Chapter 1
Neuse River Subbasin 03-04-01
Including: Eno River, Little River, Flat River and the entire Falls Lake watershed

1.1 Subbasin Overview

Subbasin 03-04-01 at a Glance

Land Cover (percent)

Forest/Wetland:	72.6
Water:	2.7
Urban:	7.3
Cultivated Crop:	3.4
Pasture/ Managed Herbaceous:	13.7

Counties
Durham, Franklin, Granville, Orange, Person and Wake

Municipalities
Hillsborough, Butner, Creedmoor, Stem, Durham, Roxboro and Raleigh

Stream Statistics

Total Streams:	468.85 mi/14,576.3 ac
Total Supporting:	172.5 mi
Total Impaired:	43.7 mi
Total Not Rated:	12 mi/0.0 ac
Total No Data:	240.3 mi

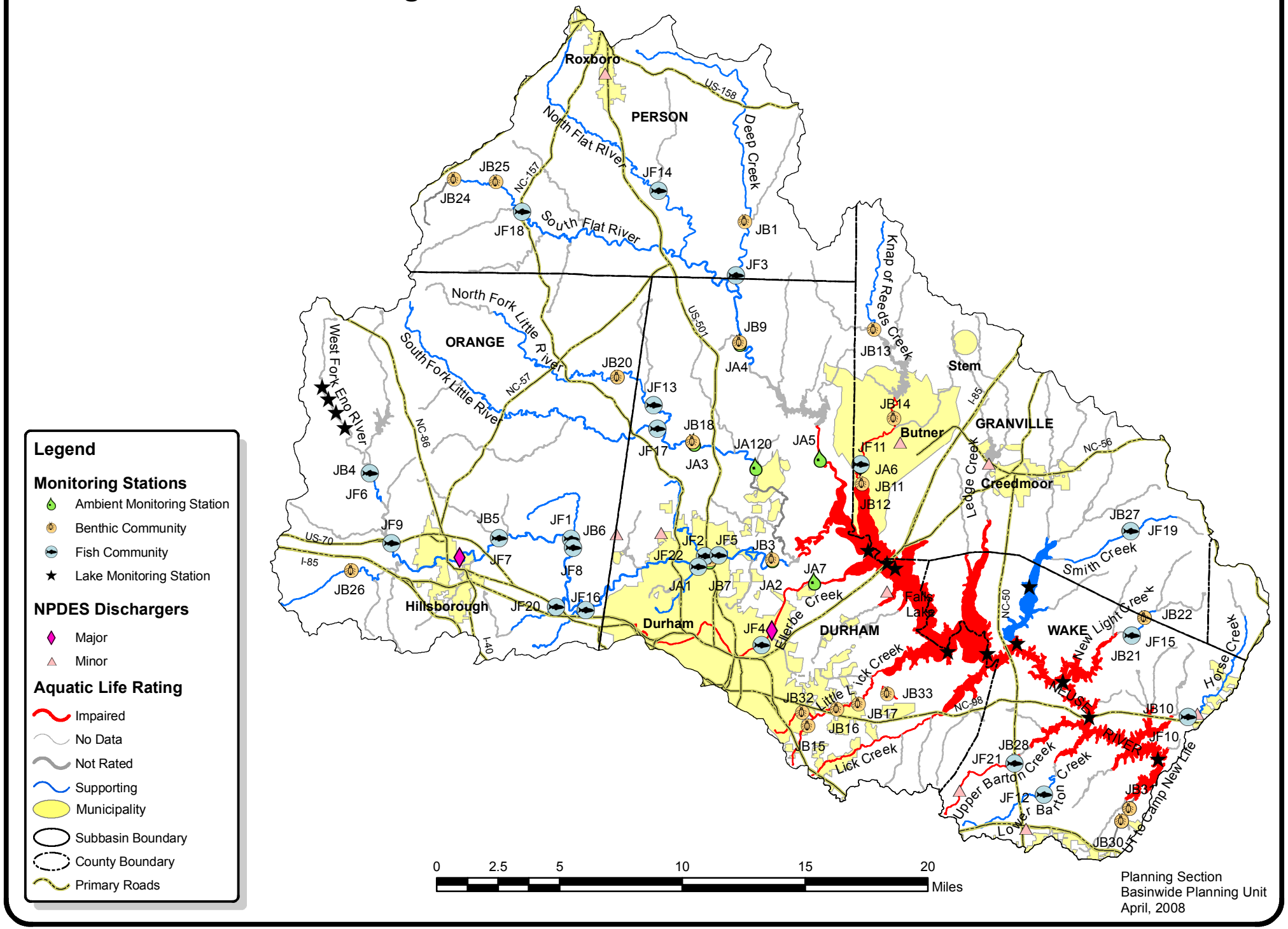
This subbasin is the 770 square mile watershed of Falls Lake and is often referred to as the Upper Neuse River Basin. It covers part of 6 counties and is the home to about 190,000 people. A 50 percent increase in population is projected in the Falls Lake watershed by 2025. Most of the expected growth will occur in Wake, Durham and Granville Counties. There are 9 public drinking water supply reservoirs that serve over 500,000 people. These include: Lake Michie, Little River Reservoir, Lake Holt, Lake Orange, West Fork Eno Reservoir, Corporation Lake, Lake Ben Johnson, Lake Rogers and Falls Lake. The upper portion of the watershed is comprised of three major tributaries, the Flat River, Little River and the Eno River. The Neuse River and Falls Lake is formed by the confluence of the Flat and Eno Rivers. Falls Lake covers almost 12,500 acres and stretches 28 miles from the confluence near Durham to the dam located just outside of Raleigh. Falls Lake serves many functions: a drinking water reservoir for many surrounding communities, a flood control reservoir for downstream communities, habitat for wildlife and a recreational area for outdoor enthusiasts.

