - 50); specific conductance ~ 100 µS/cm; consistently very few species, total number of species known from site = 16; Redlip Shiner has never been collected at the site; Bluehead Chub has been the dominant species in 2001 and 2006; NCIBI ratings have ranged from high Fair to high Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
N SECOND CR	**US 70**	**07/24/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21	354305	803544

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	117.4	11	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	0	20

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Second Creek WWTP	NC0078361	0.03
Arteva Specialties	NC0004944	2.3

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	129
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	12
Bottom Substrate (15)	2
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	52

Site Photograph

Substrate Sand, Silt, Rubble, Boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9983	75	18	6.3	5.6	Good-Fair
07/02/02	8855	65	14	6.8	6.0	Fair
07/24/01	8492	66	16	6.8	6.1	Fair
08/07/96	7154	54	17	6.2	5.8	Good-Fair

Taxonomic Analysis

No major changes in the benthic community were observed. Abundant taxa included *Pseudocloeon propinquum, Stenonema modestum, Tricorythodes, Cheumatopsyche, Hydropsyche betteni, Hydroptila, Nextopsyche exquisita, Triaenodes ignitus, Ancyronyx variegatus, Macronychus glabratus, Boyeria vinosa, Gomphus, Ophiogomphus, Conchapelopia* group, *Polypedilum illinoense, P. scalaenum, Anopholes, Antocha* , and *Corbicula fluminea* .

Data Analysis

This is the most downstream site on North Second Creek approximately one half mile downstream of the confluence with Withrow Creek. It is also an ambient chemistry monitoring site. The outfall from Second Creek WWTP is located approximately 150 meters upstream of the bridge. This site rated Good-Fair in 1996, fell to Fair in 2001 and 2002, and increased back to Good-Fair in 2006. The lowest EPT taxa richness and highest Biotic Index scores for this site were recorded in 2001 and 2002 during the drought. Since the WWTP has not incurred any limit violations in the past five years, these low ratings appear to be more drought related than from WWTP effluent impacts. The Good-Fair rating in 2006 indicates some recovery since the drought.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
WITHROW CR	**SR 1547**	**07/24/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	6	03040102	12-108-21-3	354109	804152

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	29.0	7	0.1

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

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

Water Quality Parameters

Temperature (°C)	25
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	92
pH (s.u.)	6.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	2
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	55

Site Photograph

Substrate Sand, Gravel, Silt, Detritus

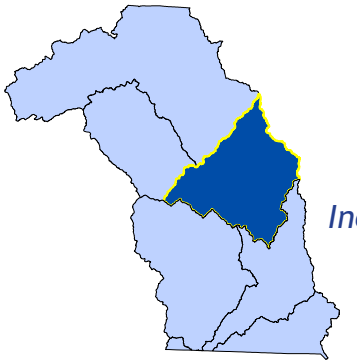
Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
07/24/06	9985	--	19	--	4.7	Good-Fair
07/25/01	8491	--	18	--	4.8	Good-Fair
08/07/96	7155	--	14	--	4.8	Good-Fair

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris, Isonychia, Stenonema modestum, Serratella deficiens, Tricorythodes, Cheumatopsyche* , and *Triaenodes ignitus* .

Data Analysis

Withrow Creek, a tributary to North Second Creek, was sampled at this location to assess the overall water quality of this portion of the North Second Creek watershed. This site has rate Good-Fair since 1996. Thus, no changes in water quality were observed. EPT taxa richness and EPT Biotic Index have been nearly identical since 1996.



Yadkin River

Subbasin HUC: 03040103

Includes High Rock Lake, Tucker Town Reservoir, Badin Lake and tributaries

Water Quality Overview

Of the monitored streams, 59 percent are supporting aquatic life, while 37 percent do not meet the standards and are rated as impaired. Of the monitored lakes, 37 percent are also impaired. These impairments closely follow population and land development patterns. Habitat degradation is the stressor that accounts for the largest percentage of stream impairments, while nutrient enrichment is negatively impacting the lakes. A major study is underway to develop a total maximum daily load for High Rock Lake to identify possible nutrient reduction actions.

Watershed at a Glance

Counties

Davidson, Forsyth, Guilford, Montgomery, Rowan, Randolph, Stanly

Municipalities

High Point, Thomasville, Randleman, Lexington, Spencer, East Spencer, Salisbury, Granite Quarry, China Grove, Rockwell, Denton, Asheboro

Permitted Facilities

NPDES WWTP:	
Major	10
Minor	39
NPDES Nondischarge:	22
NPDES Stormwater:	
General	184
Individual	11
Phase II	6
Animal Operations:	42

Stream Summary

Total Streams:.....787mi
.....31,523 ac
Total Monitored:.....328 mi
.....30,975 ac
Total Supporting:.....192 mi
.....12,783.3 ac
Total Impaired.....119.8 mi
.....11,344.6 ac
Total Not Rated: .....16.1 mi
.....6,847 ac
Total No Data:.....458.4 mi
..... 548.3 ac

General Description

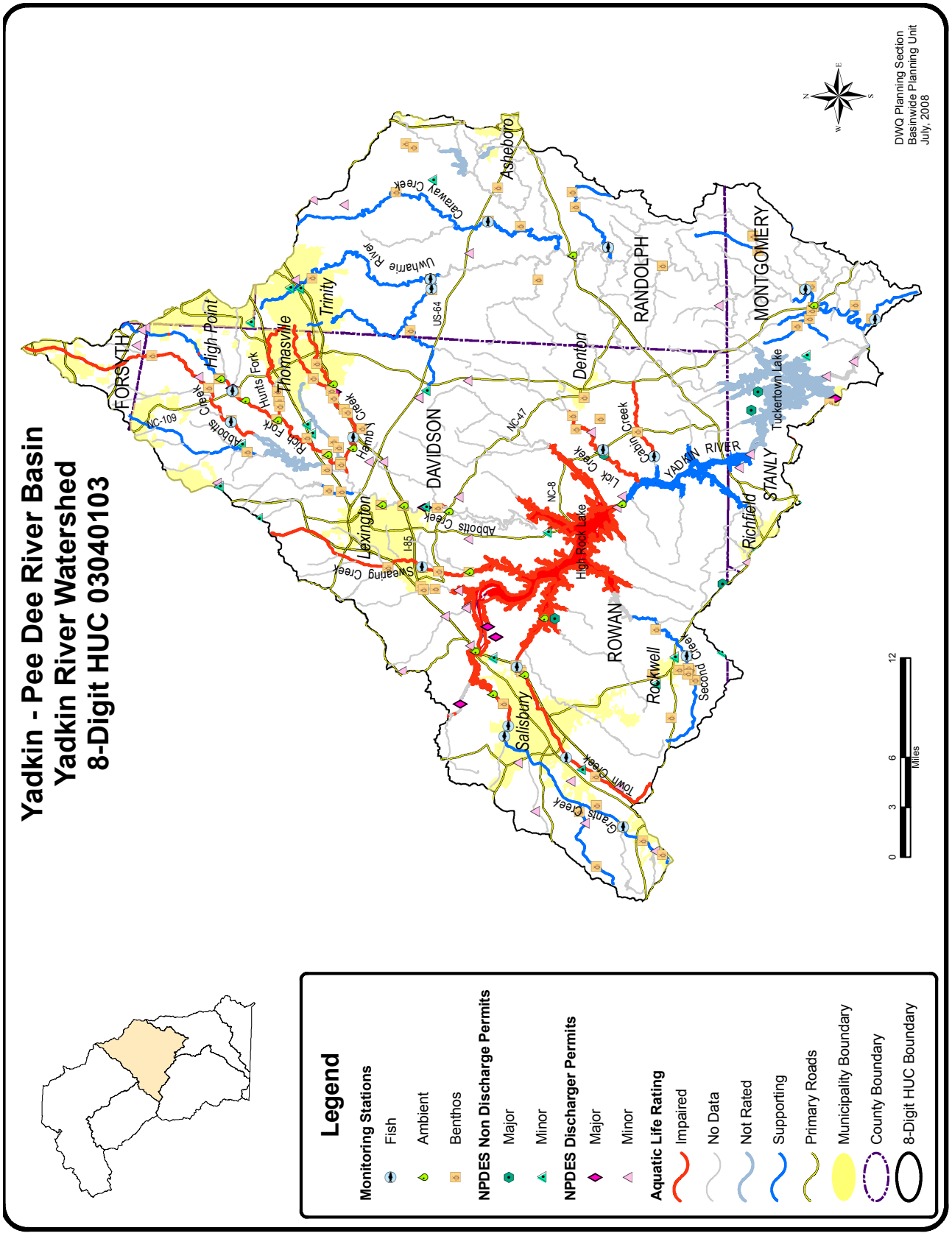
The Yadkin River Watershed is roughly bounded on the north by High Point, Thomasville, Lexington and Salisbury. The drainage contains High Rock Lake, Tuckertown Reservoir, and Badin Lake. Major tributaries include Abbotts Creek and the Uwharrie River. Much of the eastern portion drains the relatively undeveloped area forming the Uwharrie National Forest. Most of the streams in this watershed are located in the Carolina Slate Belt portion of the piedmont ecoregion. These streams usually have a rocky substrate and may experience very low flow during drought conditions. Agricultural land use affects most streams outside of the urban areas.

The Abbotts Creek watershed starts just south of Kernersville and flows south through Lexington and empties into High Rock Lake. Smaller streams in the watershed are Rich and Hunts Forks and Swearing and Hamby Creeks, which drain High Point, Thomasville, and the west side of Lexington. This watershed is located primarily in Davidson County and is bisected by the industrial and commercial US 64 and I-85 corridors. This area has easily eroded soils. Consequently, streams in areas of urban or agricultural land use are affected by sediment inputs, and have large amounts of coarse sand.

The largest municipalities in the subbasin are Lexington, Thomasville, and Highpoint. The largest discharger is the City of High Point's WWTP with a permitted flow of 6.2 MGD into Rich Fork. Other large municipal WWTP dischargers are Thomasville (4 MGD to Hamby Creek) and Lexington (5.5 MGD to Abbotts Creek).

The upper Uwharrie River watershed, primarily in Randolph County, includes portions of the municipalities of High Point, Thomasville, Archdale, Randleman, and Asheboro. The lower portion of the watershed, in southern Randolph and northwestern Montgomery counties, is within the Uwharrie National Forest. Most of the subbasin is forested or used for agriculture. The Uwharrie River is within the piedmont Carolina Slate Belt ecoregion, but some tributaries draining the Uwharrie Mountains have montane characteristics. Certain geological subdivisions of the Carolina Slate Belt appear to have ecological significance. The sandiest streams were observed in the northern portion of the subbasin. More rocky streams were observed in the southern portion of the watershed.

Figure 3-1. Yadkin River HUC 03040103



How to Read this Document

This document was written to correspond with our new *Online Geographic Document Distribution* tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add *http://web.ceo.ncsu.edu/basinplans/dwq.kml* to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The *Use Support* report provides information on how and why water quality ratings are determined and DWQ's "*Redbook*" describes in detail water quality standards for each waterbody *classification*. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality *Plans*"

Figure 3-1. shows monitoring station locations and impaired streams for the Yadkin River subbasin.
Appendix A. provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C. provides summaries of biological and fish assessment monitoring sites.

Current Status and Significant Issues

General Biological Health

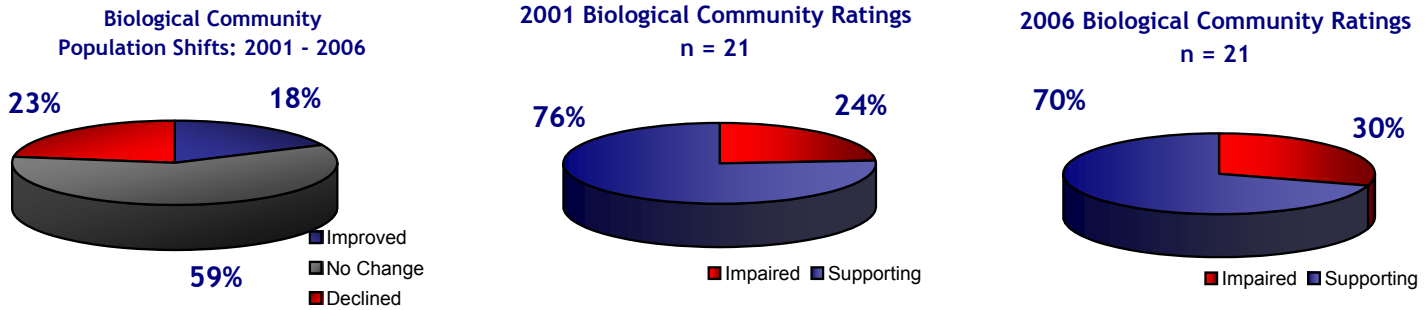
Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006 (Figure 3-1).

Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

Leonards Creek (Davidson County), previously sampled as a basinwide site was not sampled in 2006 due to low flow conditions. Similarly, Rich Fork at Davidson County SR 2005 was not sampled for benthos during 2006 due to excessive depth caused by operations of sand-dipping operations. It is likely that the latter site will therefore be discontinued.

Figure 3-2. Biological Health Summary



Overall, the basinwide sampling effort in the HUC 03040103 increased by 23 percent. The percentage of Impaired streams increased by 6 percent.

Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006. Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle. In these conditions, nonpoint source pollution impacts are generally reduced while point source pollution has a more significant impact.

Special Studies

UT Second Creek

This stream (near Dutch Creek Rd) in Rowan County was sampled in January 2002 for possible removal from the 303(d) list of impaired water. This creek was the former site of the Town of Rockwell's WWTP. The WWTP ceased discharging into UT second creek in 1996. Both upstream and downstream segments were rated Not Impaired. (BAU memo B-020328)

Town Creek

A TMDL study was done on Town Creek in June 2004 to characterize the possible stressors impacting the stream. Urban impacts from upstream were characterized as a major cause of degraded water quality. (BAU memo B-040916) The stream was sampled again in September 2006 for possible removal from the impaired streams list. Located below an inactive WWTP outfall in Spencer, NC, it was determined the stream remains impacted. (BAU memo B-070129a)

Second Creek

Second Creek in Rowan County was sampled in September 2006 to document and characterize the water quality before animal operations are expanded in its watershed. The stream was found to be relatively unimpacted at SR 2370. (BAU memo B-070129a)

Little Creek

Little Creek in Rowan County was sampled in September 2006 for possible removal from the impaired streams list. It was discovered that the stream was erroneously put on the 303(d) list. Little Creek has never been sampled for fish; and benthic sampling in 1990 resulted in a Not Impaired rating. The stream was assigned a Good-Fair bioclassification as a result of the 2006 benthic collections and is categorized as impacted because of habitat degradation, but it is not impaired.

Fish Community Urbanization Study

Grants Creek at SR 1506 and at SR 1910, and Second Creek at SR 2338 in Rowan County, as well as Swearing Creek at SR 1104 (Davidson County), were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data).

Swearing Creek, NC 47, Davidson County

This site was resampled in 2002 to determine whether the stream should be placed on North Carolina's 303(d) list. This site received a Fair rating, which verified the Fair rating it received in 2001. (BAU Memo B-021001) The stream is rated as impaired with habitat degradation and low dissolved oxygen as the stressors to its aquatic life.

Hamby Creek TMDL Stressor Study

A TMDL stressor study was conducted at seven sites in the Hamby Creek watershed in Davidson County in May 2003. Results of this study suggest that the cause of impairment in Hamby Creek appears to be chemical and/or physical

pollutants in the form of toxic chemicals from urban runoff and nutrient inputs. (BAU Memo B-031016)

Planning Section Requests

Three additional benthic sites were requested by the Planning Section for sampling in 2006. Samples from these streams were needed to see if impairment is still warranted. Hunts Fork at SR 1787 and Rich Fork at SR 1755 are on North Carolina's 303d impaired streams list. In 2006, Hunts Fork received a Fair rating, Rich Fork was rated Good-Fair and Hamby Creek at SR 2025 received a Poor bioclassification. (BAU Memorandum B-061114)

Abbotts Creek, SR 1735, Davidson County

At the request of Winston-Salem Regional Office, Abbotts Creek was sampled near the Davidson/Wilkes County line to provide baseline data prior to construction of a Dell computer plant. This site was borderline Good-Fair/Good. (BAU Memo B-061114)

Yadkin TMDL Stressor Study

A TMDL stressor study was conducted at eight sites in Subbasin 03-07-07 (Davidson County) in May and September 2006. Overall, five of the sites received Good-Fair ratings, two received Fair ratings (Abbotts Creek at SR 1243, Hamby Creek at SR 2017) and one received a Poor rating (Hamby Creek at SR 2025). (BAU Memo B-060108)

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. (BAU MemoB-040212)

Uwharrie River

A site on the Uwharrie River at NC 109 was sampled in March 2005 by both DWQ and Duke Energy biologists as a quality assurance measure comparing methods of both groups.

Uwharrie River EEP Study

Per a request received by the Biological Assessment Unit (BAU) from Ecosystems Enhancement Program (EEP) staff, seven benthos sites were sampled in May 2006. The reference site, Barnes Creek received a bioclassification of Excellent; five study sites earned bioclassifications of Good (Uwharrie River at SR 1406 and SR 1564, Little Uwharrie River at SR 1405, Brier Creek at SR 1402, and Caraway Creek at SR 1524 and one site, Caraway Creek at Randolph SR 1331), earned a bioclassification of Good-Fair.

Habitat Degradation

Many streams in this subbasin are impaired or impacted by habitat degradation. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in this region make streams highly vulnerable to these stressors.

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMPs***, ordinance/rule changes at the local, state, and federal levels, volunteer activism, and education programs. Figure 3-3 illustrates a general process for ***developing watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. DWQ has begun such a process in Grants Creek. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

FIGURE 3-3

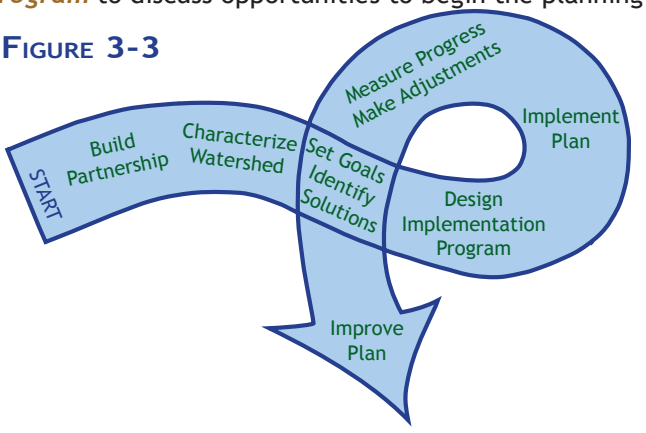


Table 3-2. Monitored Streams Impaired and Impacted by Habitat Degradation

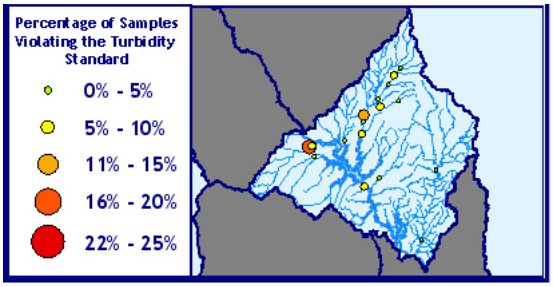
Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Potential Source	Miles
12-119-(1)	Abbotts Creek	03-07-07	WS-III	X		Stormwater Runoff	18.8
12-119-(6)	Abbotts Creek	03-07-07	C	X		Stormwater Runoff	8.0
12-119-5-(1)	Brushy Fork	03-07-07	WS-III		X	Stormwater Runoff	9.5
12-127-(2)	Cabin Creek	03-07-08	WS-IV	X		Impoundment	5.8
						Natural Conditions	
12-110a	Grants Creek	03-07-04	C		X	Stormwater Runoff	19.7
					X	General Agriculture/Pasture	
12-110b	Grants Creek	03-07-04	C		X	Stormwater Runoff	1.2
					X		
12-119-7-4	Hamby Creek	03-07-07	C	X		Impoundment	11.1
						Impervious Surface	
12-110-3	Little Creek	03-07-04	C		X	General Agriculture/Pasture	6.5
12-119-7a	Rich Fork	03-07-07	C		X	Impervious Surface	8.5
					X	General Agriculture/Pasture	
12-119-7b	Rich Fork	03-07-07	C	X		Stormwater Runoff	12.1
12-117-2	Second Creek	03-07-04	C		X	Industrial Site	13.5
12-113	Swearing Creek	03-07-07	C		X	Stormwater Runoff	14.4
12-115-3	Town Creek	03-07-04	C	X		Impervious Surface	15.4
13-2-(0.5)	Uwharrie River	03-07-09	WS-III		X	Stormwater Runoff	18.3
						Total	**162.8**

Ambient Water Quality

Turbidity

Turbidity violations are common throughout hydrologic unit 03040103 (Figure 3-4). Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at many of the biological sample sites in this hydrologic unit. Turbidity concentrations have trended downward over the last assessment cycle. The exact cause of this decline cannot be determined, but it is likely a combination of reduced runoff due to drought and implementation of agriculture BMPs.

Figure 3-4. Turbidity Violations



Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. Impervious surfaces and stormwater runoff appear to be driving the turbidity problems in this hydrologic unit. This trend is seen by comparing turbidity violations (Figure 3-4) to human population concentrations (Figure 3-6). Soils in this area are highly erodible and the increased volume and intensity of stormwater runoff from urbanizing watersheds cause significant streambank erosion. As stream velocity slows, the eroded soils are deposited on the streambed. As a result, huge sediment deposits are developing in the backwaters of High Rock Lake. The deposits restrict boat navigation, threaten water supply intakes, and may increase the damage caused by flooding. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas***.

To appropriately address turbidity and sediment problems in the Yadkin River hydrologic unit, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. Much of this assessment will be addressed through the development of a High Rock Lake TMDL. In the meantime, all

reasonable efforts to reduce or eliminate human sources of erosion should be implemented immediately. These efforts can be organized by developing watershed restoration plans based on the process outlined in Figure 3-3. Plans are needed for each watershed listed below.

Table 3-3. Monitored Streams Impaired and Impacted by Turbidity

Assessment Unit	Name	Subbasin	Class	Impaired	Impacted	Source	Length/ Area	Units
12-119-(6)	Abbotts Creek	03-07-07	C	X		Stormwater Runoff	8.0	Miles
						Agriculture/Pasture		
12-118.5b	Abbotts Creek Arm of High Rock Lake	03-07-07	WS-V;B	X		Stormwater Runoff	5.9	Miles
12-110a	Grants Creek	03-07-04	C		X	Construction	19.7	Miles
						MS4 NPDES		
						WWTP NPDES		
12-110b	Grants Creek	03-07-04	C	X		Agriculture/Pasture	1.2	Miles
						MS4 NPDES		
						WWTP NPDES		
12-(108.5)b	YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)	03-07-04	WS-V	X		Stormwater Runoff	5,569	Acres
						Total	**34.8**	**Miles**
						Total	**5,569**	**Acres**

Fecal Coliform Bacteria

Fecal Coliform concentrations often exceeded 400 colonies/100ml in the Yadkin River Watershed (Figure 3-5). The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste. Fecal coliform concentrations trended downward over the last assessment cycle. The exact cause of this decline cannot be determined, but it is likely a combination of reduced runoff due to drought, implementation of agricultural BMPs, and sewer infrastructure improvements. However, concentrations remain elevated and further work remains to be done. Additional funds will be necessary to continue implementing these improvements.

Figure 3-5. Fecal Coliform Bacteria Violations

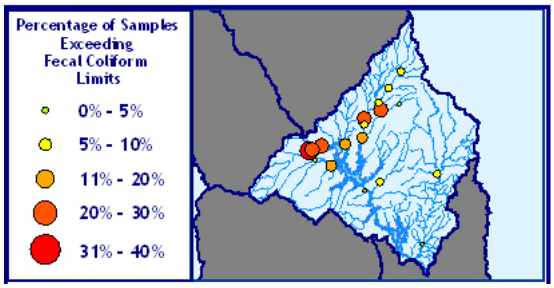


Table 3-4. Monitored Streams Impaired and Impacted by Fecal Coliform

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
12-119-(6)	Abbotts Creek	03-07-07	C		X	Stormwater Runoff	8.0
						Agriculture/Pasture	
12-110b	Grants Creek	03-07-04	C		X	Stormwater Runoff	1.2
12-119-7-4	Hamby Creek	03-07-07	C		X	Failing Septic Systems	11.1
						MS4 NPDES	
						WWTP NPDES	
12-119-7a	Rich Fork	03-07-07	C	X		Failing Septic Systems	8.5
						Natural Conditions	
						Agriculture/Pasture	
						MS4 NPDES	
						WWTP NPDES	

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
12-119-7b	Rich Fork	03-07-07	C		X	MS4 NPDES	12.1
						WWTP NPDES	
						Agriculture/Pasture	
						Failing Septic Systems	
						Total	41.0

Nutrient Enrichment

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as "nutrients." Nitrogen compounds include ammonia-nitrogen (NH3-N), total Kjeldahl nitrogen (TKN) and nitrite+nitrate nitrogen (NO2+NO3-N). Phosphorus is measured as total phosphorus. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes, or runoff from urban or agricultural land, the excessive growth of algae (algal blooms) and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form NH4OH, a form toxic to fish and other aquatic organisms.

High Rock Lake is impaired by nutrient related stressors. The majority of the lake is demonstrating the symptoms described above. DWQ and many local stakeholders are involved in the development of a TMDL that will address these impacts. Implementation of this TMDL will be difficult and costly. Local governments and citizens at large should begin implementing measures to reduce nutrient loads to High Rock Lake immediately.

Table 3-5. Impaired or Impacted Waters by Stressors Indicating Nutrient Enrichment

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Stressor	Source	Length/ Area	Units
12-118.5	Abbotts Creek Arm of High Rock Lake	03-07-07	WS-V;B	X		Chlorophyll a	Stormwater Runoff	9.6	Miles
						High pH			
1 3 - 2 - 3 - 3 - (0.7)	Back Creek (Back Creek Lake)	03-07-09	WS-II;		X	Chlorophyll a	Stormwater Runoff	0.6	Miles
						Nutrient Impacts			
12-119-7-4	Hamby Creek	03-07-07	C		X	Nutrient Impacts	WWTP NPDES	11.1	Miles
12-126-(3)	Lick Creek	03-07-08	WS-IV		X	Nutrient Impacts	WWTP NPDES	7.1	Miles
12-126-(3)	Lick Creek	03-07-08	WS-IV	X		Low Dissolved Oxygen			
12-119-7b	Rich Fork	03-07-07	C		X	Low Dissolved Oxygen	Stormwater Runoff	12.1	Miles
12-117-(3)	Second Creek Arm of High Rock Lake	03-07-04	WS-IV; B	X		High pH	Stormwater Runoff	894.9	Acres
						Chlorophyll a			
12-113	Swearing Creek	03-07-07	C		X	Low Dissolved Oxygen	Stormwater Runoff	14.4	Miles
12-115-3	Town Creek	03-07-04	C	X		Nutrient Impacts	MS4 NPDES	15.4	Miles
							WWTP NPDES		
13-2-3-3-2-2-(2)	Unnamed Tributary to Cedar Fork Creek (Lake Bunch)	03-07-09	WS-II;		X	Chlorophyll a	Unknown	0.6	Miles
12-(114)	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B	X		Chlorophyll a	Stormwater Runoff	4,870.1	Acres
				X		High pH	Stormwater Runoff		
12-(124.5)a	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B,CA	X		Chlorophyll a	Stormwater Runoff	10.8	Acres
				X		High pH	Stormwater Runoff		

12-(124.5)b	YADKIN RIVER (including upper portion of Tucktertown Lake)	03-07-04	WS-IV; B,CA		X	Low Dissolved Oxygen	Impoundment	3.5	Miles
12-(108.5)b	YADKIN River (including upper portion of High Rock Lake below normal operating level	03-07-04	WS-V	X		Chlorophyll a	Stormwater Runoff	5,568.8	Acres
							Total	**74.4**	**Miles**
							Total	**11,344.6**	**Acres**

Table 3-6. Monitored Streams Impaired and Impacted by Other Stressors

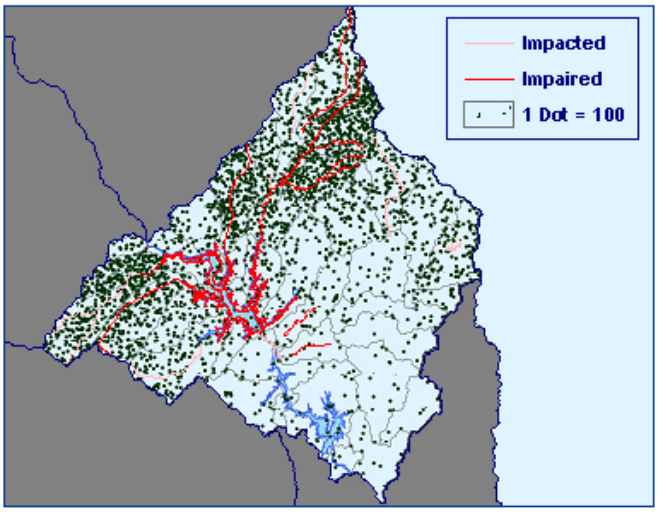
Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Stressor	Source	Length/ Area	Units
12-119-7-4	Hamby Creek	03-07-07	C	X		Toxic Impacts	Stormwater Runoff	11.1	Miles
12-119-7-4-1	North Hamby Creek	03-07-07	C	X		Toxic Impacts	Stormwater Runoff	5.8	Miles
12-117-(3)	Second Creek Arm of High Rock Lake	03-07-04	WS-IV; B		X	Temperature	Natural Conditions	894.9	Acres
							Impoundment		
12-115-3	Town Creek	03-07-04	C	X		Toxic Impacts	Stormwater Runoff	15.4	Miles
12-(114)	YADKIN RIVER (including lower portion of High Rock Lake)	03-07-04	WS-IV; B		X	Temperature	Impoundment	4,870.1	Acres
							Total	32.3	Miles
								5,765.0	Acres

See: *Yadkin Ambient Monitoring System Report* and *Yadkin Basinwide Assessments* for more information regarding specific monitoring sites.

Population and Land Use

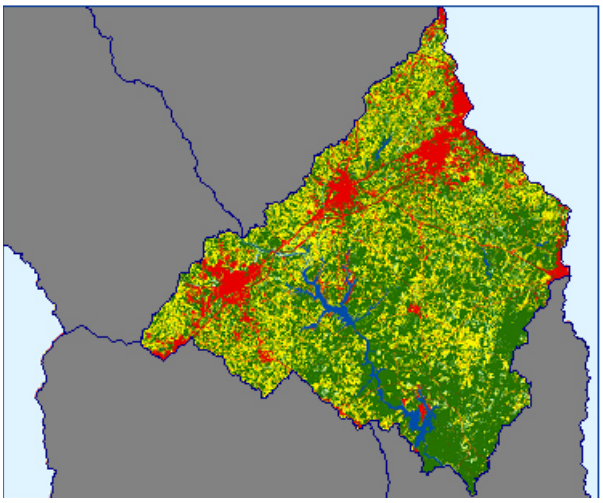
Population distribution and land use patterns are highly variable in this hydrologic unit. Land use varies from generally undisturbed in the southeastern portion to decidedly urban in the northern portion of the watershed around the I-85 corridor. The population distribution closely follows this pattern. The highest population densities are located around Thomasville, Lexington, and Salisbury. The agricultural and forested regions in the southeastern part of the watershed have much lower population densities.

Figure 3-6. Population Density in 2000



Stream impacts closely follow the population density and land use patterns. They are more common in agriculture areas than in the forested headwaters and most concentrated in the urban centers (Figure 3-6 & 3-7). Development pressure is increasing around the lake shoreline and urban centers. Research suggests that streams begin to degrade when watershed imperviousness reaches 10 percent of the total land area. DWQ's own data indicates degradation may begin at even lower levels of imperviousness. These trends demonstrate the importance of *protecting and conserving stream buffers and natural areas.*

Figure 3-7. Land Use in 03040103



TMDLs

A TMDL or **Total Maximum Daily Load** is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

A TMDL provides a detailed water quality assessment that provides the scientific foundation for an implementation plan. An implementation plan outlines the steps necessary to reduce pollutant loads in a certain body of water to restore and maintain human uses or aquatic life. Plan implementation is usually voluntary. The development of TMDL implementation plans is often the best method to improve water quality. The following TMDLs have been completed in the Yadkin River hydrologic unit and should be adopted by all residents and local governments within the watershed. Allocations defined in these TMDLs will be incorporated into water quality permits as appropriate.

Table 3-7. Finalized TMDLs in the Yadkin River Watershed

Waterbody	Pollutant	Link	Final TMDL Date
Grants Creek	Fecal Coliform	*Final TMDL*	Sept. 27, 2002
Fourth Creek	Fecal Coliform	*Final TMDL*	Dec. 19, 2001
Rich Fork and Hamby Creeks	Fecal Coliform	*Final TMDL*	Apr. 28 , 2004

High Rock Lake TMDL

High Rock Lake is impaired due to violations of the turbidity and chlorophyll *a* standards. Therefore, DWQ has initiated a TMDL development process for the lake. As discussed above, turbidity and sedimentation are a significant water quality issue in this hydrologic unit. Much of the sediment and nutrient inputs arrive from upstream via the Yadkin and South Yakin hydrologic units. The sediment generated in these hydrologic units contributes directly to the water quality impairment observed in High Rock Lake. In addition to sediment, runoff from these hydrologic units delivers substantial nutrients to High Rock Lake that lead to chlorophyll *a* violations. Residents and government agencies in the Yadkin River Headwaters should be active in the TMDL development process for the lake and continue implementing nonpoint source pollution reduction strategies.

Local Initiatives

Cooperative Conservation Partner Initiative

The Cooperative Conservation Partnership Initiative (*CCPI*) is a voluntary program established to foster conservation partnerships that focus technical and financial resources on conservation priorities in watersheds of special significance. See the ***Rapid Watershed Assessment*** completed for the Yadkin River subbasin for more information.

Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made some investments in the Yadkin River Hydrologic Unit. Figure 3-8 shows the distribution of projects to date in the watershed and Table 3-9, at the end of this document, includes a list of projects and their cost. These projects include land acquisitions and capital improvements to wastewater and stormwater infrastructure.

Figure 3-8. CWMTF Projects

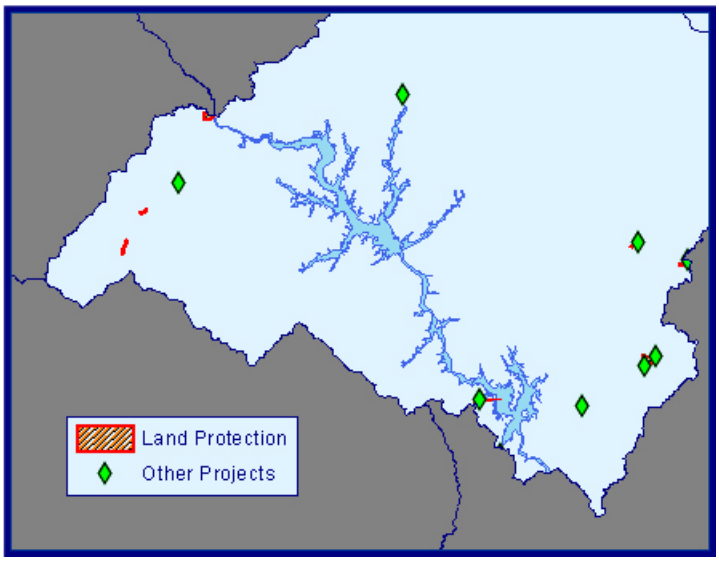


Table 3-9. CWMTF Funded Projects (9/1/2001-8/31/2006)

Project Number	Application Name	Proposed Project Description	Amount Funded
2001A-010	Environmental Impact RC&D- Camp Barnhardt BSA/Badin Lk Land Acq	Purchase a permanent conservation easement of 142 acres on Badin Lake. Proceeds from the sale of the easement will be used to replace a failing septic tank system at the existing Boy Scouts Camp. Includes an additonal 142 acres in donated CE.	$708,000
2002A-012	LandTrust for Central North Carolina- Acq/ Poison Fork & Barnes Cr.	Acquire 235 acres through fee simple purchase along Poison Creek and its tributaries. CWMTF would fund purchase of 64% of the tract.	$200,000
2004B-019	LandTrust for Central North Carolina- Acq/ Uwharrie Farms Conservation Project, Uwharrie River	Protect through a permanent conservation easement 120 ac of farmland along the Uwharrie River. CWMTF funds to purchase a working forest easement on the riparian 26 acres and upland 94 ac to be managed under federal Farm & Ranchland Preservation Program.	$150,000
2004B-511	Lexington, City of - WW/ Reclaimed Wastewater, Abbotts Creek	Design, permit & construct a 0.3 MGD wastewater treatment facility to "scalp" wastewater from an existing outfall, treat to reuse standards, & irrigate a golf course on a seasonal basis. Project will reduce total discharge to Abbotts Ck & High Rock Lake.	$1,206,000
2005B-601	Handy Sanitary District - Septic/ Failing On-Site Systems and Decommissioning of WWTPs, Badin Lake	Install a low pressure wastewater collection system (~50 mi. of line) along shores of Badin Lake to serve 2,100 residences (including many failing septic systems). Decommission two land application treatment facilities and pump waste to Troy's WWTP.	$3,000,000
This list does not include: regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.			

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 5 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining seventy percent is made available through a competitive grants process.

319 grant funds have been allocated to support the High Rock Lake TMDL. No other 319 projects have been awarded in this watershed. Any of the impaired streams listed above are candidates for 319 funding. Interested parties should contact the ***Basinwide Planning Program*** to discuss potential projects.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Yadkin River Hydrologic Unit. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 3-7 shows the number of projects implemented and in the Yadkin River Hydrologic Unit and the dollar amount invested. Table 3-8 shows the water quality benefits realized from that investment.

Table 3-7. ACSP Project Expenditures In the Yadkin Hydrologic Unit

	Erosion Reduction/ Nutrient Loss Reduction in Fields		Sediment/Nutrient Delivery Reduction from Fields		Stream Protection from Animals			Proper Animal Waste Management		
12-digit HU	Total Implemented	Cost	Total Implemented	Cost	Total Implemented		Cost	Total Implemented		Cost
030401030100	98.1 ac.	$14,444			131.5 units	9,760 LF	$88,597	1 unit		$10,000
030401030200	372.1 ac.	$31,316	663.9 ac.	$11,950	16 units	9,585 LF	$32,613	2 units		$11,546
030401030300	202.39 ac.	$24,688			26 units	14,265 LF	$67,440	1 unit		$2,967
030401030400	101.1 ac.	$9,595			1 unit		$6,906	3 units		$62,276
030401030500	136.7 ac.	$17,039						7 units		$144,536
030401030501										
Total		$97,082		$11,950			$195,556			$231,325

Table 3-8. NC ASCP Water Quality Benefits

	Water Quality Benefits				
	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401020100	633	9,745	1,988	5,580	1,980
030401020101	3,368	48,815	54,288	15,016	12,994
030401020200	1,968	6,690	3,148	648	548
030401020300	2,167	9,560	5,577	80,840	102,160
030401020400	253	12,566	12,566	146,973	177,941
030401020500					
Total	8,389	87,376	77,567	249,057	295,623

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

Appendix A

Use Support Ratings for All Monitored Waterbodies in Yadkin River Subbasin

HUC-03040103

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-119-(1)	**Abbotts Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	2008	5
From source to a point 0.5 mile upstream of Davidson County SR 1810			Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III	03-07-07	18.8 FW Miles								
12-119-(6)a	**Abbotts Creek**			Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From upstream side of culvert at U.S. Hwys. 29 & 70 to SR1243				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2004	4s
C	03-07-07	6.4 FW Miles		Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
12-119-(6)b	**Abbotts Creek**			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2004	5
From SR1243 toI85				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
C	03-07-07	1.6 FW Miles								
12-119-(4.5)	**Abbotts Creek (including Lexington-Thomasville Water Supply Reservoir at normal reservoir elevation, Tom-A-Lex Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
From a point 0.5 mile upstream of Davidson County SR 1810 to the upstream side of culvert at U.S. Hwys. 29 & 70										
WS-III;CA	03-07-07	2.3 FW Miles								
12-118.5a	**Abbotts Creek Arm of High Rock Lake**			Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
From source at I-85 to NC 47				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-V,B	03-07-07	3.7 FW Miles								
12-118.5b	**Abbotts Creek Arm of High Rock Lake**			Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
From NC 47 to Davidson County SR 2294				Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
WS-V,B	03-07-07	5.9 FW Miles		Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
13-2-3-3-(0.7)	**Back Creek (Back Creek Lake)**		**Chlorophyll a**	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
From a point 1.0 mile downstream of Randolph County SR 1504 to dam at Back Creek Lake (City of Asheboro water supply intake)			**Nutrient Impacts**	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
WS-II;HQW,CA	03-07-09	0.6 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-2-18-(2.5)	**Barnes Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From a point 0.2 mile upstream of Montgomery County SR 1303 to Uwharrie River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV;ORW	03-07-09	0.8 FW Miles								
13-2-5	**Betty McGees Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Uwharrie River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
C	03-07-09	9.4 FW Miles								
13-2-1-1	**Brier Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Little Uwharrie River										
WS-III	03-07-09	5.8 FW Miles								
12-119-5-(1)	**Brushy Fork**		**Habitat Degradation** Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Buck Branch										
WS-III	03-07-07	9.5 FW Miles								
12-127-(2)	**Cabin Creek**		**Habitat Degradation** Impoundment Natural Conditions	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From N.C. Hwy. 109 to a point 0.1 mile downstream of Davidson County SR 2536										
WS-IV	03-07-08	5.8 FW Miles								
13-2-3	**Caraway Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Uwharrie River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-09	26.4 FW Miles								
13-2-24	**Dutchmans Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Uwharrie River										
WS-IV	03-07-09	4.9 FW Miles								
12-110a	**Grants Creek**		**Habitat Degradation** **Turbidity** Construction MS4 NPDES WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to SR 1910										
C	03-07-04	19.7 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-110b	**Grants Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	1998	4a
From SR 1910 to Yadkin River			**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
C	03-07-04	1.2 FW Miles	**Turbidity**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
			General Agriculture/Pasture	Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
			MS4 NPDES							
			WWTP NPDES							
12-119-7-4	**Hamby Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Not Rated	Potential Standards Violation	Copper-Historic Listing	1998	1998	3a
From source to Rich Fork			Failing Septic Systems	Aquatic Life	Not Rated	Data Inconclusive	Nutrients-Historic Listing	1998	1998	3a
C	03-07-07	11.1 FW Miles	MS4 NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
			WWTP NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
			Habitat Degradation	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
			Impervious Surface							
			Impoundment							
			Nutrient Impacts							
			WWTP NPDES							
			Toxic Impacts							
			Stormwater Runoff							
12-119-7-3	**Hunts Fork**			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
From source to Rich Fork										
C	03-07-07	7.1 FW Miles								
12-119-7-4-2	**Jimmys Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2003		3a
From source to Hamby Creek										
C	03-07-07	6.8 FW Miles								
12-119-8-(3)	**Leonard Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
From dam at City Lake Lexington to Abbotts Creek										
C	03-07-07	2.6 FW Miles								
12-126-(3)	**Lick Creek**		**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From East Branch Lick Creek to a point 1.0 mile upstream of Davidson County SR 2501			WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
			Nutrient Impacts	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	5
WS-IV	03-07-08	7.1 FW Miles	WWTP NPDES	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-126-(4)	**Lick Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 1.0 mile upstream of Davidson County SR 2501 to Tuckertown Lake, Yadkin River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
WS-IV;CA	03-07-08	0.7 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	5
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-110-3	**Little Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Grants Creek			General Agriculture/Pasture							
C	03-07-04	6.5 FW Miles								
13-2-1	**Little Uwharrie River (Wheatmore Pond)**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Uwharrie River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III	03-07-09	11.9 FW Miles								
13-2-20-(0.7)	**McLeans Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From a point 0.8 mile upstream of Montgomery County SR 1154 to Uwharrie River										
WS-IV	03-07-09	4.0 FW Miles								
13-2-20-1-1	**Moccasin Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to West Branch										
WS-IV	03-07-09	2.1 FW Miles								
12-119-7-4-1	**North Hamby Creek**		**Toxic Impacts**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	1998	5
From source to Hamby Creek										
C	03-07-07	5.8 FW Miles								
13-(1)	**PEE DEE RIVER (including Lake Tillery below normal operating levels)**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From mouth of Uwharrie River to Norwood Dam				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV,B;CA	03-07-08	4,845.5 FW Acres		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-2-18-1	**Poison Fork**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Barnes Creek										
C;ORW	03-07-09	4.5 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-119-7a	**Rich Fork**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Payne Creek			Failing Septic Systems	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-07	8.5 FW Miles	General Agriculture/Pasture	Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
			MS4 NPDES							
			Natural Conditions							
			WWTP NPDES							
			Habitat Degradation							
			General Agriculture/Pasture							
			Impervious Surface							
12-119-7b	**Rich Fork**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Payne Creek to Abbotts Creek			Failing Septic Systems	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	1998	5
C	03-07-07	12.1 FW Miles	General Agriculture/Pasture	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006	1998	4a
			MS4 NPDES							
			WWTP NPDES							
			Habitat Degradation							
			Low Dissolved Oxygen							
12-117-2	**Second Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Second Creek Arm of of High Rock Lake, Yadkin River			Industrial Site	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-04	13.5 FW Miles								
12-117-(3)	**Second Creek Arm of High Rock Lake**		**Chlorophyll a**	Aquatic Life	Not Rated	Data Inconclusive	High Water Temperature	2006	2008	3a
From a point 1.7 miles downstream of Rowan County SR 1004 to High Rock Lake			Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
WS-IV,B	03-07-04	894.9 FW Acres	**High pH**	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
			Stormwater Runoff							
			Temperature							
			Impoundment							
			Natural Conditions							
12-113	**Swearing Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to High Rock Lake, Yadkin River			**Low Dissolved Oxygen**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	2004	5
C	03-07-07	14.4 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-115-3	**Town Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Crane Creek			Impervious Surface							
C	03-07-04	15.4 FW Miles	**Nutrient Impacts**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	1998	5
			MS4 NPDES							
			WWTP NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
			Toxic Impacts							
			Stormwater Runoff	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-2-3-3-2-2-(2)	**Unnamed Tributary to Cedar Fork Creek (Lake Bunch)**		**Chlorophyll a**	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
From a point 1.1 miles upstream of mouth to Cedar Fork Creek (City of Asheboro water supply intake)										
WS-II;HQW,CA	03-07-09	0.6 FW Miles								
13-2-(0.5)	**Uwharrie River**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to a point 0.4 mile downstream of Little Uwharrie River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III	03-07-09	18.3 FW Miles								
13-2-(1.3)	**Uwharrie River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.4 mile downstream of Little Uwharrie River to Randolph County SR 1314 (including Lake Reese)				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
WS-III;CA	03-07-09	7.4 FW Miles								
13-2-(1.5)	**Uwharrie River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Randolph County SR 1314 to to Randolph County SR 1174				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III;CA	03-07-09	9.8 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-2-(17.5)	**Uwharrie River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 1.3 miles upstream of the mouth of Barnes Creek to mouth of Dutchmans Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV,B	03-07-09	9.3 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-2-(4.5)	**Uwharrie River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Randolph County SR 1174 to a point 1.3 miles upstream of mouth of Barnes Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
B	03-07-09	18.8 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-2-20-1	**West Branch**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to McLeans Creek										
WS-IV	03-07-09	3.8 FW Miles								
12-(114)	**YADKIN RIVER (including lower portion of High Rock Lake)**		**Chlorophyll a** Stormwater Runoff; **High pH** Stormwater Runoff; **Temperature** Impoundment	Aquatic Life	Not Rated	Data Inconclusive	High Water Temperature	2006		3a
From a line across High Rock lake from the downstream side of mouth of Crane Creek to the downstream side of mouth of Swearing Creek to a point 0.6 mile upstream of dam of High Rock Lake, except for the Abbotts Creek Arm of High Rock Lake upstream of Davi				Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
WS-IV,B	03-07-04	4,870.1 FW Acres		Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-(124.5)a	**YADKIN RIVER (including lower portion of High Rock Lake)**		**Chlorophyll a** Stormwater Runoff; **High pH** Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
From a point 0.6 mile upstream of dam of High Rock Lake to High Rock Dam				Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
WS-IV,B;CA	03-07-04	10.8 FW Acres		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
12-(124.5)c	**YADKIN RIVER (including Tuckertown Lake, Badin Lake)**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From the mouth of Cabin Creek to Badin Lake				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV,B;CA	03-07-04	7,937.8 FW Acres		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
12-(124.5)d	**YADKIN RIVER (including Tuckertown Lake, Badin Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
Badin Lake										
WS-IV,B;CA	03-07-04	6,847.0 FW Acres								
12-(108.5)b	**YADKIN RIVER (including upper portion of High Rock Lake below normal operating level)**		**Chlorophyll a** Stormwater Runoff; **High pH** Stormwater Runoff; **Turbidity** Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	High pH	2006	2008	5
From mouth of Grants Creek to a line across High Rock Lake from the downstream side of mouth of Crane Creek to the downstream side of mouth of Swearing Creek				Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
WS-V	03-07-04	5,568.8 FW Acres		Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2004	5
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
12-(124.5)b	**YADKIN RIVER (including upper portion of Tucktertown Lake)**		**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From High Rock Dam to mouth of Cabin Creek			Impoundment	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV,B;CA	03-07-04	3.5 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040103 - YADKIN RIVER

Description

HUC 03040103 is roughly bounded on the north by High Point, Thomasville, Lexington and South Salisbury. The drainage contains the Yadkin chain lakes High Rock, Tuckertown Reservoir, Badin and the major tributaries of Abbotts Creek and the Uwharrie River (Figure 4). Much of the eastern portion of the HUC drains the relatively undeveloped area forming the Uwharrie National Forest. This HUC contains Yadkin River subbasins 4 (in part), 7, 8 (in part) and 9. The streams in this HUC are mostly located in the Carolina Slate Belt portion of the piedmont ecoregion. These streams usually have a rocky substrate, but may have very low flow during drought conditions.

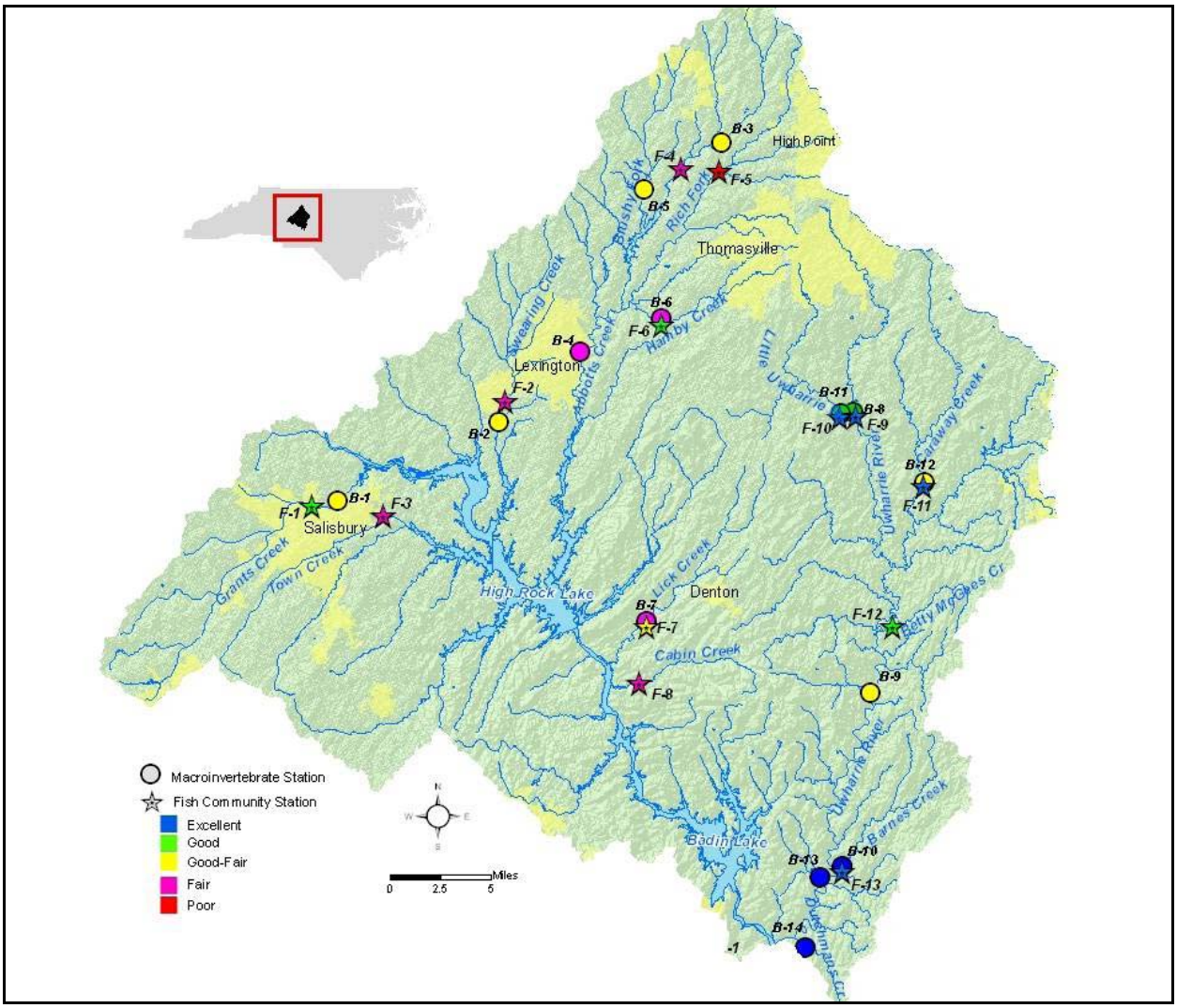


Figure 4. Sampling sites in HUC 03040103 in the Yadkin River basin. Monitoring sites are listed in Table ---.

The lower portion of Yadkin subbasin 4, bisected north/south approximately by NC 150, contains High Rock Lake and the lower portions of Swearing Creek and Abbotts Creek, southwest of Lexington. Agricultural land use affects most streams outside of the urban areas. This area has easily eroded soils. Consequently, streams in areas of urban or agricultural land use are affected by sediment inputs, and have large amounts of coarse sand.

The Abbotts Creek watershed (subbasin 07), starts just south of Kernersville and flows south through Lexington and empties into High Rock Lake. Smaller streams in the watershed are Rich and Hunts Forks and Swearing and Hamby Creeks, which drain High Point, Thomasville, and the west side of Lexington. This watershed is located primarily in Davidson County and is bisected by the industrial and commercial US 64 and I-85 corridors. The largest municipalities in the subbasin are the cities of Lexington, Thomasville, and Highpoint. The largest discharger is the City of High Point's WWTP with a permitted flow of 6.2 MGD into Rich Fork. Other large municipal WWTP dischargers are Thomasville (4 MGD to Hamby Creek) and Lexington (5.5 MGD to Abbotts Creek). Land use is primarily forest and pasture though this watershed contain a high percentage of urban area.

The upper portion of Yadkin subbasin 8 in this HUC contains Tuckertown Reservoir and Badin Lake. Much of the land in this area is used for agriculture and undeveloped gamelands.

Subbasin 9 encompasses the entire Uwharrie River watershed. The upper watershed, primarily in Randolph County, includes portions of the municipalities of High Point, Thomasville, Archdale, Randleman, and Asheboro. The lower portion of the watershed in southern Randolph and northwestern Montgomery counties is within the Uwharrie National Forest. Most of the subbasin is forested. The Uwharrie River is within the piedmont Carolina Slate Belt ecoregion, but some tributaries draining the Uwharrie Mountains have montane characteristics. Certain geological subdivisions of the Carolina Slate Belt appear to have ecological significance. The sandiest streams were observed in the northern portion of the subbasin, where the underlying rocks are metamudstone and metaargillite. More rocky streams were observed in the southern portion of the subbasin where the underlying rocks are metavolcanic.

Overview of Water Quality

Fourteen sites were sampled for benthic macroinvertebrates in this HUC in 2006 (Table 3). Among these, four sites (Grants Creek, Swearing Creek, Little Uwharrie River, and Uwharrie River at SR 1406) showed improved bioclassifications compared with 2001 sampling, seven sites retained the same bioclassification as 2001, and two sites (Lick Creek and Uwharrie River at SR 1143) showed degraded bioclassifications compared to 2001. Dutchmans Creek, not rated in 2001 was rated Excellent in 2006. None of the sites improved or degraded more than one level of bioclassification.

Eleven sites were sampled to evaluate fish populations. No site showed an improved bioclassification, three sites retained their 2001 classification, and three sites (Cabin Creek, Rich Fork, Abbotts Creek) showed degraded classification compared to 2001. Five additional fish sites were sampled for the first time in 2006.

Table 3. Waterbodies monitored in HUC 03040103 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	Grants Cr	Rowan	SR 1912	Fair	Good-Fair
B-2	Swearing Cr	Davidson	NC 47	Fair	Good-Fair
B-3	Abbotts Cr	Davidson	SR 1755	Good-Fair	Good-Fair
B-4	Abbotts Cr	Davidson	SR 1243	Fair	Fair
B-5	Brushy Fk	Davidson	SR 1810	Good-Fair	Good-Fair
B-6	Hamby Cr	Davidson	SR 2017	Fair	Fair
B-7	Lick Cr	Davidson	NC 8	Good-Fair	Fair
B-8	Uwharrie R	Randolph	SR 1406	Good-Fair	Good
B-9	Uwharrie R	Randolph	SR 1143	Good	Good-Fair
B-10	Uwharrie R	Montgomery	NC 109	Excellent	Excellent
B-11	L Uwharrie R	Randolph	SR 1405	Good-Fair	Good
B-12	Caraway Cr	Randolph	SR 1331	Good-Fair	Good-Fair
B-13	Barnes Cr	Montgomery	SR 1303	Excellent	Excellent
B-14	Dutchmans Cr	Montgomery	SR 1150	Not Rated	Excellent
F-1	Grants Cr	Rowan	SR 2200 (SR 1910)	Good-Fair	Good (2004)[2]
F-2	Swearing Cr	Davidson	SR 1104	---	Fair (2004)[2]
F-3	Town Cr	Rowan	SR 2118	---	Fair
F-4	Abbotts Cr	Davidson	SR 1800	Good-Fair	Fair
F-5	Rich Fk	Davidson	NC 109	Fair	Poor
F-6	Hamby Cr	Davidson	SR 2017	---	Good
F-7	Lick Cr	Davidson	NC 8	Good-Fair	Good-Fair
F-8	Cabin Cr	Davidson	SR 2536	Good	Fair
F-9	Uwharrie R	Randolph	SR 1406	Excellent (1999)	Excellent
F-10	L Uwharrie R	Randolph	SR 1405	---	Excellent
F-11	Caraway Cr	Randolph	SR 1331	---	Excellent
F-12	Betty McGees Cr	Randolph	SR 1107	Good	Good
F-13	Barnes Cr	Montgomery	SR 1303	Excellent	Excellent

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.
[2]special study site that has become a basinwide site.

River and Stream Assessment

Leonards Creek (Davidson County), previously sampled as a basinwide site in subbasin 07 was not sampled in 2006 due to low flow conditions. Similarly, Rich Fork at Davidson County SR 2005 was not sampled for benthos during 2006 due to excessive depth caused by operations of sand-dipping operations. It is likely that the latter site will therefore be discontinued.

Specific site summaries of the 14 benthic macroinvertebrate and 13 fish community samples may be found at this link: **03040103**.

SPECIAL STUDIES

UT Second Creek

This stream (near Dutch Creek Rd) in Rowan County was sampled in January 2002 for possible removal from the 303(d) list. This creek was the former site of the Town of Rockwell's WWTP. The WWTP ceased discharging into UT second creek in 1996. Both upstream and downstream segments were rated Not Impaired. (BAU memo B-020328)

Town Creek

A TMDL study was done on Town Creek in June 2004 to characterize the possible stressors impacting the stream. Urban impacts from upstream were characterized as a major cause of degraded water quality. (BAU memo B-040916) The stream was sampled again in September 2006 for possible removal from the impaired streams list. Located below an inactive WWTP outfall in Spencer, NC, it was determined that the stream remains impacted. (BAU memo B-070129a

Second Creek
Second Creek in Rowan County was sampled in September 2006 to document and characterize the water quality before animal operations are expanded in its watershed. The stream was found to be relatively unimpacted at SR 2370. (BAU memo B-070129a)

Little Creek
Little Creek in Rowan County was sampled in September 2006 for possible removal from the impaired streams list. It was discovered that the stream was erroneously put on the 303(d) list. It has never been sampled for fish and benthic sampling in 1990 resulted in a Not Impaired rating. The stream was assigned a Good-Fair bioclassification as a result of the 2006 benthic collections.

Fish Community Urbanization Study
Grants Creek at SR 1506 and at SR 1910, and Second Creek at SR 2338 in Rowan County, as well as Swearing Creek at SR 1104 (Davidson County), were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data).

Swearing Creek, NC 47, Davidson County
This site was resampled in 2002 to determine whether the stream should be placed on North Carolina's 303(d) list. This site received a Fair rating, which verified the Fair rating it received in 2001. (BAU Memo B-021001)

Hamby Creek TMDL Stressor Study
A TMDL stressor study was conducted at seven sites in the Hamby Creek watershed in Davidson County in May 2003. Results of this study suggest that the cause of impairment in Hamby Creek appears to be chemical and/or physical pollutants in the form of toxic chemicals from urban runoff and nutrient inputs. (BAU Memo B-031016)

Planning Section Requests
Three additional benthic sites were requested by the Planning Section for sampling in 2006. Hunts Fork at SR 1787 and Rich Fork at SR 1755 are on North Carolina's 303d impaired streams list. Samples from these streams were needed to see if impairment is still warranted. In 2006 Hunts Fork received a Fair rating. Rich Fork rated Good-Fair. Hamby Creek at SR 2025 received a Poor bioclassification. (BAU Memorandum B-061114)

Abbotts Creek, SR 1735, Davidson County
At the request of Winston-Salem Regional Office, Abbotts Creek was sampled near the Davidson/Wilkes County line to provide baseline data prior to construction of a Dell computer plant. This site was borderline Good-Fair/Good. (BAU Memo B-061114)

Yadkin Subbasin 07 TMDL Stressor Study
A TMDL stressor study was conducted at eight sites in Subbasin 07 (Davidson County) in May and September 2006. Overall, five of the sites received Good-Fair ratings, two received Fair ratings (Abbotts Creek at SR 1243, Hamby Creek at SR 2017) and one received a Poor rating (Hamby Creek at SR 2025). (BAU Memo B-060108)

Lick Creek TMDL
Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. (BAU MemoB-040212)

Uwharrie River
A site on the Uwharrie River at NC 109 was sampled in March 2005 by both DWQ and Duke Energy biologists as a quality assurance measure comparing methods of both groups.

Uwharrie River EEP Study
Per a request received by the Biological Assessment Unit (BAU) from Ecosystems Enhancement Program (EEP) staff, seven benthos sites were sampled in May 2006. The reference site, Barnes Creek

received a bioclassification of Excellent ; five study sites earned bioclassifications of Good (Uwharrie River at SR 1406 and SR 1564, Little Uwharrie River at SR 1405, Brier Creek at SR 1402, and Caraway Creek at SR 1524 and one site, Caraway Creek at Randolph SR 1331, earned a bioclassification of Good-Fair.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Grants Cr	**SR 1910**	**07/08/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	4	03040103	354134	802813	12-110	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	56.9	--	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	25	0	25 (golf course)

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

Water Quality Parameters

Temperature (°C)	23.3
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	133
pH (s.u.)	6.6

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	4
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	**60**

Site Photograph

Substrate Sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/08/04	2004-114	19	48	Good
05/02/01	2001-35	12	42	Good-Fair

Most Abundant Species Bluegill and Bluehead Chub

Exotic Species Common Carp, Red Shiner, Green Sunfish, and Spotted Bass

Species Change Since Last Cycle

Gains -- Common Carp, Red Shiner, Eastern Silvery Minnow, Golden Shiner, Creek Chubsucker, Spotted Sucker, Flat Bullhead, White Catfish, Pumpkinseed, Bluegill, sunfish hybrid, Black Crappie, Spotted Bass, and Largemouth Bass. **Losses** -- Redlip Shiner, Rosyside Dace, Creek Chub, Brown Bullhead, Eastern Mosquitofish, and Warmouth.

Data Analysis

Watershed -- drains central and northeastern Rowan County, including the towns of Spencer, Salisbury, China Grove, and Landis; site is ~3.5 miles upstream from the backwaters of the Yadkin River and High Rock Lake and 1.3 miles downstream of 2001 site at SR 2200, difference in drainage area is 1.8 square miles. **Habitat** -- sandy runs, snag pools, one riffle; golf course along southern shoreline. **2004** -- diverse, but the proximity to reservoir and river influenced the fish community; intolerant species were absent; slightly greater than expected percentage of omnivores+herbivores; 8 of 19 species represented by only 1 or 2 fish per species; loss of the Redlip Shiner - second most abundant species in 2001. **2001 and 2004** -- 25 species are known from the site, but only 6 collected in both years (Bluehead Chub, Redbreast Sunfish, Green Sunfish, Tessellated Darter, and Fantail Darter); dominant species both years was the Bluehead Chub; sampled in 2004 as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
GRANTS CR	**SR 1910**	**08/09/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ROWAN	4	03040103	12-110	354151	802649

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	61.8	8	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	25	0	50 (fallow)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None: The Salisbury WWTP was erroneously reported to be upstream in 2003 report	---	---

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	5.9
Specific Conductance (µS/cm)	159
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	5
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	0
Total Habitat Score (100)	54

Site Photograph

Substrate mostly sand with some cobble (rip-rap)

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/09/06	10047	87	18	6.4	6.0	Good-Fair
08/07/01	8463	72	13	6.6	6.3	Fair
08/06/96	7126	74	20	6.4	5.5	Good-Fair
07/13/89	4981	67	20	6.2	5.5	Good-Fair

Taxonomic Analysis

EPT taxa in 2006 increased modestly to 18 from the 13 collected in 2001. This increase was comprised of one mayfly and 4 caddisfly taxa. Two caddisflies not previously collected at this site, the intolerant *Neophylax oligius* and *Chimarra* , occurred though were rare in abundance. The abundant mayfly, *Procloeon* , was also collected for the first time in 2006. The decrease of the Biotic index to 6.4 indicates a return to the marginally better water quality seen prior to 2001.

Data Analysis

Located aprroximatley 2.5 miles from the confluence with the Yadkin River, this site predominately receives urban runoff from Salisbury and Spencer. Grants Creek also suffers from poor habitat with a mostly homogenoeous substrate (sand), poor riffles and lack of pools. Additionally, the riparian areas are minimal with moderate erosion. Results form the 2006 benthic survey indicate a return to the Good-Fair conditions seen prior to 2001. Grants Creek was rated a Fair in 2001, a low flow year, suggesting that a higher than normal concentration of pollutants was affecting the benthic community for that year.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Swearing Cr	**SR 1104**	**07/08/04**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	354612	801803	12-113	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.8	--	12	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	0	35	25 (suburban residential)

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

Water Quality Parameters

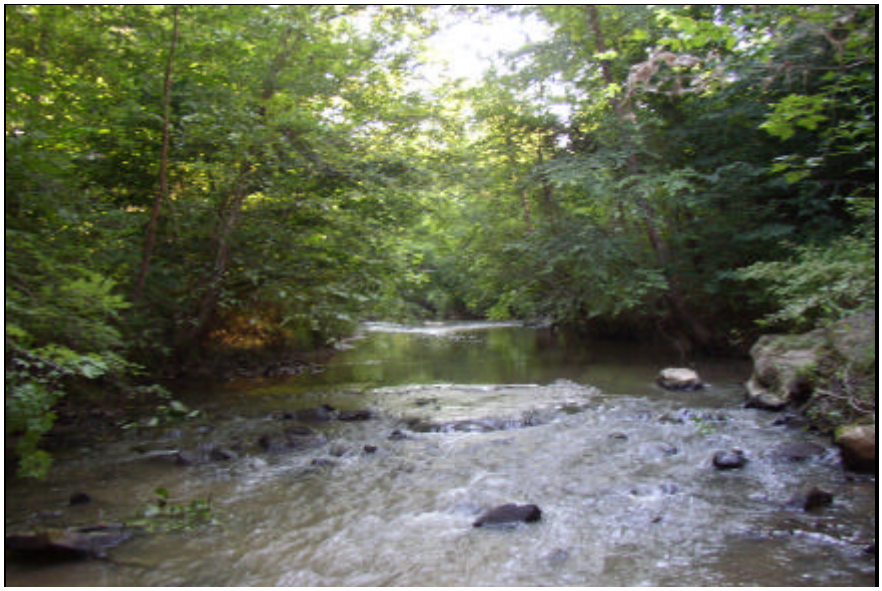
Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.7

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	5
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**66**

Site Photograph



Substrate Sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/08/04	2004-113	12	40	Fair

Most Abundant Species	Fantail Darter, Redbreast Sunfish, Eastern Silvery Minnow	**Exotic Species**	Red Shiner and Green Sunfish

Species Change Since Last Cycle	N/A; new site in 2004.

Data Analysis

Watershed -- drains the western portion of the City of Lexington; tributary to High Rock Lake. **Habitat** -- sandy runs, snag pools, and bedrock riffles; bank instability. **2004** -- total number of fish, total species diversity, and diversity of darters lower than expected; intolerant species and species of suckers were absent; percentage of tolerant fish (Satinfin Shiner, Red Shiner, Golden Shiner, Flat Bullhead, Redbreast Sunfish, and Green Sunfish) moderately high; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
SWEARING CR	**NC 47**	**09/11/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-113	354520	801820

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	34.8	6	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	25	25	0

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

Water Quality Parameters

Temperature (°C)	21.4
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	131
pH (s.u.)	6.4
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	6
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	51

Site Photograph

Substrate Sand, Detritus, Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/11/06	9996	57	17	6.4	5.5	Good-Fair
07/03/02	8858	63	12	6.6	5.7	Fair
07/25/01	8493	--	13	--	5.8	Fair
08/07/96	7156	--	16	--	5.2	Good-Fair

Taxonomic Analysis

Abundant taxa included *Baetis intercalaris*, *Stenonema modestum*, *Cheumatopsyche*, *Ancyronyx variegatus*, *Macronychus glabratus*, *Argia*, *Boyeria vinosa*, *Calopteryx*, *Macromia*, *Progomphus obscurus*, and *Corbicula fluminea*. Taxa collected in 2006 that had not been previously collected at this site included *Baetis pluto*, *Baetisca*, *Pteronarycs*, *Chimarra*, *Nectopsyche exquisita*, and *Oecetis persimilis*.

Data Analysis

This tributary to the Yadkin River has been sampled four times since 1996. It received a Good-Fair rating in 1996, decreased to Fair in 2001 and 2002, and was back to Good-Fair in 2006. The 2001 and 2002 samples were borderline Fair/Good-Fair with each needing one more taxon to receive a Good-Fair rating. Based on the benthic data no major changes in water quality have been observed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Town Cr	**off SR 2118**	**05/11/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Rowan	4	03040103	354110	802424	12-115-3	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	16.5	---	8	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	---	---	50 (Salisbury Spencer WWTP)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	17.0
Dissolved Oxygen (mg/L)	7.7
Specific Conductance (µS/cm)	262
pH (s.u.)	6.8

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**68**

Site Photograph

Substrate cobble, gravel, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-42	14	38	Fair

Most Abundant Species Green Sunfish

Exotic Species Green Sunfish, Redear Sunfish, Red Shiner

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains East Spencer and south Salisbury in central Rowan County; a tributary to High Rock Lake. **Habitats** -- side snags, boulders, runs, short riffles; good riparian on left; WWTP on right, but it no longer discharges to Town Creek. **2006** -- new fish community monitoring site; the trophic structure of this fish community was skewed towards a high percentage of Insectivores (93%), many of which were tolerant species (73% of total, Green Sunfish = 36% of sample); six sunfish species collected, all having large individuals; no intolerant species collected; high conductivity due to urban runoff.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ABBOTTS CR	**SR 1755**	**09/13/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-(1)	355730	800643

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-III	22.3	8	0.2

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

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

Water Quality Parameters

Temperature (°C)	18.5
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	133
pH (s.u.)	7.5
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	69

Site Photograph

Substrate Gravel, Sand, Silt, Rubble, Boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/13/06	10000	65	17	5.8	5.1	Good-Fair
09/28/01	8640	--	15	--	5.4	Good-Fair
08/08/96	7158	--	16	--	5.2	Good-Fair

Taxonomic Analysis

Abundant taxa included *Acentrella* , *Hexagenia* , *Stenonema modestum* , *Tricorythodes* , *Cheumatopsyche* , *Leucotrichia pictipes* , and *Nectopsyche exquisita* .

Data Analysis

This site is located north of NC 109 and is the most upstream benthic sampling site on Abbotts Creek. It has been sampled three times since 1996 and has always rated Good-Fair. EPT taxa richness and EPT Biotic Index scores were nearly identical for all three samples which suggests no major changes in water quality.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Abbotts Cr	**SR 1800**	**05/10/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	355619	800853	12-119-(4.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III; CA	37.1	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	25	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)	8.9
Specific Conductance (µS/cm)	138
pH (s.u.)	6.2

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**54**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-37	14	40	Fair
05/01/01	2001-32	15	46	Good-Fair
04/24/96	96-34	15	44	Good-Fair

Most Abundant Species Bluehead Chub (2006)

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Gizzard Shad, Rosyside Dace, White Sucker, Notchlip Redhorse, and Pumpkinseed. **Gains** -- Creek Chub, Flat Bullhead, and Green Sunfish (first time collected at the site).

Data Analysis

Watershed -- drains the extreme southeastern corner of Forsyth and the northeastern corner of Davidson counties, including the southern portion of the City of Kernersville; semi-rural/suburban; upstream of Lake Tom-a-Lex. Habitat -- coarse woody debris; large deadfalls; snags; eroded vertical banks. **2006** -- decline in the number of species of suckers and increase in the percentage of tolerant fish (primarily Satinfin Shiner and Redbreast Sunfish). **1996 - 2006** -- total habitat scores have averaged ~ 50; specific conductance has gradually increased from 104 to 121 to 138 µS/cm since 1996; an abundant, but not diverse community; total number of species known from site = 19; no intolerant species are known from the site; the percentage of tolerant fish has increased from 10 to 17 to 37% since 1996; trophically no change, very stable metrics; Bluehead Chub has consistently been the dominant species (~40%); NCIBI ratings range between 40 and 46, NCIBI ratings from high Fair to high Good-Fair. 2006 data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ABBOTTS CR	**SR 1243**	**09/12/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-(6)	354824	801407

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	175.0	12	0.3

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

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

Water Quality Parameters

Temperature (°C)	21.2
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	153
pH (s.u.)	6.6
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	13
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	74

Site Photograph

Substrate Rubble, Gravel, Boulder, Sand, Silt, Bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9997	63	11	6.7	6.2	Fair
07/25/01	8494	61	15	6.8	6.2	Fair
08/09/96	7161	62	17	6.5	6.2	Fair
11/13/85	1612	49	12	7.4	6.2	Fair

Taxonomic Analysis

Several taxa typically found in urban streams (I.e., *Cheumatopsyche* , *Hydropsyche betteni* , *Argia* , *Ablabesmyia mallochi* , *Conchapelopia* group, *Polypedilum illinoense* group, and *Rheocricotopus robacki*) were found in abundance.

Data Analysis

This site is located within Lexington city limits and is the most downstream sampling location for benthos on Abbotts Creek. It has consistently received a Fair rating since 1985. Abbotts Creek receives urban runoff from the city of Lexington. In addition, the city of Lexington WWTP is permitted to discharge 5.5 MGD to Abbotts Creek Arm of High Rock Lake, which is located approximately 2.5 miles downstream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rich Fk	**NC 109**	**05/10/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	355615	800652	12-119-7	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.6	--	6	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of High Point's Westside WWTP; Instream Waste Concentration = 93%	NC0024228	6.2

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	372
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**52**

Site Photograph

Substrate Soft, sinking sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-38	16	34	Poor
05/01/01	2001-33	13	40	Fair
04/25/96	96-35	10	34	Poor

Most Abundant Species Redbreast Sunfish and Bluegill

Exotic Species Swallowtail Shiner, Green Sunfish, and Redear Sunfish

Species Change Since Last Cycle **Losses** -- Gizzard Shad, Rosyside Dace, and Spottail Shiner. **Gains** -- Creek Chub, White Catfish, Eastern Mosquitofish, Warmouth, and Tessellated Darter (first time ever at site).

Data Analysis

Watershed -- drains the west-southwest areas of the City of High Point and northeast corner of Davidson County. Habitat -- runs, snags, coarse, woody debris; sand dipping operation downstream and WWTP upstream. WWTP with frequent violations in 2003 and 2004 for biochemical oxygen demand and fecal coliform bacteria, proceeded to enforcement; occasional other violations for pH, total phosphorus, and total ammonia; no reported violations in 2006 (BIMS query 12/14/2006). **2006** -- decline in the number of fish, increase in total diversity; no intolerant species; high percentage of tolerant fish; 92% of all fish were insectivores. **1996 - 2006** -- specific conductance consistently greater than 325 µS/cm; total habitat scores range from 39 to 66; total species at site = 21; has steadily increased to 16; no intolerant species known from site; percentage of tolerant fish consistently high; Redbreast Sunfish typically one of the dominant species; percentage of species with multiple ages increased from 30 to 46 to 50% since 1996. 2006 data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BRUSHY FK	**SR 1810**	**09/12/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-5-(1)	355528	801049

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	WS-III	20.8	7	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	50	25	0

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

Water Quality Parameters

Temperature (°C)	19.5
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	116
pH (s.u.)	6.4
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	3
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	55

Site Photograph

Substrate Sand, Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9999	61	15	5.9	5.0	Good-Fair
07/30/01	8498	53	20	5.4	4.4	Good
08/08/96	7159	--	13	--	4.7	Fair

Taxonomic Analysis

Abundant taxa included *Hexagenia*, *Isonychia*, *Stenonema modestum*, *Tricorythodes*, *Paragnetina fumosa*, *Cheumatopsyche*, *Triaenodes ignitus*, *Macronychus glabratus*, *Macromia*, *Calopteryx*, *Conchapelopia* group, *Polypedilum convictum*, and *Corbicula fluminea*.

