Chapter 3
Neuse River Subbasin 03-04-03
Including the: Middle Creek and Terrible Creek

3.1 Subbasin Overview

Subbasin 03-04-03 at a Glance

Land Cover (percent)

Forest/Wetland:	57.3
Surface Water:	1.1
Urban:	22.0
Cultivated Crop:	17.6
Pasture/Managed Herbaceous:	1.9

Counties
Johnston and Wake

Municipalities
Holly Springs, Apex and Fuquay-Varina

Stream Statistics

Total Streams:	117.7 mi/98.0 ac
Total Supporting:	45.0 mi
Total Impaired:	10.2 mi
Total Not Rated:	2.5 mi/0.0 ac
Total No Data:	50.6/98.0 ac

This subbasin is located in southern Wake and Central Johnston counties. Middle Creek is the largest stream in this subbasin, flowing from one end to the other. All other streams are tributaries to Middle Creek, and drain agricultural areas.

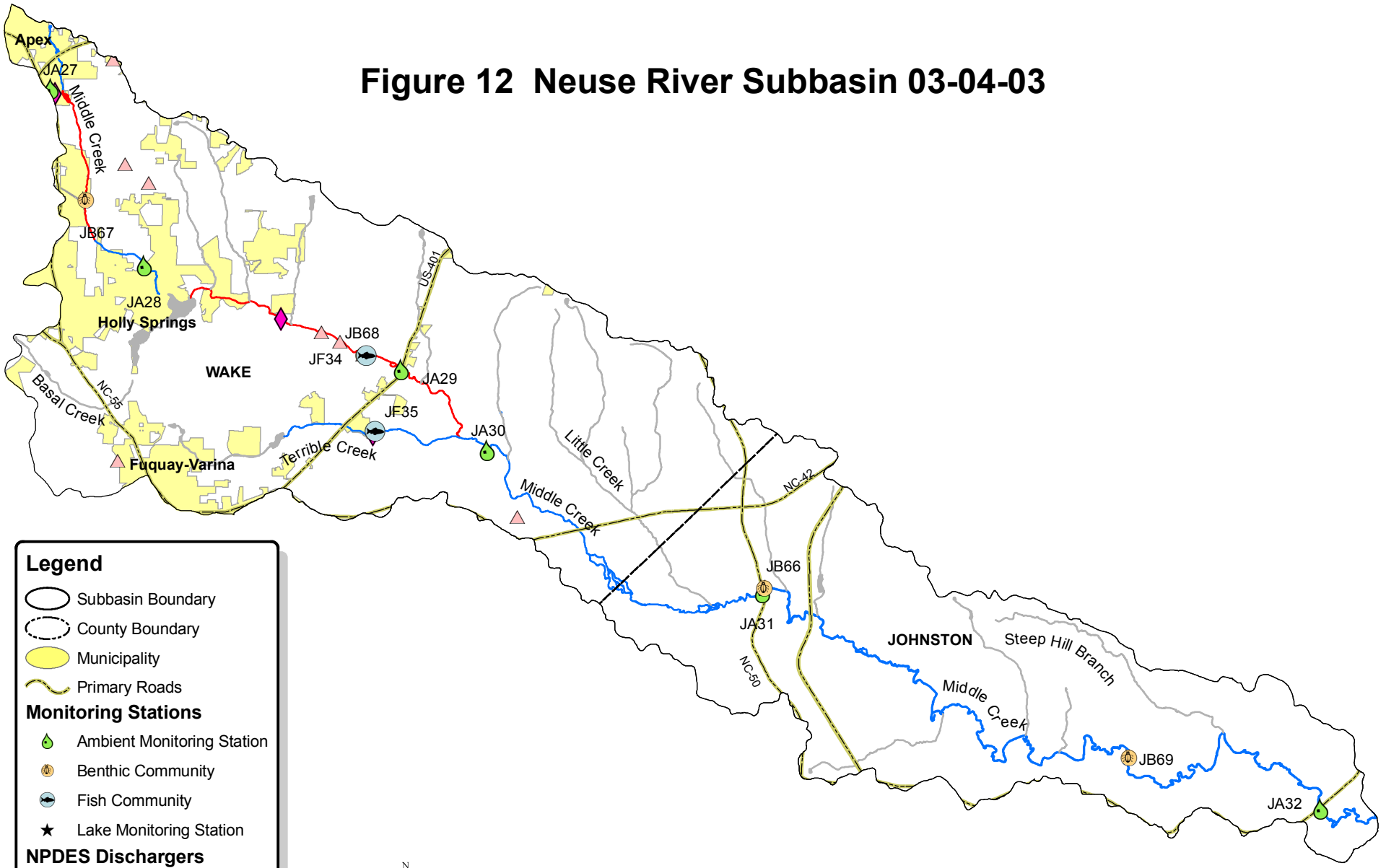
The two fastest growing municipalities in this subbasin are Apex and Holly Springs. Over the past decade, the population of Holly Springs has increased by 88.9 percent (8,168) and Apex increased by 76.3 percent (15,423). Land cover is roughly one-half forest/wetland and one-quarter urban; cropland makes up the majority of the remainder of land cover. Additional information regarding population and land use changes throughout the entire basin can be found in Chapter 16.