Most of the streams in this watershed have some type of water supply (WS) classification: WS-II, WS-III, or WS-IV. WS-II waters have the most protective regulations, and have the same management strategy as a High Quality Water classification. WS-II waters in this subbasin include the Eno River and tributaries above Hillsborough and the Little River and its tributaries above Little River Reservoir. The Eno River Corridor contains some of the most scenic and biologically important natural areas in the entire eastern piedmont. Deep Creek and Rocky Fork Branch in the Flat River watershed were recently reclassified to Outstanding Resource Waters (ORW) in order to protect the exceptional water quality in this area.

Land use in this northern half of the subbasin is mostly agricultural and forest. The major land cover types within this subbasin are forest (61 percent), agriculture (16 percent) and urban and suburban developed lands (17 percent). There is an estimated 60,000 acres or about 12 percent of this watershed preserved as open space. The Upper Neuse River Basin Association (UNRBA) projects that by 2025 about 50,000 acres of the remaining undeveloped land will be converted to developed lands bringing the total developed land to 140,000 acres or 28 percent of the watershed. Because Falls Lake receives drainage from the entire watershed in this subbasin it is highly susceptible to the cumulative impacts from the upstream degradation.

The UNRBA has developed a watershed management plan, that when implemented by local governments will help protect all waters in this subbasin from the increasing potential for

Figure 3 Neuse River Basin 03-04-01



Legend

Monitoring Stations
- Ambient Monitoring Station
- Benthic Community
- Fish Community
- Lake Monitoring Station

NPDES Dischargers
- Major
- Minor

Aquatic Life Rating
- Impaired
- No Data
- Not Rated
- Supporting
- Municipality
- Subbasin Boundary
- County Boundary
- Primary Roads

0 2.5 5 10 15 20 Miles

Planning Section
Basinwide Planning Unit
April, 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) 0302020101 Flat River											
Subwatershed (WBD-12 Number) 030202010101 North Flat River											
27-3-2	**North Flat River**		**2**								
From source to Flat River											
WS-III;NSW	03-04-01	16.4 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
Subwatershed (WBD-12 Number) 030202010102 South Flat River											
27-3-3a	**South Flat River**		**3a**		Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2004		3a
From source to SR 1009											
WS-III;NSW	03-04-01	3.0 FW Miles									
27-3-3b	**South Flat River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From SR 1009 to Flat River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2004		1
WS-III;NSW	03-04-01	14.2 FW Miles									
Subwatershed (WBD-12 Number) 030202010103 Deep Creek											
27-3-4	**Deep Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Flat River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-III;NSW	03-04-01	16.3 FW Miles									
Subwatershed (WBD-12 Number) 030202010104 Lake Michie-Flat River											
27-(1)	**NEUSE RIVER (Falls Lake below normal pool elevation)**		**5**	**Chlorophyll a**	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
From source (confluence of Eno River Arm of Falls Lake and Flat River Arm of Falls Lake) to I-85 bridge					Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
WS-IV;NSW,CA	03-04-01	2,703.6 FW Acres		**Nutrient Impacts** General Agriculture/Pasture Land Clearing MS4 NPDES WWTP NPDES **Turbidity** General Agriculture/Pasture Land Clearing MS4 NPDES WWTP NPDES	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	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
27-3-(1)	**Flat River**		**2**		Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From source to a point 2.0 miles downstream of Durham County SR 1614					Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
WS-III;NSW	03-04-01	9.1 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-3-(8)	**Flat River**		**5**	**Low Dissolved Oxygen** Impoundment	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
From dam at Lake Michie to a point 0.2 miles upstream of Durham County SR 1004					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
WS-IV;NSW	03-04-01	1.1 FW Miles			Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-3-(9)	**Flat River (including the Flat River Arm of Falls Lake)**		**5**	**Low Dissolved Oxygen** Impoundment	Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From a point 0.2 miles upstream of Durham County SR 1004 to Falls Lake, Neuse River					Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
WS-IV;NSW,CA	03-04-01	0.6 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
Watershed (WBD-10 Number) 0302020102 Little River											
Subwatershed (WBD-12 Number) 030202010201 North Fork Little River											
27-2-21-3b	**North Fork Little River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From SR 1519 to Little River					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-II;HQW,NSW	03-04-01	12.8 FW Miles									
Subwatershed (WBD-12 Number) 030202010202 South Fork Little River											
27-2-21-(1)	**Little River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From source to a point 0.1 mile upstream of Durham County SR 1461					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-II;HQW,NSW	03-04-01	2.3 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
27-2-21-2	**South Fork Little River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Little River											
WS-II;HQW,NSW	03-04-01	18.5 FW Miles									
Subwatershed (WBD-12 Number) 030202010203 Mountain Creek-Little River											