Data Analysis

Brushy Fork, located north of Lexington, is a tributary to Tom-a-Lex Lake (the water supply for the cities of Lexington and Thomasville). In 1996, the site received a Fair rating and in 2001, it increased to Good. The rating dropped to Good-Fair in 2003 and 2006. According to Historic Palmer Drought Indices (http:\\www.ncdc.noaa.gov/oa/climate/research/drought/palmer-maps/), 1996 was a normal year for rainfall whereas, in 2001, the area was in a moderate drought. The increased rating in 2001 may be due to the low flow limiting impacts from nonpoint sources. In addition, a slight increase in available habitat and an increase in abundance of intolerant taxa were also noted in 2001. Although the 1996 sample was an EPT sample, when a correction factor is applied to compare with a Full Scale sample, the 1996 sample is comparable to the 2006 sample in terms of EPT taxa richness, indicating no real change in water quality even though the bioclass changed. Both samples were borderline Fair/Good-Fair.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
HAMBY CR	**SR 2017**	**09/12/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	7	03040103	12-119-7-4	354953	800948

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	21.0	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	50	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Thomasville WWTP	NC0024112	4.0

Water Quality Parameters

Temperature (°C)	20
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	379
pH (s.u.)	6.8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	77

Site Photograph

Substrate Rubble, Sand, Boulder, Gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/12/06	9998	51	11	6.9	6.4	Fair
05/12/03	9128	60	9	7.2	6.3	Fair
07/30/01	8499	58	12	6.5	6.1	Fair

Taxonomic Analysis

Although dissolved oxygen was not low at the time of sampling, *Argia* and *Calopteryx* were very abundant. Species indicative of nutrient enrichment, toxicity, and urbanization were also abundant (I.e., *Cheumatopsyche* , *Hydropsyche betteni* , *Conchapelopia* group, *Polypedilum scalaenum* , and *Natarsia*).

Data Analysis

This site is located approximately four and one half miles downstream of Thomasville WWTP and has been sampled three times since 2001. All three samples received Fair bioclassifications and the benthic community has remained relatively unchanged: EPT taxa richness has been 12, 9, and 11 and the EPT Biotic Index ranged from 6.1 to 6.4.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hamby Cr	**SR 2017**	**05/10/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	7	03040103	354954	800947	12-119-7-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	20.4	--	10	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	0	25 -- residential

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Thomasville's Hamby Creek WWTP; Instream Waste Concentration = 94%	NC0024112	6

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	305
pH (s.u.)	6.8

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**75**

Site Photograph

Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-39	15	48	Good

Most Abundant Species Redbreast Sunfish and Bluehead Chub

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains northeast Davidson County, including the I-85 corridor and the City of Thomasville; headwaters in Thomasville; borders the Carolina Slate Belt. **WWTP** -- many violations during the period June 2001 to June 2006 for biochemical oxygen demand, fecal coliform bacteria, total residual chlorine, metals (nickel, cadmium, and chromium), cyanide, pH, nutrients, and total suspended solids; proceeded to enforcement for many of the repeated violations (BIMS query 12/14/2006). **Habitat** --a Carolina Slate Belt type stream; bedrock, sand, and silts in the pools; shallow riffles; good riparian on right. **2006** -- large biomass of White Sucker, Creek Chubsucker, Brassy Jumprock, Flat Bullhead, Bluegill, Redbreast Sunfish, and Largemouth Bass; no Redlip Shiner or intolerant species; discharge from WWTP augments stream flow and nutrients stimulate fish production; data were summarized in BAU Memorandum 20061120.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LICK CR	**NC 8**	**08/11/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
DAVIDSON	8	03040103	12-126-(3)	353647	801026

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	28.7	8	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	30	0	0	70 (50 fallow, 20 disturbed)

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

Water Quality Parameters

Temperature (°C)	24.9
Dissolved Oxygen (mg/L)	4.2
Specific Conductance (µS/cm)	179
pH (s.u.)	6.5
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Site Photograph

Substrate Boulder, cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10053	81	13	6.7	6.6	Fair
09/03/03	9287	79	17	6.5	5.7	Good-Fair
08/07/01	8504	---	11	---	6.5	Fair
08/06/96	7128	---	12	---	5.6	Fair

Taxonomic Analysis

A loss of four EPT and an increase in the biotic index occurred since a special study was conducted on Lick Creek in 2003. No intolerant species were abundant while the cosmopolitan tolerant mayflies *Maccaffertium modestum* and *Stenacron interpunctatum* as well as the hydropsychid caddisflies *Cheumatopsyche* and *Hydropsyche betteni* were abundant. The silt loving mayfly,*Caenis,* was abundant as well. An indicator of slate belt streams and their low flow conditions, *Stenonema femoratum* was collected though it was only common. Chironomids indicative of organic enrichment (*Dicrotendipes neomodestus*) and of low dissolved oxygen (*P. illinoense* gr) were abundant while the low DO indicator *Physa* (a snail) made its first appearance in this stream.

Data Analysis

Lick creek drains a portion of southeastern Davidson county including the municipality of Denton. Aside from the urban impacts of Denton, the most probable reason for the Fair bioclass is the influence of the Denton WWTP and low flow. The plant, a minor discharger, is located about 2.5 miles upstream of NC 8 and is the most likely source of organic enrichment in the stream. The specific conductance in 2006 was higher than in 2003 (100) though much lower than in the drought year of 2001 (382). High amounts of silt and flocculent sediments were observed covering the hard substrate and the bottom of the pools. Low dissolved oxygen was probable in restricting the macroinvertebrate fauna and may have resulted from high organic enrichment and low flows inherent in slate belt streams.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lick Cr	**NC 8**	**05/10/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	8	03040103	353647	801024	12-126-3	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	28	--	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	0	20 -- dirt bike track on left

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Denton's WWTP; Instream Waste Concentration = 100%	NC0026689	0.8

Water Quality Parameters

Temperature (°C)	15.8
Dissolved Oxygen (mg/L)	8.7
Specific Conductance (µS/cm)	123
pH (s.u.)	6.5

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	4
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**78**

Site Photograph

Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/10/06	2006-40	14	44	Good-Fair
04/19/01	2001-27	16	44	Good-Fair
04/23/96	96-31	14	44	Good-Fair

Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle **Losses** -- Golden Shiner, Eastern Mosquitofish, Pumpkinseed, and Fantail Darter. **Gains** -- Highfin Shiner and Largemouth Bass.

Data Analysis

Watershed -- drains the Town of Denton and the southeastern corner of Davidson County; site is ~ 3 mi. below the WWTP outfall. WWTP provides constant flows during droughts; WWTP with rare violations for biochemical oxygen demand, fecal coliform bacteria, and nickel from June 2001 to June 2006 (BIMS query 12/14/2006). Habitat -- a typical Carolina Slate Belt type stream; pools; runs; short and shallow riffles (a function of low flow); good riparian on right with bluff. **2006** -- slight decrease in the total species diversity and darter diversity; slight improvements in the percentages of omnivores and piscivores; continued high percentage of tolerant fish, primarily Redbreast Sunfish. **1996 - 2006** -- total habitat scores average ~ 75; specific conductance averages ~ 75 µS/cm; gradual improvements in the trophic metrics; dominant species are Redbreast Sunfish and Bluehead Chub; 20 species known from site, but no intolerants; NCIBI score and rating consistent at 44 and Good-Fair, respectively.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cabin Cr	**SR 2536**	**05/11/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Davidson	8	03040103	353406	801046	12-127-(2)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	18.7	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	65	0	35	0

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

Water Quality Parameters

Temperature (°C)	16.0
Dissolved Oxygen (mg/L)	8.0
Specific Conductance (µS/cm)	102
pH (s.u.)	6.3

Water Clarity	Clear, tannin stained

Habitat Assessment Scores (max)

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

Site Photograph

Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/11/06	2006-41	16	38	Fair
05/01/01	2001-34	15	48	Good
04/24/96	96-32	12	52	Good

Most Abundant Species Bluegill

Exotic Species Black Bullhead, Green Sunfish, Redear Sunfish, and Yellow Perch

Species Change Since Last Cycle

Losses -- Spotted Sucker, Margined Madtom, and Largemouth Bass. **Gains** -- Notchlip Redhorse, Black Bullhead, Chain Pickerel, and Pumpkinseed.

Data Analysis

Watershed -- small drainage area in the southeastern corner of Davidson County, south of the Town of Denton; ~ 0.8 mi. above Tuckertown Reservoir. Habitat -- a typical Carolina Slate Belt type stream; short, but rare riffles (a function of low flow); pools; good riparian on left (bordered by NCWRC Gamelands). **2006** -- decrease in the number of fish; skewed trophic metrics (91% of all fish were insectivores); increase in the percentage of disease (popeye in Bluegill). **1996 - 2006** -- consistently elevated specific conductance, > 100 µS/cm; total habitat scores ~ 70; number of fish has declined from 252 to 142 to 116 since 1996; total species at site = 22, including 7 species of sunfish, but only 1 species of minnow, never any Redlip Shiner or intolerant species; Bluegill usually the dominant species; Fantail Darter not collected since 1996; proximity to reservoir influences species assemblage and is also a barrier to recolonization after prolonged droughts.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	**SR 1406**	**05/16/06**	**GOOD**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-(0.5)	354556	795933

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-III	40.7	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100			

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

Water Quality Parameters

Temperature (°C)	15.6
Dissolved Oxygen (mg/L)	10.5
Specific Conductance (µS/cm)	142
pH (s.u.)	6.8
Water Clarity	Slightly Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	55

Site Photograph

Substrate Gravel with some sand and rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/16/06	9902	72	24	5.8	4.5	Good
08/09/01	8556	NA	18	NA	5.3	Good-Fair

Taxonomic Analysis

Increases in mayfly, stonefly and caddisfly taxa, along with the presence of sensitive taxa like *Paraleptophlebia, Dolophilodes* and *Chimarra* helped improve the 2001 bioclassification of Good-Fair to the current Good rating. Mayfly richness led this improvement, with a net gain of 4 taxa.

Data Analysis

The upper Uwharrie River drains the southern portions of High Point and Archdale then passes through a mostly agricultural/rural section above this site. The upper portion of the drainage falls outside of the Carolina Slate Belt and has more sediment entering the system that in this lower section. Some of this transition is apparent at this site with the substrate consisting of relatively large proportion of fine gravel and course sand. Some bank erosion if evident though the riparian area remains mostly intact. Benthic macroinvertebrate results suggest a slight improvement in water quality conditions since prior sampling in 2001.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Uwharrie R	**SR 1406**	**05/02/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354556	795933	13-2-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	41.3	--	10	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	131
pH (s.u.)	7.2
Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	3
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**68**

Site Photograph

Substrate Sand, bedrock, slate, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/02/06	2006-30	22	58	Excellent
10/26/99	99-71	15	52	Good
06/15/99	99-49	20	56	Excellent
04/14/99	99-13	18	58	Excellent
04/24/96	96-33	24	54	Excellent

Most Abundant Species Bluegill

Exotic Species Swallowtail Shiner, Green Sunfish, and Redear Sunfish

Species Change Since Last Cycle **Losses** -- Rosyside Dace, Whitefin Shiner, Warmouth, and Piedmont Darter. **Gains** -- Creek Chub, White Sucker; Pumpkinseed (all collected for the first time at the site), and Redear Sunfish.

Data Analysis

Watershed -- drains northwestern Randolph County, including the Town of Archdale, the southwest portion of the City of High Point, and the I-85 and US 29/70 corridors; upstream from Lake Reese; borders the Southern Outer Piedmont. **Habitat** -- shallow sandy runs, boulder runs/chutes; side pools and snags; bluffs on left; forested riparian zones. **2006** -- 1 of 3 sites with 4 species of suckers; only 2 species of darters (Tessellated Darter and Fantail Darter), Piedmont Darter is rare at the site. **1996 - 2006** -- an abundant and species-rich site, 28 species known from the site; dominant species include Bluehead Chub, Swallowtail Shiner, Brassy Jumprock, Bluegill, and Redbreast Sunfish; data were summarized in BAU Memorandum 20061121; the fish community qualifies as High Quality Waters, if so petitioned; although the river did not qualify as Outstanding Resource Waters as detailed in BAU Memorandum 20021028.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	**SR 1143**	**09/27/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	03040103	13-2-(1.5)	353348	795832

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	291.5	14	0.6

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

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

Water Quality Parameters

Temperature (°C)	20.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	104
pH (s.u.)	6.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	1
Total Habitat Score (100)	69

Site Photograph

Substrate Boulder with cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/27/06	10055	92	19	5.9	4.2	Good-Fair
08/09/01	8553	84	27	5.7	4.9	Good
08/08/96	7136	72	19	5.2	4.7	Good

Taxonomic Analysis

A significant drop in EPT taxa richness occurred from 2001 to 2006 and consisted of 4 less mayflies, one less stonefly, and 3 less caddisflies. Also EPT abundance was significantly less in 2006 (EPT N = 73) than in either subsequent sampling years (118 in 1996 and 111 in 2001). Sensitive species such as the stonefly *Neoperla* and the caddisfly *Ceraclea ancylus* were abundant while only two tolerant EPT taxa were abundant, the caddisfly *Cheumatopsyche* and the mayfly *Maccaffertium modestum*. A high diversity of beetles and snails (including the intolerant *Elimia*) existed within the stream. A higher number of oligochaete and chironomid taxa than in previous years served to increase the biotic index slightly and included organic enrichment indicators *Polypedilum illinoense* gr and *P. flavum* (abundant in 2006 though they were also abundant or common in 1996 and 2001). The first state record of the dragonfly *Dythemis* occured at this site in 2006. Other notable taxa included the caddisfies *Ceraclea neffi* (15th state record) and *Triaenodes perna*.

Data Analysis

The Uwharrie River at SR 1143 drains adjacent agricultural lands and has no major NPDES dischargers. Initial sampling of this site was postponed 45 days due to high turbidity. This may have served to allow the emergence of more than a few EPT taxa thus, in effect, reducing the bioclassification from Good to Good-Fair. Support for this assertion may be seen in the low EPT biotic index (lower than in 1996 and 2001). However, water degradation may also be occuring as evidenced by the year to year increase in the biotic index. Overall, no major water quality problems were observed at this site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
UWHARRIE R	**NC 109**	**08/11/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	03040103	13-2-(17.5)	352551	800105

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, B	361	31	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	20	0

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

Water Quality Parameters

Temperature (°C)	26.3
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	101
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	6
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	83

Site Photograph

Substrate boulder, cobble and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/11/06	10051	118	35	5.2	3.8	Excellent
08/08/01	8551	89	33	5.0	3.9	Excellent
08/08/96	7135	80	27	5.3	4.1	Good
07/23/90	5389	81	30	5.2	4.2	Good
07/15/88	4612	101	30	5.3	3.9	Good

Taxonomic Analysis

EPT taxa richness has increased slightly over the last few sampling cycles ensuring an Excellent bioclassification rating. The biotic index, however, did increase slightly reflecting the higher number of chironomid and oligochaete taxa (27 and 16 in 2006, respectively and 17 and 1 in 2001). However, overall there were many intolerant taxa that were abundant such as the mayfly *Leucrocuta* , the stonefly *Neoperla,* and the caddisflies *Ceraclea ancylus* , *Paranyctiophylax celta* , *Lepidostoma* and *Polycentropus* . Many infrequently collected taxa were also collected at this site such as the caddisflies *Ceraclea maculata* (rare), *Hydropsyche mississippiensis* (abundant), *Helicopsyche borealis* (common), *Triaenodes injustus* (common), *Oecetis sp A* (rare) and *Mystacides* (rare).

Data Analysis

The Uwharrie river at NC 109 is surrounded mostly by forest with some agricultural land use. Of note was the extreme abundance of periphyton, filamentous algae and podostemum and the associated mollusc fauna on the substrate indicating probable nutrient enrichment from upstream. Overall, the Uwharrie River demonstrates stable conditions and excellent water quality.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L UWHARRIE R	**SR 1405**	**05/16/06**	**GOOD**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-1	354552	800015

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-III	48.4	12	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100			

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

Water Quality Parameters

Temperature (°C)	14.7
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	133
pH (s.u.)	6.4
Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	86

Site Photograph

Substrate Mix of gravel, rubble, boulder

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/16/06	9904	75	18	5.6	4.4	Good
08/09/01	8555	NA	18	NA	4.7	Good-Fair
08/08/96	7141	NA	14	NA	4.3	Good-Fair

Taxonomic Analysis

EPT taxa richness in 2006 was identical to that of 2001 though EPT biotic index reflected a shift toward less tolerant species; improving the site's bioclassification from Good-Fair to Good. Mayfly abundance notably decreased between the sampling events with several taxa decreasing from abundant to common even though number of mayfly taxa increased from 8 to 11. caddisfly taxa decreased from 7 in 2001 to 3 in 2006.

Data Analysis

The Little Uwharrie River drains a relatively undisturbed forested watershed. The rocky substrate of the site is slightly embedded with silt. The riffle sampled is somewhat uncharacteristic of the more sandy nature of other sections of the river. Results of this sampling event indicate that water quality has remained consistent or possibly improved during the previous ten years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little Uwharrie R	**SR 1405**	**05/02/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354552	800010	13-2-1	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	42.9	--	13	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	13.5
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	106
pH (s.u.)	6.5

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**87**

Site Photograph

Substrate Gravel, cobble, boulder outcrops

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/02/06	2006-29	23	56	Excellent

Most Abundant Species Redlip Shiner and Bluehead Chub

Exotic Species Swallowtail Shiner and Green Sunfish.

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains northwestern Randolph County, a small portion of eastern Davidson County, including the area south of the City of Thomasville, and the US 64 corridor. **Habitat** -- pools; two good riffles; snags; large dead trees across channel; good riparian zones. **2006** -- high abundance and species diversity including 3 species of darters, 4 species of sunfish and bass, 3 species of suckers, and 2 intolerant species; data were summarized in BAU Memorandum 20061121.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CARAWAY CR	SR 1331	05/15/06	GOOD-FAIR

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
RANDOLPH	9	3040103	13-2-3	354257	795546

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	42.9	12	0.1

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	10	10	

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

Water Quality Parameters

Temperature (°C)	16.2
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	128
pH (s.u.)	6.5
Water Clarity	Slightly Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	8
Bottom Substrate (15)	8
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	10
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	59

Site Photograph

Substrate Gravel with some sand and rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/15/06	9906	74	17	5.8	4.9	Good-Fair
08/09/01	8554	NA	18	NA	4.3	Good-Fair
08/08/96	7139	NA	17	NA	4.7	Good-Fair

Taxonomic Analysis

Taxa observed in 2006 sampling indicated a slight increase in mayfly taxa including the sensitive *Paraleptophlebia* though previously abundant or common taxa including *Isonychia* and *Leucrocuta* were absent. Caddisfly taxa declined in abundance and stonefly taxa remained fairly stable. The sensitive stonefly genus *Neoperla* was collected in 2006. EPT biotic index increased slightly between 2002 and 2006 indicating a slightly more tolerant community.

Data Analysis

This site on Caraway Creek lies south of US 64 in an area of the creek with a fairly broad floodplain and is bounded in many cases by agricultural fields. Upstream, the creek drains a mostly forested watershed between Shepherd and Caraway Mountains after passing the town of Hillsville. As previously recorded, some stream bank erosion was evident. With limited substrate, canopy, and pools, the site's habitat rating of 59 ranked fairly low among other sites sampled in the subbasin. The benthic community observed appears fairly consistent for the previous ten years

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Caraway Cr	**SR 1331**	**05/08/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	354257	795549	13-2-3	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	43.9	--	12	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	15.4
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	117
pH (s.u.)	6.3

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	12
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**79**

Site Photograph

Substrate Gravel, sand, cobble, bedrock boulders

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-31	19	54	Excellent

Most Abundant Species Redbreast Sunfish and Bluehead Chub

Exotic Species Redear Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains west-central Randolph County; the US 311 corridor traverses its headwaters northwest of the City of Asheboro, and the US 64 corridor dissects the lower one-third of the watershed west of Asheboro. **Habitat** -- two good riffles, runs; side snags and pools; good riparian zones. **2006** -- good species diversity including 3 species of darters, 4 species of sunfish and bass, 2 species of suckers, and 2 intolerant species; data were summarized in BAU Memorandum 20061121.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Betty McGees Cr	**SR 1107**	**05/08/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	9	03040103	353638	795724	13-2-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	8	--	5	0.3	Yes

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

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

Water Quality Parameters

Temperature (°C)	14.0
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	90
pH (s.u.)	6.3

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**73**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-32	18	52	Good
04/16/01	2001-15	15	52	Good
04/18/96	96-24	14	54	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Largemouth Bass. **Gains** -- Eastern Mosquitofish (first time collected at the site), Margined Madtom, Bluegill, and Redear Sunfish (first time collected at the site).

Data Analysis

Watershed -- drains a small rural area in southwestern Randolph County including the northern portion of the Birkhead Wilderness Area in the USFS Uwharrie National Forest. **Habitat** -- a typical Carolina Slate Belt stream; short and shallow riffles; side snags; a few pools; poor quality (Chinese privet), but wide riparian zones; water withdrawal structure within reach may affect stream during low flow periods. **2006** -- increase in the number of species from 15 to 18; increase in the percentage of species with multiple age groups; data were summarized in BAU Memorandum 20061120. **1996 - 2006** -- specific conductance has averaged ~ 95 µS/cm; total species at site = 19; number of species has increased from 14 to 15 to 18 since 1996; Bluehead Chub and Redbreast sunfish dominant species; NCIBI scores and ratings range from a high Good to a low Excellent.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BARNES CR	**SR 1303**	**05/16/06**	**EXCELLENT**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	3040103	13-2-18-(0.5)	352619	795956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, ORW	23.3	12	0.5

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100			

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

Water Quality Parameters

Temperature (°C)	15.3
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	55
pH (s.u.)	6.4
Water Clarity	Slightly Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	90

Site Photograph

Substrate Bedrock with boulder and rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
05/15/06	9908	95	37	5	4.2	Excellent
09/28/01	8637	79	38	4.1	3	Excellent
08/09/01	8552	108	40	4.2	3.5	Excellent
08/07/86	7134	99	36	4.4	3.4	Excellent
08/01/85	3573	87	29	4.8	4	Excellent

Taxonomic Analysis

Total and EPT taxa abundunce remained fairly consisitent at this site in 2006 relative to previous years. An increase in overall biotic index and EPT biotic index may indicate a shift toward slightly more tolerant taxa in since 2001 sampling. A decline on trichopeteran txa may reflect low flow encountered during sampling and minimized stream-edge root mats. Midge taxa increased from 15 in 2001 to 32 in 2006, the greatest number yet recorded at the site.

Data Analysis

Barnes Creek drains from the Uwharrie Nationl Forest, a mostly undisturbed , and relatively mountianous terrain. The rocky, slate-belt substrate of the stream, mostly bedrock, provides quite good habitat for a variety of species; many of which are found more often in more western/northern North Carolina mountain regions. This site has an ORW designation and has maintained Excellent water quality (as measured by benthic community for two decades of sampling.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Barnes Cr	**SR 1303**	**05/09/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	9	03040103	352617	795956	13-2-18-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,ORW	22.4	--	8	0.4	Yes

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

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

Water Quality Parameters

Temperature (°C)	14.2
Dissolved Oxygen (mg/L)	10.2
Specific Conductance (µS/cm)	51
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**96**

Site Photograph

Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-35	17	58	Excellent
04/16/01	2001-16	16	54	Excellent
10/17/97	97-86	12	44	Good-Fair
04/22/96	96-25	10	48	Good

Most Abundant Species Bluehead Chub and Redlip Shiner

Exotic Species Smallmouth Bass

Species Change Since Last Cycle **Losses** -- Rosyside Dace and Creek Chub. **Gains** -- Flat Bullhead and Chain Pickerel.

Data Analysis

Watershed -- drains rural northwestern Montgomery and southwestern Randolph counties; no municipalities in watershed. **Habitat** -- second greatest habitat score of any fish site in 2006; good riffles and pools; angular bedrock and boulders; *Podostemum;* water slightly stained. Lowest specific conductance of any fish community site in the Piedmont in 2006. 2006 -- lower than expected percentage of species with multiple age groups. **1996 - 2006** -- consistently high total habitat scores; specific conductance ~ 45 µS/cm; total species at site = 23, including 3 species of darters and 3 species of suckers; dominant species are Bluehead Chub, Redbreast Sunfish, and Redlip Shiner; 1996 sample collected near bridge, 1997 data collected after very high flows in 1996 followed by low flows in 1997; 1996 - 2006 data were summarized in BAU Memorandum 20061121.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
DUTCHMANS CR	**SR 1150**	**08/10/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MONTGOMERY	9	03040103	13-2-24	352247	800149

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	3.5	3	0.1

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

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

Water Quality Parameters

Temperature (°C)	26.6
Dissolved Oxygen (mg/L)	5.9
Specific Conductance (µS/cm)	62
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	92

Site Photograph

Substrate boulder, cobble with some gravel and bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10050	---	30	---	3.6	Excellent
08/08/01	8550	---	26	---	3.0	Not Rated
08/07/96	7133	63	29	3.8	3.1	Excellent

Taxonomic Analysis

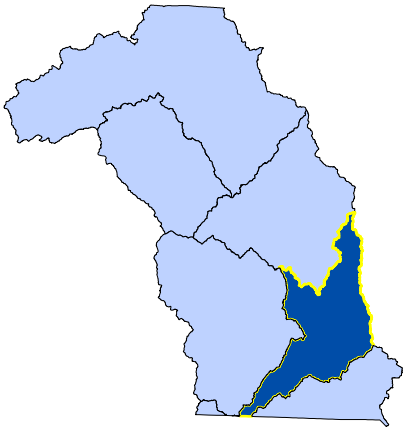
The 2006 sample garnered more EPT than any other sampling year. Abundant intolerant taxa dominated the fauna by two to one (to tolerant taxa) and included the mayflies *Leucrocuta* and *Paraleptophlebia* , the stonefly *Acroneuria abnormis* , and the caddisfly *Chimarra.* Other notable intolerant taxa include the mayfly *Diphetor hageni* and *Epeorus rubidus* as well as the caddisflies *Anisocentropus pyraloides* , *Rhyacophila* , and *Paranyctiophylax moestus.*

Data Analysis

A small streams reference site, Dutchmans Creek's watershed lies entirely in an undeveloped portion of the Uwharrie Mountains. This stream contains an intolerant faunal assemblage that is typical of streams with excellent water quality. Though not rated in 2001 because of low flows, the 2006 sampling occured during flow typical of a small stream and thus was assigned an Excellent rating. Of note was an extremely high wrack line and a reworked upstream segment from extreme highflows that in all probability occured during a spate of hurricanes in 2004.

Lake Tillery/Pee Dee River

Subbasin HUC: 03040104



Water Quality Overview

Of the monitored streams in the Lake Tillery / Pee Dee River subbasin 74 percent are supporting aquatic life and 22 percent do not meet the standards required to support aquatic life. Water quality is generally good compared to other subbasins within the greater Yadkin- Pee Dee River Basin. Issues to be noted include the inability of low flow streams to assimilate waste, impoundments resulting in low dissolved oxygen levels, runoff from agriculture operations and areas of excellent water quality that have the potential to be reclassified as High Quality Water (HQW) to facilitate protecting the water quality in the future.

Watershed at a Glance

Counties

Randolph, Montgomery, Stanly, Anson, Richmond

Municipalities

Arlington, Bethania, Blowing Badin, Albemarle, Norwood, Mt. Gilead, Star, Troy, Biscoe, Candor, Ansonville, Polkton, Wadesboro

Permitted Facilities

NPDES WWTP:	
Major	0
Minor	10
NPDES Nondischarge:	4
NPDES Stormwater:	
General	40
Individual	2
Phase II	0
Animal Operations:	20

Waterbody Summary

Total Streams:.....782.1 mi
.....2,177.3 ac
Total Monitored:.....243 mi
Total Supporting:....179.9 mi
Total Impaired:.....52.3 mi
Total Not Rated:.....10.7 mi
Total No Data:.....539.2 mi
.....2,177.3 ac

General Description

The boundaries of this subbasin are oddly defined. The northeast portion of the subbasin includes the Little River watershed. The western portion includes the Mountain and Brown Creek watersheds. The central portion includes the Pee Dee River from the confluence of the Yadkin and Uwharrie Rivers to the dam at Blewett Falls Reservoir. The Rocky and Uwharrie Rivers are large tributaries, and constitute major 8-digit hydrologic units (HUC) in their own right and are discussed in separate documents.

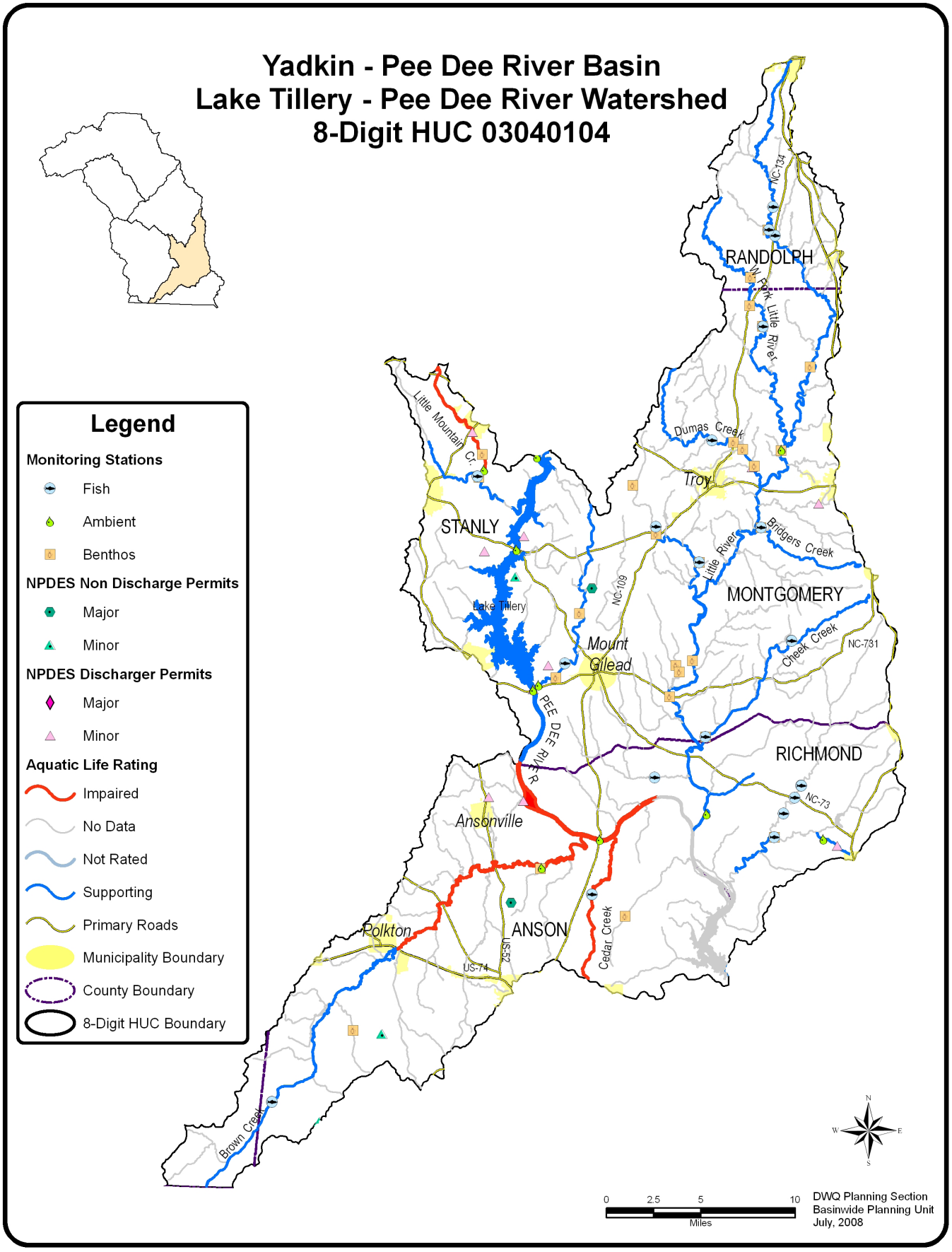
The Mountain Creek watershed flows south of Morrow Mountain and enters the Pee Dee River from the west. This area includes portions of Albemarle and Norwood. A large portion of the Little River is located within the Uwharrie National Forest. The land is mostly forested, but with some areas utilized for agriculture and silviculture. Streams throughout this area have low base flows and tend to stop flowing in summer months.

Troy is the largest urban areas in the northeastern part of this subbasin. Polkton, Ansonville, Mt. Gilead, and portions of Wadesboro are larger communities in the southwestern and central portions of the subbasin.

The Pee Dee River has several minor dischargers. Many of these are located within watersheds where biological samples were collected for this report. These include Greater Badin WWTP (NC 0074756), discharging up to 0.55 MGD to Little Mountain Creek; Mount Gilead Town WWTP (NC 0021105), 0.85 MGD to Clarks Creek; and Montgomery County WTP (0080322), 0.47 MGD to UT Clarks Creek. Three facilities are located within the Little River Watershed. These are Biscoe Town WWTP (NC 0021504) discharging up to 0.6 MGD to Hickory Branch; Carolina Trace Utilities Inc. (NC 0038831), 0.325 MGD to the Upper Little River; and Troy Town WWTP (NC 0028916), 0.84 MGD to Densons Creek.

One discharger, Ansonville Town WWTP (NC 008125), discharges up to 0.12 MGD directly to the Pee Dee River. Another facility, Stony Gap Fish House (NC 0040801) has ceased discharging up to 0.004 MGD to UT Jacobs Creek prior to January 2007.

Figure 4-1. Pee Dee River HUC 03040104



How to Read this Document

This document was written to correspond with our new *Online Geographic Document Distribution* tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add *http://web.ceo.ncsu.edu/basinplans/dwq.kml* to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The *Use Support* report provides information on how and why water quality ratings are determined and DWQ's "*Redbook*" describes in detail water quality standards for each waterbody *classification*. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality *Plans*"

Figure 4-1. shows monitoring station locations and impaired streams for the Lake Tillery/ Pee Dee River subbasin.
Appendix A. provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C. provides summaries of biological and fish assessment monitoring sites.

Current Status and Significant Issues

General Biological Health

A total of 18 biological monitoring sites were sampled within HUC 03040104 for basinwide assessment of water quality. Of those sites, nine rated Excellent, five Good and two Good-Fair. Two sites were Fair. No sites rated Poor in either 2004 or 2006. The two Fair streams, Little Mountain Creek and Cedar Creek are both affected by naturally low flows typically seen in the area. Flows in Little Mountain Creek appear unable to dilute effluent from the upstream Badin WWTP. No anthropogenic influences could be detected that contributed to the naturally low flows at Cedar Creek to cause it to be in a biologically degraded condition.

Of the six benthic sites sampled in 2006, three improved in bioclassification (Little River at NC 731, Mountain Creek at SR 1150 and Clarks Creek at SR 1110); one site declined (West Fork Little River at SR 1311); and two sites remained the same (Little River at SR 1340 and Little Mountain Creek at SR 1720). Mountain Creek (at SR 1720) and Cheek Creek (at SR 1541), benthic sites that were sampled in 2001, were not sampled in 2006. Both streams lacked sufficient flows to enable sampling. In 2001, Mountain Creek rated Good-Fair and Cheek Creek rated Fair.

There were 12 fish sites sampled in 2006 (or in 2004 as special studies). Compared with the 2001 basinwide sampling effort: four improved in bioclassification (Little River at SR 1127, Bridges Creek at SR 1519, Mountain Creek at SR 1720 and Mountain Creek at SR 1150); three declined (Brown Creek at SR 1230, Cedar Creek at SR 1709 and Cheek Creek at SR 1541); and four remained the same (West Fork Little River at SR 1311, Rocky Creek at SR 1549, Clarks Creek at SR 1110 and Cheek Creek at SR 1563). One site, Densons Creek at SR 1323 was only sampled once (in 2004). Fish sites that were not sampled in 2006 (or 2004) that were sampled in 2001 included Dumas Creek (at SR 1310) and Hamer Creek (SR 1159). Hamer Creek is within an area of Triassic geology and was not flowing during spring 2006. This site has since been discontinued as a basin sampling location. Time restrictions did not permit the sampling of Dumas Creek in 2006.

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

SPECIAL STUDIES

Mountain Creek, Little Mountain Creek and Jacobs Creek, Ecosystem Enhancement Program Study

Three sites were sampled for benthic macroinvertebrates in January 2004 as part of the Memorandum of Agreement between the Division of Water Quality and the North Carolina Ecosystem Enhancement Program in the creation of a Local Watershed Plan for the Mountain Creek planning area. Bioclassifications ranged from Poor to Good-Fair. The

benthic communities at all three sites indicate the low flow conditions naturally present in the Slate Belt ecoregion. See ***memorandum B-040831*** for more information.

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating.

Small Streams Study

One benthic site, Wood Run at SR 1150, was sampled twice in 2005 as part of the Small Streams Study. It rated Not Impaired on both occasions. No memorandum is available for this site.

Fish Community Ecosystem Enhancement Program Study

The instream and riparian habitats, physical and chemical characteristics, and fish communities of Mountain, Little Mountain, and Jacobs Creeks in Stanly County were evaluated by DWQ in 2004. These streams are downstream from the Towns of Badin and Albemarle and near Morrow Mountain State Park. Nonpoint nutrient runoff from pastures and livestock which have access to the streams contributed to slightly elevated conductivities, abundant periphyton, and an abundance of nutrient indicator species and tolerant fish.

Fish Community Urbanization Study

Clarks Creek at SR 1110 and Densons Creek at SR 1323 in Montgomery County were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). The fish communities were rated Excellent and Good-Fair, respectively.

Habitat Degradation

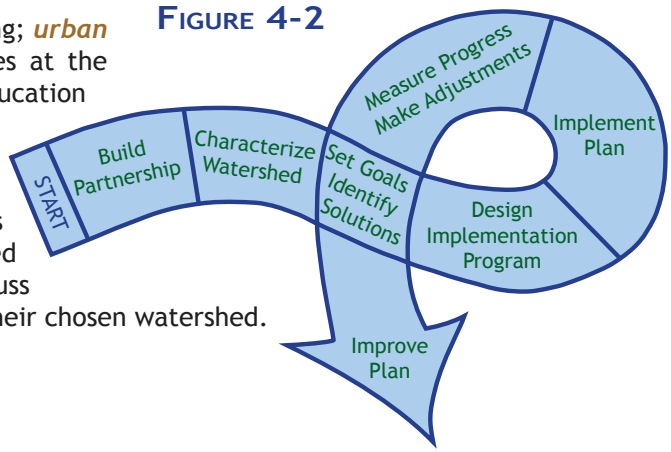
Many streams in this hydrologic unit are impaired or impacted by habitat degradation. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in the area make streams highly vulnerable to these stressors.

Table 4-1. Stream Impaired and Impacted by Habitat Degradation in HUC 03040104

Assessment Unit	Name	Source	Subbasin	Class.	Impaired	Impacted	Miles
13-20a	Brown Creek	General Agriculture/Pasture	03-07-10	C		X	16.5
		Natural Conditions				X	
13-20b	Brown Creek	General Agriculture/Pasture	03-07-10	C	X		28.5
		Impervious Surface					
13-21	Cedar Creek	Natural Conditions	03-07-10	C	X		10.7
		Stormwater Runoff					
13-25-20-(9)	Densons Creek	Impoundment	03-07-15	C		X	2.8
		Natural Conditions					
						Total	58.5

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMPs***, ordinance/rule changes at the local, state, and federal levels, volunteer activism, and education programs. In this watershed, agricultural BMP's are needed most. Figure 4-2 illustrates a general process for developing ***watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. Efforts on all streams listed in Table 4-1 are necessary. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

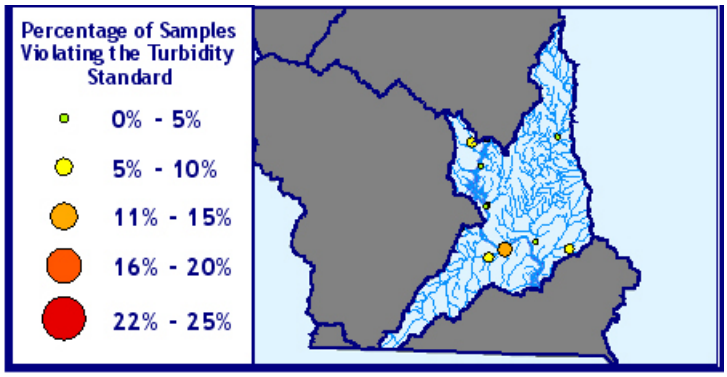
Figure 4-2



Turbidity

There were several ambient sites with turbidity violations in this subbasin (Figure 4-3). Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning beds (reducing fish survival and growth rates), harm fish food sources, fill in pools (reducing cover from prey and high temperature refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul water treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at many of the biological sample sites.

Figure 4-3. Turbidity Violations



Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. It appears violations are highest in the agricultural areas in the Brown Creek watershed. Violations are lowest where land use is predominantly forest. This trend demonstrates the importance of ***protecting and conserving stream buffers and natural areas.***

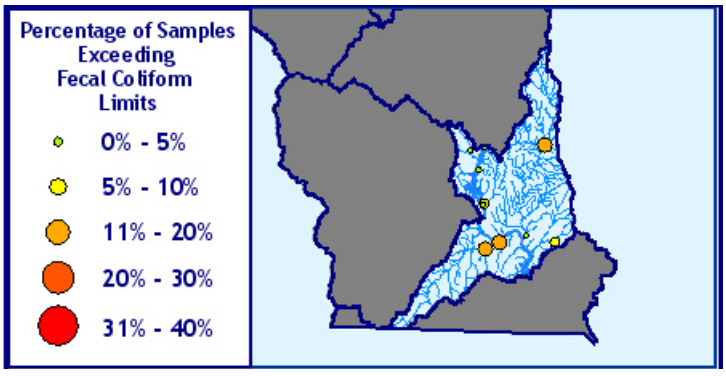
Table 4-2. Streams Impaired by Turbidity Violation in Hydrologic Unit 03040104

Assessment Unit	Name	Source	Subbasin	Class.	Impaired	Miles
13-(15.5)b	Pee Dee River	Stormwater Runoff	03-07-10	WS-V;B	X	10.4
		General Agriculture/Pasture				
		Natural Conditions				

Fecal Coliform Bacteria

Fecal coliform bacteria concentrations did exceed 400 colonies/100ml. in this subbasin (Figure 4-4). The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Figure 4-4. Fecal Violations



An analysis of all ambient water quality stations in the Lake Tillery – Pee Dee River subbasin shows a downward trend in fecal coliform bacteria concentrations from 2002-2006. Rainfall, which influences bacteria concentrations, did not appear to be driving this trend. Therefore, the decrease is likely due to implementation of agricultural BMPs and sewer infrastructure improvements. However, concentrations remain elevated and further work remains to be done. Additional funds will be necessary to continue implementing these improvements.

Table 4-3. Streams Impacted and Impaired by Fecal Coliform Bacteria Concentrations

Assessment Unit	Name	Source	Subbasin	Class.	Impacted	Miles
13-(15.5)b	Pee Dee River	Stormwater Runoff	03-07-10	WS-V; B	X	10.4
		General Agriculture/Pasture				
		Natural Conditions				
13-20b	Brown Creek	General Agriculture/Pasture	03-07-10	C	X	28.5
					Total	38.9

Other Stressors

Low dissolved oxygen is a problem throughout this subbasin. In many cases, naturally low flow in the summer depresses oxygen levels. In the case of Little Mountain Creek, the low flows are not able to dilute the Badin WWTP discharge, further degrading the stream. A CWMTF grant, used to rehabilitate the sewer system feeding the Badin WWTP, may also help improve conditions by reducing raw sewage overflows. New discharges with significant biological oxygen demands should not be permitted in low flow streams. These and existing discharges should be directed to the Pee Dee main stem or streams with consistent flows, suitable for waste assimilation. Water reuse options, such as the one *i*mplemented by Troy should be explored.

The Lake Tillery dam causes the low dissolved oxygen impact on the Pee Dee River. Water with low dissolved oxygen is drawn from the bottom of Lake Tillery to produce electricity and the discharged into the river. This dam was part of a major FERC Relicensing effort for all the dams owned by Progress Energy and the Aluminum Company of America (ALCOA). Physical upgrades and operational changes negotiated as part of this effort are expected to improve dissolved oxygen conditions in the river.

Table 4-4. Other Stressors Impacting Streams In Hydrologic Unit 03040104

Assessment Unit	Name	Stressor	Source	Subbasin	Class.	Impaired	Impacted	Length Miles
13-(15.5)a	Pee Dee River	Low Dissolved Oxygen	Impoundment	03-07-10	WS-V; B		X	4.9
13-(15.5)b	Pee Dee River	Low Dissolved Oxygen	Natural Conditions	03-07-10	WS-V; B		X	10.4
			Stormwater Runoff					
13-20b	Brown Creek	Low Dissolved Oxygen	Natural Conditions	03-07-10	C	X		28.5
13-5-1-(2)	Little Mountain Creek	Low Dissolved Oxygen	Natural Conditions	03-07-08	C		X	5.7
			WWTP NPDES					
			Impoundment					
		Nutrient Impacts	WWTP NPDES					
13-9-(2)	Jacobs Creek	Nutrient Impacts	Stormwater Runoff	03-07-08	WS-IV; CA		X	0.5
		Low Dissolved Oxygen	Stormwater Runoff					
							Total	50.1

See *Yadkin Ambient Monitoring System Report* and *Yadkin Basinwide Assessments* for more information regarding specific monitoring sites.

Population and Land Use

This is a rural area with a few small towns. A large part of the northeast portion of HUC is located within the Uwharrie National Forest. The land is mostly forested, but with some areas utilized for agriculture and silviculture. The town of Troy is the largest urban area. Land use in the southwestern part of the watershed is primarily a combination of forest and agriculture with smaller towns like Polkton and Ansonville. The town of Wadesboro is partially contained within this area.

DWQ biological and ambient data suggest the urban areas are having a minimal impact on water quality. Most impacts are coming from agricultural impacts in the southwestern part of the watershed, around Brown and Cedar Creeks. ***Agricultural BMPs*** are needed in these watersheds. The remainder of the watershed offers many opportunities for ***protecting and conserving stream buffers and natural areas*** that will prevent stream degradation in the long term. Many of the streams in this area are rated Excellent. Residents and local governments should consider requesting a ***stream reclassification to High Quality Waters*** to help preserve excellent water quality.

Figure 4-5. 2000 Population Density

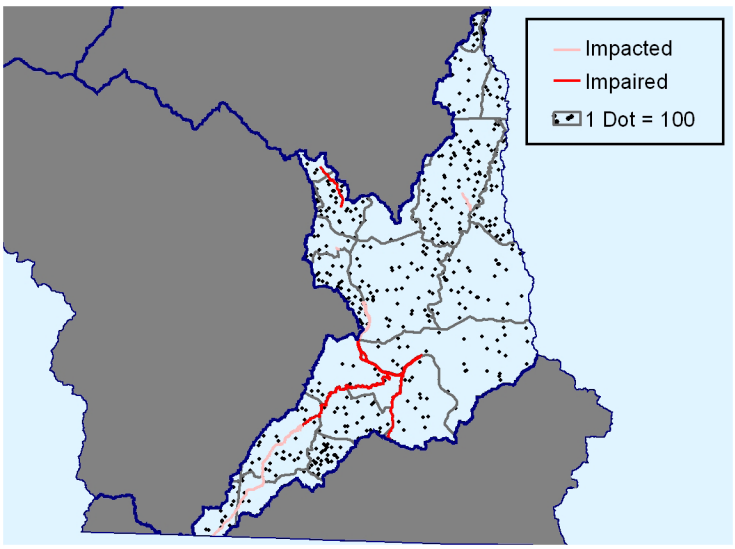
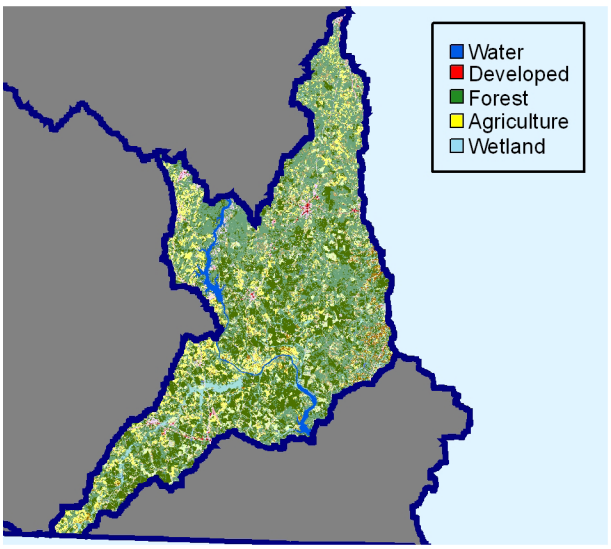


Figure 4-6. Land Cover



Local Initiatives

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 5 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining seventy percent is made available through a competitive grants process.

319 projects have not been awarded in this watershed. Any of the impaired streams listed above are candidates for 319 funding. Interested parties should contact the ***Basinwide Planning Program*** to discuss potential projects.

Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made significant investment in this hydrologic unit. Figure 4-7 shows the distribution of projects to date in the watershed and Table 4-5, at the end of this document, includes a list of projects and their cost. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and creative water reuse systems.

Figure 4-7. CWMTF Projects

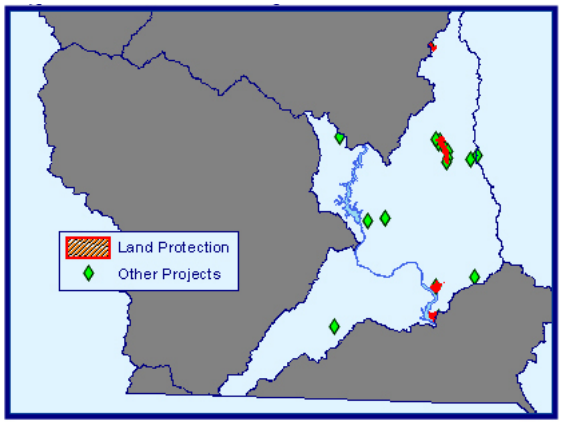


Table 4-5. CWMTF Funded Projects In 03040104 (9/1/2001 - 8/31/2006)

Project Number	Application Name	Proposed Project Description	Amount Funded
2001B-049	Troy, Town of - Acquisition/ Densons Creek & Little River (Phase III)	Protect 58 acres through fee simple purchase and conservation easements along Densons Creek and Little River.	$372,000
2002B-021	Troy, Town of - Acq./ Denson's Cr. Phase IV	Protect through permanent conservation easements 37 riparian acres along Densons Creek and Little River.	$236,800
2002B-501	Greater Badin Water & Sewer District - Sewer System Rehabilitation/Little Mt. Cr.	Rehabilitate sewer collection system by replacing 18,400 LF of sewer collection lines and 83 manholes, and installing 208 service connections. Reduce overflow of raw sewage to Little Mountain Creek.	$1,677,000
2003A-041	Troy, Town of - Acq./ Densons Creek, Phase IV	Acquire through fee simple purchase 5.9 acres and purchase a permanent conservation easement on 64 acres along the Little River and Smitherman Creek. This tract adds to the south end of an existing protected corridor of 640 acres along 6 miles of stream.	$287,000
2003A-513	Troy, Town of - Wastewater/ Densons Creek Reuse	Design and permit a wastewater system to seasonally divert 87% of Troy's average daily discharge from Denson's Creek to a nearby golf course for irrigation.	$55,000
2003A-801	Biscoe, Town of- Plan./ Regional Wastewater Feasability, Cedar Cr.	Evaluate possible wastewater treatment and disposal alternatives, including the feasibility of wastewater regionalization, in the Hickory Branch and Cotton Creek drainages. Wastewater treatment for the towns of Biscoe and Star will be a focus.	$36,000
2004B-506	Ellerbe, Town of - WW/ UV Disinfection, Toms Creek	Design, permit and construct a sand filtration and UV disinfection system as an additional treatment step to the Town's existing lagoon treatment process. Project will reduce fecal coliform and chlorine contamination of Toms Creek.	$365,000
2005A-502	Biscoe, Town of - WW/ Treatment Plant Upgrade, Cedar Creek	Reduce fecal coliform and chlorine delivery to Cedar Creek by repairing the Town's WWTP. Includes closing an unused lagoon, replacing a pump station, and installing dechlorination equipment at the WWTP and telemetry equipment at 9 pump stations.	$480,000
2006A-034	NC Wildlife Resources Commission - Acq./ Mountain Creek Tracts	Protect through fee simple purchase 373 ac along Mountain Creek. CWMTF funds to purchase 157 riparian ac. Tract aids protection of rare aq spp & will be part of NC Game Lands Program and is adjacent to existing WRC public boat ramp on Blewett Falls Lake.	$277,000
2006A-521	Mount Gilead, Town of- WW/ I&I Rehabilitation, Pee Dee River	Conduct a feasibility study to investigate the cost-effectiveness and advantages of a low pressure system to minimize future upgrade and operation and maintenance costs. The sewer system runs along Clarks Creek, a 303(d)-listed stream.	$55,000
2006A-533	Troy, Town of- WW/Acq/ Land Application Site and Greenway, Dumas Creek	Purchase 151 acres in fee for land application of wastewater. Reestablish buffers where needed and a greenway trail. Compliments Town's extensive efforts to improve water quality in the Denson's Creek watershed.	$1,455,000
2006A-813	Mount Gilead, Town of- Plan/WW/Storm/ GIS Mapping, Harner Creek	Fund GIS mapping of the Town's stormwater and sewer systems by locating lines, manholes and catch basins. The Town will use this information to develop programs to eliminate sources of pollution to both surface and groundwaters.	$29,000

This list does not include: regional or statewide projects that were in multiple river basins or projects that were funded and subsequently withdrawn.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Pee Dee River watershed. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 4-6 shows the number of projects implemented and in this watershed and the dollar amount invested. Table 4-7 shows the water quality benefits realized from that investment.

Table 4-6. ACSP Project Expenditures In the Yadkin Hydrologic Unit

	Erosion Reduction/Nutrient Loss Reduction in Fields		Sediment/Nutrient Delivery Reduction from Fields		Stream Protection from Animals			Proper Animal Waste Management		
12-digit HU	Total Implemented	Cost	Total Implemented	Cost	Total Implemented		Cost	Total Implemented		Cost
030401040100	38.82 ac.	$4,407			2 units	710 LF	$5,163	1 unit		$22,194
030401040200	109.1 ac.	$19,105						6 units		$89,381
030401040300	0.2 ac.	$3,469						5 units		$82,837
030401040400	0.1 ac.	$292	1 unit	$306	1 unit		$4,985	6 units		$89,166
030401040500								1 unit		$6,607
030401040600								4 units		$23,478
030401040700	0.8 ac.	$766						1 unit		$1,901
030401040800	86.8 ac.	$8,587						9 units	1 ton	$137,552
Total		$36,626		$306			$10,148			$453,116

Table 4-7. NC ASCP Water Quality Benefits

	Water Quality Benefits				
	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401040100	274	742	22	36,720	56,160
030401040200	639	26,428	37,318	77,073	120,735
030401040300		23,328	35,910	113,253	178,249
030401040400	26	33,722	40,028	96,856	144,030
030401040500				10,920	17,976
030401040600				145,189	158,554
030401040700	8	8	1		
030401040800	488	2,409	325	133,986	170,948
Total	1,435	86,637	113,604	613,997	846,652

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

Appendix A

Use Support Ratings for All Monitored Waterbodies in Lake Tillery / Pee Dee River Subbasin

HUC- 03040104

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-25-24	**Bridgers Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Little River										
C;HQW	03-07-15	9.2 FW Miles								
13-20a	**Brown Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From N.C.-S.C. State Line to mouth of Lick Creek			General Agriculture/Pasture							
C	03-07-10	16.5 FW Miles	Natural Conditions							
13-20b	**Brown Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	1998	5
From mouth of Lick Creek to Pee Dee River			General Agriculture/Pasture	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1996	1998	4s
C	03-07-10	28.5 FW Miles	Impervious Surface	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Low Dissolved Oxygen							
			Natural Conditions							
13-21	**Cedar Creek**		**Habitat Degradation**	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Pee Dee River			Natural Conditions							
C	03-07-10	10.7 FW Miles	Stormwater Runoff							
13-25-36a	**Cheek Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to NC 731										
C	03-07-15	9.3 FW Miles								
13-25-36b	**Cheek Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From NC 731 to Little River										
C	03-07-15	8.1 FW Miles								
13-16	**Clarks Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Pee Dee River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
C	03-07-10	12.6 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-25-20-(9)	**Densons Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From dam at Troy Reservoir to Little River			Impoundment							
C	03-07-15	2.8 FW Miles	Natural Conditions							
13-25-20-8	**Dumas Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2001		1
From source to Densons Creek										
C;HQW	03-07-15	9.4 FW Miles								

Assessment Unit Number / Description / Classification	DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-9-(2) Jacobs Creek			**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From a point 0.3 mile upstream of Stanly County SR 1740 to Lake Tillery, Pee Dee River			**Nutrient Impacts**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2004		1
WS-IV;CA	03-07-08	0.5 FW Miles								
13-25-38-1 Little Buffalo Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to Buffalo Creek										
WS-IV	03-07-15	2.7 FW Miles								
13-5-1-(1) Little Mountain Creek				Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to a point 0.5 mile upstream of Stanly County SR 1545				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
C	03-07-08	1.4 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-5-1-(2) Little Mountain Creek			**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.5 mile upstream of Stanly County SR 1545 to Mountain Cr.			Impoundment Natural Conditions WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
WS-IV	03-07-08	5.7 FW Miles	**Nutrient Impacts**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-25-(1) Little River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Suggs Creek										
C	03-07-15	23.9 FW Miles								
13-25-(11.5) Little River				Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Suggs Creek to Densons Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C;HQW	03-07-15	12.9 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-25-(19) Little River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Densons Creek to Hammer Creek										
C	03-07-15	18.5 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-25-(37.5)	**Little River**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Hamer Creek to Pee Dee River										
WS-IV	03-07-15	3.7 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-28-(0.5)	**Mountain Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to a point 1.1 miles upstream of mouth										
WS-IV	03-07-10	4.6 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
13-5-(0.7)	**Mountain Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From Stanly County SR 1542 to a point 0.5 mile upstream of mouth										
WS-IV	03-07-08	7.3 FW Miles								
13-(15.5)a	**PEE DEE RIVER**		**Low Dissolved Oxygen** Impoundment	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Norwood Dam to Rocky River										
WS-V,B	03-07-10	4.9 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-(15.5)b	**PEE DEE RIVER**		**Low Dissolved Oxygen** Natural Conditions Stormwater Runoff **Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Rocky River to mouth of Turkey Top Creek				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-V,B	03-07-10	10.4 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-(34)a	**PEE DEE RIVER**		**Habitat Degradation** Impoundment **Mercury** Impoundment	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Blewett Falls Dam to mouth of Hitchcock Creek				Fish Consumption	Impaired	Standard Violation	Mercury	2004	2004	5
C	03-07-16	6.3 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-25-30-(0.5)	**Rocky Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From N.C. Hwy. 27 to Little River										
C;HQW	03-07-15	6.4 FW Miles								
13-28-2-4	**Toms Branch**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Little Mountain Creek										
C	03-07-10	2.3 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-25-15	**West Fork Little River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Little River										
C	03-07-15	23.7 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
13-7-(2)	**Wood Run**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From a point 0.2 mile upstream of Montgomery County SR 1150 to Lake Tillery, Pee Dee River										
WS-IV;CA	03-07-08	0.6 FW Miles								

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040104 – LAKE TILLERY/PEE DEE RIVER

Description

This HUC encompasses subbasins 10, 15, and a portion of 08. The portion of subbasin 08 included in begins at the confluence of the Uwharrie and Yadkin rivers, which forms the Pee Dee River (Figure 5).

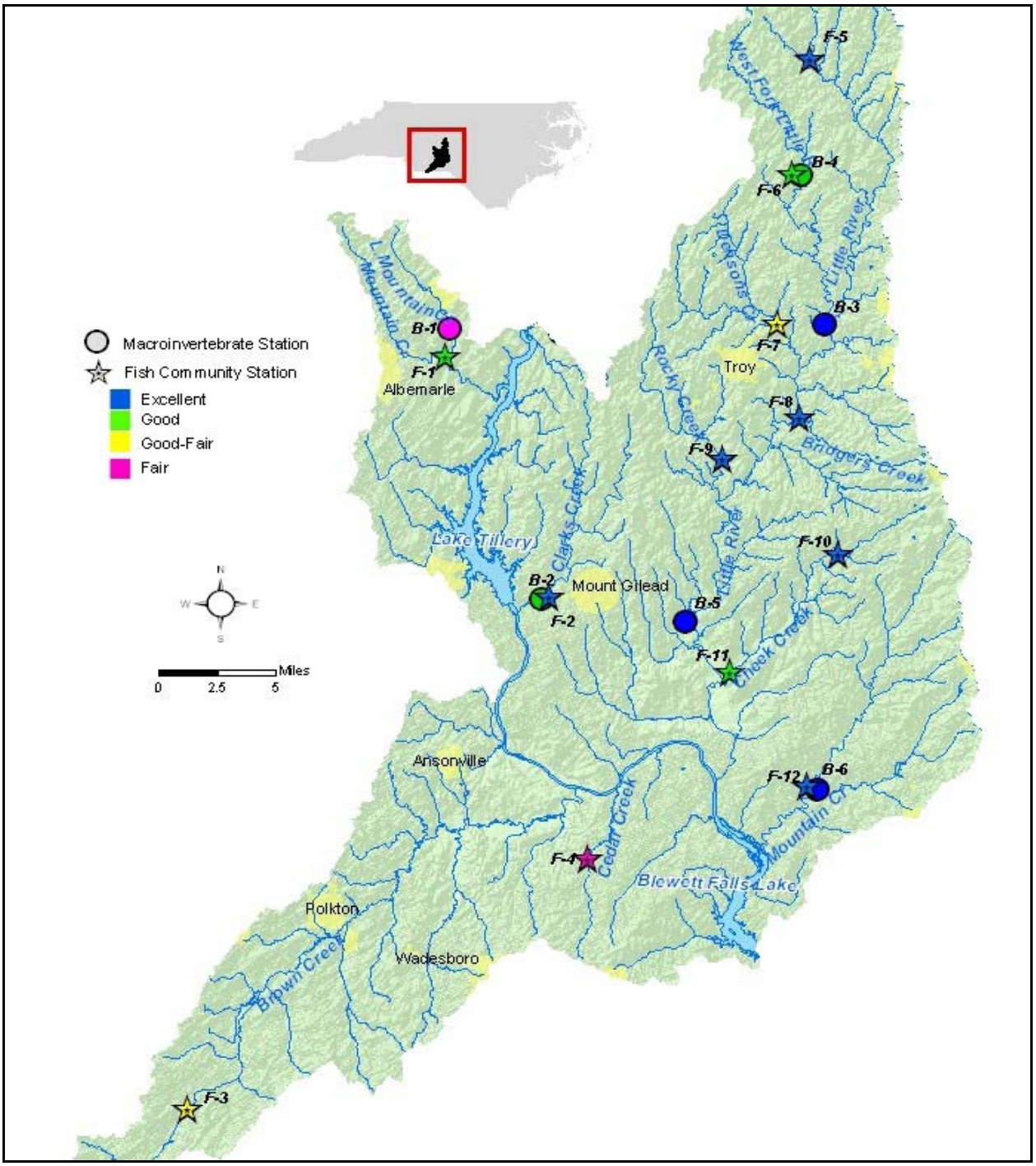


Figure 5. Sampling sites in HUC 03040104 in the Yadkin River basin. Monitoring sites are listed in Table 4.

The Uwharrie River watershed is not included in this HUC. Near this boundary and included in this HUC is the Mountain Creek watershed that flows south of Morrow Mountain and enters the Pee Dee River from the west. This area includes the municipalities of Albemarle (in part) and Norwood. The principle impoundment on the Pee Dee River in this part of the HUC, is Lake Tillery. East and north of this area (formerly subbasin 030715) is the Little River and its tributaries. The Little River itself is a tributary of the Pee Dee River. A large portion of this area of the HUC is located within the Uwharrie National Forest. The land is mostly forested, but with some areas utilized for agriculture and silviculture. The town of Troy is the largest urban area in this northeastern part of HUC 03040104. The Carolina Slate Belt subecoregion dominates the northern part of the HUC. This subecoregion has some of the lowest water yielding geology in the state resulting in the tendency of streams to dry up in summer.

Just south of this area is an approximately 50 mile long and 10 mile wide band of Triassic geology that runs southwest to northeast. Streams in the Triassic subecoregion have low base flows and also tend to stop flowing in summer months. This area consists of the portion of the Pee Dee River and its tributaries from the Rocky River confluence to the dam at Blewett Falls Lake. Land use here is primarily a combination of forest and agriculture with smaller towns like Polkton and Ansonville. The town of Wadesboro is partially contained within this area. Clarks Creek is contained within a narrow portion of Carolina Slate Belt geology that exists in the extreme southeastern part of this HUC.

The Pee Dee River has many permitted dischargers. However, contained within this HUC are less than 10 permitted facilities, none of which are listed as Major dischargers. Several of these are located within watersheds where biological samples were collected for this report. These include Greater Badin WWTP (NC 0074756), discharging up to 0.55 MGD to Little Mountain Creek; Mount Gilead Town WWTP (NC 0021105), 0.85 MGD to Clarks Creek; and Montgomery County WTP (0080322), 0.47 MGD to UT Clarks Creek. Three facilities are located within the Little River Watershed. These are Biscoe Town WWTP (NC 0021504) discharging up to 0.6 MGD to Hickory Branch; Carolina Trace Utilities Inc. (NC 0038831), 0.325 MGD to the Upper Little River; and Troy Town WWTP (NC 0028916), 0.84 MGD to Densons Creek.

One discharger, Ansonville Town WWTP (NC 008125), discharges up to 0.12 MGD directly to the Pee Dee River. Another facility, Stony Gap Fish House (NC 0040801) has ceased discharging up to 0.004 MGD to UT Jacobs Creek before January 2007.

Overview of Water Quality

A total of 18 biological monitoring sites were sampled within HUC 03040104 for basinwide assessment of water quality (Table 4). Of those sites, nine rated Excellent, five Good and two Good-Fair. Two sites were Fair. No sites rated Poor in either 2004 or 2006. The two Fair streams, Little Mountain Creek and Cedar Creek are both affected by naturally low flows typically seen in both Carolina Slate Belt and Triassic Basin ecoregions. Flows in Little Mountain Creek however appear unable to dilute effluent from the upstream Badin WWTP. No anthropogenic influences could be detected that contributed to the naturally low flows at Cedar Creek to cause it to be in an biologically degraded condition.

Water quality in HUC 03040104 appears to be stable between the 2001 to 2006 samplings (Table 4). Of the six benthic sites sampled in 2006, three improved in bioclassification (Little River at NC 731, Mountain Creek at SR 1150 and Clarks Creek at SR 1110); one site declined (West Fork Little River at SR 1311); and two sites remained the same (Little River at SR 1340 and Little Mountain Creek at SR 1720).

There were12 fish sites sampled in 2006 (or in 2004 as special studies). Compared with the 2001 basinwide sampling effort: four improved in bioclassification (Little River at SR 1127, Bridges Creek at SR 1519, Mountain Creek at SR 1720 and Mountain Creek at SR 1150); three declined (Brown Creek at SR 1230, Cedar Creek at SR 1709 and Cheek Creek at SR 1541); and four remained the same (West Fork Little River at SR 1311, Rocky Creek at SR 1549, Clarks Creek at SR 1110 and Cheek Creek at SR 1563). One site, Densons Creek at SR 1323 was only sampled once (in 2004).

Table 4. Waterbodies monitored in the Yadkin River HUC 03040104 for basinwide assessment, 2001-2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	Little Mountain Cr	Stanly	SR 1720	Fair	Fair
B-2	Clarks Cr	Montgomery	SR 1110	Good-Fair	Good
B-3	Little R	Montgomery	SR 1340	Excellent	Excellent
B-4	West Fk Little R	Montgomery	SR 1311	Excellent	Good
B-5	Little R	Montgomery	NC 731	Good	Excellent
B-6	Mountain Cr	Richmond	SR 1150	Good	Excellent
F-1	Mountain Cr	Stanly	SR 1720	Good-Fair	Good (2004)
F-2	Clarks Cr	Montgomery	SR 1188 (SR1110)	Excellent	Excellent (2004)
F-3	Brown Cr	Anson	SR 1230	Good	Good-Fair
F-4	Cedar Cr	Anson	SR 1709	Good-Fair	Fair
F-5	Little R	Randolph	SR 1127	Good	Excellent
F-6	W Fk Little R	Montgomery	SR 1311	Good	Good
F-7	Densons Cr	Montgomery	SR 1323	---	Good-Fair (2004)[2]
F-8	Bridgers Cr	Montgomery	SR 1519	Good	Excellent
F-9	Rocky Cr	Montgomery	SR 1549	Excellent	Excellent
F-10	Cheek Cr	Montgomery	SR 1563	Excellent (1999)	Excellent
F-11	Cheek Cr	Montgomery	SR 1541	Excellent	Good
F-12	Mountain Cr	Richmond	SR 1150	Good	Excellent

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.
[2]special study site that has become a basinwide site.

River and Stream Assessment

Mountain Creek (at SR 1720) and Cheek Creek (at SR 1541), benthic sites that were sampled in 2001, were not sampled in 2006. Both streams lacked sufficient flows to enable sampling. In 2001, Mountain Creek rated Good-Fair and Cheek Creek rated Fair. Fish sites that were not sampled in 2006 (or 2004) that were sampled in 2001 included Dumas Creek (at SR 1310) and Hamer Creek (SR 1159). Hamer Creek is within an area of Triassic geology and was not flowing during spring 2006. This site has since been dropped as a basin sampling location. Time restrictions did not permit the sampling of Dumas Creek in 2006.

Specific site summaries of the 6 benthic macroinvertebrate and 12 fish community samples may be found at this link: **03040104**.

SPECIAL STUDIES

Mountain Creek, Little Mountain Creek and Jacobs Creek, Ecosystem Enhancement Program Study

Three sites were sampled for benthic macroinvertebrates in January 2004 as part of the Memorandum of Agreement between the Division of Water Quality and the North Carolina Ecosystem Enhancement Program in the creation of a Local Watershed Plan for the Mountain Creek planning area. Bioclassifications ranged from Poor to Good-Fair. The benthic communities at all three sites indicate the low flow conditions naturally present in the Slate Belt ecoregion. See memorandum B-040831 for more information.

Lick Creek TMDL

Two benthic sites were sampled in 2003 because Lick Creek was considered impaired from its source to a point one mile upstream of Davidson County SR 2501, not far above the confluence with the Yadkin River. Both sites received a Good-Fair rating. See memorandum B-040212 for more information.

Small Streams Study

One benthic site, Wood Run at SR 1150, was sampled twice in 2005 as part of the Small Streams Study. It rated Not Impaired on both occasions. No memorandum is available for this site.

Fish Community Ecosystem Enhancement Program Study
The instream and riparian habitats, physical and chemical characteristics, and fish communities of Mountain, Little Mountain, and Jacobs Creeks in Stanly County were evaluated by DWQ in 2004 (Biological Assessment Unit Memorandum 20040501). These streams are downstream from the Towns of Badin and Albemarle and near Morrow Mountain State Park. Nonpoint nutrient runoff from pastures and livestock which have access to the streams contributed to slightly elevated conductivities, abundant periphyton, and an abundance of nutrient indicator species and tolerant fish.

Fish Community Urbanization Study
Clarks Creek at SR 1110 and Densons Creek at SR 1323 in Montgomery County were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study (unpublished data). The fish communities were rated Excellent and Good-Fair, respectively.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mountain Cr	**SR 1720**	**03/22/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	8	03040104	352148	800657	13-5-(0.7)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	14	--	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	0	40	20 (rural residential)

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

Water Quality Parameters

Temperature (°C)	8.5
Dissolved Oxygen (mg/L)	12.0
Specific Conductance (µS/cm)	96
pH (s.u.)	6.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	8
Riffle Habitat (16)	15
Left Bank Stability (7)	6
Right Bank Stability (7)	4
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	2
Total Habitat Score (100)	**81**

Site Photograph

Substrate Cobble, slate

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
03/22/04	2004-01	16	50	Good
04/17/01	2001-18	15	46	Good-Fair
04/18/96	96-23	13	50	Good

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle **Gains --** Highfin Shiner, Flat Bullhead, and Pumpkinseed. **Losses** -- Brassy Jumprock and Redear Sunfish.

Data Analysis

Watershed -- drains semi-rural, east-central Stanly County; tributary to Lake Tillery (Pee Dee River) at Morrow Mountain State Park. **Habitat** -- a typical Carolina Slate Belt type stream; high quality instream habitats; angled bedrock; open canopy at the bridge; open forested riparian zones; water easily silted with periphyton; slick rocks with thick periphyton; bluegreen algal mats on some rocks; livestock with access to the stream causing bank erosion, breaks in the riparian zones, and nutrient enrichment. **2004** -- only 1 species of darter collected; no intolerant species; and percentage of tolerant fish moderately elevated. **1996 - 2004** -- specific conductance has averaged ~ 90 µS/cm; 18 species are known from the site, but no intolerant species and only 1 species of darter present; lack of intolerant species and the low diversity of darters are the result of Lake Tillery serving as a recolonization barrier; dominant species is consistently the Bluehead Chub; 2004 data were summarized in Biological Assessment Unit Memorandum F-20040501.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
L MOUNTAIN CR	**SR 1720**	**08/10/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	8	03040104	13-5-1-(2)	352253	800647

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV	8.5	5	0.1

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

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

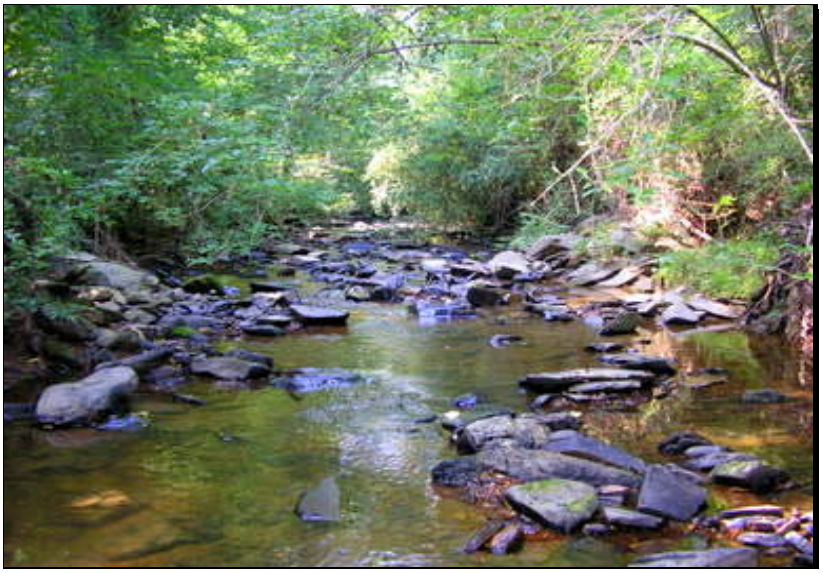
Water Quality Parameters

Temperature (°C)	25.5
Dissolved Oxygen (mg/L)	5.3
Specific Conductance (µS/cm)	192
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	14
Pool Variety (10)	4
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	76

Site Photograph



Substrate boulder, rubble gravel sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/10/06	10049	53	10	6.2	5.9	Fair
08/08/01	8547	54	12	5.9	5.8	Fair
08/07/96	7130	---	11	---	5.9	Fair

Taxonomic Analysis

The number of EPT taxa collected has remained stable since the first collection in 1996. Though the 2006 collection included two new taxa for this site (intolerant caddisflies *Polycentropus* and *Diplectrona modesta*), these taxa were rare in abundance. One intolerant stonefly (*Eccoptura xanthenes*) was also collected though it too was rare. Abundant taxa at the site (the caddisflies *Cheumatopsyche* and *Hydropsyche betteni*, the omnipresent mayfly *Maccaffertium modestum* and the snail *Elimia)* were highly tolerant with the exception of intolerant *Elimia*. A midge, *Dicrotendipes noemodestus,* a species indicative of organic enrichment, was present in abundance.