There are 3 major and 11 minor NPDES wastewater discharge permits in this subbasin with a total permitted flow of 26 MGD (Figure 12). The largest are South Cary WRF (16 MGD), Terrible Creek WWTP (6 MGD), and Middle Creek WWTP (3.6 MGD). There are also six individual NPDES stormwater permit in the subbasin. Refer to Appendix III for identification and more information on NPDES permit holders. Wake County has developed a stormwater programs under Phase II. Apex, Holly Springs and Johnston County have developed model stormwater ordinances and administer local stormwater programs as required by the Neuse NSW strategy stormwater rules (Chapter 18). There are 2 permitted animal operations in this subbasin.

There are two new water quality impairments in this subbasin, a biological impairment based on a fair benthic bioclassification in the upper portion of the watershed and a turbidity impairment below Sunset Lake. Turbidity and fecal coliform bacterial levels were elevated throughout the upper portion of the Middle Creek watershed most likely due to the high rate of growth in the Apex and Holly Spring area. The increased volume of stormwater runoff is contributing to instream habitat loss and sedimentation. With the projected increase in population growth for this area, this trend is likely to continue unless we take steps now to improve stormwater controls and preserve critical areas against further development. Local governments, land trusts and watershed groups need to work together to protect and preserve sensitive lands within this watershed.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 6. Table 11 contains a list of assessment unit numbers (AU#) and length, streams monitored, monitoring data types, locations and use support ratings for waters in the subbasin. Refer to http://h2o.enr.state.nc.us/tmdl/General_303d.htm for more information about use support methodology.

Figure 12 Neuse River Subbasin 03-04-03



Planning Section
Basinwide Planning Unit
March 2008

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
Watershed (WBD-10 Number) 0302020109 Middle Creek											
Subwatershed (WBD-12 Number) 030202010901 UpperMiddle Creek											
27-43-15-(1)a Middle Creek From source to 0.8 miles south of US 1			**3a**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
C;NSW	03-04-03	1.4 FW Miles			Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
27-43-15-(1)b1 Middle Creek From 0.8 miles south of US 1 to ut on west of creek 3.0 miles downstream			**5**	**Habitat Degradation** MS4 NPDES WWTP NPDES **Low Dissolved Oxygen** WWTP NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2005	2008	5
C;NSW	03-04-03	3.0 FW Miles									
27-43-15-8-(2) Terrible Creek From dam at Johnsons Pond to Middle Creek			**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
C;NSW	03-04-03	7.8 FW Miles									
27-43-15-(1)b2 Middle Creek From ut on west isde of creek 3.0 miles downstream to backwaters of Sunset Lake			**3a**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
C;NSW	03-04-03	1.6 FW Miles			Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
27-43-15-(4)a Middle Creek From dam at Sunset Lake to Terrible Creek			**5**	**Fecal Coliform Bacteria** MS4 NPDES Stormwater Runoff **Nutrient Impacts** General Agriculture/Pasture Stormwater Runoff **Turbidity** Construction Stormwater Runoff	Aquatic Life	Not Rated	Data Inconclusive	Zinc	2006		3m
C;NSW	03-04-03	7.2 FW Miles			Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
					Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
Subwatershed (WBD-12 Number) 030202010902 Middle Middle Creek											
27-43-15-(4)b Middle Creek From Terrible Creek to Mill Branch			**2**		Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
					Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
C;NSW	03-04-03	10.1 FW Miles			Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2002		3a
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Assessment Unit Number / Description / Classification	Name / DWQ Subbasin	Miles/Acres	Overall Category	Potential Stressors / Potential Sources	Use Support Category	Use Support Rating	Reason for Rating	Parameter of Interest	Collection Year	Listing Year	IR Category
27-43-15-(4)c	**Middle Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From Mill Branch to Swift Creek											
C;NSW	03-04-03	27.1 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1

Note:

See Section 23.3 for Overall and IR Category explanation.