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
27-2-21-(3.5)	**Little River (Little River Reservoir)**		**2**		Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From a point 0.1 mile upstream of Durham County SR 1461 to dam at Little River Reservoir					Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
WS-II;HQW,NSW,CA	03-04-01	32.4 FW Acres			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-2-21-(6)	**Little River**		**3a**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards 1n3	2006		1
From dam at Little River Reservoir to a point 0.9 mile upstream of mouth					Aquatic Life	Not Rated	Data Inconclusive	Water Quality Standards Aquatic Life	2006		3a
WS-IV;NSW	03-04-01	6.5 FW Miles			Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
					Water Supply	Not Rated	Data Inconclusive	Water Quality Standards Water Supply	2006		3a

Watershed (WBD-10 Number) 0302020103 Eno River

Subwatershed (WBD-12 Number) 030202010301 Lake Orange-Eno River

27-2-2a	**West Fork Eno River**		**2**		Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
From source to Reservoir dam											
WS-II;HQW,NSW	03-04-01	204.0 FW Acres									

Subwatershed (WBD-12 Number) 030202010302 Sevenmile Creek-Eno River

27-2-(1)	**Eno River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to a point 0.4 mile upstream of Dry Run					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-II;HQW,NSW	03-04-01	2.2 FW Miles									
27-2-(7)	**Eno River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From dam at Lake Ben Johnston to Orange County SR 1561											
C;NSW	03-04-01	8.2 FW Miles									
27-2-6-(0.5)	**Sevenmile Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From source to a point 0.4 mile upstream of I-85											
WS-II;HQW,NSW	03-04-01	5.8 FW Miles									

Subwatershed (WBD-12 Number) 030202010303 Stony Creek-Eno River

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
27-2-(10)	**Eno River**		**2**		Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From Orange County SR 1561 to U. S. Highway 501					Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
WS-IV,B;NSW	03-04-01	16.2 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2003		1
					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
					Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-2-12	**Buckwater Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Eno River											
WS-IV;NSW	03-04-01	4.7 FW Miles									
27-2-13-(2)	**Stony Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From a point 0.4 mile upstream of Orange County SR 1710 to Eno River											
WS-IV;NSW	03-04-01	3.0 FW Miles									
				Subwatershed (WBD-12 Number) 030202010304				**Crooked Creek-Eno River**			
27-2-(19)	**Eno River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From U. S. Highway 501 to a point 0.5 mile upstream of City of Durham emergency pumping facility raw water intake (Lat: 36 04' 40" Long: 78 53' 00")					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2003		1
WS-IV;NSW	03-04-01	1.6 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-2-(19.3)	**Eno River**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
From a point 0.5 mile upstream of Durham emergency pumping facility raw water intake to Durham emergency pumping facility raw water intake					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
WS-IV;NSW,CA	03-04-01	0.4 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

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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
27-2-(19.5)	**Eno River (including the Eno River Arm of Falls Lake)**	**2**		Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
From City of Durham emergency pumping facility raw water intake to a point 0.5 mile upstream of Little River				Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
WS-IV;NSW	03-04-01 4.3 FW Miles			Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2006		1
				Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
27-2-14	**Rhodes Creek**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Eno River										
WS-IV;NSW	03-04-01 3.3 FW Miles									
27-2-17	**Jumping Run**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Eno River										
WS-IV;NSW	03-04-01 3.4 FW Miles									
27-2-18	**Crooked Creek**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Eno River										
WS-IV;NSW	03-04-01 5.2 FW Miles									

Watershed (WBD-10 Number) 0302020104 Upper Falls Lake

Subwatershed (WBD-12 Number) 030202010401 Upper Knap of Reeds Creek

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
27-4-(1)	**Knap of Reeds Creek**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2004		1
From source to a point 0.3 mile upstream of mouth of Camp Creek										
WS-II;HQW,NSW	03-04-01 5.2 FW Miles									

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
27-4-(6)	**Knap of Reeds Creek**	**4c**	**Antimony**	Aquatic Life	Not Rated	Potential Standards Violation	Zinc	2006		3m
From dam at Lake Butner to a point 1.9 miles downstream of Granville County SR 1120			WWTP NPDES							
WS-IV;NSW	03-04-01	5.6 FW Miles	**Chlorine**	Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
			WWTP NPDES							
			Fecal Coliform Bacteria	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
			Animals	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
			General Agriculture/Pasture							
			MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2004	1998	4c
			Habitat Degradation	Recreation	Supporting	No Criteria Exceeded	Fecal Coliform (recreation)	2006		1
			Impoundment	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
			MS4 NPDES							
			Low Dissolved Oxygen							
			Impoundment							
			Nutrient Impacts							
			Landfills							
			MS4 NPDES							
			WWTP NPDES							
Subwatershed (WBD-12 Number) 030202010402 Lower Knap of Reeds Creek										
27-4-(8)	**Knap of Reeds Creek**	**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2004	1998	5
From a point 1.9 miles downstream of Granville County SR 1120 to Falls Lake, Neuse River			Animals							
WS-IV;NSW,CA	03-04-01	0.6 FW Miles	MS4 NPDES							
			Habitat Degradation							
			Impoundment							
			MS4 NPDES							
			WWTP NPDES							
			Low Dissolved Oxygen							
			Impoundment							
			Nutrient Impacts							
			Landfills							
			MS4 NPDES							
			WWTP NPDES							
Subwatershed (WBD-12 Number) 030202010403 Ellerbe Creek										
27-(5.5)	**NEUSE RIVER (Falls Lake below normal pool elevation)**	**5**	**Chlorophyll a**	Aquatic Life	Impaired	Standard Violation	Chlorophyll a	2006	2008	5
From I-85 bridge to dam at Falls Lake				Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
WS-IV,B;NSW,CA	03-04-01	9,530.3 FW Acres	**Nutrient Impacts**							
			General Agriculture/Pasture							
			Land Clearing							
			MS4 NPDES							
			WWTP NPDES							