Data Analysis

Approximately 1.5 miles downstream of the Badin WWTP, Little Mountain Creek exhibits the intermittent flow characteristic of slate belt streams. Low flows during the summer months fail to dilute the the effluent from the WWTP resulting in elevated specific conductance. An increase in the EPT BI is most likely due to lower abundances of EPT collected in 2006 as compared to 2001 (43 and 70, respectively). It is probable that low flows and organic enrichment are prohibiting an improvement in water quality as habitat was not restrictive.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Clarks Creek	**SR 1110**	**08/22/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	10	03040104	13-16	351236	800230

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	30.7	3	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	0

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

Water Quality Parameters

Temperature (°C)	25.6
Dissolved Oxygen (mg/L)	8.1
Specific Conductance (µS/cm)	86
pH (s.u.)	6.9
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	7
Riffle Habitat (16)	14
Left Bank Stability (7)	3
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	81

Site Photograph

Substrate Rubble, boulder, gravel, bedrock

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10081	NA	21	NA	4.3	Good
08/08/01	8549	NA	18	NA	4.9	Good-Fair
08/07/96	7132	82	26	5.8	5.2	Good-Fair

Taxonomic Analysis

This site has been sample twice using EPT methodology (2001 and 2006). The 2006 collection resulted in two previously uncollected (at this location) intolerant mayfly taxa (*Habrophlebiodes sp* . and *Habrophlebia vibrans*) as well as one new intolerant caddisfly record (*Pycnopsyche sp* .).

Data Analysis

The first time addition of several intolerant mayfly and caddisfly taxa at this location resulted in an improved Good bioclassification for 2006. However, the minimum EPT needed for a Good bioclassification for a Piedmont stream is 21. As a result, the 2006 Good bioclassification was borderline. Indeed, the EPTN was identical (91) from 2001 to 2006. These data suggest stable conditions upstream of this stream segment. Currently, the most important influence on this slate belt system is likely related to low summer flows.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clarks Cr	**SR 1110**	**06/24/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	10	03040104	351234	800230	13-16	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.6	--	7	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	0	25 (rural residential)

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

Water Quality Parameters

Temperature (°C)	24.3
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	62
pH (s.u.)	--

Water Clarity: Slightly tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	16
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**86**

Site Photograph

Substrate: Cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-107	25	54	Excellent
04/12/01	2001-14	19	54	Excellent

Most Abundant Species: Bluehead Chub

Exotic Species: Green Sunfish, Redear Sunfish, and Yellow Perch.

Species Change Since Last Cycle: **Gains** -- Coastal Shiner, Yellow Bullhead, Flat Bullhead, Speckled Killifish, Pumpkinseed, Warmouth, Bluegill, Redear Sunfish, sunfish hybrid, and Largemouth Bass. **Losses** -- Creek Chub, Rosyside Dace, Satinfin Shiner, Notchlip Redhorse, and Brassy Jumprock.

Data Analysis

Watershed -- drains southwestern Montgomery County, including the western area of the Town of Mount Gilead; site is ~ 1.2 miles below site sampled in 2001 (difference in drainage area is 6.6 square miles); tributary to Pee Dee River immediately below Lake Tillery, site is ~ 1.5 miles from the creek's mouth. **Habitat** -- a typical Carolina Slate Belt type streams; riffles (good short and long shallow riffles), runs, pools, snags, and deadfalls. **2004** -- seven species of sunfish collected; moderately elevated percentage of omnivores+herbivores; sampled as part of a NCSU Urban Fish Study. **2001 and 204** -- 29 species known from the creek, including 3 species of darters, 4 species of suckers, and 7 species of sunfish; increase in the percentage of omnivores+herbivores in 2004 and decrease in the percentage of insectivores; site qualifies as High Quality Waters if so petitioned.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Brown Cr	**SR 1230**	**04/12/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	10	03040104	345252	801806	13-20	Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	25.2	--	6	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	14.0
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	126
pH (s.u.)	6.1

Water Clarity	Slightly turbid,tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	6
Pool Variety (10)	7
Riffle Habitat (16)	4
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	**58**

Site Photograph

Substrate Sand, cobble, clay, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-14	18	44	Good-Fair
04/10/01	2001-09	20	52	Good
04/16/96	96-16	17	50	Good

Most Abundant Species Bluegill

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Bowfin, Creek Chubsucker, Black Bullhead, Eastern Mosquitofish, Mud Sunfish, and Black Crappie. **Gains** -- Rosyside Dace, Bluehead Chub (first record for Brown Creek watershed), Yellow Bullhead, and Swamp Darter.

Data Analysis

Watershed -- originates in Chesterfield County, SC, flows through the southeastern corner of Union County into southwestern Anson County; site is in the upper part of the watershed and borders the Carolina Slate Belt and Sand Hills. Habitat -- snags; a couple of shallow riffles (a function of low flow); side pools; unstable banks. Specific conductance elevated (low flow effect?); has steadily increased from 92 to 102 to 126 µS/cm since 1996; no NPDES facilities in watershed. **2006** -- lowest percentage of species with multiple age classes of any fish site, 9 of 18 species with only 1 or 2 fish/species; number of fish declined substantially; no suckers, no intolerant species. **1996 - 2006** -- a species rich site (n = 25), including 9 species of sunfish, but no intolerant species; dominant species include Pirate Perch, Whitemouth Shiner, Bluegill, Redbreast Sunfish, and Carolina Darter. Carolina Darter, a species of Special Concern, consistently collected. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cedar Cr	**SR 1709**	**04/10/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	10	3040104	350237	800020	13-21	Triassic Basins

Stream	Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width Average (m)	Depth (m)	Reference Site
	C	8.6	--	4	0.2	Yes

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

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

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	9.3
Specific Conductance (µS/cm)	125
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	6
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**72**

Site Photograph

Substrate Sand, gravel, cobble, woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-07	10	36	Fair
04/10/01	2001-07	12	46	Good-Fair
06/10/96	96-67	12	40	Fair

Most Abundant Species Creek Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle **Losses** -- Redlip Shiner and Yellow Bullhead. **Gains** -- none.

Data Analysis

Watershed -- small, rural drainage area in northeastern Anson County, northeast of the Town of Wadesboro; no municipalities; tributary to the Pee Dee River; stream may go intermittent during low flow periods; borders the Carolina Slate Belt. **Habitat** -- very shallow and sandy runs; gravel and cobble riffles; snags; loss of habitats due to low flow. **2006** -- specific conductance elevated (low flow effect?); decrease in the number of species and a substantial decline in the number of fish from 472 and 484 in 1996 and 2001 to 119 in 2006; increase in the percentage of tolerant fish; Redlip Shiner declined from 112 in 2001 to 0 in 2006. **1996 - 2006** -- specific conductance has steadily increased from 85 to 107 to 125 µS/cm since 1996 , no NPDES facilities in watershed; habitat scores average ~ 70; total species at site = 12, but no intolerant species or piscivores; reproduction usually good. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Little R	**SR 1127**	**05/08/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Randolph	15	03040104	353322	795043	13-25-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	24.7	--	12	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	14.3
Dissolved Oxygen (mg/L)	9.0
Specific Conductance (µS/cm)	71
pH (s.u.)	6.4

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**94**

Site Photograph

Substrate Cobble, boulder, slick rocks

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/08/06	2006-33	19	56	Excellent
04/14/99	99-12	14	52	Good

Most Abundant Species Bluehead Chub and Redlip Shiner

Exotic Species Redear Sunfish

Species Change Since Last Cycle

Losses -- Sandbar Shiner. **Gains** -- Rosyside Dace, Creek Chub, Creek Chubsucker, Snail Bullhead, Warmouth, and Redear Sunfish.

Data Analysis

Watershed -- drains southern Randolph County, south of the City of Asheboro; headwaters in Asheboro near the intersection of US 49/64/220. Habitat -- very high quality (3rd greatest in 2006 of any fish site); a typical Carolina Slate Belt type stream (riffles, runs, pools, undercut banks, root mats, boulder pools); great riparian zones. **2006** -- diverse and overall abundant, but 8 of 19 species represented by only 1 or 2 fish per species; decrease in the number of fish from 1999, but increase in the diversity of suckers; slightly less dominance by Bluehead Chub than in 1999. **1999 and 2006** -- 20 species known from site; dominant species both years were Bluehead Chub and Redlip Shiner.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Little River	**SR 1340**	**08/24/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-(11.5)	352311	794956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C, HQW	105.5	20	0.3

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

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

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	80
pH (s.u.)	6.8
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	4
Riffle Habitat (16)	9
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	74

Site Photograph

Substrate Bedrock, rubble, boulder, gravel, sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/06	10085	105	34	5.1	3.8	Excellent
08/13/01	8581	93	30	4.6	3.4	Excellent
08/22/96	7198	98	39	5.1	3.9	Excellent
07/15/88	4613	106	40	4.8	3.7	Excellent
07/31/85	3611	104	40	4.3	3.6	Excellent

Taxonomic Analysis

EPT and overall taxa richness have been remarkably consistent at this location for the last 20 years. Nevertheless, several new EPT taxa were collected in 2006 and included the burrowing mayfly *Ephemera sp*., the stonefly *Acroneuria arenosa*, and the caddisflies *Micrasema wataga*, and *Helicopsyche borealis*.

Data Analysis

Nearly every community metric at this station has remained stable since sampling started 20 years ago. These data demonstrate stable and favorable water quality in the Little River watershed upstream of this location.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Little River	**NC 731**	**08/23/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-(19)	351147	795605

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Triassic Basins	C, HQW	252	25	0.3

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

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

Water Quality Parameters

Temperature (°C)	26.5
Dissolved Oxygen (mg/L)	9
Specific Conductance (µS/cm)	78
pH (s.u.)	6.5
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	9
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	76

Site Photograph

Substrate Gravel, sand, rubble, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10082	85	31	4.7	4	Excellent
08/15/01	8589	72	29	5	4.3	Good
08/21/96	7196	76	29	5.3	4.2	Good

Taxonomic Analysis

The 2006 sample produced both the highest EPT taxa richness and total taxa richness values ever measured at this station. New, intolerant EPT taxa for this location included the mayfly *Stenonema lenati*, the stoneflies *Paragnetina sp.*, *Acroneuria arenosa*, and the caddisflies *Agapetus sp.*, *Hydropsyche incommoda*, and *Psychomyia flavida*. In addition, the number of pollution tolerant oligocheates have decreased from three in 1996 to only one in 2006. These data suggest slightly improved conditions in this portion of the Little River watershed.

Data Analysis

Every community metric has exhibited gradual improvement since sampling was initiated at this site in 1996. In addition, the EPTN has increased from 106 (1996), to 118 (2001), to 164 in 2006. These date suggest improving conditions along this segment of the Little River.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
West Fork Little River	**SR 1311**	**08/24/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Montgomery	15	03040104	13-25-15	352855	795103

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	19.4	5	0.3

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

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

Water Quality Parameters

Temperature (°C)	23.9
Dissolved Oxygen (mg/L)	4.9
Specific Conductance (µS/cm)	72
pH (s.u.)	6.6
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	82

Site Photograph

Substrate Rubble, bedrock, boulder, gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/24/06	10086	NA	26	NA	4	Good
08/13/01	8580	38	26	4.2	4	Excellent
08/22/96	7199	NA	30	NA	4	Excellent

Taxonomic Analysis

Although the 2006 sample decreased to a Good bioclassification, the EPT taxa richness has been quite stable since 1996. Nevertheless, a new intolerant mayfly taxa (*Habrophlebiodes sp.*) was collected (at this site) for the first time as was the intolerant caddisfly (*Psilotreta frontalis)* . In addition, the long lived, intolerant stonefly *Acroneuria abnormis* was common here in 2006 and has either been common or abundant from each of the previous samples. These data suggest, that despite the lowered bioclassification in 2006, the West Fork Little River catchment remains stable.

Data Analysis

Although the bioclassification was down in 2006, the EPT sample produced the same number of EPT taxa as did the more intensive (Full-Scale) sample from 2001 and was only two EPT taxa short of receiving an Excellent bioclassification. In addition, the EPTBI has been identical from each of the three sample efforts. Also, the EPTN in 2006 (132) was higher than that measured in 1996 (113) and was down just slightly (most likely the result of the more intense Full-Scale sample) from the 143 measured in 2001. These data suggest stable conditions in this stream segment.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
W Fk Little R	**SR 1311**	**05/09/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	352855	795101	13-25-15	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19	--	9	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	10	0

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

Water Quality Parameters

Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	9.4
Specific Conductance (µS/cm)	56
pH (s.u.)	6.3

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	16
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**97**

Site Photograph

Substrate Cobble, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-34	19	52	Good
04/17/01	2001-20	16	52	Good
04/23/96	96-30	14	56	Excellent

Most Abundant Species Bluehead Chub and Redlip Shiner

Exotic Species None

Species Change Since Last Cycle **Losses** -- Whitemouth Shiner and White Sucker. **Gains** -- Golden Shiner, Creek Chub, Flat Bullhead, Chain Pickerel, and Eastern Mosquitofish.

Data Analysis

Watershed -- drains rural northeastern Montgomery and southwestern Randolph counties; no municipalities. Habitat -- very high quality habitats (greatest score of any fish site in 2006); a typical Carolina Slate Belt stream; high gradient riffles; plunge pools; great riparian. **2006** -- diverse and very abundant (n = 1,131), but only 1 species of sunfish; open canopy at new bridge and some nutrients contributed to dominance by Bluehead Chub (38% of all fish collected). **1996 - 2006** -- 23 species known from site, but only 1 native species of sunfish, Pumpkinseed and Bluegill not collected at the site and Green Sunfish not collected since 1996; dominant species have been Bluehead Chub and Redlip Shiner; Bluehead Chub dominance has increased from 13 to 29 to 38% since 1996, may signify increase in nonpoint nutrient sources.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Densons Cr	**SR 1323**	**07/27/04**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	03040104	352313	795206	13-25-20-(9)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.2	--	7	0.3	Yes

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

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

Water Quality Parameters

Temperature (°C)	25.9
Dissolved Oxygen (mg/L)	6.0
Specific Conductance (µS/cm)	55
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**83**

Site Photograph

Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/27/04	2004-137	20	44	Good-Fair

Most Abundant Species	Redbreast Sunfish	**Exotic Species**	Green Sunfish

Species Change Since Last Cycle	N/A; new site in 2004.

Data Analysis

Watershed -- drains rural, central/north-central Montgomery County, north of the Town of Troy; site is above an old breached dam and ~1,000 ft. below the Town of Troy Reservoir dam; riparian zone is part of the Town of Troy's protected buffer corridor funded through the Clean Water Management Trust Fund. **Habitat** -- a typical Carolina Slate Belt type stream (very rocky with good instream and riparian habitats); riffles, side snags, deadfalls, angular rock; low flow; stream became very turbid when walking in the channel. **2004** -- high percentage of tolerant fish present (Flat Bullhead, Eastern Mosquitofish, Redbreast Sunfish and Green Sunfish); suckers absent, represented by only young-of-year (Creek Chubsucker, White Sucker, Brassy Jumprock, and Spotted Sucker); three other species also represented solely by young-of-year (Golden Shiner, Whitemouth Shiner, and Black Crappie); stream probably went dry during 2002 drought; sampled as part of a NCSU Urban Fish Study. Carolina Darter, a species of Special Concern, was collected. A low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bridgers Cr	**SR 1519**	**04/26/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351937	795101	13-25-24	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,HQW	7.3	--	6	0.3	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	0	35	5 -- residential

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

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.9
Specific Conductance (µS/cm)	74
pH (s.u.)	5.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	15
Pool Variety (10)	7
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**91**

Site Photograph

Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-28	15	54	Excellent
04/22/96	96-27	17	52	Good

Most Abundant Species Highfin Shiner

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Brassy Jumprock, Warmouth, and Largemouth Bass. **Gains** -- Creek Chub and Green Sunfish.

Data Analysis

Watershed -- drains a small, rural area in east-central Montgomery County; no municipalities; tributary to the Little River; stream may go dry during low flow periods. Habitat -- a typical Carolina Slate Belt type stream; good riparian zones; riffles; shallow pools; undercuts; water clear, but stained. **2006** -- no intolerant species; slight increase in the number of fish and in the percentage of species with multiple age classes. **1996 and 2006** -- total number of species = 19, but no intolerant species, maybe related to flow and size of stream, Fieryblack Shiner, Highback Chub, and Piedmont Darter may not inhabit very small Carolina Slate Belt streams; Carolina Darter, a species of Special Concern, collected both years.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Cr	**SR 1549**	**05/09/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351800	795429	13-25-30-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C,HQW	24.6	0	8	0.4	Yes

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	0	50 -- rural residential

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

Water Quality Parameters

Temperature (°C)	14.1
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	47
pH (s.u.)	6.5

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	8
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	3
Total Habitat Score (100)	**70**

Site Photograph

Substrate Cobble, boulder, sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/09/06	2006-36	15	54	Excellent
04/17/01	2001-19	18	54	Excellent

Most Abundant Species Redlip Shiner

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Whitemouth Shiner, Fathead Minnow, Creek Chubsucker, Spotted Sucker, Flat Bullhead, and Piedmont Darter. **Gains** -- Creek Chub, Green Sunfish, and Largemouth Bass.

Data Analysis

Watershed -- drains rural central Montgomery County; one tributary (Warner Creek) drains the Town of Troy; tributary to the Little River. Habitat -- three shallow riffles; *Podostemum;* runs, side snags, undercuts, poor quality (Chinese privet) riparian zones. **2006** -- decline in the number of fish; diversity of suckers and darters slightly lower than expected. **2001 and 2006** -- consistent percentages and dominance by Redlip Shiner and Bluehead Chub; 21 species known from site; no change in NCIBI scores or ratings.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cheek Cr	**SR 1563**	**04/26/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	351424	794914	13-25-36	Carolina Slate Belt/Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	10	--	5	0.3	Yes

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

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

Water Quality Parameters

Temperature (°C)	18.6
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	77
pH (s.u.)	6.1

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	8
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**83**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-27	17	58	Excellent
10/26/99	99-72	18	56	Excellent
06/15/99	99-48	18	56	Excellent
04/13/99	99-09	16	58	Excellent
09/21/98	98-70	14	58	Excellent

Most Abundant Species Bluehead Chub and Redlip Shiner

Exotic Species Green Sunfish (collected for first time in 2006 from the watershed)

Species Change Since Last Cycle **Losses** -- Whitemouth Shiner, Brassy Jumprock, and Redear Sunfish. **Gains** -- Flat Bullhead and Green Sunfish.

Data Analysis

Watershed -- drains a small, rural area in southeastern Montgomery County; no municipalities; timbered watershed; tributary to the Little River. Habitat -- a typical Carolina Slate Belt type stream (shallow riffles, pools, snags, and undercuts); riparian zones bordered by NCWRC Gamelands and USFS Uwharrie National Forest. **2006** -- Brassy Jumprock not collected, had been present in all previous collections. **1998 - 2006** -- consistently high total habitat scores, average = 88; specific conductance averages ~ 75 µS/cm; for its size, an abundant and diverse community, 20 species known from site; dominant species include Bluehead Chub, Redlip Shiner, Highback Chub, and Redbreast Sunfish; Special studies conducted in 1998 and 1999. Qualifies as High Quality Waters with Excellent ratings and habitats, if so petitioned.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cheek Cr	**SR 1541**	**04/26/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Montgomery	15	3040104	350950	795402	13-25-36	Carolina Slate Belt/Triassic Basins

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.3	0	7	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	0	5	0

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

Water Quality Parameters

Temperature (°C)	19.8
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	110
pH (s.u.)	6.0

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	14
Bottom Substrate (15)	4
Pool Variety (10)	7
Riffle Habitat (16)	4
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**58**

Site Photograph

Substrate Gravel, sand, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/26/06	2006-26	21	50	Good
04/23/96	96-29	19	54	Excellent

Most Abundant Species Tessellated Darter, Redbreast Sunfish, and Green Sunfish

Exotic Species Comely Shiner and Green Sunfish (both collected for the first time in 2006 from the watershed).

Species Change Since Last Cycle **Losses** -- American Eel, Rosyside Dace, Highback Chub, Highfin Shiner, and Brassy Jumprock. **Gains** -- Whitemouth Shiner, Comely Shiner, Yellow Bullhead, Eastern Mosquitofish, Green Sunfish, Bluegill, and Largemouth Bass.

Data Analysis

Watershed -- drains rural southeastern Montgomery County; no municipalities, timbered and agricultural watershed; 3X larger than upper site on Cheek Creek; site is 0.5 mi. above confluence with the Little River. **Habitat** -- entrenched; good forested bluff on right; bare and unstable vertical banks; large trees as deadfalls; low flow conditions. Specific conductance doubled between 1996 and 2006 (55 vs. 110 µS/cm, respectively). **2006** -- high diversity, but low abundance; high percentage of tolerant fish, Green Sunfish abundance equal to that of the Redbreast Sunfish. **1996 and 2006** -- 26 species known from site; Tessellated Darter the dominant species, Bluehead Chub and Redbreast Sunfish also abundant; percentage of tolerant fish increased from 19 to 44% due to abundance of Green Sunfish; Fantail Darter not known from watershed.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Mountain Creek	**SR 1150**	**08/21/06**	**Excellent**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	10	03040104	13-28-(4)	350521	795007

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	WS-IV, CA	64	11	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10-Road

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

Water Quality Parameters

Temperature (°C)	24.7
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	88
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	13
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	2
Right Riparian Score (5)	5
Total Habitat Score (100)	79

Site Photograph

Substrate Rubble, Gravel, Sand, Boulder, Bedrock, and Silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10076	NA	32	NA	4	Excellent
08/15/01	8588	NA	25	NA	3.7	Good
08/21/96	7194	NA	30	NA	3.9	Excellent

Taxonomic Analysis

The 2006 sample produced the highest EPT richness ever measured at this location and taxa collected for the first time included the mayflies (*Plauditus punctiventris* , *Baetis flavistriga* , *Habrophlebiodes sp* ., *Plauditus dubius* , *Procloeon sp* .) and the stonefly, *Acroneuria arenosa* .

Data Analysis

In addition to producing the highest EPT richness, the 2006 sample also produced the highest EPTN (149) measured at this location. With the exception of the 2001 sample, this segment of Mountain Creek has maintained a very stable EPT richness. While EPT taxa richness declined in 2001, the EPTBI and EPTN remained similar to values measured from the 1996 sample and was only three EPT taxa short of an Excellent rating. Overall, these data suggest favorable and stable water quality in the Mountain Creek catchment.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mountain Cr	**SR 1150**	**04/25/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	10	3040104	350519	795007	13-28-(0.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV	65.1	--	12	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 road, SR 1150

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

Water Quality Parameters

Temperature (°C)	26.0
Dissolved Oxygen (mg/L)	8.4
Specific Conductance (µS/cm)	62
pH (s.u.)	6.2

Water Clarity	Clear, slightly stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**80**

Site Photograph

Substrate Cobble, gravel, sand, bedrock, boulder outcrops

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-25	20	56	Excellent
04/15/96	96-12	16	52	Good

Most Abundant Species Redlip Shiner

Exotic Species Roanoke Bass (collected for the first time from the watershed in 2006; 161 and 180 mm total length).

Species Change Since Last Cycle **Losses** -- Fieryblack Shiner, Brassy Jumprock, and Pirate Perch. **Gains** -- Rosyside Dace, Dusky Shiner, Coastal Shiner, Sandbar Shiner, Creek Chub, Flat Bullhead, and Roanoke Bass.

Data Analysis

Watershed -- drains rural, north-northwestern region of Richmond County; the Town of Ellerbee drains into Little Mountain Creek; tributary to Blewett Falls Reservoir. **Habitat** -- a typical Carolina Slate Belt type stream; some good deep, rocky pools. **2006** -- high diversity and abundance; Redlip Shiner very abundant. **1996 and 2006** -- 23 species known from site; substantially more species and fish in 2006 than in 1996, especially numbers of Bluehead Chub, Redlip Shiner, Redbreast Sunfish, Fantail Darter, and Tessellated Darter.

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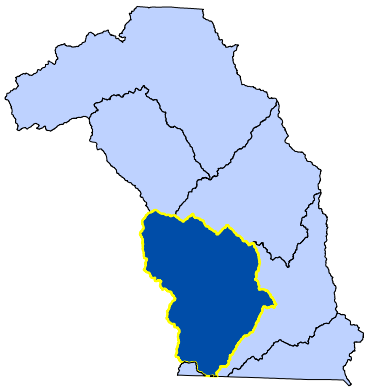


Rocky River Watershed

Subbasin HUC 03040105

Water Quality Overview

This subbasin is located adjacent to the City of Charlotte where rapid development along with limited stream waste assimilation capacity is having a major impact on water quality. Of the monitored waters, 29 percent are supporting and 65 percent are impaired. New impairments corresponded with an increase in number of sample sites, indicating as more monitoring is done more water quality problems will likely be detected. The network of ambient monitoring sites in the Rocky River watershed indicate that turbidity and nutrients (nitrogen and phosphorus) are notably higher in this area than in other parts of the Yadkin – Pee Dee River basin. Fecal coliform bacteria, iron, and copper are also pollutants of concern in this watershed. Iron and copper occur naturally in the soils of this region and further investigation is needed to determine the groundwater contribution of these metals to surface waters. Other possible sources include nonpoint source runoff from urban areas and waste land-application sites. Goose Creek is the home to the endangered Carolina Heelsplitter Mussel which requires special land use management strategies to protect and restore its habitat.

Watershed at a Glance

Counties

Anson, Cabarrus, Iredell, Mecklenburg, Rowan, Stanley, Union

Municipalities

Albemarle, Charlotte, China Grove, Concord, Cornelius, Davidson, Gold Hill, Harrisburg, Huntersville, Indian Trail, Kannapolis, Lake Park, Landis, Locust, Marshville, Matthews, Mint Hill, Mooresville, Mount Pleasant, New London, Norwood, Oakboro, Peachland, Richfield, Stallings, Stanfield, Wingate

Permitted Facilities

NPDES WWTP:	
Major	8
Minor	45
NPDES Nondischarge:	24
NPDES Stormwater:	
General	141
Individual	9
Phase II	10
Animal Operations:	75

Stream Summary

Total Streams:.....1,158.3mi
Total Monitored:.....605.8mi
Total Supporting:.....175.3mi
Total Impaired:.....392.9mi
Total Not Rated:.....37.6 mi
Total No Data:.....552.5 mi

General Description

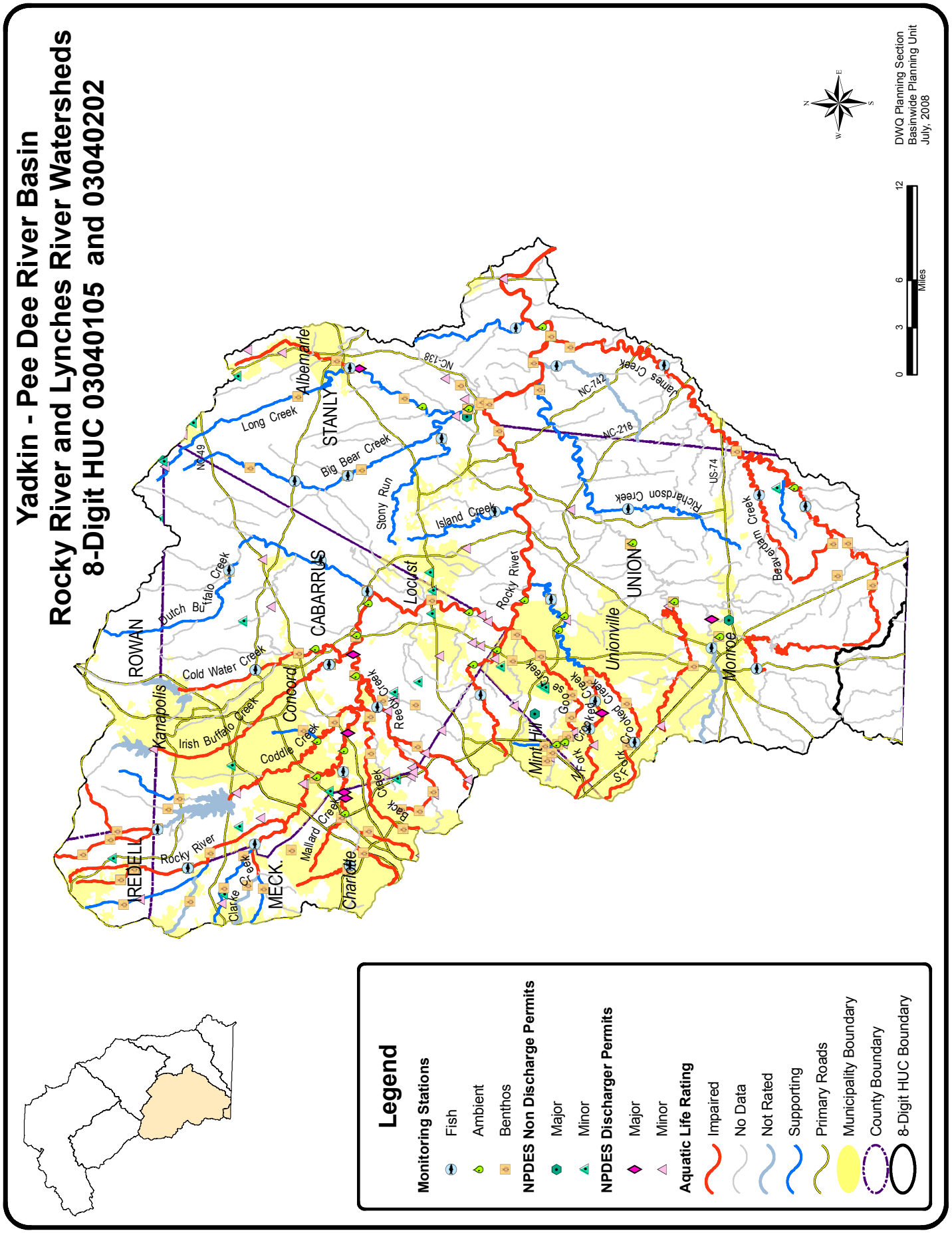
The Rocky River is the largest tributary of the Yadkin - Pee Dee River and flows for almost 100 miles from its headwaters near Mooresville in Iredell County to its confluence with the Pee Dee River. Coddle Creek is a major tributary in the northwestern part of the watershed, while Irish Buffalo Creek, Goose Creek, and Crooked Creek drain central portion of the watershed.

This region contains many rapidly growing urban areas including Mooresville, Concord, Cornelius, Davidson, Huntersville, eastern Mecklenburg County, Concord, and Kannapolis. Pressure from urban expansion is rapidly shifting agricultural land towards residential and commercial uses. Stream degradation due to impacts from this shift is the greatest threat to water quality in the area.

Going downstream, stream type shifts from those characterized by sandy substrates and generally consistent summer flow regimes to those characterized by low summer flows, extensive bedrock formations, and the prevalence of boulder and cobble substrate. These are considered Carolina Slate Belt streams and are found primarily in eastern Cabarrus and Union Counties.

Big Bear, Long, Richardson, and Lanes Creeks form the major tributaries in the southeastern portion of the Rocky River watershed. These are all considered Slate Belt Streams. The Albemarle WWTP and the Town of Oakboro's WWTP both discharge to Long Creek. The Towns of Marshville, Wingate, and Monroe (along the US 74 corridor) are the large urban areas area. The Monroe WWTP is a major discharge to Richardson Creek. Land use in this area is mostly comprised of hay fields and pasture, although there are large numbers of swine and poultry operations. Moreover, numerous confined animal operations (CAFOs) are found in the Richardson and Lanes Creeks catchments. Many of these operations land apply their manure or litter. The effect of long-term land application programs on water quality is unknown.

Figure 5-1. Rocky River Watershed HUC 03040105



How to Read this Document

This document was written to correspond with our new *Online Geographic Document Distribution* tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add ***http://web.ceo.ncsu.edu/basinplans/dwq.kml*** to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The *Use Support* report provides information on how and why water quality ratings are determined and DWQ's "*Redbook*" describes in detail water quality standards for each waterbody *classification*. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality *Plans*"

Figure 5-1. shows monitoring station locations and impaired streams for the Rocky River subbasin.
Appendix A provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C provides summaries of biological and fish assessment monitoring sites.

Local Watersheds In The Rocky River Watershed

Local watersheds represent groupings of 12-digit hydrologic units with similar characteristics and are named for the largest stream in the watershed. The Rocky River Watershed is divided into the following local watersheds. As information and resources become available specific watershed reports will be developed.

- *Upper Rocky River*
- *Middle Rocky River*
- *Lower Rocky River*
- *Cold Water Creek*
- *Long Creek*
- *Richardson Creek*
- *Lanes Creek*

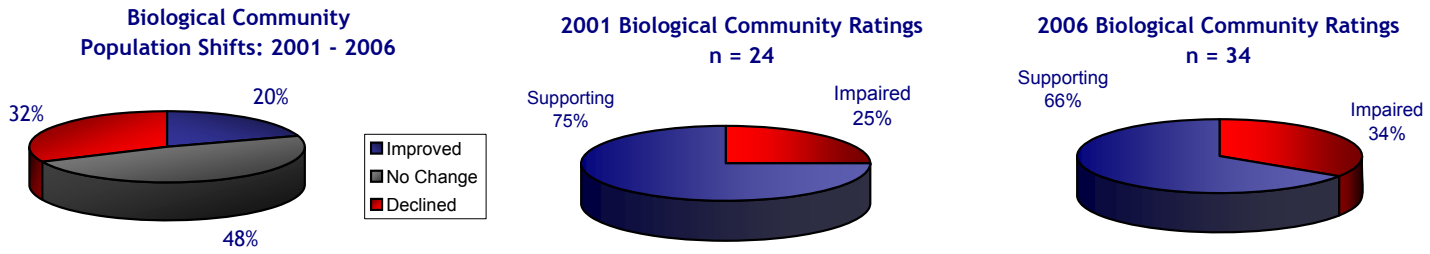
Current Status and Significant Issues

General Biological Health

Thirteen benthic and twenty-one fish sites were sampled as part of the five-year basinwide sampling program. Additionally, several special studies were conducted during the assessment period including TMDL stressor studies of McKee and Coddle Creeks, a detailed assessment of benthic communities in the upper Rocky River watershed, and a survey to assess urban fish populations.

Of the sites that were sampled in both 2001 and 2006, over thirty percent declined in bioclassification while just twenty percent showed an improvement. Further, the total number of samples increased by 41 percent and corresponded to a 37 percent increase in the number of impaired sites. This suggests that as further investigations are performed, more water quality problems are uncovered. (Figure 5-2)

Figure 5-2. Biological Health Summary



Wetlands Restoration Program Rocky River Study

In response to existing impacts from agricultural land uses and anticipated residential growth, the ***Ecosystem Enhancement Program*** (EEP, formerly the Wetlands Restoration Program) targeted the Rocky River Watershed for water quality and habitat quality improvements. DWQ sampled twenty stream sites in southern Iredell County, southern Rowan County, eastern Mecklenburg County, and most of western Cabarrus County in July 2003 to help EEP prioritize streams for restoration.

Nearly all of the streams sampled in the Rocky River drainage had highly impervious catchments as a result of their proximity to urban and suburban areas of Charlotte. This highly impervious environment is reflected by the fact that 12 of 14 sites in the Rocky River catchment received Fair bioclassifications, while only 2 out of 6 sites in the less developed Coddle Creek catchment received bioclassifications of Fair or worse.

Habitat degradation was a chronic problem in all the sites within this study. Streams with agricultural watersheds and no NPDES discharges were in slightly better condition overall. Streams in urbanized watersheds were in the worst condition. As this area continues to develop, urban stormwater is becoming the primary cause of water quality degradation. Local commitment from town and county leaders to require ***low impact development*** for all new construction is necessary to prevent further degradation in this watershed. ***State and federal funding*** can be used to match this commitment with restoration projects to address existing degradation.

Habitat Degradation

As mentioned above, many streams in the Rocky River Watershed are impaired or impacted by habitat degradation. The severe bank erosion, shifting sandy substrates, channelization, and sedimentation point to an overall pattern of habitat degradation in the watershed. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in the Rocky River watershed make streams highly vulnerable to these stressors.

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMPs***, ordinance/ rule changes at the local, state, and federal levels, volunteer activism, and education programs. New and existing development should employ ***stormwater BMPs*** wherever practical. Figure 5-3 illustrates a general process for developing ***watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

Figure 5-3

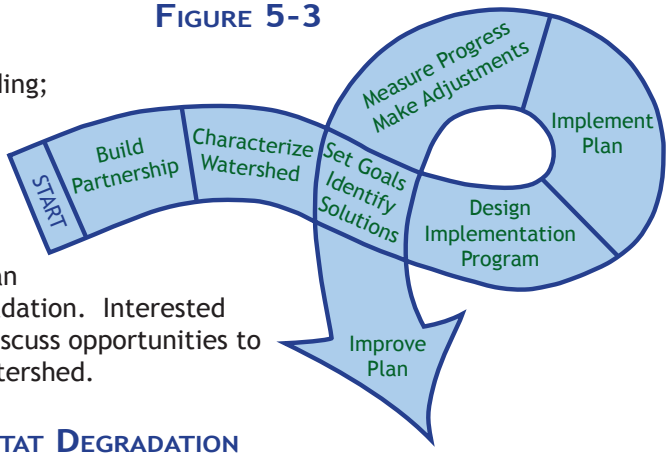
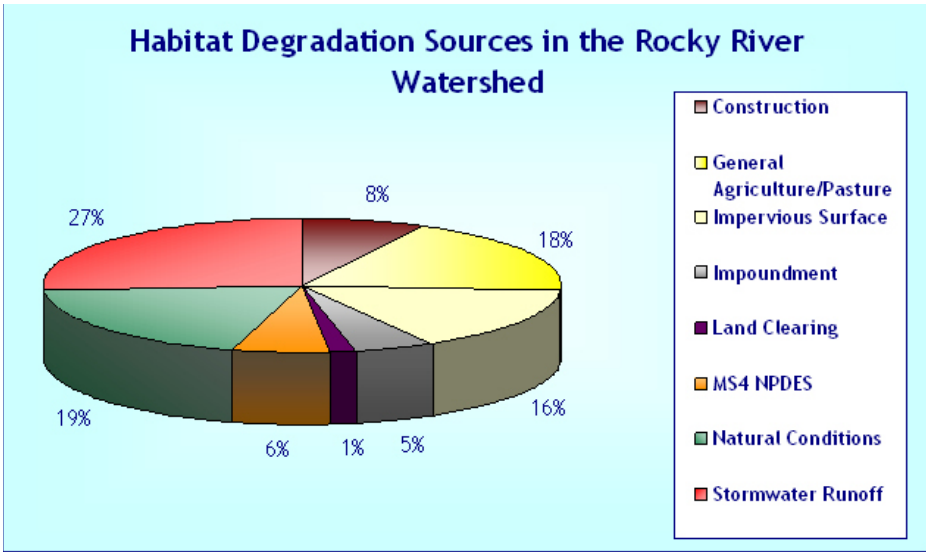


Table 5-1. Stream Impaired and Impacted by Habitat Degradation

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
13-17-11-(1)	Dutch Buffalo Creek	03-07-12	WS-II; HQW		X	Natural Conditions	12.6
						Agriculture/Pasture	
13-17-11-(5)	Dutch Buffalo Creek	03-07-12	C		X	Agriculture/Pasture	11.3
						Natural Conditions	
13-17-17	Clear Creek	03-07-11	C	X		Stormwater Runoff	13.1
13-17-18a	Goose Creek	03-07-12	C		X	Construction	3.2
						Land Clearing	
13-17-18b	Goose Creek	03-07-12	C	X		Construction	13.1
						Impervious Surface	
						MS4 NPDES	
13-17-2	Dye Creek (Branch)	03-07-11	C	X		MS4 NPDES	4.4
						Impervious Surface	
13-17-20-1	North Fork Crooked Creek	03-07-12	C	X		Stormwater Runoff	12.0
						Construction	
13-17-20-2a	South Fork Crooked Creek	03-07-12	C	X		Construction	5.6
						Stormwater Runoff	

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
13-17-20-2b	South Fork Crooked Creek	03-07-12	C	X		Stormwater Runoff	8.8
				X		Construction	
13-17-31	Long Creek	03-07-13	C		X	Stormwater Runoff	26.7
13-17-3-1	South Prong West Branch Rocky River	03-07-11	C		X	Impervious Surface	4.6
						Land Clearing	
13-17-31-1	Little Long Creek	03-07-13	C	X		Impervious Surface	8.5
13-17-31-5	Big Bear Creek	03-07-13	C		X	Natural Conditions	19.9
13-17-31-5-5	Stony Run	03-07-11	C		X	Natural Conditions	11.9
13-17-36-15	Negro Head Creek	03-07-14	C		X	Agriculture/Pasture	13.0
						Impervious Surface	
13-17-36-9-(1)	Stewarts Creek	03-07-14	WS-III	X		Agriculture/Pasture	8.3
						Impervious Surface	
13-17-4	Clarke Creek	03-07-11	C	X		Stormwater Runoff	5.5
13-17-40-(12)	Lanes Creek	03-07-14	C	X		Impoundment	27.1
						Agriculture/Pasture	
						Natural Conditions	
13-17-5-2	Clarks Creek	03-07-11	C	X		Stormwater Runoff	4.4
						Impervious Surface	
13-17-5-3	Doby Creek	03-07-11	C	X		Impervious Surface	4.1
						Stormwater Runoff	
13-17-5-5	Stony Creek	03-07-11	C	X		Stormwater Runoff	5.1
						Impervious Surface	
13-17-5b	Mallard Creek	13-17-5b	C	X		Stormwater Runoff	4.8
						Impervious Surface	
13-17-6-(0.5)	Coddle Creek	03-07-11	WS-II; HQW	X		Agriculture/Pasture	7.6
13-17-6-1	East Fork Coddle Creek	03-07-11	WS-II; HQW	X		Natural Conditions	6.4
						Agriculture/Pasture	
13-17-6-5-(1)	Mill Creek	03-07-11	WS-II; HQW		X	Natural Conditions	5.1
					X	Agriculture/Pasture	
13-17-7	Back Creek	03-07-11	C	X		Stormwater Runoff	12.5
13-17-8	Reedy Creek	03-07-11	C	X		Impervious Surface	15.2
						Stormwater Runoff	
13-17-8-4	McKee Creek	03-07-11	C	X		Agriculture/Pasture	6.9
						Stormwater Runoff	
13-17-9-(2)	Irish Buffalo Creek	03-07-12	C	X		Stormwater Runoff	16.7
						Total	298.3

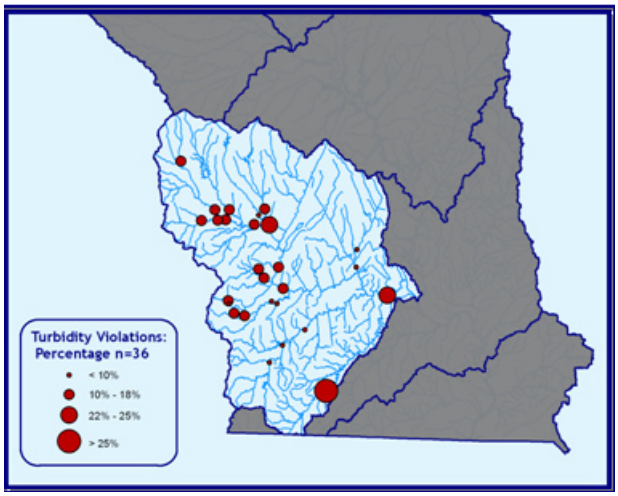
Figure 5-4. Habitat Degradation Sources



Turbidity

Turbidity violations are common throughout the Rocky River watershed, and their frequency and intensity are concerning. In fact, violations are more common here than in any other area in the Yadkin – Pee Dee River Basin. Turbidity is a measure of cloudiness in water and is often accompanied with excessive sediment deposits in the streambed. Excessive sediments deposited on stream and lake bottoms can choke spawning gravels (reducing fish survival and growth rates), impair fish food sources, fill in rearing pools (reducing cover from prey and thermal refuges), and reduce habitat complexity in stream channels. Excessive suspended sediments can make it more difficult for fish to find prey and at high levels can cause direct physical harm, such as clogged gills. Sediments can cause taste and odor problems, block water supply intakes, foul treatment systems, and fill reservoirs. (USEPA, 1999 and Waters, 1995). Sand and silt were noted in the stream substrate at most of the biological sample sites in the Rocky River watershed.

Figure 5-5. Turbidity Violations



Soil erosion is the most common source of turbidity and sedimentation and while some erosion is a natural phenomenon, human land use practices can accelerate the process to unhealthy levels. Construction sites, mining operations, agricultural operations, logging operations, excessive stormwater flow off impervious surfaces are all potential sources. The distribution of turbidity violations and sample locations make it difficult to isolate a single source of erosion in the Rocky River watershed.

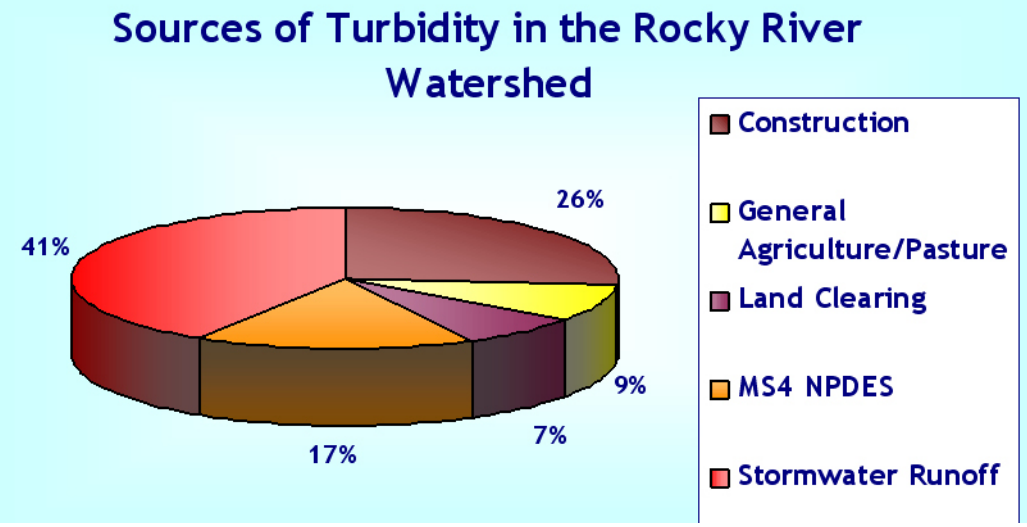
It is likely that a combination of human caused land disturbances and natural erosion are causing the majority of turbidity violations in this watershed, with human causes being the leading contributor. For example, the Lanes Creek monitoring station, in a primarily agricultural watershed, violated the state turbidity standard in almost 70 percent of the measurements. Ambient stations in the northern and eastern portion of the watershed, where urban construction is accelerating and large areas of impervious surfaces are common, consistently violated the standard in 10 to 20 percent of the measurements (Figure 5-5). To appropriately address turbidity and sediment problems in the Rocky River watershed, an assessment to determine the contribution of human accelerated erosion sources relative to natural processes should be undertaken. All reasonable efforts to reduce or eliminate human source of erosion should be implemented immediately. Local commitment from town and county leaders to require ***low impact development*** for all new construction will also help to prevent further degradation in this watershed.

Table 5-2. Stream Impaired and Impacted by Turbidity in Hydrologic Unit 03040105

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
13-17-17	Clear Creek	03-07-12	C	X		Construction	13.1
				X		MS4 NPDES	
				X		Impervious Surface	
13-17-18a	Goose Creek	03-07-12	C		X	Construction	3.2
						MS4 NPDES	
						Impervious Surface	
13-17-20	Crooked Creek	03-07-12	C		X	Stormwater Runoff	12.9
						Construction	
13-17-20-1	North Fork Crooked Creek	03-07-12	C	X		Stormwater Runoff	12.0
						Construction	
13-17-36-(5)a2	Richardson Creek	03-07-14	C	X		Agriculture/Pasture	7.3
13-17-36-(5)a1a	Richardson Creek	03-07-14	C	X		Unknown	8.2
13-17-40-(1)	Lanes Creek	03-07-14	WS-V		X	Agriculture/Pasture	27.4
13-17-5b	Mallard Creek	03-07-11	C	X		Stormwater Runoff	4.8
13-17-6-(5.5)	Coddle Creek	03-07-11	C	X		Stormwater Runoff	14.5
13-17-9-(2)	Irish Buffalo Creek	03-07-12	C		X	Impervious Surface	16.7

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
						MS4 NPDES	
13-17-9-4-(1.5)	Cold Water Creek	03-07-12	C	X		Stormwater Runoff	12.5
13-17a	Rocky River	03-07-11	C	X		Construction	34.1
						Stormwater Runoff	
						MS4 NPDES	
13-17b	Rocky River	03-07-12	C	X		Stormwater Runoff	8.5
						Construction	
13-17c	Rocky River	03-07-12	C	X		Stormwater Runoff	21.6
						Construction	
13-17d	Rocky River	03-07-14	C	X		Land Clearing	29.3
						Stormwater Runoff	
						Total	226.1

Figure 5-6. Turbidity Sources



Fecal Coliform

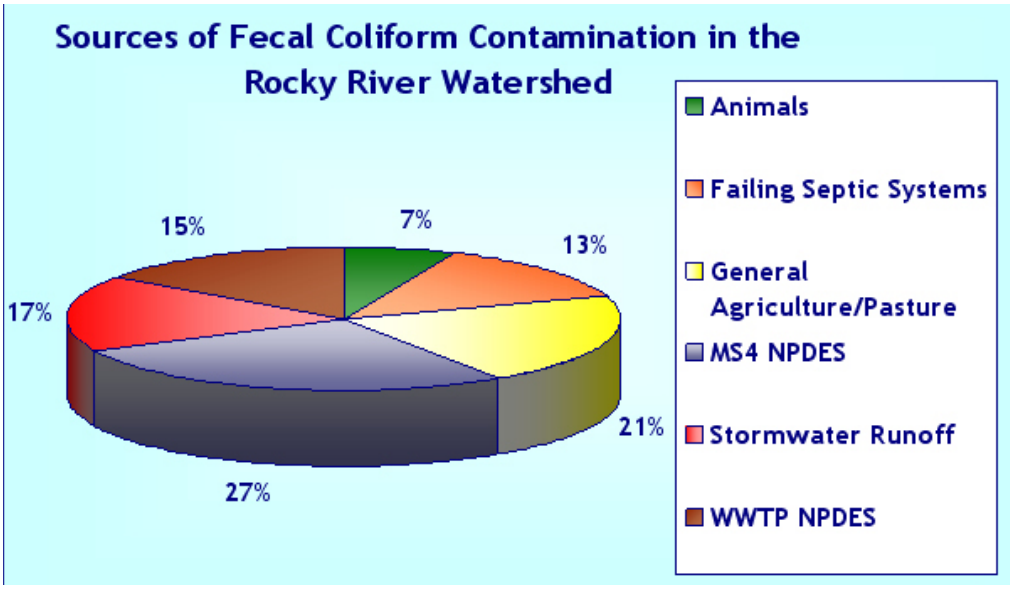
Fecal Coliform concentrations did exceed the standard of 400 colonies/100ml in the Rocky River subbasin. The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.

Table 5-3. Stream Impaired and Impacted by Fecal Coliform Bacteria in 03040105

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
13-17-18a	Goose Creek	03-07-12	C	X		WWTP NPDES	3.2
						Animals	
						Failing Septic Systems	
						MS4 NPDES	
13-17-18b	Goose Creek	03-07-12	C	X		WWTP NPDES	13.1
						Failing Septic Systems	
						MS4 NPDES	
						Animals	
13-17-20-1	North Fork Crooked Creek	03-07-12	C		X	Stormwater Runoff	12.0

Assessment Unit	Name	Subbasin	Class.	Impaired	Impacted	Source	Miles
13-17-40-(1)	Lanes Creek	03-07-14	WS-V		X	Agriculture/Pasture	27.4
13-17-40-10	Barkers Branch	03-07-14	WS-V		X	Agriculture/Pasture	4.6
13-17-40-11	Beaverdam Creek	03-07-14	WS-V		X	Agriculture/Pasture	12.1
13-17-8-4	McKee Creek	03-07-11	C	X		Agriculture/Pasture	6.9
13-17-9-(2)	Irish Buffalo Creek	03-07-12	C		X	MS4 NPDES	16.7
						Failing Septic Systems	
13-17a	Rocky River	03-07-11	C	X		MS4 NPDES	34.1
13-17c	Rocky River	03-07-12	C		X	WWTP NPDES	21.6
13-17d	Rocky River	03-07-14	C		X	Stormwater Runoff	29.3
						Total	180.9

Figure 5-6. Fecal Coliform Bacteria Sources



Nutrient Impacts

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as "nutrients." Nitrogen compounds include ammonia-nitrogen (NH3-N), total Kjeldahl nitrogen (TKN) and nitrite+nitrate nitrogen (NO2+NO3-N). Phosphorus is measured as total phosphorus. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes, or runoff from urban or agricultural land, the excessive growth of algae (algal blooms) and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form NH4OH, a form toxic to fish and other aquatic organisms. The waterbodies that are impaired or impacted by nutrient enrichment are listed in Table 5-4 below.

Table 5-4. Stream Impaired and Impacted by Nutrient Impacts in 03040105

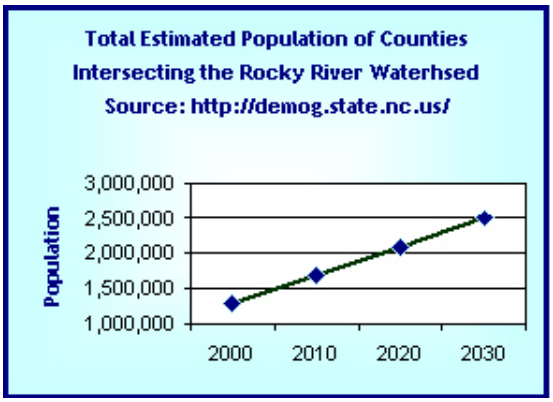
Assessment Unit	Name	Subbasin	Class.	Stressor	Impaired	Impacted	Source	Miles
13-17-18b	Goose Creek	03-07-12	C	Low Dissolved Oxygen	X		Stormwater Runoff	13.1
13-17-2	Dye Creek (Branch)	03-07-11	C	Low Dissolved Oxygen	X		WWTP NPDES	4.4
				Nutrient Impacts				
13-17-20	Crooked Creek	03-07-12	C	Low Dissolved Oxygen		X	Natural Conditions	12.9
							WWTP NPDES	
13-17-31	Long Creek	03-07-13	C	Low Dissolved Oxygen		X	Natural Conditions	26.7

Assessment Unit	Name	Subbasin	Class.	Stressor	Impaired	Impacted	Source	Miles
							WWTP NPDES	
13-17-31-5	Big Bear Creek	03-07-13	C	Nutrient Impacts		X	Agriculture/Pasture	19.9
13-17-31-5-5	Stony Run	03-07-13	C	Nutrient Impacts		X	Agriculture/Pasture	11.9
13-17-36-(3.5)	Richardson Creek (Lake Lee)	03-07-14	WS-IV; CA	Nutrient Impacts	X		Agriculture/Pasture	2.5
13-17-36-4-(0.5)	Little Richardson Creek (Lake Monroe)	03-07-14	WS-IV	High pH		X	Agriculture/Pasture	78.9 ac
13-17-36-4-(2)	Little Richardson Creek (Lake Monroe)	03-07-14	WS-IV; CA	High pH, Chlorophyll a	X		Unknown	39.2 ac
13-17-4	Clarke Creek	03-07-11	C	Low Dissolved Oxygen	X		Stormwater Runoff	5.5
13-17-40-(1)	Lanes Creek	03-07-14	C	Low Dissolved Oxygen		X	Natural Conditions	27.4
				Nutrient Impacts			Agriculture/Pasture	
13-17-40-10	Barkers Branch	03-07-14	WS-V	Low Dissolved Oxygen		X	Natural Conditions	4.6
13-17-40-11	Beaverdam Creek	03-07-14	WS-V	Low Dissolved Oxygen	X		Natural Conditions	12.1
13-17-5b	Mallard Creek	03-07-11	C	Nutrient Impacts	X		Stormwater Runoff	4.8
13-17-8-4	McKee Creek	03-07-11	C	Nutrient Impacts	X		WWTP NPDES	6.9
							Agriculture/Pasture	
13-17-9-(2)	Irish Buffalo Creek	03-07-12	C	Nutrient Impacts	X		Stormwater Runoff	16.7
13-17-9-4-(1)	Cold Water Creek (Lake Fisher)	03-07-12	WS-IV; CA	Nutrient Impacts		X	Stormwater Runoff	0.6
13-17-9-4-2-(2)	Unnamed Tributary to Cold Water Creek (Lake Concord)	03-07-12	WS-IV; CA	Nutrient Impacts		X	Stormwater Runoff	0.5

Population and Land Use

Human activity impacts water quality. The many types of pollution generated by human activities may seem insignificant when viewed separately, but when taken as a whole, can be very stressful to aquatic ecosystems. Population growth results in dramatic impacts on the natural landscape. The most obvious impact is the expansion of urban and suburban areas and the associated impervious surfaces. Impervious surfaces are materials that prevent infiltration of water into the soil and include roads, rooftops and parking lots. Impervious surfaces alter the natural hydrology, prevent the infiltration of water into the ground, and concentrate the flow of stormwater over the landscape. In general, impervious surface coverage increases at twice the rate of population growth (USDA-NRCS, 2001; U.S. Census Bureau, 2000).

Figure 5-8. Population Growth



Studies over the past decade converge on a central point, when more than 10 percent of the acreage in a watershed is covered in roads, parking lots, rooftops, and other impervious surfaces, the rivers and streams within the watershed become seriously degrade (Center for Watershed Protection, 2003). Studies show that if urbanized areas cover more than 25 percent of a watershed, there is a point where the decline in the health of the ecosystem is irreversible (Beach, 2002; Galli, 1991). The growth rate of municipalities that lie at least partly within the Rocky River Watershed was almost 30 percent between 2000 and 2005 (Table 5-5). At that rate, one would expect to see a 60 percent increase in impervious surface over the same time period. Unfortunately, the land cover data necessary to test this hypothesis is unavailable. However, DWQ's biological and ambient data indicate

streams in urbanizing areas of the Rocky River Watershed are demonstrating negative water quality impacts.

Reversing the existing water quality impairments and preventing new impairments will depend on programs that control stormwater runoff from new and existing development, restore stream and *riparian* habitat, and educate the public about *personal choices* they can make to improve water quality. Most of these *programs* must be implemented at the local government level and will require protective ordinances and adequate enforcement staff. State and federal programs can provide guidance and limited financial support.

Figure 5-9. Population Density

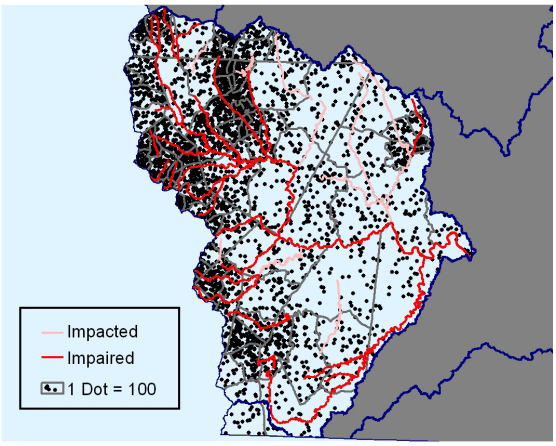
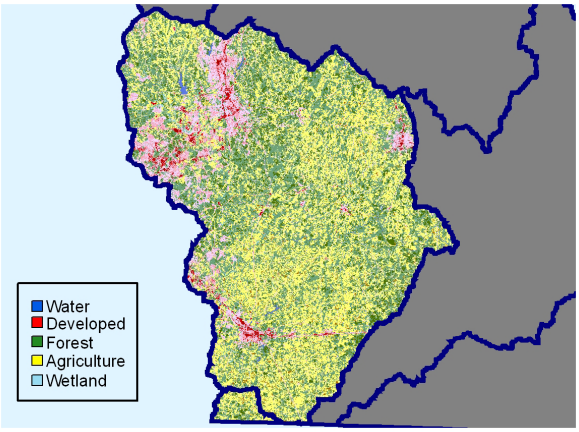


Figure 5-10. Land Cover



Source: http;//demog.state.nc.us/

Table 5-5. Population of Towns in the Rocky River Watershed

Municipality	Apr-00	Jul-05	% Change	Municipality	Apr-00	Jul-05	% Change
ALBEMARLE	15,680	15,645	-0.2	MARSHVILLE	2,360	2,762	17.0
CHARLOTTE	540,167	640,270	18.5	MATTHEWS	22,125	25,442	15.0
CHINA GROVE	3,616	4,219	16.7	MINT HILL	15,609	18,804	20.5
CONCORD	55,977	63,429	13.3	MOORESVILLE	18,823	23,125	22.9
CORNELIUS	11,969	16,856	40.8	MOUNT PLEASANT	1,259	1,417	12.5
DAVIDSON	7,139	8,162	14.3	NEW LONDON	326	604	85.3
HARRISBURG	4,493	5,451	21.3	NORWOOD	2,216	2,858	29.0
HUNTERSVILLE	24,960	31,646	26.8	OAKBORO	1,198	1,153	-3.8
INDIAN TRAIL	11,749	22,030	87.5	PEACHLAND	554	578	4.3
KANNAPOLIS	36,910	40,139	8.7	RICHFIELD	515	512	-0.6
LAKE PARK	2,093	2,840	35.7	STALLINGS	3,171	9,508	199.8
LANDIS	2,996	3,036	1.3	STANFIELD	1,113	1,277	14.7
LOCUST	2,416	2,790	15.5	WINGATE	2,406	3,706	54.0
Average Growth Rate: 29.7 percent							

TMDLs

A TMDL or *Total Maximum Daily Load* is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

A TMDL provides a detailed water quality assessment that provides the scientific foundation for an implementation plan. An implementation plan outlines the steps necessary to reduce pollutant loads in a certain body of water to restore and maintain human uses or aquatic life. Plan implementation is usually voluntary. The development of TMDL implementation plans is often the best method to improve water quality. The following TMDLs have been completed in the Rocky River watershed and should be adopted by all residents and local governments within the watershed.

Table 5-6. Finalized TMDLs in the Rocky River Watershed

Waterbody	Pollutant	Final TMDL Date	Link
McKee and Clear Creeks	Fecal Coliform	August 1, 2003	*Final TMDL*
Rocky River	Fecal Coliform	September 19, 2002	*Final TMDL*
Goose Creek	Fecal Coliform	July 8, 2005	*Final TMDL*

Threatened & Endangered Species

The Goose Creek tributary is home to the Federally Endangered Carolina Heelsplitter Mussel. DWQ has been required by Rule 15A NCAC 2B .0110 to develop site-specific management strategies for waters providing habitat for federally-listed threatened and endangered aquatic animal species. In order to meet the requirement to maintain and restore the water quality of the Goose Creek watershed for the Carolina Heelsplitter freshwater mussel, DWQ has drafted rule language to meet this goal. Several state and federal agencies prepared written draft technical recommendations for DWQ to consider in its final recommendations.

DWQ has written an explanation of its proposed rule language in the report entitled "Report on Water Quality Recommendations in the Site-Specific Management Strategy for the Goose Creek Watershed". The proposed rule language is included in that report. See ***http://h2o.enr.state.nc.us/csu/GooseCreek.html*** for more information.

Inter-Basin Transfers

The rapid population growth discussed above has also led to an urgent need to identify and develop new water sources for the communities in the Rocky River watershed. One option for increasing the local water supply is to transfer water from neighboring basins. In 1993, the Legislature adopted the Regulation of Surface Water Transfers Act (G.S. 143-215.22I). The intention of the law is to regulate large surface water transfers between river basins by requiring a certificate from the Environmental Management Commission (EMC). In general, a transfer certificate is required for a new transfer of 2 million gallons per day (MGD) or more and for an increase in an existing transfer by 25 percent or more, if the total including the increase is 2 MGD or more. However, if a transfer facility existed or was under construction on July 1, 1993, a certificate is not required up to the full capacity of that facility to transfer water, regardless of the transfer amount.

The following links lead to specific details about the two inter-basin transfer certificates currently issued for the Rocky River watershed. Charlotte-Mecklenburg Utilities is currently pursuing a revised certificate that could allow additional water transfers into the Goose Creek portion of the Rocky River watershed. Additional transfer certificates are likely in the future as the region continues to grow and the demand for water increases.

- ***Charlotte-Mecklenburg Utilities (CMUD)***
  - A 33 MGD transfer from the Catawba River basin to the Rocky River basin.
- ***Cities of Concord and Kannapolis***
  - A transfer to the Rocky River basin of 10 MGD from the Catawba River basin and 10 MGD from the Yadkin River basin.

Issues surrounding inter-basin transfers to the Rocky River watershed are complex and controversial. At a minimum, the natural flow of water through the landscape is altered and impacts aquatic communities. Depending on the size of the transfer, the impacts can be significant on both the source and receiving streams. At the regional level, inter-basin transfers facilitate higher density development and support a larger human population. As discussed in the population section above, this urban expansion can bring a suite of additional water quality concerns including habitat degradation, impervious surfaces, and expanding waste water discharges. Collectively, these are considered Secondary and Cumulative impacts.

Because these concerns are highly complex and address issues far beyond the simple transfer of water, inter-basin transfers should be evaluated in terms of a comprehensive regional water use strategy that includes long term plans to address the change in hydrology, secondary and cumulative impacts, and wastewater discharge/assimilative capacity. Due to the rapid urban expansion and anticipated population growth in this region, secondary and cumulative impacts should receive a review equal to or exceeding that which is currently dedicated to primary impacts. Inter-basin transfer certificates should not be issued without assurance that strong and permanent measures to mitigate secondary and cumulative impacts are in place.

Local Initiatives

Watershed Improvement Commission

This 3-member commission works closely with the Cabarrus County Soil and Water Conservation Office and seeks to improve the County's water resources. Activities include efforts to reduce flooding, improve water quality and quantity and to reduce future problems through erosion control, water storage, cover protection, and education. Appointments are for terms of six years.

Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. The fund has made significant investment in the Rocky River Watershed. Table 5-7 includes a list of projects and their cost. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. The CWMTF often partners with conservation groups and clusters projects into specific watersheds in order to leverage additional funds and increase the benefits to water quality and conservation.

Table 5-7. CWMTF Funded Projects (9/1/2001-8/31/2006).

Project Number	Application Name	Proposed Project Description	Amount Funded
2001A-003	Cabarrus Co W&S Authority-Lake Don T. Howell Land Acq	Acquire 104 acres of land, through fee simple purchase, along Park Creek.	$361,000
2002B-005	Catawba Lands Conservancy - Acq./Wilson Farm, S. Fork Catawba R.	Acquire through conservation easements 135 acres along the Rocky River. CWMTF funds to acquire a permanent conservation easement on 49 riparian acres.	$245,000
2005B-502	Concord, City of - WW/ WWTP Discharge Elimination, Rocky River	Eliminate the discharge of raw sewage from an abandoned 5,600 gpd WWTP to Rocky River. Install 3,100 linear feet of new collection line and associated manholes to route waste from 14 residences to the Rocky River WWTP.	$175,000
2006A-536	Wingate, Town of- WW/ Sewer Repair, Rays Branch	Design and permit rehabilitation project on 29,000 linear feet of sewer line along Rays Fork, a 303(d)-listed stream.	$100,000

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Rocky River Watershed. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 5-8 shows the number of projects implemented and in the Yadkin River Headwaters and the dollar amount invested. Table 5-9 shows the water quality benefits realized from that investment.

Table 5-8. ACSP Project Expenditures In the Rocky River Watershed

	Erosion Reduction/Nutrient Loss Reduction in Fields		Stream Protection from Animals		Proper Animal Waste Management	
12-digit HUC	Total Implemented	Cost	Total Implemented	Cost	Total Implemented	Cost
030401050100	61.7 ac.	$7,416	6 units	$46,543	1 unit	$7,000
030401050200	113 ac.	$12,048	73 units	$33,515	9 units	$91,318
030401050300	20.62 ac.	$1,547			1 unit	$14,361
030401050400					5 units	$69,049
030401050500	40.2 ac.	$4,565	1 unit	$1,022	6 units	$38,162
030401050600	317.96 ac.	$42,183	21 units	$35,819	19 units	$233,277
030401050700					15 units	$165,463
030401050800			2 units	$2,055	10 units	$64,234
Total		$67,759		$118,954		$682,864

Table 5-9. NC ASCP Water Quality Benefits - Rocky River Watershed

	Water Quality Benefits				
12-digit HUC	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030401050100	307	7,114	35	17,473	17,354
030401050200	1,017	13,809	101	136,368	163,001
030401050300	32	1,373	3	12,750	24,750
030401050400				43,510	76,069
030401050500	314	694	16	63,700	135,643
030401050600	2,220	9,932	379	371,777	636,881
030401050700				156,336	234,631
030401050800	3			93,763	136,585
Total	3,893	32,923	535	895,677	1,424,914

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Appendix A

Use Support Ratings for All Monitored Waterbodies in Rocky River Subbasin

HUC- 03040105

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-7	**Back Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Rocky River			Stormwater Runoff							
C	03-07-11	12.5 FW Miles								
13-17-40-10	**Barkers Branch**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Lanes Creek			General Agriculture/Pasture	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
WS-V	03-07-14	4.6 FW Miles	**Low Dissolved Oxygen**	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
			Natural Conditions							
13-17-36-6	**Bearskin Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Richardson Creek										
C	03-07-14	9.7 FW Miles								
13-17-40-11	**Beaverdam Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
From source to Lanes Creek			General Agriculture/Pasture	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
WS-V	03-07-14	12.1 FW Miles	**Low Dissolved Oxygen**	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
			Natural Conditions	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-17-31-5	**Big Bear Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Long Creek			Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-13	19.9 FW Miles	**Nutrient Impacts**							
			General Agriculture/Pasture							
13-17-8-5a	**Caldwell Creek**			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Freeman Drive										
C	03-07-11	6.0 FW Miles								
13-17-8-5b	**Caldwell Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From Freeman Drive to Reedy Creek										
C	03-07-11	1.4 FW Miles								
13-17-4	**Clarke Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2006	1998	5
From source to Rocky River			Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
C	03-07-11	5.5 FW Miles	**Low Dissolved Oxygen**							
			Stormwater Runoff							

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-5-2	**Clarks Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Mallard Creek			Impervious Surface							
C	03-07-11	4.4 FW Miles	Stormwater Runoff							
13-17-17	**Clear Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From source to Rocky River			Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
C	03-07-12	13.1 FW Miles	**Turbidity**	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Construction							
			Impervious Surface							
			MS4 NPDES							
13-17-6-(0.5)	**Coddle Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2004	2008	5
From source to a point 0.5 mile downstream of East Coddle Creek			General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
WS-II;HQW	03-07-11	7.6 FW Miles								
13-17-6-(5.5)	**Coddle Creek**		**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From a point 0.2 mile upstream of N.C. Hwy. 73 to Rocky River			Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	4s
C	03-07-11	14.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17-6-(1.5)	**Coddle Creek, including water supply reservoir for Concord)**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
From a point 0.5 mile downstream of East Coddle Creek to a point 0.2 mile upstream of N.C. Hwy. 73 (Concord water supply intake)										
WS-II;HQW,CA	03-07-11	1.4 FW Miles								
13-17-9-4-(1.5)	**Cold Water Creek**		**Turbidity**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From dam at Lake Fisher to Irish Buffalo Creek				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	4s
C	03-07-12	12.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17-9-4-(1)	**Cold Water Creek (Lake Fisher)**		**Nutrient Impacts**	Aquatic Life	Not Rated	Data Inconclusive	Turbidity	2006		3a
From a point 0.5 mile downstream of Rowan County SR 1221 to dam at Lake Fisher			Stormwater Runoff	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
WS-IV;CA	03-07-12	0.6 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-17-37	**Cribs Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Rocky River										
C	03-07-14	11.2 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-20	**Crooked Creek**		**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Rocky River			Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-12	12.9 FW Miles	WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
			Turbidity	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Construction							
			Stormwater Runoff							
13-17-5-3	**Doby Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Mallard Creek			Impervious Surface							
C	03-07-11	4.1 FW Miles	Stormwater Runoff							
13-17-18-3	**Duck Creek**			Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1998	2008	5
From source to Goose Creek										
C	03-07-12	9.7 FW Miles								
13-17-11-(1)	**Dutch Buffalo Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to a point 0.6 mile downstream of Cabarrus County SR 2416			General Agriculture/Pasture							
WS-II;HQW	03-07-12	12.6 FW Miles	Natural Conditions							
13-17-11-(5)	**Dutch Buffalo Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From a point 0.5 mile upstream of N.C. Hwy. 49 to Rocky River			General Agriculture/Pasture							
C	03-07-12	11.3 FW Miles	Natural Conditions							
13-17-2	**Dye Creek (Branch)**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
From source to Rocky River			Impervious Surface							
C	03-07-11	4.4 FW Miles	MS4 NPDES							
			Low Dissolved Oxygen							
			WWTP NPDES							
			Nutrient Impacts							
			WWTP NPDES							
			Toxic Impacts							
			WWTP NPDES							
13-17-6-1	**East Fork Coddle Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
From source to Coddle Creek			General Agriculture/Pasture							
WS-II;HQW	03-07-11	6.4 FW Miles	Natural Conditions							

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-18a	**Goose Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to SR 1524			Animals	Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
C	03-07-12	3.2 FW Miles	Failing Septic Systems							
			MS4 NPDES							
			WWTP NPDES							
			Habitat Degradation							
			Construction							
			Land Clearing							
			Turbidity							
			Construction							
			Impervious Surface							
			MS4 NPDES							
13-17-18b	**Goose Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From SR 1524 to Rocky River			Animals	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2004	5
C	03-07-12	13.1 FW Miles	Failing Septic Systems	Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	2006	1998	4a
			MS4 NPDES							
			WWTP NPDES							
			Habitat Degradation							
			Construction							
			Impervious Surface							
			MS4 NPDES							
			Low Dissolved Oxygen							
13-17-42	**Hardy Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Rocky River										
C	03-07-14	9.0 FW Miles								
13-17-9-(2)	**Irish Buffalo Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Kannapolis Water Supply Dam to Rocky River			Failing Septic Systems	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-12	16.7 FW Miles	MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	5
			Habitat Degradation	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
			MS4 NPDES							
			Stormwater Runoff							
			Nutrient Impacts							
			Stormwater Runoff							
			Turbidity							
			Impervious Surface							
			MS4 NPDES							

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-9-(1)	**Irish Buffalo Creek [Kannapolis Lake (Cannon Lake)]**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
From a point 0.5 mile upstream of Rowan County SR 1197 to Kannapolis Water Supply Dam										
WS-III;CA	03-07-12	0.7 FW Miles								
13-17-26	**Island Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Rocky River										
C	03-07-14	10.0 FW Miles								
13-17-40-(1)	**Lanes Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Not Rated	Potential Standards Violation	Turbidity	2006		3a
From source to Marshville Water Supply Dam (located 0.1 mile downstream of Beaverdam Creek)			General Agriculture/Pasture							
WS-V	03-07-14	27.4 FW Miles	**Low Dissolved Oxygen**	Aquatic Life	Not Rated	Potential Standards Violation	Low Dissolved Oxygen	2006		3a
			Natural Conditions							
			Nutrient Impacts	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
			General Agriculture/Pasture							
			Turbidity	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1989	2004	5
			General Agriculture/Pasture							
				Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-17-40-(12)	**Lanes Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1996	1998	5
From Marshville Water Supply Dam (located 0.1 mile downstream of Beaverdam Creek) to Rocky River			General Agriculture/Pasture							
C	03-07-14	27.1 FW Miles	Impoundment							
			Natural Conditions							
13-17-31-1	**Little Long Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
From source to Long Creek			Impervious Surface							
C	03-07-13	8.5 FW Miles								
13-17-36-4-(0.5)	**Little Richardson Creek (Lake Monroe)**		**Chlorophyll a**	Aquatic Life	Not Rated	Data Inconclusive	High pH	2006		3a
From source to a point 0.6 mile upstream of Buck Branch			**High pH**	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
WS-IV	03-07-14	78.9 FW Acres								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-36-4-(2)	**Little Richardson Creek (Lake Monroe)**			Aquatic Life	Not Rated	Data Inconclusive	High pH	2006		3a
				Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
From a point 0.6 mile upstream of Buck Creek to Richardson Creek										
WS-IV;CA	03-07-14	39.2 FW Acres								
13-17-31	**Long Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Rocky River			Stormwater Runoff							
C	03-07-13	26.7 FW Miles	**Low Dissolved Oxygen**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
			Natural Conditions							
			WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17-5b	**Mallard Creek**		**Habitat Degradation**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Stoney Creek to Rocky River			Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
C	03-07-11	4.8 FW Miles	Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	4s
			Nutrient Impacts	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Stormwater Runoff							
			Turbidity							
			Stormwater Runoff							
13-17-8-4	**McKee Creek**		**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Data Inconclusive	Sediment Historic Listing	1998	1998	5
From source to Reedy Creek			General Agriculture/Pasture	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
C	03-07-11	6.9 FW Miles	**Habitat Degradation**	Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	1998	1998	4a
			General Agriculture/Pasture							
			Stormwater Runoff							
			Nutrient Impacts							
			General Agriculture/Pasture							
			WWTP NPDES							
13-17-6-5-(1)	**Mill Creek**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From source to a point 0.3 mile downstream of Cabarrus County SR 1609			General Agriculture/Pasture							
			Natural Conditions							
WS-II;HQW	03-07-11	5.1 FW Miles								
13-17-36-15	**Negro Head Creek (Salem Creek)**		**Habitat Degradation**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Richardson Creek			General Agriculture/Pasture							
C	03-07-14	13.0 FW Miles	Impervious Surface							

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-20-1	**North Fork Crooked Creek**		**Fecal Coliform Bacteria** Stormwater Runoff **Habitat Degradation** Construction Stormwater Runoff **Turbidity** Construction Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
From source to Crooked Creek				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	1998	4s
C	03-07-12	12.0 FW Miles		Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
13-17-4-1	**North Prong Clarke Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2002		3a
From source to Clarke Creek										
C	03-07-11	4.4 FW Miles								
13-17-6-3-(2)	**Park Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From a point 0.1 mile upstream of Cabarrus County SR 1615 to Coddle Cr.										
WS-II;HQW,CA	03-07-11	0.5 FW Miles								
13-17-4-4	**Ramah Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From source to Clarke Creek										
C	03-07-11	5.8 FW Miles								
13-17-8	**Reedy Creek**		**Habitat Degradation** Impervious Surface Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Rocky River				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
C	03-07-11	15.2 FW Miles								
13-17-36-(5)a1a	**Richardson Creek**			Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From Monroe Water Supply Dam (Lake Lee) to Mill Creek 13-17-36-10				Aquatic Life	Impaired	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	4s
C	03-07-14	8.2 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17-36-(5)a1b	**Richardson Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Mill Creek 13-17-36-10 to Watson Creek				Aquatic Life	Impaired	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	5
C	03-07-14	3.9 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17-36-(5)a2	**Richardson Creek**		**Turbidity**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From Watson Creek to Negro Head Creek (Salem Creek)				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
C	03-07-14	4.7 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-36-(5)b	**Richardson Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From mouth of Negro Head Creek (Salem Creek) to Rocky River										
C	03-07-14	15.3 FW Miles								
13-17-36-(3.5)	**Richardson Creek (Lake Lee)**		**Chlorophyll a** General Agriculture/Pasture **Nutrient Impacts** General Agriculture/Pasture	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
				Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From a point 0.2 mile downstream of mouth of Beaverdam Creek to Monroe Water Supply Dam										
WS-IV;CA	03-07-14	2.5 FW Miles		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-17a	**Rocky River**		**Fecal Coliform Bacteria** MS4 NPDES **Turbidity** Construction MS4 NPDES Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	1998	5
				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to mouth of Reedy Creek										
C	03-07-11	34.1 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	1998	4s
				Recreation	Impaired	Standard Violation	Fecal Coliform (recreation)	1998	1998	4a
13-17b	**Rocky River**		**Turbidity** Construction Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	1998	4s
From mouth of Reedy Creek to mouth of Dutch Buffalo Creek										
C	03-07-12	8.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-17c	**Rocky River**		**Fecal Coliform Bacteria** WWTP NPDES **Turbidity** Construction Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2004	5
				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From the mouth of Dutch Buffalo Creek to the mouth of Island Creek										
C	03-07-12	21.6 FW Miles		Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
13-17d	**Rocky River**		**Fecal Coliform Bacteria** **Turbidity** Land Clearing Stormwater Runoff	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From the mouth of Island Creek to the Pee Dee River										
C	03-07-14	29.3 FW Miles		Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
13-17-20-2a	**South Fork Crooked Creek**		**Habitat Degradation** Construction Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	1995	1998	5
				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1995	1998	5
From source to SR 1515										
C	03-07-12	5.6 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-20-2b From SR 1515 to Crooked Creek C	**South Fork Crooked Creek** 03-07-12	8.8 FW Miles	**Habitat Degradation** Construction; Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1995	1998	5
13-17-4-2 From source to Clarke Creek C	**South Prong Clarke Creek** 03-07-11	3.5 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
13-17-3-1 From source to West Branch Rocky River C	**South Prong West Branch Rocky River** 03-07-11	4.6 FW Miles	**Habitat Degradation** Impervious Surface; Land Clearing	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2002		3a
13-17-36-9-(1) From source to a point 0.4 mile downstream of mouth of Stumplick Branch WS-III	**Stewarts Creek** 03-07-14	8.3 FW Miles	**Habitat Degradation** General Agriculture/Pasture; Impervious Surface	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2006	2008	5
13-17-36-9-(4.5) From a point 0.4 mile downstream of mouth of Stumplick Branch to Union County SR 1681 (City of Monroe water supply intake) WS-III;CA	**Stewarts Creek [Lake Twitty (Lake Stewart)]** 03-07-14	1.1 FW Miles	**Chlorophyll a** Stormwater Runoff	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
13-17-5-5 From source to Mallard Creek C	**Stony Creek** 03-07-11	5.1 FW Miles	**Habitat Degradation** Impervious Surface; Stormwater Runoff **Toxic Impacts** Stormwater Runoff	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5
13-17-31-5-5 From source to Big Bear Creek C	**Stony Run** 03-07-13	11.9 FW Miles	**Habitat Degradation** Natural Conditions **Nutrient Impacts** General Agriculture/Pasture	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
13-17-5-4 From source to Mallard Creek C	**Toby Creek** 03-07-11	4.4 FW Miles		Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2003	2008	5

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-17-9-4-2-(2)	**Unnamed Tributary to Cold Water Creek (Lake Concord)**		**Nutrient Impacts**	Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
From a point 0.7 mile downstream of Rowan/Cabarrus County Line to dam at Lake Concord			Stormwater Runoff	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
WS-IV;CA	03-07-12	0.5 FW Miles								
13-17-3	**West Branch Rocky River**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2002		1
From source to Rocky River										
C	03-07-11	8.8 FW Miles								
13-17-6-7	**Wolf Meadow Branch**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2003		1
From source to Coddle Creek										
C	03-07-11	3.0 FW Miles								

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040105 - ROCKY RIVER

Description

This HUC contains subbasins 11 through 14 (Figure 6). Streams in the uppermost reach of the Rocky River watershed as well as the Coddle Creek catchment are located primarily in the Southern Outer Piedmont ecoregion and are characterized by sandy substrates and generally consistent summer flow regimes (Griffith *et al*. 2002). The Rocky River, the largest tributary of the Yadkin River, flows for approximately 25 river miles from its headwaters near Mooresville in Iredell County to its confluence with Irish Buffalo Creek in Cabarrus County. Outside of this region's numerous urban areas (e.g., Mooresville, Concord, Cornelius, Davidson, Huntersville, eastern Mecklenburg County), landuse is primarily agricultural.