Supporting waters are listed in Categories 1-3.

Impaired waters are listed in Categories 4 or 5.

Waters in the following sections and in Table 11 are identified by an assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, list 303(d) Impaired waters and identify waters throughout the basin plan. The AU# is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU# indicates that the assessment is smaller than the DWQ index segment. No letter indicates that the AU# and the DWQ index segment are the same.

3.2 Use Support Assessment Summary

All surface waters in the state are assigned a classification appropriate to the best-intended use of that water. Waters are regularly assessed by DWQ to determine how well they are meeting their best-intended use. For aquatic life, an Excellent, Good, Good-Fair, Fair, or Poor bioclassification is assigned to a stream based on the biological data collected by DWQ. For more information about bioclassification and use support assessment, refer to http://h2o.enr.state.nc.us/tmdl/General_303d.htm. Appendix X provides definitions of the terms used throughout this basin plan.

Refer to Table 12 for a summary of use support for waters in subbasin 03-04-03 (see Chapter 23, Section 23.3 for description of the IR category (for each parameter of interest) and Overall (river segment) category).

3.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2002) or are newly Impaired based on recent data. If previously identified as Impaired, the water will either remain on the state's 303(d) list or will be delisted based on recent data showing water quality improvements. If the water is newly Impaired, it will likely be placed on the 2008 303(d) list. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Information regarding 303(d) listing and reporting methodology can be found at http://h2o.enr.state.nc.us/tmdl/General_303d.htm.

Table 12 Summary of Use Support Ratings in Subbasin 03-04-03

Units	Total Monitored Waters	Total Impaired Waters		Total Supporting Waters		Total Not Rated Waters	Total No Data	Total
	Miles/ Acres	Miles/ Acres	%	Miles/ Acres	%	Miles/ Acres	Miles/ Acres	Miles/ Acres
Freshwater acres (impoundments)	0	0	0.0	0	0.0	0	98	98
Freshwater miles (streams)	58	10	9	45	38	3	60	118

% - Percent of total miles/acres.

3.3.1 Middle Creek Watershed [AU# 27-43-15-(1)a, 27-43-15-(1)b1, 27-43-15-(1)b2, 27-43-15-(2), 27-43-15-(4)a & 27-43-15-(4)b]

2002 Recommendations

DWQ will also attempt to determine the source of the low dissolved oxygen levels in the upper watershed. Apex received a CWMTF grant to make WWTP upgrades. Because of the water quality impacts noted and the increasing development pressure, Middle Creek is a NCEEP (formerly NCWRP) targeted local watershed.

Current Status

Middle Creek [AU# 27-43-15-(1)a]

Middle Creek [AU# 27-43-15-(1)a; C; NSW] from source to 0.8 miles South of US-1 (1.4 miles) is Supporting for aquatic life because none of the ambient monitoring criteria that is used to assess aquatic life was exceeded at ambient monitoring station JA27. This section of Middle Creek was added to the 2004 303(d) list for DO standard violations with 16 percent of the samples less than 4 mg/l during the last assessment period. During the current assessment period there were 5 percent of the readings below 4 mg/l and 14 percent below 5 mg/l. Nutrients and turbidity levels were elevated as well as conductivity, which ranged between 53 to 577 µmhos/cm. These are all indicators that there are still issues that need to be addressed within this section of the watershed.

The state standard for dissolved oxygen is no more that 10 percent of the reading less than a daily average of 5.0 mg/l with a minimum instantaneous reading of 4 mg/l. All the ambient monitoring stations throughout the Neuse use instantaneous reading (except for a few stations within the Neuse River Estuary). As indicated by the data collected at this station, this segment is no longer below 4 mg/l more than 10 percent of the time. However, there are still 14 percent of the samples below 5 mg/l which will have a negative effect on the aquatic organisms in this watershed as will be seen in the segment below.

This segment of Middle Creek will be removed from the 2008 303(d) list for low DO standard violation. Depending on the watershed development and stream protection efforts made, this segment of Middle Creek could easily end up back on the 303(d) list.

This section of Middle Creek is also Not Rated for recreational use due to elevated fecal coliform bacteria levels in 34 percent of the samples. There was no 5-in-30 day fecal sampling done at this location because this segment of Middle Creek is classified as class C waters. Due to personnel and budgetary constraint, DWQ is unable to intensively sample all areas with elevated fecal coliform bacteria levels. DWQ makes class B waters a priority for 5-in-30 day sampling.