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
27-5-(0.3)	**Ellerbe Creek**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2005	1998	5
From source to I-85 Bridge				MS4 NPDES							
C;NSW	03-04-01	6.1 FW Miles		**Habitat Degradation**							
				MS4 NPDES							
				WWTP NPDES							
				Nutrient Impacts							
				Landfills							
				MS4 NPDES							
				WWTP NPDES							
				Turbidity							
				MS4 NPDES							
27-5-(0.7)	**Ellerbe Creek**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity FishCom	2005	1998	5
From I-85 Bridge to a point 0.2 mile upstream of Durham County SR 1636				MS4 NPDES							
WS-IV;NSW	03-04-01	5.9 FW Miles		**Habitat Degradation**							
				MS4 NPDES							
				WWTP NPDES							
				Nutrient Impacts							
				Landfills							
				MS4 NPDES							
				WWTP NPDES							
				Turbidity							
				MS4 NPDES							
27-5-(2)	**Ellerbe Creek**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Not Rated	Potential Standards Violation	Zinc	2006		3m
From a point 0.2 mile upstream of Durham County SR 1636 to Falls Lake, Neuse River				MS4 NPDES	Aquatic Life	Not Rated	Data Inconclusive	Iron	2006		3m
				WWTP NPDES	Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
WS-IV;NSW,CA	03-04-01	0.5 FW Miles		**Habitat Degradation**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	1998	5
				MS4 NPDES	Recreation	Not Rated	Potential Standards Violation	Fecal Coliform (recreation)	2006		3a
				Nutrient Impacts	Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
				MS4 NPDES							
				WWTP NPDES							
				Turbidity							
				MS4 NPDES							

Watershed (WBD-10 Number) 0302020105 Middle Falls Lake

Subwatershed (WBD-12 Number) 030202010502 Lick Creek

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
27-11-(0.5)	**Lick Creek**		**5**	**Fecal Coliform Bacteria** Failing Septic Systems MS4 NPDES **Habitat Degradation** MS4 NPDES **Nutrient Impacts** Failing Septic Systems MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	1998	5
From source to Wake County SR 1809											
WS-IV;NSW	03-04-01	6.5 FW Miles									
27-11-(1.5)	**Lick Creek**		**5**	**Fecal Coliform Bacteria** Failing Septic Systems MS4 NPDES **Habitat Degradation** MS4 NPDES **Nutrient Impacts** Failing Septic Systems MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	2004	5
From Wake County SR 1809 to Falls Lake, Neuse River											
WS-IV;NSW,CA	03-04-01	0.7 FW Miles									
Subwatershed (WBD-12 Number) 030202010503 Beaverdam Creek											
27-12-(0.7)	**Beaverdam Creek (Beaverdam Creek Reservoir below normal pool elevation)**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Water Quality Standards Aquatic Life	2006		1
					Water Supply	Supporting	No Criteria Exceeded	Water Quality Standards Water Supply	2006		1
From backwaters of Beaverdam Creek Reservoir to dam at Beaverdam Creek Reservoir (at backwaters of Falls Lake)											
WS-IV,B;NSW,CA	03-04-01	974.4 FW Acres									
27-12-2-(2)	**Smith Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
					Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
From a point 0.5 mile downstream of Granville County SR 1711 to a point 0.4 mile upstream of mouth											
WS-IV;NSW	03-04-01	5.7 FW Miles									
Subwatershed (WBD-12 Number) 030202010504 Little Lick Creek-Neuse River											

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
27-9-(0.5)	**Little Lick Creek**		**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	1998	5
From source to a point 0.4 mile upstream of Durham County SR 1811				Failing Septic Systems	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
WS-IV;NSW	03-04-01	7.2 FW Miles		MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	1998	4s
				Habitat Degradation							
				Construction							
				MS4 NPDES							
				Natural Conditions							
				Low Dissolved Oxygen							
				Nutrient Impacts							
				Failing Septic Systems							
				MS4 NPDES							
				Toxic Impacts							
				MS4 NPDES							
				Turbidity							
				MS4 NPDES							
27-9-(0.5)ut2	**UT2 to Little Lick Creek**		**5**	**Habitat Degradation**	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
From source to Little Lick Creek				MS4 NPDES	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2005		3a
WS-IV;NSW	03-04-01	2.4 FW Miles		**Low Dissolved Oxygen**							
				Nutrient Impacts							
				Failing Septic Systems							
				MS4 NPDES							
				Toxic Impacts							
				MS4 NPDES							
				Turbidity							