Further downstream are the middle portion of the Rocky River watershed and four of its largest tributaries: Irish Buffalo Creek, Goose Creek, and Crooked Creek. Streams in this area primarily drain the metropolitan areas of Kannapolis and Concord in central Cabarrus County and landuse outside of these urban areas is primarily agricultural. Streams located in western Cabarrus County are contained within the Southern Outer Piedmont (Griffith *et al*. 2002) ecoregion and are characterized by sandy substrates and generally consistent summer flow regimes, while streams located in eastern Cabarrus County (and further south in Union County) are typical Carolina Slate Belt streams characterized by low summer flows, extensive bedrock formations, and the prevalence of boulder and cobble substrate in streams.

Big Bear and Long Creeks are the primary tributaries to the Rocky River in subbasin 13 and the area is encompassed wholly within the Carolina Slate Belt. The predominant landuse is almost evenly divided between forest and pasture and the Town of Albemarle is the only major metropolitan area in this area. The Albemarle WWTP (16.0 MGD) and the Town of Oakboro's WWTP (0.5 MGD) both discharge to Long Creek.

Subbasin 14 is the final subbasin in this HUC and includes the Rocky River and the entire watersheds of Richardson and Lanes Creeks which are large tributaries of the middle reach of the Rocky River. The Towns of Marshville, Wingate, and Monroe (along the US 74 corridor) are the only large urban areas in this subbasin. Landuse in this subbasin is mostly comprised of cultivated cropland, although there are large numbers of swine and poultry operations in this subbasin. Moreover, numerous confined animal operations (CAFOs) are found in the Richardson and Lanes Creeks catchments. These are also Slate Belt streams.

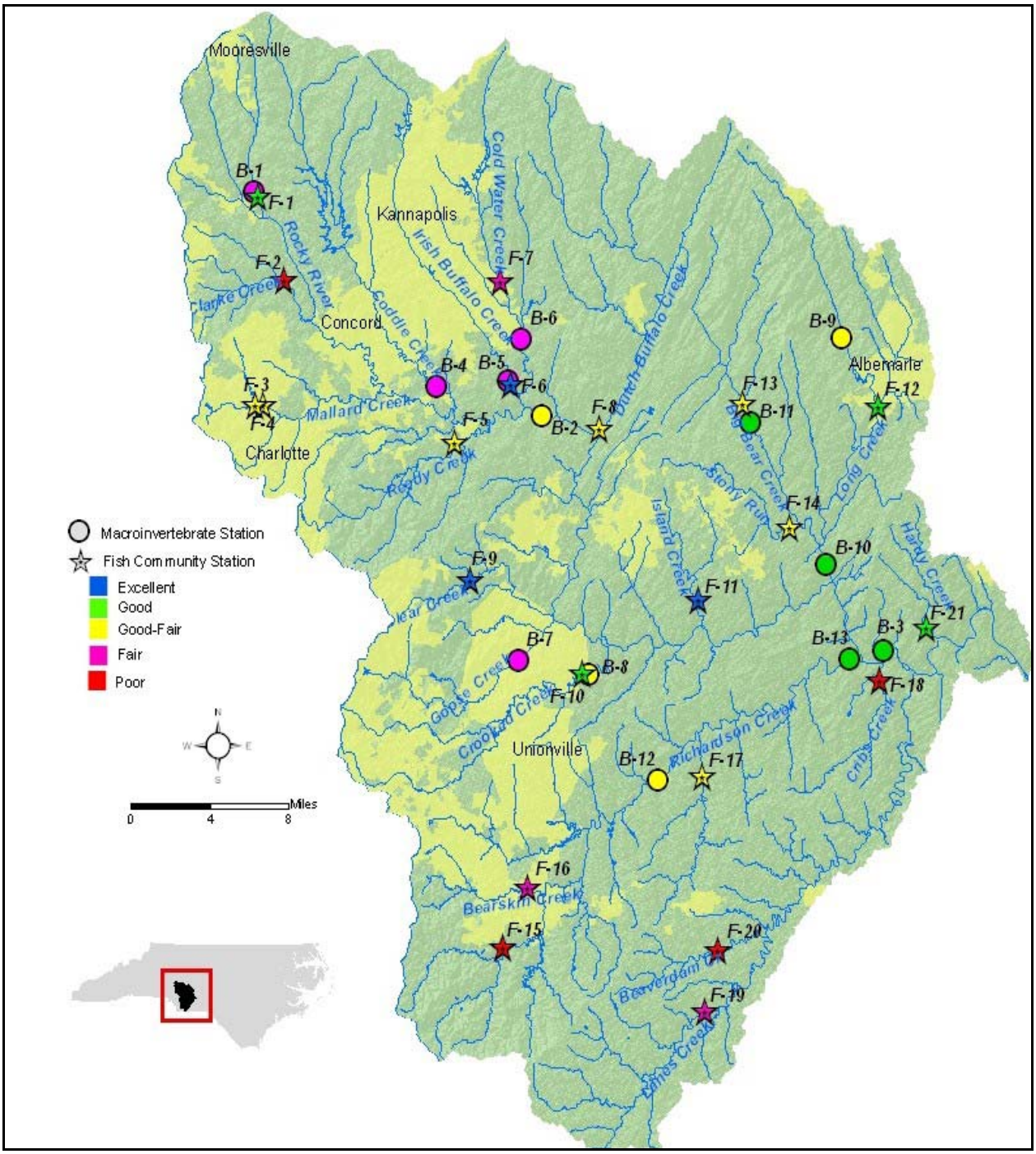

Figure 6. Sampling sites in HUC 03040105 in the Yadkin River basin. Monitoring sites are listed in Table 5.

Overview of Water Quality

In 2006, the Rocky River at SR 2420 location received a Fair benthos bioclassification which was unchanged from the 1996 and 2001 samples. A Fair benthos bioclassification was also assigned to Coddle Creek (NC 49) in 1996, 2001 and 2006. Fish samples included several locations exhibiting drastic changes in bioclassification: Rocky River (SR 1608) was Poor in 1999 but Good in 2006, while Mallard

Creek (SR 2467) was Excellent in 2001 but declined to Good-Fair in 2006. The only other fish site with previous data was Reedy Creek (SR 1136) which was Good-Fair in both 2001 and 2006. Two new fish sites were added and included Mallard Creek (SR 1300) which received a Good-Fair bioclassification and Clarke Creek (SR 1449) which received a Poor rating (Table 5).

Table 5. Waterbodies monitored in HUC 03040105 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	Rocky R	Mecklenburg	SR 2420	Fair	Fair
B-2	Rocky R	Cabarrus	US 601	Fair	Good-Fair
B-3	Rocky R	Stanly	SR 1943	Good	Good
B-4	Coddle Cr	Cabarrus	NC 49	Fair	Fair
B-5	Irish Buffalo Cr	Cabarrus	SR 1132	Good-Fair	Fair
B-6	Coldwater Cr	Cabarrus	NC 49	Good-Fair	Fair
B-7	Goose Cr	Union	US 601	Poor	Fair
B-8	Crooked Cr	Union	SR 1547	Good-Fair	Good-Fair
B-9	Long Cr	Stanly	SR 1401	Good-Fair	Good-Fair
B-10	Long Cr	Stanly	SR 1917	Good-Fair	Good
B-11	Big Bear Cr	Stanly	SR 1225	Good	Good
B-12	Richardson Cr	Union	SR 1649	Fair	Good-Fair
B-13	Richardson Cr	Anson	SR 1600	Good	Good
F-1	Rocky R	Cabarrus	SR 1608	Poor (1999)	Good
F-2	Clarke Cr	Cabarrus	SR 1449	---	Poor
F-3	Mallard Cr	Mecklenburg	SR 2467	Excellent	Good-Fair
F-4	Mallard Cr	Cabarrus	SR 1300	---	Good-Fair (2004)[2]
F-5	Reedy Cr	Cabarrus	SR 1136	Good-Fair	Good-Fair
F-6	Irish Buffalo Cr	Cabarrus	SR 1132	Good	Excellent
F-7	Coldwater Cr	Cabarrus	NC 73	Good-Fair	Fair
F-8	Dutch Buffalo Cr	Cabarrus	SR 2622 (NC 200)	Good	Good-Fair (2004)[2]
F-9	Clear Cr	Mecklenburg	SR 3181	---	Excellent (2004)[2]
F-10	Crooked Cr	Union	SR 1547	---	Good
F-11	Island Cr	Stanly	SR 1118	Excellent	Excellent
F-12	Long Cr	Stanly	off SR 1900	---	Good (2004)[2]
F-13	Big Bear Cr	Stanly	NC 73 (SR 1134)	Good	Good-Fair (2004)[2]
F-14	Stony Run	Stanly	SR 1970	---	Good-Fair
F-15	Richardson Cr	Union	NC 207	Good-Fair	Poor
F-16	Bearskin Cr	Union	NC 200	---	Fair
F-17	Salem Cr	Union	SR 1006	Good	Good-Fair
F-18	Cribs Cr	Anson	SR 1610	---	Poor
F-19	Lanes Cr	Union	SR 1929	Fair	Fair
F-20	Beaverdam Cr	Union	SR 1005	---	Poor
F-21	Hardy Cr	Stanly	SR 1934	---	Good

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.
[2]Special study site that has become a basinwide site.

Based upon benthic macroinvertebrate data, the Rocky River at US 601 reverted back to a Good-Fair bioclassification in 2006 (this station received Good-Fair ratings in 1989 and 1996) and was an improvement from Fair bioclassifications received here in 2001 and 2002. Conversely, Irish Buffalo Creek (SR 1132) declined to Fair for the first time in 2006 with all previous samples (1996 and 2001) receiving Good-Fair bioclassifications. This same trend was also noted for Coldwater Creek (NC 49): Fair in 2006, Good-Fair in 1996 and 2001. For 2006, Crooked Creek (SR 1547) maintained its Good-Fair rating from 2001 (which was an improvement from the Fair rating in 1996). Goose Creek (US 601) has been sampled in 1996, 1998, and 2001 with all collections resulting in a Poor bioclassification. In 2006, this station achieved a Fair rating. Five fish sites were sampled in subbasin 12, two of which represent new collections: Clear Creek (SR 3181) received an Excellent bioclassification while Crooked Creek (SR 1547) received a Good rating. Two of the three remaining fish stations in this subbasin declined in bioclassification with Coldwater Creek going from Good-Fair in 2001 to Fair in 2006 while Dutch Buffalo Creek at SR 2622 (NC 200) declined from Good to Good-Fair. Only Irish Buffalo Creek (SR 1132) improved in bioclassification from Good (2001) to Excellent in 2006.

In 2006 Long Creek (SR 1401) received a Good-Fair benthos rating and was unchanged from the 2001 collection. Long Creek (SR 1917) has shown a steady trend of improvement since sampling started at this benthos location with samples in 1983 and 1986 rating Fair, collections in 1989, 1996, and 2001 producing Good-Fair ratings, and the 2006 sample demonstrating additional improvement to a Good bioclassification. The 2006 sample at Big Bear Creek (SR 1225) received a Good bioclassification and was unchanged from the 2001 sample. Three fish stations were also sampled: Long Creek (off SR 1900) received a Good bioclassification while Stony Run (SR 1970) rated a Good-Fair. The only long-term fish site (Big Bear Creek at NC 73/SR 1134) declined from a Good bioclassification in 2002 to Good-Fair in 2006.

For 2006, three long-term benthos stations were sampled in subbasin 14 . Rocky River (SR 1943) has been sampled at this location twice with both the 2001 and 2006 samples producing Good bioclassifications. The Rocky River has also been sampled nearby at SR 1935 (just one road crossing downstream of the present SR 1943 location) a total of eight times with two samples producing Good-Fair bioclassifications (1983 and 1986) and six collections resulting in Good bioclassifications: 1984 (two in 1985), 1986, 1988, 1990, and 1996. Richardson Creek (SR 1600) produced a Good bioclassification in both 2001 and 2006 and represented an improvement from the 1996 (Good-Fair) sample. Richardson Creek (SR 1649) received a Good-Fair bioclassification in 2006 improving from the Fair bioclassifications measured at this site in 1987, 1990, 1996, and 2001. There are eight stations monitored for fish community data in subbasin 14 and half of these represent new fish data: Bearskin Creek (NC 200) rated Fair, Cribs Creek (SR 1610) rated Poor, Beaverdam Creek (SR 1005) also received a Poor bioclassification, and Hardy Creek (SR 1934) produced a Good bioclassification. The remaining three fish locations exhibited very disparate patterns of bioclassifications with Lanes Creek (SR 1929) remaining Fair in 2001 and 2006, while Richardson Creek (NC 207) dropped from Good-Fair in 2001 to Poor in 2006 and Salem Creek (SR 1006) dropping from Good in 2001 to Good-Fair in 2006.

River and Stream Assessment

The benthos station on Dutch Buffalo Creek at NC 200 (Cabarrus County) was not successfully sampled in 2006. During the 2006 collection attempt, stream flow at this station actually reversed during the sample as an apparent result of its close proximity to the Rocky River which was very high after thunderstorms. The next week there was not enough flow to sample. Due to the interference with the Rocky River, this location should be dropped as a basin site.

Specific site summaries of the 13 benthic macroinvertebrate and 21 fish community samples may be found at this link: **03040105**.

SPECIAL STUDIES

Wetlands Restoration Program Rocky River Study

Nearly all of the streams sampled in the Rocky River drainage had highly impervious catchments as a result of their proximity to urban and suburban areas of Charlotte. This highly impervious environment is reflected by the fact that 12 of 14 sites in the Rocky River catchment received Fair bioclassifications, while only 2 out of 6 sites in the less developed Coddle Creek catchment received bioclassifications of Fair or worse.

Many streams in southern Iredell, Rowan Cabarrus and eastern Mecklenburg County (Yadkin Subbasin 11) are experiencing impacts from existing agricultural and urban nonpoint activities in addition to impacts from the 15 minor and major NPDES discharges in this area. The potential deleterious impacts associated with these point and nonpoint sources resulted in the Wetlands Restoration Program (WRP) targeting these catchments for water quality and habitat quality improvement. (BAU Memo-031110)

Resamples of Fair Streams

Basinwide sampling in 2001 generated a number of new Fair ratings, which then required a resample in 2002 to determine if they should be placed on the 303d list. As part of this process, Rocky River at US 601 in Cabarrus County was re-sampled. Low flow at Rocky River (US 601) magnified the influence of upstream dischargers although the specific conductance was high in all years (1996: 680, 2001: 743,

2002: 558). Dominance by Hydropyschidae and Chironomidae indicated organic loading and low dissolved oxygen. There has been a steady shift towards a more tolerant community since 1996. (BAU Memo B-021001)

2006 Regional Office Requests
Samples were collected at three sites: Dye Creek below the Mooresville WWTP in Iredell County, Little Long Creek (Old Charlotte Road) in Albemarle in Stanly County, and Stewarts Creek in Union County. All three sites in this study had degraded benthic macroinvertebrate communities. Dye Creek below the Mooresville WWTP has had a Poor bioclassification since 1985. Though Poor again in 2006, there was a slight improvement in EPT taxa richness and the NCBI value. Little Long Creek is an urban stream that flows through Albemarle in Stanly County. It was given a Fair bioclassification and while lacking in EPT taxa, it did have a fairly diverse, though tolerant overall community. Stewarts Creek in Union County above Lake Twiddy was also rated Fair. This suburban stream is likely affected by both low flows and nonpoint runoff from its urban/suburban watershed. (BAU Memo B-060928)

Benthos Overlap Study—Richardson Creek
Richardson Creek (SR 1600, Anson County) was sampled as an overlap site in 2006. An EPT sample on 8/22/2006 received a Good bioclassification with 21 EPT collected, an EPTBI of 4.2 and an EPT abundance of 141. The 8/23/2006 EPT sample collected by another crew also produced a Good bioclassification with 24 EPT taxa collected, an EPTBI of 4.1, and an EPT abundance of 122. No memorandum is available for this internal study.

Fish Community Urbanization Study
Seven sites in this HUC were sampled by DWQ in 2004 as part of a North Carolina State University fish community urbanization study:

1. Mallard Creek at SR 1300, Cabarrus County, Good-Fair;
2. Coddle Creek at SR 1612, Cabarrus County, Poor;
3. Dutch Buffalo Creek at SR 1006 and at NC 200, Cabarrus County, both Good-Fair;
4. Clear Creek at SR 3181, Mecklenburg County, Excellent;
5. Long Creek, off SR 1900, Stanly County, Good; and
6. Big Bear Creek, SR 1134, Stanly County, Good-Fair (DWQ, unpublished data).

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	SR 2420	08/21/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
MECKLENBURG	11	03040105	13-17	352830	804647

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	13	6	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	25	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rocky River WWTP	NC0046728	>1MGD

Water Quality Parameters

Temperature (°C)	26
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	375
pH (s.u.)	7.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	3
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	38

Site Photograph

Substrate 85% sand with some gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10057	48	9	6.6	6.1	Fair
08/21/01	8597	41	8	6.7	6.3	Fair
08/19/96	7164	N/A	7	N/A	5.8	Fair
03/26/85	3416	64	13	6.4	4.9	Fair

Taxonomic Analysis

New EPT taxa at this site are *Lype diversa* and *Procloeon* . The habitat score was 38 at this site and habitat may be a limiting factor. Tolerant taxa such as *Baetis intercalaris* , *Huydropsyche betteni* , *Boyeria vinosa* and *Physella* were abundant. There were no intolerant taxa present in 2006.

Data Analysis

This sampling location is in the upper Rocky River watershed, but is below the Mooresville/Rocky River WWTP which discharges to Dye Branch. This reach of the river is very small compared to downstream locations. Rocky River at SR 2420 has been sampled four times since 1985 and has received a bioclassification of Fair each time. However, the 1985 sample had the most EPT taxa (13) and the Lowest EPT BI of all the sampling efforts. Thus, a slight trend of decreasing water qualtiy since 1985 is present.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky R	**SR 1608**	**05/12/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352831	804648	13-17	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13.4	--	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	95	0	5	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Town of Mooresville's Rocky River WWTP; Instream Waste Concentration = 94%	NC0046728	5.2

Water Quality Parameters

Temperature (°C)	13.7
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	362
pH (s.u.)	6.6

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**52**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-45	16	50	Good
04/14/99	99-14	11	32	Poor
04/17/96	96-18	10	34	Poor

Most Abundant Species Bluehead Chub and Redlip Shiner

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- none. **Gains** -- Spottail Shiner, Green Sunfish, Warmouth, Tessellated Darter, and Piedmont Darter.

Data Analysis

Watershed -- drains small portions of southeastern Iredell, northeastern Mecklenburg, and northwestern Cabarrus counties, including the Town of Mooresville. **WWTP** -- flow is augmented by discharge; specific conductance declined 25% since 1999 (fewer textile dischargers); WWTP with rare violations for fecal coliform bacteria, lead, and total suspended solids over the period June 2001 to June 2006 (BIMS query 12/14/2006). **Habitat** -- soft, shifting sand; snags; entrenched; sloughing banks; stick riffles; snags in the current. **2006** -- 3rd greatest specific conductance of any fish site in 2006; increases in the numbers of species and fish; darters collected for the first time from the site; percentages of omnivores and diseased fish lower in 2006 than in 2001. **1996 - 2006** -- consistently low total habitat scores (~ 50); 16 species known from site, all collected in 2006; no suckers or piscivores ever collected from the site; dominant species usually Bluehead Chub and Rosyside Dace. Special Study conducted in 1999.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	US 601	08/29/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17	351926	803059

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	392	15	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	25	25	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Rocky River WWTP	NC0036269	34.0 MGD
Chemical Specialties Inc.	NC0006351	0.025 MGD
Mallard Creek WWTP	NC0030210	12.0 MGD
Rocky River WWTP	NC0046728	5.2 MGD

Water Quality Parameters

Temperature (°C)	27.5
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	327
pH (s.u.)	6.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	5
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	56

Site Photograph

Substrate Mostly sand with some gravel, cobble and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/29/06	10069	53	13	6.4	5.5	Good-Fair
07/02/02	8847	40	9	6.8	6.5	Fair
08/22/01	8601	48	15	6.6	5.8	Fair
08/20/96	7168	56	19	6.1	5.5	Good-Fair
07/12/89	4978	66	19	6.3	5.4	Good-Fair

Taxonomic Analysis

Although *Caenis* was not collected in 2006 as in years past, *Lepidostoma* and *Chimarra* were present for the first time. Common and Abundant indicator taxa such as *Argia* , *Ophiogomphus* , *Tanytarsus* , *Limnodrilous hoffmiesteri* and two leech taxa suggest that this reach is stressed by low DO and nutrient enrichment. Intolerant txa present in 2006 include *Lepidostoma* (TV=0.9) and *Nectopsyche* (TV=2.9).

Data Analysis

This site is located about one mile below the Rocky River WWTP which has an IWC of greater than 70%. It is also located below Kannapolis. This site rated Good-Fair in 1989 and 1996, fell to Fair in 2001 and the drought year of 2002, and then most recently received a bioclassification of Good-Fair in 2006. During 2002, only 9 EPT taxa were collected, as compared to 13-19 during the other years. The influence of the WWTP would be expected in increase in years of low flow. The Good-Fair rating in 2006 indicates some recovery toward the ratings found in 1989 and 1996.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
ROCKY R	SR 1943	08/29/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	14	03040105	13-17	350951	801222

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	1232	40	0.4

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Lomg Creek WWTP	NC0024244	16.0 MGD
Monroe WWTP	NC0024333	10.4 MGD
Rocky River WWTP	NC0036269	34.0 MGD
Chemical Specialies Inc.	NC0006351	0.025 MGD
Mallard Creek WWTP	NC0030210	12.0 MGD
Rocky River WWTP	NC0046728	5.2 MGD

Water Quality Parameters

Temperature (°C)	27.2
Dissolved Oxygen (mg/L)	6.7
Specific Conductance (µS/cm)	247
pH (s.u.)	7.3
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	0
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	2
Left Riparian Score (5)	3
Right Riparian Score (5)	3
Total Habitat Score (100)	60

Site Photograph

Substrate Good mix of boulder, cobble, gravel, and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/29/06	10068	63	21	5.4	4.5	Good
08/23/01	8607	62	24	5.1	4.2	Good
08/21/96	7175	68	22	5.4	4.6	Good
07/24/90	5391	80	28	5.4	5.2	Good

Taxonomic Analysis

This site has only been sampled twice. As a result ten EPT taxa were not present in 2006 that were collected in 2001 and eight taxa were present in 2006 which have never been seen at this location. No particular stressor is suggested by the indicator taxa present in this reach. Several intolerant taxa were present at this locaation; *Psephenus herricki* (TV=2.4), *Microcylloepus pusillus* (TV=2.1), *Stenonema lenati* (TV=2.3), *Leucrocuta* (TV=2.4) *Heptagenia* (TV=2.6) *Elimia* (TV=2.5), *Acroneuria mela* (TV=0.9), and *Hydropsyche demora* (TV=2.1).

Data Analysis

The Rocky River near Norwood is the most downstream monitoring location on the Rocky River. Data has been collected from this area (exact location moved one bridge up in 2001) since 1983, and this data can be found in prior basinwide reports. Although the ratings in both 2001 and 2006 were Good, there has been a slight decrease in water qualtiy based on the Biotic Index and EPT taxa richness. The BI rose from 5.1 to 5.4 in 2006 and the number of EPT taxa fell from 24 in 2001 to 21 in 2006. This, however, was not enough to change the overall bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clarke Cr	**SR 1449**	**07/18/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352451	804507	13-17-4	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	21.9	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	15	5 -- residential

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

Water Quality Parameters

Temperature (°C)	24.6
Dissolved Oxygen (mg/L)	2.9
Specific Conductance (µS/cm)	194
pH (s.u.)	6.3

Water Clarity	Gray-green turbidity

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	11
Bottom Substrate (15)	2
Pool Variety (10)	2
Riffle Habitat (16)	0
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**42**

Site Photograph

Substrate Sand, silt

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-100	9	30	Poor

Most Abundant Species Redbreast Sunfish and Eastern Mosquitofish

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains northeastern Mecklenburg County, including the Town of Huntersville. **Habitat** -- poor quality instream habitats; sandy, shallow runs, side snags. **2006** -- 3rd lowest dissolved oxygen concentration and saturation of any fish site in 2006; less than the water quality standard; lowest NCIBI score of any fish site in 2006; low diversity, no suckers, no intolerant species, 63% of all fish were tolerant species including Golden Shiner, Eastern Mosquitofish, Redbreast Sunfish, and Green Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mallard Cr	**SR 2467**	**07/18/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Mecklenburg	11	03040105	351936	804630	13-17-5	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	11.9	--	10	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	22.3
Dissolved Oxygen (mg/L)	7.1
Specific Conductance (µS/cm)	139
pH (s.u.)	6.1

Water Clarity	Turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	4
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**80**

Site Photograph

Substrate Boulder, cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-99	16	44	Good-Fair
04/19/01	2001-26	20	56	Excellent
06/10/96	96-69	19	50	Good

Most Abundant Species Spottail Shiner

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Rosyside Dace, Highback Chub, Highfin Shiner, White Sucker, Creek Chubsucker, and Brassy Jumprock. **Gains** -- Eastern Mosquitofish and Redear Sunfish.

Data Analysis

Watershed -- drains a small northeast area of the City of Charlotte. **Habitat** -- good for an urban stream; extremely rocky and angular substrate, not channelized, low embeddedness, frequent riffles and shelves, and stable banks. **2006** -- suckers and intolerant species absent; number of Highback Chub (an intolerant species) declined from 96 to 0; increase in the percentage of omnivores, 46% of all fish were Spottail Shiner and Bluehead Chub. **1996 - 2006** -- total habitat scores averages ~ 75; specific conductance elevated, but not extremely high for an urban stream, ~ 140 µS/cm; an abundant and diverse community, 24 species known from the site; dominant species include Bluehead Chub, Redlip Shiner, Spottail Shiner, and Redbreast Sunfish; NCIBI scores and ratings variable, from Good-Fair to Excellent. Low flow affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mallard Cr	**SR 1300**	**07/16/04**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	352001	804006	13-17-5	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	37.5	--	7	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Charlotte Mecklenburg Utility Department's Mallard Creek WWTP	NC 0030210	12

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	6.0
Specific Conductance (µS/cm)	385
pH (s.u.)	6.7

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	1
Right Bank Stability (7)	1
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**47**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/16/04	2004-126	18	46	Good-Fair

Most Abundant Species	Spottail Shiner	**Exotic Species**	Channel Catfish and Green Sunfish

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- drains the northeastern metropolitan Charlotte area; site is ~2.3 miles below WWTP and ~ 0.6 miles above the mouth. **Habitat** -- lots of large, coarse, woody debris, deadfalls, and tree trunks in the creek; woody debris riffles; sandy runs; and undercuts; unstable and eroding banks. **2004** -- chlorine smell and very elevated specific conductance; very high percentage of omnivores present including Spottail Shiner (63% of all the fish), indicative of nutrient enrichment and favorable sandy run habitats; Creek Cub and Rosyside dace represented only by young-of-year; low flow and easily silted; sampled as part of a NCSU Urban Fish Study.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Reedy Cr	**SR 1136**	**07/18/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	11	03040105	351812	803541	13-17-8	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.9	--	5	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	24.7
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	329
pH (s.u.)	6.2

Water Clarity	Very slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	11
Bottom Substrate (15)	3
Pool Variety (10)	8
Riffle Habitat (16)	2
Left Bank Stability (7)	0
Right Bank Stability (7)	0
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	5
Total Habitat Score (100)	**46**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-101	17	46	Good-Fair
04/18/01	2001-24	17	46	Good-Fair

Most Abundant Species Spottail Shiner and Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- White Sucker, Brassy Jumprock, Flat Bullhead, Margined Madtom, and Redear Sunfish. **Gains** -- Gizzard Shad, Sandbar Shiner, Warmouth, Largemouth Bass, and Piedmont Darter.

Data Analysis

Watershed -- drains northeastern Mecklenburg and southwestern Cabarrus counties, including the northeast City of Charlotte metropolitan area. Downstream (but distance greater than 1 mi.) from seven WWTP and one WTP with a combined flow of 2.3 MGD (largest discharger is 0.95 MGD); very high specific conductance. **Habitat** -- sloughing banks contribute large quantities of sand; large, fallen tree trunks provide snags and side pools; severe erosion and sediment transport. **2006** -- high percentage of omnivores, ~ 50% of all the fish were Spottail Shiner and Bluehead Chub; no suckers. **2001 and 2006** -- low total habitat scores, specific conductance increased 1.5 times between 2001 and 2006; 22 species known from site, dominant species are Bluehead Chub and Spottail Shiner; no change in NCIBI scores or ratings.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CODDLE CR	**NC 49**	**08/21/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	11	03040105	13-17-6-(5.5)	352034	803646

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	74	10	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	0	50	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
N/A		

Water Quality Parameters

Temperature (°C)	25.8
Dissolved Oxygen (mg/L)	6.5
Specific Conductance (µS/cm)	202
pH (s.u.)	7.1
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	3
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	41

Site Photograph

Substrate primarily sand with some gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10058	65	13	6.3	5.4	Fair
07/31/03	9119	48	12	6.6	5.8	Fair
08/21/01	8598	67	14	6.6	5.7	Fair
08/19/96	7165	N/A	13	N/A	5.4	Fair

Taxonomic Analysis

Two caddisfly taxa, *Pycnopsyche* and *Oecetis nocturna*, were collected at this site for the first time in 2006. No stoneflies have been seen at this site since 1996. Common and abundant indicator taxa such as *Calopteryx*, *Argia*, *Pisidium*, *Caenis*, *Conchapelopia gr*, *Rheocricotopus robacki,* and *Physella* suggest that low DO and organic enrichment may be issues at this location. Only two intolerant taxa were found in 2006, *Pycnopsyche* (TV=2.5) and *Nectopsyche* (TV=2.9).

Data Analysis

This location is below the Concord metropolitan area and receives urban runoff. Coddle Creek at NC 49 has received a Fair rating for each sampling event since 1996. The Biotic Index has remained fairly stable over that time period ranging from 6.3 to 6.6. In 2003, the sample collected contain much fewer taxa than in 2001 and 2006. This may be due to drought conditions in 2002. Overall, biotic conditions at this site improved slightly from 2001.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
IRISH BUFFALO CR	**SR 1132**	**09/29/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17-9-(2)	352050	803252

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	45	8	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
N/A		

Water Quality Parameters

Temperature (°C)	26.5
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	182
pH (s.u.)	8
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	2
Right Riparian Score (5)	2
Total Habitat Score (100)	66

Site Photograph

Substrate Mostly sand with some cobble, boulders and gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
09/29/06	10070	54	12	6.5	6.1	Fair
08/19/96	7166	58	15	6	5.3	Good-Fair

Taxonomic Analysis

Five EPT taxa were not present in 2006 as in years previous, however, *Acentrella* and *Paracloedes minutus* were collectd for the first time at this site. Tolerant taxa such as *Baetis intercalaris* , *Stenonema modestum, Hydropsyche betteni, Cheumatopsyche* , *Calopteryx* , *Polypedilum illinoense* and *Corbicula fluminea* were abundant. However, no particular stressor was evident based on indicator taxa collected. The only intolerant taxon present was *Nectopsyche* (TV=2.9).

Data Analysis

This monitoring siste is below Concord and receives urban runoff, but no large point source discharges. This site rated Good-fair in 1996 and Fair in 2006. This drop in bioclassification was due to a higher Biotic Index and lower EPT taxa richness in 2006. Reduced water quality over the ten year period is indicated by the data. Another possible cause for the decline in bioclassification might be the thick coating of algae that was covering alll the rocks in the stream. This algae was identified as Cymbella.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Irish Buffalo Cr	**SR 1132**	**05/12/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352054	803254	13-17-9-(2)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	45.4	--	10	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	45	5 -- residential

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

Water Quality Parameters

Temperature (°C)	14.2
Dissolved Oxygen (mg/L)	9.7
Specific Conductance (µS/cm)	206
pH (s.u.)	7.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	12
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	**75**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-46	18	54	Excellent
04/19/01	2001-25	22	50	Good
04/17/96	96-20	20	52	Good

Most Abundant Species Bluehead Chub and Fantail Darter

Exotic Species Threadfin Shad and Green Sunfish

Species Change Since Last Cycle

Losses -- Highback Chub, Golden Shiner, Whitemouth Shiner, Creek Chubsucker, Pumpkinseed, Redear Sunfish, and Largemouth Bass. **Gains** -- Gizzard Shad, Threadfin Shad, and Brassy Jumprock.

Data Analysis

Watershed -- drains southwestern Rowan County and northern Cabarrus County, including the cities of Kannapolis and Concord; impounded upstream by Kannapolis Lake. Habitat -- borders the Carolina Slate Belt; cobble riffles; shallow, snag pools; a couple of fast runs. **2006** -- numbers of species and fish declined, but no appreciable change; some nutrient enrichment as evident by an higher than expected percentage of omnivores; species of shad likely migrants from the Rocky River. **1996 - 2006** -- high specific conductance (~ 200 µS/cm) from urban runoff, no known point source dischargers upstream; total habitat scores better in 2006 than 2001 (related to flow and re-vegetation of banks); 2 of 3 scores > 70; an abundant and diverse community; 26 species known from site; Bluehead Chub and Redlip Shiner have been the dominant species; NCIBI scores and ratings vary between medium Good and low Excellent.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Coldwater Cr	**NC 73**	**05/12/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352457	803321	13-17-9-4-(1.5)	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	34.6	--	7	0.2	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	40	5	30	25 -- soccer complex

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)	7.7
Specific Conductance (µS/cm)	202
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	8
Bottom Substrate (15)	3
Pool Variety (10)	3
Riffle Habitat (16)	1
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	**40**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
05/12/06	2006-47	14	36	Fair
04/18/01	2001-23	17	44	Good-Fair
04/17/96	96-19	19	52	Good

Most Abundant Species Whitemouth Shiner

Exotic Species None

Species Change Since Last Cycle

Losses -- Redlip Shiner, Highback Chub, Yellow Bullhead, Eastern Mosquitofish, and Fantail Darter.
Gains -- White Sucker and Margined Madtom.

Data Analysis

Watershed -- drains southwestern Rowan and northern Cabarrus counties, including the cities of Kannapolis and Concord; impounded upstream by lakes Fisher and Concord. **Habitat** -- riffles absent; shallow channel filled with sand; snags; unstable banks; ATVs with access to stream and evidence of being in the stream. **2006** -- declines in the number of fish and species; skewed trophic metrics, only one Bluehead Chub collected and 97% of all fish were insectivores. **1996 - 2006** -- specific conductance from urban runoff has increased from 130 in 1996 to 202 µS/cm in 2006, no known point source dischargers upstream; consistently low (~45) total habitat scores; total species at site = 22, but declining since 1996; dominant species are Whitemouth Shiner, Speckled Killifish, and Redbreast Sunfish; loss of intolerant species; declines in sunfish diversity and percentages of species with multiple age classes; and slight increase in the percentage of tolerant fish; NCIBI scores and ratings have gradually declined from Good in 1996 to Fair in 2006.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
COLDWATER CR	**NC 49**	**08/22/06**	**Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
CABARRUS	12	03040105	13-17-9-4-(1.5)	352236	803211

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Southern Outer Piedmont	C	57.6	10	0.4

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	0	50	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
N/A		

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	6.4
Specific Conductance (µS/cm)	101
pH (s.u.)	5.9
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	7
Bottom Substrate (15)	3
Pool Variety (10)	2
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	4
Total Habitat Score (100)	44

Site Photograph

Substrate sand with some gravel and silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10059	N/A	13	N/A	5.9	Fair
08/21/01	8600	N/A	15	N/A	5.5	Good-Fair
08/19/96	7167	N/A	14	N/A	5.1	Good-Fair

Taxonomic Analysis

Although the mayfly *Procloeon* was seen for th first time in 2006, the stonefly *Eccoptura xanthenes* was not collected as it has been in the past. In fact no stoneflies were present in the 2006 sample as in previous years. The only intolerant taxon present in 2006 was *Serratella deficiens* (TV=2.8).

Data Analysis

Coldwater Creek drains Kannapolis and Concord before its confluence with Irish Buffalo Creek below this site. The bioclassification at Coldwater Creek NC 49 fell from Good-Fair in 2001 to Fair in 2006. In fact, the EPT Biotic Index has increased from 5.1 in 1996 to 5.5 in 2001 to 5.8 in 2006. This indicates a trend of decreasing water qulaity at this location. EPT taxa richness, however, has only changed slightly. The site was very turbid when sampled after a thunderstorm the night before.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Dutch Buffalo Cr	**NC 200**	**07/16/04**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Cabarrus	12	03040105	352127	802551	13-17-11-(5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	98.2	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	60	0	30	10 (rural residential)

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

Water Quality Parameters

Temperature (°C)	22.5
Dissolved Oxygen (mg/L)	6.3
Specific Conductance (µS/cm)	157
pH (s.u.)	6.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	9
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	2
Left Bank Stability (7)	2
Right Bank Stability (7)	2
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	3
Total Habitat Score (100)	**46**

Site Photograph

Substrate Sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/16/04	2004-127	14	42	Good-Fair
04/18/01	2001-22	19	52	Good
04/17/96	96-21	17	44	Good-Fair

Most Abundant Species Spottail Shiner

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Gains -- Flat Bullhead, Pumpkinseed, and sunfish hybrid. **Losses** -- Whitemouth Shiner, Highfin Shiner, Redlip Shiner, Highback Chub, Notchlip Redhorse, Speckled Killifish, and Largemouth Bass.

Data Analysis

Watershed -- drains semi-rural eastern and northeastern Cabarrus and a small southeastern portion of Rowan counties; includes the Town of Mount Pleasant; site is ~ 0.6 miles above mouth and ~ 4.5 miles below the SR 2622 basinwide site sampled in 1996 and 2001, difference in the drainage area is 3.8 square miles. **Habitat** -- deadfalls, snags, undercuts, woody debris riffles, severe bank erosion, pools and sandy runs. **2004** -- low flow and easily silted; suckers absent; moderate total species diversity and abundance of tolerant fish (Satinfin Shiner; Creek Chub, Flat Bullhead, Redbreast Sunfish, Green Sunfish, and sunfish hybrids); high percentage of omnivores (Spottail Shiner and Bluehead Chub); Rosyside Dace, Speckled Killifish, Notchlip Redhorse, Brassy Jumprock, and Largemouth Bass represented only by young-of-year; sampled as part of a NCSU Urban Fish Study. **1996 - 2004** -- increase in the percentages of tolerant fish and omnivores+herbivores; 24 species known from the two lower reaches of the creek, not especially species rich for a stream of its size. A low flow affected stream in 2004.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Clear Cr	**SR 3181**	**06/23/04**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Mecklenburg	12	03040105	351230	803447	13-17-17	Southern Outer Piedmont

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	12.6	--	6	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	0	0	25 (rural residential)

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

Water Quality Parameters

Temperature (°C)	23.5
Dissolved Oxygen (mg/L)	7.5
Specific Conductance (µS/cm)	146
pH (s.u.)	--

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	11
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	7
Left Riparian Score (5)	4
Right Riparian Score (5)	1
Total Habitat Score (100)	**66**

Site Photograph

Substrate Cobble, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/23/04	2004-102	19	54	Excellent

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- drains northeastern Mecklenburg County, including the Town of Mint Hill. **Habitat** -- a typical Carolina Slate Belt type stream; pools, short and shallow riffles, snags, deadfalls, unstable banks, and a narrow riparian zone along the right shoreline. **2004** -- a very abundant and diverse community for a stream with a relatively small watershed; only one species of sucker present; White Sucker represented only by young-of-year; creek dried-up during the 2002 drought (anecdotal comment from nearby landowner), if so, then fish community repopulated the creek very quickly; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
GOOSE CR	US 601	08/22/06	Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	12	03040105	13-17-18	350914	803206

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	24	6	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	50	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
N/A		

Water Quality Parameters

Temperature (°C)	24.8
Dissolved Oxygen (mg/L)	5.7
Specific Conductance (µS/cm)	165
pH (s.u.)	0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	5
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	1
Right Riparian Score (5)	5
Total Habitat Score (100)	60

Site Photograph

Substrate Mostly sand with a mix of other substrates

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/22/06	10060	67	11	6.9	6.6	Fair
08/22/01	8603	48	5	7.2	6.0	Poor
04/21/98	7550	47	10	7.4	5.9	Poor
08/20/96	7170	N/A	2	N/A	6	Poor

Taxonomic Analysis

The mayflies *Isonychia* , *Baetis intercalaris* , and *Paracloeodes minutus* as well as the caddisfly *Hydroptila* were collected at this site for the first time in 2006. Common and Abundant indicator taxa such as *Caenis* , *Conchapelopia gr* , *Tanytarsus* , *Calopteryx* , *Argia* , *Dicrotendipes neomodestus* , *C/O SP1* , *Limnodrilus hoffmiesteri* , *Helisoma* , *Physella* , and three species of leeches suggest that low DO conditions and nutrient enrichment may be occuring at this site. *Psephenus herricki* was the only intolerant taxa present in 2006.

Data Analysis

Goose Creek is a small tributary of the Rocky River. The Goose Creek watershed is important as habitat for rare mussel species. Increasing development in the watershed has focused protection efforts in this area. The bioclassification at Goose Creek US 601 increased from Poor in 2001 to Fair in 2006. This trend can be seen in the decrease of the biotic Index from 7.4 in 1998 to 6.9 in 2006. In addition, total richness increased from 48 in 2001 to 67 in 2006 while the EPT abundance increased from 23 to 58 during the same time period. These changes indicate an increase in water quality over the past 5 years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
CROOKED CR	SR 1547	08/23/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	12	03040105	13-17-20	350842	802818

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	47	10	0.2

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Crooked Cr WWTP #2	NC0069841	1.9 MGD

Water Quality Parameters

Temperature (°C)	25.7
Dissolved Oxygen (mg/L)	7
Specific Conductance (µS/cm)	319
pH (s.u.)	0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	10
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	76

Site Photograph

Substrate Mostly cobble and gravel with few boulders and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10061	63	11	6.3	5.8	Good-Fair
08/22/01	8604	68	18	5.9	5.2	Good-Fair
08/20/96	7171	N/A	12	N/A	4.6	Fair

Taxonomic Analysis

Although *Asioplax dolani* and *Oecetis persimilis* were found for the first time at this site in 2006, both *Neoperla* and *Stenacron interpunctatum* were not present as they were in previous years. Common and abundant indicator taxa such as *Caenis* , *Argia, Helisoma* , *Conchapelopia gr* , *Procladius* , *Dicrotendipes neomodestus* , *Tanytarsus* , *C/O SP1* , and *Physella* suggest that Low DO and nutrient enrichment may be problems at this location. *Psephenus herricki* (TV=2.4) and *Asioplax* (TV=1.4) were the only intolerant taxa present.

Data Analysis

This site on Crooked Creek assesses water quality in the entire watershed, including the upstream WWTP. The Biotic Index at this location has increased from 5.9 in 2001 to 6.3 in 2006, at the same time that EPT taxa richness has dropped from 18 to 11. This indicates a decrease in water quality at this site in the past 10 years, despite the Good-Fair ratings in both 2001 and 2006. EPT taxa richness in 2006 was similar to the value in 1996 when the site was rated Fair, despite a more intense sampling method in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Crooked Cr	**SR 1547**	**07/19/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	12	03040105	350841	802817	13-17-20	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	47.3	--	12	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Union County's Crooked Creek WWTP No. 2; Instream Waste Concentration = 100%	NC0069841	1.9

Water Quality Parameters

Temperature (°C)	25.8
Dissolved Oxygen (mg/L)	6.2
Specific Conductance (µS/cm)	473
pH (s.u.)	6.7

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	8
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**85**

Site Photograph

Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-105	20	48	Good

Most Abundant Species Bluehead Chub and Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains northwestern Union and a small part of southeastern Mecklenburg counties, including the cities of Indian Trail and Mathews. **WWTP** -- highest specific conductance of any fish site in 2006; WWTP augments flow during drought periods; WWTP with frequent violations between 2002 and 2006 for biochemical oxygen demand; violations rare for total suspended solids; proceeded to enforcement and Notice of Violations (BIMS query 12/14/2006). **Habitat** -- a typical Carolina Slate Belt type stream; pools and short, shallow riffles. **2006** -- abundant and diverse fauna; percentage of tolerant fish (primarily Redbreast Sunfish) moderately high; suckers absent, only represented by young-of-year Creek Chubsucker and White Sucker. Carolina Darter, a species of Special Concern, collected at the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Island Cr	**SR 1118**	**04/13/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	14	03040105	351151	802226	13-17-26	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19.2	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	20	0

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

Water Quality Parameters

Temperature (°C)	13.4
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	106
pH (s.u.)	5.8

Water Clarity	Clear, but easily silted

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	12
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**83**

Site Photograph

Substrate Cobble, bedrock, boulder

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-17	18	54	Excellent
04/11/01	2001-13	20	54	Excellent

Most Abundant Species Bluehead Chub and Tessellated Darter

Exotic Species Green Sunfish and Redear Sunfish

Species Change Since Last Cycle

Losses -- Rosyside Dace, Greenfin Shiner, Whitefin Shiner, Highback Chub, White Sucker, and Notchlip Redhorse. **Gains** -- Spottail Shiner, Bluegill, Redear Sunfish, and Largemouth Bass.

Data Analysis

Watershed -- drains the southwest corner of Stanly County; primarily rural with small towns of Stanfield and Oakboro. **Habitat** -- a typical Carolina Slate Belt type stream; bedrock and cobble riffles; side deadfalls; undercuts with roots; flocculent periphyton; low flow. **2006** -- a substantial decline in the number of fish (from 472 in 2001 to 194 in 2006); loss of two species of suckers and an intolerant species; but an increase in the diversity of sunfish and the percentage of piscivores. **2001 and 2006** -- 24 species known from the site; Bluehead Chub dominant species; no change in NCIBI scores or ratings. Carolina Darter, a species of Special Concern, was collected in 2001 and 2006. Qualifies as High Quality Waters with Excellent ratings and habitats, if petitioned.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LONG Cr	SR 1401	08/23/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Stanly	13	03040105	13-17-31	352251	801450

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	27	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	10	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)

Water Quality Parameters

Temperature (°C)	24.2
Dissolved Oxygen (mg/L)	7.3
Specific Conductance (µS/cm)	221
pH (s.u.)	6.8
Water Clarity	turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	5
Riffle Habitat (16)	14
Left Bank Stability (7)	5
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	78

Site Photograph

Substrate Rubble, boulder, sand, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10083	NA	17	NA	4.9	Good-Fair
08/20/01	8594	NA	17	NA	5.1	Good-Fair

Taxonomic Analysis

EPT taxa richness has been identical at this location since sampling commenced in 2001. Although total EPT taxa richness has not changed, there were several, largely pollution intolerant EPT taxa collected at this location for the first time and included the mayfly *Heptagenia marginalis* , the stonefly *Eccoptura xanthenes* , and the caddisflies *Diplectrona modesta* , and *Polycentropus sp* .

Data Analysis

The new additional EPT taxa collected at this location in 2006 helped lower the EPTBI slightly from 2001 levels. In addition, while EPT richness was identical, EPTN increased slightly from 77 in 2001 to 83 in 2006. Overall, these data suggest stable conditions in the Long Creek watershed.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Long Cr	**off SR 1900**	**06/24/04**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	351959	801251	13-17-31	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	32.9	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	25	25 (Town of Albemarle's WWTP)

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

Water Quality Parameters

Temperature (°C)	24.4
Dissolved Oxygen (mg/L)	6.1
Specific Conductance (µS/cm)	226
pH (s.u.)	--

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	6
Pool Variety (10)	8
Riffle Habitat (16)	4
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**63**

Site Photograph

Substrate Cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-106	18	50	Good

Most Abundant Species Redbreast Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- drains north-central Stanly, including the City of Albemarle, northeastern Cabarrus, and a very small portion of southeastern Rowan counties; site is on WWTP property, but above the WWTP discharge and above the confluence with Little Long Creek; site is ~ 2.8 miles below Long Lake. **Habitat** -- a typical Carolina Slate Belt type stream; shallow, cobble runs; some snags; some urban debris in the creek and along the banks. **2004** -- elevated specific conductance (urban runoff); no intolerant species; high percentage of tolerant fish, including Golden Shiner, White Sucker, Flat Bullhead, Redbreast Sunfish, and Green Sunfish; large specimens of Redbreast Sunfish and Largemouth Bass; sampled as part of a NCSU Urban Fish Study.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
LONG CR	SR 1917	08/23/06	Good

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
STANLY	13	03040105	13-17-31	351326	801533

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	196	10	0.4

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Oakboro WWTP	NC0043532	0.9 MGD
Long Creek WWTP	NC0024244	16.0 MGD

Water Quality Parameters

Temperature (°C)	28.2
Dissolved Oxygen (mg/L)	8.6
Specific Conductance (µS/cm)	270
pH (s.u.)	0
Water Clarity	colored (from dyes)

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	12
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	75

Site Photograph

Substrate Good mix of boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10065	72	22	5.8	5.1	Good
08/23/01	8606	71	20	5.8	4.9	Good-Fair
08/22/96	7177	64	14	5.7	5.3	Good-Fair
07/12/89	4976	76	22	6.1	5.2	Good-Fair
07/24/86	3859	88	12	6.8	5.6	Fair
09/02/83	3068	59	15	6.6	4.9	Fair

Taxonomic Analysis

Several EPT taxa were ffirst collected at this site in 2006; *Heterocloeon curiosum* , *Stenonema lenati* , *Stenacron interpunctatum* , *Acroneuria arenosa* , *Ceraclea ancylus* , *Lepidostoma* , *Neophylax oligius* , and *Oecetis persimilis* . Common and abundant indicator taxa such as *Caenis* , *Argia* , *Helisoma* , *Physella* and two species of leeches suggest that low DO may be a stressor in this reach. Intolerant taxa found in 2006 include *Psephenus herricki* (TV=2.4), *Leucrocuta* (TV=2.4), *Stenonema lenati* (TV= 2.3) and *Pyralidae* (TV=2). Thousands of the snail, *Amnicola,* covered the rocks.

Data Analysis

Albemarle's WWTP is located above this site and its discharge makes up much of the flow. The water had a red tinge in 2006 as has been noted in prior sampling. The rating at this location has increased from Fair in 1983 to Good in 2006. However, over the past 10 years, the biotic Index has remained fairly stable, with changes in the number of EPT taxa making the slight increase in bioclassification from Good-Fair to Good.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Big Bear Cr	**SR 1134**	**06/24/04**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	352001	802009	13-17-31-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	55.6	--	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	25	0	50	25 (rural residential)

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

Water Quality Parameters

Temperature (°C)	23.0
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	112
pH (s.u.)	--

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**82**

Site Photograph

Substrate Cobble, slate, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
06/24/04	2004-105	16	46	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2004.

Data Analysis

Watershed -- drains rural west-central Stanly and northeastern Cabarrus counties; no municipalities in the watershed. **Habitat** -- a typical Carolina Slate Belt type stream; angular bedrock pools and riffles; shallow pools and riffles; slick rocks; good riparian zones along both banks. **2004** -- low flow; intolerant species absent; indications of nutrient enrichment (dominance by Bluehead Chub and an abundance of other omnivores such as White Sucker, Creek Chubsucker, and Yellow Bullhead); Pirate Perch represented only by young-of-year; sampled as part of a NCSU Urban Fish Study. Data collected in 1996 and 2001 were from a site at NC 73, ~ 4 miles upstream and with a drainage area of 19.1 square miles.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
BIG BEAR CR	**SR 1225**	**08/23/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Stanly	13	03040105	13-17-31-5	351917	801944

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	58.1	6	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10-Residential

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)

Water Quality Parameters

Temperature (°C)	27.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	97
pH (s.u.)	6.7
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	80

Site Photograph

Substrate Bedrock, Boulder, Rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10084	NA	21	NA	5	Good
08/20/01	8595	NA	22	NA	4.5	Good

Taxonomic Analysis

EPT taxa collected for the first time (at this site) in 2006 included the mayflies *Baetis intercalaris* , *Eurylophella sp* ., *Stenonema vicarium* , and the caddisflies *Hydroptila sp* ., *Oecetis persimilis* , and *Triaenodes perna* . The slate-belt indicators (mayflies) *Stenonema vicarium* and *Stenonema femoratum* were both present at this site in 2006.

Data Analysis

The overall EPT community richness has remained stable along this reach of Big Bear Creek since 2001. In addition, the EPTN was remarkably similar from 2001 (90) to 2006 (91). The slight increase in the 2006 EPTBI value from the 2001 sample was partially the result of the addition of one pollution tolerant mayfly (*Baetis intercalaris)* and one facultative caddisfly *(Hydroptila sp.)* . Overall, these data suggest generally stable and favorable water quality in Big Bear Creek.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Stony Run	**SR 1970**	**04/13/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	13	03040105	351452	801734	13-17-31-5-5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	19.7	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	65	0	30	5 -- residential

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

Water Quality Parameters

Temperature (°C)	14.6
Dissolved Oxygen (mg/L)	9.8
Specific Conductance (µS/cm)	108
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	15
Pool Variety (10)	10
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**92**

Site Photograph

Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-18	12	46	Good-Fair

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains southwestern Stanly County, including the Town of Oakboro; tributary to Big Bear Creek. **Habitat** -- high quality habitats; a typical Carolina Slate Belt type stream; angular bedrock slick with periphyton; low flow. **2006** -- dominance by the omnivorous Bluehead Chub and abundant periphyton indicative of nonpoint nutrient inputs; Green Sunfish was the most abundant sunfish and has displaced the Redbreast Sunfish; three species of darters and one intolerant species collected. Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Richardson Cr	**NC 207**	**07/19/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345715	803242	13-17-36-(3.5)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-IV, CA	32.6	0	12	0.4	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 -- residential

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

Water Quality Parameters

Temperature (°C)	22.6
Dissolved Oxygen (mg/L)	1.8
Specific Conductance (µS/cm)	170
pH (s.u.)	5.8

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	9
Riffle Habitat (16)	0
Left Bank Stability (7)	2
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**66**

Site Photograph

Substrate Cobble, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-103	12	30	Poor
04/11/01	2001-11	14	46	Good-Fair

Most Abundant Species Green Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Whitemouth Shiner, Highfin Shiner, Creek Chubsucker, Redbreast Sunfish, Carolina Darter, and Tessellated Darter. **Gains** -- White Catfish, Yellow Bullhead, Flat Bullhead, and Black Crappie.

Data Analysis

Watershed -- drains south-central Union County, including a portion of the City of Monroe; suburban/rural with poultry operations, no WWTPs upstream. **Habitat** -- a typical Carolina Slate Belt stream; primarily one long pool, no riffles; entrenched with eroded banks; good canopy; Chinese privet riparian zone on right; cattle excluded from stream; low flow; periphyton thick at beginning of reach in open canopy area. **2006** -- elevated specific conductance and 2nd lowest dissolved oxygen concentration and saturation (early morning) of any fish site in 2006, less than the water quality standard; very few fish and low diversity; 1 of 5 sites with no Redbreast Sunfish; no darters, suckers, or intolerant species; high percentage of tolerant fish; skewed trophic metrics; few species with multiple age classes, 8 of 12 species represented by only 1 or 2 fish per species. **2001 and 2006** -- Green Sunfish has displaced the Redbreast Sunfish; percentage of tolerant fish increased from 36 to 61%. Low flow-affected stream.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
RICHARDSON CR	**SR 1649**	**08/23/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
UNION	14	03040105	13-17-36-(5)	350420	802430

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	156	22	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Monroe WWTP	NC0024333	10.4 MGD

Water Quality Parameters

Temperature (°C)	25.4
Dissolved Oxygen (mg/L)	6.6
Specific Conductance (µS/cm)	600
pH (s.u.)	0
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	8
Pool Variety (10)	6
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	4
Total Habitat Score (100)	81

Site Photograph

Substrate Good mix of boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10063	57	14	5.9	5.4	Good-Fair
08/23/01	8609	46	10	6.4	6.2	Fair
08/20/96	7172	46	12	6.2	5.6	Fair
07/24/90	5392	57	10	6.9	6.1	Fair
07/08/87	4132	57	10	6.9	5.9	Fair

Taxonomic Analysis

Baetis tricaudatis , *Chimarra* and *Leucotrichia pictipes* were collected for the first time at this site in 2006. No clear stressor was suggested from indicator taxa present in this reach. Intolerant taxa present were *Baetis tricaudatus* (TV=1.6) and *Pyralidae* (TV=2).

Data Analysis

This sampling site is located midway in the Richardson Creek watershed, and is located below the Town of Monroe and its WWTP. Substrate here was typical of Slate Belt streams. Richardson Creek at SR 1649 rated Fair in four samples since 1987. In 2006 the bioclassification increased to Good-Fair due to a decrease in Biotic Index and an increase in the number of EPT taxa found at the site. This suggests increasing water quality in the past 5 years.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
RICHARDSON CR	**SR 1600**	**08/23/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
ANSON	14	03040105	13-17-36-(5)	350929	801411

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	235	18	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	50	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Monroe WWTP	NC0024333	10.4 MGD

Water Quality Parameters

Temperature (°C)	28
Dissolved Oxygen (mg/L)	7.6
Specific Conductance (µS/cm)	296
pH (s.u.)	0
Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	20
Bottom Substrate (15)	12
Pool Variety (10)	4
Riffle Habitat (16)	12
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	2
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	76

Site Photograph

Substrate Good mix of boulder, cobble, gravel and sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/23/06	10064	N/A	24	N/A	4.2	Good
08/23/01	8608	N/A	24	N/A	4.0	Good
08/21/96	7176	N/A	18	N/A	3.9	Good-Fair

Taxonomic Analysis

Although *Stenacron interpunctatum* and *Hydropsyche phalerata* were not collected in 2006 as in previous years, *Tricorythodes robacki* , *Triaenodes marginatus* , and *Leucotrichia pictipes* were present for the first time at this site. Intolerant taxa found in 2006 include *Leucrocuta* (TV=2.4), *Stanacron pallidum* (TV=2.7), *Acroneuia abnormis* (TV=2.1), *Neoperla* (TV=1.5), *Lepidostoma* (TV=0.9), *Ceraclea ancylus* (TV=2.3), *Triaenodes injustus* (TV=2.5), and *Hydropsyche demora* (TV=2.1).

Data Analysis

This site in Anson County is located near the confluence with the Rocky River. Richardson Creek at SR 1600 recievd a Good bioclassification in 2006, the same rating given in 2001. The 1996 rating was Good-Fair. Increases in the number of EPT present account for the increase in 2001 and 2006. The Good rating at this site indicates recovery, as the upstream sampling location had a Good-Fair rating in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bearskin Cr	**NC 200**	**07/18/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345946	803123	13-17-36-6	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	14.3	--	4	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	90	0	0	10 -- Union County gas facility

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

Water Quality Parameters

Temperature (°C)	26.9
Dissolved Oxygen (mg/L)	7.0
Specific Conductance (µS/cm)	273
pH (s.u.)	6.0

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	19
Bottom Substrate (15)	14
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**93**

Site Photograph

Substrate Cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/18/06	2006-102	9	36	Fair

Most Abundant Species Bluehead Chub

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains central Union County, including the City of Monroe and the US 74/601 corridor; tributary to Richardson Creek; no WWTPs. **Habitat** -- very high quality habitats; a typical Carolina Slate Belt type stream; very rocky; runs, riffles, pools, root wads, undercuts, snags; very shallow (low flow). **2006** -- elevated specific conductance from upstream urban nonpoint sources; lower than expected total diversity; no suckers, no intolerant species; five species (Creek Chub, Spottail Shiner, Whitemouth Shiner, Creek Chubsucker, and Largemouth Bass) represented by only young-of-year and not counted in the analyses, would have increased the diversity metrics; high percentage of tolerant species (primarily Redbreast Sunfish and Flat Bullhead) and omnivores (Bluehead Chub). Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Salem Cr	**SR 1006**	**04/12/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	350430	802206	13-17-36-15	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	23.6	--	11	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	17.6
Dissolved Oxygen (mg/L)	11.2
Specific Conductance (µS/cm)	195
pH (s.u.)	6.4

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	11
Pool Variety (10)	9
Riffle Habitat (16)	5
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**81**

Site Photograph

Substrate Cobble, boulder, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-16	17	46	Good-Fair
04/11/01	2001-12	18	48	Good
06/10/96	96-68	19	36	Fair

Most Abundant Species Green Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Golden Shiner, Redlip Shiner, Spotted Sucker, Brown Bullhead, Margined Madtom, and Largemouth Bass. **Gains** -- Spottail Shiner, Eastern Mosquitofish, and Pumpkinseed.

Data Analysis

Watershed -- drains eastern Union County, including the north side of the Town of Marshville; tributary to Richardson Creek. **Habitat** -- a typical Carolina Slate Belt type stream; pools, two good riffles, but almost dry; thick filamentous algae; very low flow; left riparian zones logged within last 5 years, but a narrow buffer remains. **2006** -- supersaturation of dissolved oxygen; elevated and slight increase in specific conductance, regional office reports of sanitary sewer overflows in headwaters; decrease in the number of fish collected; increase in the percentage of Green Sunfish and tolerant fish; no Redlip Shiners. **1996 - 2006** -- consistently good total habitat scores (~80); a species-rich site (n = 27), but no intolerant species; dominant species include Highfin Shiner, Whitemouth Shiner, Redbreast Sunfish, Green Sunfish, and Tessellated Darter; Redlip Shiner rare at the site; increase in the percentage of Green Sunfish since 1996; slight change in NCIBI score and rating between 2001 and 2006. A low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Cribs Cr	**SR 1610**	**04/12/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	14	03040105	350834	801234	13-17-37	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	7.1	--	7	0.2	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	50	0	45	5 -- residential

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

Water Quality Parameters

Temperature (°C)	11.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	144
pH (s.u.)	6.3

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	13
Pool Variety (10)	6
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	4
Right Riparian Score (5)	5
Total Habitat Score (100)	**75**

Site Photograph

Substrate Flat cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-13	5	26	Poor

Most Abundant Species Tessellated Darter

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- small, rural watershed draining northwest Anson County; no municipalities; site is ~ 1 mile upstream of the confluence with the Rocky River. **Habitat** -- a typical Carolina Slate Belt type stream; very low flow which affected the habitat; short and shallow riffles; shallow pools; thick filamentous algae/periphyton; easily silted with flocculent material. **2006** -- lower than expected total diversity (fewest species at any fish site in 2006); few fish (n = 52); no Redlip Shiner or Redbreast Sunfish; Green Sunfish was the dominant sunfish; no suckers or intolerant species. Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Lanes Cr	**SR 1929**	**04/12/06**	**Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345442	802148	13-17-40-(1)	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	47.8	--	9	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	15.2
Dissolved Oxygen (mg/L)	11.5
Specific Conductance (µS/cm)	158
pH (s.u.)	6.2

Water Clarity	Slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	18
Bottom Substrate (15)	12
Pool Variety (10)	10
Riffle Habitat (16)	7
Left Bank Stability (7)	4
Right Bank Stability (7)	4
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**78**

Site Photograph

Substrate Cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/12/06	2006-15	10	36	Fair
04/11/01	2001-10	14	40	Fair

Most Abundant Species Green Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle

Losses -- Golden Shiner, Highfin Shiner, White Sucker, Eastern Mosquitofish, Margined Madtom, and Pumpkinseed. **Gains** -- Bluegill and Carolina Darter.

Data Analysis

Watershed -- originates in northern Chesterfield County, SC and drains primarily rural southeastern Union and northwestern Anson counties; no municipalities in watershed. **Habitat** -- a typical Carolina Slate Belt type stream; very rocky; abundant filamentous algae and flocculent periphyton; low flow. **2006** -- supersaturation of dissolved oxygen and specific conductance elevated; decrease in the number and diversity of fish; no intolerant species; increase in the percentage of tolerant fish; decrease in the percentage of species with multiple age classes; Green Sunfish displaced the Redbreast Sunfish (from 23 to 61% for Green Sunfish and from 14 to 1% for Redbreast Sunfish); Carolina Darter, a species of Special Concern, collected. **2001 and 2006** -- for its size, but due to flow conditions, not a particular species-rich site, only 16 species known from the site; no intolerant species nor the Redlip Shiner are known from the site. A low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaverdam Cr	**SR 1005**	**07/19/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Union	14	03040105	345716	802105	13-17-40-11	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-V	14.9	--	7	0.4	No

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

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

Water Quality Parameters

Temperature (°C)	23.8
Dissolved Oxygen (mg/L)	1.1
Specific Conductance (µS/cm)	161
pH (s.u.)	5.8
Water Clarity	Slightly turbid, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	10
Pool Variety (10)	9
Riffle Habitat (16)	2
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**68**

Site Photograph

Substrate Cobble, bedrock, gravel, sand

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
07/19/06	2006-104	9	30	Poor

Most Abundant Species Bluegill and Green Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains eastern Union County; no municipalities; poultry operations in rural watershed; tributary to Lanes Creek. **Habitat** -- a typical Carolina Slate Belt type stream; very low flow; pools; dry riffles; eroded banks; entrenched; good canopy; Chinese privet riparian zone on left. **2006** -- lowest dissolved oxygen concentration and saturation of any fish site in 2006; less than the water quality standard; lower than expected total diversity; only 1 of 3 sites in the Piedmont and Mountains with no species of darters; no intolerant species; no Bluehead Chub or Redlip Shiner, no Redbreast Sunfish (displaced by Green Sunfish); high percentage of tolerant species (primarily Green Sunfish and Eastern Mosquitofish). Low flow-affected stream.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hardy Cr	**SR 1934**	**04/13/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Stanly	14	03040105	351049	801004	13-17-42	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	14.7	--	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	85	0	10	5 -- residential

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

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	11.0
Specific Conductance (µS/cm)	109
pH (s.u.)	6.2

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	17
Bottom Substrate (15)	15
Pool Variety (10)	9
Riffle Habitat (16)	14
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**92**

Site Photograph

Substrate Cobble, boulder, bedrock, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/13/06	2006-19	14	50	Good

Most Abundant Species Green Sunfish

Exotic Species Green Sunfish

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains southeastern Stanly County, including the small town of Aquadale in its headwaters; rural.; site is 1.6 miles upstream of confluence with Rocky River. **Habitat** -- very high quality habitats; a typical Carolina Slate Belt type stream; very rocky; low flow; pools, short riffles; abundant filamentous algae and periphyton. **2006** -- supersaturation of dissolved oxygen; good species diversity and abundance; 3 species of darters and sunfish, 2 species of suckers, and 1 intolerant species; very high percentage of tolerant fish, the Green Sunfish has displaced the Redbreast Sunfish; no Redlip Shiner. Low flow-affected stream, but not to the extent as observed at other sites.

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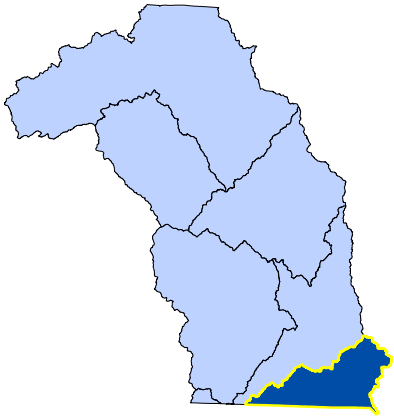


Pee Dee River

Subbasin HUC 03040201

Water Quality Overview

Of the monitored streams 53 percent are supporting their uses and 10 percent are impaired in the aquatic life category. The current impairments resulted from samples taken during the mid-1990s. Recent sampling efforts have not resulted in any new impairments to this subbasin. Habitat degradation, nutrient enrichment and low dissolved oxygen are aquatic life stressors that need to be addressed to prevent future impairments.

Watershed at a Glance

Counties

Anson, Richmond, Scotland

Municipalities

Hamlet, Hoffman, Rockingham, Wadesboro

Permitted Facilities

NPDES WWTP:	
Major	4
Minor	2
NPDES Nondischarge:	5
NPDES Stormwater:	
General	22
Individual	2
Phase II	0
Animal Operations:	19

Stream Summary

Total Streams:.....329 mi
.....17.5 ac
Total Monitored:.....138.6 mi
.....12.2 ac
Total Supporting:.....73.3 mi
.....12.2 ac
Total Impaired:.....23.9 mi
Total Not Rated:.....41.4 mi
Total No Data:.....190.4 mi
.....5.3 ac

General Description

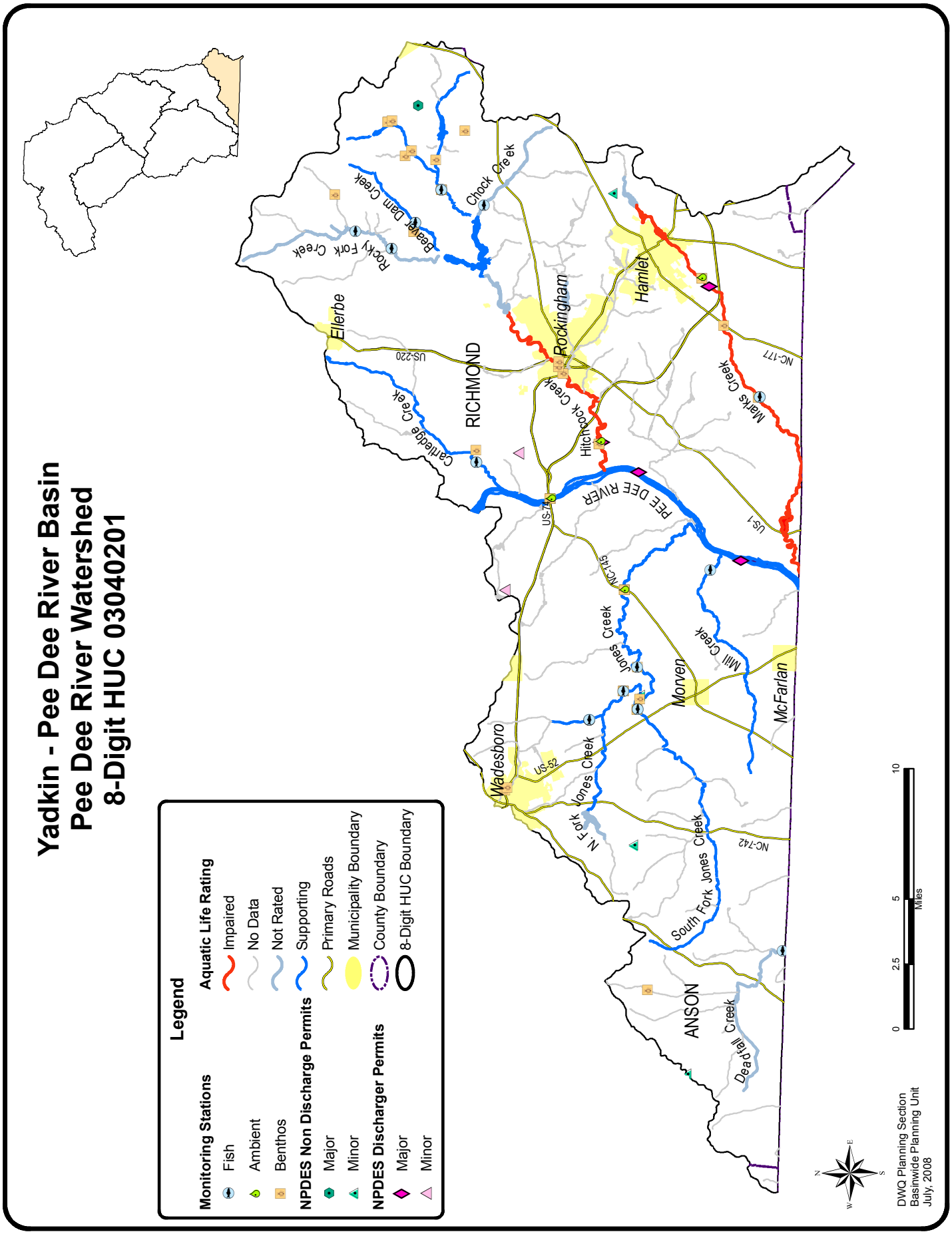
The Pee Dee River hydrologic unit (HUC) includes the Pee Dee River and its tributaries below Blewett Falls Lake. Much of Anson and Richmond Counties are included in this subbasin. Rockingham, Hamlet, and a portion of Wadesboro are the largest urban areas. Most of the land cover is forest.