The Division of Water Quality assessed this segment of Middle Creek following a large industrial fire at the EQ Storage facility. No impacts to the stream were noted.

Middle Creek [AU# 27-43-15-(1)b1]

Middle Creek [AU# 27-43-15-(1)b1; C; NSW] from 0.8 miles South of US 1 to ut (unnamed tributary) on west of creek 3.0 miles downstream (3.0 miles) is Impaired for aquatic life due to a Fair benthic bioclassification at site JB67. This was the first time this site was sampled and was added during this assessment period to help assess impacts from activities in the upper part of the Middle Creek watershed (runs through part of Apex and Holly Springs). Stream banks were

subject to erosion due to a lack of woody vegetation. The riparian zone was wide and intact in the area sampled upstream of the road crossing (SR1301). The high conductivity (319µmhos/cm) potentially reflects the discharger and urbanization present upstream of this site. Apex Water Reclamation Facility (NC0064050) is the only major NPDES discharger upstream. The tolerance assessment of the taxa found ranged from very slightly intolerant to highly tolerant species with some abundant taxa indicators of low dissolved oxygen and organic enrichment.

This segment of Middle Creek will be added to the 2008 303(d) list due to impaired biological integrity.

Middle Creek [AU# 27-43-15-(1)b2
Middle Creek [AU# 27-43-15-(1)b2; C; NSW] from the ut on west side of creek 3.0 miles downstream to backwaters of Sunset Lake (1.6 miles) is Supporting aquatic life due to No Criteria Exceeded at ambient monitoring station JA28. Station JA28 is about 2 miles down stream of the benthic site (JB67) and exhibited elevated turbidity in exactly 10 percent of the samples during this assessment period. The maximum turbidity recorded was 150 NTUs. The conductivity and nutrients were also high with conductivity ranging between 86 and 588 µmhos/cm and the maximum recorded NO_2+NO_3 and TP were 3.04 mg/l and 4.7 mg/l respectively. These were much higher than the ambient monitoring station upstream (JA27).

This segment is Not Rated for recreational uses due to elevated fecal coliform bacteria levels at JA28. The levels were elevated in 28 percent of the samples collected.

Middle Creek (Sunset Lake) [AU# 27-43-15-(2)]
Middle Creek (Sunset Lake) [AU# 27-43-15-(2); B; NSW] from backwaters of Sunset Lake to dam at Sunset Lake is currently listed as No Date due to the fact that it was not monitored during this assessment period.

Middle Creek [AU# 27-43-15-(4)a]
Middle Creek [AU# 27-43-15-(4)a; C; NSW] from the dam at Sunset Lake to Terrible Creek (7.2 miles) is Impaired for aquatic life due to a turbidity standards violation in 11 percent of the samples collected at JA128. Site JA128 replaced site JA29 in July 2005. Both sites had elevated fecal coliform levels with 21 and 17 percent of the samples above 400 cfu/100ml at JA29 and JA128, respectively. Due to the elevated fecal coliform counts, this segment is Not Rate for recreational uses.

The biologist found the macroinvertebrates to be rated Good-Fair and the fish community to be Excellent at sites JB68 and JF34.

Although this stream has been historically noted as having eroded banks, breaks in the riparian zone were rare, and plant coverage was good in this section of the stream. Bluegreen algal mats in the stream indicate the high nutrient load from the many NPDES dischargers and nonpoint runoff in the upstream watershed. The Specific conductance measurements were 221 and 283 µmhos/cm during the benthos and fish community samples, respectively. The conductivity ranged from 82 to 519 µmhos/cm at the ambient stations. The Good-Fair rating was consistent with the last assessment in 2000, however it had been rated Fair in both 1986 and 1995. The biologist found that there has been a shift in the substrate composition since the 1986, with a replacement of larger substrate by smaller resulting in a shift in benthic taxa seen at this location (see ESS Basinwide Assessment Report Neuse River Basin April 2006 for more information on substrate shift (http://h2o.enr.state.nc.us/esb/Basinwide/Neuse06BasinReportFinal.pdf)).

This was the first time that a fish community assessment was made at this location. Fish community assessments have been made at 4 other Middle Creek watershed locations in the past, however this was the only site monitored during this assessment period. The Middle Creek watershed has always shown a high diversity of fish and this remained true during this assessment period, which resulted in an Excellent fish rating. The fish fauna in this stream were clearly not showing any negative affects from the elevated conductivity. The DWQ biologist recommend continued sampling in this portion of the watershed, as the fish community may eventually show signs of stress from the changing substrate.