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
27-9-(2)	**Little Lick Creek (including portion of Little Lick Creek Arm of Falls Lake)**	**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2000	1998	4s
From a point 0.4 mile upstream of Durham SR 1811 to Falls Lake, Neuse River			Failing Septic Systems	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
WS-IV;NSW,CA	03-04-01	0.6 FW Miles	MS4 NPDES	Aquatic Life	Impaired	Standard Violation	Turbidity	2006	2008	5
			Habitat Degradation							
			MS4 NPDES							
			Low Dissolved Oxygen							
			Nutrient Impacts							
			Failing Septic Systems							
			MS4 NPDES							
			Toxic Impacts							
			MS4 NPDES							
			Turbidity							
			Construction							
			MS4 NPDES							
27-9-(2)ut2	**UT2 to Little Lick Creek (including portion of Little Lick Creek Arm of Falls Lake)**	**5**	**Fecal Coliform Bacteria**	Aquatic Life	Impaired	Standard Violation	Low Dissolved Oxygen	2006	2008	5
From a source to Falls Lake Little Lick Creek			Failing Septic Systems	Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2005		3a
WS-IV;NSW,CA	03-04-01	0.9 FW Miles	MS4 NPDES							
			Habitat Degradation							
			MS4 NPDES							
			Low Dissolved Oxygen							
			Toxic Impacts							
			MS4 NPDES							
			Turbidity							
			Construction							
			MS4 NPDES							

Watershed (WBD-10 Number) 0302020106 Lower Falls Lake

Subwatershed (WBD-12 Number) 030202010601 New Light Creek

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
27-13-(0.1)	**New Light Creek**	**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to Wake County SR 1911				Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity Benthos	2005		1
WS-IV;NSW	03-04-01	1.8 FW Miles								

Subwatershed (WBD-12 Number) 030202010602 Upper Barton Creek-Neuse River

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
27-15-(1)	**Upper Barton Creek**	**5**	**Fecal Coliform Bacteria**	Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2005		1
From source to a point 0.5 mile upstream of Wake County SR 1844			MS4 NPDES	Aquatic Life	Impaired	Biological Criteria Exceeded	Ecological/biological Integrity Benthos	2005	2008	5
WS-IV;NSW	03-04-01	4.9 FW Miles	WWTP NPDES							
			Habitat Degradation							
			MS4 NPDES							

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
27-16-(1)	**Lower Barton Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From source to Wake County SR 1834											
WS-IV;NSW	03-04-01	6.1 FW Miles									
Subwatershed (WBD-12 Number) 030202010603 Horse Creek											
27-17-(0.7)	**Horse Creek**		**2**		Aquatic Life	Supporting	No Criteria Exceeded	Ecological/biological Integrity FishCom	2004		1
From a point 0.3 mile upstream of Franklin County SR 1139 to a point 0.1 mile downstream of Wake County SR 1923											
WS-IV;NSW	03-04-01	6.0 FW Miles									
Subwatershed (WBD-12 Number) 030202010604 Honeycutt Creek-Neuse River											
27-20.5-(2)ut1	**UT1 to Unnamed Tributary at Camp New Life**		**3a**		Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2006		3a
From source to UT at Camp New Life											
WS-IV;NSW	03-04-01	1.8 FW Miles									
27-20.5-(3)	**Unnamed Tributary at Camp New Life**		**3a**		Aquatic Life	Not Rated	Data Inconclusive	Ecological/biological Integrity Benthos	2006		3a
From a point 0.3 mile upstream of Wake County SR 2002 to Falls Lake, Neuse River											
WS-IV;NSW,CA	03-04-01	0.6 FW Miles									

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.

sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources (see section 1.5.2 for more details). DWQ recommends local governments implement this 2003 watershed management plan.

Falls Lake has been placed on the 2008 303(d) list of impaired waters due to chlorophyll *a* standard violations in the entire lake and turbidity standard violations in the upper portion of the lake. These are the direct result of high nutrient and sediment loading occurring in the watershed. The Division is in the process of developing a lake and watershed model. The Division is also working with stakeholders to develop a comprehensive nutrient management strategy for Falls Lake and its watershed. These rules will ultimately require reductions in nutrients from the contributing sources in the watershed.

There are 3 major and 13 minor NPDES wastewater discharge permits in this subbasin with a total permitted flow of just over 29.4 MGD. The largest facilities are North Durham WRF (20.0 MGD), South Granville Water and Sewer Authority WWTP (5.50 MGD) and Hillsborough WWTP (3.0 MGD). There are also 35 individual NPDES stormwater permits in the subbasin. Refer to Appendix III for identification and more information on NPDES permit holders. The City of Durham holds a Phase I stormwater permit, and Durham and Wake counties have developed stormwater programs under Phase II requirements. Durham, Orange and Wake counties have also submitted stormwater ordinances as required by the Neuse NSW strategy stormwater rules (Chapter 18). Eleven animal operations in this subbasin hold non-discharge permits issued by the DWQ.

The water quality in this subbasin is mainly assessed using biological indicators (macroinvertebrates and fish). The upper portion of this basin has been found to exhibit good water quality while those waters closest to Falls Lake, in the areas with the highest development densities, have exhibited poor water quality. The biological integrity has decreased at most of the sites since they were last sampled in 2000. With the projected increase in population growth for this area, this trend is likely to continue unless additional proactive measures (e.g. preserve critical areas against further development) to prevent additional degradation are taken. Local governments, land trusts, and watershed groups need to continue to working together to implement a comprehensive suite of watershed management strategies, such as those recommended in the UNRBA's Upper Neuse Watershed Management Plan.