The subbasin straddles the divide between the piedmont and coastal plain and containing portions of three ecoregions. Far western portions of the subbasin fall within a Triassic Basin, which consists of shale, sandstones, mudstones, siltstones, and conglomerates. Streams often experience low flow as a result of clay soils with little permeability. Stream substrates are generally composed of sands and clays. The remainder of much of the western half of the HUC is in the Carolina Slate Belt. Boulders and cobbles compose much of the stream substrate. Most of the eastern half of the subbasin is in the Sand Hills, a hilly region composed primarily of sands and clays. Permeable sandy soils allow for a large capacity for infiltration; therefore, streams in the ecoregion rarely dry or flood. Sands make up much of the substrate for streams in the region.

Several stream corridors, watersheds, and ecosystems in Richmond County were identified by the North Carolina Natural Heritage Program as significant.

- The upper portions of Rocky Fork, Beaverdam, and Hitchcock Creeks drain the western section of the Sand Hills Game Land (SGL) in Richmond County. SGL is composed of large areas mostly in Richmond and Scotland Counties. SGL contains an ecosystem that is nearly intact, supports a high diversity of flora and fauna, and provides a population pool for longleaf pine.
- The lower 1.5 miles of Hitchcock Creek falls within the Pee Dee River Megasite, and is significant for flowing from the coastal plain to the piedmont (only one of four North Carolina streams to do this), cutting a relatively deep valley before its confluence with Pee Dee River. A floodplain forest is also found on this lower section of Hitchcock Creek.
- Marks Creek shares the unusual characteristic with Hitchcock Creek of flowing from the coastal plain to the piedmont. The lower portion has few road crossings, affording some protection to the beech-dominant hardwood forest in the stream corridor. The coastal plain section of Marks Creek includes a large area of swamp forest dominated by black gum.
- Whites Creek Headwaters includes a large contiguous longleaf pine forest. Water from the drainage area flows into South Carolina and eventually into Pee Dee River.

Figure 6-1. Pee Dee River Watershed HUC 03040201



How to Read this Document

This document was written to correspond with our new *Online Geographic Document Distribution* tool using Google Earth™. If you are unable to use Google Earth™, this document provides maps and associated water quality information and a discussion of water quality trends occurring in the subbasin. Google Earth™ is an independent software program which can be downloaded to a personal, business, and most local and state government computers; the program allows you to view satellite imagery of the earth's surface along with location identifiers. DWQ's Basinwide Planning Unit created a "transparency" add on layer to Google Earth™ with basinwide water quality data, which allows a user to locate their watershed, pinpoint a waterbody and use support ratings, find a location of a permit and provides links to PDF subbasin reports. After installing Google Earth™, add *http://web.ceo.ncsu.edu/basinplans/dwq.kml* to your internet browser. Please contact Heather Patt for more information at heather.patt@ncmail.net or 919-807-6448.

Impaired streams are those streams not meeting their associated water quality standards in more than 10 percent of the samples taken within the assessment period (January 1, 2002 through December 31, 2006) and impacted streams are those not meeting water quality standards in 7 to 9 percent of the samples. The *Use Support* report provides information on how and why water quality ratings are determined and DWQ's "*Redbook*" describes in detail water quality standards for each waterbody *classification*. For a general discussion of water quality parameters, potential issues, and rules please see "Supplemental Guide to North Carolina's Basinwide Planning: Support Document for Basinwide Water Quality *Plans*"

Figure 1. shows monitoring station locations and impaired streams for the Pee Dee River subbasin.
Appendix A provides descriptions of all monitored waterbodies in the subbasin.
Appendix B. provides a summary of each ambient data monitoring station.
Appendix C provides summaries of biological and fish assessment monitoring sites.

Current Status and Significant Issues

General Biological Health

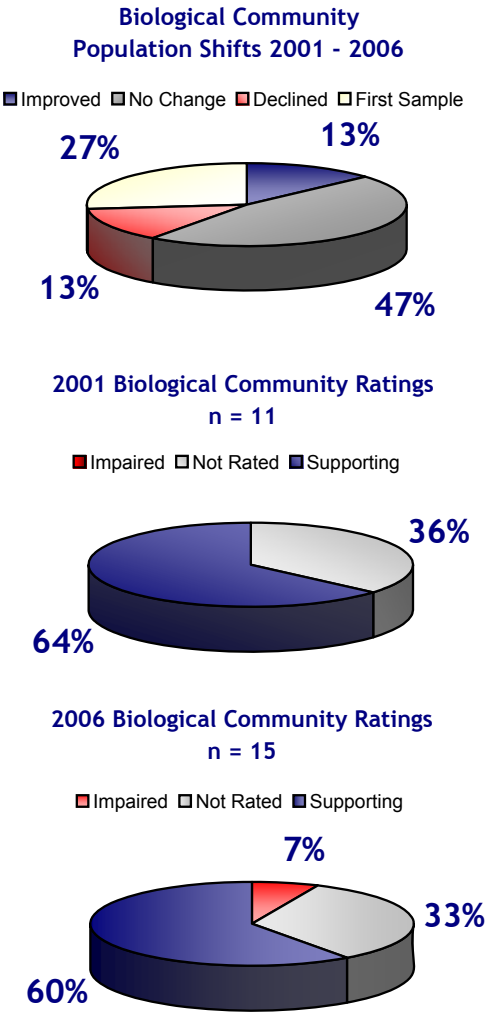
Thirteen basinwide collections were made in 2006. Nine sites were sampled for fish only, two for macroinvertebrates only, and two were sampled for both macroinvertebrates and fish. Fish sites in the Sand Hills ecoregion are not rated because of naturally low flows. Otherwise for fish sites there was one rating of Excellent, two Good, two Good-Fair, and one Poor. For benthic sites three rated as Good, one as Good-Fair.

The watershed above the fish site on Cartledge Creek at SR 1142/ Richmond County drains a portion of Ellerbe at its headwaters. There was little change in the fish community at the site between 2001 and 2006.

The upper portion of the Hitchcock watershed was sampled at four sites for fish in 2006; one of those four sites was also sampled for macroinvertebrates. None of the fish sites received ratings because of naturally low flow. The ecosystem, however, appeared healthy at these sites. The benthic data for three sampling events (1996, 2001, and 2006) at Hitchcock Creek at SR 1486/Richmond County indicate stable water quality. Overall, biological data from the upper Hitchcock watershed indicate constant to slightly improving water quality.

In contrast to the upper portion of the watershed, the macroinvertebrate site on Hitchcock Creek at SR 1109/Richmond County in the lower portion of the watershed has shown a marked improvement over three sampling events in 1996, 2001, and 2006. The site is about 1.5 stream miles above the confluence with Pee Dee River. Improving water quality at the site coincides with the loss of discharge to the stream from Laurel Hill Paper Company beginning in February 1998. Bioclassifications for the site have improved from Poor in 1996, to Good-Fair in 2001, and to Good in 2006.

Figure 6-2. Biological Health Summary



The watershed above the fish site on Bailey Creek at SR 1811/Anson County includes western portions of Wadesboro. Between sampling events at the site in 1996 and 2001 there was very little change in the number of species collected and in NCIBI values; the site was rated Good for both of those years. A marked drop in the number of species collected and in the NCIBI value resulted in a bioclassification of Good-Fair for 2006. Low flow in 2006 may be influencing the results for the latest collection.

The fish site on South Fork Jones Creek at SR 1821/Anson County is within one stream-mile of the confluence with North Fork Jones Creek. There is a marked difference between the fish collections made in 2001 and 2006. Three fewer species collected and a 10-point drop in the NCIBI value resulted in a drop of two classifications between 2001 and 2006, from Excellent to Good-Fair. As with Bailey Creek, the decline in the fish community at South Fork Jones Creek may be due to low-flow conditions sometime during the year as indicated by the loss of several species of sunfish, which inhabit pools.

A new fish site was established on Mill Creek at SR 1826/Anson County, and rated as Excellent for 2006. The site was the most species-rich for all fish sites sampled in 2006, and is a new regional fish reference site.

Marks Creek at SR 1104/Richmond County has been sampled for fish in 2001 and 2006. Along with other Sand Hills fish sites, the site was not rated. There was a gain in the number of species collected, from 13 in 2001 to 21 in 2006. High abundance and diversity may be due to enrichment from Hamlet WWTP. Specific conductance at the site is elevated for a Sand Hills stream.

Deadfall Creek at SR 1109/Anson County was sampled for fish for the first time in 2006. The site received a rating of Poor. A lack of diverse habitat and low flow at the site are implicated for low numbers of individuals and species collected.

The Yadkin River basin was experiencing moderate to severe drought conditions in 2001, which had the potential to reduce the impacts from nonpoint sources and magnify the impacts from point source discharges. This below average flow regime in the basin should be considered when looking at changes in the 2006 monitoring cycle.

Habitat Degradation

Several streams are impacted by habitat degradation. In most cases habitat is degraded by the cumulative effect of several stressors acting in concert. These stressors often originate in the upland portions of the watershed and may include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. Naturally erodible soils in the area make streams highly vulnerable to these stressors.

Many tools are available to address habitat degradation including; ***urban stormwater BMPs, agricultural BMP***s, ordinance/rule changes at the local, state, and federal levels, volunteer activism, and education programs. Figure 6-3 illustrates a general process for developing ***watershed restoration plans***. This process can and should be applied to streams suffering from habitat degradation. Organizations have begun this process in a few watersheds in the Yadkin River Headwaters. Similar efforts on all streams listed in Table 6-1 are necessary. Interested parties should contact the ***Basinwide Planning Program*** to discuss opportunities to begin the planning and restoration process in their chosen watershed.

FIGURE 6-3

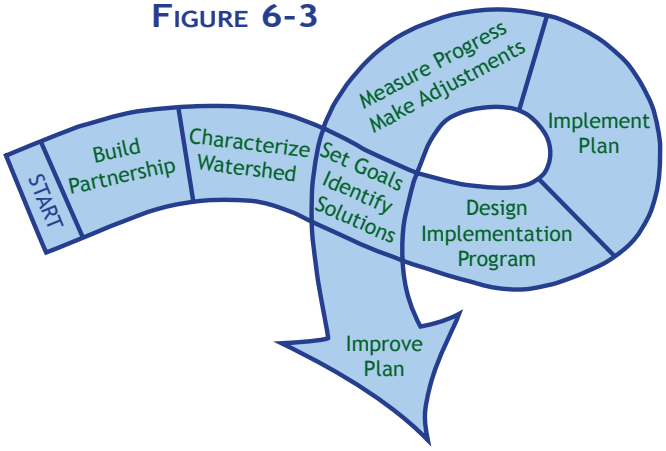


Table 6-1. Stressors in the Pee Dee River Watershed

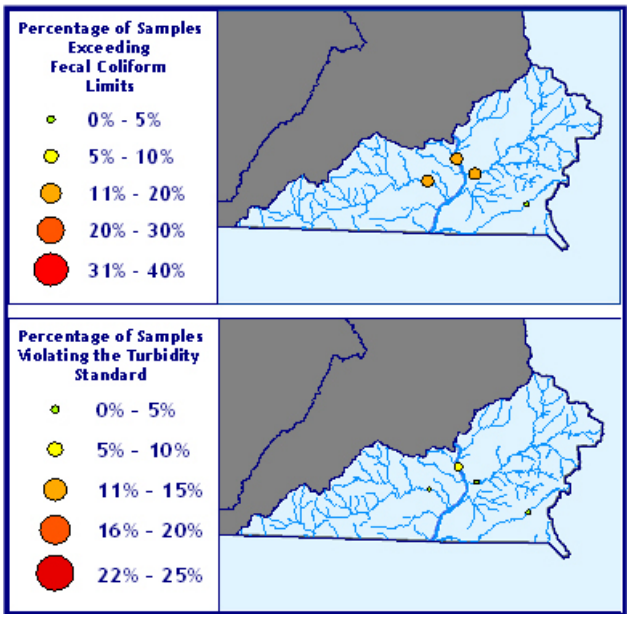
Assessment Unit	Name	Subbasin	Class.	Stressor	Impaired	Impacted	Potential Source	Length Miles
13-(34)a	Pee Dee River	03-07-16	C	Mercury	X		Impoundment	6.3
				Habitat Degradation			Impoundment	
13-39-(1)	Hitchcock Creek (McKinney Lake, Ledbetter Lake)	03-07-16	WS-III	Mercury	X		Impoundment	10.0
13-39-(10)	Hitchcock Creek (Midway Pond, Steeles Mill Pond)	03-07-10	C	Low pH		X	Natural Conditions	11.3
13-42-1-(0.5)	North Fork Jones Creek	03-07-17	C	Habitat Degradation		X	Natural Conditions	7.4
							Impoundment	
13-42-1-3	Bailey Creek	03-07-17	C	Nutrient Impacts		X	Impervious Surface	2.0
				Habitat Degradation			Agriculture/Pasture	
							Natural Conditions	
13-42-2	South Fork Jones Creek	03-07-17	C	Habitat Degradation		X	Agriculture/Pasture	15.0
							Natural Conditions	
13-45-(2)a	Marks Creek (Boyds Lake, City Lake, Everetts Lake)	03-07-16	C	Low Dissolved Oxygen		X	Natural Conditions	5.4
				Low pH			WWTP NPDES	
13-39-12-(7.5)	Falling Creek	03-07-16	WS-III; CA	Aquatic Weeds	X			0.6
							Total	57.4

Ambient Water Quality

Fecal Coliform Bacteria

Fecal coliform concentrations often exceed 400 colonies/100ml. in the Pee Dee River (Figure 6-4). The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or other warm-blooded animals. At the time this occurred, the source water might have been contaminated by pathogens or disease producing bacteria or viruses that can also exist in fecal material. Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A. The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water. Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste. BMPs similar to those mentioned in the Habitat Degradation section can also be used to reduce fecal coliform contamination.

Figure 6-4. Turbidity and FCB Violations



Nutrient Enrichment

Compounds of nitrogen and phosphorus are major components of living organisms and thus are essential to maintain life. These compounds are collectively referred to as "nutrients." Nitrogen compounds include ammonia-nitrogen (NH_3-N), total Kjeldahl nitrogen (TKN) and nitrite+nitrate nitrogen (NO_2+NO_3-N). Phosphorus is measured as total phosphorus. When nutrients are introduced to an aquatic ecosystem from municipal and industrial treatment processes, or runoff from urban or agricultural land, the excessive growth of algae (algal blooms) and other plants may be accelerated. In addition to the possibility of causing algal blooms, ammonia-nitrogen may combine with high pH water to form NH_4OH, a form toxic to fish and other aquatic organisms. Nutrient inputs also influence dissolved oxygen concentrations in streams.

Dissolved oxygen is one of the most important of all the chemical measurements. Dissolved oxygen provides valuable information about the ability of the water to support aquatic life and the capacity of water to assimilate pollution. Concentrations less than 4.0 mg/L can be problematic. Consistently low concentrations of dissolved oxygen can point to excessive wastewater discharges or nutrient rich runoff, although sometimes low dissolved oxygen can occur naturally in and near swamp waters.

Several streams in this subbasin suffer from low dissolved oxygen. Because this is a transitional area between the piedmont and sandhills/coastal plain, some of the low dissolved oxygen measurements may be natural (Hitchcock Creek). However, biologists identified excessive algal growth in some streams that indicate the dissolved oxygen values are human induced (Bailey and Marks Creeks). Most sources of nutrient enrichment in this hydrologic unit are agricultural runoff and waste water treatment plants. DWQ will continue to work with treatment plant operators to reduce nutrient impacts. Agricultural inputs can be addressed through the ***Agriculture Cost Share Program.***

See: ***Yadkin Ambient Monitoring System Report*** and ***Yadkin Basinwide Assessments*** for more information regarding specific monitoring sites.

Population and Land Use

The human population is clustered around Rockingham, Hamlet, and Wadesboro. Impervious surface is highest in these areas. The rest of the watershed is sparsely populated and characterized by large tracts of forest and agriculture lands.

Stream impacts roughly follow the population density and land use patterns. They occur in the eastern portion of the watershed near Rockingham (Figures 6-5 & 6-6). ***Urban Stormwater*** and ***Agricultural BMPs*** are needed in these watersheds. The remainder of the watershed offers many opportunities for ***protecting and conserving stream buffers and natural areas*** that will prevent stream degradation in the long term.

Figure 6-5. Population Density in 2000

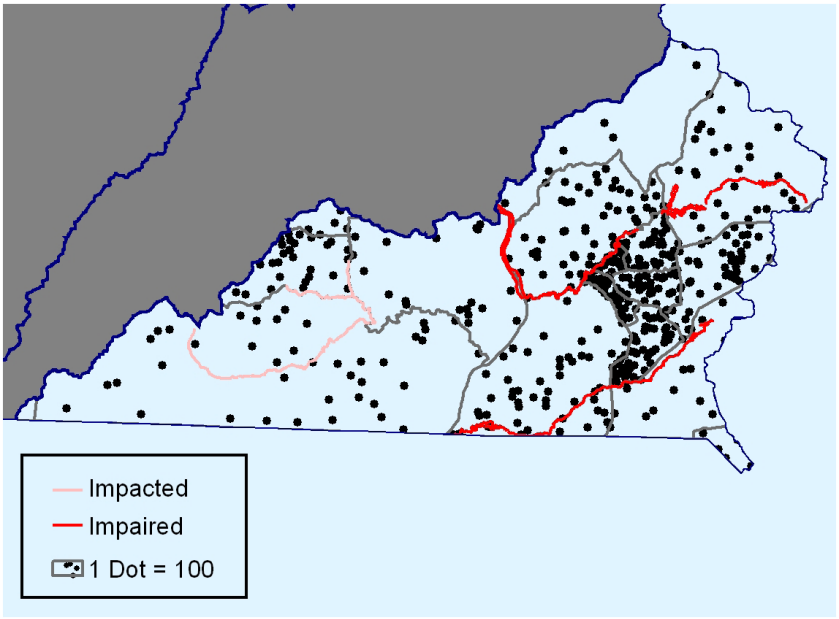
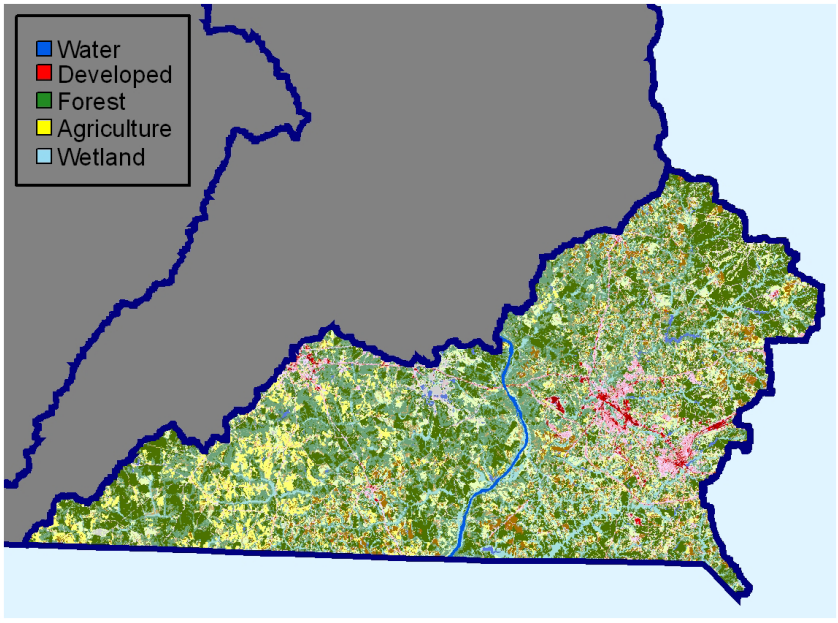


Figure 6-6. Land Cover



Clean Water Management Trust Fund

Created in 1996, the ***Clean Water Management Trust Fund*** (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. Figure 6-7 shows the distribution of projects to date in the watershed and Table 6-2, includes a list of projects and their cost. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restoration planning.

Figure 6-7. CWMTF Projects

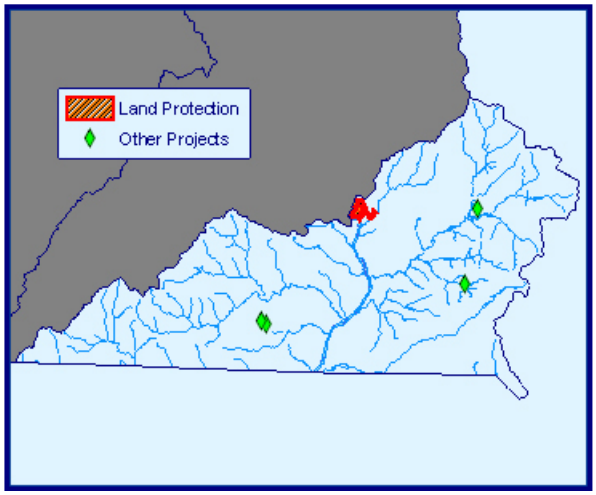


Table 6-2. CWMTF Funded Projects (9/1/2001-8/31/2006).

Project Number	Application Name	Proposed Project Description	Amount Funded
2002A-505	Morven, Town of, - Jones Creek Sewer System Rehabilitation	Replace 10 manholes and inspect sewer lines with video along Mill and Jones Creek.	$63,000
2003A-808	Resource Institute, Inc.- Plan./ Hitchcock Creek	Conduct a watershed assessment in the Hitchcock Creek watershed to determine stream restoration needs. Includes inventory of 91 miles of stream, erosion indexing, site selection and prioritization, landowner outreach, and mapping.	$215,000
2005B-807	Morven, Town of - Plan/ WW/ Collection System Rehabilitation Strategy, Jones & Mill Creeks	Continue smoke testing and video inspections for infiltration and inflow problems and needs. CWMTF previously funded a project to inspect the first 2/3 of the system. This project will complete the study.	$40,000
2006A-029	NC Wildlife Resources Commission - Acq./ Chalk/ Howell Tracts, Cartledge Creek	Protect through fee simple purchase 610 acres along Cartledge Creek. CWMTF funds to purchase the 180 riparian acres. Aids protection of rare aquatic species. Tract to become part of the NC Game Lands Program.	$433,000
This list does not include:			
regional or statewide projects that were in multiple river basins, or projects that were funded and subsequently withdrawn.			

Section 319-Grant Program

The ***Section 319 Grant Program*** was established to provide funding for efforts to reduce nonpoint source (NPS) pollution, including that which occurs though stormwater runoff. The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Each fiscal year North Carolina is awarded nearly 5 million dollars to address nonpoint source pollution through its 319 Grant Program. Thirty percent of the funding supports ongoing state nonpoint source programs. The remaining seventy percent is made available through a competitive grants process. Any of the impaired streams listed above are candidates for 319 funding. Interested parties should contact the ***Basinwide Planning Program*** to discuss potential projects.

Table 6-3. 319 Project

Fiscal Year	Contract Number	Name	Description	Agency	Funding
1999	EW200024	Sandhills WQ Project	Agriculture, Innovative BMP	Env. Impact RC&D	$37,000

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stream degradation in the Pee Dee River Watershed. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

Financial incentives are provided through ***North Carolina's Agriculture Cost Share Program***. The ***Division of Soil and Water Conservation*** in the Department of Environment and Natural Resources administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 6-4 shows the number of projects implemented and in the Pee Dee River Hydrologic unit and the dollar amount invested. Table 6-5 shows the water quality benefits realized from that investment.

Table 6-4. ACSP Project Expenditures

	Erosion Reduction/ Nutrient Loss Reduction in Fields		Sediment/ Nutrient Delivery Reduction from Fields		Stream Protection from Animals			Proper Animal Waste Management		
12-digit HU	Total Implemented	Cost	Total Implemented	Cost	Total Implemented		Cost	Total Implemented		Cost
030402010100	230.8 ac.	$27,692						1 unit	2 tons	$20,205
030402010200	12.6 ac.	$2,835			13.2 units	1,466 LF	$21,778	2 units		$11,393
030402010300										
030402010400								3 units		$24,631
030402010600										
030402010700								1 unit		$15,601
Total		$30,527					$21,778			$71,830

Table 6-5. NC ASCP Water Quality Benefits

	Water Quality Benefits				
	Soil Saved (tons)	Nitrogen Saved (lbs)	Phosphorus Saved (lbs)	Waste-N Managed (lbs)	Waste-P Managed (lbs)
030402010100	531	2,034	319	153,327	142,054
030402010200	21	1,712		64,405	60,750
030402010300					
030402010400				4,653	8,521
030402010600				66,880	72,320
030402010700				9,504	15,840
Total	552	3,746	319	298,769	299,485

References

U.S. Environmental Protection Agency (USEPA) 1999. Protocol for Developing Sediment TMDLs. First Edition. EPA 841-B-99-044. U.S. EPA, Office of Water, Washington D.C.

Waters, T.F. 1995. Sediment in streams—Sources, biological effects, and control. American Fisheries Society Monograph 7. American Fisheries Society, Bethesda, MD.

Appendix A

Use Support Ratings for All Monitored Waterbodies in Pee Dee River Subbasin

HUC-03040201

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	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category (USC).
1t	Supporting the assessed use no criteria exceeded (NCE) for a parameter of interest (POI) in a Use Support Category and there is an approved TMDL for the POI.
2	Supporting or not Impaired for all monitored uses
3a	Instream/monitoring data are inconclusive (DI)
3c	No Data available for assessment
3t	No Data available for assessment –AU is in a watershed with an approved TMDL
4a	Impaired for the assessed USC/POI; There is a standards violation (SV) and an approved TMDL for the POI.
4b	Impaired for the assessed USC/POI; Other program expected to address POI
4c	Impaired for the assessed USC/POI loss of use (LOU) and POI is a non pollutant
4cr	Impaired for LOU Recreation use and there is no data for TMDL (swimming advisories posted)
4ct	Impaired for the assessed USC/POI and the AU is in a watershed that is part of TMDL study area for the POI.
4s	Impaired Biological integrity with an identified Aquatic Life Standards Violation listed in Category 5
5	Impaired for the assessed USC/POI in need of TMDL for POI
5s	Impaired Biological integrity and stressor study does not indicate aquatic life standard violations.

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-42-1-3	**Bailey Creek**		**Habitat Degradation** Natural Conditions **Nutrient Impacts** General Agriculture/Pasture Impervious Surface	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to North Fork Jones Creek										
C	03-07-17	2.0 FW Miles								
13-39-8-7	**Beaver Dam Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Rocky Fork Creek										
WS-III	03-07-16	5.2 FW Miles		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2001		1
13-39-5	**Bones Fork Creek (Lake Bagget)**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
From source to Hitchcock Creek										
WS-III	03-07-16	12.2 FW Acres								
13-35	**Cartledge Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Pee Dee River										
C	03-07-16	10.2 FW Miles								
13-39-6	**Chock Creek (Gibson Pond)**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Hitchcock Creek										
WS-III	03-07-16	4.7 FW Miles								
13-47-2	**Deadfall Creek**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to N.C.-S.C. State Line										
C	03-07-17	8.5 FW Miles								
13-39-12-(7.5)	**Falling Creek**			Aquatic Life	Not Rated	Data Inconclusive	Aquatic Weeds	1998	1998	5
From a point 1.4 miles downstream of Richmond County SR 1640 to Rockingham Water Supply Intake										
WS-III;CA	03-07-16	0.6 FW Miles								
13-39-(1)	**Hitchcock Creek (McKinney Lake, Ledbetter Lake)**		**Mercury** Impoundment	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to a point 0.5 mile downstream of Richmond County SR 1442				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-III	03-07-16	10.0 FW Miles		Fish Consumption	Impaired	Standard Violation	Mercury	1998	1998	5

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-39-(10)	**Hitchcock Creek (Midway Pond, Steeles Mill Pond)**		**Low pH**	Aquatic Life	Not Rated	Potential Standards Violation	Low pH	2006		3a
From dam at Roberdel Lake to Pee Dee River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-16	11.3 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-39-(8.5)	**Hitchcock Creek (Roberdel Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
From a point 0.5 mile downstream of Richmond County SR 1442 to dam at Roberdel Lake (City of Rockingham water supply intake)										
WS-III;CA	03-07-16	0.8 FW Miles								
13-42	**Jones Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to Pee Dee River				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-17	12.5 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-45-(2)a	**Marks Creek (Boyds Lake, City Lake, Everetts Lake)**		**Low Dissolved Oxygen** Natural Conditions WWTP NPDES **Low pH**	Aquatic Life	Not Rated	Potential Standards Violation	Low pH	2006		3a
From dam of lower Water Lake to NC 177				Aquatic Life	Not Rated	Potential Standards Violation	Low Dissolved Oxygen	2006		3a
C	03-07-16	5.4 FW Miles		Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
13-45-(2)b	**Marks Creek (Boyds Lake, City Lake, Everetts Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From NC 177 to N.C.-S.C. State Line				Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	1991	1998	5
C	03-07-16	13.3 FW Miles								
13-45-(1)	**Marks Creek (Water Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
From a point 1.3 miles upstream of dam of lower Water Lake to dam of lower Water Lake (Town of Hamlet water supply intake)										
WS-II;HQW,CA	03-07-16	0.6 FW Miles								
13-43	**Mill Creek**			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Pee Dee River										
C	03-07-16	11.5 FW Miles								
13-42-1-(0.5)	**North Fork Jones Creek**		**Habitat Degradation** Impoundment Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From Wadesboro Water Supply Intake to Jones Creek				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
C	03-07-17	7.4 FW Miles								

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
13-42-1-(0.3)	**North Fork Jones Creek (City Pond)**			Aquatic Life	Not Rated	Data Inconclusive	Chlorophyll a	2006		3a
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
From a point 1.0 mile downstream of Anson County SR 1122 to Wadesboro Water Supply Intake										
WS-II;HQW,CA	03-07-17	0.6 FW Miles								
13-(34)b	**PEE DEE RIVER**			Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From mouth of Hitchcock Creek to N.C.-S.C. State Line				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
C	03-07-16	9.4 FW Miles								
13-39-8	**Rocky Fork Creek (Mill stone Lake)**			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity FishCom	2006		3a
From source to Ledbetter Lake, Hitchcock Creek										
WS-III	03-07-16	9.5 FW Miles								
13-42-2	**South Fork Jones Creek**		**Habitat Degradation** General Agriculture/Pasture Natural Conditions	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2006		1
From source to Jones Creek										
C	03-07-17	15.0 FW Miles								

Appendix C

Biological Data Sample Sites

Summary

YADKIN RIVER HUC 03040201 – PEE DEE RIVER

Description

HUC 03040201 is Yadkin subbasins 16 and 17 and includes Pee Dee River and its tributaries below Blewett Falls Lake (Figure 7). Much of Anson and Richmond Counties are included in the HUC. Rockingham, Hamlet, and a portion of Wadesboro are the largest urban areas. Most of the land cover is forest. Major active NPDES dischargers are given in Table 6.

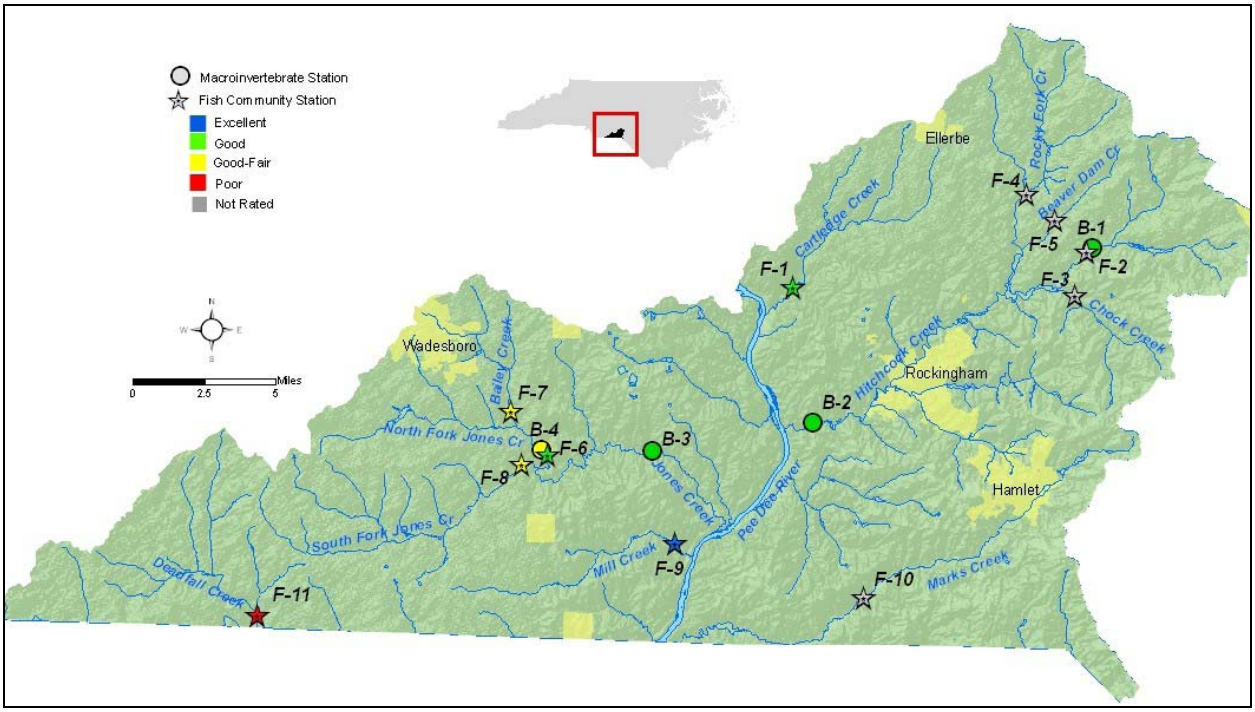


Figure 7. Sampling sites in HUC 03040201 in the Yadkin River basin. Monitoring sites are listed in Table 7.

Table 6. Major NPDES permitted dischargers in HUC 03040201.

Permit	Facility	County	Receiving Waterbody	Permitted Flow (MGD)
NC0043320	Burlington Industries LLC, Richmond Plant	Richmond	Hitchcock Creek	1.2
NC0047562	Hamlet WWTP	Richmond	Marks Creek	1.0
NC0041408	Anson County Regional WWTP	Anson	Pee Dee River	3.5
NC0020427	Rockingham WWTP	Richmond	Pee Dee River	9.0

The HUC straddles the divide between the piedmont and coastal plain and contains portions of three ecoregions as defined by Griffith *et al.* (2002). Far western portions of the HUC fall within a Triassic Basin, which consists of “unmetamorphosed shales, sandstones, mudstones, siltstones, and conglomerates.” Streams with low base flow result from clay soils with little permeability. Stream substrates are generally composed of sands and clays. The remainder of much of the western half of the HUC is in the Carolina Slate Belt. Metavolcanic and metasedimentary rocks make up the slates present in the ecoregion. Boulders and cobbles compose much of the stream substrate. Most of the eastern half of the HUC is in the Sand Hills, “a rolling to hilly region composed primarily of Cretaceous-age marine sands and clays.” Permeable sandy soils allow for a large capacity for infiltration; therefore, streams in the ecoregion rarely dry or flood. Sands make up much of the substrate for streams in the region.

Following an inventory of natural areas in Richmond County by the North Carolina Natural Heritage Program, several stream corridors, watersheds, and ecosystems that fall within the HUC were recognized as significant (Sorrie 2001).

- The upper portions of Rocky Fork, Beaverdam, and Hitchcock Creeks drain the western section of the Sand Hills Game Land (SGL) in Richmond County. SGL is composed of large areas mostly in Richmond and Scotland Counties. SGL contains an ecosystem that is nearly intact, supports a high diversity of flora and fauna, and provides a population pool for longleaf pine.
- The lower 1.5 miles of Hitchcock Creek falls within the Pee Dee River Megasite, and is significant for flowing from the coastal plain to the piedmont (only one of four North Carolina streams to do this), cutting a relatively deep valley before its confluence with Pee Dee River. A floodplain forest is also found on this lower section of Hitchcock Creek.
- Marks Creek shares the unusual characteristic with Hitchcock Creek of flowing from the coastal plain to the piedmont. The lower portion has few road crossings, affording some protection to the beech-dominant hardwood forest in the stream corridor. The coastal plain section of Marks Creek includes a large area of swamp forest dominated by black gum.
- Whites Creek Headwaters includes a large contiguous longleaf pine forest. Waters from the drainage area flow into South Carolina and eventually into Pee Dee River.

Overview of Water Quality

The following stream segments within HUC 03040201 are on the 303(d) impaired waters list for 2004: Pee Dee River from Blewett Falls Dam to the mouth of Hitchcock Creek (low dissolved oxygen; fish advisory for mercury); Hitchcock Creek from source to a point 0.5 mile downstream of SR 1442/Richmond County (fish advisory for mercury); Falling Creek from a point 1.4 miles downstream of SR 1640/Richmond County to the water supply intake for Rockingham (aquatic weeds); and Marks Creek from NC 177 to the state border (impaired biological integrity).

Thirteen basinwide collections were made in 2006 (Table 7). Nine sites were sampled for fish only, two for macroinvertebrates only, and two were sampled for both macroinvertebrates and fish. Fish sites in the Sand Hills ecoregion are not rated because of naturally low flows. Otherwise for fish sites there was one rating of Excellent, two Good, two Good-Fair, and one Poor. For benthic sites three rated as Good, one as Good-Fair. Fish and macroinvertebrate sites sampled in 2006 are given in Table 6.

Table 7. Waterbodies monitored in HUC 03040201 in the Yadkin River basin for basinwide assessment, 2001 and 2006.

Map #[1]	Waterbody	County	Location	2001	2006
B-1	Hitchcock Creek	Richmond	SR 1486	Good	Good
B-2	Hitchcock Creek	Richmond	SR 1109	Good-Fair	Good
B-3	Jones Creek	Anson	NC 145	Good-Fair	Good
B-4	N Fork Jones Creek	Anson	SR 1121	Good-Fair	Good-Fair
F-1	Carteledge Cr	Richmond	SR 1142	Good	Good
F-2	Hitchcock Cr	Richmond	SR 1486	Not Rated	Not Rated
F-3	Chock Cr	Richmond	SR 1475	---	Not Rated
F-4	Rocky Fork Cr	Richmond	SR 1424	Not Rated	Not Rated
F-5	Beaver Dam Cr	Richmond	SR 1486	Not Rated (1996)	Not Rated
F-6	N Fk Jones Cr	Anson	SR 1121	---	Good
F-7	Bailey Cr	Anson	SR 1811	Good	Good-Fair
F-8	S Fk Jones Cr	Anson	SR 1821	Excellent	Good-Fair
F-9	Mill Cr	Anson	SR 1826	---	Excellent
F-10	Marks Cr	Richmond	SR 1104	Not Rated	Not Rated
F-11	Deadfall Cr	Anson	SR 1109	---	Poor

[1]B = benthic macroinvertebrate monitoring sites; F = fish community monitoring sites.

The watershed above the fish site on Carteledge Creek at SR 1142/Richmond County drains a portion of Ellerbe at its headwaters. There was little change in the fish community at the site between 2001 and 2006.

The upper portion of the Hitchcock watershed was sampled at four sites for fish in 2006; one of those four sites was also sampled for macroinvertebrates. None of the fish sites received ratings. Three of the fish sites had been collected prior to 2006. The fish site on Rocky Ford Creek at SR 1424/Richmond County experienced a loss in the number of fish species collected between 2001 and 2006, from 14 to 11. Beaverdam Creek at SR 1486/Richmond County saw an increase of species collected, from 6 in 1996 to 8 in 2006. Hitchcock Creek at SR 1486/Richmond County also experienced an increase in number of fish species collected, from 12 in 2001 to 15 in 2006. The benthic data for three sampling events (1996, 2001, and 2006) at Hitchcock Creek at SR 1486/Richmond County indicate stable water quality; the site has maintained a rating of Good for each year sampled. Overall, biological data from the upper Hitchcock watershed indicate constant to slightly improving water quality.

In contrast to the upper portion of the watershed, the macroinvertebrate site on Hitchcock Creek at SR 1109/Richmond County in the lower portion of the watershed has shown a marked improvement over three sampling events in 1996, 2001, and 2006. The site is about 1.5 stream miles above the confluence with Pee Dee River. Improving water quality at the site coincides with the loss of discharge to the stream from Laurel Hill Paper Company beginning in February 1998. Bioclassifications for the site have improved from Poor in 1996, to Good-Fair in 2001, and to Good in 2006.

The watershed above the fish site on Bailey Creek at SR 1811/Anson County includes western portions of Wadesboro. Between sampling events at the site in 1996 and 2001 there was very little change in the number of species collected and in NCIBI values; the site was rated Good for both of those years. A marked drop in the number of species collected and in the NCIBI value resulted in a bioclassification of Good-Fair for 2006. Low flow in 2006 may be influencing the results for the latest collection.

Downstream of the Bailey Creek site there is a shared fish/benthic site on North Fork Jones Creek at SR 1121/Anson County. Fish were collected for the first time from the site in 2006; the resulting fish bioclassification is Good. The site has been collected for benthos using Full-Scale methods in 2001 and 2006. The benthic community in both years was very similar, an indication of stable water quality at the site for those two sampling events. The site rated as Good-Fair in both years.

South Fork Jones Creek drains an area adjacent to and southeast of North Fork Jones Creek. The fish site on South Fork Jones Creek at SR 1821/Anson County is within one stream-mile of the confluence with North Fork Jones Creek. There is a marked difference between the fish collections made in 2001 and 2006. Three fewer species collected and a 10-point drop in the NCIBI value resulted in a drop of two classifications between 2001 and 2006, from Excellent to Good-Fair. As with Bailey Creek, the decline in the fish community at South Fork Jones Creek may be due to low-flow conditions sometime during the year as indicated by the loss of several species of sunfish, which inhabit pools.

At the confluence of the North and South Forks, Jones Creek begins. Slightly downstream of the midpoint of the length of the stream is the benthic site at NC 145. A greater number of EPT taxa collected in 2006 compared to 1996 and 2001 may be reflecting better water quality at the site in 2006 over the prior two sampling events. The sited rated as Good in 2006; it has rated as Good-Fair for all other sampling events back to 1987.

Generally for the Jones Creek watershed stable water quality conditions are indicated. Low flows are implicated for reduced fish results on Bailey Creek and South Fork Jones Creek. Slightly better water quality than for previous sampling events may be indicated for the site furthest downstream.

A new fish site was established on Mill Creek at SR 1826/Anson County, and rated as Excellent for 2006. The site was the most species-rich for all fish sites sampled in 2006, and is a new regional fish reference site.

Marks Creek at SR 1104/Richmond County has been sampled for fish in 2001 and 2006. Along with other Sand Hills fish sites, the site was not rated. There was a gain in the number of species collected, from 13 in 2001 to 21 in 2006. High abundance and diversity may be due to enrichment from Hamlet WWTP. Specific conductance at the site is elevated for a Sand Hills stream.

Deadfall Creek at SR 1109/Anson County was sampled for fish for the first time in 2006. The site received a rating of Poor. A lack of diverse habitat and low flow at the site are implicated for low numbers of individuals and species collected.

River and Stream Assessment

Beaver Dam Creek at SR 1486/Richmond County is a basinwide benthic site last sampled in 2001 that was not sampled for invertebrates in 2006. The following basinwide benthic sites have not been sampled since 1996: Carteledge Creek at SR1142/Richmond County; Marks Creek at SR 1812/Richmond County; South Fork Jones Creek at SR 1821/Anson County. Sampling at all benthic basinwide sites should continue during the next cycle for the basin if conditions permit. It was suggested in the prior BAU basinwide report that the benthic site on Marks Creek be investigated as a possible swamp site.

Specific site summaries of the four benthic macroinvertebrate and 11 fish community samples may be found at this link: **03040201**.

SPECIAL STUDIES

No special studies were conducted in this HUC during this basin cycle.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Carteledge Cr	**SR 1142**	**04/10/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	345914	795043	13-35	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	30.2	--	5	0.3	Yes

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

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

Water Quality Parameters

Temperature (°C)	11.8
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	67
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
Riffle Habitat (16)	11
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**78**

Site Photograph

Substrate Gravel, sand, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-06	21	52	Good
04/06/01	2001-05	17	50	Good

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle

Losses -- Highback Chub, Spotted Sucker, and Green Sunfish. **Gains** -- Rosyside Dace, Coastal Shiner, Sandbar Shiner, Redfin Pickerel, Eastern Mosquitofish, Warmouth, and Piedmont Darter.

Data Analysis

Watershed -- drains rural western Richmond County; headwaters in the Town of Ellerbee; tributary to the Pee Dee River. **Habitat** -- coarse woody debris; riffles; snags; good riparian zones; low flow. **2006** -- increase in numbers and species; diverse, but no suckers; 11 of 21 species with only 1 or 2 fish per species (similar to 2001). **2001 and 2006** -- 24 species known from the site; dominant species are Bluehead Chub and Redlip shiner; slight increase in NCIBI score, but no change in NCIBI rating.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Hitchcock Creek	**SR 1486**	**08/21/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	16	03040201	13-39-(1)	350028	793939

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Sand Hills	WS-III	15.7	6	0.3

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

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

Water Quality Parameters

Temperature (°C)	26.1
Dissolved Oxygen (mg/L)	5.5
Specific Conductance (µS/cm)	17
pH (s.u.)	5
Water Clarity	clear/tannic

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	16
Bottom Substrate (15)	9
Pool Variety (10)	5
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	72

Site Photograph

Substrate sand, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10023	---	24	---	3.5	Good
08/14/01	8585	---	23	---	3.2	Good
08/19/96	7184	---	21	---	3.3	Good

Taxonomic Analysis

The EPT community at this location has been stable since sampling commenced in 1996 and is typical of a mostly forested catchment. Only three previously uncollected taxa (at this location) were observed in 2006 and included the mayfly *Plauditus punctiventris* , the intolerant, and long-lived stonelfy *Acroneuria abnormis* , and the caddisfly *Oecetis nocturna* . Of note, four stonefly taxa (*A. abnormis* , *A. carolinensis* , *A. lycorias* , and *Leuctra*) were all collected in 2006 while each previous sample resulted in only two stonefly taxa.

Data Analysis

The 2006 sample continues to demonstrate the gradual increase in EPT taxa richness observed at this location since 1996. Although the EPTBI increased very slightly over prior samples, the doubling of total stonefly taxa richness in 2006 (relative to the two previous samples) may indicate slightly improved physical conditions along this reach of Hitchcock Creek in 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Hitchcock Cr	**SR 1486**	**04/24/06**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350028	793939	13-39-(1)	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	15.7	--	6	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	20.8
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	18
pH (s.u.)	5.2

Water Clarity	Black water

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**96**

Site Photograph

Substrate Sand, silt, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-21	15	--	Not Rated
04/05/01	2001-01	12	--	Not Rated

Most Abundant Species Yellow Perch

Exotic Species Yellow Perch

Species Change Since Last Cycle

Losses -- Bluespotted Sunfish and Sawcheek Darter. **Gains** -- Margined Madtom, Pirate Perch, Lined Topminnow, Black Crappie, and Largemouth Bass.

Data Analysis

Watershed -- drains east-central Richmond County, including the Sand Hills Gamelands; site is ~ 2 mi. downstream from McKinney Lake and ~ 2 mi. upstream of Ledbetter Lake. **Habitat** -- very high quality habitats (2nd greatest habitat score of any fish site in 2006); a typical Sand Hills type stream; runs; single riffle at beginning of reach; good riparian; *Valisneria* **2006** -- lowest specific conductance and pH of any fish site in 2006; Yellow Perch and Black Crappie possible migrants from Ledbetter Lake. **2001 and 2006** -- typical Sand Hills fauna including Spotted Sucker, Chain Pickerel, and Dollar Sunfish; 17 species known from the site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Hitchcock Creek	**SR 1109**	**08/21/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Richmond	16	03040201	13-39-(10)	345508	794956

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Sand Hills	C	140	11	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	20	0	0

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Burlington Industries LLC, RIchmond Plant	NC0043320	1.2

Water Quality Parameters

Temperature (°C)	26.6
Dissolved Oxygen (mg/L)	10
Specific Conductance (µS/cm)	57
pH (s.u.)	6.6
Water Clarity	tannic

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	8
Pool Variety (10)	5
Riffle Habitat (16)	9
Left Bank Stability (7)	6
Right Bank Stability (7)	5
Light Penetration (10)	8
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	70

Site Photograph

Substrate sand, gravel, silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10077	79	32	5.6	4.5	Good
08/15/01	8587	72	21	6.0	4.6	Good-Fair
08/20/96	7188	40	5	7.8	6.4	Poor

Taxonomic Analysis

This site has improved drastically since sampling commenced in 1996. The 2006 sample garnered the most EPT taxa ever collected here as well as the most total taxa. Previously uncollected (at this location) EPT taxa included the intolerant mayflies *Heptagenia pulla* , *Paraleptophlebia* , the stoneflies *Acroneuria abnormis* , *Eccoptura xanthenes* , *Neoperla* , *Paragnetina fumosa* , and a caddisfly rarely collected in North Carolina, *Protoptila* . Moreover, the 2006 collection was the first time any stonefly taxa (several of which are long-lived as nymphs) have been observed here. In addition, a low dissolved oxygen indicator, *Physella* (a gastropod), declined from abundant in 1996 to rare in 2006. Last, the number of pollution tolerant oligocheates declined from six taxa in 1996 to only three taxa in 2006. These data clearly demonstrate improving conditions along this segment of Hitchcock Creek.

Data Analysis

Every benthic macroinvertebrate metric has improved steadily since the first sample in 1996. Not only have all taxa richness metrics increased and all biotic index measures decreased, but the EPTN has increased from 25 in 1996, to 70 in 2001, to 136 in 2006. These improved metrics correspond well with the conductivity data as this parameter was 305 (µS/cm) in 1996, decreased to 74 (µS/cm) in 2001, and has decreased again to 57 (µS/cm) in 2006. The Laurel Hill Paper Company discharged upstream of this location up until February 1998. The stream continues to recover as a result of the removal of this facility.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Chock Cr	**SR 1475**	**04/25/06**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	345903	794016	13-39-6	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	13.8	--	6	0.3	No

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

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

Water Quality Parameters

Temperature (°C)	19.4
Dissolved Oxygen (mg/L)	8.2
Specific Conductance (µS/cm)	30
pH (s.u.)	5.9

Water Clarity	Black water

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	6
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**89**

Site Photograph

Substrate Soft sand, muck, and detritus; coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-24	13	---	Not Rated

Most Abundant Species Dollar Sunfish and Dusky Shiner

Exotic Species Yellow Perch

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains eastern Richmond County, northwest of US 1 and NC 177; a tributary to Ledbetter Lake, site is ~ 0.5 mi. above lake. **Habitat** -- high quality habitats; a typical Sand Hills stream; runs; coarse woody debris riffles; *Valisneria.* **2006** - typical Sand Hills fauna including Dusky Shiner, Spotted Sucker, Dollar Sunfish, and Mud Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Rocky Fork Cr	**SR 1424**	**04/24/06**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350207	794204	13-39-8	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	29.7	--	6	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	80	0	0	20 -- residential

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

Water Quality Parameters

Temperature (°C)	18.2
Dissolved Oxygen (mg/L)	8.3
Specific Conductance (µS/cm)	23
pH (s.u.)	6.2

Water Clarity	Stained, slightly turbid

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	13
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**95**

Site Photograph

Substrate Sand, silt, detritus, cobble, boulder, bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-20	11	--	Not Rated
04/05/01	2001-02	14	--	Not Rated

Most Abundant Species Redbreast Sunfish

Exotic Species None

Species Change Since Last Cycle

Losses -- Bluehead Chub, Creek Chubsucker, Snail Bullhead, Chain Pickerel, Warmouth, Largemouth Bass, and Yellow Perch. **Gains** -- Yellow Bullhead, Flat Bullhead, Mud Sunfish, and Dollar Sunfish.

Data Analysis

Watershed -- drains northeast Richmond County, including the Sand Hills Gamelands; tributary to Ledbetter Lake. **Habitat** -- very high quality habitats (2nd greatest habitat score of any fish site in 2006); a typical Sand Hills type stream; runs, boulder outcrops near old mill site; *Valisneria;* good riparian zones; coarse woody debris. **2006** -- low abundance of most species (only 1 or 2 fish per species), but a typical Sand Hills fauna present including Dusky Shiner, Spotted Sucker, Dollar Sunfish, and Mud Sunfish. **2001 and 2006** -- 18 species known from the site.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Beaverdam Cr	**SR 1486**	**04/24/06**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	350120	794100	13-39-8-7	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
WS-III	4.5	0	3	0.2	Yes

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

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

Water Quality Parameters

Temperature (°C)	19.2
Dissolved Oxygen (mg/L)	8.5
Specific Conductance (µS/cm)	19
pH (s.u.)	5.6

Water Clarity	Blackwater

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	7
Pool Variety (10)	8
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**87**

Site Photograph

Substrate Sand, organic detritus

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/24/06	2006-22	8	--	Not Rated
04/15/96	96-13	6	--	Not Rated

Most Abundant Species Sandhills Chub

Exotic Species None

Species Change Since Last Cycle

Losses -- Bluehead Chub, Creek Chubsucker, and Redbreast Sunfish. **Gains** -- Sandhills Chub, Yellow Bullhead, Margined Madtom, Bluegill, and Largemouth Bass.

Data Analysis

Watershed -- small watershed draining northeast Richmond County, including the Sand Hills Gamelands; tributary to Ledbetter Lake. **Habitat** -- a typical Sand Hills stream; narrow; very organic substrate; *Panicum* and bay forested riparian zones; logged on upper zones and lower right riparian zones, but ~ 200 ft. buffer remains. **2006** -- very low specific conductance; 2nd lowest of any fish site in 2006; very few fish collected, but the stream is small; Sandhills Chub, a species of Special Concern, collected. **1996 and 2006** -- Typical Sand Hills fauna including Sandhills Chub, Redfin Pickerel, Pirate Perch, and Dollar Sunfish; 11 species known from the small site.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
Jones Creek	**NC 145**	**08/21/06**	**Good**

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Anson	17	03040201	13-42	345415	795551

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	93.9	16	0.3

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

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

Water Quality Parameters

Temperature (°C)	25.3
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	79
pH (s.u.)	6.6
Water Clarity	slightly turbid

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	14
Bottom Substrate (15)	11
Pool Variety (10)	4
Riffle Habitat (16)	7
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	71

Site Photograph

Substrate sand, gravel, bedrock, boulder, rubble

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10079	66	27	5.7	5.2	Good
08/14/01	8583	74	18	5.9	4.4	Good-Fair
08/20/96	7189	63	17	5.8	4.8	Good-Fair
07/23/90	5388	73	16	5.9	5.0	Good-Fair
07/07/87	4131	70	24	5.9	4.6	Good-Fair

Taxonomic Analysis

The 2006 sample produced the most EPT taxa ever observed at this site and included the following new (for this location) mayflies (*Acentrella alachua* , *Heterocloeon curiosum* , *Procloeon*), stoneflies (*Eccoptura xanthenes*), and caddsiflies (*Nectopsyche pavida* , *Oecetis nocturna* , and *Triaenodes perna)* . In addition, an indicator of organic enrichment and low dissolved oxygen, *Polypedilum illinoense* (a chironomid), was absent from the 2006 collection but was present (common to abundant) in all previous samples. Moreover, there were no oligocheate taxa observed in the 2006 sample whereas all previous samples had at least one oligocheate taxon present. These data suggest slightly improving conditions in the Jones Creek catchment.

Data Analysis

Although EPT taxa richness and EPT abundance were the highest ever observed at this site in 2006, the total taxa richness was less than in all previous samples other than the 1996 collection. Most of this reduction was caused by a substantial decrease in chironomid taxa with only seven taxa present in 2006 whereas 13, 18, 16, and 21 chironomid taxa were collected in 1987, 1990, 1996, and 2001 respectively. The increased number of EPT taxa and decreased chironomid (and oligocheate) taxa accounted for the slight reduction of the BI observed in 2006. These data loosely correlate with a reduction in the conductivity measured at this site since 1996 (93 µS/cm) and 2001 (110µS/cm). These data suggest slightly improved physical conditions in Jones Creek relative to previous samples.

Benthic Macroinvertebrate Sample

Waterbody	Location	Date	Bioclassification
North Fork Jones Creek	SR 1121	08/21/06	Good-Fair

County	Subbasin	8 digit HUC	Index Number	Latitude	Longitude
Anson	17	03040201	13-42-1-(0.5)	345414	795957

Level IV Ecoregion	Stream Classification	Drainage Area (mi2)	Stream Width (m)	Stream Depth (m)
Carolina Slate Belt	C	35.4	5	0.2

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

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

Water Quality Parameters

Temperature (°C)	25.3
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	102
pH (s.u.)	6.2
Water Clarity	clear/tannic

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	12
Bottom Substrate (15)	4
Pool Variety (10)	3
Riffle Habitat (16)	3
Left Bank Stability (7)	6
Right Bank Stability (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	58

Site Photograph

Substrate sand, silt, trace of gravel

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
08/21/06	10078	64	14	6.2	5.3	Good-Fair
08/13/01	8582	63	16	6.1	5.4	Good-Fair
08/20/96	7190	---	11	---	5.1	Fair

Taxonomic Analysis

The 2006 Full-Scale sample produced a nearly identical benthic community to that measured during the last Full-Scale collection in 2001. The only previously uncollected EPT taxa (for this location) included the mayflies *Procloeon*, *Plauditus cestus*, and the tolerant caddisfly *Hydropsyche betteni*. Moreover, nearly all of the remaining non-EPT taxa remained unchanged from the 2001 collection.

Data Analysis

As was noted in the 2001 basinwide assessment document, the 1996 sample was conducted under higher flow conditions. Conversely, the 2001 and 2006 samples were collected under definite low flow conditions. As is the case in a catchment that is dominated by non-point pollution inputs, lower flows tend to improve the benthic community and that is the probable explanation (given the lack of NPDES dischargers upstream) for the differences observed between 1996 and 2001. This phenomenon also accounts for the near-identical metrics between the low flow years of 2001 and 2006.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
N Fk Jones Cr	**SR 1121**	**04/11/06**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345415	795957	13-42-1-0.5	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	35.4	---	9	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	---	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	11.6
Dissolved Oxygen (mg/L)	7.8
Specific Conductance (µS/cm)	86
pH (s.u.)	6.9

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	7
Riffle Habitat (16)	3
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**63**

Site Photograph

Substrate sand, gravel, a little cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-09	23	50	Good

Most Abundant Species Bluehead Chub

Exotic Species Redear Sunfish

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains the south side of Wadesboro and is downstream of Bailey Creek watershed (eastern Wadesboro) in south east Anson County. **Habitats** -- sandy runs, snags, small stick riffles, some bedrock outcrops, some small cobble riffles. **2006** -- new fish community monitoring site; high diversity; balanced trophic structure (61% Insectivores including 16% Redlip Shiner, 13% Redbreast Sunfish, and 13% Whitemouth Shiner); water quality approaching the highest bioclassification.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Bailey Cr	**SR 1811**	**04/10/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345522	800107	13-42-1-3	Carolina Slate Belt/Triassic Uplands

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	13	---	4	0.3	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.1
Dissolved Oxygen (mg/L)	10.3
Specific Conductance (µS/cm)	90
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	12
Bottom Substrate (15)	3
Pool Variety (10)	4
Riffle Habitat (16)	2
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	1
Right Riparian Score (5)	4
Total Habitat Score (100)	**52**

Site Photograph

Substrate sand, gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/10/06	2006-08	14	44	Good-Fair
04/06/01	2001-06	20	52	Good
04/15/96	96-14	19	52	Good

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle

Losses -- Pumpkinseed, Warmouth, Redear Sunfish, Spottail Shiner, Yellow Bullhead, Margined Madtom, Piedmont Darter. **Gains** -- Redfin Pickerel

Data Analysis

Watershed -- drains the eastern half of Wadesboro in southeast-central Anson County. Atypical substrate for a stream of the Carolina Slate Belt ecoregion. **Habitats** -- sandy runs, snags, undercuts, thin riparian, very silty, thick periphyton. **2006** -- Low flow; six fewer species than in 2001; no intolerants collected. **1996-2006** -- 24 fish species known from this watershed; a decline in the NCIBI score and rating since 2001, may be due to low flow in 2006; conductivity continues to show evidence of nutrient enrichment from urban runoff and agriculture.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
S Fk Jones Cr	**SR 1821**	**04/11/06**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	345346	800041	13-42-2	Carolina Slate Belt/Triassic Uplands

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	34.6	---	8	0.3	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	---	---	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	12.0
Dissolved Oxygen (mg/L)	10.0
Specific Conductance (µS/cm)	65
pH (s.u.)	6.2

Water Clarity	Clear, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	3
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	3
Right Bank Stability (7)	3
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**65**

Site Photograph

Substrate sand, some gravel

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-10	15	44	Good-Fair
04/10/01	2001-08	18	54	Excellent

Most Abundant Species Bluehead Chub, Redlip Shiner

Exotic Species None

Species Change Since Last Cycle

Losses -- Pumpkinseed, Warmouth, Bluegill, Largemouth Bass, Whitemouth Shiner, Sea Lamprey.
Gains -- Golden Shiner, Creek Chub, Redfin Pickerel.

Data Analysis

Watershed -- drains rural south central Anson County; atypical stream for this ecoregion, borders Triassic Uplands Ecoregion. **Habitats** -- sandy runs, snags, some bedrock outcrops; Privet was dense in the riparian zone. **2006** -- the two most abundant species each represented 38% of the sample; Redbreast Sunfish was the only sunfish species collected. **2001-2006** -- 21 species known from this site; 14% fewer total fish collected in 2006; loss of four sunfish species may be flow related; decline of 10 points in NCIBI; water quality rating has dropped by two bioclassifications.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Mill Cr	**SR 1826**	**04/11/06**	**Excellent**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	16	03040201	345123	795500	13-43	Carolina Slate Belt/Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	18.6	--	7	0.4	Yes

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

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

Water Quality Parameters

Temperature (°C)	14.4
Dissolved Oxygen (mg/L)	9.9
Specific Conductance (µS/cm)	58
pH (s.u.)	6.3

Water Clarity	Clear, tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	5
Instream Habitat (20)	16
Bottom Substrate (15)	6
Pool Variety (10)	9
Riffle Habitat (16)	7
Left Bank Stability (7)	6
Right Bank Stability (7)	6
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**74**

Site Photograph

Substrate Sand, coarse woody debris, cobble

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-11	26	56	Excellent

Most Abundant Species Bluehead Chub

Exotic Species None

Species Change Since Last Cycle N/A; new site in 2006.

Data Analysis

Watershed -- drains the southeastern corner of Anson County, including the small Town of Morven; rural; tributary to the Pee Dee River; borders the Carolina Slate Belt and Sand Hills. **Habitat** -- characteristics of Piedmont; Sand Hills, and Coastal Plain; Sand Hills habitat score = 91; riffles; runs, coarse woody debris; great riparian zones. New regional reference site. **2006** -- fauna a mixture of Piedmont, Coastal Plain, and Sand Hills species; most species-rich fish site in 2006, including 3 species of darters and 7 species of sunfish; unique species include Sea Lamprey, American Eel, Spotted Sunfish, and Mud Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Marks Cr	**SR 1104**	**04/25/06**	**Not Rated**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Richmond	16	03040201	344947	794759	13-45-(2)	Sand Hills

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	29.9	--	8	0.4	No

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

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
City of Hamlet's Hamlet WWTP	NC0047562	1

Water Quality Parameters

Temperature (°C)	18.9
Dissolved Oxygen (mg/L)	6.8
Specific Conductance (µS/cm)	49
pH (s.u.)	5.8

Water Clarity	Blackwater

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	18
Bottom Substrate (15)	7
Pool Variety (10)	10
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	**90**

Site Photograph

Substrate Sand, coarse woody debris

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/25/06	2006-23	21		Not Rated
04/06/01	2001-04	13		Not Rated

Most Abundant Species Dusky Shiner

Exotic Species None

Species Change Since Last Cycle

Losses -- Tadpole Madtom. **Gains** -- Golden Shiner, Creek Chubsucker, Spotted Sucker, Chain Pickerel, Mud Sunfish, Flier, Pumpkinseed, and Largemouth Bass.

Data Analysis

Watershed -- drains southwest Richmond County, including the cities of Hamlet and East Hamlet; tributary to Everetts Lake and the Pee Dee River. **WWTP** -- with frequent violations over the period 2001 to 2004 for biochemical oxygen demand; proceeded to enforcement (BIMS query 12/14/2006); specific conductance low, but elevated for a Sand Hills stream (43 and 49 µS/cm in 2001 and 2006, respectively). **Habitat** -- high quality habitats; Coastal Plain like; pools; snags; runs; good bottomland riparian zones. **2006** -- most species of sunfish (n = 9) of any fish site in 2006; high abundance (n = 238) and diversity (n = 21) for a Sand Hills stream (some enrichment from WWTP?). **2001 and 2006** -- high diversity, 22 species known from the site; fauna includes American Eel, Dusky Shiner, Spotted Sucker, Mud Sunfish, Flier, Bluespotted Sunfish, and Dollar Sunfish.

FISH COMMUNITY SAMPLE

Waterbody	Location	Date	Bioclassification
Deadfall Cr	**SR 1109**	**04/11/06**	**Poor**

County	Subbasin	8 digit HUC	Latitude	Longitude	Index Number	Level IV Ecoregion
Anson	17	03040201	344850	801026	13-47-2	Carolina Slate Belt

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Average Depth (m)	Reference Site
C	31.5	---	8	0.5	No

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	75	---	25	---

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
---	---	---

Water Quality Parameters

Temperature (°C)	16.4
Dissolved Oxygen (mg/L)	11.6
Specific Conductance (µS/cm)	135
pH (s.u.)	6.1

Water Clarity	Clear

Habitat Assessment Scores (max)

Channel Modification (5)	4
Instream Habitat (20)	15
Bottom Substrate (15)	12
Pool Variety (10)	9
Riffle Habitat (16)	0
Left Bank Stability (7)	5
Right Bank Stability (7)	5
Light Penetration (10)	7
Left Riparian Score (5)	5
Right Riparian Score (5)	2
Total Habitat Score (100)	**64**

Site Photograph

Substrate boulder, gravel, some bedrock

Sample Date	Sample ID	Species Total	NCIBI	Bioclassification
04/11/06	2006-12	10	30	Poor

Most Abundant Species Redbreast Sunfish

Exotic Species Redear Sunfish

Species Change Since Last Cycle N/A, new site in 2006

Data Analysis

Watershed -- drains part of south central Anson County to South Carolina; a tributary to Thompson Creek (SC). **Habitats** -- entrenched; one long straight pool of mostly uniform depths with no riffles; abundant algae; very low flow. **2006** -- new fish community monitoring site; very few fish collected (total = 52); no cyprinids collected; high percentage of Insectivores (87% of total, including 7 of 10 species); low fish species abundances due to very low flow and uniform depths; low flow effected stream.

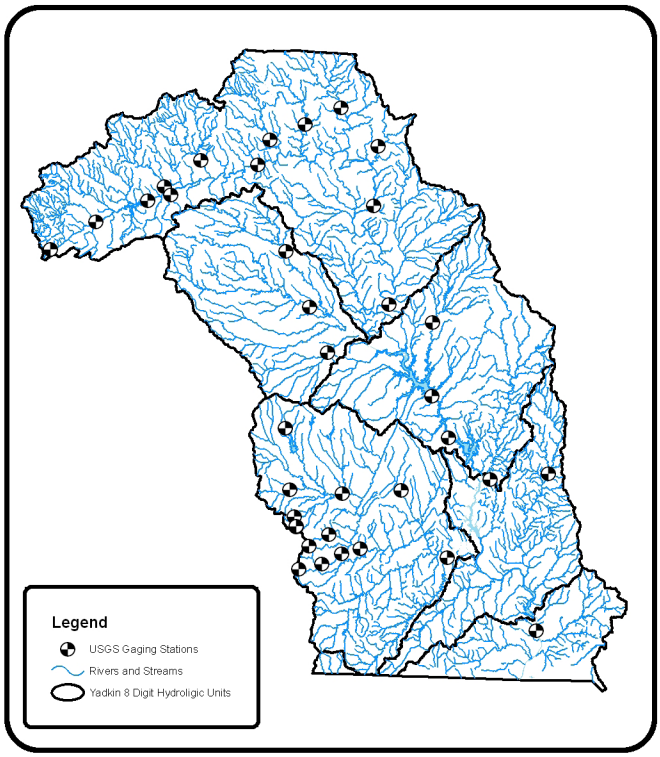
Managing Water Quality & Quantity

Quantity Management in the Yadkin Pee Dee River Basin

Understanding Stream Flow

Stream flow is monitored by U.S. Geological Survey gaging stations (Figure 1) and the 7-day 10-year low flow (7Q10) statistic is calculated to determine minimum flow requirements appropriate for water use activities. Examples of these activities include point source discharger effluent assimilation, water withdrawals, protection of aquatic life, navigation, wetland maintenance, recreation, hydropower and TMDL development. Flows less than the 7Q10 may be the result of drought, but also can be caused by water withdrawals or impoundments. When stream flow falls below the 7Q10, water quality violations may occur. Flow requirements are often thought of as minimum flows or releases, but they can also include maximum flow limits for peaking hydropower dams, seasonal releases for fish spawning, or weekend releases for recreation. Flow often abbreviated as "Q" is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). For more information about instream flow see DWR website: ***http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html***

Figure 1. USGS Gaging Station Locations



Water Quality Issues Related to Drought

The recent drought in North Carolina has highlighted natural resource management and the importance of the relationship between water quantity and quality. Droughts and floods are natural processes and their impacts are often amplified by land use activities. Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because high flows may carry increased loadings of substances (e.g., metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients). These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures, algae growth increases due to longer periods of sunlight, and stream flows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When stream flows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As stream flows decrease, less habitat is available for aquatic insects and fish, particularly around lake shorelines. Less water is also available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic insects is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause problems for recreation and difficulty in water treatment resulting in taste and odor problems in finished drinking water.

Managing Streamflows from Impoundments

Under the authority of the Federal Power Act, the ***Federal Energy Regulatory Commission*** (FERC) licenses all non-federal dams located on the navigable waters in the United States that produce hydropower for the purposes of interstate commerce. The license may include requirements for flows from the project for designated in-stream or off-stream uses. Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water downstream of the impoundment. One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. The ***Division of Water Resources*** (DWR), in conjunction with the ***Wildlife Resources Commission*** (WRC), recommends conditions related to release of flows to satisfy minimum instream flow requirements. The ***Division of Land Resources*** (DLR) issues the ***permits*** and is responsible for enforcement. Calculated mimimum streamflows for impoundments in the Yadkin-Pee Dee River Basin are listed Table 1.

Table 1. Minimal Streamflow Requirements for Impoundments

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cfs)
Dams associated with Power Production				
W. Kerr Scott	Near Wilkesboro	Yadkin River	367.0	125-4001.0
Idols	Near Clemmons	Yadkin River	1,945.0	5,542.0
Eury hydropower dam		Little River	232.0	36.3
Robinson Dam		Little River	200.0	31.0
Yadkin Division of APGI FERC Project No. 21978				
High Rock	Near Denton	Yadkin River	3,973.0	See Footnote[3]
Tuckertown	Near Richfield	Yadkin River	4,080.0	Run-of River[4]
Narrows (Badin)	Near Badin	Yadkin River	4,180.0	See Footnote[3]
Falls	Near Badin	Yadkin River	4,190.0	Run-of River
Progress Energy-CP&L FERC Project No. 22068				
Tillery	Near Albemarle	Yadkin River	4,638.0	405.0
Blewett Falls	Near Rockingham	Yadkin River	6,821.0	150.0
Cooleemee	Near Cooleemee	South Yadkin River	564.0	1,246.0
Ledbetter	Near Rockingham	Hitchcock Creek	73.1	6.5-9.57
Other Impoundments				
Lake Broyhill	Near Charlotte	Big Warrior Creek	3.9	0.8
John Andrews Dam	Near Charlotte	Unnamed Tributary to Little Warrior Creek	0.4	0.1
Allgood Mill Dam	East Bend	Unnamed Tributary to Yadkin River	5.1	0.8
Recreational Pond	Pilot Mountain	Unnamed Tributary to Grassy Creek	0.5	0.1 requested
Jack Holyfield Dam	Surry County	Unnamed Tributary to Snow Creek	1.3	0.4
Stewarts Creek	Near Mount Airy	Stewarts Creek		19.0
Fred Snow Pond Dam	Near King	Unnamed Tributary to King Creek	0.6	0.2

Name	Location	Waterbody	Drainage Area (sq. mi.)	Min. Release (cfs)
Reynolds Tobacco Dam Number One	Near Winston-Salem	Unnamed Tributary to Johnson Creek	1.0	0.2
C.L. White Dam	Surry County	Snow Creek	2.0	0.7
USDA NRCS flood control impoundment	Sugar Valley Airport	Sugar Creek	5.0	0.2
Lake Reese	Asheboro	Uwharrie	99.0	3.0
Lake Lucas	Asheboro	Back Creek	15.7	0.2
Highland Creek Golf Club's Highland Creek Dam	Albemarle	Unnamed Tributary to Clarke Creek	1.7	0.3
Rankin Dam	Ellerbe	Little Mountain Creek	15.7	0.8
Black Run Creek Reservoir	Mt. Pleasant	Black Run Creek	6.7	0.2
Edward Dawkins Dam	Rockingham	Unnamed Tributary to Hitchcock Creek	0.5	0.2
Lake Howell	Near Concord	Coddle Creek	47.6	6.0
1 Minimum flow ranges from 125 cfs when reservoir pool level is 1000.0-1003.99 feet to 400 cfs when pool level is at or above 1029 feet.				
2 The hydropower facility burned in 1998.				
3 Minimum discharge requirements for the Yadkin Project are measured at the Narrows Powerhouse and vary based on time of year. March 6-May 14: 1,500 CFS; May 15-July 1: 1,610 CFS; July 2-September 15: 1,400 CFS; September 16-March 5: no requirement, however, if streamflow into High Rock Reservoir is 3,600 CFS or less, discharge equivalent from Narrows. High Rock Reservoir is the primary storage reservoir for the Yadkin Project. Narrows Reservoir also offers storage. A drawdown schedule calls first on High Rock Reservoir then Narrows Reservoir is followed during abnormally dry and drought periods. The minimum discharges and drawdown schedule are subject to modification during extended periods of drought. APGI is currently operating the Yadkin Project in accordance with an annual license issued by the FERC on May 2, 2008 under the terms and conditions of its prior license, however, the minimum flows from the Yadkin Project reservoirs are likely to change prior to the next revision of the Basinwide Plan upon issuance of a new FERC license for the Yadkin Project. Under APGI's proposed minimum flows for the new FERC license, the Yadkin Project would, except when operating under the Low Inflow Protocol for the Yadkin-Pee Dee River Hydroelectric Projects (LIP) or Hydro Project Maintenance and Emergency Protocol, be required to provide a daily average minimum flow from the Falls Development according to the following schedule: June 1 – January 31 1,000 cfs; February 1 – May 15 2,000 cfs; May 16 – May 31 1,500 cfs. Flows under APGI's proposal would be modified during drought conditions under the agreed upon LIP.				
4 The development usually operates in a run-of-river mode (i.e., inflow equals outflow).				
5 Leakage from the dam has been measured by the USGS at 112 cfs.				
6 This flow is required in the bypass reach below the dam. Project should operate in a run-of-river mode such that inflow to the dam equals outflow from the powerhouse.				
7 Minimum flow requirements are 6.5 cfs when reservoir pool level is more than five feet below the crest and 9.5 cfs when reservoir pool level is less than five feet below the crest.				
8 FERC License Expired in April 2008; currently operating on annual license issued May 2008.				

PROPOSED PROJECTS WITH MINIMUM FLOWS

South Deep Creek

The Town of Yadkinville plans to expand withdrawals up to a capacity of 5.5 mgd and construct a pump-storage impoundment for low-flow periods. Yadkinville's intake is downstream of Highway 601. An instream flow study established a flow target of 15 cfs below the town's withdrawal. An agreement established a withdrawal limit of 1.7 cfs, 20 percent of the 7Q10 (8.4 cfs), when stream flow was equal to or below the 7Q10. The town can withdraw up to capacity when stream flow exceeds 8.4 cfs. The pump-storage impoundment, to be located on a north-draining, intermittent tributary of South Deep Creek just east of Highway 601, is still in development and should be completed in 2008.

The Yadkin County Soil and Water Conservation District and the Yadkin County Board of Commissioners are sponsoring the construction of a proposed impoundment upstream of Cranberry Creek. The dam will be subject to the N.C. Dam Safety Law and will be required to provide a minimum flow. The minimum flow from the dam will not be less than the 7Q10 of 4.0 cfs. The P.L. 566 work plan supplement is complete and all permits have been secured. Engineering contract has been let and design is underway. The project is waiting for federal funds in order to proceed.

Yadkin River

Caldwell County is proceeding with a water diversion weir on the Yadkin River at a drainage area of 85.2 sq. mi. in

conjunction with an impoundment on a nearby unnamed tributary, ("Donnahue Creek"), that will serve as a pump storage reservoir. The diversion weir will divert the following target flows from the Yadkin River: 15.4 cfs when flows equal or exceed 46.4 cfs; 9.2 cfs when river flow equals or exceeds 37 cfs; 4.6 cfs when river flow equals or exceeds 31 cfs; and no diversion when river flow is less than 24.8 cfs.