Middle Creek [AU# 27-43-15-(4)b]

Middle Creek [AU# 27-43-15-(4)b; C; NSW] from Terrible Creek to Mill Creek (10.1 miles) is Not Rated for aquatic life due to the rating given at the benthic site JB66. This basinwide site could not be sampled in 2005 because this segment of the stream was too deep to wade. This site was sampled in 2002 during a special drought study to assess the effects of low rainfall between 1999 and 2002. It was found that this site was highly impacted by the lack of rain in the area and was given a Not Rated bioclassification. None of the ambient monitoring parameters used to assess aquatic life exceeded the state standards at site JA30 or JA31, however there was a single turbidity violation of 665 NTUs at ambient monitoring station JA31. This large amount of sediment could possibly have had a severe effect on the benthic habitat at this location. The conductivity was also high at both ambient monitoring stations with reading ranging between 58 and 495 µmhos/cm. The benthic site should be reassessed during the next assessment period.

This segment of the Middle Creek watershed is Supporting for recreation because the fecal coliform bacteria levels were within allowable limits at the ambient monitoring stations JA30 and JA31.

Middle Creek [AU# 27-43-15-(4)c]

Middle Creek [AU# 27-43-15-(4)c; C; NSW] from Mill Creek to Swift Creek (27.1 miles) is Supporting aquatic life due to a Good-Fair bioclassification at site JB69. Benthic site JB69 is ~13 miles down stream from JB66 and was sampled to assess the impacts from the rapidly developing area around the Town of Smithfield. The banks were moderately stable and the riparian zone was wide and intact. The conductivity was still high (221 µmhos/cm) at this site even though there are no dischargers within 10 miles. With increasing stress on the community predicted due to rapid development in the watershed, it is recommended that this site be added as a benthic basinwide site for continual monitoring of water quality.

None of the ambient monitoring parameters used to assess aquatic life exceeded the state standards at site JA32. The conductivity ranged between 70 and 388 µmhos/cm.

This segment of the Middle Creek watershed is also Supporting for recreation because the fecal coliform bacteria levels were within allowable limits at the ambient monitoring station JA32.

Wake County used funds from the County's Capital Improvement Fund as well as funds from a 2005 CWMTF grant ($714,000) to purchase 233 acres as well as an adjoining property, which contains wetlands and riparian buffers along Middle Creek for the future Wake County Southeast Regional Park. This conservation area will include the Middle Creek Aquatic Habitat, a Natural Heritage site of local significance. It supports several rare animal species. Among the rare mussel species found here are the Atlantic Pigtoe, Yellow Lance, Triangle Floater, Eastern Lampmussel, Roanoke Slabshell, as well as a rare fish the Carolina Madtom and the North

Caroline Spiny Crayfish. The CWMTF grant requires that the county convey to the state a conservation easement on any property for which CWMTF funds were used. This will provide water quality protection as well as allow for the development and use of the property for public greenway trails, walking, biking, educational tours, scientific study and other uses in accord with the County's Open Space Program.

Recommendations.
With the projected increase in population growth for this area, steps are needed now to improve stormwater controls and preserve critical areas against further development. Local governments, land trusts and watershed groups need to work together to protect and preserve sensitive lands within this watershed.

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 would be beneficial.

Recommendations on how to protect and reduce water quality impacts from existing and future urbanization of the watershed can be found in Chapter 12 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm).

Water Quality Initiative
Wake County purchased approximately 225 acres of open space along Middle Creek in segment AU# 27-43-15-(4)a.

The Triangle Greenway Council accepted the donation of 78 acres on Middle Creek, conserving a proposed greenway corridor approximately one mile long that includes Natural Heritage Program Element Occurrences. Negotiations are continuing with the owners of approximately 80 acres of adjoining floodplains and wetlands that may be conserved.

The Triangle Greenway Council also accepted donation of 24 acres on Middle Creek in Holly Springs that is part of an existing greenway corridor with a paved trail.

3.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed below are not Impaired. However, notable water quality problems and concerns were documented for these waters during this assessment. Attention and resources should be focused on these waters to prevent additional degradation and facilitate water quality improvements. DWQ will notify local agencies of these water quality concerns and work with them to conduct further assessments and to locate sources of water quality protection funding. Additionally, education on local water quality issues and voluntary actions are useful tools to prevent water quality problems and to promote restoration efforts. The current status and recommendations for addressing these waters are presented below, and each is identified by an AU#. Nonpoint source program agency contacts are listed in Appendix IV.