The major stressors in this subbasin are high nutrient and sediment loading, high chlorophyll *a* levels due to the high nutrients, high fecal coliform, low dissolved oxygen, and habitat degradation. The major sources of these stressors are urban and agricultural runoff, new construction and existing development, and point source dischargers. All of these are contributing to the decreasing water quality in this watershed.

A unique geological zone know as the Triassic Basin runs through a portion of this watershed requiring a unique management strategies due to the erosive soil type and lack of flow during dry periods (Bain and Harvey, 1977). Due to the less than suitable soil type and the low infiltrations rate in the Triassic region, this area is highly impacted by stormwater runoff. On-site sewage treatment using conventional septic systems is often not an option resulting in the use of sand filters for on-site treatment for many of the single family homes in this region. These systems are often not adequately maintained resulting in high fecal coliform and nutrient discharge, which ultimately ends up in the creek and Falls Lake (NC DENR-EEP, 2006;

http://www.nceep.net/services/lwps/little_lick/LittleLick_LWP.pdf). To see a NC Geological map go to http://www.geology.enr.state.nc.us/usgs/geomap.htm.

A map including the locations of the NPDES facilities and water quality monitoring stations is presented in Figure 3. Table 3 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.

Waters in the following sections and in Table 3 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.

1.2 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 4 for a summary of use support for waters in subbasin 03-04-01 (see Chapter 23, Section 23.3 for description of the IR category (for each parameter of interest) and Overall (river segment) category).

1.3 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 number. Information regarding 303(d) listing and reporting methodology is presented at http://h2o.enr.state.nc.us/tmdl/General_303d.htm.

Table 4 Summary of Use Support Ratings in Subbasin 03-04-01

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)	13,445	12,234	84	1,211	8	0	1132	14,576
Freshwater miles (streams)	229	44	9	173	37	12	240	469

% - Percent of total miles/acres.

1.3.1 Ellerbe Creek [AU# 27-5-(0.3), 27-5-(0.7) & 27-5-(2)]

2002 Recommendations

DWQ will establish a biological monitoring station above the WWTP in order to monitor changes in the upper Ellerbe Creek watershed. As part of the 303(d) list approach, DWQ will begin the process of identifying problem parameters that may be causing biological impairment in Ellerbe Creek. DWQ will continue to support the City of Durham stormwater programs.

The NCEEP has created a Local Watershed Plan (LWP) in the Ellerbe Creek watershed. City of Durham is now working to implement portions of the Ellerbe Creek LWP. This effort will develop detailed recommendations to improve water quality.

The impaired biological community in Ellerbe Creek is typical of streams that run through urban areas.

Current Status

Ellerbe Creek [AU# 27-5-(0.3); C; NSW] from source to I-85 bridge (6.1 miles) and [AU# 27-5-(0.7); WS-IV; NSW] from the I-85 bridge to a point 0.2 miles upstream of Durham County SR 1636 (5.9 miles) is Impaired for aquatic life due to a Poor fish community bioclassification at site JF4. This biological assessment was completed as result of the previous recommendation listed above. There were steep terraced banks, sparse instream habitat consisting mostly of runs and a few side snags as well as an abundance of urban debris. The total number of fish collected at this site in 2005 declined by 87 percent since the last fish collection in 1995. This may be due to the noted stressor such as upstream urban impacts, lack of suitable habitat, an open canopy, and the possible streams proximity to a landfill. The entire 12.5 mile length of Ellerbe Creek [AU# 27-5-(0.3), 27-5-(0.7) and 27-5-(2)] was first listed on the 303(d) list for Impaired Biological Integrity in 1998.

Ellerbe Creek [AU# 27-5-(2); WS-IV; NSW; CA], from a point 0.2 miles upstream of Durham County SR 1636 to Falls Lake, Neuse River (0.5 miles), is impaired for biological integrity due to a benthic sample that was collected at the end of the previous assessment window (8/23/00). Station JB165 at SR1636 received a Fair rating in 2000 and a Poor rating in 1995. This station was not assessed during this assessment period. None of the ambient monitoring data exceeded state standards at station JA7; however turbidity was elevated above the state standard of 50 NTUs in 7 percent of the samples. The maximum recorded turbidity level was 190 NTUs. The conductivity was high and ranged between 104 and 501 µmhos/cm. The nutrient levels were also very high at this ambient monitoring station. The readings ranged between 0.02-1.3 mg/l

NH3, 0.31-6.4 mg/l NO2+NO3, 0.62-2.4 mg/l TKN, and 0.07-4.5 mg/l TP. All of this data indicates that this watershed is highly impacted by both point and nonpoint sources of pollution and is likely having an impact on the water quality of Falls Lake (see Section 1.3.7).

This same section of Ellerbe Creek is Not Rated for recreational uses due to elevated fecal coliform bacteria levels in 21 percent of the samples. DWQ was unable to complete a 5-in-30 (assess 5 samples in 30 days), which is required in order to rate a stream with elevated fecal coliform levels (greater than 20 percent of the samples with a count of 400 CFU/100 ml or a geometric mean greater than 200 CFU/100 ml). DWQ focuses its limited resources on assessing class B waters (primary recreation waters; see http://h2o.enr.state.nc.us/tmdl/General_303d.htm for more information on use support methodology).

The entire length of Ellerbe Creek will remain on the 303(d) list of impaired waters for impaired biological integrity (Figure 3 and 4).