Unnamed Tributary of Yadkin River ("Donnahue Creek")

Caldwell County intends to impound the unnamed tributary, locally known as Donnahue Creek, to serve has a public water supply, pump storage impoundment for water withdrawn from the Yadkin River. (The tributary is the third, unnamed tributary indicated on the Grandin topographic map downstream of Hawkins Creek, draining Gill Knob on the north side of the Yadkin River.) The minimum flow from the Donnahue Creek impoundment will be an estimated 7Q10 flow of 0.5 cfs.

Yadkin River

The City of Winston Salem constructed a new water intake and low-head weir to meet future water demands. The city constructed riffle habitat downstream of the weir to mitigate the loss of aquatic habitat and a canoe-access primitive camp. They will also coordinate with the U.S. Army Corps of Engineers to maintain the 7Q10 stream flow target of 554 cfs below Idols dam with storage in W. Kerr Scott Reservoir.

Stewarts Creek

DWR requested a minimum flow requirement of 19.0 cfs (7Q10) below the Town of Mount Airy's Doggett Water Treatment Plant dam following the raising of the dam's height by five feet. The dam has a drainage area of 65 sq. mi. As a requirement for approval of raising the Doggett WTP dam height, the town agreed to release enough flow from the flood and water supply impoundment, Structure 1A, located upstream at a drainage area of 15 sq. mi. to maintain 19 cfs downstream of the intake during pumping when flow above the intake equals 19 cfs plus the volume pumped.

Coddle Creek

Lake Don T. Howell is owned by Cabarrus County – Water and Sewer Authority of Cabarrus County (WSACC). The water is used by the cities of Concord and Kannapolis. The Division of Water Resources requested a 6.0 cfs minimum flow from the reservoir. WSACC has sought to amend their 404 permit for the dam to lower flow requirements when available storage in the reservoir decreases. The top tier still requires a 6 cfs release. Flow would be reduced to 3 cfs when still in the top tier but reservoir inflow is below 75 percent of historical monthly flow for the month. The bottom tier would be 2 cfs when storage is less than or equal to 70 percent of storage. Lake Don T. Howell has a drainage area of 47.6 sq.mi.

Hitchcock Creek

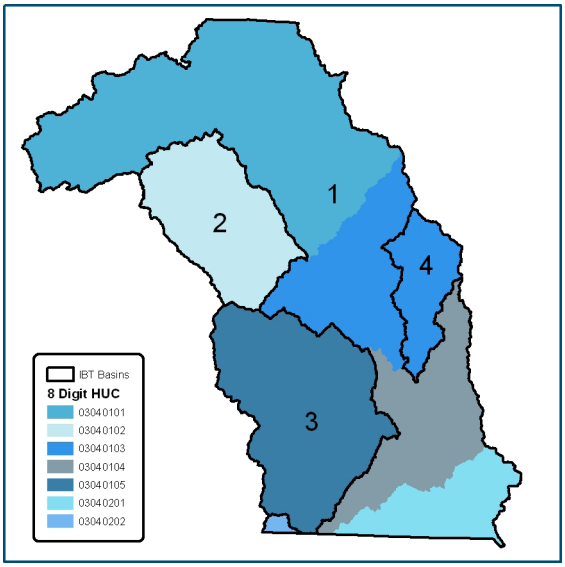
The Steeles Mill (FERC Project No. 8282) hydropower facility, located near Cordova, N.C., is no longer in operation. A final EA for the dam's removal has been submitted and the dam should be removed in 2008.

Interbasin Transfers (IBT)

Water users in North Carolina are also required to register surface water transfers with the Division of Water Resources if the amount is 100,000 gallons per day or more. Also, persons wishing to transfer more than the minimum transfer quantity allowed by the IBT law (usually 2 MGD) must first obtain a certificate from the Environmental Management Commission (G.S. 143-215.22I). The river basin boundaries that apply to these requirements are designated on a map entitled Major River Basins and Sub-Basins in North Carolina, on file in the Office of the Secretary of State, and included as part G.S. 143-215.22G of the law. These boundaries differ slightly from the 17 major river basins delineated by DWQ (Figure 11-2).

In 2007, the North Carolina General Assembly passed *House Bill 820* to enhance the IBT application process and review water regulations. This bill added additional requirements to

Figure 2. IBT Basins



demonstrate the need for and IBT and gain more public input. Here is a summary of the major points:

- Calls for a study by the Environmental Review Commission (EMC) of water allocation, interbasin transfer, consumptive water use
- Calls for development of a comprehensive plan to regulate surface water withdrawals
- Requires the *Division of Water Resources* to develop a new map defining the extent to which river basins extend from North Carolina into other states.
- An IBT applicant must file a notice of intent to file a petition and hold three public scooping meetings on the environmental documents to accompany the petition.
- The applicant must provide additional public notice along with the requirements of the previous statute, including newspaper notices in adjacent states that share the source river basin and mail notices to local governments in adjacent states that share the same basin. In addition, the applicant must send mail notices to public water system users and wastewater dischargers upstream and downstream of the proposed transfer.
- An environmental impact statement (EIS) is mandatory for any transfer from a major river basin to another basin.
- The EMC must hold a public hearing on the draft EIS.
- The EMC may appoint a mediation officer to initiate settlement negotiations between the applicant and interested parties.
- The EMC must issue a draft certificate, including findings of fact and conditions on the proposed transfer, and hold a public hearing on the draft.
- The EMC shall only approve the IBT certificate when it finds the applicant cannot satisfy its water needs from alternatives within the receiving basin, including unused capacity from other approved transfers and the purchase of water from other water systems, and that there is no reasonable alternative to the proposed transfer.
- The certificate must require the applicant to have water use efficiency and drought management plans that equal or exceed the most stringent plans in place in the source river basin.
- The EMC may amend the certificate to reduce the transfer if it appears that an additional water source is available to the certificate holder or if the holder's projected water needs are determined to be less than at the time the certificate was approved.
- The certificate holder cannot resell transferred water unless the buyer was a co-applicant.

Existing Interbasin Transfers

Table 2 lists interbasin transfers for the Yadkin-Pee Dee River basin. The DWR map of major river basins can be found on their website: ***http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/BasinMap.gif***, which is used for determining interbasin transfers, considers the South Yadkin River, Rocky River and Uwharrie River as major river basins in and of themselves. Therefore, 13 of the transfers listed in the table are between these major tributaries and the Yadkin-Pee Dee River. For more information on interbasin transfers, visit the website: ***www.ncwater.org*** or call DWR at (919) 733-4064.

Table 2. Existing Interbasin Transfers in 1997

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfers (MGD)
Anson County	Anson County	Yadkin	Rocky	0.6
Anson County	Marshville	Yadkin	Rocky	0.3
Anson County	Union County	Yadkin	Rocky	0.8
Asheboro	Asheboro	Uwharrie	Deep	4.6
Davidson Water	Davidson Water	Yadkin	Uwharrie	1.1
Davidson Water	Davidson Water	Yadkin	Deep	0.4
Davidson Water	Archdale	Yadkin	Deep	0.2
Winston-Salem	Winston-Salem	Yadkin	Roanoke	0.4
High Point	High Point	Deep	Yadkin	4.4
Montgomery County	Montgomery County	Yadkin	Deep, Lumber, Uwharrie	1.7 (total)
Montgomery County	Star	Yadkin	Deep	Unknown
Albemarle	Albemarle	Yadkin	Rocky	5.8
Albemarle	Stanly County	Yadkin	Rocky	0.8

Supplying System	Receiving System	Source Subbasin	Receiving Subbasin	Estimated Transfers (MGD)
Albemarle	Pfeiffer – North Stanly	Yadkin	Rocky	0.1
Norwood	Norwood	Yadkin	Rocky	0.4
Alexander County WC	Taylorsville	South Yadkin	Catawba	0.4
Statesville	West Iredell WC	South Yadkin	Catawba	Unknown
Asheboro	Asheboro	Uwharrie	Deep	4.6
Kannapolis	Kannapolis	Yadkin	Rocky	4.5
Union County	Union County	Catawba	Rocky	3.6
Union County	Monroe	Catawba	Rocky	2
Mooresville	Mooresville	Catawba	Rocky	Unknown
Mooresville	Mooresville	Catawba	South Yadkin	Unknown
Charlotte-Mecklenburg	Charlotte-Mecklenburg	Catawba	Rocky	16.1*
Mocksville	Mocksville	South Yadkin	Yadkin	0.6
Burlington Industries	Mooresville	Catawba	Rocky	0.4

Active Interbasin Transfer Certificates

Charlotte – Mecklenburg Utilities

A 33 mgd transfer from the Catawba River basin to the Rocky River basin.

Cities of Concord and Kannapolis

A transfer to the Rocky River basin of 10 mgd from the Catawba River basin and 10 mgd from the Yadkin River basin.

Local Water Supply Planning and Registered Water Withdrawals

In 1989 the North Carolina General Assembly established a water supply planning process to assure that communities have an adequate supply of potable water. Under the original legislation, all units of local government that provide water to the public are required to prepare a Local Water Supply Plan, submit the plan to the Division of Water Resources and update the plan at least every five years. In 2003 the General Assembly extended the requirement to any community water system that serves 1000 or more service connections or 3000 or more individuals. This change extended the requirement to the larger community water systems not operated by a unit of local government.

Local Water Supply Plans provide an assessment of a water system's present and future water needs and its ability to meet those needs. There are seventy-nine water systems within the Yadkin-Pee Dee River Basin that have submitted a Local Water Supply Plan to the Division of Water Resources. Some of these plans are for systems that are still in the planning and development phases and were not actually serving customers in 2002, the year when most local plans were last updated. Thirty-three systems have surface water intakes that provide water to an additional thirty-four water systems through various water sharing agreements. These systems, on average, withdrew about 147 million gallons per day of surface water to meet the demands of these sixty-seven water systems. In addition, twelve water systems withdrew just over three million gallons per day of ground water. These seventy-nine systems supplied over 935,000 persons in 2002.

Due to growth in the areas supplied by these water systems they expect to need 278 million gallons per day to supply service populations of over 1.6 million persons by 2030 and 400 million gallons per day to supply almost 2.2 million persons by 2050. These figures represent a 74% increase in service population from 2002 by 2030 and a 135% increase by 2050. Table 3 lists the water systems and their water use and service populations. Table 4 shows the systems that have surface water intakes in the basin.

In addition to the water systems submitting Local Water Supply Plans, eighty smaller community water systems provide water to residential customers. They have registered average water withdrawals totaling 1.2 million gallons per day of

ground water from this basin. Only one of these systems uses more than 100,000 gallons per day, most of them use less than 30,000 gallons per day.

Table 3. Local Water Supply Planning in the Yadkin-Pee Dee River Basin

County	Water System	Service Area Demand (MGD) 2002	Service Area Demand (MGD) 2030	Service Area Demand (MGD) 2050	Service Area Population 2002	Service Area Population 2030	Service Area Population 2050
Alexander							
	Energy United Water	1.009	2.345	3.530	9906	22680	32760
	Sugarloaf Water District	0.000	0.000	0.000	987	987	987
	Taylorsville	0.806	0.548	0.568	2000	2300	2500
Anson							
	Anson County	3.481	3.981	4.928	11067	13494	15000
	Ansonville	0.144	0.162	0.176	1850	2000	2100
	Lilesville	0.068	0.060	0.062	900	851	865
	McFarlan	0.014	0.014	0.014	90	90	90
	Morven	0.068	0.068	0.068	750	750	750
	Peachland	0.047	0.056	0.057	620	645	650
	Polkton	0.076	0.104	0.116	890	1185	1365
	Wadesboro	0.909	1.081	1.122	6450	7000	7200
Cabarrus							
	Cabarrus Woods/Cambridge Subdivision	0.377	0.377	0.377	4389	4389	4389
	Concord	9.494	28.512	40.217	63136	170000	235643
	Harrisburg	0.480	2.286	3.798	5600	24237	37616
	Mount Pleasant --WSACC	0.296	1.064	1.609	1296	5500	8441
	Pine Ridge MHP	0.003	0.003	0.003	50	50	50
	Pine Ridge MHP II	0.003	0.003	0.003	50	50	50
	Water and Sewer Authority of Cabarrus Co.1	0.000	0.000	0.000	0	0	0
Davidson							
	Davidson Water	10.321	17.390	24.876	126353	210353	270353
	Denton	0.614	0.710	0.781	1492	1725	1900
	Handy Sanitary District	0.652	2.016	5.626	9250	16500	21500
	Lexington	3.287	4.157	4.765	22230	25815	28461
	Thomasville	3.109	3.960	3.960	22700	26000	26000
Davie							
	Davie County	2.723	4.617	5.872	21075	40437	53237
	Mocksville	0.755	1.179	1.613	4670	7264	9909
Forsyth							
	Winston-Salem	43.411	69.168	86.897	248500	335300	397300
Iredell							
	Iredell Water Corporation 2	1.899	3.077	4.159	16777	35560	48060
	Love Valley	0.010	0.000	0.000	75	75	75
	Statesville	3.559	5.892	7.017	23974	35309	46536
	Troutman	0.297	0.964	1.298	2465	8012	10779

County	Water System	Service Area Demand (MGD) 2002	Service Area Demand (MGD) 2030	Service Area Demand (MGD) 2050	Service Area Population 2002	Service Area Population 2030	Service Area Population 2050
	West Iredell Water Corp.	0.405	0.844	1.308	4270	9000	14000
Montgomery							
	Badin Shores Resort	0.115	0.153	0.174	450	525	600
	Biscoe	0.396	0.550	0.706	1737	2336	2930
	Candor	0.105	0.133	0.137	834	900	950
	Montgomery County	1.500	1.522	1.573	8752	11252	14244
	Mount Gilead	0.136	0.193	0.230	1398	1950	2318
	Star	0.258	0.245	0.258	830	875	950
	Troy	0.734	0.000	0.000	3632	3632	3632
Randolph							
	Asheboro	4.796	8.287	10.879	23694	34128	41627
Richmond							
	Ellerbe	0.175	0.175	0.175	1500	1500	1500
	Hamlet	1.417	2.097	2.212	11027	12500	11000
	Richmond County	2.878	3.990	5.070	15850	22000	28000
	Rockingham	2.988	5.283	6.817	10652	12347	13101
Rowan							
	China Grove	0.506	1.072	1.573	3855	8644	12845
	Cleveland	0.097	0.084	0.088	808	869	912
	East Spencer	0.279	0.404	0.521	1738	2635	3397
	Faith	0.084	0.137	0.000	920	1495	1495
	Kannapolis	6.154	14.855	21.955	40032	103000	136587
	Landis	0.495	1.232	2.032	3008	5947	9805
	Salisbury	5.763	32.560	67.069	42827	146398	308112
Stanly							
	Albemarle	6.016	9.697	13.962	15758	25413	36594
	Norwood	0.335	1.430	1.764	3000	3560	3955
	Oakboro	0.201	0.240	0.289	1198	1595	1931
	Pfeiffer-North Stanly WA	0.460	0.535	0.602	3175	4148	4800
	Stanly County	0.968	1.322	1.654	6833	9400	11750
Stokes							
	King	1.658	2.340	2.992	19853	28029	35828
	Stokes County Water Sewer Authority	0.043	0.024	0.030	175	254	313
Surry							
	Dobson2	0.000	0.000	0.000			
	Elkin	1.200	1.274	1.295	4100	4500	4700
	Mount Airy	3.494	10.220	14.880	11034	27246	40487
	Pilot Mountain	0.384	0.807	1.422	1926	5397	10410
Union							
	Marshville	0.316	0.499	0.691	3658	6109	8798
	Monroe	6.787	10.027	12.212	27756	52960	64000

County	Water System	Service Area Demand (MGD) 2002	Service Area Demand (MGD) 2030	Service Area Demand (MGD) 2050	Service Area Population 2002	Service Area Population 2030	Service Area Population 2050
	Union County (from Anson County)3	0.951	-	-	-	-	-
Wilkes							
	Blue Ridge WA	0.696	1.952	4.598	6975	21160	38220
	Broadway Water Association, Inc.	0.234	0.249	0.258	2642	2800	2900
	Cricket-Millers Creek Water Assoc.	1.037	1.232	1.475	10872	13590	15937
	Moravian Falls Water Works	0.371	0.630	6.080	2845	5000	6000
	Mulberry Fairplains WA	0.501	0.911	1.055	8000	9500	10000
	North Wilkesboro	0.978	1.105	1.267	4135	6123	8098
	Ronda	0.033	0.219	0.365	406	3000	5000
	Wilkesboro	3.513	4.130	4.625	3110	4211	5095
Yadkin							
	Boonville	0.165	0.250	0.250	1138	1648	1648
	East Bend	0.064	0.101	0.108	1360	1600	1720
	Jonesville	0.331	0.673	0.839	2350	2550	2670
	Yadkinville	0.926	1.222	1.493	4920	6740	8326
	Total	149	279	401	934,625	1,627,024	2,201,751

Table 4. Current Surface Water Withdrawals by Local Water Supply Plan Systems

County	Water System	Surface Water Source	Average Daily Withdrawal (MGD)	Source Basin
Alexander				
	Energy United Water	South Yadkin River	1.600	South Yadkin River (18-2)
Anson				
	Anson County	Pee Dee River / Blewett Falls Lake	6.568	Yadkin River (18-1)
	Wadesboro	Jones Creek	0.616	Yadkin River (18-1)
Cabarrus				
	Concord	Cold Water Creek and Tributary	4.029	Rocky River (18-4)
	Mount Pleasant --WSACC	Dutch Buffalo Creek	0.266	Rocky River (18-4)
	Water and Sewer Authority of Cabarrus Co.	Coddle Creek	6.950	Rocky River (18-4)
Davidson				
	Davidson Water	Yadkin River	10.449	Yadkin River (18-1)
	Denton	Yadkin River / Tuckertown Reservoir	1.379	Yadkin River (18-1)
	Lexington	Abbotts Creek / Lake Tom-A-Lex	3.287	Yadkin River (18-1)

County	Water System	Surface Water Source	Average Daily Withdrawal (MGD)	Source Basin
	Thomasville	Abbotts Creek / Lake Tom-A-Lex	3.109	Yadkin River (18-1)
Davie				
	Davie County	Yadkin River	1.478	Yadkin River (18-1)
		South Yadkin River	1.245	South Yadkin River (18-2)
	Mocksville	Hunting Creek	0.755	South Yadkin River (18-2)
Forsyth				
	Winston-Salem	Yadkin River	39.490	Yadkin River (18-1)
		Salem Creek	4.630	Yadkin River (18-1)
Iredell				
	Statesville	South Yadkin River	3.924	South Yadkin River (18-2)
Montgomery				
	Montgomery County	Pee Dee River / Lake Tillery	3.106	Yadkin River (18-1)
Randolph				
	Asheboro	Back Creek	2.578	Uwharrie River (18-3)
		Uwharrie	2.520	Uwharrie River (18-3)
Richmond				
	Hamlet	Marks Creek / City Water Lake	1.400	Yadkin River (18-1)
	Richmond County	Pee Dee River / Blewett Falls Lake	3.204	Yadkin River (18-1)
	Rockingham	Hitchcock Creek / Roberdel Lake	1.310	Yadkin River (18-1)
		Falling Creek	0.674	Yadkin River (18-1)
Rowan				
	Kannapolis	Second Creek	2.260	South Yadkin River (18-2)
		Irish Buffalo Creek	1.500	Rocky River (18-4)
	Landis	Grants Creek	0.680	Yadkin River (18-1)
	Salisbury (Plan Revised 2006)	Yadkin River	6.246	Yadkin River (18-1)
Stanly				
	Albemarle	Yadkin River / Narrows Reservoir	4.040	Yadkin River (18-1)
		Yadkin River / Tuckertown Reservoir	3.524	Yadkin River (18-1)
	Norwood	Pee Dee River / Lake Tillery	0.371	Yadkin River (18-1)
Stokes				
	King	Yadkin River	1.658	Yadkin River (18-1)
Surry				
	Elkin	Elkin Creek	1.200	Yadkin River (18-1)
	Mount Airy	Stewarts Creek	2.935	Yadkin River (18-1)
		Lovills Creek	0.575	Yadkin River (18-1)

County	Water System	Surface Water Source	Average Daily Withdrawal (MGD)	Source Basin
	Pilot Mountain	Toms Creek	0.384	Yadkin River (18-1)
Union				
	Monroe	Stewarts Creek	6.860	Rocky River (18-4)
Wilkes				
	North Wilkesboro	Reddies River	2.678	Yadkin River (18-1)
	Wilkesboro	Yadkin River	4.640	Yadkin River (18-1)
Yadkin				
	Jonesville	Yadkin River	0.330	Yadkin River (18-1)
	Yadkinville	South Deep Creek	0.926	Yadkin River (18-1)
1) WASACC provides raw water to Concord and Kannapolis and wastewater treatment services in the county				
2) Dobson has not updated their Local Water Supply Plan				
3) Amount supplied to Union County water system in 2002, future amounts unknown				

North Carolina General Statute 143-215.22H requires that persons withdrawing 100,000 gallons or more per day for non-agricultural uses or 1,000,000 gallons or more per day for agricultural uses must register their withdrawals with the Division of Water Resources. And, like the local plans this data must be updated at five-year intervals. In the Yadkin-Pee Dee Basin there are seventeen mining operations, four industrial facilities and one thermoelectric power plant that registered withdrawals in 2004. Also there are five users that registered withdrawals for golf course irrigation. Table 5 lists these registered users and their average daily withdrawals. Details of this program can be found on the DWR's website at: ***www.ncwater.org***

Table 5. 2004 Non-residential Registered Water Withdraws in the Yadkin River Basin

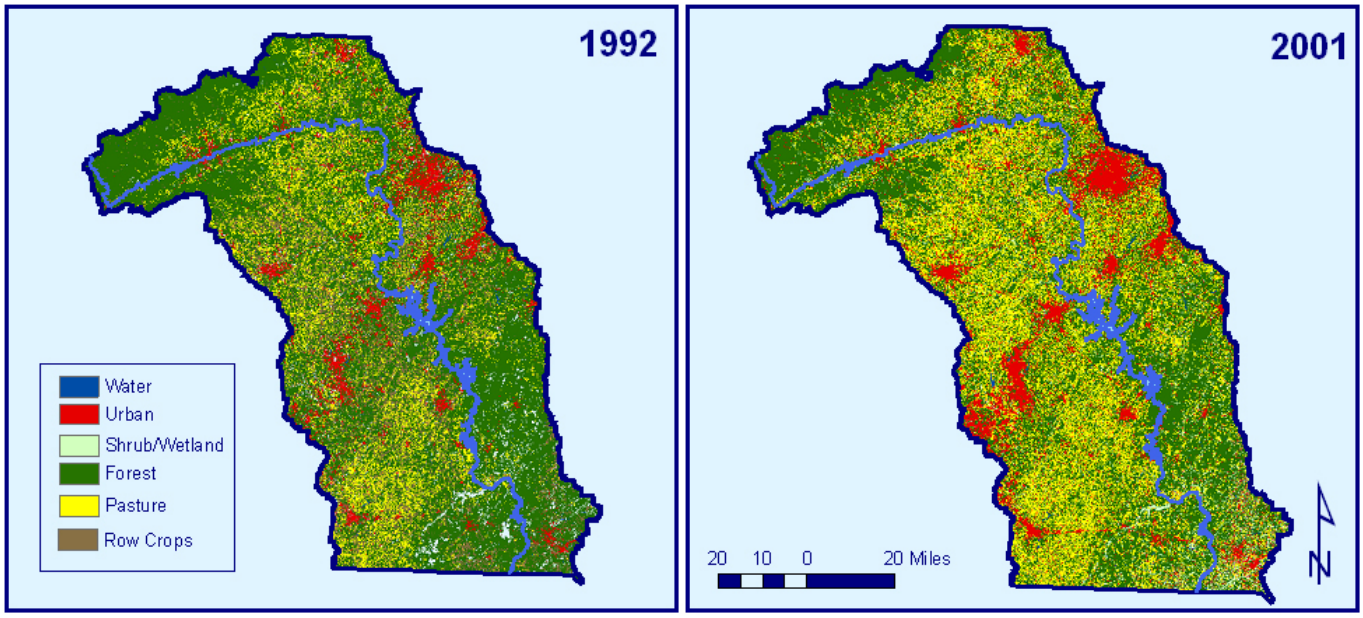
County	Owner	Facility	Type of Use	Average Daily Withdrawal (MGD)
Anson				
	B.V. Hedrick Gravel And Sand Co.	Hedrick Mine	Mining	0.320
Cabarrus				
	Martin Marietta Materials. Inc.	Bonds Quarry	Mining	0.153
	Martin Marietta Materials. Inc.	Rocky River Quarry	Mining	0.048
	Vulcan Construction Materials. L. P.	Cabarrus Quarry	Mining	0.028
	Vulcan Construction Materials. L. P.	Gold Hill Quarry	Mining	0.034
Davidson				
	Martin Marietta Materials. Inc.	Thomasville Quarry	Mining	0.206
	Salem Glen Country Club LLC	Salem Glen Country Club	Irrigation, Golf	0.383
	Sapona Country Club	Sapona Country Club	Irrigation, Golf	0.024
Davie				
	Vulcan Construction Materials. L. P.	Smith Grove Quarry	Mining	0.001
Forsyth				
	Forsyth County	Tanglewood Park	Irrigation, Golf	0.095
	Martin Marietta Materials. Inc.	Salem Stone Quarry	Mining	0.166
	Vulcan Construction Materials. L. P.	East Forsyth Quarry	Mining	0.011
	Vulcan Construction Materials. L. P.	North Quarry	Mining	0.015
Iredell				
	Martin Marietta Materials. Inc.	Statesville Quarry	Mining	0.167
	Tyson Foods. Inc	River Valley Animal Foods	Industrial	0.030

County	Owner	Facility	Type of Use	Average Daily Withdrawal (MGD)
Mecklenburg				
	Martin Marietta Materials. Inc.	Mallard Creek Quarry	Mining	0.240
	North Stone Golf Club	North Stone Golf Club (2005)	Irrigation, Golf	0.188
	Skybrook Golf Club	Skybrook Golf Club (2006)	Irrigation, Golf	0.031
	Vulcan Construction Materials. L. P.	Clear Creek Quarry	Mining	0.003
Rowan				
	Duke Power a Duke Energy Company	Buck Steam Station	Thermoelectric	212.305
	Invista Sarl	Invista. Sarl	Industrial	1.021
	Martin Marietta Materials. Inc.	Kannapolis Quarry	Mining	0.200
	Martin Marietta Materials. Inc.	Woodleaf Quarry	Mining	0.381
Surry				
	Interface. Inc.	Interface Fabrics	Industrial	0.900
	Vulcan Construction Materials. L. P.	Elkin Quarry	Mining	0.007
Union				
	Martin Marietta Materials. Inc.	Bakers Quarry	Mining	0.125
Wilkes				
	Lousiana Pacific Corporation	Lousiana Pacific Corporation	Industrial	1.450

Managing Population & Land Use Change for Water Quality Protection

The Yadkin Pee Dee River Basin encompasses much of the North Carolina piedmont. Large tracts of fertile agricultural lands, rural communities, and forests also fall within its borders. Conversely, it contains two of North Carolina's largest population centers. Several major interstate corridors including I-85, I-40, and I-77 cross it. Population growth is booming around the major cities and transportation corridors. With this growth comes increased pressure on the natural environment. Every person living in or passing through a watershed creates water quality impacts. If water pollution is to be reduced, each individual must be aware of these contributions and take actions to reduce them. The following paragraphs discuss the most common impacts of human activity and offer suggestions to lessen those impacts.

Figure 1. Land Cover Patterns in the Yadkin Pee Dee River Basin



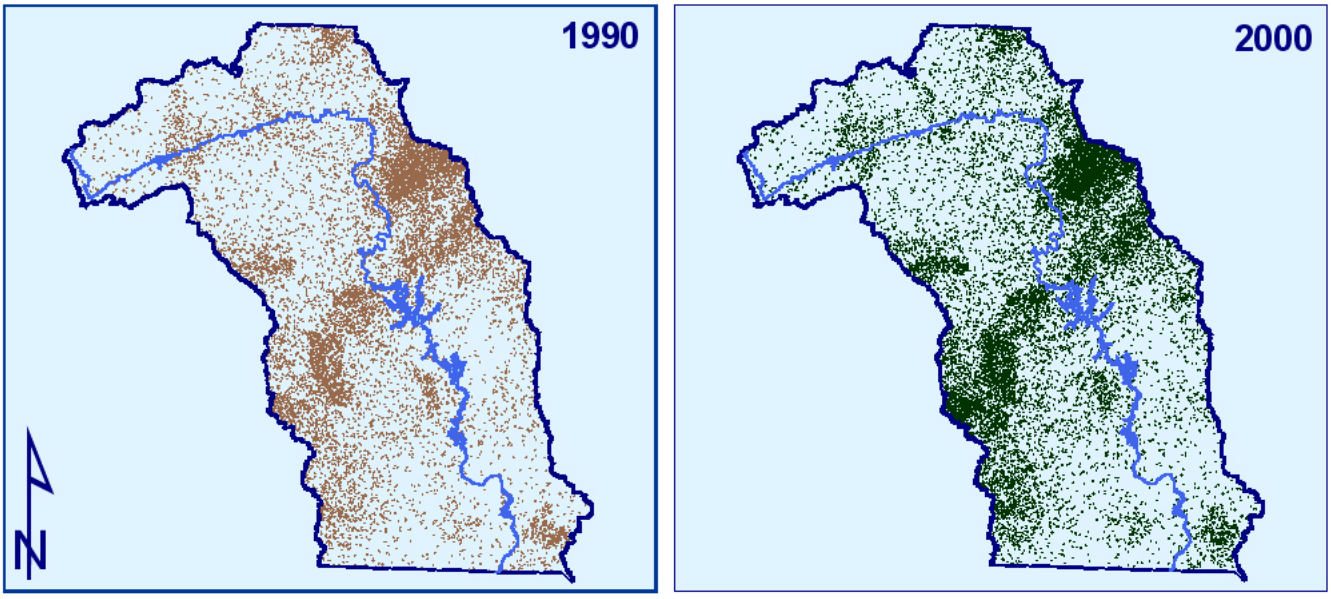
Source: Multi-Resolution Land Characteristics Consortium http://www.mrlc.gov/
Note: Due to sampling and classification differences, data from 1992 and 2001 cannot be compared directly. These maps are prepared here to qualitatively demonstrate general land cover patterns.

IMPACTS FROM POPULATION GROWTH AND LAND COVER CHANGE

Rapid Urbanization

Population growth results in dramatic impacts on the natural landscape. The most obvious impact is the expansion of urban and suburban areas. New stores, roads, and subdivisions are products of growing populations. What is not so obvious is the astonishing rate at which rural landscapes are converted to developed land. Between 1982 and 1997, the United States population increased by 15 percent. Over the same period, developed land increased by 34 percent – more than double the rate of population growth (NRI, 2001; U.S. Census Bureau, 2000). Locally, the trend can be even more pronounced. Between 1992-1997 the population in North Carolina increased by approximately 11 percent, concurrently the state ranked sixth in the nation for annual rate of land developed, at over 100,000 acres per year (NC OSBM, 2008; NRCS, 2008). Studies have not been completed for the Yadkin-Pee Dee river basin, but similar trends are expected. Figures 1 and 2 demonstrate the increase in urban land area corresponding to the population increase along the southeastern basin boundary, around the Charlotte Metropolitan area.

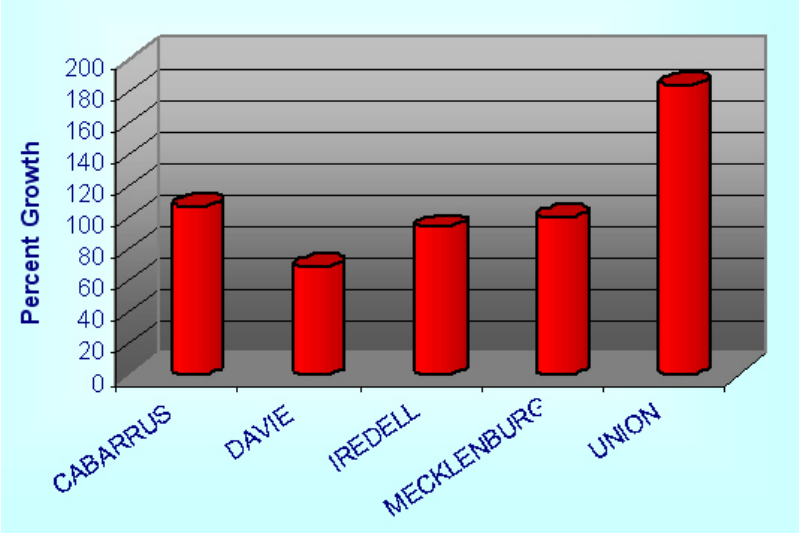
Figure 2. Population Distribution in the Yadkin Pee Dee River Basin



Most county populations in counties wholly or partial contained in the Yadkin-Pee Dee river basin will grow significantly between 2000 and 2030 (See Tables 1 and 2). County growth rates over this period range from slight decreases in Richmond and Anson Counties to a staggering 184 percent increase in Union County. If development patterns follow the trends described above, urban land use may increase by over 350 percent in Union County by 2030. Cabarrus, Davie, Iredell, and Mecklenburg Counties are projected to nearly double in population over the same period. Such an increase in developed land poses a significant threat to water quality and stream health because it will be accompanied by a similar increase in impervious surfaces.

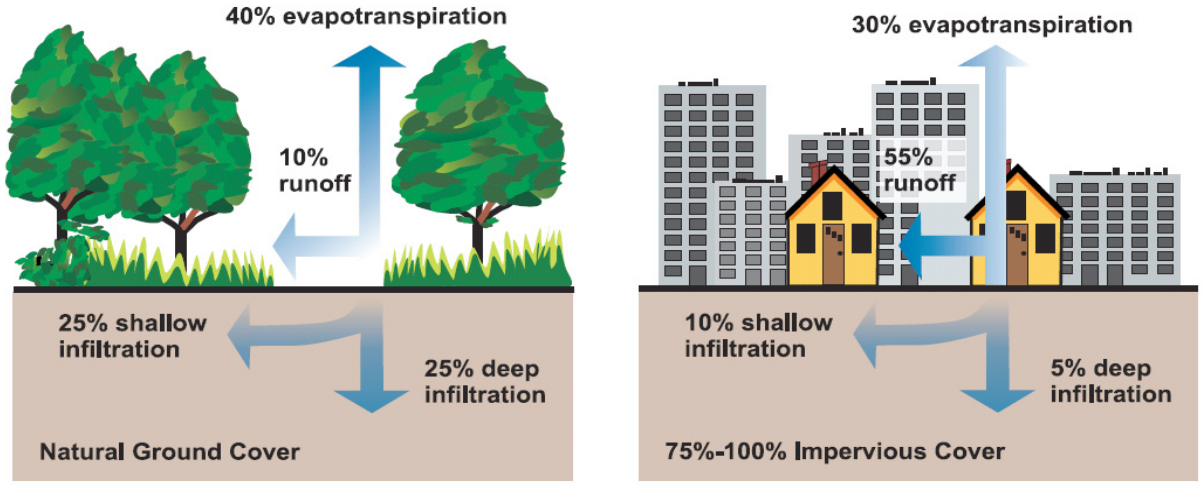
Impervious surfaces are materials that prevent infiltration of water into the soil and include roads, rooftops, and parking lots. Impervious surfaces alter the natural hydrology, prevent the infiltration of water into the ground, and concentrate the flow of stormwater over the landscape. In undeveloped watersheds, stormwater filters down through the soil, replenishing groundwater quantity with water of good quality.

Figure 3. Population Growth Rates for the 5 Fastest Growing Counties in the Yadkin Pee Dee River Basin 2000-2030



Vegetation holds down the soil, slows the flow of stormwater over land, and filters out some pollutants, by both slowing the flow of the water and trapping some pollutants in the root system. As the imperviousness of a watershed increases, the greater volume of stormwater it produces increases the possibility of flooding and reduces the potential for pollutants to settle out. Thus, more pollution is delivered to streams and drinking water supplies. Too much paving and hardening of a watershed can reduce infiltration and groundwater levels which in turn can decrease the availability of aquifers, streams and rivers for drinking water supplies (Kauffman and Brant, 2000). It is well established that stream degradation begins to occur when 10 percent or more of a watershed is covered with impervious surfaces. The stream is significantly degraded when imperviousness reaches 30 percent of the watershed (Schueler, 1995). If projects described in the preceding paragraphs hold true, many more streams in these areas will be Impaired by 2030 unless bold and comprehensive measures are taken immediately to protect water quality. The following discussion provides a general overview of potential solutions that must be catered to suit individual communities.

Figure 4. Impervious Cover and Surface Runoff (EPA, 2003)



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

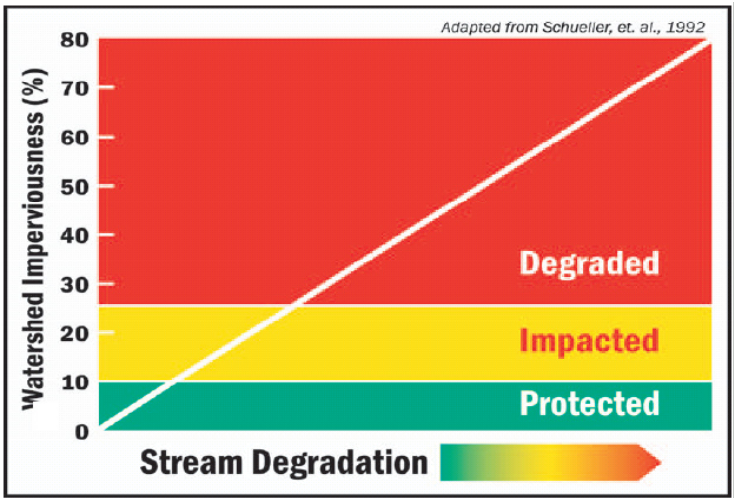
POPULATION GROWTH AND IMPACTS ON AQUATIC RESOURCES

Urbanization poses one of the greatest threats to aquatic resources. For example, a one-acre parking lot produces 16 times more runoff than a one-acre meadow (Schueler and Holland, 2000). A wide variety of studies over the past decade converge on a central point: when more than 10 percent of the acreage in a watershed is covered in roads, parking lots, rooftops, and other impervious surfaces, the rivers and streams within the watershed become seriously degraded. Brown trout populations have been shown to decline sharply at 10 to 15 percent imperviousness. If urbanized area covers more than 25 percent of a watershed, these studies point to an irreversible decline in ecosystem health (Beach, 2002 and Galli, 1991).

Greater numbers of homes, stores, and businesses require greater quantities of water. Growing populations not only require more water, but they also lead to the discharge and runoff of greater quantities of waste and pollutants into the state's streams, rivers, lakes and groundwater. Thus, just as demand and use increases, some of the potential water supply is lost (Orr and Stuart, 2000).

As development in surrounding metropolitan areas consumes neighboring forests and fields, the impacts on rivers, lakes, and streams can be significant and permanent if stormwater runoff is not controlled (Orr and Stuart, 2000). As watershed vegetation is replaced with impervious surfaces, the ability of the landscape to absorb and diffuse the effects of natural rainfall is diminished. Urbanization results in increased surface runoff and correspondingly earlier and higher peak stream flows after rainfall. Flooding frequency also increases. These effects are compounded when small streams are channelized (straightened) or piped, and storm sewer systems are installed to increase transport of stormwater downstream. Bank scour from these frequent high flow events tends to enlarge streams and increase suspended sediment. Scouring also destroys the variety of habitat in streams, leading to degradation of benthic macroinvertebrate populations and loss of fisheries (EPA, 2003).

Figure 5. Impervious Cover and Stream Degradation



KEY ELEMENTS OF A COMPREHENSIVE WATERSHED PROTECTION STRATEGY

Extensive research on the impacts of development and sobering population growth projections make it clear that comprehensive land use planning is necessary to protect aquatic resources. In order for land use planning to effectively protect watersheds in the long-term, tools and strategies must be applied at several scales. Effective implementation will require commitment ranging from the individual citizen to the state government. A comprehensive watershed protection plan should act on the following elements:

Basin Scale (Implemented by Town, County, and State Governments)

1. Characterize the watersheds within a basin as developed or undeveloped, identifying the watersheds that are currently less than 10 percent impervious and those that are more than ten percent impervious.
2. Focus new construction projects to the already developed watersheds first. Then assign any construction that cannot be accommodated in developed watersheds to a limited number of undeveloped watersheds. The watersheds to be developed should be determined by their ecological importance and by other regional growth considerations, such as the value of terrestrial ecosystems, the economic development potential as determined by proximity to roads and rail lines, and the disposition of landowners in the area toward land preservation and development.
3. Adopt policies that maintain impervious surfaces in undeveloped watersheds at less than ten percent. These can include private conservation easements, purchase of development rights, infrastructure planning, urban service boundaries, rural zoning (20-200 acres per unit, depending on the area), and urban growth boundaries.
4. Ensure that local governments develop land use plans to provide adequate land for future development within developed or developing watersheds.

Neighborhood Scale (Implemented by Town and County Governments)

1. Allow residential densities that support transit, reduce vehicle trips per household and minimize land consumption. The minimum density for new development should be seven to ten net units per acre.
2. Require block densities that support walking and reduce the length of vehicle trips. Cities that support walking and transit often have more than 100 blocks per square mile.
3. Connect the street network by requiring subdivision road systems to link to adjacent subdivisions.
4. Integrate houses with stores, civic buildings, neighborhood recreational facilities, and other daily or weekly destinations.
5. Incorporate pedestrian and bike facilities (greenways) into new development and ensure these systems provide for inter-neighborhood travel.
6. Encourage and require other design features and public facilities that accommodate and support walking by creating neighborhoods with a pleasing scale and appearance. (e.g., short front-yard setbacks, neighborhood parks, alleys, and architectural and material quality)

Site Scale (Implemented by Individual Property Owners, Developers, and Town and County Governments)

1. Require application of the most effective structural stormwater practices, especially focusing on hot spots such as high-volume streets, gas stations, and parking lots.
2. Establish buffers and setbacks that are appropriate for the area to be developed – more extensive in undeveloped watersheds than in developed watersheds. In developed watersheds, buffers and setbacks should be reconciled to other urban design needs such as density and a connected street network.
3. Educate homeowners about their responsibility in watershed management, such as buffer and yard maintenance, proper disposal of oil and other toxic materials, and the impacts of excessive automobile use (Beach, 2002).

FOCUS AREAS FOR MANAGING THE IMPACTS OF POPULATION GROWTH

The elements of watershed protection listed in above are intended to guide land use planning and population density decision-making. This section discusses specific concepts necessary to reduce the impacts of population growth.

CONTROL STORMWATER RUNOFF AND POLLUTION

Stormwater runoff is rainfall or snowmelt that runs off the ground and impervious surfaces (e.g., buildings, roads, parking lots, etc.). Because urbanization usually involves creation of new impervious surfaces, stormwater can quickly become a major concern in growing communities.

The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands traps rainwater and snowmelt and allows them to filter slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts.

Common Pollutants in Stormwater

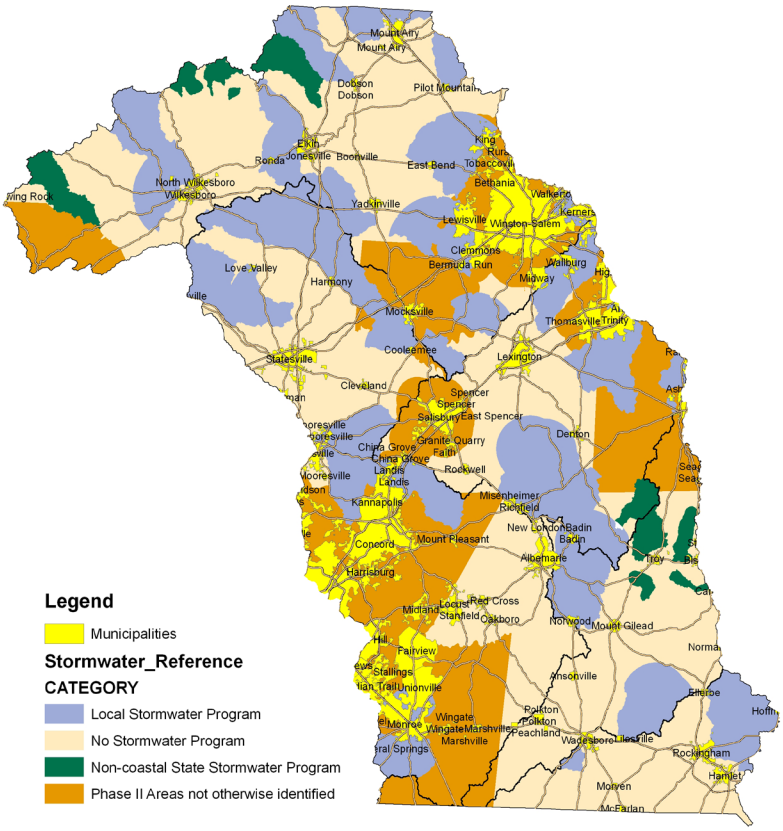
Storm sewer systems concentrate runoff into smooth, straight conduits. This runoff gathers speed and power as it travels through the pipes. When this runoff leaves the storm drains and empties into a stream, its excessive volume and power blast out streambanks, damaging streamside vegetation and destroying aquatic habitat. These increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. They often carry higher water temperatures from streets, rooftops, and parking lots, which are harmful to the health and reproduction of aquatic life. The steep slopes and large elevation changes in western North Carolina intensify this effect as water rushes downhill.

Storm sewers should not be confused with sanitary sewers, which transport human and industrial wastewaters to a treatment plant before discharging into surface waters. There is no pre-treatment of stormwater in North Carolina.

Uncontrolled stormwater runoff has many impacts on both humans and the environment. Cumulative effects include flooding, undercut and eroding streambanks, widened stream channels, threats to public health and safety, impaired recreational use, and increased costs for drinking and wastewater treatment. For more information on stormwater runoff, visit the DWQ Stormwater Permitting Unit at ***http://h2o.enr.state.nc.us/su/stormwater.html*** or the NC Stormwater information page at ***http://www.ncstormwater.org/***. Additional fact sheets and information can also be found at ***http://www.stormwatercenter.net/intro_factsheets.htm*** and ***www.bae.ncsu.edu/stormwater/***. Areas covered by regulated stormwater programs are indicated in Figure 6.

Figure 6.

Stormwater Program Coverage



Controlling Stormwater Runoff and Pollution

Many daily activities have the potential to cause stormwater pollution. Any situation where activities can contribute more pollutants to stormwater runoff is an area that should be considered for efforts to minimize stormwater impacts. A major component in reducing stormwater impacts involves planning up front in the design process. New construction designs should include plans to prevent or minimize the amount of runoff leaving the site. Wide streets, large cul-de-sacs, long driveways, and sidewalks lining both sides of the street are all features of urbanizing areas that create excess impervious cover and consume natural areas. In many instances, the

presence of intact riparian buffers and/or wetlands in urban areas can reduce the impacts of urban development. Establishment and protection of buffers should be considered where feasible, and the amount of impervious cover should be limited as much as possible.

"Good housekeeping" to reduce the volume of stormwater leaving a site and reducing the amount of pollutants used in our own backyards can also minimize the impact of stormwater runoff. DWQ has published a pamphlet entitled Improving Water Quality in Your Own Backyard: Stormwater Management Starts at Home. The pamphlet provides information on how homeowners and businesses can reduce the amount of runoff leaving their property and how to reduce the amount and types of pollutants in that runoff. This document is available on-line at ***http://h2o.enr.state.nc.us/nps/documents/BackyardPDF.pdf*** or by calling (919) 807-6305.

Preserving the natural streamside vegetation (riparian buffer) is one of the most economical and efficient BMPs. In particular, forested buffers provide a variety of benefits including filtering runoff and taking up nutrients, moderating water temperature, preventing erosion and loss of land, providing flood control and helping to moderate streamflow, and providing food and habitat for both aquatic and terrestrial wildlife (NCDENR-DWQ, 2004). For more information or to obtain a free copy of DWQ's Buffers for Clean Water brochure, call (919) 807-6305.

PROTECT HEADWATER STREAMS

FIGURE 7. DIAGRAM OF HEADWATER STREAMS WITHIN A WATERSHED BOUNDARY

Many streams in a given river basin are only small trickles of water that emerge from the ground. A larger stream is formed at the confluence of these trickles. This constant merging eventually forms a large stream or river. Most monitoring of fresh surface waters evaluates these larger streams. The many miles of small trickles, collectively known as headwaters, are not directly monitored and in many instances are not even indicated on maps (Figure 6). These streams account for approximately 80 percent of the stream network and provide many valuable services for quality and quantity of water delivered downstream (Meyer et al., 2003). However, degradation of headwater streams can (and does) impact the larger stream or river.

There are three types of headwater streams: 1) perennial (flow year-round); 2) intermittent (flow during wet seasons); and 3) ephemeral (flow only after precipitation events). All types of headwater streams provide benefits to larger streams and rivers. Headwater streams control flooding, recharges groundwater, maintain water quality, reduce downstream sedimentation, recycle nutrients, and create habitat for plants and animals (Meyer et al., 2003).

In smaller headwater streams, fish communities are not well developed and benthic macroinvertebrates dominate aquatic life. Benthic macroinvertebrates are often thought of as "fish food" and, in mid-sized streams and rivers, they are critical to a healthy fish community. However, these insects, both in larval and adult stages, are also food for small mammals, such as river otter and raccoons, birds and amphibians (Erman, 1996). Benthic macroinvertebrates in headwater streams also perform the important function of breaking down coarse organic matter, such as leaves and twigs, and releasing fine organic matter. In larger rivers, where coarse organic matter is not as abundant, this fine organic matter is a primary food source for benthic macroinvertebrates and other organisms in the system (CALFED, 1999). When the benthic macroinvertebrate community is changed or extinguished in an area, even temporarily, as occurs during land use changes, it can have repercussions in many parts of both the terrestrial and aquatic food web.

Headwater streams also provide a source of insects for repopulating downstream waters where benthic macroinvertebrate communities have been eliminated due to human alterations and pollution. Adult insects have short life spans and generally live in the riparian areas surrounding the streams from which they emerge (Erman, 1996). Because there is little upstream or stream-to-stream migration of benthic macroinvertebrates, once headwater populations are eliminated, there is little hope for restoring a functioning aquatic community. In addition to macroinvertebrates, these streams support diverse populations of plants and animals that face similar problems if streams are disturbed. Headwater streams are able to provide these important ecosystem services due to their unique locations, distinctive flow patterns, and small drainage areas.

Because of the small size of headwater streams, they are often overlooked during land use activities that impact water quality. All landowners can participate in the protection of headwaters by keeping small tributaries in mind when making land use management decisions on the areas they control. This includes activities such as retaining vegetated stream buffers, minimizing stream channel alterations, and excluding cattle from streams. Local rural and urban planning initiatives should also consider impacts to headwater streams when land is being developed. For a more detailed description of watershed hydrology and watershed management, refer to EPA's Watershed Academy website at ***http://www.epa.gov/OWOW/watershed/wacademy/acad2000/watershedmgt/principle1.html***.

REDUCE IMPACTS FROM STEEP SLOPE DISTURBANCE

Dramatic elevation changes and steep slopes define mountain topography. Building sites perched along mountainsides provide access to unparalleled vistas and are a major incentive for development. However, construction on steep slopes presents a variety of risks to the environment and human safety. This is of particular interest to communities in the northwestern portiong of the Yadkin-Pee Dee river basin, where second home development is increasing along mountain ridges.

Poorly controlled erosion and sediment from steep slope disturbance negatively impact water quality, hydrology, aquatic habitat, and can threaten human safety and welfare. Soil types, geology, weather patterns, natural slope, surrounding uses, historic uses, and other factors all contribute to unstable slopes. Steep slope disturbance usually involves some form of grading. Grading is the mechanical excavation and filling of natural slopes to produce a level working surface. Improper grading practices disrupt natural stormwater runoff patterns and result in poor drainage, high runoff velocities, and increased peak flows during storm events. There is an inherent element of instability in all slopes and those who choose to undertake grading and/or construction activities should be responsible for adequate site assessment, planning, designing, and construction of reasonably safe and stable artificial slopes.

In cases where construction activities occur on steep slopes, slope stabilization should be mandated through a Site Grading Plan and/or Site Fingerprinting. Site Grading Plans identify areas intended for grading and address impacts to existing drainage patterns. They identify practices to stabilize, maintain and protect slopes from runoff and include a schedule for grading disturbance as well as methods for disposal of borrow and fill materials. Site Fingerprinting is a low-impact development (LID) best management practice (BMP) that minimizes land disturbances. Fingerprinting involves clearing and grading only those onsite areas necessary for access and construction activities. Extensive clearing and grading accelerates sediment and pollutant transport off-site. Fingerprinting and maintenance of vegetated buffers during grading operations provide sediment control that reduces runoff and off-site sedimentation (Yaggi and Wegner, 2002).

Local communities also have a role in reducing impacts from steep slope development. These impacts can also be addressed through the implementation of city and/or county land use and sediment and erosion control plans. Land use plans are a non-regulatory approach to protect water quality, natural resources and sensitive areas. In the planning process, a community gathers data and public input to guide future development by establishing long-range goals for the local community over a ten- to twenty-year period. They can also help control the rate of development, growth patterns and conserve open space throughout the community. Land use plans examine the relationship between land uses and other areas of interest including quality-of-life, transportation, recreation, infrastructure and natural resource protection (Jolley, 2003).

Sediment and Erosion Control Plans are a regulatory approach to reducing the impacts of steep slope development and ensure that land disturbing activities do not result in water quality degradation, soil erosion, flooding, or harm to human health (i.e., landslides). The Division of Land Resources (DLR) Land Quality Section (LQS) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced during construction activities. Under the Sedimentation Pollution Control Act, cities and counties are given the option to adopt local ordinances that meet or exceed the minimum requirements established by the State. Local programs must be reviewed and approved by the NC Sedimentation Control Commission. Once approved, local staff performs plan reviews and enforces compliance. If for some reason the local program is not being enforced, the NC Sedimentation Control Commission may rescind delegation and the program be taken back by the State. Once the local government shows that they are able to carry out the responsibilities of a delegated program, they may request that delegation be reinstated by the NC Sedimentation Control Commission. The Sedimentation and Pollution Control Act as well as an example of a local ordinance can be found on the DLR website: ***http://www.dlr.enr.state.nc.us/pages/sedimentation_new.html***

The requirements outlined in the Sedimentation Pollution Control Act were designed to be implemented statewide and may not fully capture the needs of mountain communities. For example, only projects disturbing more than one-acre of land are required to produce a sediment and erosion control plan. Many small construction projects fall below this threshold. In steep mountainous terrain, even these small disturbances can produce an astounding volume of sediment runoff. DWQ strongly encourages local governments to adopt Sediment and Erosion Control ordinances that exceed the State's minimum requirements.

THE ROLE OF LOCAL GOVERNMENTS

REDUCING IMPACTS FROM EXISTING URBANIZATION

Below is a summary of management actions recommended for local authorities, followed by discussions on large, watershed management issues. These actions are necessary to address current sources of impairment and to prevent future degradation in all streams. The intent of these recommendations is to describe the types of actions necessary to improve stream conditions, not to specify particular administrative or institutional mechanisms for implementing remedial practices. Those types of decisions must be made at the local level. Because of uncertainties regarding how individual remedial actions cumulatively impact stream conditions and in how aquatic organisms will respond to improvements, the intensity of management effort necessary to bring about a particular degree of biological improvement cannot be established in advance. The types of actions needed to improve biological conditions can be identified, but the mix of activities that will be necessary – and the extent of improvement that will be attainable – will only become apparent over time as an adaptive management approach is implemented. Management actions are suggested below to address individual problems, but many of these actions are interrelated (NCDENR-DWQ, 2003).

Actions one through five are important to restoring and sustaining aquatic communities in watersheds, with the first three recommendations being the most important.

(1) **Feasible and cost-effective stormwater retrofit projects should be implemented throughout the watershed to mitigate the hydrologic effects of development** (e.g., increased stormwater volumes and increased frequency and duration of erosive and scouring flows). This should be viewed as a long-term process. Although there are many uncertainties, costs in the range of $1 million per square mile can probably be anticipated.

   (a) Over the short term, currently feasible retrofit projects should be identified and implemented.
   (b) In the long term, additional retrofit opportunities should be implemented in conjunction with infrastructure improvements and redevelopment of existing developed areas.
   (c) Grant funds for these retrofit projects may be available from EPA initiatives, such as EPA Section 319 funds, or the North Carolina Clean Water Management Trust Fund.

(2) **A watershed scale strategy to address toxic inputs should be developed and implemented, including a variety of source reduction and stormwater treatment methods.** As an initial framework for planning toxicity reduction efforts, the following general approach is proposed:

   (a) Implementation of available best management practice (BMP) opportunities for control of stormwater volume and velocities. As recommended above to improve aquatic habitat potential, these BMPs will also remove toxics from stormwater.
   (b) Development of a stormwater and dry weather sampling strategy in order to facilitate the targeting of pollutant removal and source reduction practices.
   (c) Implementation of stormwater treatment BMPs, aimed primarily at pollutant removal, at appropriate locations.
   (d) Development and implementation of a broad set of source reduction activities focused on: reducing non-storm inputs of toxics; reducing pollutants available for runoff during storms; and managing water to reduce storm runoff.

(3) **Stream channel restoration activities should be implemented in target areas, in conjunction with stormwater retrofit BMPs, in order to improve aquatic habitat.** Before beginning stream channel restoration, a geomorphologic survey should be conducted to determine the best areas for stream channel restoration. Additionally, it would be advantageous to implement retrofit BMPs before embarking on stream

channel restoration, as restoration is best designed for flows driven by reduced stormwater runoff. Costs of approximately $200 per foot of channel should be anticipated (Haupt, et al., 2002 and Weinkam, 2001). Grant funds for these retrofit projects may be available from federal sources, such as EPA Section 319 funds, or state sources including North Carolina Clean Water Management Trust Fund.

(4) Actions recommended above (e.g., stormwater quantity and quality retrofit BMPs) are likely to reduce nutrient/organic loading, and to some extent, its impacts. Activities recommended to address this loading include the identification and elimination of illicit discharges; education of homeowners, commercial applicators, and others regarding proper fertilizer use; street sweeping; catch basin clean-out practices; and the installation of additional BMPs targeting biological oxygen demand (BOD) and nutrient removal at appropriate sites.

(5) Prevention of further channel erosion and habitat degradation will require effective post-construction stormwater management for all new development in the study area.

(6) Effective enforcement of sediment and erosion control regulations will be essential to the prevention of additional sediment inputs from construction activities. Development of improved erosion and sediment control practices may also be beneficial.

(7) Watershed education programs should be implemented and continued by local governments with the goal of reducing current stream damage and preventing future degradation. At a minimum, the program should include elements to address the following issues:

(a) Redirecting downspouts to pervious areas rather than routing these flows to driveways or gutters;
(b) Protecting existing woody riparian areas on all streams;
(c) Replanting native riparian vegetation on stream channels where such vegetation is absent; and
(d) Reducing and properly managing pesticide and fertilizer use.

REDUCING IMPACTS OF FUTURE URBANIZATION

Proactive planning efforts at the local level are needed to assure that urbanization is done in a manner that maintains water quality. These planning efforts will need to find a balance between water quality protection, natural resource management, and economic growth. Managing population growth requires planning for the needs of increased population, as well as developing and enforcing environmental protection measures. These actions are critical to water quality management and the quality of life for the residents of the basin. Public education is also needed in the Savannah River basin so that citizens can learn and understand the value of urban planning and stormwater management.

Streams in areas adjacent to high growth areas of the basin are at a high risk of loosing healthy aquatic communities. These biological communities are important to maintaining the ecological integrity in the Savannah River basin. Unimpacted streams are important sources of benthic macroinvertebrates and fish for reestablishment of biological communities in nearby streams that are recovering from past impacts or are being restored.

To prevent further impairment to aquatic life in streams in urbanizing watersheds local governments should:
(1) Identify waters that are threatened by construction activities.
(2) Protect existing riparian habitat along streams.
(3) Implement stormwater BMPs during and after construction.
(4) Develop land use plans that minimize disturbance in sensitive areas of watersheds.
(5) Minimize impervious surfaces including roads and parking lots.
(6) Develop public outreach programs to educate citizens about stormwater runoff.
(7) Enact a Stormwater Control Ordinance. EPA offers a model ordinance at: ***http://www.epa.gov/nps/ordinance/stormwater.htm***

For more detailed information regarding recommendations for new development found in the text box, refer to EPA's website at www.epa.gov/owow/watershed/wacademy/acad2000/protection, the Center for Watershed Protection website at www.cwp.org, and the Low Impact Development Center website at ***www.lowimpactdevelopment.org***. For an example of local community planning effort to reduce stormwater runoff, visit ***http://www.charmeck.org/Home.htm***.

THE ROLE OF HOMEOWNERS AND LANDOWNERS

TEN SIMPLE STEPS TO REDUCE POLLUTION FROM INDIVIDUAL HOMES

1. To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns.
2. Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose.
3. Instead of disposing of yard waste, use the materials to start a compost pile.
4. Learn to use Integrated Pest Management (IPM) in the garden and on the lawn to reduce dependence on harmful pesticides.
5. Pick up after pets.
6. Use, store, and dispose of chemicals properly.
7. Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed.
8. Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff.
9. Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.
10. Support local government watershed planning efforts and ordinance development.

Table 1. County Population Growth Projections 2000-2030

COUNTY	% of County in Basin	2000	Estimated Population 2010	% Change `00 -`10	Estimated Population 2020	% Change `10 -`20	Estimated Population 2030	% Change `20 -`30	% Change `00 -'30
ALEXANDER	32	33,609	37,839	13	41,509	10	44,976	8	34
ALLEGHANY	9	10,680	11,320	6	11,869	5	12,266	3	15
ANSON	100	25,275	24,729	-2	24,303	-2	23,748	-2	-6
ASHE	1	24,384	26,808	10	28,450	6	29,780	5	22
CABARRUS	100	131,030	176,774	35	221,997	26	271,194	22	107
CALDWELL	25	77,710	81,057	4	83,830	3	85,966	3	11
DAVIDSON	100	147,269	160,499	9	175,834	10	191,080	9	30
DAVIE	100	34,835	43,165	24	50,846	18	58,682	15	68
FORSYTH	76	306,044	350,784	15	394,528	12	439,967	12	44
GUILFORD	1	421,048	474,605	13	533,495	12	593,830	11	41
IREDELL	78	122,664	161,561	32	198,632	23	237,564	20	94
MECKLENBURG	26	695,427	925,084	33	1,151,640	24	1,391,703	21	100
MONTGOMERY	88	26,836	28,222	5	30,299	7	32,486	7	21
RANDOLPH	44	130,470	144,643	11	162,178	12	180,076	11	38
RICHMOND	81	46,551	47,046	1	47,019	0	46,757	-1	0
ROWAN	100	130,348	138,931	7	152,160	10	165,647	9	27
SCOTLAND	1	35,998	37,569	4	37,670	0	37,392	-1	4
STANLY	100	58,100	60,134	4	63,401	5	66,247	4	14
STOKES	15	44,707	47,515	6	51,279	8	54,723	7	22
SURRY	97	71,227	74,629	5	79,594	7	84,859	7	19
UNION	75	123,738	203,527	64	274,147	35	350,928	28	184
WATAUGA	17	42,693	44,433	4	45,984	3	46,866	2	10
WILKES	100	65,624	67,778	3	70,564	4	72,983	3	11
YADKIN	100	36,348	39,341	8	43,234	10	47,243	9	30
Total		2,842,615	3,407,993		3,974,462		4,566,963		61

Table 2: Yadkin-Pee Dee Basin Municipal Populations

Municipality	County	Apr-00	Jul-05	% Change
ALBEMARLE	STANLY	15,680	15,645	-0.2
ANSONVILLE	ANSON	636	624	-1.9
ARCHDALE	GUILFORD, RANDOLPH	9,007	9,472	5.2
ASHEBORO	RANDOLPH	21,672	23,213	7.1
BADIN	STANLY	1,154	1,964	70.2
BERMUDA RUN	DAVIE	1,431	1,504	5.1
BETHANIA	FORSYTH	354	372	5.1
BISCOE	MONTGOMERY	1,700	1,752	3.1
BLOWING ROCK	CALDWELL, WATAUGA	1,418	1,427	0.6
BOONVILLE	YADKIN	1,138	1,153	1.3
CANDOR	MONTGOMERY	825	841	1.9
CHARLOTTE	MECKLENBURG	540,167	640,270	18.5
CHINA GROVE	ROWAN	3,616	4,219	16.7
CLEMMONS	FORSYTH	13,827	17,234	24.6
CLEVELAND	ROWAN	808	817	1.1
CONCORD	CABARRUS	55,977	63,429	13.3
COOLEEMEE	DAVIE	905	951	5.1
CORNELIUS	MECKLENBURG	11,969	16,856	40.8
DAVIDSON	IREDELL, MECKLENBURG	7,139	8,162	14.3
DENTON	DAVIDSON	1,450	1,694	16.8
DOBBINS HEIGHTS	RICHMOND	936	898	-4.1
DOBSON	SURRY	1,457	1,497	2.7
EAST BEND	YADKIN	659	667	1.2
EAST SPENCER	ROWAN	1,755	1,700	-3.1
ELKIN	SURRY, WILKES	4,109	4,175	1.6
ELLERBE	RICHMOND	1,021	991	-2.9
FAITH	ROWAN	695	703	1.2
GRANITE QUARRY	ROWAN	2,175	2,252	3.5
HAMLET	RICHMOND	6,018	5,837	-3.0
HARMONY	IREDELL	526	573	8.9
HARRISBURG	CABARRUS	4,493	5,451	21.3
HEMBY BRIDGE	UNION	1,414	1,704	20.5
HIGH POINT	DAVIDSON, FORSYTH, GUILFORD, RANDOLPH	85,839	92,491	7.7
HOFFMAN	RICHMOND	624	662	6.1
HUNTERSVILLE	MECKLENBURG	24,960	31,646	26.8
INDIAN TRAIL	UNION	11,749	22,030	87.5
JONESVILLE	YADKIN	2,259	2,255	-0.2
KANNAPOLIS	CABARRUS, ROWAN	36,910	40,139	8.7
KERNERSVILLE	FORSYTH, GUILFORD	17,126	21,277	24.2
KING	FORSYTH, STOKES	5,952	6,206	4.3
LAKE PARK	UNION	2,093	2,840	35.7
LANDIS	ROWAN	2,996	3,036	1.3
LEWISVILLE	FORSYTH	8,826	12,852	45.6
LEXINGTON	DAVIDSON	19,953	20,918	4.8

Municipality	County	Apr-00	Jul-05	% Change
LILESVILLE	ANSON	459	447	-2.6
LOCUST	CABARRUS, STANLY	2,416	2,790	15.5
LOVE VALLEY	IREDELL	30	50	66.7
MARSHVILLE	UNION	2,360	2,762	17.0
MATTHEWS	MECKLENBURG	22,125	25,442	15.0
MINT HILL	MECKLENBURG	15,609	18,804	20.5
MOCKSVILLE	DAVIE	4,178	4,454	6.6
MONROE	UNION	26,228	32,454	23.7
MOORESVILLE	IREDELL	18,823	23,125	22.9
MORVEN	ANSON	579	567	-2.1
MOUNT AIRY	SURRY	8,484	8,579	1.1
MOUNT GILEAD	MONTGOMERY	1,389	1,396	0.5
MOUNT PLEASANT	CABARRUS	1,259	1,417	12.5
NEW LONDON	STANLY	326	604	85.3
NORMAN	RICHMOND	72	74	2.8
NORTH WILKESBORO	WILKES	4,116	4,168	1.3
NORWOOD	STANLY	2,216	2,858	29.0
OAKBORO	STANLY	1,198	1,153	-3.8
PEACHLAND	ANSON	554	578	4.3
PILOT MOUNTAIN	SURRY	1,281	1,293	0.9
POLKTON	ANSON	1,916	2,910	51.9
RANDLEMAN	RICHMOND	3,557	4,088	14.9
RICHFIELD	STANLY	515	512	-0.6
ROCKINGHAM	RICHMOND	9,672	9,484	-1.9
ROCKWELL	ROWAN	1,971	1,998	1.4
RONDA	WILKES	460	476	3.5
RURAL HALL	FORSYTH	2,464	2,566	4.1
SALISBURY	ROWAN	26,462	29,058	9.8
SEAGROVE	RANDOLPH	246	252	2.4
SPENCER	ROWAN	3,355	3,394	1.2
STALLINGS	UNION	3,171	9,508	199.8
STANFIELD	STANLY	1,113	1,277	14.7
STAR	MONTGOMERY	807	811	0.5
STATESVILLE	IREDELL	23,320	25,344	8.7
TAYLORSVILLE	ALEXANDER	1,813	1,924	6.1
THOMASVILLE	DAVIDSON, RANDOLPH	19,788	26,084	31.8
TOBACCOVILLE	FORSYTH, STOKES	2,209	2,501	13.2
TRINITY	RANDOLPH	6,714	6,880	2.5
TROUTMAN	IREDELL	1,592	1,700	6.8
TROY	MONTGOMERY	3,430	4,103	19.6
UNIONVILLE	UNION	4,797	6,617	37.9
WADESBORO	ANSON	3,568	5,617	57.4
WALKERTOWN	FORSYTH	4,009	4,599	14.7
WILKESBORO	WILKES	3,159	3,178	0.6
WINGATE	UNION	2,406	3,706	54.0

Municipality	County	Apr-00	Jul-05	% Change
WINSTON-SALEM	FORSYTH	185,776	198,593	6.9
YADKINVILLE	YADKIN	2,818	2,809	-0.3

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Source Water Assessment Program

OVERVIEW

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendments require that states develop and implement a SWAP to:

- Delineate source water assessment areas;
- Inventory potential contaminants in these areas; and
- Determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled North Carolina's Source Water Assessment Program Plan, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website at ***http://www.deh.enr.state.nc.us/pws/index.htm***.

Delineation of Source Water Assessment Areas

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

Wellhead Protection (WHP) Program

North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found at ***http://www.deh.enr.state.nc.us/pws/swap***.

Water Supply Watershed Protection (WSWP) Program

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at ***http://h2o.enr.state.nc.us/wswp/index.html***.

Susceptibility Determination - North Carolina's Overall Approach

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

Overall Susceptibility Rating

The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined "susceptible", a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

Inherent Vulnerability Rating

Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (i.e., turbidity and total coliform) and watershed characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).
Contaminant Rating

The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

Inventory of Potential Contaminant Sources (PCSs)

In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

Source Water Protection

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- Fact sheets outlining sources of funding and other resources for local SWP efforts.
- Success stories describing local SWP efforts in North Carolina.
- Guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found at ***http://www.deh.enr.state.nc.us/pws/swap***.

Public Water Supply Susceptibility Determination in the Yadkin-Pee Dee River Basin

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. A second round of assessments was completed in April 2005. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the "NCSWAP Info" icon on the ***PWS web page***. To view a report, select the PWS System of interest by clicking on the "SWAP Reports" icon.

In the Yadkin River Basin, 1,265 public water supply sources were identified. Forty-nine are surface water sources and 1,216 are groundwater sources. Of the 1,216 groundwater sources, 28 of them have a Higher, 1,182 have a Moderate and 4 have a Lower susceptibility rating. Table 1 identifies the surface water source and its overall susceptibility rating. It is

important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply's potential to become contaminated by the identified PCSs within the assessment area.

Table 10-1: SWAP Results for Surface Water Sources in the Yadkin Pee Dee River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
113010	H	L	M	LAKE FISHER/	CONCORD, CITY OF
				COLDWATER CRK	
113010	M	L	M	LAKE CONCORD/	CONCORD, CITY OF
				COLDWATER CR	
113010	M	L	M	LAKE DON T HOWELL	CONCORD, CITY OF
113020	M	L	M	BLACK RUN CRK RESERVIOR	MOUNT PLEASANT, TOWN OF(WSACC)
113020	H	L	M	DUTCH BUFFALO CREEK	MOUNT PLEASANT, TOWN OF(WSACC)
102015	H	L	M	S YADKIN RIVER	ENERGY UNITED WATER CORP
180065	M	L	M	CODDLE CREEK	KANNAPOLIS, CITY OF
180065	H	L	M	SECOND CREEK/BACK CREEK	KANNAPOLIS, CITY OF
190010	M	M	M	LAKE TWITTY	MONROE, CITY OF
184010	H	M	H	NARROWS RESERVOIR/ BADIN L	ALBEMARLE, CITY OF
184010	H	M	H	TUCKERTOWN RESERVOIR	ALBEMARLE, CITY OF
184015	H	H	H	LAKE TILLERY	NORWOOD, TOWN OF
197010	H	M	H	REDDIES RIVER	NORTH WILKESBORO, TOWN OF
197025	H	L	M	YADKIN RIVER	WILKESBORO, TOWN OF
229020	M	M	M	TOM-A-LEX LAKE	THOMASVILLE, CITY OF
229025	H	M	H	YADKIN RIVER	DAVIDSON WATER INC
229030	H	M	H	YADKIN RIVER	DENTON, TOWN OF
230010	H	M	H	HUNTING CREEK	MOCKSVILLE, TOWN OF
230015	H	M	H	SOUTH YADKIN RIVER	DAVIE COUNTY WATER SYSTEM
230015	H	M	H	YADKIN RIVER	DAVIE COUNTY WATER SYSTEM
234010	M	H	H	SALEM LAKE	WINSTON-SALEM, CITY OF
234010	H	M	H	YADKIN RIVER (IDOLS DAM)	WINSTON-SALEM, CITY OF
229010	M	M	M	THOM-A-LEX LAKE	LEXINGTON, TOWN OF
229010	H	H	H	ABBOTTS CREEK	LEXINGTON, TOWN OF
229010	M	L	M	CITY LAKE	LEXINGTON, TOWN OF
276010	M	M	M	LAKE LUCAS	ASHEBORO, CITY OF
276010	M	H	H	LAKE REESE	ASHEBORO, CITY OF
276010	M	L	M	LAKE BUNCH	ASHEBORO, CITY OF
285010	H	M	H	YADKIN RIVER	KING, CITY OF
286010	H	L	M	STEWARTS CREEK	MOUNT AIRY, CITY OF
286010	H	L	M	LOVILLS CREEK	MOUNT AIRY, CITY OF
286020	H	L	M	BIG ELKIN CRK	ELKIN, TOWN OF
286025	M	L	M	TOMS CREEK	PILOT MOUNTAIN, TOWN OF
286030	M	L	M	FISHER RIVER	DOBSON, TOWN OF
299010	H	M	H	YADKIN RIVER	JONESVILLE, TOWN OF
299015	H	L	M	SOUTH DEEP CREEK	YADKINVILLE, TOWN OF

Table 10-1: SWAP Results for Surface Water Sources in the Yadkin Pee Dee River Basin

PWS ID Number	Inherent Vulnerability Rating	Contaminant Rating	Overall Susceptibility Rating	Name of Surface Water Source	PWS Name
304010	H	L	M	PEE DEE RIVER	ANSON COUNTY WATER SYSTEM
304020	M	L	M	CITY LAKE	WADESBORO, TOWN OF
362010	M	H	H	LAKE TILLERY	MONTGOMERY COUNTY WATER SYSTEM
377010	M	L	M	WATER LAKE	HAMLET WATER SYSTEM
377015	M	L	M	ROBERDEL LAKE	ROCKINGHAM, CITY OF
377015	M	L	M	CITY LAKE	ROCKINGHAM, CITY OF
377109	H	L	M	PEE DEE RIVER	RICHMOND COUNTY WATER SYSTEM
149010	H	L	M	SOUTH FORK YADKIN RIVER	STATESVILLE, CITY OF
180010	H	L	M	YADKIN RIVER	SALISBURY, CITY OF
180038	M	L	M	LAKE CORRIHER	LANDIS, TOWN OF
180038	M	L	M	LAKE WRIGHT	LANDIS, TOWN OF
180065	M	L	M	KANNAPOLIS LAKE	KANNAPOLIS, CITY OF

Yadkin-Pee Dee River Basin Association

Overview

The ***NPDES Discharge Monitoring Coalition Program*** was developed by DWQ to utilize NPDES instream monitoring requirements to create an effective program for assessing water quality within a watershed context. Participating permit holders voluntarily develop a monitoring program with the DWQ that is designed to evaluate coalition interests and watershed specific issues. In order to better utilize the resources spent by NPDES permittees, the monitoring locations are coordinated with the State's existing ambient and biological monitoring networks. This integrated management of monitoring resources reduces duplication and provides a more complete picture of watershed conditions. Coalition coordinators within DWQ are able to facilitate the collection of water quality data at two hundred sixty-nine monitoring locations on a monthly basis. The coalition program substantially increases the data resources available to the State for making basin-wide water quality management decisions. The Yadkin- Pee Dee River Basin Association (***YPDRBA***) was formed in 1998 and now consists of 39 permitted facilities. The following is a description of their operational plan.

Vision

To play a leading role in the overall enhancement of water quality throughout the Yadkin-Pee Dee River basin to a plateau that places the river among those of the highest quality in the United States.

Mission

Pool financial resources and expertise of private and public organizations and individuals to monitor the water quality of the Yadkin-Pee Dee River Basin and to evaluate, recommend, and assist with implementation of management strategies that will reduce, control, and/or manage pollutant discharge into the basin to preserve the basin as a major source of water supply.

To preserve the waters of the Yadkin-Pee Dee River as a major source of water supply by:

1. Pooling financial resources and expertise;
2. Collecting and analyzing information and data and developing, evaluating and implementing strategies in and effort to reduce, control and manage pollutant discharge;
3. Providing technical, management, regulatory and legal recommendations regarding the implementation of strategies and appropriate effluent limitations on discharges into the Yadkin-Pee Dee River.