3.4.1 Terrible Creek [AU# 27-43-15-8-(2)]

2002 Recommendations
The Fuquay-Varina Terrible Creek WWTP has had past aquatic toxicity failures. DWQ will work with the town to remedy the toxicity problems.

Current Status
Terrible Creek [AU# 27-43-15-8-(2); C; NSW] from the dam at Johnsons Pond to Middle Creek is Supporting for aquatic life based on a Good fish community bioclassification at site JF35. This is not a normal basinwide sampling site. This sample was requested by the Raleigh Regional Office to assess the biological impacts below the Fuquay Varina WWTP outfall in response to repeated weekly and monthly permit violations of total ammonia nitrogen, 5-day biochemical oxygen demand, and fecal coliform bacteria. The facility began operations in the mid 1990s and treats approximately 95 percent domestic waste and 5 percent industrial waste. The facility is permitted to discharge up to 1 MGD and has a staged permit to discharge upon expansion up to 6 MGD. The instream concentration is 100 percent with a summer 7Q10 equaling 0 cfs. The instream substrate was moderately embedded and riffles were infrequent. At places along the left shoreline, the channel was entrenched and the bank was severely eroded and collapsing due to storm and flood events. The left bank had a very narrow riparian zone. Livestock in the area were excluded from the stream by a fence. The right bank was wooded with a wide forested riparian zone.

The Terrible Creek WWTP (NC0066516) did not experience any aquatic toxicity failures during this assessment period, however they did have many limit violations. In 2006 alone, the facility had experienced 7 months with BOD limit violations, 9 months with fecal coliform, 8 months with Ammonia and 2 months with total suspended solids violations. Of these violations, the facility was assessed a penalty by DWQ for 14 limit violations resulting in fines totaling $10,427. They have requested remission from these fines. As of June 2007, no violations have been reported in BIMS (Basinwide Information Management System) for this facility. This facility has a new operator and it appears that they are making great strides in complying with their discharge limits.

Recommendations
Given the repeated violation by this discharger as well as the increase in development in this area, DWQ would recommend that a benthic macroinvertebrate sample be taken at this location during the next assessment period. The benthic community is more likely to be affected by the repeated exposure to high ammonia and low DO levels. Fish have the ability to swim down stream if conditions are unpleasant where as the benthic community is relegated to a single location with not much ability to quickly relocate if needed. These would be a more sensitive indicator of repeated violation by a discharger or impacts due to a developing watershed.

Recommendations on how to protect and reduce water quality impacts from existing and future urbanization of the watershed can be found in Chapter 12 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm).

3.5 Additional Water Quality Issues within Subbasin 03-04-03

The previous sections discussed water quality concerns for specific stream segments. The following section discusses issues that may threaten water quality in the subbasin that are not specific to particular streams, lakes, or reservoirs. The issues discussed may be related to waters near certain land use activities or within proximity to different pollution sources.

3.5.1 Mercury Contamination – Fish Tissue Assessment

The Division conducted fish tissue surveys at four stations within the Neuse River Basin from 1999 to 2004. These surveys were conducted as part of the mercury contaminant assessments in the eastern part of the state and during statewide pesticide assessments.

Tissue samples collected from the Neuse River at Goldsboro contained organic contaminants at undetectable levels or at levels less than the US EPA, US FDA, and State of North Carolina criteria. The Goldsboro samples consisted of composites of largemouth bass.

Elevated mercury concentrations (greater than the EPA and NC level of 0.4 ppm) were detected in fish samples collected from all four stations within the Neuse Basin. These included the Eno River near Durham, Neuse River at Goldsboro, Neuse River at Kinston, and Contentnea Creek at Snow Hill. Elevated levels were most often detected in largemouth bass, a species at the top of the food chain and most often associated with mercury bioaccumulation in North Carolina. Presently, there are no site-specific fish consumption advisories for mercury in the Neuse River basin; however, an advisory for the consumption of bowfin, and chain pickerel east of Interstate 85 was issued by NCDHHS in 2002 and a statewide advisory for the consumption of largemouth bass in 2006.

Because fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Contamination of aquatic resources has been documented for heavy metals, pesticides, and other complex organic compounds. Once these contaminants reach surface waters, they may be available for bioaccumulation, either directly or through aquatic food webs, and may accumulate in fish and shellfish tissues. Results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water.