Recommendations

DWQ is strongly recommending that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners as well as implementing the local watershed plan developed by the NC Ecosystem Enhancement Program (EEP).

The following areas are also recommended for protection and acquisition needs within the Ellerbe Creek watershed.

- The upper watershed and headwaters area. Headwater protection is critically needed to improve and protect water quality in Ellerbe Creek.
- The area between Avondale Dr. and Falls Lake. Development is occurring rapidly in this area. There is a need to protect the remaining large, contiguous, undeveloped riparian area through acquisition, conservation easements, deed restrictions and other methods.
- To create a string of interconnected preserved areas from the headwaters to the terminus at Falls Lake. This would help limit impervious surfaces and control stormwater, improving water quality in Ellerbe Creek and Falls Lake as well as provide a place where people can enjoy nature.
- There is a need for improved stormwater management throughout the watershed, with particular emphasis on the highly developed areas between Hillandale and Roxboro Roads.
- Lands identified for acquisition through the Upper Neuse Clean Water Initiative (see section 1.5.3).

Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed 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 Initiatives

A local watershed plan (LWP) was developed through an EEP (previously called Wetlands Restoration Program) stakeholder process which evaluated the varied sources of water quality degradation and recommended a comprehensive set of strategies to address the water quality problems within Ellerbe Creek. Ellerbe Creek was identified as having the highest percentage of impervious surfaces and delivering the highest nutrient loads to Falls Lake. The Ellerbe Creek watershed is predominately urban and currently is estimated to have 22 percent impervious cover while is projected to increase to 27.5 percent by 2025.

The primary strategy of the watershed management plan is to protect and restore the watershed functions. Five major management goals were established, these are:

1. Improve Aquatic Life
2. Reduce Destructive Flooding
3. Create Recreational Opportunities
4. Educate the Local Community about Ellerbe Creek
5. Reduce Nutrient Loads going into Falls Lake Water Supply Reservoir.

The recommendations to attain these goals were:

1. Critical Area Protection
2. Riparian Area Management
3. Stream and Riparian Buffer Restoration
4. Better Site Design for Stormwater Management
5. Code and Ordinance Review and Revision
6. Stormwater Retrofits
7. Reduce Illicit Discharges and Illegal Dumping
8. Stream Monitoring
9. Strengthening Watershed Education and Stewardship
10. Sediment and Erosion Control.

The recommendations need to be implemented by local, regional, and state-level watershed stakeholders. The local watershed plan can be found at http://www.nceep.net/services/lwps/Upper_Neuse/Ellerbe_Creek_Local_Watershed_Plan.pdf.

City of Durham Initiative

The City of Durham has hired a consultant to develop a Watershed Implementation Plan based on the LWP developed by EEP several years ago. The consultant and City staff performed stream condition assessments for 35 miles of the Ellerbe Creek watershed, including South Ellerbe and Goose Creeks. The consultant and City staff also updated the inventory and checked status of 48 BMPs in the Ellerbe Creek Watershed. Opportunities for retrofits to existing structural BMPs, and potential locations for new BMPs, were evaluated during the field reconnaissance. Currently, 27 existing BMPs have been identified for possible retrofits. The City has identified five pilot subwatersheds to evaluate further and prioritize BMP installation based on a number of different criteria including utility conflicts, landowner cooperation/consent, pollutant removal, and educational opportunity. For more information on the City of Durham's Ellerbe Creek Watershed Improvement Projects go to http://www.durhamnc.gov/departments/works/stormwater_ellerbe.cfm.

Upper Neuse River Basin Association Initiative

The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed

Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

Ellerbe Creek Watershed Association Initiative

The Ellerbe Creek Watershed Association received a $411,000 NC Clean Water Management Trust Fund Grant in September 2007 to restore Ellerbe Creek between Albany St. and Interstate 85. In total, the project will restore a half mile of channelized, deeply incised, heavily eroded portion of Ellerbe Creek. The proximity of the restoration to the greenway will enhance visibility of the project, help to promote improved stewardship of the creek and maximize the environmental and recreational assets of this popular site.

Through the use of natural channel design, the project will reduce suspended sediment loads by drastically reducing stream bank erosion from an estimated 8-tons/linear foot/year to near zero following the restoration (Stream Restoration and Stormwater Treatment in the Ellerbe Creek Watershed, NCSU Water Quality Group, 2004). The restoration will decrease storm flow velocity, improve the quality of vegetation on stream banks and in riparian areas, increase low flow levels and help to restore the hydrography of the watershed. These improvements will improve water quality and aquatic habitat and help to address the causes of impaired biological integrity in the creek. The W. Ellerbe Creek Greenway is currently severely threatened by erosion of the highly channelized stream. This project will help stabilize the stream banks and protect the City of Durham's $175,000 paved greenway trail. In addition, the project will help protect future investment in connecting the trail to the city system and ensure the long-term protection of this important and highly valued recreation resource. For more information on the Ellerbe Creek Watershed Associations initiative projects go to http://www.ellerbecreek.org/.

Durham Soil and Water Conservation District Initiative

The Durham Soil and Water Conservation District has partnered with Blue Devil Ventures on a Green Roof Project in Downtown Durham. The Green Roof project is within the Ellerbe Creek Watershed. It will consist of two 3,000 foot sections of green roof that will be used for experimenting with media design, water conservation with cisterns, and water monitoring for runoff. The Durham Soil and Water Conservation District secured a $100,000 grant from Clean Water Management Trust Fund for this project.