Strategies

1. Maintain a financially sound, cost-effective and goal-oriented organization
2. Develop, implement, and maintain a comprehensive program of in-stream water quality monitoring
3. Be and advocate/resource for point-source dischargers, providing them with available Association resources necessary to meet water quality standards
4. Communicate plans and accomplishments with the public, government agencies and other interested parties
5. Utilize funding from various sources, including State and Federal grants, to improve and protect water quality throughout the basin
6. Endeavor to influence legislation affecting the water quality of the Yadkin-Pee Dee River Basin in a manner that is both beneficial to dischargers and the environment
7. Encourage and promote Association Growth through membership recruitment, education and referral

Projects

The YPDRBA monitors water quality at 71 stations throughout the Yadkin-Pee Dee River basin. In addition, they are the lead organization for a stream restoration project on ***Grants Creek*** and are assisting with the High Rock Lake TMDL development and coordination. To support this TMDL, the Association is collecting data to support chlorophyll a and turbidity modeling.

For additional information about the YPDRBA in general, including its various program activities and products, visit ***http://www.yadkinpeedee.org***.

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Ecosystem Enhancement Program

OVERVIEW

The North Carolina Ecosystem Enhancement Program (NCEEP) is responsible for providing ecologically effective compensatory mitigation in advance of permitted impacts associated with road projects and other development activities. The fundamental mission of the program is to restore, enhance and protect key watershed functions in the 17 river basins across the state. This is accomplished through the implementation of wetland, stream and riparian buffer projects within selected local watersheds. The vital watershed functions that NCEEP seeks to restore and protect include water quality, floodwater conveyance and storage, fisheries and wildlife habitat.

The NCEEP is not a grant program, but can implement its restoration projects cooperatively with other state or federal programs such as the Section 319 Program. Combining NCEEP-funded restoration or preservation projects with 319 or other local watershed initiatives (e.g., those funded through the Clean Water Management Trust Fund or local/regional Land Trusts) increases the potential to improve the water quality, hydrologic and habitat functions within selected watersheds.

Watershed Planning by NCEEP

The selection of optimal sites for NCEEP mitigation projects is founded on a basinwide and local watershed planning approach that results, respectively, in the development of River Basin Restoration Priorities and Local Watershed Plans.

River Basin Restoration Planning

In developing River Basin Restoration Priorities (RBRP) (formerly called Watershed Restoration Plans), the NCEEP identifies local watersheds with the greatest need and opportunity for restoration, enhancement or preservation projects. These high-priority watersheds are called "Targeted Local Watersheds" (TLWs). Targeted Local Watersheds are identified, in part, using information compiled by DWQ's programmatic activities (e.g., Basinwide Assessment Reports). Local factors considered in the selection of TLWs include: water quality impairment, habitat degradation, the presence of critical habitat or significant natural heritage areas, the presence of water supply watersheds or other high-quality waters, the status of riparian buffers, estimates of impervious cover, existing or planned transportation projects, and the opportunity for local partnerships. Recommendations from local resource agency professionals and the presence of existing or planned watershed projects are given significant weight in the selection of TLWs. Targeted local watersheds represent those areas within a river basin where NCEEP resources can be focused for maximum benefit to local watershed functions. TLWs are therefore given priority by NCEEP for the implementation of new stream and wetland restoration/enhancement or preservation projects.

The 2003 Watershed Restoration Plan for the Yadkin-Pee Dee basin can be found on the NCEEP website at ***http://www.nceep.net/services/restplans/watershedplans.html***. The NCEEP is currently updating its selections of Targeted Local Watersheds within the Yadkin- Pee Dee basin. NCEEP Planning staff will be finalizing TLW selections by the end of 2008. The updated TLW information for the Yadkin- Pee Dee basin will be made available on the NCEEP website by early 2009.

Local Watershed Planning

In addition to river basin restoration planning, NCEEP also develops Local Watershed Plans (LWPs), usually within targeted local watersheds identified in the RBRPs. Through the local watershed planning process, NCEEP conducts watershed characterization and field assessment tasks to identify critical stressors in local watersheds. The NCEEP

planners and their consultants coordinate with local resource professionals and local governments to identify optimal watershed projects and management strategies to address the major functional stressors identified. The LWPs prioritize restoration/enhancement projects, preservation sites, and best management practices (BMP) projects that will provide water quality improvement, habitat protection and other environmental benefits to the local watershed.

NCEEP planners make decisions regarding the possible need for new LWP initiatives within a given basin annually. These decisions are based primarily on the quantity and type of compensatory mitigation projects the Program is required to implement, as well as the opportunity for local partnerships within selected 14-digit hydrologic units within the basin. NCEEP has initiated a new Local Watershed Planning effort in the lower Yadkin, Catalog Unit (CU) 03040105, focusing on the identification of stream and wetland restoration, enhancement and preservation projects within the Goose and Crooked Creek watersheds. Goose and Crooked Creeks are located within Mecklenburg and Union Counties, southeast of the City of Charlotte. Stakeholder kick-off for this plan took place in July 2008 and Phase I efforts are expected to continue through late 2008 or early 2009. For more information on this LWP, see the online factsheet at ***http://www.nceep.net/services/lwps/Goose_Crooked/Goose_Crooked_1_07.pdf*** (Goose and Crooked Creek Local Watershed Plan) or contact NCEEP Planner Anjie Ackerman at (919) 715-1950 or via email at anjie.ackerman@ncmail.net.

NCEEP also initiated a new Local Watershed Planning effort in the upper Yadkin (CU 03040101) in the spring of 2008, focusing on the identification of stream restoration/enhancement and preservation projects within the Ararat River drainage in eastern Surry County. This is designed as a "fast track" planning effort, to be completed by July of 2009. Local stakeholder meetings are scheduled for October 2008, February 2009 and June 2009. For more information on this LWP, see the online factsheet at ***http://www.nceep.net/services/lwps/fact_sheet_list.htm*** (Ararat River and Upper Yadkin LWP) or contact NCEEP Planner Hal Bryson at (828) 450-9408 or via email at hal.bryson@ncmail.net.

NCEEP has completed previous LWP initiatives in the Yadkin-Pee Dee basin including the Kerr Scott Reservoir LWP in the northwest area of the basin and the Upper Rocky River LWP in the central area of the basin to the east of the City of Charlotte. In addition, there are two LWP initiatives that are currently on hold due to lack of current mitigation need; these are the Mountain/Little Mountain Creeks LWP and the Upper Uwharrie LWP.

For further information on NCEEP LWPs please visit the NCEEP factsheets located online at ***http://www.nceep.net/services/lwps/localplans.htm***.

NCEEP PROJECTS IN THE YADKIN-PEE DEE BASIN

As of summer 2008, a total of 89 NCEEP mitigation projects have been implemented within the Yadkin basin. Implemented projects include stream and wetland restoration/enhancement and preservation projects that are in one of three stages: design; construction; or monitoring (construction complete). The 89 NCEEP projects in this river basin include 11 projects under construction and 32 in monitoring. Of these 89 projects, 18 have been acquired through NCEEP's full delivery mitigation program.

Table 1: EEP Mitigation Project in the Yadkin-Pee Dee River Basin by County

County	Number of Projects	County	Number of Projects	County	Number of Projects	County	Number of Projects
Anson	6	Forsyth	3	Richmond	4	Wilkes	7
Cabarrus	8	Iredell	6	Rowan	5	Yadkin	3
Caldwell	1	Mecklenburg	5	Stanly	3		
Davidson	2	Montgomery	8	Surry	5		
Davie	3	Randolph	10	Union	10		

For more information on NCEEP mitigation projects in the Yadkin-Pee Dee River basin, contact Mike McDonald (western regional supervisor) at (828) 231-7912, or Deborah Amaral (central regional supervisor) at (919) 715-3466.

For additional information about NCEEP's Project Implementation efforts, go to:
http://www.nceep.net/services/implementation/project_implementation.htm.

For additional information about NCEEP in general, including its various program activities and products, visit ***http://www.nceep.net/***.

Forestry & Water Quality

North Carolina Department of Environment and Natural Resources

Division of Forest Resources

Forestry and Water Quality Impacts Overview

Forests are an ideal land use for water quality protection because they stabilize soil and filter stormwater runoff from adjoining, non-forested areas. In order to sustain a forest's ability to protect water quality, some degree of management is often required. Timber harvesting is part of the forest renewal cycle and is usually the most intensive forest management activity that requires special attention to assure water quality is protected. Inappropriate management practices can impact water quality by destabilizing streambanks, reducing riparian vegetation and removing tree canopies. Any one of these impacts can alter the interface of the aquatic and terrestrial ecosystem, influence downstream flooding and change watershed functions. Sedimentation is the most common water pollution agent that may result from forestry activities. Potential sources of sedimentation include stream crossings, forest roads, skid trails and log decks. As a result, the majority of regulations and erosion control recommendations pertaining to forestry focus on these four main areas.

Forestland Ownership*

Individuals privately own approximately 91 percent of the forestland in the basin. The remaining forestland ownership is split fairly evenly between forest industry and public agencies. Notable public forestland areas in the basin include:

- The 3,000-acre Rendezvous Mountain Educational State Forest in Wilkes County, managed by the N.C. Division of Forest Resources;
- A sizable portion of the Uwharrie National Forest, managed by the U.S. Forest Service;
- Stone Mountain, Pilot Mountain, and Morrow Mountain State Parks;
- Pee Dee National Wildlife Refuge, managed by the U.S. Fish & Wildlife Service.

* The ownership estimates come from the most recent data published by the USDA-Forest Service ("Forest Statistics for North Carolina, 2002." Brown, Mark J. Southern Research Station Resource Bulletin SRS-88. January 2004).

Forest Practices Guidelines Related to Water Quality (FPGs)

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (GS Ch.113A Art.4 referred to as "SPCA"). However, forestry operations may be exempted from the permit and plan requirements of the SPCA, if the operations meet the compliance standards outlined in the Forest Practices Guidelines Related to Water Quality (15A NCAC 1I .0100 - .0209, referred to as "FPGs") and General Statutes regarding stream and ditch obstructions (GS 77-13 and GS 77-14).

The North Carolina Division of Forest Resources (DFR) is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the DFR works to resolve identified FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by the DFR are referred to the appropriate State agency for enforcement action

During the period September 1, 2001 through August 31, 2006, the DFR conducted 3,572 FPG inspections of forestry-related activities in the basin; 95% of the sites inspected were in compliance.

Other Water Quality Regulations

In addition to the State regulations noted above, DFR monitors the implementation of the following Federal rules relating to water quality and forestry operations:

- The Section 404 silviculture exemption under the Clean Water Act
- The federally mandated 15 best management practices (BMPs) related to road construction in wetlands
- The federally mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S.

Water Quality Foresters

In 2005, the DFR received three new Water Quality Forester positions; two of these positions are assigned to areas within the Yadkin/Pee-Dee basin, thereby completing full coverage of this basin by Water Quality Foresters. Statewide, the DFR currently has a Water Quality Forester position in ten of its thirteen Districts. Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry. These foresters also assist County Rangers on follow-up site inspections and provide enhanced technical assistance to local DFR staff.

Forestry Best Management Practices

Implementing forestry Best Management Practices (BMPs) is strongly encouraged to efficiently and effectively protect the water resources of North Carolina. In 2006, the first ever revision to the North Carolina forestry Best Management Practices (BMP) manual was completed. This comprehensive update to the forestry BMP manual is the result of nearly four years of effort by the DFR and a DENR-appointed Technical Advisory Committee consisting of multiple sector stakeholders, supported by two technical peer-reviews. The forestry BMP manual describes recommended techniques that may be used to help comply with the forestry regulations while protecting water quality. Copies of the new forestry BMP manual can be obtained at DFR's County Ranger or District Forester offices statewide. The new manual is also available at ***www.dfr.state.nc.us***.

In the Yadkin Pee Dee River basin during this reporting period, the DFR assisted or observed over 5,800 forestry activities in which BMPs were either implemented or recommended over an area amounting to nearly 252,000 acres.

From March 2000 through March 2003, the DFR conducted a statewide BMP Implementation Survey on 565 active forest harvest operations to evaluate the usage of forestry BMPs. This survey evaluated 76 sites in the Yadkin/Pee-Dee basin, with a resulting BMP implementation rate of 83%. The problems most often cited in this survey across the state relate to stream crossings, skid trails and site rehabilitation. This survey, and subsequent surveys to be conducted, will serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP implementation and training.

Christmas Tree Production & Vineyards

It should be noted that the DFR does not oversee regulations or activities relating to timber and land clearing for Christmas tree production or winery vineyards. These activities are not recognized as forestry ("silviculture") activities. Generally, these types of land-use practices are deemed to be an agricultural or horticultural activity. County Soil & Water Conservation District or USDA-Natural Resources Conservation Service (NRCS) staff can provide BMP assistance for these activities. Significant sedimentation problems can be reported to the N.C. Division of Land Resources' Complaint Hotline: 1-866-STOPMUD.

Protecting Stream Crossings with Bridgemats

The DFR provides bridgemats on loan to loggers for establishing temporary stream crossings during harvest activities in an effort to educate loggers about the benefits of installing crossings in this manner. Temporary bridges can be a very effective solution for stream crossings, since the equipment and logs stay completely clear of the water channel. Starting in 2005, the DFR's District Offices across the entire Yadkin/Pee-Dee river basin have had bridgemats available for loan-out. Statewide, there have been over 200 loan-events between 2000 and 2006, which have protected 261 stream crossings.

Forest Management

At least 75,000 acres of land were established or regenerated with forest trees across the basin from September 1, 2001 through August 31, 2006. Of these acres, approximately 75% were Loblolly Pine, 5% White Pine, and the remaining mostly in hardwoods or mixed pine/hardwood. During this same time period the DFR provided over 6,700 individual forest plans for landowners that encompassed nearly 375,000 acres in the basin.

Forest Products Industry

Forest industry manufacturing is a significant economic driver across North Carolina, contributing nearly $18 billion annually to the state's gross economic product. This is especially true within the Yadkin/Pee-Dee basin, with the associated demand for raw materials promoting the sustainability of managed forestlands across the basin area.

Forty-seven (47) different businesses in the basin are directly related to the manufacture of forest products, including several of the larger-scale facilities found in North Carolina. Some examples include mills that produce lumber, wood chips, veneer, structural panels, posts or pallets. In addition to the direct and in-direct economic benefits of employment from these facilities, these manufacturers pay an assessment to the state based upon the volume of timber they utilize. The payments from these assessments are combined with annual legislative budget appropriations to fund the "Forest Development Program" (FDP), which provides cost-shared forest management and regeneration assistance to forest landowners in North Carolina.

Stream & Watershed Restoration

A multi-year stream and watershed restoration project got underway during 2005 on Purlear Creek in Wilkes County at Rendezvous Mountain Educational State Forest. Purlear Creek is within thewatershed of the W. Kerr Scott Reservoir, which is the primary public water supply for the greater Wilkesboro area. By the fall of 2006, approximately 700 linear feet of a Priority-1 restoration had been completed on a tributary of Purlear Creek, resulting in a newly constructed perennial stream channel and establishment of a riparian forest corridor. In 2007, an additional 1,800 linear feet of Purlear Creek will be enhanced and restored. In addition, the DFR is utilizing a suite of tools called the Sand Wand® to remove embedded sediment from within the upper reaches of Purlear Creek in a low-impact manner that does not require the use of tractors or construction machinery. So far, DFR estimates that nearly 9 tons of sediment has been removed from Purlear Creek using this equipment. The N.C. Clean Water Management Trust Fund and the U.S. EPA Nonpoint Source Section 319 Grant jointly provide overall funding, with technical oversight provided by the NCSU Department of Biological & Agricultural Engineering. Progress of the work can be followed from the DFR Web site in the 'Water Quality' portion: ***www.dfr.state.nc.us***.

Table 1: Forestry Contacts

Office Location	Contact Person	Phone	Address
Lenoir District - D2	Water Quality Forester	(828) 757-5611	1543 Wilkesboro Blvd. NE Lenoir, NC 28645-8215
Lexington District - D10	Water Quality Forester	(336) 956-2111	304 Old Hargrave Road Lexington, NC 27295-7594
Mt. Holly District - D12	Water Quality Forester	(704) 827-7576	1933 Mountain Island Hwy Mt. Holly, NC 28120
Rockingham District - D3	Water Quality Forester	(910) 997-9220	1163 North US Hwy 1 Rockingham, NC 28379
Mountain Region - Reg.III	Asst. Regional Forester	(828) 251-6509	14 Gaston Mountain Road Asheville, NC 28806-9101
Piedmont Region - Reg.II	Asst. Regional Forester	(919) 542-1515	3490 Big Woods Road Chapel Hill, NC 27517-7652
Raleigh Central Office (Statewide)	Nonpoint Source Unit Forest Hydrologist	(919) 857-4856	1616 Mail Service Center Raleigh, NC 27699-1616
Griffiths Forestry Center (Statewide)	Water Quality & Wetlands Staff Forester	(919) 553-6178 ext. 230	2411 Old US Hwy 70-West Clayton, NC 27520

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Use Support Methodology 2008

How and Why Water Quality Ratings are Determined

Purpose

Section 303(d) of the federal Clean Water Act (CWA) which Congress enacted in 1972 requires States, Territories and authorized Tribes to identify and establish a priority ranking for waterbodies for which technology-based effluent limitations required by section 301 are not stringent enough to attain and maintain applicable water quality standards, establish total maximum daily loads (TMDLs) for the pollutants causing impairment in those waterbodies, and submit, from time to time, the list of impaired waterbodies and TMDLs to the U.S. Environmental Protection Agency (EPA). Current federal rules require states to submit 303(d) lists biennially, by April 1st of every even numbered year. EPA is required to approve or disapprove the state-developed §303(d) list within 30 days. For each water quality limited segment impaired by a pollutant and identified in the §303(d) list, a Total Maximum Daily Load (TMDL) must be developed.

Assessment Units and Water Quality Classifications

Water quality assessments are based on water quality classifications as well as data availability. Water quality classifications are associated with a stream reach or area that is described in the schedule of classifications. Reaches vary in length or area and are sometimes split into smaller units to represent application of water quality data. Classifications are represented by a series of numbers called index numbers (27-33-43-(1) as an example). Water quality assessments are applied to assessment units or AUs. AUs are, for the most part, the same as index numbers. When an AU is subdivided because of data applicability a letter is added to indicate this smaller unit. If Index number 27-33-43-(1) (12 miles in length) is divided into three different segments because of three different available data types the new segments would be 27-33-43-(1)a, 27-33-43-(1)b and 27-33-43-(1)c. The combined mileage of the AUs would be 12 miles.

Decisions on the length or area to apply data to are based on the data type, waterbody characteristics, watershed information and landmarks on which to base descriptions. The segments where water quality concerns are found used as markers. Solutions to water quality concerns, including TMDLs, typically encompass entire watersheds.

Data Window

The data window for the 2008 Use Support Assessment (303d listings) includes data collected in calendar years 2002 through 2006. Some AUs may have biological data collected earlier for waters that have not been resampled during this data window or where the current impairment is based on that sample. The data collection year is noted for each AU.

Data Availability and Quality

Data are collected by various state and federal agencies. NC DWQ collects most of the data used for water quality assessments. There are significant data sets collected by NC DEH for use in coastal water quality assessment. Local governments and environmental groups as well as industry, municipal and university coalitions also provide data. Submitted data sets must include an approved QAPP to assure that the data were collected in a manner consistent with agency data. A standing solicitation for data is maintained on the NC DWQ website.

Use Support Categories and Water Quality Standards

There are numerical and narrative water quality standards that are in place to protect the various best uses of North Carolina waters. Best uses include aquatic life or biological integrity, recreation or swimming, fish consumption,

shellfish harvesting and water supply. Water quality assessments are based on the standards and data availability for the applicable use support category- aquatic life, recreation etc. Dissolved oxygen standards are used to assess aquatic life and pathogen indicators are used to assess recreation for example. Standards assessment criteria have been developed for each parameter assessed. The standards assessment criteria are used to make water quality assessments- not the standards themselves. While the standards assessment criteria are based on the standards they are different in that a frequency term is included. The details of how each standard is assessed are discussed in the following sections.

Aquatic Life Assessment Methodology

Dissolved Oxygen

Dissolved Oxygen (DO) Standards

Freshwater dissolved oxygen: not less than 6.0 mg/l for trout waters; for non-trout waters, not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l; swamp waters, lake coves or backwaters, and lake bottom waters may have lower values if caused by natural conditions.

Salt water dissolved oxygen: not less than 5.0 mg/l, except that swamp waters, poorly flushed tidally influenced streams or embayments, or estuarine bottom waters may have lower values if caused by natural conditions.

Freshwater Dissolved Oxygen (DO) Assessment (Class C, B, WS)

A fresh non-swamp water AU was assessed as Impaired for aquatic life when greater than 10% of samples were below 4 mg/l for instantaneous samples (monthly) or when greater than 10% of samples are below a daily average of 5mg/l. A minimum of 10 samples (or 10 daily averages) were needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Saltwater Dissolved Oxygen (DO) Assessment (Class SC, SB, SA)

A saline/estuarine non-swamp water AU was assessed as Impaired for aquatic life when greater than 10% of samples were below 5 mg/l. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Trout Water Dissolved Oxygen (DO) Assessment (Secondary Class Tr)

A secondary classified Trout water AU was assessed as Impaired for aquatic life when greater than 10% of samples were below 6 mg/l. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Swamp Water Dissolved Oxygen (DO) Assessment (Secondary Class Sw)

A classified swamp (Sw) AU was not rated for aquatic life when greater than 10% of samples were below 4 mg/l (5 for salt) for instantaneous samples (monthly) or when greater than 10% of samples were below a daily average of 5 mg/l (freshwater only). There is not a numerical standard for these water bodies and natural background conditions cannot be determined. This is a category 3a listing not requiring a TMDL.

A swamp like AU (not classified Sw) was not rated for aquatic life when greater than 10% of samples were below 4 mg/l (5 for salt) for instantaneous samples (monthly) or when greater than 10% of samples were below a daily average of 5mg/l (freshwater only) and when greater than 10% of samples were below a pH of 6.0 (SU) for freshwater or 6.8 (SU) for saltwater. Geographic location, biological data, tributary classifications, discharges and land use were considered when making use support determinations on waters considered to be swamp like or receiving significant swamp water input.

pH

pH Standards

Freshwater pH: shall be normal for the waters in the area, which generally shall range between 6.0 and 9.0 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions;

Saltwater pH: shall be normal for the waters in the area, which generally shall range between 6.8 and 8.5 except that swamp waters may have a pH as low as 4.3 if it is the result of natural conditions.

Low pH Assessment (Class C, SC, B, SB, SA, WS)

A non-swamp water AU was assessed as Impaired for aquatic life when greater than 10% of samples were below a pH of 6.0 (SU) for freshwater or 6.8 (SU) for saltwater. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

A swamp like AU (not classified Sw) was not rated for aquatic life when greater than 10% of samples were below a pH of 6.0 (SU) for freshwater or 6.8 (SU) for saltwater or when greater than 10% of samples were below a dissolved oxygen of 4 mg/l (5 for salt) for instantaneous samples (monthly) or when greater than 10% of samples were below a daily average of 5mg/l (freshwater only) Geographic location, biological data, tributary classifications, discharges and land use were considered when making use support determinations on waters considered to be swamp like or receiving significant swamp water input.

High pH Assessment (Class C, SC, B, SB, SA, WS)

An AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than a pH of 9 (SU) for freshwater or 8.5 (SU) for saltwater. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Swamp Water Low pH Assessment (Secondary Class Sw)

A classified swamp (Sw) AU was assessed as Impaired when greater than 10% of samples were below 4.3 (SU). A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Temperature

Temperature Standards

For freshwaters- Temperature: not to exceed 2.8 degrees C (5.04 degrees F) above the natural water temperature, and in no case to exceed 29 degrees C (84.2 degrees F) for mountain and upper piedmont waters and 32 degrees C (89.6 degrees F) for lower piedmont and coastal plain waters. The temperature for trout waters shall not be increased by more than 0.5 degrees C (0.9 degrees F) due to the discharge of heated liquids, but in no case to exceed 20 degrees C (68 degrees F).

Lower piedmont and coastal plain waters mean those waters of the Catawba River Basin below Lookout Shoals Dam; the Yadkin River Basin below the junction of the Forsyth, Yadkin, and Davie County lines; and all of the waters of Cape Fear, Lumber, Roanoke, Neuse, Tar□Pamlico, Chowan, Pasquotank, and White Oak River Basins; except tidal salt waters which are assigned S classifications.

Mountain and upper piedmont waters mean all of the waters of the Hiwassee; Little Tennessee, including the Savannah River drainage area; French Broad; Broad; New; and Watauga River Basins; and those portions of the Catawba River Basin above Lookout Shoals Dam and the Yadkin River Basin above the junction of the Forsyth, Yadkin, and Davie County lines.

For saltwaters- Temperature: shall not be increased above the natural water temperature by more than 0.8 degrees C (1.44 degrees F) during the months of June, July, and August nor more than 2.2 degrees C (3.96 degrees F) during other

months and in no cases to exceed 32 degrees C (89.6 degrees F) due to the discharge of heated liquids.

Temperature Assessment

A mountain or upper piedmont water AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than 29°C. A minimum of 10 samples was needed to rate the water as Impaired.

A lower piedmont or coastal plain stream AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than 32°C. A minimum of 10 samples was needed to rate the water as Impaired.

If the 10% criterion was exceeded and fewer than 10 samples were collected the water was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Temperature Screening Criteria for Tr Classified Waters

A trout water AU was not rated for aquatic life when greater than 10% of samples were greater than 20°C for classified trout waters (Tr). The presence of heated discharges was not determined. This is a category 3a listing not requiring a TMDL.

Assessment of Extreme Temperature Conditions

A waterbody that exceeds the above criteria may be not rated for aquatic life because of meteorological conditions that occur on a regular basis. These conditions must be documented and reassessment will occur after more normal conditions return. This is a category 3a listing not requiring a TMDL. Examples of extreme conditions may include extreme drought, reservoir drawdown, hurricane impacts and flooding, dam failure, and saltwater encroachment. Other extreme conditions may be documented as needed for future assessments

Chlorophyll a

Chlorophyll a Standard

Chlorophyll a (corrected): not greater than 40 mg/l in sounds, estuaries, and other waters subject to growths of macroscopic or microscopic vegetation.

Other waters subject to growths are interpreted by NC DWQ to include dam backwaters, lakes and reservoirs.

Chlorophyll a Standards Assessment

An AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than 40 mg/l. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. Some reservoirs in North Carolina are sample fewer than 10 times during the assessment period. These data are used to document eutrophication issues. Reservoirs are targeted for increased monitoring to determine if there is a standards violation using the above methodology. This is a category 3a listing not requiring a TMDL.

Toxic Substances

Toxic Substances Numerical Standards

Refer to Water Quality “Redbook” for complete text of standards
Arsenic: 50 ug/l
Beryllium: 6.5 ug/l;
Cadmium: 0.4 ug/l for trout waters and 2.0 ug/l for non□trout waters;
Chlorine, total residual: 17 ug/l;
Chromium, total recoverable: 50 ug/l;
Cyanide: 5.0 ug/l
Fluorides: 1.8 mg/l;
Lead, total recoverable: 25 ug/l;
Mercury (assessed in fish consumption category)
Nickel: 88 ug/l; 8.3 ug/l
Chlorides: 230mg/l; (note this is an action level standard)

Toxic Substances Assessment

An AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than the above standards. A minimum of 10 samples was needed to rate the water as Impaired. These are category 5 listings requiring

a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Toxic Substances Action Level Standards

Refer to Water Quality "Redbook" for complete text of standards
Copper: 7 ug/l
Iron: 1.0 mg/l;
Silver: 0.06 ug/l;
Zinc: 50 ug/l;
Chlorides were assessed with other toxic substances when data were available

Toxic Substances Action Level Assessment

Copper, Iron, Silver, and Zinc exceedances of the 10% criterion were not adequate indicators of impacts to ecological/ biological integrity in North Carolina waters due to high naturally occurring levels and were not used to assess waters as Impaired.

Turbidity

Turbidity Standards

Turbidity: the turbidity in the receiving water shall not exceed 50 Nephelometric Turbidity Units (NTU) in streams not designated as trout waters and 10 NTU in streams, lakes or reservoirs designated as trout waters; for lakes and reservoirs not designated as trout waters, the turbidity shall not exceed 25 NTU; if turbidity exceeds these levels due to natural background conditions, the existing turbidity level cannot be increased.

Turbidity Assessment

An AU was assessed as Impaired for aquatic life when greater than 10% of samples were greater than 50 NTU or 10 NTU for Tr waters or 25 NTU lakes, reservoirs and estuarine waters. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Ecological/ Biological Integrity

Aquatic Life Standards

Waters shall be suitable for aquatic life propagation and maintenance of biological integrity, wildlife, secondary recreation, and agriculture. Sources of water pollution which preclude any of these uses on either a short□term or long□term basis shall be considered to be violating a water quality standard;

Aquatic Life Assessment

An AU was assessed as Impaired for aquatic life when a fish community or benthos sample received a bioclassification of Severe, Poor or Fair and there were no other Aquatic Life standards violations. This is a category 5 listing requiring a TMDL.

An AU was assessed as Impaired for aquatic life when a fish community or benthos sample received a bioclassification of Severe, Poor or Fair and there were other Aquatic Life standards violations. This is a category 4s listing requiring a TMDL for the identified aquatic life numerical standards violation (category 5 or 4a listing) impairing the ecological/ biological integrity of the waterbody.

An AU was assessed as Impaired for aquatic life when a fish community or benthos sample received a bioclassification of Severe, Poor or Fair and an approved TMDL for an aquatic life numerical water quality standard has been completely implemented. This is a category 5s listing requiring a TMDL.

Recreation Assessment Methodology

Recreation standards were assessed using fecal coliform bacteria data collected at DWQ ambient stations and special study sites and enterrococci data collected at DEH RECMON beach monitoring sites in coastal waters. Screening criteria were used to assess areas for potential standards violations. DEH advisory postings were also used for recreation assessments as well. The following criteria were used to assess waters for recreation.

Pathogen Indicator Standards

Organisms of coliform group: fecal coliforms not to exceed geometric mean of 200/100 ml (MF count) based on at least five consecutive samples examined during any 30▫day period and not to exceed 400/100 ml in more than 20 percent of the samples examined during such period.

Enterococcus, including Enterococcus faecalis, Enterococcus faecium, Enterococcus avium and Enterococcus gallinarium: not to exceed a geometric mean of 35 enterococci per 100 ml based upon a minimum of five samples within any consecutive 30 days.

Fecal Coliform Bacteria Assessment Criteria

An AU was assessed as Impaired when the geometric mean was greater than 200 colonies/100ml or greater than 20% of the samples were higher than 400 colonies/100ml. At least 5 samples must have been collected within the same 30-day period. This is a category 5 listing requiring a TMDL.

Fecal Coliform Bacteria Screening Assessment

An AU was Not Rated when the geometric mean was greater than 200 colonies/100ml or greater than 20% of the samples were higher than 400 colonies/100ml. Samples were not collected in the same 30 day period. This is a category 3a listing not requiring a TMDL. These AUs are prioritized for resampling 5 times in 30 days based on classification and available resources. Data are reviewed yearly for prioritization.

Enterrococci Assessment Criteria

An AU was assessed as Impaired when the geometric mean was greater than 35 colonies/100ml. At least 5 samples must have been collected within the same 30-day period. This is a category 5 listing requiring a TMDL.

Enterrococcus Screening Assessment

An AU was Not Rated when the geometric mean was greater than 35 colonies/100ml. Samples were not collected in the same 30 day period. This is a category 3a listing not requiring a TMDL.

Advisory Posting Assessment

An AU was assessed as Impaired when a swimming advisory was posted greater than 61 days in any 5 year period (includes permanent postings). This is a category 4cr listing not requiring a TMDL.

Shellfish Harvesting Assessment Methodology

Shellfish Harvesting standards were assessed using fecal coliform bacteria data collected at DEH monitoring stations in Class SA waters. DEH growing area classifications were also used for use assessments. The following criteria were used to assess waters for shellfish harvesting.

Shellfish Harvesting Standards

Organisms of coliform group: fecal coliform group not to exceed a median MF of 14/100 ml and not more than 10 percent of the samples shall exceed an MF count of 43/100 ml in those areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

Fecal Coliform Bacteria Assessment Criteria

An AU was assessed as Impaired when the geometric mean was greater than 14 colonies/100ml or greater than 10% of the samples were higher than 43 colonies/100ml. This is a category 5 listing requiring a TMDL.

DEH Shellfish Sanitation Growing Area Classification Assessment

An AU was assessed as Impaired when the DEH growing area classification was Prohibited or Conditionally approved. This is a category 4cs listing not requiring a TMDL.

Water Supply Assessment Methodology

Water Supply standards were assessed using data collected at DWQ ambient stations located in Class WSI-WSV waters. The following criteria were used to Impair waters for water supply. Category 5 listings were only made when Standards Assessment Criteria (SAC) were exceeded.

Water Supply Standards

Refer to Water Quality "Redbook" for complete text of standards
Barium: 1.0 mg/l;
Chloride: 250 mg/l;
Manganese: 200 ug/l; (not human health or aquatic life- not assessed)
Nickel: 25 ug/l;
Nitrate nitrogen: 10.0 mg/l;
2,4¤D: 100 ug/l;
2,4,5¤TP (Silvex): 10 ug/l;
Sulfates: 250 mg/l;

Water Supply Assessment

An AU was assessed as Impaired for water supply when greater than 10% of samples were greater than the above standards except for manganese. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Fish Consumption Assessment Methodology

Fish Consumption was assessed based on site-specific fish consumption advisories. The advisories were based on DHHS consumption advisories developed using fish tissue data that exceed standards. The following criteria were used to Impair waters for fish consumption. Because of the statewide Mercury advice there were no use cases for Supporting fish consumption and therefore no overall Category 1 waters.

PCBs Assessment Criteria

An AU was assessed as Impaired when a site-specific advisory was posted for PCBs. This is a category 5 listing requiring a TMDL.

Dioxin Assessment Criteria

An AU was assessed as Impaired when a site-specific advisory was posted for dioxins. This is a category 5 listing requiring a TMDL.

Mercury Assessment Criteria

An AU was assessed as Impaired for fish consumption when greater than 10% of samples were greater than 0.012 mg/l. A minimum of 10 samples was needed to rate the water as Impaired. This is a category 5 listing requiring a TMDL.

If the 10% criterion was exceeded and fewer than 10 samples were collected the AU was not rated and targeted for further sampling. This is a category 3a listing not requiring a TMDL.

Statewide advice for Mercury in fish tissue was not assessed because it was not associated with a specific AU but was applied to all waters of the state. Previous Category 5 listings for Mercury based on site specific advisories will remain.

Reporting Requirements of the Federal Clean Water Act

The North Carolina Water Quality Assessment and Impaired Waters List is an integrated report that includes both the 305(b) and 303(d) reports. The 305(b) Report is compiled to meet the federal Clean Water Act (CWA) Section 305(b) reporting requirements. The 305(b) portion of the integrated report presents how well waters support designated uses (e.g., swimming, aquatic life, water supply), as well as likely stressors (e.g., sediment, nutrients) and potential sources of impairment. The 303(d) List is a comprehensive account of impaired waters that require total maximum daily loads (TMDLs).

Section 303(d) of the CWA enacted in 1972 required States, Territories and authorized Tribes to 1) identify and establish a priority ranking for waters for which technology-based effluent limitations are not stringent enough to attain and maintain water quality standards, 2) establish TMDLs for the pollutants causing impairment in those waters, and 3) develop and submit the list of impaired waters and TMDLs to the U.S. Environmental Protection Agency (EPA). EPA is required to approve or disapprove the state-developed 303(d) list within 30 days. For each segment impaired by a pollutant and identified in the 303(d) list, a TMDL must be developed.

Introduction to TMDLs

A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The calculation must include a margin of safety to ensure that the waterbody can still attain its designated uses. The calculation must also account for seasonal variation and critical conditions in water quality.

For more information on TMDLs and the 303(d) listing process, visit the NC TMDL website at http://h2o.enr.state.nc.us/tmdl/.

Contents of the Integrated Report

The Integrated Report includes descriptions of monitoring programs, the use support methodology, and the impaired waters list. Guidance from EPA encourages placement of all waterbody assessment units into one unique assessment category. Each category is described in detail below:

Category 1: Attaining the water quality standard and no use is threatened. This category consists of those waterbody assessment units where all applicable use support categories are rated "Supporting". Data and information are available to support a determination that the water quality standards are attained and no use is threatened. Future monitoring data will be used to determine if the water quality standard continues to be attained. However, because of the statewide fish consumption advice for mercury, there are no Category 1 waters.

Category 2: Supporting or not Impaired for all monitored uses. This category consists of those waterbody assessment units where at least one of the applicable use support categories are rated "Supporting" and the other use support categories are rated "Not Rated" or "No Data". Also included in this category are waters where at least one of the applicable use support categories, except Fish Consumption, are rated "Supporting"; the remaining applicable use support categories, except Fish Consumption, are rated "Not Rated"; and the Fish Consumption category is rated "Impaired-Evaluated". Data and information are available to support a determination that some, but not all, uses are attained. Attainment status of the remaining uses is unknown because there are insufficient or no data or information. Future monitoring data will be used to determine if the uses previously found to be in attainment remain in attainment, and to determine the attainment status of those uses for which data and information were previously insufficient to make a determination.

Category 3: No data or insufficient information to determine if any designated use is attained. This category consists of those waterbody assessment units where all applicable use support categories, except Fish Consumption, are rated "Not Rated", and the Fish Consumption category is rated "Impaired-Evaluated". Measured data or information to support an attainment determination for any use are not available. Supplementary data and information, or future monitoring, will be required to assess the attainment status. This category contains distinct sub-categories:

Category 3a- Instream/monitoring data are inconclusive
Category 3c- No Data available for assessment
Category 3t- No Data available for assessment – Assessment Unit is in a watershed with an approved TMDL

Category 4: Impaired or threatened for one or more designated uses but does not require the development of a TMDL. This category contains distinct sub-categories:

Category 4a: TMDL has been completed. This category consists of those waterbody assessment units for which EPA has approved or established a TMDL and water quality standards have not yet been achieved. Monitoring data will be

considered before moving an assessment unit from Category 4a to Categories 1 or 2.

Category 4b: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. This category consists of those waterbody assessment units for which TMDLs will not be attempted because other required regulatory controls (e.g., NPDES permit limits, Stormwater Program rules, implemented watershed plan, etc.) are expected to attain water quality standards within a reasonable amount of time. Future monitoring will be used to verify that the water quality standard is attained as expected.

Category 4c: Impaired- Loss of use because impairment is not caused by a pollutant. This category consists of assessment units that are impaired by pollution, not by a pollutant. EPA defines pollution as "The man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of the water." EPAs staff have verbally stated that this category is intended to be used for impairments related to water control structures (e.g., dams). Future monitoring will be used to confirm that there continues to be an absence of pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Category 4cr: Impaired- Loss of recreation use because swimming advisories were posted; however, no data is available for TMDL development.

Category 4cs: Impaired- Loss of shellfish harvesting use because the growing area is not approved for shellfish harvesting by the Department of Environmental Health and no data is available for TMDL development.

Category 4ct: Impaired- Assessment Unit is in a watershed that is part of a TMDL study area for the parameter of interest.

Category 4s: Impaired ecological/biological integrity with a concurrent category 5 aquatic life parameter of interest.

Category 5: Impaired for one or more designated uses by a pollutant(s) and requires a TMDL. This category consists of those waterbody assessment units that are impaired by a pollutant and the proper technical conditions exist to develop TMDLs. As defined by the EPA, the term pollutant means "dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into the water". When more than one pollutant is associated with the impairment of a single waterbody assessment unit in this category, the assessment unit will remain in Category 5 until TMDLs for all listed pollutants have been completed and approved by the EPA.

Category 5s: Impaired ecological/biological integrity and stressor study does not indicate any aquatic life standard violations.

The draft 2008 North Carolina 303(d) list for the State of North Carolina only includes Category 5 waters. An impaired waters list (Categories 4 & 5) and the complete use support summary of monitored waterbodies in the North Carolina (Integrated Report/305(b)) will be available for downloading on the DWQ website: http://h2o.enr.state.nc.us/tmdl/General_303d.htm.

How North Carolina Delists Waters

Waters appearing on the previously approved impaired waters list will be moved to Categories 1, 2, 3 or 4 under the following circumstances:

- Applicable water quality standards are being met (i.e., no longer impaired for a given pollutant).
- The basis for putting the water on the list is determined to be invalid (i.e., was mistakenly identified as impaired in accordance with 40 CFR 130.7(b)(6)(iv) and/or National Clarifying Guidance for State and Territory 1998 Section 303(d) Listing Decisions. Robert Wayland, III, Director. Office of Wetlands, Oceans and Watersheds. Aug 27, 1997).
- A water quality variance has been issued for a specific standard (e.g., chloride).
- Removal of fish consumption advisories or modification of fish eating advice.
- Typographic listing mistakes (e.g., the wrong water was identified).
- EPA has approved a TMDL.

Scheduling TMDLs

Category 5 waters, those for which TMDLs are required, are at many different stages on the path to an approved TMDL. Some require additional data. Some require more outreach to increase stakeholder involvement. Others need to have a technical strategy budgeted, funded and scheduled. Some are ready for EPA submittal.

According to EPA guidance (EPA 2004), prioritization of waterbody assessment units for TMDLs need not be reflected in a "high, medium or low" manner. Instead, prioritization can be reflected in the TMDL development schedule. Generally, North Carolina attempts to develop TMDLs within 8-13 years of the original pollutant listing. TMDLs under development are listed on the NC TMDL website at http://h2o.enr.state.nc.us/tmdl/.

Revising TMDLs

Current federal regulations do not specify when TMDLs should be revised. However, there are several circumstances under which it would seem prudent to revisit existing TMDLs. The TMDL analysis of targets and allocations is based upon the existing water quality standards, hydrology, water quality data (chemical and biological), and existing, active NPDES wastewater discharges. Conditions related to any of these factors could be used to justify a TMDL revision. Specific conditions that the Division will consider prior to revising an existing, approved TMDL include the following:

- A TMDL has been fully implemented and the water quality standards continue to be violated. If a TMDL has been implemented and water quality data indicate no improvement or a decline in overall water quality, the basis for the TMDL reduction or the allocation may need to be revised;
- The addition or removal of hydraulic structures to a waterbody (e.g., dams). Substantial changes to waterbody hydrology and hydraulics have the potential to change many aspects of target setting, including the water quality standard upon which the TMDL was developed, the water quality data, and the water quality modeling;
- Incorrect assumptions were used to derive the TMDL allocations. This would include errors in calculations and omission of a NPDES permitted discharge.

Should a TMDL be revised due to needed changes in TMDL targets, the entire TMDL would be revised. This includes the TMDL target, source assessment, and load and wasteload allocations. However, the Division may elect to revise only specific portions of the TMDL. For example, changes may be justifiable to the load and wasteload allocation portions of a TMDL due to incorrect calculations or inequities. In these cases, revisions to the TMDL allocations would not necessarily include a revision of TMDL targets. Any TMDL revisions would include a public notice and comment period.

Alternatives to TMDLs

Watershed restoration efforts include many other activities besides TMDLs. Protection and prevention of impairment are least expensive and most efficient in the long term. Local direct action to correct water quality problems, before a TMDL is developed, is preferable in many cases. The division will consider postponing TMDL development at the request of local governments and/or organizations actively attempting to achieve water quality standards. Factors such as funding, ordinances, expertise, planning, and timetable will be evaluated. Another more formal alternative to TMDL development is a Category 4b demonstration. Such demonstrations must include the following six EPA required elements:

1) Identification of segment and statement of problem causing the impairment;
2) Description of pollution controls and how they will achieve water quality standards;
3) An estimate or projection of the time when WQS will be met;
4) Schedule for implementing pollution controls;
5) Monitoring plan to track effectiveness of pollution controls; and
6) Commitment to revise pollution controls, as necessary.

For more information about the Clean Water Act Sections 303(d), 305(b), and 314 integrated reporting and listing decisions see EPA's watershed website: ***http://www.epa.gov/owow/tmdl/2008_ir_memorandum.html***.
For more information on watershed planning see EPA's website: ***http://iaspub.epa.gov/watershedplan/watershedPlanning.do?pageId=48&navId=35***.

Table A. NPDES Discharge Permits

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0004308	Aluminum Company Of America	Badin Works	Stanly	Mooresville	Industrial Process & Commercial	Major	30708	YADKIN RIVER (Badin Lake)
NC0004626	PPG Industries Fiber Glass Products Inc	Lexington Facility	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	North Potts Creek (Second Potts Creek)
NC0004774	Duke Energy Corporation	Buck Steam Station	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	YADKIN RIVER (including upper portion of High Ro
NC0004774	Duke Energy Corporation	Buck Steam Station	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	YADKIN RIVER (including upper portion of High Ro
NC0004774	Duke Energy Corporation	Buck Steam Station	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	YADKIN RIVER (including upper portion of High Ro
NC0004774	Duke Energy Corporation	Buck Steam Station	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	YADKIN RIVER (including upper portion of High Ro
NC0004774	Duke Energy Corporation	Buck Steam Station	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	YADKIN RIVER (including upper portion of High Ro
NC0004898	Hampton Capital Partners LLC	Turnersburg Plant WWTP	Iredell	Mooresville	Industrial Process & Commercial	Minor	30706	Rocky Creek
NC0004898	Hampton Capital Partners LLC	Turnersburg Plant WWTP	Iredell	Mooresville	Industrial Process & Commercial	Minor	30706	Rocky Creek
NC0004944	INVISTA S.a.r.l.	Salisbury Plant	Rowan	Mooresville	Industrial Process & Commercial	Major	30706	Second Creek (North Second Creek)
NC0005126	Tyson Poultry Inc	Harmony plant	Iredell	Mooresville	Industrial Process & Commercial	Major	30706	Hunting Creek
NC0005266	Louisiana Pacific Corporation	ABTCo mill	Wilkes	Winston-Salem	Industrial Process & Commercial	Major	30701	YADKIN RIVER
NC0005312	Interface Fabrics Group South Inc	IFGS Inc WWTP	Surry	Winston-Salem	Industrial Process & Commercial	Major	30702	YADKIN RIVER
NC0006220	City of Kannapolis	Kannapolis WTP	Rowan	Mooresville	Water Treatment Plant	Minor	30712	Irish Buffalo Creek
NC0006254	Omni Supply	River Road Site	Caldwell	Asheville	Industrial Process & Commercial	Minor	30701	YADKIN RIVER
NC0006254	Omni Supply	River Road Site	Caldwell	Asheville	Industrial Process & Commercial	Minor	30701	YADKIN RIVER
NC0006351	Chemical Specialties Inc	Chemical Specialties Incorporated	Cabarrus	Mooresville	Industrial Process & Commercial	Major	30711	Rocky River
NC0006548	Wayne Farms LLC	Dobson Plant	Surry	Winston-Salem	Industrial Process & Commercial	Minor	30702	Fisher River

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0020338	Town of Yadkinville	Yadkinville WWTP	Yadkin	Winston-Salem	Municipal , Large	Major	30702	North Deep Creek
NC0020427	City of Rockingham	Rockingham WWTP	Richmond	Fayetteville	Municipal , Large	Major	30716	PEE DEE RIVER
NC0020567	Town of Elkin	Elkin WWTP	Surry	Winston-Salem	Municipal , Large	Major	30702	YADKIN RIVER
NC0020591	City of Statesville	Third Creek WWTP	Iredell	Mooresville	Municipal , Large	Major	30706	Third Creek (Third Creek WS No. 37)
NC0020621	Town of Boone	Jimmy Smith WWTP	Watauga	Winston-Salem	Municipal , Large	Major	50701	South Fork New River
NC0020761	Town of North Wilkesboro	Thurman Street WWTP	Wilkes	Winston-Salem	Municipal , Large	Major	30701	YADKIN RIVER
NC0020931	Town of Boonville	Boonville WWTP	Yadkin	Winston-Salem	Municipal , < 1MGD	Minor	30702	Tanyard Creek (Buck Creek)
NC0020966	Town of Spencer Mountain	Spencer Mountain WWTP	Gaston	Mooresville	Municipal , < 1MGD	Minor	30836	South Fork Catawba River
NC0021105	Town of Mount Gilead	Mount Gilead WWTP	Montgomery	Fayetteville	Municipal , < 1MGD	Minor	30710	PEE DEE RIVER (including Blewett Falls Lake belo
NC0021121	City of Mount Airy	Mount Airy WWTP	Surry	Winston-Salem	Municipal , Large	Major	30703	Ararat River
NC0021326	Town of Dobson	Dobson WWTP	Surry	Winston-Salem	Municipal , < 1MGD	Minor	30702	Cody Creek
NC0021491	Town of Mocksville	Dutchman's Creek WWTP	Davie	Winston-Salem	Municipal , < 1MGD	Minor	30705	Dutchman Creek
NC0021504	Town of Biscoe	Biscoe WWTP	Montgomery	Fayetteville	Municipal , < 1MGD	Minor	30715	Hickory Branch
NC0021580	Town of Jonesville	Jonesville WWTP	Yadkin	Winston-Salem	Municipal , < 1MGD	Minor	30702	Sandyberry Creek
NC0021628	Town of Norwood	Norwood WWTP	Stanly	Mooresville	Municipal , < 1MGD	Minor	30714	Rocky River
NC0021717	Town of Wilkesboro	Cub Creek WWTP	Wilkes	Winston-Salem	Municipal , Large	Major	30701	YADKIN RIVER
NC0021784	Town of Ellerbe	Ellerbe WWTP	Richmond	Fayetteville	Municipal , < 1MGD	Minor	30710	Toms Branch
NC0023191	David L Millsaps	Seven Cedars Mobile Home Park WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0023604	Thomasville Furniture Company	SFD/64 Lumber Plant	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	Flat Swamp Creek
NC0023604	Thomasville Furniture Company	SFD/64 Lumber Plant	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	Flat Swamp Creek
NC0023884	City of Salisbury	Salisbury-Rowan WWTP	Rowan	Mooresville	Municipal , Large	Major	30704	YADKIN RIVER (including upper portion of High Ro

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0024112	City of Thomasville	Hamby Creek WWTP	Davidson	Winston-Salem	Municipal , Large	Major	30707	Hamby Creek
NC0024228	City of High Point	Westside WWTP	Davidson	Winston-Salem	Municipal , Large	Major	30707	Rich Fork
NC0024244	City of Albemarle	Long Creek WWTP	Stanly	Mooresville	Municipal , Large	Major	30713	Long Creek
NC0024333	City of Monroe	Monroe WWTP	Union	Mooresville	Municipal , Large	Major	30714	Richardson Creek
NC0024872	Davie County Water System	Cooleemee WWTP	Davie	Winston-Salem	Municipal , Large	Major	30706	South Yadkin River
NC0025259	Carolina Water Service Inc of NC	Lamplighter Subdivision WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	McKee Creek
NC0026646	Town of Pilot Mountain	Pilot Mountain WWTP	Surry	Winston-Salem	Municipal , Large	Major	30703	Ararat River
NC0026689	Town of Denton	Denton WWTP	Davidson	Winston-Salem	Municipal , < 1MGD	Minor	30708	Lick Creek
NC0027502	Town of Landis	Landis WTP	Rowan	Mooresville	Water Treatment Plant	Minor	30704	Grants Creek
NC0027944	Bassett Furniture Industries	Bassett Furniture Industries	Surry	Winston-Salem	Industrial Process & Commercial	Minor	30703	Ararat River
NC0027944	Bassett Furniture Industries	Bassett Furniture Industries	Surry	Winston-Salem	Industrial Process & Commercial	Minor	30703	Ararat River
NC0028037	City of Lexington	Lexington WTP #1 & 2	Davidson	Winston-Salem	Water Treatment Plant	Minor	30707	Abbotts Creek
NC0028169	BV Hedrick Sand & Gravel	Aquadale Quarry	Stanly	Mooresville	Industrial Process & Commercial	Minor	30713	Long Branch
NC0028606	State of North Carolina Department of Transporta	I-77 Rest Area Iredell County	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Camel Branch
NC0028614	State of North Carolina Department of Transporta	I-77 Rest Area Yadkin County	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30706	Rocky Branch
NC0028916	Town of Troy	Troy WWTP	Montgomery	Fayetteville	Municipal , < 1MGD	Minor	30715	Densons Creek
NC0028941	Rayco Utilities Inc	Pine Valley WWTP	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30706	Setman Branch
NC0029190	State of North Carolina Department of Transporta	Surry County Rest Area	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Naked Run
NC0029246	Norfolk Southern Railway Company	Linwood Yard	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	High Rock Lake
NC0029246	Norfolk Southern Railway Company	Linwood Yard	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	Second Creek Arm of High Rock Lake
NC0029432	Stanly County Board of Education	Aquadale Elementary School	Stanly	Mooresville	100% Domestic < 1MGD	Minor	30713	Long Branch

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0029599	Yadkin County Board of Education	Courtney Elementary School WWTP	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Harmon Creek
NC0029602	Yadkin County Board of Education	Forbush Elementary School WWTP	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Logan Creek
NC0029611	Yadkin County Board of Education	East Bend Elementary School WWTP	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Logan Creek
NC0029742	NC Department of Correction	Iredell Correctional Center WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Fifth Creek (Five Mile Branch)
NC0029947	Davidson County Schools	Churchland Elementary School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	South Potts Creek (First Potts Creek)
NC0030210	Charlotte Mecklenburg Utility Department	Mallard Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	30711	Mallard Creek
NC0030210	Charlotte Mecklenburg Utility Department	Mallard Creek WWTP	Mecklenburg	Mooresville	Municipal , Large	Major	30711	Mallard Creek
NC0030597	Union County Public Schools	New Salem Elementary School	Union	Mooresville	100% Domestic < 1MGD	Minor	30714	Richardson Creek
NC0031160	NCDENR	Pilot Mountain State Park	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Grassy Creek
NC0031836	City of Statesville	Fourth Creek WWTP	Iredell	Mooresville	Municipal , Large	Major	30706	Fourth Creek
NC0034452	Willow Creek Holdings LLC	Willow Creek WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Abbotts Creek
NC0034703	Rowan-Salisbury Schools	Knollwood Elementary School	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30704	Little Creek
NC0034711	Cedar Park Estates LLC	Cedar Park Estates LLC	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Reedy Creek
NC0034762	Goose Creek Utility Company	Fairfield Plantation WWTP	Union	Mooresville	100% Domestic < 1MGD	Minor	30712	Goose Creek
NC0034827	Forsyth County School System	Old Richmond Elementary School	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Fries Creek
NC0034959	Rowan-Salisbury Schools	West Rowan High School	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30706	Withrow Creek
NC0035033	Carolina Water Service Inc of NC	Cabarrus Woods WWTP	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Reedy Creek
NC0035041	Carolina Water Service Inc of NC	Hemby Acres WWTP	Union	Mooresville	100% Domestic < 1MGD	Minor	30712	North Fork Crooked Creek
NC0035939	Camp Carolwood Inc	Camp Carolwood WWTP	Caldwell	Asheville	100% Domestic < 1MGD	Minor	30701	Cove Branch
NC0036269	Water and Sewer Authority of Cabarrus County	Rocky River WWTP	Cabarrus	Mooresville	Municipal , Large	Major	30712	Rocky River
NC0036561	United Church Retirement Home	United Church Retirement Home	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Pounder Fork

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0037184	Lakeside Investment Properties	Oak Haven Mobile Home Park	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30704	Grants Creek
NC0037371	Iredell-Statesville Schools	North Iredell High School	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Patterson Creek
NC0037834	City of Winston-Salem	Archie Elledge WWTP	Forsyth	Winston-Salem	Municipal , Large	Major	30704	Salem Creek (Middle Fork Muddy Creek)
NC0038172	Guilford County Schools	McLeansville Middle School WWTP	Guilford	Winston-Salem	100% Domestic < 1MGD	Minor	30602	South Buffalo Creek
NC0038709	Wilkes County Schools	Roaring River Elementary School	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	YADKIN RIVER
NC0038822	Central Care Inc	Central Care, Inc.	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Stewarts Creek
NC0038997	Roaring Gap Club Inc	Roaring Gap Club Incorporated	Alleghany	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Mitchell River
NC0039420	Virginia DOT	Virginia DOT/I 77 Rest Area	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Naked Run
NC0040045	Bills Truck Stop Inc	Bills Truck Stop Incorporated	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	South Potts Creek (First Potts Creek)
NC0040908	Randolph County Schools	Tabernacle Elementary School	Randolph	Winston-Salem	100% Domestic < 1MGD	Minor	30709	Caraway Creek
NC0041068	Cabarrus County Schools	Bethel Elementary School	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30712	Muddy Creek
NC0041181	Caldwell County Schools	Happy Valley Elementary School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	30701	YADKIN RIVER
NC0041190	Caldwell County Schools	Kings Creek Elementary School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	30701	Kings Creek
NC0041408	Anson County	Anson County Regional WWTP	Anson	Fayetteville	Municipal , Large	Major	30716	PEE DEE RIVER
NC0041599	Davidson County Schools	Central Middle & Senior High School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Abbotts Creek Arm of High Rock Lake
NC0041602	Davidson County Schools	Silver Valley Elementary School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Flat Swamp Creek
NC0041629	Davidson County Schools	Extended Day School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Hamby Creek
NC0041718	Colony Ridge Apartments	Colony Ridge Apartments	Stanly	Mooresville	100% Domestic < 1MGD	Minor	30708	Curl Tail Creek
NC0041866	Surry County Schools	Mountain Park Elementary	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Flat Branch
NC0041904	Surry County Schools	Flat Rock Elementary School	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Champ Creek

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0041939	Surry County Schools	J. Sam Gentry Middle School	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Stewarts Creek
NC0041947	Surry County Schools	North Surry High School	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30703	Stewarts Creek
NC0041955	Surry County	Beulah Community Center	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Beaverdam Creek
NC0042072	Davidson County Schools	Northwest Elementary School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Huffmans Creek
NC0042145	Davidson County Schools	Midway Elementary School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Leonard Creek
NC0042439	Westside Swim & Racquet Club	Westside Swim & Racquet Club	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30704	Draft Branch
NC0042749	Davidson County Schools	Southwood Elementary School WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Swearing Creek
NC0043125	Patterson School Inc	Patterson School	Caldwell	Asheville	100% Domestic < 1MGD	Minor	30701	YADKIN RIVER
NC0043320	WLR Burlington Finance Acquistion LLC	Burlington Industries LLC - Richmond Plant	Richmond	Fayetteville	Industrial Process & Commercial	Major	30716	Hitchcock Creek (Roberdel Lake)
NC0043532	Town of Oakboro	Oakboro WWTP	Stanly	Mooresville	Municipal , < 1MGD	Minor	30713	Long Creek
NC0043532	Town of Oakboro	Oakboro WWTP	Stanly	Mooresville	Municipal , < 1MGD	Minor	30714	Rocky River
NC0044024	City of Albemarle	Highway 52 WTP	Stanly	Mooresville	Water Treatment Plant	Minor	30713	Little Long Creek
NC0044211	Brintle Enterprises	Brintles Truck Stop	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Little Fisher River
NC0044253	NC Lions	NC Lions/ Camp Dogwood	Catawba	Mooresville	100% Domestic < 1MGD	Minor	30832	Mountain Creek
NC0044717	Town of Mount Pleasant	Mount Pleasant WTP	Cabarrus	Mooresville	Water Treatment Plant	Minor	30712	Dutch Buffalo Creek
NC0045012	Hill Haven Residential Care	Hill Haven Residential Care	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0045471	Barium Spings Home for Children	Barium Springs Home WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Duck Creek
NC0045993	Allvac	Monroe Plant	Union	Mooresville	Industrial Process & Commercial	Major	30714	Richardson Creek
NC0046035	High Point Care Center	High Point Care Center	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Rich Fork
NC0046388	Wilkes County Schools	East Wilkes High School WWTP	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Hughes Branch
NC0046388	Wilkes County Schools	East Wilkes High School WWTP	Wilkes	Winston-Salem	Water Treatment Plant	Minor	30701	Hughes Branch
NC0046418	Wilkes County Schools	Mountain View Elementary School	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Mulberry Creek
NC0046426	Wilkes County Schools	Traphill Elementary School WWTP	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Little Sandy Creek

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0046728	Town of Mooresville	Rocky River WWTP	Iredell	Mooresville	Municipal , Large	Major	30711	Dye Creek (Branch)
NC0047091	Silver Maple Mobile Estates	Silver Maples Community	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Rocky River
NC0047562	City of Hamlet	Hamlet WWTP	Richmond	Fayetteville	Municipal , Large	Major	30716	Marks Creek (Boyds Lake, City Lake, Everetts Lak
NC0049867	Town of Cleveland	Cleveland WWTP	Rowan	Mooresville	Municipal , < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0049905	Associated Asphalt	Salisbury plant	Rowan	Mooresville	Industrial Process & Commercial	Minor	30704	Grants Creek
NC0050342	City of Winston-Salem	Muddy Creek WWTP	Forsyth	Winston-Salem	Municipal , Large	Major	30704	YADKIN RIVER
NC0050342	City of Winston-Salem	Muddy Creek WWTP	Forsyth	Winston-Salem	Municipal , Large	Major	30704	Muddy Creek
NC0050903	Town of Mocksville	Bear Creek WWTP	Davie	Winston-Salem	Municipal , < 1MGD	Minor	30706	Bear Creek
NC0051489	Three R's Mobile Home Park	Three R's Mobile Home Park	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Leak Creek
NC0051632	Carolina Water Service Inc of NC	Huntwick WWTP	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Fuda Creek
NC0051713	Lakeview Mobile Home Park	Lakeview Mobile Home Park	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Cuddybum Creek
NC0055158	Town of Bermuda Run	Bermuda Run WWTP	Davie	Winston-Salem	Municipal , < 1MGD	Minor	30702	YADKIN RIVER
NC0055212	Auman's Mobile Home Park LLC	Auman's Mobile Home Park WWTP	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30707	Rich Fork
NC0055590	Town of Wilkesboro	Wilkesboro WTP	Wilkes	Winston-Salem	Water Treatment Plant	Minor	30701	Moravian Creek (Yellow Jacket Lake)
NC0055611	Susan Glenn	Blackberry Ridge WWTP	Caldwell	Asheville	100% Domestic < 1MGD	Minor	30701	YADKIN RIVER
NC0055786	City of Lexington	Lexington Regional WWTP	Davidson	Winston-Salem	Municipal , Large	Major	30707	Abbotts Creek
NC0056201	Countryside LLC	Countryside Mobile Home Park WWTP	Randolph	Winston-Salem	100% Domestic < 1MGD	Minor	30709	Caraway Creek
NC0057223	Head Mobile Home Park	Head Mobile Home Park	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Little Creek
NC0058815	Hope Valley Inc	Hope Valley Incorporated	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Fisher River
NC0059218	Captain Stevens Seafood Rest	Captain Stevens Seafood Rest	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Reedy Creek
NC0059536	Hilltop Living Center	Hilltop Living Center	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	YADKIN RIVER

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0060691	Blyth Homescents International	Blyth Homescents International	Surry	Winston-Salem	Industrial Process & Commercial	Minor	30702	YADKIN RIVER
NC0060691	Blyth Homescents International	Blyth Homescents International	Surry	Winston-Salem	Industrial Process & Commercial	Minor	30702	YADKIN RIVER
NC0061034	Rowan Assoc & Mercantile Ctr	Rowan Assoc & Mercantile Ctr	Rowan	Mooresville	100% Domestic < 1MGD	Minor	30704	Town Creek
NC0061204	Thomas Alphin	Scarlett Acres MHP WWTP	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Mill Creek
NC0061786	Poplar Trails Subdivision	Poplar Trails Subdivision	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Rocky River
NC0061808	Neighbors Food Stores, Inc.	Neighbors Fuel Center #12	Surry	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Little Fisher River
NC0063584	Heater Utilities Inc	Oxford Glen WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30712	Stevens Creek
NC0063720	AquaSource Inc	Forest Ridge WWTP	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Blanket Creek
NC0063762	Carolina Village Mobile Home Park	Carolina Village Mobile Home Park	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Rocky River
NC0063932	White Forest WWT Trust	White Forest WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	Reedy Creek
NC0064726	Town of East Bend	East Bend Industrial Park WWTP	Yadkin	Winston-Salem	Municipal , < 1MGD	Minor	30702	YADKIN RIVER
NC0064734	Bradfield Farms Water Company	Bradfield Farms WWTP	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	McKee Creek
NC0065587	Heater Utilities Inc	Frye Bridge WWTP	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Muddy Creek
NC0065684	Heater Utilities Inc	Country Wood WWTP	Union	Mooresville	100% Domestic < 1MGD	Minor	30712	Goose Creek
NC0065749	Heater Utilities Inc	Ashe Plantation WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30712	Duck Creek
NC0065773	Heater Utilities Inc	Willow Creek WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	Reedy Creek
NC0067644	Rocky River Run Subdivison	Rocky River Run Subdivison	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	Caldwell Creek
NC0068365	Town of Pilot Mountain	Pilot Mountain WTP	Surry	Winston-Salem	Water Treatment Plant	Minor	30703	Toms Creek
NC0068543	Davis Davis & Dodson LLC	Mountain Home Assisted Living	Wilkes	Winston-Salem	Industrial Process & Commercial	Minor	30701	Naked Creek
NC0068632	Craftmaster Furniture Corporation	Craftmaster Furniture Corporation	Alexander	Mooresville	100% Domestic < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0069523	Union County Public Works Department	Tallwood Estates WWTP	Union	Mooresville	Municipal , < 1MGD	Minor	30712	Clear Creek
NC0069841	Union County Public Works Department	Crooked Creek WWTP #2	Union	Mooresville	Municipal , Large	Major	30712	North Fork Crooked Creek
NC0070033	Quail Run Mobile Home Park	Quail Run Mobile Home Park	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30704	Miller Creek

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0070289	Ridgewood Farms Subdivision	Ridgewood Farms Subdivision	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30711	Caldwell Creek
NC0070459	Yadkin County Board of Education	Starmount High School WWTP	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30702	South Deep Creek
NC0070637	Kurz Transfer Products	Kurz Transfer Products	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	Reedy Creek
NC0070637	Kurz Transfer Products	Kurz Transfer Products	Davidson	Winston-Salem	Industrial Process & Commercial	Minor	30704	Reedy Creek
NC0071773	Yadkin County Board of Education	Forbush High School WWTP	Yadkin	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Forbush Creek
NC0071781	Aqua North Carolina, Inc.	McCarron Subdivision WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	Reedy Creek
NC0072508	Union County Public Works Department	Hunley Creek WWTP	Union	Mooresville	100% Domestic < 1MGD	Minor	30712	Goose Creek
NC0072664	Shurtape Technologies Inc	Stony Point Tape Plant	Alexander	Mooresville	100% Domestic < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0073539	AquaSource Inc	Willowbrook WWTP	Mecklenburg	Mooresville	100% Domestic < 1MGD	Minor	30711	Ramah Creek
NC0073822	State of North Carolina Department of Transporta	Surry County Office	Surry	Winston-Salem	Groundwater Remediation	Minor	30702	Fisher River
NC0074241	Associated Asphalt Greensboro, Inc.	Associated Asphalt Greensboro	Guilford	Winston-Salem	Industrial Process & Commercial	Minor	30608	East Fork Deep River
NC0074390	Anson County	Anson County WTP	Anson	Fayetteville	Water Treatment Plant	Minor	30716	McCoy Creek
NC0074756	Greater Badin Water & Sewer District	Badin WWTP	Stanly	Mooresville	Municipal , < 1MGD	Minor	30708	Little Mountain Creek
NC0075078	Wilkes County Airport	Wilkes County Airport	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Rock Creek
NC0075515	Wilkes County Schools	Boomer Ferguson Elementary School	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Warrior Creek
NC0075523	RDH Tire & Retread	RDH Tire & Retread	Rowan	Mooresville	Industrial Process & Commercial	Minor	30706	Beaverdam Creek
NC0075701	City of Albemarle	Tuckertown WTP	Stanly	Mooresville	Water Treatment Plant	Minor	30708	YADKIN RIVER (including lower portion of High Ro
NC0076066	Wilkes County Schools	North Wilkes High School WWTP	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	Wolf Branch
NC0076287	Randolph County Schools	Farmer Elementary School	Randolph	Winston-Salem	100% Domestic < 1MGD	Minor	30709	Uwharrie River
NC0076333	Statesville Auto Auction	Statesville Auto Auction WWTP	Iredell	Mooresville	Industrial Process & Commercial	Minor	30706	Fifth Creek (Five Mile Branch)

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0076775	Alcoa Power Generating Inc	Falls Powerhouse	Stanly	Mooresville	Industrial Process & Commercial	Minor	30708	YADKIN RIVER (including Falls Lake below normal
NC0077364	Carolina Water Service Inc of NC	Cabarrus Woods Well 6 Water Treatment Facility	Cabarrus	Mooresville	Water Treatment Plant	Minor	30711	Crozier Branch
NC0077615	Homer Prevette	Homer's Truck Stop	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Third Creek (Third Creek WS No. 37)
NC0077704	Cabarrus County Schools	Mount Pleasant High School	Cabarrus	Mooresville	100% Domestic < 1MGD	Minor	30712	Adams Creek
NC0078140	Northwest Textile Inc	Ronda Industrial Park WWTP	Wilkes	Winston-Salem	100% Domestic < 1MGD	Minor	30701	YADKIN RIVER
NC0078361	Town of Salisbury	Second Creek WWTP	Rowan	Mooresville	Municipal , < 1MGD	Minor	30706	Second Creek (North Second Creek)
NC0079260	Town of Yadkinville	Yadkinville WTP	Yadkin	Winston-Salem	Water Treatment Plant	Minor	30702	South Deep Creek
NC0079774	Davidson Downes Subdivision	Davidson Downes Subdivision	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30711	West Branch Rocky River
NC0079821	City of Winston-Salem	RA Thomas WTP	Forsyth	Winston-Salem	Water Treatment Plant	Minor	30704	Salem Creek (Middle Fork Muddy Creek)
NC0079898	CNA Holdings Inc	Needmore Road Landfill	Rowan	Mooresville	Groundwater Remediation	Minor	30706	South Yadkin River
NC0080322	Montgomery County	Montgomery County WTP	Montgomery	Fayetteville	Water Treatment Plant	Minor	30710	Clarks Creek
NC0080381	City of Monroe	John Glenn WTP	Union	Mooresville	Water Treatment Plant	Minor	30714	Stewarts Creek
NC0080586	Carolina Stalite Company	Carolina Stalite Company	Rowan	Mooresville	Industrial Process & Commercial	Minor	30713	Long Creek
NC0080748	Precision Fibers	Ronda Plant	Wilkes	Winston-Salem	Industrial Process & Commercial	Minor	30701	YADKIN RIVER
NC0080853	Lucent Technologies Inc	Salem Business Park remediation site	Forsyth	Winston-Salem	Groundwater Remediation	Minor	30704	Salem Creek (Middle Fork Muddy Creek)
NC0081281	Richmond County	Richmond County WTP	Richmond	Fayetteville	Water Treatment Plant	Minor	30716	PEE DEE RIVER
NC0081621	Water and Sewer Authority of Cabarrus County	Muddy Creek WWTP	Cabarrus	Mooresville	Municipal , < 1MGD	Minor	30712	Rocky River
NC0081825	Town of Ansonville	Ansonville WWTP	Anson	Fayetteville	Municipal , < 1MGD	Minor	30710	PEE DEE RIVER
NC0081931	Alcoa Power Generating Inc	High Rock Powerhouse	Rowan	Mooresville	Industrial Process & Commercial	Minor	30708	YADKIN RIVER (including Falls Lake below normal
NC0081949	Alcoa Power Generating Inc	Tuckertown Powerhouse	Stanly	Mooresville	Industrial Process & Commercial	Minor	30708	YADKIN RIVER (including Falls Lake below normal

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0081957	Alcoa Power Generating Inc	Narrows Powerhouse	Stanly	Mooresville	Industrial Process & Commercial	Minor	30708	YADKIN RIVER (including Falls Lake below normal
NC0082821	Southern States Cooperative Inc	Southerrn States Fertilizer Plant	Iredell	Mooresville	Groundwater Remediation	Minor	30706	Fourth Creek
NC0082949	Town of Denton	Denton WTP	Davidson	Winston-Salem	Water Treatment Plant	Minor	30708	YADKIN RIVER (including lower portion of High Ro
NC0083119	City of Concord	Coddle Creek WTP	Cabarrus	Mooresville	Water Treatment Plant	Minor	30711	Coddle Creek
NC0083291	Reddies River Water Works	Reddies River WTP	Wilkes	Winston-Salem	Water Treatment Plant	Minor	30701	Reddies River
NC0083763	Dixie Yarns Inc	Dixie Yarns remediation site	Stanly	Mooresville	Groundwater Remediation	Minor	30712	Rock Hole Branch
NC0083925	Heater Utilities Inc	Salem Glen Subdivision WWTP	Davidson	Winston-Salem	100% Domestic < 1MGD	Minor	30702	YADKIN RIVER
NC0084042	EnergyUnited Water Corporation	Colonel R.L. Tatum WTP	Alexander	Mooresville	Water Treatment Plant	Minor	30706	South Yadkin River
NC0084212	Davie County	Sparks Road WTP	Davie	Winston-Salem	Water Treatment Plant	Minor	30702	YADKIN RIVER
NC0084409	Heater Utilities Inc	Wellesley Place WWTP	Forsyth	Winston-Salem	100% Domestic < 1MGD	Minor	30702	Mill Creek
NC0084425	Davidson Water Inc	Davidson Water WTP	Davidson	Winston-Salem	Water Treatment Plant	Minor	30704	YADKIN RIVER
NC0084786	Furniture Illustrators Inc	Furniture Illustrators WWTP	Randolph	Winston-Salem	Industrial Process & Commercial	Minor	30709	Uwharrie River
NC0085120	Lowe's Home Centers Inc	Iredell Distribution Center WWTP	Iredell	Mooresville	100% Domestic < 1MGD	Minor	30706	Rocky Creek (Rocky River)
NC0085812	Union County Public Works Department	Grassy Branch WWTP	Union	Mooresville	Municipal , < 1MGD	Minor	30712	Crooked Creek
NC0085871	Flakt Products Inc	Flakt Products remediation site	Forsyth	Winston-Salem	Groundwater Remediation	Minor	30704	Brushy Fork
NC0086011	City of Winston-Salem	Neilson WTP	Forsyth	Winston-Salem	Water Treatment Plant	Minor	30704	Muddy Creek
NC0086029	Trinity American Corp	Glenola remediation site	Randolph	Winston-Salem	Groundwater Remediation	Minor	30709	Caraway Creek
NC0086169	Corning Inc	Fiber Optic Facility	Cabarrus	Mooresville	Industrial Process & Commercial	Minor	30712	Muddy Creek
NC0086169	Corning Inc	Fiber Optic Facility	Cabarrus	Mooresville	Industrial Process & Commercial	Minor	30712	Clear Creek
NC0086169	Corning Inc	Fiber Optic Facility	Cabarrus	Mooresville	Industrial Process & Commercial	Minor	30712	Rocky River

Permit	Owner	Facility	County	Region	Type	Class	Subbasin	Receiving Stream
NC0086487	Dawson International Properties	Albemarle site	Stanly	Mooresville	Groundwater Remediation	Minor	30713	Poplin Branch
NC0086762	City of Winston-Salem	Northwest WTP	Forsyth	Winston-Salem	Water Treatment Plant	Minor	30702	Bashavia Creek
NC0087033	Town of Harmony	Harmony WWTP	Iredell	Mooresville	Municipal <1 MGD	Minor	30706	Dutchman Creek
NC0087858	Equipment & Supply, Inc.	Equipment & Supply, Inc.	Union	Mooresville	Groundwater Remediation	Minor	30714	Stewarts Creek
NC0088081	Former Cookson Facility DOG	Former Cookson Facility DOG	Anson	Fayetteville	Groundwater Remediation	Minor	30710	Buffalo Creek

Table B. General Stormwater Permits

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG020013	Martin Marietta-Asheboro	Randolph	Winston-Salem	03-07-09	Back Creek	WS-II;HQW
NCG020048	Carolina Quarries Incorporated	Rowan	Mooresville	03-07-04	Church Creek	C
NCG020062	Carolina Quarries Incorporated	Rowan	Mooresville	03-07-04	Crane Creek	C
NCG020063	Martin Marietta-Woodleaf	Rowan	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG020068	Martin Marietta-Kannapolis	Rowan	Mooresville	03-07-12	Unnamed Tributary to Cold Water Creek	WS-IV
NCG020070	Martin Marietta-Bakers	Union	Mooresville	03-07-14	Stewarts Creek	WS-III
NCG020074	Solar White Quarry	Rowan	Mooresville	03-07-04	Crane Creek	C
NCG020075	Martin Marietta-Bonds Quarry	Cabarrus	Mooresville	03-07-10	Rocky River	C
NCG020076	Martin Marietta-Thomasville	Davidson	Winston-Salem	03-07-07	Jimmys Creek	C
NCG020081	Vulcan Construction Materials- Mocksville	Davie	Winston-Salem	03-07-05	Cedar Creek	C
NCG020082	Vulcan Construction Materials-North Quarry	Forsyth	Winston-Salem	03-07-04	Mill Creek	C
NCG020096	Martin Marietta-Salem Stone	Forsyth	Winston-Salem	03-07-07	Sprugeon Creek	WS-III
NCG020106	Martin Marietta-Pee Dee Quarry	Anson	Fayetteville	03-07-10	PEE DEE RIVER	C
NCG020107	Vulcan Construction Materials-Rockingham	Richmond	Fayetteville	03-07-16	Hitchcock Creek (Midway Pond, Steeles Mill Pond)	C
NCG020108	Vulcan Construction Materials-Gold Hill	Cabarrus	Mooresville	03-07-13	Long Creek	C
NCG020109	Martin Marietta-Statesville	Iredell	Mooresville	03-07-06	Gregory Creek	C
NCG020114	Martin Marietta-Yadkin	Yadkin	Winston-Salem	03-07-02	South Deep Creek	WS-IV
NCG020115	Vulcan Construction Materials-E Forsyth	Forsyth	Winston-Salem	03-07-07	Cuddybum Creek	WS-III
NCG020120	Hanson Brick - Anson County Mine	Anson	Fayetteville	03-07-10	Little Brown Creek	C
NCG020139	Oldcastle Stone Products/ Bosnal Mining	Richmond	Fayetteville	03-07-16	Cartledge Creek	C
NCG020160	Vulcan Construction Materials-115 Quarry	Wilkes	Winston-Salem	03-07-06	Hunting Creek	WS-III
NCG020172	Vulcan Construction Materials-Cabarrus Quarr	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG020173	Martin Marietta-Mallard Creek	Mecklenburg	Mooresville	03-07-11	Mallard Creek	C
NCG020206	Jacob's Creek Stone Co-Slate Min	Davidson	Winston-Salem	03-07-08	Beaverdam Creek	WS-IV
NCG020242	Boral Bricks Incorporated	Rowan	Mooresville	03-07-12	Little Buffalo Creek	C
NCG020266	Statesville Brick Co-Gold Hil	Rowan	Mooresville	03-07-08	Riles Creek	C
NCG020313	Immanuel Lutheran Church	Cabarrus	Mooresville	03-07-12	Little Buffalo Creek	C
NCG020344	Jacob's Creek Stone Co-Denton Si	Davidson	Winston-Salem	03-07-15	Cheek Creek	C
NCG020430	CEMEX-Norman Sand Mine	Montgomery	Fayetteville	03-07-09	Big Creek	C
NCG020441	South Fork Quarry	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG020456	Tarheel Sand & Stone Incorporated	Wilkes	Winston-Salem	03-07-01	Mulberry Creek	C
NCG020513	North Carolina Granite Corporation	Surry	Winston-Salem	03-07-03	Ararat River	WS-IV;Tr
NCG020515	Zion Church Mine	Rowan	Mooresville	03-07-12	Little Buffalo Creek	C
NCG020580	Martin Marietta - Richmond Quarry	Richmond	Fayetteville	03-07-16	Solomons Creek	C

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG020656	Ervin Materials of Concord	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG020684	Parker Mine	Stanly	Mooresville	03-07-13	Town Creek	C
NCG020689	North American Emerald Mines, Inc.	Alexander	Mooresville	03-07-06	Wallace Creek	WS-II;HQW
NCG020695	Seagrove Quarry	Montgomery	Fayetteville	03-07-15	Little River	C
NCG030009	Thomas Built Buses Incorporated	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG030081	Douglas Battery Mfg Co	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG030087	Kewaunee Scientific Corporation	Iredell	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG030101	Irotas Mfg Co Incorporated	Forsyth	Winston-Salem	03-07-07	Abbotts Creek	WS-III
NCG030129	J & J Machine Works Incorporated	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG030146	Union County remediation site	Union	Mooresville	03-07-14	Dry Fork	C
NCG030178	Grass America Incorporated	Forsyth	Winston-Salem	03-07-07	Abbotts Creek	WS-III
NCG030190	Proctor & Schwartz	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG030200	Taracorp Imaco Incorporated	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG030227	Corning Cable Systems LLC	Forsyth	Winston-Salem	03-07-04	Fiddlers Creek	C
NCG030232	Cooper Tools Inc	Union	Mooresville	03-07-14	Joes Branch	C
NCG030238	TurboCare Inc	Forsyth	Winston-Salem	03-07-04	Muddy Creek	C
NCG030253	Berenfield Containers SE	Cabarrus	Mooresville	03-07-11	Back Creek	C
NCG030271	Champion Industries	Forsyth	Winston-Salem	03-07-04	Leak Fork	C
NCG030293	Imo Industries Inc- Imo Pump	Union	Mooresville	03-07-14	Dry Fork	C
NCG030377	W S Tyler Incorporated	Rowan	Mooresville	03-07-04	Town Creek	C
NCG030442	Commscope Incorporated	Iredell	Mooresville	03-07-06	Gregory Creek	C
NCG030460	Emerson Network Power	Davidson	Winston-Salem	03-07-07	Cain Creek	WS-III
NCG030497	DANA SOHPP	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG030503	Engineered Sintered Components Company	Iredell	Mooresville	03-07-06	I-L Creek	C
NCG030505	Avdel Cherry LLC-Stanfield Operations	Stanly	Mooresville	03-07-12	Rock Hole Branch	C
NCG030509	Consolidated Metco Inc - Secrest	Union	Mooresville	03-07-14	Richardson Creek	WS-IV
NCG030511	Scott Health & Safety	Union	Mooresville	03-07-14	Bearskin Creek	C
NCG030512	Amphenol TCS	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek, Salem Lake)	WS-III;CA
NCG030513	Goodyear Tire & Rubber Co - Statesville	Iredell	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG030517	Mickey Truck Body Inc - High Point	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG030521	Spencer Steel Supply Company	Rowan	Mooresville	03-07-04	Town Creek	C
NCG030522	SPX Contech Metal Forge - Mabry Drive	Stanly	Mooresville	03-07-13	Long Creek	C
NCG030528	Winston Steel & Stair	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG030534	Caledonian Alloys, Inc.	Union	Mooresville	03-07-14	Richardson Creek	C
NCG030536	Holland USA, Inc. - Monroe Facility	Union	Mooresville	03-07-14	Richardson Creek	C

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG030537	ASMO North Carolina, Inc.	Iredell	Mooresville	03-07-06	Beaver Creek	C
NCG030540	USP Structural Connectors	Wilkes	Winston-Salem	03-07-01	Fishing Creek	C
NCG030544	Haldex Hydraulics Corporation	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG030549	Power Curbers, Inc.	Rowan	Mooresville	03-07-04	Town Creek	C
NCG030552	Square D, IPACS	Rowan	Mooresville	03-07-04	Town Creek	C
NCG030554	Thermcraft, Inc.	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG050002	Owens Illinois Incorporated	Richmond	Fayetteville	03-07-16	Falling Creek	WS-III;CA
NCG050025	Premtec Incorporated-Rowan	Rowan	Mooresville	03-07-12	Unnamed Tributary to Cold Water Creek	WS-IV
NCG050029	Uniwood	Iredell	Mooresville	03-07-06	Morrison Creek	C
NCG050036	Shurtape Tech Inc-Stony Point	Alexander	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG050041	Plastics Color Corporation Of NC	Randolph	Winston-Salem	03-07-09	Taylors Creek	C
NCG050074	Morton Custom Plastics	Cabarrus	Mooresville	03-07-11	Back Creek	C
NCG050075	ABT Incorporated	Iredell	Mooresville	03-07-06	Duck Creek	C
NCG050084	Charlotte Pipe & Foundry Co	Union	Mooresville	03-07-14	Stewarts Creek	WS-III
NCG050088	L B Plastics Incorporated	Iredell	Mooresville	03-08-32	Reeds Creek	WS-IV,B
NCG050098	International Paper Co-Container	Iredell	Mooresville	03-07-06	Gregory Creek	C
NCG050110	Oracle Flexible Packaging - Plant 604	Forsyth	Winston-Salem	03-07-04	Silas Creek	C
NCG050118	Valspar Industries USA Incorporated	Mecklenburg	Mooresville	03-07-11	Mallard Creek	C
NCG050141	Exopack Thomasville	Davidson	Winston-Salem	03-07-07	Hunts Fork	C
NCG050152	Laurel Hill Paper Co	Richmond	Fayetteville	03-07-16	Hitchcock Creek (Roberdel Lake)	WS-III;CA
NCG050153	Cascades Tissue Group - NC Inc	Richmond	Fayetteville	03-07-16	Hitchcock Creek (Roberdel Lake)	WS-III;CA
NCG050157	Interflex Group Carolina Plant	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG050202	Southeastern Packaging Company	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG050214	Prestige Fabricators Incorporated	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG050221	Smurfit-Stone Container Corp-Davidson	Davidson	Winston-Salem	03-07-07	Rat Spring Branch	C
NCG050270	Hexagon Polymers Compounding NC, Inc.	Iredell	Mooresville	03-07-06	Beaver Creek	C
NCG050288	Kurz Transfer Products	Davidson	Winston-Salem	03-07-04	Reedy Creek	C
NCG050289	Foam Tech	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG050299	McKenzie Sports Products	Rowan	Mooresville	03-07-04	Town Creek	C
NCG050303	OMNOVA Solutions	Union	Mooresville	03-07-14	Dry Fork	C
NCG050304	Meridian Automotive Systems Inc	Rowan	Mooresville	03-07-06	Second Creek (North Second Creek)	C
NCG050321	R J Reynolds Tobacco Co - Plant 641	Forsyth	Winston-Salem	03-07-04	Silas Creek	C
NCG050323	Covalence Specialty Materials-Thomasville	Davidson	Raleigh	03-07-07	Hunts Fork	C
NCG050332	Alpha Plastics Division	Richmond	Fayetteville	03-07-16	Marks Creek (Boyds Lake, City Lake, Everetts Lake)	C
NCG050333	VF Jeanswear Winston-Salem	Forsyth	Winston-Salem	03-07-04	Fiddlers Creek	C

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG050341	Alliance, a Division of Rock-Tenn Company	Forsyth	Winston-Salem	03-07-04	Grassy Creek	C
NCG050342	Amesbury Textile Group	Iredell	Mooresville	03-07-06	Gregory Creek	C
NCG050343	Paragon Films, Inc.	Alexander	Mooresville	03-07-06	Bull Branch	WS-II;HQW
NCG050344	Atrium Windows and Doors	Davidson	Winston-Salem	03-07-07	Cain Creek	WS-III
NCG050348	Mack Molding Company	Iredell	Mooresville	03-08-32	Broad Meadow Creek	WS-IV
NCG050349	Berry Tri-Plas Corporation	Union	Mooresville	03-07-12	South Fork Crooked Creek	C
NCG050350	Imaflex USA Inc.	Davidson	Winston-Salem	03-07-07	Hanks Branch	C
NCG050355	Sealed Air Corporation	Richmond	Fayetteville	03-07-16	Hitchcock Creek (Midway Pond, Steeles Mill Pond)	C
NCG050356	Shaw Industries Group, Inc Plant LP	Davidson	Winston-Salem	03-07-07	Cain Creek	WS-III
NCG060003	Kao Specialties Americas LLC	Guilford	Winston-Salem	03-07-07	Kennedy Mill Creek	C
NCG060003	Kao Specialties Americas LLC	Guilford	Winston-Salem	03-07-07	Kennedy Mill Creek	C
NCG060020	Tyson Foods Inc - Wilkesboro	Wilkes	Winston-Salem	03-07-01	Cub Creek	C
NCG060020	Tyson Foods Inc - Wilkesboro	Wilkes	Winston-Salem	03-07-01	Cub Creek	C
NCG060022	Harmony plant	Iredell	Mooresville	03-07-06	Hunting Creek	WS-III
NCG060022	Harmony plant	Iredell	Mooresville	03-07-06	Hunting Creek	WS-III
NCG060043	Corn Products International In	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060043	Corn Products International In	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060065	Fast Food Merchandiser-Rowan	Rowan	Mooresville	03-07-04	Grants Creek	C
NCG060065	Fast Food Merchandiser-Rowan	Rowan	Mooresville	03-07-04	Grants Creek	C
NCG060079	Tobaccoville plant	Forsyth	Winston-Salem	03-07-04	Barkers Creek	C
NCG060079	Tobaccoville plant	Forsyth	Winston-Salem	03-07-04	Barkers Creek	C
NCG060080	Reynolds Boulevard facility	Forsyth	Winston-Salem	03-07-04	Silas Creek	C
NCG060080	Reynolds Boulevard facility	Forsyth	Winston-Salem	03-07-04	Silas Creek	C
NCG060095	Goulston Technologies	Union	Mooresville	03-07-14	Bearskin Creek	C
NCG060095	Goulston Technologies	Union	Mooresville	03-07-14	Bearskin Creek	C
NCG060103	PTIC, LLC	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060103	PTIC, LLC	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060144	Carolina By-Products - Wadesboro Div	Anson	Fayetteville	03-07-10	Hurricane Creek	C
NCG060144	Carolina By-Products - Wadesboro Div	Anson	Fayetteville	03-07-10	Hurricane Creek	C
NCG060156	Bartlett Milling Company	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG060156	Bartlett Milling Company	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG060178	Sunset Feeds Inc	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060178	Sunset Feeds Inc	Forsyth	Winston-Salem	03-07-04	South Fork Muddy Creek	C
NCG060182	Marshville, NC Processing Facility Residuals	Union	Mooresville	03-07-14	Negro Head Creek (Salem Creek)	C
NCG060185	Wayne Farms LLC - Dobson Fresh Plant	Surry	Winston-Salem	03-07-02	Fisher River	WS-II;Tr,HQW

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG060185	Wayne Farms LLC - Dobson Fresh Plant	Surry	Winston-Salem	03-07-02	Fisher River	WS-II;Tr,HQW
NCG060220	Bakery Feeds	Union	Mooresville	03-07-14	Negro Head Creek (Salem Creek)	C
NCG060220	Bakery Feeds	Union	Mooresville	03-07-14	Negro Head Creek (Salem Creek)	C
NCG060249	Elkin Poultry Feed Mill 2	Surry	Winston-Salem	03-07-02	YADKIN RIVER	C
NCG060249	Elkin Poultry Feed Mill 2	Surry	Winston-Salem	03-07-02	YADKIN RIVER	C
NCG060259	Philip Morris USA Inc - Concord	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG060259	Philip Morris USA Inc - Concord	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG060268	Pet Dairy	Wilkes	Winston-Salem	03-07-01	Cub Creek	C
NCG060270	Triangle Ice - Troy	Montgomery	Fayetteville	03-07-15	Warner Creek	C
NCG060293	ITW Texwipe	Forsyth	Winston-Salem	03-07-07	Abbotts Creek	WS-III
NCG060293	ITW Texwipe	Forsyth	Winston-Salem	03-07-07	Abbotts Creek	WS-III
NCG070025	Carolina Perlite Co - Rowan Site	Rowan	Mooresville	03-07-08	Riles Creek	C
NCG070030	PPG - Lexington Facility	Davidson	Winston-Salem	03-07-07	Sooky Creek	C
NCG070034	B & C Concrete Products	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG070036	High Point Precast Incorporated	Randolph	Winston-Salem	03-07-09	Caraway Creek	C
NCG070040	L S Starrett Comapny - Surry	Surry	Winston-Salem	03-07-03	Lovills Creek (Lovell Creek)	WS-IV
NCG070055	DUCO-Sci, Inc	Union	Mooresville	03-07-14	Rays Fork	C
NCG070057	Hitachi Metals North Carolina	Rowan	Mooresville	03-07-12	Cold Water Creek	WS-IV
NCG070060	NGK Ceramics USA Inc	Iredell	Mooresville	03-07-06	South Fork Withrow Creek	C
NCG070064	Owens - Brockway Glass Container Inc - Lexin	Davidson	Winston-Salem	03-07-07	Leonard Creek	WS-III
NCG070065	Hydro Conduit Corp-Cabarrus	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG070066	Hanson Brick - Monroe Plant and Mine	Union	Mooresville	03-07-12	South Fork Crooked Creek	C
NCG070077	Cemex - Liberty Street	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG070122	Hydro Conduit Corp-Davidson	Davidson	Winston-Salem	03-07-07	Hamby Creek	C
NCG070124	Hydro Conduit Corp-Davidson	Davidson	Winston-Salem	03-07-07	Hamby Creek	C
NCG070128	Cemex-N Wilkesboro	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG070159	Hildreth Septic Tanks	Anson	Fayetteville	03-07-17	North Fork Jones Creek	WS-II;HQW
NCG070164	Southeastern Concrete Products of NC	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG070167	Boral Bricks Incorporated	Rowan	Mooresville	03-07-04	Town Creek	C
NCG070168	Surfaces Unlimited	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG070171	Triangle Brick Company, Inc.-Wadesboro Plant	Anson	Fayetteville	03-07-10	Grindstone Branch	C
NCG070174	Hanson Pipe & Products-Oakboro	Stanly	Mooresville	03-07-13	Big Bear Creek	C
NCG080057	G L Wilson Bldg Co-Wilson Pk	Iredell	Mooresville	03-07-06	Beaver Creek	C
NCG080059	Harrell Oil Company	Surry	Winston-Salem	03-07-03	Lovills Creek (Lovell Creek)	WS-IV
NCG080092	Cardinal Freight Carriers	Cabarrus	Mooresville	03-07-11	Afton Run	C

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NCG080141	Homer's Truck Stop of Statesville LLC	Iredell	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG080142	A T Williams Oil Co - Winston Salem	Forsyth	Winston-Salem	03-07-04	Leak Fork	C
NCG080143	Pilot Travel Centers LLC #56	Cabarrus	Mooresville	03-07-12	Little Cold Water Creek	C
NCG080170	A T Williams Oil Co-Wilco	Iredell	Mooresville	03-07-06	Kerr Creek	WS-II;HQW
NCG080184	United Parcel Service-High Point	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG080185	United Parcel Service-Kannapolis	Cabarrus	Mooresville	03-07-12	Unnamed Tributary to Cold Water Creek	WS-IV
NCG080187	United Parcel Service-Monroe	Union	Mooresville	03-07-14	Bearskin Creek	C
NCG080188	Central Transport Inc-High Point	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG080190	United Parcel Service-Statesville	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG080192	United Parcel Service-Wilkesboro	Wilkes	Winston-Salem	03-07-01	Moravian Creek (Yellow Jacket Lake)	C
NCG080241	Salem Carriers Incorporated	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG080258	Murrows Transfer Incorporated	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG080266	H & W Trucking Co Incorporated	Surry	Winston-Salem	03-07-03	Lovills Creek (Lovell Creek)	WS-IV
NCG080271	Bulk Storage Incorporated	Davidson	Winston-Salem	03-07-07	Rat Spring Branch	C
NCG080280	Swing Transport Incorporated-Forsyth	Forsyth	Winston-Salem	03-02-01	West Belews Creek (West Belews Creek Arm of of Belews L	C
NCG080312	Iredell Milk Transportation	Iredell	Mooresville	03-07-11	Rocky River	C
NCG080398	Allied Systems Limited	Forsyth	Winston-Salem	03-07-04	Frazier Creek (Winston Lake)	C
NCG080411	Browning Ferris Industries-Troy	Montgomery	Fayetteville	03-07-15	Warner Creek	C
NCG080467	Concord, NC Terminal	Cabarrus	Mooresville	03-07-12	Irish Buffalo Creek	WS-III
NCG080491	NC Nat Gd- Hamlet	Richmond	Fayetteville	03-07-16	Marks Creek (Water Lake)	WS-II;HQW
NCG080509	NC Nat Gd- Rockingham	Richmond	Fayetteville	03-07-16	South Prong Falling Creek	C
NCG080539	NC Nat Gd-Concord/Oms # 6	Cabarrus	Mooresville	03-07-11	Unnamed Tributary to Coddle Creek (Emerson Lake)	WS-II;HQW,CA
NCG080565	NC Nat Gd- N Wilkesboro	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG080567	NC Nat Gd-Salisbury/Aasf #2	Rowan	Mooresville	03-07-04	Grants Creek	C
NCG080573	NC Nat Gd-Winston-Salem/Oms #7	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG080614	Rex Oil Company	Davidson	Winston-Salem	03-07-07	Jimmys Creek	C
NCG080695	Landis Public Works Department	Rowan	Mooresville	03-07-04	Flat Rock Branch (South Branch Grants Creek) (Lake Corr	WS-IV;CA
NCG080698	Kannapolis Public Works Operation Center	Cabarrus	Mooresville	03-07-12	Irish Buffalo Creek	C
NCG080702	High Point City Transit	Guilford	Winston-Salem	03-06-08	Richland Creek	WS-IV:*
NCG080708	Union County Garage	Union	Mooresville	03-07-14	Stewarts Creek	WS-III
NCG080711	263rd Combat Communications Squadron	Stanly	Mooresville	03-07-08	Little Mountain Creek	WS-IV
NCG080723	Willard's Cab Co Inc	Forsyth	Winston-Salem	03-07-04	Peters Creek	C
NCG080738	North Charlotte Bins	Mecklenburg	Mooresville	03-07-11	Doby Creek	C

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NCG080748	Monroe Bins	Union	Mooresville	03-07-14	Richardson Creek	C
NCG080750	Albemarle Bins	Stanly	Mooresville	03-07-13	Long Creek	C
NCG080751	Concord Bins	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG080756	ATC/Rider Bus Garage	Cabarrus	Mooresville	03-07-12	Irish Buffalo Creek	C
NCG080763	J. B. Hunt-Concord Terminal	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG080769	America Charters, LTD	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG080787	Garbage Disposal Service-Davie	Davie	Winston-Salem	03-07-05	Elisha Creek	C
NCG090009	Aldo Products Company Incorporated	Rowan	Mooresville	03-07-12	Cold Water Creek (Lake Fisher)	WS-IV;CA
NCG090009	Aldo Products Company Incorporated	Rowan	Mooresville	03-07-12	Cold Water Creek (Lake Fisher)	WS-IV;CA
NCG090021	Akzo Nobel Coatings Incorporated	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG090021	Akzo Nobel Coatings Incorporated	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG100004	S & J Motor Co Inc Of Yadkin	Yadkin	Winston-Salem	03-07-02	Forbush Creek	C
NCG100008	Lewisville Motor Company Inc	Forsyth	Winston-Salem	03-07-04	Tomahawk Creek	C
NCG100052	Don's Auto Parts Incorporated	Union	Mooresville	03-07-12	Crooked Creek	C
NCG100056	K & C Auto Salvage Incorporated	Cabarrus	Mooresville	03-07-12	Rocky River	C
NCG100066	Louia Motor Co Incorporated	Davidson	Winston-Salem	03-07-07	Pounder Fork	WS-V,B
NCG100080	LKQ Salisbury Inc	Rowan	Mooresville	03-07-04	Town Creek	C
NCG100131	67 Motors	Forsyth	Winston-Salem	03-07-02	Bashavia Creek	C
NCG100132	Rik's Motor Company Inc	Yadkin	Winston-Salem	03-07-02	YADKIN RIVER	WS-IV
NCG100134	AAA Auto Salvage Inc	Randolph	Winston-Salem	03-07-07	Hunts Fork	C
NCG100135	Carolina Wrecking Co	Randolph	Winston-Salem	03-07-07	Hunts Fork	C
NCG100136	109 U Pull It Used Auto	Forsyth	Winston-Salem	03-07-04	Fiddlers Creek	C
NCG100137	A-1 Auto Salvage	Davidson	Winston-Salem	03-07-04	Soakas Creek	C
NCG100138	L & M Used Auto Parts Inc	Forsyth	Winston-Salem	03-07-04	Lowery Mill Creek	WS-III
NCG100140	Guil-Rand Auto Salvage	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG100142	Stamper & Haynes Salvage	Wilkes	Winston-Salem	03-07-01	Joshua Creek	C;Tr
NCG100144	Lilly's Auto Repair and Salvage	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG100146	Triad Auto Salvage	Forsyth	Winston-Salem	03-07-04	Soakas Creek	C
NCG100150	Mark's Used Parts	Forsyth	Winston-Salem	03-07-04	Sawmill Branch	C
NCG100166	Stricklin Auto & Truck Parts, Inc.	Rowan	Mooresville	03-07-06	Withrow Creek	C
NCG100167	Foyell Auto Service	Forsyth	Winston-Salem	03-07-04	Peters Creek	C
NCG100173	Pull-A-Part of Charlotte	Mecklenburg	Mooresville	03-07-11	Toby Creek	C
NCG100190	Davidson Auto Salvage	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG100192	C&W Cores, Inc.	Davidson	Winston-Salem	03-07-09	Little Uwharrie River (Wheatmore Pond)	WS-III
NCG110013	City of Winston-Salem - Archie Elledge WWTP	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C

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NCG110014	Wilkesboro North Town-Landfil	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG110018	Westside WWTP	Davidson	Winston-Salem	03-07-07	Rich Fork	C
NCG110022	Monroe WWTP	Union	Mooresville	03-07-14	Richardson Creek	WS-IV
NCG110031	wilkesboro - Cub Creek WWTP	Wilkes	Winston-Salem	03-07-01	Cub Creek	C
NCG110050	Long Creek WWTP	Stanly	Mooresville	03-07-13	Long Creek	C
NCG110065	Mooresville WWTP	Iredell	Mooresville	03-07-11	Dye Creek (Branch)	C
NCG110069	Rocky River WWTP	Cabarrus	Mooresville	03-07-10	Rocky River	C
NCG110070	Crooked Creek WWTP #2	Union	Mooresville	03-07-12	South Fork Crooked Creek	C
NCG110079	Anson County Regional WWTP	Anson	Fayetteville	03-07-17	South Fork Jones Creek	C
NCG110093	Lexington Regional WWTP	Davidson	Winston-Salem	03-07-07	Abbotts Creek Arm of High Rock Lake	WS-V,B
NCG110094	Hamby Creek WWTP	Davidson	Winston-Salem	03-07-07	North Hamby Creek	C
NCG120019	Rowan Co-Landfill	Rowan	Mooresville	03-07-06	Second Creek (North Second Creek)	C
NCG120034	Winston Salem - Hanes Mill Rd Sanitary Landf	Forsyth	Winston-Salem	03-07-04	Grassy Creek	C
NCG120038	Davidson Co- Solid Waste Fac	Davidson	Winston-Salem	03-07-07	Hamby Creek	C
NCG120042	Iredell Co-Twins Oaks Rd 3260	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG120053	BFI Waste Systems of NA	Cabarrus	Mooresville	03-07-12	Rocky River	C
NCG120064	Anson Co-Waste Mgmt Facility	Anson	Fayetteville	03-07-10	Brown Creek	C
NCG120066	Roaring River Landfill	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	WS-V
NCG120074	Albemarle City Municipal Solid Waste Landfil	Stanly	Mooresville	03-07-08	Jacobs Creek	WS-IV
NCG120076	Surry County Municipal Solid Waste Landfill	Surry	Winston-Salem	03-07-03	Ararat River	C
NCG120077	U S Tire Recycling LP	Cabarrus	Mooresville	03-07-11	Rocky River	C
NCG120078	Uwharrie Regional Recycling Complex - Yard W	Montgomery	Fayetteville	03-07-08	Rocky Creek	WS-IV
NCG130040	U S Tire Recycling LP	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG130043	Republic Waste Services-Winston Salem-2876	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek, Salem Lake)	WS-III;CA
NCG140032	Dean's Ready Mixed Incorporated	Stanly	Mooresville	03-07-13	Long Creek	C
NCG140040	Concrete Supply Co- Concord	Cabarrus	Mooresville	03-07-12	Irish Buffalo Creek	WS-III
NCG140119	Central Concrete Company	Rowan	Mooresville	03-07-04	Second Creek Arm of High Rock Lake	WS-V,B
NCG140142	Cemex-Country Club Road	Forsyth	Winston-Salem	03-07-04	Tomahawk Creek	C
NCG140143	Cemex-King	Stokes	Winston-Salem	03-07-02	Crooked Run Creek	WS-IV
NCG140146	Cemex-Mount Airy-South	Surry	Winston-Salem	03-07-03	Lovills Creek (Lovell Creek)	WS-IV
NCG140165	Southern Concrete Mat-Mecklen	Mecklenburg	Mooresville	03-07-11	Back Creek	C
NCG140170	Ready Mixed Concrete Co -Clemmonsville Road	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG140177	Carl Rose and Sons - Hwy 67 Ready-Mix	Yadkin	Winston-Salem	03-07-02	Fall Creek	C
NCG140193	Cemex-Wadesboro	Anson	Fayetteville	03-07-10	Culpepper Creek	C
NCG140194	Cemex-Monroe	Union	Mooresville	03-07-14	Bearskin Creek	C

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NCG140195	Cemex-Concord	Cabarrus	Mooresville	03-07-11	Unnamed Tributary to Coddle Creek (Emerson Lake)	WS-II;HQW,CA
NCG140238	Concrete Supply Co-Mocksville	Davie	Winston-Salem	03-07-05	Leonard Creek	C
NCG140241	Concrete Supply Co- Monroe	Union	Mooresville	03-07-14	Bearskin Creek	C
NCG140255	Cabarrus Concrete Co	Cabarrus	Mooresville	03-07-12	Irish Buffalo Creek	WS-III
NCG140273	Cabarrus Concrete Co-Salisbury	Rowan	Mooresville	03-07-04	Town Creek	C
NCG140283	Thomas Concrete Of Carolina Inc	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG140287	Hartleys Ready Mix Concrete	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG140323	Combs Construction Co Inc	Mecklenburg	Mooresville	03-07-11	Ramah Creek	C
NCG140336	Charlotte Project	Cabarrus	Mooresville	03-07-11	Coddle Creek	C
NCG140339	Cemex - Lowery Street	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek, Salem Lake)	WS-III;CA
NCG140343	Cemex- Hamlet	Richmond	Fayetteville	03-07-16	Marks Creek (Boyds Lake, City Lake, Everetts Lake)	C
NCG140351	Macleod Construction Inc.- East Plant	Cabarrus	Mooresville	03-07-11	Back Creek	C
NCG160001	APAC Atlantic Inc - Concord Plant (42460)	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG160028	Carl Rose and Sons - Statesville	Wilkes	Winston-Salem	03-07-06	Hunting Creek	WS-III
NCG160042	Larco Construction Co - Winston-Salem	Forsyth	Winston-Salem	03-07-04	Leak Fork	C
NCG160063	Apac Atlantic Inc - Gold Hill Plant	Rowan	Mooresville	03-07-04	Reedy Creek	C
NCG160068	Maymead Materials, Inc. - Statesville	Iredell	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG160088	Rea Contracting LLC Mallard Creek 066	Mecklenburg	Mooresville	03-07-11	Mallard Creek	C
NCG160119	Apac Atlantic Inc - Randleman Plant (42406)	Randolph	Winston-Salem	03-06-09	Haskett Creek	C
NCG160157	APAC Atlantic Inc - Kernersville Plant (4240	Forsyth	Winston-Salem	03-07-07	Rich Fork	C
NCG160158	APAC Atlantic Inc - North Quarry Plant (4240	Forsyth	Winston-Salem	03-07-04	Mill Creek	C
NCG160166	Mount Airy Asphalt Plant	Surry	Winston-Salem	03-07-03	Ararat River	C
NCG160170	Rea Contracting LLC - Kannapolis Plant 076	Rowan	Mooresville	03-07-12	Cold Water Creek (Lake Fisher)	WS-IV;CA
NCG160172	Ferebee Asphalt Corporation	Mecklenburg	Mooresville	03-07-11	Coddle Creek	C
NCG160175	APAC Atlantic Inc - Mocksville	Davie	Winston-Salem	03-07-05	Cedar Creek	C
NCG170009	Hanes Dye & Finishing Company	Forsyth	Winston-Salem	03-07-04	Peters Creek	C
NCG170059	General Elastic Corp-Randolph	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG170061	Wade Manufacturing Co	Anson	Fayetteville	03-07-17	Jones Creek	C
NCG170084	Lamp Crafters Incorporated	Davidson	Winston-Salem	03-07-07	Michael Branch	C
NCG170127	Carolina Mills Inc-Plant #12	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG170154	Unifi Inc- Plant 21	Yadkin	Winston-Salem	03-07-02	North Deep Creek	C
NCG170185	Tuscarora Yarns Inc-Mt Pleasan	Cabarrus	Mooresville	03-07-12	Dutch Buffalo Creek	WS-II;HQW
NCG170187	Tuscarora Yarns Inc-China Grov	Rowan	Mooresville	03-07-12	Unnamed Tributary to Cold Water Creek	WS-IV

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NCG170197	Richmond Plant	Richmond	Fayetteville	03-07-16	Hitchcock Creek (Roberdel Lake)	WS-III;CA
NCG170234	Kayser Roth Corp- Asheboro Plant	Randolph	Winston-Salem	03-06-09	Haskett Creek	C
NCG170235	Gulistan Carpet	Iredell	Mooresville	03-07-06	Rocky Creek (Rocky River)	C
NCG170380	Intex Corporation	Surry	Winston-Salem	03-07-03	Heatherly Creek	C
NCG170401	Interface Fabrics Group	Surry	Winston-Salem	03-07-02	YADKIN RIVER	C
NCG170405	Microfibres, Inc.	Forsyth	Winston-Salem	03-07-04	Salem Creek (Middle Fork Muddy Creek)	C
NCG180039	Linwood Furniture Inc.	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG180041	Plant 5	Davidson	Winston-Salem	03-07-07	Rat Spring Branch	C
NCG180051	Stanley Furniture Co-Davidson	Davidson	Winston-Salem	03-07-07	Michael Branch	C
NCG180069	Nomus Interiors Inc	Yadkin	Winston-Salem	03-07-02	Bowman Mill Creek	C
NCG180071	Pearson Company	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG180119	Southern Furniture Co-Orbit 2	Iredell	Mooresville	03-07-06	Third Creek (Third Creek WS No. 37)	C
NCG180163	Plant C & M	Davidson	Winston-Salem	03-07-07	North Hamby Creek	C
NCG180167	Plant D	Davidson	Winston-Salem	03-07-07	North Hamby Creek	C
NCG180194	Klaussner Furniture-Pl 1 5 6 7	Randolph	Winston-Salem	03-07-09	Unnamed Tributary to Cedar Fork Creek	WS-II;HQW
NCG180203	Dar Ran Furniture Inc-Archdale	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG180217	High Point Furniture Industrie	Randolph	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG180220	High Point Furniture Industrie	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG180226	Leggett & Platt Incorporated	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG180231	B/E Aerospace	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG200349	Atlantic Scrap&Processing, LLC -W-Salem	Forsyth	Winston-Salem	03-07-04	Brushy Fork	C
NCG200357	Foils Incorporated	Cabarrus	Mooresville	03-07-11	Coddle Creek	WS-II;HQW
NCG200422	Metal Recycling Services, Inc.	Union	Mooresville	03-07-14	Richardson Creek	C
NCG200424	Keywell LLC	Union	Mooresville	03-07-14	Richardson Creek	C
NCG200430	Albemarle City Recycling Facility	Stanly	Mooresville	03-07-08	Jacobs Creek	WS-IV
NCG200434	Iredell County Recycling Facility	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG200438	Yadkin County Recycling Facility	Yadkin	Winston-Salem	03-07-02	Forbush Creek	C
NCG200439	Metal Recycling Services, Inc.	Union	Mooresville	03-07-14	Rays Fork	C
NCG200440	TKZ Recycling	Yadkin	Winston-Salem	03-07-02	North Deep Creek	C
NCG200442	Uwharrie Salvage & Scrap	Montgomery	Fayetteville	03-07-15	Little River	C;HQW
NCG210001	B & H Panel Company	Randolph	Winston-Salem	03-07-09	Cedar Fork Creek	C
NCG210003	Intercraft	Iredell	Mooresville	03-07-06	Fourth Creek	C
NCG210013	Doorcraft Of NC - Challenge Door of NC	Davidson	Winston-Salem	03-07-07	Swearing Creek	C
NCG210034	Troy Lumber Company	Montgomery	Fayetteville	03-07-15	Spencer Branch (Blake Creek)	C
NCG210046	Uwharrie Lumber Company Incorporated	Montgomery	Fayetteville	03-07-15	Spencer Branch (Blake Creek)	C

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG210071	T I Industries	Davidson	Winston-Salem	03-07-07	Michael Branch	C
NCG210094	Church And Church Lumber Co-BFR 2	Wilkes	Winston-Salem	03-07-01	Fish Dam Creek (Fishtrap Creek)	WS-IV
NCG210101	Select Hardwoods	Wilkes	Winston-Salem	03-07-01	Millers Creek	WS-IV
NCG210116	Brittain Lumber Company	Iredell	Mooresville	03-07-06	Back Creek	C
NCG210128	Stock Building Supply Inc - Monroe	Union	Mooresville	03-07-14	Richardson Creek	WS-IV
NCG210157	Jimmy Ward Hardwoods Incorporated	Randolph	Winston-Salem	03-07-15	Wagners Branch	C
NCG210212	Pallet Resource Of NC Incorporated	Davidson	Winston-Salem	03-07-04	Reedy Creek	C
NCG210214	Central Lumber Co Incorporated	Davidson	Winston-Salem	03-07-07	Pounder Fork	WS-V,B
NCG210239	Church And Church Lumber Co-BFR 1	Wilkes	Winston-Salem	03-07-01	Fish Dam Creek (Fishtrap Creek)	WS-IV
NCG210281	CMH Manufacturing, Inc., d/b/a Schult Homes-	Rowan	Mooresville	03-07-04	Second Creek	C
NCG210282	CMH Manufacturing, Inc. d/b/a Schult Homes -	Rowan	Mooresville	03-07-04	Second Creek	C
NCG210291	McDowell Lumber Company Inc	Randolph	Winston-Salem	03-07-09	Caraway Creek	C
NCG210306	Miller Brothers Lumber Co	Surry	Winston-Salem	03-07-02	Turkey Creek	C
NCG210316	Key City Furniture Co-Wilkes	Wilkes	Winston-Salem	03-07-01	YADKIN RIVER	C;Tr
NCG210335	Ornamental Products Inc-Plt 2	Guilford	Winston-Salem	03-07-09	Uwharrie River	WS-III
NCG210354	Unilin	Montgomery	Fayetteville	03-07-15	Disons Creek	C
NCG210357	Clayton Homes - Richfield	Stanly	Mooresville	03-07-08	Curl Tail Creek	WS-IV
NCG210358	Universal Forest Products Eastern Div Inc -	Stanly	Mooresville	03-07-13	Town Creek	C
NCG210362	Todco Inc	Davidson	Winston-Salem	03-07-07	Hamby Creek	C
NCG210367	Soil Supply, Inc.	Mecklenburg	Mooresville	03-07-11	North Prong Clarke Creek	C
NCG210372	Hull Brothers Lumber Co., Inc.	Surry	Winston-Salem	03-07-03	Stewarts Creek	WS-IV
NCG210373	Noonkester Lumber, Inc.	Surry	Winston-Salem	03-07-02	Little Fisher River	C
NCG210374	Scott Lumber	Yadkin	Winston-Salem	03-07-02	South Deep Creek	WS-III
NCG020006	Crystal Pink Quarry	Rowan	Mooresville	03-07-04	a UT of Crane Creek	
NCG020136	Rockwell Granite Company	Rowan	Mooresville	03-07-04	a UT of Second Creek	
NCG020158	Ararat Rock Products Company	Surry	Winston-Salem	03-07-03	the Ararat River and Lovills Creek	C
NCG020159	Vulcan Construction Materials, LP	Surry	Winston-Salem	03-07-02	the Yadkin River	C
NCG020170	Martin Marietta	Cabarrus	Mooresville	03-07-08	a UT of the Pee-Dee River	WSIV & B
NCG020181	Silver Hill Mines, Inc.	Davidson	Winston-Salem	03-07-04	UT Abbotts Creek	C
NCG020183	Vulcan Construction Materials, LP	Yadkin	Winston-Salem	03-07-02	a UT of Harmon Creek	WSIV
NCG020201	Vulcan Construction Materials, LP	Mecklenburg	Mooresville	03-07-11	a UT of Caldwell Creek	C
NCG020204	Benchmark Carolina Aggregates	Davidson	Winston-Salem	03-07-07	a UT of Abbotts Creek	WSV & B
NCG020220	Lessees of Hendrick Gravel & Sand Co.	Anson	Fayetteville	03-07-10	a UT of Savannah Creek	WSIV
NCG020239	Boral Bricks, Inc.	Rowan	Mooresville	03-07-04	the Yadkin River (High Rock Lake)	WSIV & B
NCG020241	Boral Bricks, Inc.	Rowan	Mooresville	03-07-04	the Yadkin River (High Rock Lake)	WSIV & B

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NCG020259	W. R. Bonsal Co.	Anson	Fayetteville	03-07-10	a UT of Smith Creek	WSIV
NCG020260	W. R. Bonsal Co.	Anson	Fayetteville	00--	Jones, Island, and McCoy Creeks	C
NCG020271	Cunningham Brick Company, Inc.	Davidson	Winston-Salem	03-07-09	a UT of Brier Creek	WSIII
NCG020285	Taylor Clay Products, Inc.	Rowan	Mooresville	03-07-04	High Rock Lake	WSIV B
NCG020310	Carolina Quarries, Inc.	Rowan	Mooresville	03-07-04	a UT of Second Creek	C
NCG020351	Taylor Clay Products Inc	Montgomery	Fayetteville	03-07-15	a UT of Cheek Creek	C
NCG020425	Rowan Pink	Rowan	Mooresville	03-07-04	UT Crane Creek	C
NCG030010	Thomas Built Buses	Guilford	Winston-Salem	03-07-07	UT To Richland Cr. And Payne Cr.	C C
NCG030037	General Electric Company	Rowan	Mooresville	03-07-04	UT To Town Creek	C
NCG030039	Cleveland Truck Manufacturing Plant	Rowan	Mooresville	03-07-06	UT To Third Creek	C
NCG030042	Timken 21c Bearing Mfg. Facility	Randolph	Winston-Salem	03-07-09	UT To Back Creek	WSII
NCG030059	Metal Forge Company	Stanly	Mooresville	03-07-13	UT To Poplin Branch	C
NCG030099	"Galvan Industries, Inc."	Cabarrus	Mooresville	03-07-11	UT To Back Creek	C
NCG030127	"Norandal USA, Inc."	Rowan	Mooresville	03-07-04	UT To Crane Creek And Town Creek	C
NCG030139	HERSEY METERS	Rowan	Mooresville	03-07-06	UT To Withrow Creek	C
NCG030189	"Elizabeth Carbide Of North Carolina, Inc."	Davidson	Winston-Salem	03-07-09	UT To Brien Creek	WSIII
NCG030194	"Electrical Controls Division, W. A. Brown	Rowan	Mooresville	03-07-04	UT To Grants Creek	C
NCG030195	"Long Meadow Drive Plant, W. A. Brown & Son	Rowan	Mooresville	03-07-04	UT To Grants Creek	C
NCG030204	"The Austin Company Of Greensboro, Inc."	Yadkin	Winston-Salem	03-07-02	UT To South Deep Creek	WSIII
NCG030224	"Johnson Controls Battery Group, Inc."	Forsyth	Winston-Salem	03-07-04	Lowrey Creek	WSIII
NCG030225	"Crown Cork & Seal Company, Inc."	Anson	Fayetteville	03-07-10	UT To Brown's Creek	C
NCG030228	Perfomed Line Products Co.	Stanly	Mooresville	03-07-08	UT To Little Mountain Creek	C
NCG030230	Trim Systems LLC	Iredell	Mooresville	03-07-06	UT To Third Creek	C
NCG030239	"R. J. Reynolds Co., Archer 200-Cunningham	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG030240	Deere-Hitachi Construction Machinery Corp.	Forsyth	Winston-Salem	03-07-04	UT To Kerners Mill Creek	WSIII
NCG030241	Ingersoll-Rand Co.	Davie	Winston-Salem	03-07-06	UT To Bear Creek	WSIV
NCG030245	ILCO -Unican -Winston-Salem	Forsyth	Winston-Salem	03-07-09	UT To Brushy Fork	C
NCG030255	JC Steele & Sons Inc.	Iredell	Mooresville	03-07-06	UT To Fourth Creek	C
NCG030264	Allied Tool & Machine Company	Forsyth	Winston-Salem	03-07-07	UT To Abbotts Creek	WSIII
NCG030286	Irving Benstock- Vanguard Supreme Plant 1	Union	Mooresville	03-07-14	Monroe Sewer System To Bearskin Creek	C
NCG030287	Irving Benstock- Vanguard Supreme Plant 2	Union	Mooresville	03-07-14	Monroe Storm Sewer To Bearskin Creek	C
NCG030291	Tubular Textile L.L.C.	Davidson	Winston-Salem	03-07-07	UT To Swearing Creek	C
NCG030303	Eaton Corporation - Clutch Div.	Cabarrus	Mooresville	03-07-11	UT To Rocky River	C
NCG030320	Jerry Smith- Carolina Steel Fabrication Inc	Forsyth	Winston-Salem	03-07-04	UT Salem Creek	C
NCG030372	"Brass Craft Thomas Manufacturing Company,	Davidson	Winston-Salem	03-07-07	Ut To Hamby Creek	C

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NCG030379	"MMI Products, Inc.-Merchants Metals"	Iredell	Mooresville	03-07-06	Ut Fourth Creek	C
NCG030402	Triad Steel Company-Davidson	Davidson	Winston-Salem	03-07-07	Ut Hunts Fork	C
NCG030411	Acme Metal Slide Inc.	Iredell	Mooresville	03-07-06	Ut Third Creek	C
NCG030461	Grinnel Fire Protection Systems, Inc.	Rowan	Mooresville	03-07-06	UT's of Withrow Creek and Beaverdam Creek	C
NCG050006	Hunt Manufacturing Company	Iredell	Mooresville	03-07-06	UT To Third Creek	C
NCG050009	Candle Corporation Of America	Surry	Winston-Salem	03-07-02	Yadkin River	C
NCG050019	McKenzie Taxidermy Supply	Rowan	Mooresville	03-07-04	UT To Church Creek	C
NCG050060	Carolina Color Corporation	Rowan	Mooresville	03-07-04	UT To Grants Creek	C
NCG050069	"United Technologies Automotive, Inc."	Surry	Winston-Salem	03-07-03	UT To Lovills Creek	C
NCG050097	Permaflex Southern Inc.	Rowan	Mooresville	03-07-04	UT To Town Creek	C
NCG050107	Gallos Plastics Corporation	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG050143	"Creative Plastic Molders, Inc."	Davidson	Winston-Salem	03-07-07	UT To Abbotts Creek	C
NCG050172	"North Carolina Foam Industries, Inc."	Surry	Winston-Salem	03-07-03	UT To Ararat River	C
NCG050174	Georgia-Pacific Corp.- Mcdowell Rd.	Randolph	Winston-Salem	03-07-05	UT To Little River	C
NCG050215	Prestige Fabricators- Randleman	Randolph	Winston-Salem	03-06-09	UT To Back Creek	C NSW
NCG050222	Packaging Corporation of America	Rowan	Mooresville	03-07-04	UT To Yadkin River	WSV
NCG050230	"Mid-Sate Plastics, Inc."	Randolph	Winston-Salem	03-07-15	UT To Kings Creek	C
NCG050235	Jefferson Smurfit Corp, (us)	Iredell	Mooresville	03-07-06	Ut Third Creek	C
NCG050237	Jefferson Smurfit Corporatoion	Forsyth	Winston-Salem	03-07-04	Winston-Samem MSSS to Manarcas Creek	C
NCG050241	Sara Lee Knit Products	Randolph	Winston-Salem	03-06-09	Asheboro MSSS to Ut Pennwood Branch	C
NCG050265	Jet Corr	Iredell	Mooresville	03-07-06	Statesville MS4 to UT Gregory Creek	C
NCG050272	Iredell Fiber, Inc.	Iredell	Mooresville	03-07-06	UT Fourth Creek	C
NCG050277	"Hayward Industries, Inc."	Forsyth	Winston-Salem	03-07-02	UT Johnson Creek	WS IV
NCG060021	"Tyson Foods, Inc., Roaring River Feed Mill	Wilkes	Winston-Salem	03-07-01	UT To Yadkin River	WSIV
NCG060023	"Tyson Foods, Inc."	Union	Mooresville	03-07-14	UT To Richardson Creek	C
NCG060041	"Peidmont Chemical Industries, Inc., LLC"	Guilford	Winston-Salem	03-07-07	High Point MSSS to Payne Creek	C
NCG060078	"R. J. Reynolds Tobacco Co., Downtown Mftng	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG060099	"Perdue Farms, Inc."	Surry	Winston-Salem	03-07-02	Yadkin River	C
NCG060117	"Showell Farms, Inc."	Anson	Fayetteville	03-07-13	Rocky River	C
NCG060129	Freirich Foods	Rowan	Mooresville	03-07-04	UT To Grants Creek	C
NCG060133	"Southern States Coop., Inc.- Southern Stat	Rowan	Mooresville	03-07-06	UT To Withrow Creek	C
NCG060184	"Cuddy Farms, Inc.- Feed Mill"	Union	Mooresville	03-07-14	UT To Richardson Creek	C
NCG060186	Wayne Farms- Elkin	Surry	Winston-Salem	03-07-02	Yadkin River	C
NCG060189	"Showell Farms, Inc.- Concord Location"	Cabarrus	Mooresville	03-07-12	UT To Irish Buffalo Creek	C
NCG060205	Custom Finishers Inc	Guilford	Winston-Salem	03-07-09	Muddy Creek	WSIII

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NCG060208	Pepsi-cola Company Inc	Forsyth	Winston-Salem	03-07-04	Ut Salem Lake	WSIII CA
NCG060230	Finetex Incorporated	Rowan	Mooresville	03-07-04	ut yadkin river	wsv
NCG070006	Carolina Solite Corporation	Stanly	Mooresville	03-07-13	Rocky River	C
NCG070018	Old Carolina Brick Company	Rowan	Mooresville	03-07-04	UT To Draft Branch	C
NCG070032	"Shoaf Precast Septic Tank, Inc."	Davidson	Winston-Salem	03-07-09	Dykers Creek	WSIV
NCG070046	Lightweight Block Co., Inc.	Davidson	Winston-Salem	03-07-04	Swearing Creek	C
NCG070084	"Cunningham Brick Company, Inc."	Davidson	Winston-Salem	03-07-09	UT To Brier Creek	WSIII
NCG070088	"Taylor Clay Products, Inc."	Rowan	Mooresville	03-07-07	Town Creek	C
NCG070109	Johnson Concrete Co.- Piedmont Block Design	Cabarrus	Mooresville	03-07-12	UT To Irish Buffalo Creek	C
NCG070132	Brooks Products Inc	Cabarrus	Mooresville	03-07-12	Coddle Creek	C
NCG070160	The Quickrete Companies	Anson	Fayetteville	03-07-14	UT Wide Mouth Branch	C
NCG080023	Winston-Salem Transit Authority	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG080038	WM Of Piedmont-Winston-Salem	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG080040	WM Of Northwest Carolinas	Surry	Winston-Salem	03-07-02	UT To Jackson Creek	C
NCG080045	WM Of Central Carolinas - Granite Quarry	Rowan	Mooresville	03-07-04	UT To Church Creek	C
NCG080078	"Propst Brothers Distributors, Inc."	Cabarrus	Mooresville	03-07-12	UT To Irish Buffalo Creek	C
NCG080114	ACTIVE USA, INC	Rowan	Mooresville	03-07-06	Withers Creek	C
NCG080150	Brewer-Hendly Oil Company	Union	Mooresville	03-07-14	Ut Richardson Creek	C
NCG080167	"Browning-Ferris Industries Of South Atlant	Anson	Fayetteville	03-07-10	UT To Swans Branch	C
NCG080168	United Parcel Service- Salisbury	Rowan	Mooresville	03-07-07	UT To Town Creek	C
NCG080195	Yarbrough Transfer Company	Forsyth	Winston-Salem	03-07-04	Winston-Salem SS To Salem Creek	C
NCG080196	United Parcel Service- Winston-Salem	Forsyth	Winston-Salem	03-07-04	Winston-Salem SS To Salem Creek	C
NCG080198	"Howard Lisk, Inc."	Anson	Fayetteville	03-07-10	UT To Cabin Branch Creek	C
NCG080201	HCFS Transport Company	Forsyth	Winston-Salem	03-07-04	UT To South Fork Muddy Creek	C
NCG080219	"Montgomery Tank Lines, Inc."	Rowan	Mooresville	03-07-04	UT To Town Creek	C
NCG080267	"Mazzeo Transportation, Inc."	Forsyth	Winston-Salem	03-07-04	Winston-Salem MSSS to Peters Creek	C
NCG080274	"Billings Freight Systems, Inc.- Lexington"	Davidson	Winston-Salem	03-07-07	UT Swearing Creek	C
NCG080279	"Swing Transport, Inc."	Rowan	Mooresville	03-07-04	Yadkin River	WSIV
NCG080298	"Stegall Milling Co., Inc."	Union	Mooresville	03-07-14	UT To Lick Branch	C
NCG080299	Holland Transfer & Distribution Center	Iredell	Mooresville	03-07-06	UT To Third Creek	C
NCG080334	"Browning-Ferris Industriesof South Atlanti	Forsyth	Winston-Salem	03-07-04	Winston-Salem MSSS to Salem Lake	WSIII CA
NCG080383	"Watkins Motor Lines, Inc."	Forsyth	Winston-Salem	03-07-07	UT Abbotts Creek	WSIII
NCG080424	Ploof Truck Lines Inc	Rowan	Mooresville	03-07-04	Ut Grants Creek	C
NCG080432	Snow Creek Trucking-	Surry	Winston-Salem	03-07-03	Ut Snow Creek	C
NCG080449	Yarbrough-Crane & Rigging	Forsyth	Winston-Salem	03-07-04	Winston-Salem MSSS to Ut Salem Creek	C

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NCG080454	Collins & Aikman Products Inc-Traffic Divis	Stanly	Mooresville	03-07-07	Ut Twin Creek	C
NCG080475	Santee Carriers/Holly Hill	Forsyth	Winston-Salem	03-07-04	Ut Salem Creek	C
NCG080481	"Shelby D. Johnson Trucking, Inc."	Davidson	Winston-Salem	03-07-07	Ut Hunts Fork Creek	C
NCG080499	NC Army National Guard-Monroe NG Armory	Union	Mooresville	03-07-14	Ut Richardson Creek	C
NCG080531	NC Army National Guard-Albemarle NG	Stanly	Mooresville	03-07-13	MSSS to Long Creek	C
NCG080532	NC Army National Guard-Asheboro NG Armory	Randolph	Winston-Salem	03-06-09	Ut Hasketts Creek	C
NCG080552	NC Army National Guard-High Pont NG Ar. & O	Davidson	Winston-Salem	03-07-07	Ut Blair Creek	C
NCG080581	"Roadway Express, Inc. - T655"	Richmond	Fayetteville	03-07-16	Ut Marks Creek	C
NCG080604	Ruan Leasing Company	Forsyth	Winston-Salem	03-07-04	Ut Fiddlers Creek	C
NCG080630	Norfolk Southern Corp.	Forsyth	Winston-Salem	03-07-04	UT Brushy Fork	C
NCG090006	"Mallard Creek Polymers, Inc."	Mecklenburg	Mooresville	03-07-11	UT To Mallard Creek	C
NCG090012	The Valspar Company	Guilford	Winston-Salem	00--	UT To Payne Creek	
NCG090017	CHEMCRAFT INTERNATIONAL, INC.	Forsyth	Winston-Salem	03-07-04	UT Frazier Creek	C
NCG090020	Lilly Industries- The Lilly Company	Guilford	Winston-Salem	03-07-07	UT Payne Creek	C
NCG090022	"Warlick Paint Co., Inc."	Iredell	Mooresville	03-07-06	UT Third Creek	C
NCG090023	"Engineered Polymer Solutions, Inc. D/b/a V	Iredell	Mooresville	03-07-06	Ut Fourth Creek	C
NCG100009	Bill's Junked Car Service	Cabarrus	Mooresville	03-07-11	UT Afton Run	C
NCG100012	21 Motors Inc.	Yadkin	Winston-Salem	03-07-06	UT North Little Hunting Creek	WSIII
NCG100016	Yadkin Superior Motor Sales	Yadkin	Winston-Salem	03-07-12	UT North Deep Creek	WSIV
NCG100018	Rays Salvage & Auto Sales	Wilkes	Winston-Salem	03-07-01	UT Roaring River	WSIV B
NCG100030	Matlocks Used Cars	Rowan	Mooresville	03-07-06	UT Fourth Creek	WSIV
NCG100039	"Hunt's Auto Parts, Inc."	Randolph	Winston-Salem	03-07-09	UT Caraway Creek	C
NCG100078	"Randolph Auto Parts, Inc.- Biscoe"	Montgomery	Fayetteville	03-07-15	UT Cedar Creek	C
NCG100087	Parker Motor Co.	Stanly	Mooresville	03-07-13	UT Rocky River	C
NCG100102	High Point Auto Salvage	Guilford	Winston-Salem	03-07-07	High Point MSSS to Rich Kennedy Mill Creek	C
NCG100105	"Iron Peddlers Parts Division, Inc."	Union	Mooresville	03-07-14	Ut South Fork Crooked Creek	C
NCG120039	Mecklenburg County Harrisburg Road Landfill	Mecklenburg	Mooresville	03-07-11	UT To Reedy Creek	C
NCG120051	"Uwharrie Environmental, Inc.- Montgomery L	Montgomery	Fayetteville	03-07-15	UT Rocky Creek	C
NCG130005	Recycle America/Winston-Salem	Forsyth	Winston-Salem	03-07-04	UT To Salem Creek	C
NCG130008	Browning Ferris Industries Of South Atlanti	Forsyth	Winston-Salem	03-07-04	Winston Salem MSSS to Salem Lake	WSIII CA
NCG130012	Sonoco Products Co.-Paperstock Dealers Win	Forsyth	Winston-Salem	03-07-04	Winston Salem MSSS to Leak Fork Creek	C
NCG130015	Sonoco Products Co.-Salisbury	Rowan	Mooresville	03-07-04	Salisbury MSSS to Grants Creek	C
NCG130027	Safety-Kleen Corporation-Randolph	Randolph	Winston-Salem	03-07-09	the Uwharrie River	WSIII
NCG140012	RMC Carolina Materials Inc-Mt. Airy Plt.	Surry	Winston-Salem	03-07-03	a UT of Lovills Creek	WSIV
NCG140013	Concrete Supply	Stanly	Mooresville	03-07-13	Albemarle MSSS to Poplin Creek	C

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NCG140014	Foltz Concrete Pipe COMPANY LLC	Davidson	Winston-Salem	03-07-04	a UT of Miller Creek	C
NCG140030	Loflin Concrete Co Inc.	Forsyth	Winston-Salem	03-07-04	a UT of Salem Lake	WSIII CA
NCG140039	Concrete Supply Co-Matthews	Union	Mooresville	03-07-12	a UT of South Fork Crooked Creek	C
NCG140044	Concrete Supply Co-Kannapolis	Rowan	Mooresville	03-07-12	Coldwater Creek	WSIV
NCG140049	Concrete Supply Co-Salisbury	Rowan	Mooresville	03-07-04	a UT of Grants Creek	C
NCG140066	RMC CAROLINA MATERIALS, INC.	Davidson	Winston-Salem	03-07-07	a UT of Hunts Fork	C
NCG140067	RMC CAROLINA MATERIALS, INC.	Davidson	Winston-Salem	03-07-07	a UT of Abbotts Creek	C
NCG140116	Unicon Concrete LLC	Forsyth	Winston-Salem	03-07-04	a UT of South Fork Muddy Creek	C
NCG140118	Troy Ready Mix, Inc.	Montgomery	Fayetteville	03-07-15	a UT of Rocky Creek	C
NCG140140	Williams Ready Mix Products Inc.	Union	Mooresville	03-07-14	a UT of Lick Branch	WSIII
NCG140144	RMC Caroina Materials Inc.- West Plant	Forsyth	Winston-Salem	03-07-04	a UT of Salem Creek	C
NCG140163	Southern Concrete Materials Inc	Union	Mooresville	03-08-38	Fork Crooked Creek	C
NCG140169	Unicon Concrete LLC	Forsyth	Winston-Salem	03-07-04	a UT of Grassy Creek	C
NCG140172	UNICON CONCRETE	Iredell	Mooresville	03-07-06	a UT of Fourth Creek	C
NCG140175	UNICON CONCRETE	Alexander	Mooresville	03-08-32	a UT of Greasy Creek	C
NCG140183	Johnson Concrete Company Inc.	Rowan	Mooresville	03-07-04	Salisbury MSSS to Town Creek	C
NCG140192	Commerical Products Inc - Union Co.	Union	Mooresville	03-07-12	a UT of South Fork Crooked Creek	C
NCG140208	Metromont Materials Corp - Statesville	Iredell	Mooresville	03-07-06	a UT of Third Creek	C
NCG140229	Gobble & Callahan Inc	Davidson	Winston-Salem	03-07-04	Longview Creek	WSIV
NCG160023	Highway Constructors-Div. of APAC	Richmond	Fayetteville	03-07-16	a UT of Hitchcock Creek	C
NCG160025	Carl Rose & Sons Inc.	Surry	Winston-Salem	03-07-02	the Yadkin River	WSIV CA
NCG160029	Carl Rose & Sons Inc.-Twin City	Wilkes	Winston-Salem	03-07-01	a UT of Yadkin River	C
NCG160059	APAC Carolina, Inc.-PAPCO	Rowan	Mooresville	03-07-04	a UT of Grants Creek	C
NCG160065	Thompson Arthur Paving Co.-Plnat 1	Forsyth	Winston-Salem	03-07-04	Morarcas Creek	C
NCG160111	MAPCO, Inc. Asphalt Plant #1	Randolph	Winston-Salem	03-07-09	a UT of Back Creek	WSII
NCG160117	Blyth Construction, Inc. - Plant 2	Cabarrus	Mooresville	03-07-11	a UT of the Rocky River	C
NCG160134	J.T. Russel & Sons, Inc.	Stanly	Mooresville	03-07-08	a UT of Curl Tail Creek	WSIV
NCG160135	APAC-Thomas Arthur Paving Co-Forsythe	Forsyth	Winston-Salem	03-07-04	a UT of Leak Fork	C
NCG170008	Melville Textile Print Works	Iredell	Mooresville	03-07-06	a UT of Third Creek	C
NCG170014	Wright Of Thomasville, Inc.	Randolph	Winston-Salem	03-07-09	a UT of Hunts Fork	C
NCG170017	John Boyle & Co., Inc.	Iredell	Mooresville	03-07-06	a UT of Fourth Creek	C
NCG170046	Highland Industries Inc.-Kernsville Plant	Forsyth	Winston Salem	03-03-07	Abbotts Creek	WSIII
NCG170051	Bloomsburg Mills Inc.	Union	Mooresville	03-07-14	Joe's Branch	C
NCG170064	Cross Creek Apparel Inc.	Surry	Winston Salem	03-07-03	the Ararat River	C
NCG170148	Parkdale America-Plant 23	Rowan	Mooresville	03-07-04	a UT of Grants Creek	C

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG170186	Tuscaroro Yarns Inc.-Oakboro Plant	Stanly	Mooresville	03-07-13	a UT of Coldwater Branch	C
NCG170215	Clark-Schwebel, Corp.	Iredell	Mooresville	03-07-06	a UT of Third Creek	C
NCG170261	Cookson Fibers Inc-Asheboro	Randolph	Winston Salem	03-06-12	a UT of Haskett Creek	C
NCG170276	Collins & Aikman Prod. Co.- Albemarle	Stanly	Mooresville	03-07-13	a UT of Town Creek	C
NCG170301	Collins & Aikman Prod. Inc.-Montgomery	Montgomery	Fayetteville	03-07-15	a UT of Suck Creek	C
NCG170327	Sara Lee Underwear	Forsyth	Winston-Salem	03-07-04	a UT of Little Creek	C
NCG170352	Parkdale Inc-Plant 11	Rowan	Mooresville	03-07-04	a UT of Grants Creek	C
NCG170353	Parkdale Inc-Plant 6 & 7	Davidson	Winston-Salem	03-07-07	a UT of Hunts Fork	C
NCG170354	Parkdale Inc-Plant 3&4	Davidson	Winston-Salem	03-07-07	Lexington MSSS to Michael Branch	C
NCG170369	American Fiber & Finishing	Stanly	Mooresville	03-07-07	Little Long Creek	C
NCG170373	UCO fabrics, inc.	Richmond	Fayetteville	03-07-16	a UT of Hitchcock Creek	C
NCG180010	Craftmaster Furniture Co.	Alexander	Mooresville	03-07-06	a UT of the South Yadkin River	WSII CA
NCG180030	Alexvale Furniture Co.	Alexander	Mooresville	03-08-32	a UT of Greasy Creek	C
NCG180034	Stanly Fixtures Co., Inc.	Stanly	Mooresville	03-07-13	the Rocky River	C
NCG180036	Haworth Inc.	Guilford	Winston Salem	03-07-07	a UT of Payne Creek	C
NCG180038	Lexington Furniture Industries	Davidson	Winston Salem	03-07-07	Lexington MSSS to Abbott's Creek	C
NCG180056	Commercial Carving Company	Davidson	Winston Salem	03-07-07	a UT of Hamby Creek	C
NCG180057	Commercial Carving Co.	Davidson	Winston Salem	03-07-07	a UT of Hamby Creek	C`
NCG180070	Baker Furniture Company	Davie	Winston Salem	03-07-05	a UT of Elisha Creek	C
NCG180104	Vaughan-Bassett Furniture Co. Inc.	Surry	Winston Salem	03-07-02	the Yadkin River	WSIV CA
NCG180107	Ladd Furniture Inc.-American Drew	Wilkes	Winston Salem	03-07-01	the Reddies River	C
NCG180108	Ladd Furniture Inc.-American Drew	Wilkes	Winston Salem	03-07-01	a UT of the Yadkin River	C
NCG180109	Ladd Furniture Inc.-American Drew	Wilkes	Winston Salem	03-07-01	a UT of Mulberry Creek	C
NCG180124	Bassett Furniture Industries	Alexander	Mooresville	03-07-06	a UT of the South Yadkin River	WSII
NCG180131	Bassett Furniture Industries	Surry	Winston Salem	03-07-03	a UT of Stewarts Creek	C
NCG180145	Councill Business Inc.	Davidson	Winston Salem	03-07-08	Denton Mss To Lick Creek	C
NCG180147	Councill Craftsmen Inc.	Davidson	Winston Salem	03-07-08	Bulla-Bay Creek	C
NCG180148	Councill Craftsmen Inc.	Davidson	Winston Salem	03-07-09	Tom's Creek	C
NCG180168	Thomasville Furniture Ind.	Forsyth	Winston Salem	03-07-04	a UT of Peters Creek	C
NCG180172	Thomasville Furniture Ind.	Iredell	Mooresville	03-07-06	a UT of I-L Creek	C
NCG180215	Patrick Industries, Inc.	Stanly	Mooresville	03-07-08	a UT of Curl Tail Creek	wsiv
NCG210340	CertainTeed Corporation	Wilkes	Winston-Salem	03-07-01	Yadkin	C
NCG210341	Edwards Wood Products	Union	Mooresville	03-07-14	Ut of Becky Branch	C
NCG030463	B & B Fabricators Incorporated	Iredell		00--		
NCG030474	Lyndon Steel Company	Forsyth		00--		

Permit	Facility	County	Region	Subbasin	Receiving Stream	Class
NCG030478	Coffing Hoists Company	Anson		00--		
NCG050286	Cascades Moulded Pulp Incorporated	Richmond		00--		
NCG050298	Adorn, LLC	Stanly		00--		
NCG070163	Bonsal American Inc	Anson		00--		
NCG080447	Browning Ferris Industries - Cleveland	Rowan		00--		
NCG080634	Sanders Transfer Incorporated	Forsyth		03-07-04	UT Fiddlers Creek	C
NCG140288	McGee Brothers Co Incorporated	Cabarrus		03-07-12	UT Muddy Creek	C
NCG170390	WestPoint Home, Inc.	Surry		00--		
NCG200353	Atlantic Scrap & Processing LLC	Forsyth		00--		
NCG200358	Holmes Iron & Metal Incorporated	Rowan		00--		
NCG200363	L Gordon Iron & Metal Co	Iredell		00--		
NCG210002	Olympic Manufacturing Co	Wilkes		00--		
NCG210006	J Neil West Sawmill	Lenoir		00--		
NCG210144	Albemarle Forest Products Co	Chowan		00--		
NCG210163	Component Concepts	Davidson		00--		
NCG210287	Genwove US Limited	Union		00--		
NCG210295	Wilderness NC, Inc.	Davidson		00--		
NCG210297	Thomasville Furniture Co - County Line	Davidson		00--		
NCG210298	Plant CDK	Davidson		00--		
NCG210309	Thomasville Furniture Co -Unity	Davidson		00--		
NCG210311	Brushy Mountain Enterprises	Alexander		00--		
NCG210337	T I Industries - Lexington	Davidson		00--		
NCG210347	Armstrong Hardwood Flooring Company-Statesville	Iredell		03-07-06	UT Fourth Creek	WS IV
NCG210352	Shaver Wood Products Incorporated	Rowan		00--		
NCG210353	Tarheel Organic Reprocessing	Cabarrus		00--		

Table C. NPDES Non-Discharge Permits

Permit	Owner	Facility	Type	Class	County	Region
WQ0000425	City of Thomasville	Thomasville WTP	Government - Municipal	Minor	Davidson	Winston-Salem
WQ0000537	Clariant Corporation	Mount Holly East (MHE) Facility	Non-Government	Major	Mecklenburg	Mooresville
WQ0000579	Pepsi Cola Bottling	Pepsi Cola Bottling-Midland D	Non-Government	Minor	Cabarrus	Mooresville
WQ0000601	CSX Transportation	CSX Transportation-Polishing	Non-Government	Minor	Richmond	Fayetteville
WQ0000807	Robert E Price	Robert Price SFR	Individual	Minor	Davie	Winston-Salem
WQ0000886	Michael C Hillard	Michael C. Hillard SFR	Individual	Minor	Davidson	Winston-Salem
WQ0000957	Valley Protein Inc	Valley Protein Inc-Wadesboro	Non-Government	Major	Anson	Fayetteville
WQ0000961	R J Reynolds Tobacco Company	Davie County Storage Facility	Non-Government	Major	Davie	Winston-Salem
WQ0000965	Oracle Flexible Packaging Inc	Oracle Flexible Packaging-Plant 200	Non-Government	Minor	Forsyth	Winston-Salem
WQ0001077	Finetex - An Octel Company	Finetex Inc-Finetex Chem Plt	Non-Government	Minor	Rowan	Mooresville
WQ0001759	City of Statesville	Fourth Creek WWTP	Government - Municipal	Minor	Iredell	Mooresville
WQ0002001	Waters Edge Poa	Waters Edge POA-Spray Systm	Non-Government	Major	Rowan	Mooresville
WQ0002075	Enterprise Rendering Company Inc	Enterprise Rendering Company WWTF	Non-Government	Major	Stanly	Mooresville
WQ0002204	NC Department Of Corrections	NC DOC-Morrison Correctional Center	Government - State	Major	Richmond	Fayetteville
WQ0002227	William P Smith	Smith, William P. - SFR	Individual	Minor	Anson	Fayetteville
WQ0002378	Town of Mooresville	Rocky River WWTP	Government - Municipal	Minor	Iredell	Mooresville
WQ0002702	Alchem Incorporated	Alchem Incorporated Residuals Reuse Program	Non-Government	Minor	Rowan	Mooresville
WQ0002714	Tyco International (PA) Inc.	Tyco Electronics-Young Philli	Non-Government	Major	Forsyth	Winston-Salem
WQ0002780	Labonte Racing Inc	Labonte Racing Shop	Non-Government	Minor	Randolph	Winston-Salem
WQ0002868	Martin Marietta Materials Inc	Martin Marietta Materials, Inc.-Salisbury Shop	Non-Government	Minor	Rowan	Mooresville
WQ0003158	Kimberly Kocik	Kimberly Kocik SFR	Individual	Minor	Union	Mooresville
WQ0003687	Gold Hill Airpk Hoa	Gold Hill Airpk Hoa-Gold Hill	Non-Government	Major	Rowan	Mooresville
WQ0003769	Lydall Thermal/Acoustical Group	Lydall Incorporated-Westex Division	Non-Government	Major	Yadkin	Winston-Salem
WQ0003874	Georgia Pacific Resins	Georgia Pacific Resins-Formal	Non-Government	Major	Davidson	Winston-Salem
WQ0003932	Owens - Brockway Glass Container Inc	Owens - Brockway Glass Container Inc - Lexington	Non-Government	Minor	Davidson	Winston-Salem
WQ0004040	City of Statesville	Third Creek WWTP	Government - Municipal	Minor	Iredell	Mooresville
WQ0004479	Handy Sanitary District	Handy Sd-Uwharrie Pt	Non-Government	Major	Montgomery	Fayetteville
WQ0004972	Thousand Trails L P	Thousand Trails-Forest Lake	Non-Government	Major	Davie	Winston-Salem
WQ0005310	United Oil of the Carolinas Inc	United Oil of the Carolinas, Inc.	Non-Government	Minor	Cabarrus	Mooresville
WQ0005555	Weyerhaeuser Company	Elkin, NC Oriented Strand Board Manufacturing Facility	Non-Government	Major	Surry	Winston-Salem
WQ0005824	Beroth Oil Company	Four Brothers Food Store # 102	Non-Government	Minor	Surry	Winston-Salem
WQ0006661	Cemex Construction Materials L P	Metromont Mat-Ready Mix / Iredell	Non-Government	Minor	Iredell	Mooresville

Permit	Owner	Facility	Type	Class	County	Region
WQ0006946	NC Department of Cultural Resources	Reed Gold Mine	Government - State	Minor	Cabarrus	Mooresville
WQ0006992	Oracle Flexible Packaging Inc	Oracle Flexible Packaging - Plant 604	Non-Government	Major	Forsyth	Winston-Salem
WQ0009220	Paul M Bost Trucking Co	Paul M Bost Trucking Co-Truc	Non-Government	Minor	Rowan	Mooresville
WQ0009619	James R Lineberger	James Lineberger SFR	Individual	Minor	Yadkin	Winston-Salem
WQ0009826	Wayne Farms LLC	Wayne Farms LLC Hatchery Spray Irrigation System	Non-Government	Minor	Surry	Winston-Salem
WQ0009849	US Forest Service	Badin Lake Recreation Area	Non-Government	Minor	Montgomery	Fayetteville
WQ0010607	Carolina Health 409 Inc	R P Scherer Corp-Chelsea Lab	Non-Government	Major	Union	Mooresville
WQ0010657	Badin Shores Resort Hoa	Badin Shores Resort	Non-Government	Major	Montgomery	Fayetteville
WQ0010878	The Spiritual Center of America	West Campus	Non-Government	Major	Watauga	Winston-Salem
WQ0011443	Southern Community Bank and Trust	Long Hill Store	Non-Government	Minor	Surry	Winston-Salem
WQ0011765	Brian D Jessup	Brian and Karen Jessup SFR	Individual	Minor	Cabarrus	Mooresville
WQ0011928	Union County Public Works Department	Olde Sycamore WWTP	Government - County	Major	Union	Mooresville
WQ0012694	The Spiritual Center of America	Maharishi Spiritual CT-East C	Non-Government	Major	Watauga	Winston-Salem
WQ0013205	David A Freeman	Jean Boulding & David Freeman - SFR	Individual	Minor	Davidson	Winston-Salem
WQ0013880	Bryant Electric Co	Bryant Electric Co-Surrett Dr	Non-Government	Minor	Randolph	Winston-Salem
WQ0013948	New London Brick Works	New London Brick Works-Rowan	Non-Government	Minor	Rowan	Mooresville
WQ0014239	Jason T Martin	Martin Jason T-SFR/Martin Pr	Individual	Minor	Anson	Fayetteville
WQ0014268	Cuddy Farms Inc	Cuddy Farms Inc-A Sludge Fac	Non-Government	Minor	Anson	Fayetteville
WQ0014451	Dale Earnhardt Inc	Dale Earnhardt, Inc.	Non-Government	Minor	Iredell	Mooresville
WQ0015491	Caraway Speedway	Caraway Speedway-Drip Irrigat	Non-Government	Minor	Randolph	Winston-Salem
WQ0015945	Linda Beard	Linda Beard SFR	Individual	Minor	Rowan	Mooresville
WQ0016165	City of Lexington	Lexington City-Pilot Spray Ir	Government - Municipal	Minor	Davidson	Winston-Salem
WQ0016526	Kenneth P Mallard	Kenneth and Natalie Mallard SFR	Individual	Minor	Cabarrus	Mooresville
WQ0017507	William H Heilig	William Heilig SFR	Individual	Minor	Stanly	Mooresville
WQ0018635	Martin B Foil	Hinds' Feet Farm, Inc. - SFR	Individual	Minor	Mecklenburg	Mooresville
WQ0019260	Sheila B Smith	Sheila Smith SFR	Individual	Minor	Cabarrus	Mooresville
WQ0020793	Tyson Farms Inc	Hays Hatchery	Non-Government	Minor	Wilkes	Winston-Salem
WQ0021861	Grady Ackerman	Ackerman WWTS - Track 4 & 3B	Non-Government	Minor	Union	Mooresville
WQ0022056	Anson County	Anson County Regional WWTP	Government - Municipal	Minor	Anson	Fayetteville
WQ0023999	Lee Spencer	Lee and JoAnna Spencer SFR	Individual	Minor	Cabarrus	Mooresville
WQ0024914	Ronald Gold Overcash	Davidson Highway Project	Individual	Minor	Cabarrus	Mooresville
WQ0029893	Mark Heitbrink	Mark and Ramona Heitbrink - SFR	Individual	Minor	Union	Mooresville
WQ0030696	James A Richardson	Betty and James Richardson SFR	Individual	Minor	Union	Mooresville