1.3.2 Little Lick Creek Watershed: Little Lick Creek [AU# 27-9-(0.5) & 27-9-(2)] & Two Unnamed Tributaries [AU# 27-9-(0.5)UT2 & 27-9-(2)UT2]

2002 Recommendations

DWQ will continue monitoring Lick Creek. As part of the 303(d) list approach, DWQ will begin the process of identifying problem parameters that may be causing biological impairment in Little Lick Creek. DWQ will continue to support the City of Durham stormwater programs.

The impaired biological community in Little Lick Creek is typical of streams that run through urban areas

Current Status

In the Little Lick Creek watershed, eleven sampling sites were assessed for physical and chemical parameters between March and June 2005, seven of these were assessed using a continuous monitoring device (datasonde) and five benthic sites were assessed in April 2005. These samples were collected by DWQ for assistance with an EEP local watershed assessment of the Little Lick Creek watershed.

Little Lick Creek is located in east Durham and flows into Falls Lake. The creek contains approximately 73 miles of streams within an area of approximately 21 square miles. The Little Lick Creek watershed lies within the Triassic basin geological region of North Carolina. The Triassic basin soils have high clay content that can provide less base flow to streams than other soil types resulting in lower summer stream flows and lower dissolved oxygen levels. Because of the associated effects from the low flow and DO levels as of 2001 the biological assessment unit is no longer assigning bioclassifications to streams sampled in the Triassic basin. General assumptions can still be made from sampling in these areas especially if there is a healthy/reference stream to make a comparison with in the same area.
Historically, Little Lick Creek from it source to Falls Lake (including the portion of Little Lick Creek arm of Falls Lake) is on the 303(d) list for Impaired biological integrity. The upper portion [AU# 27-9-(0.5)] is also on the 303(d) due to low dissolved oxygen standard violations. The stressors to this area were listed as urban runoff, storm sewers, and runoff from construction sites. During the last assessment period Little Lick Creek received a Poor benthic bioclassification. Historically, Little Lick Creek as been sampled eight times since 1985 and has received either a Poor or Fair bioclassification each time.

Since it is difficult to determine the relative degree to which the Triassic basin characteristics and urban impacts affect the macroinvertebrate communities at these five sites they are classified as Not Rated. However, since all five sites are within the Triassic basin, the difference between the benthic community at the unnamed tributary to Little Lick Creek off Santee Road and the other four sites suggest that urbanization is contributing to the stress indicated by the benthic communities at the more urban four sites (Figure 3).

Little Lick Creek [AU# 27-9-(0.5) & 27-9-(2)]
Little Lick Creek [AU# 27-9-(0.5); WS-IV; NSW] from the source to a point 0.4 miles upstream of Durham County SR 1811 (7.17 miles) and Little Lick Creek [AU# 27-9-(2); WS-IV; NSW; CA] from a pervious segment to Falls Lake, Neuse River (0.57 miles) is Impaired for aquatic life due to ambient monitoring dissolved oxygen and turbidity standard violations. These stations were assessed using a continuous monitoring probe between April and June 2005. The state standard for dissolved oxygen is not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l. Since a continuous monitoring probe was used, daily averages were calculated and used for this assessment. However, Little Lick Creek would have been classified as impaired if the lower 4 mg/l dissolved oxygen standards was used as well. The low DO violations ranged between 42 and 67 percent exceedance (percent below the standard) and the turbidity ranged between 8.6 and 55 percent exceedance with the segment closest to Falls Lake with the most extreme violations (station LLCLL10).

All of Little Lick Creek will be added to the 2008 303(d) list for dissolved oxygen and turbidity standard violations and will remain on the list for impaired biological integrity.

Unnamed Tributaries to Little Lick Creek [AU# 27-9-(0.5)ut2 & 27-9-(2)ut2]
Unnamed tributary to Little Lick Creek [AU# 27-9-(0.5)ut2; WS-IV; NSW] from the source to Little Lick Creek (2.4 miles) and [AU# 27-9-(2)ut2; WS-IV; NSW; CA] from the source to Falls Lake Little Lick Creek (0.9 miles) are both Impaired for aquatic life due to dissolved oxygen standard violations of 54 (station LLCUT03) and 29 (station LLCUT11) percent respectively. Both unnamed tributaries also had high turbidity levels; however they did not exceed the standard more than 10 percent of the time.

Both of these tributaries will be added to the 2008 303(d) list of impaired waters for dissolved oxygen standard violations (Figure 3 and 4).

Fecal coliform bacteria levels rose significantly after a storm event at all sites within the study area. Little Lick Creek is Not Rated for recreational uses because a 5-in-30 sampling effort was not done (5 samples collected over a 30 day period required in order to assess for fecal coliform bacteria).

Elevated specific conductivity was also seen in this watershed. This is an indication of polluted waters. The range of specific conductivity in this watershed was between 59-564 µS/cm. The DWQ biologist noted in their assessment of the Little Lick Creek Watershed that the stream banks were severely eroded and the riparian zones were essentially not intact at most of the benthic sites. The reference site also suffered from erosional areas however the riparian zones were wide and intact. The watershed was noticeably more rural and less disturbed than the other four sites and supported a less impacted macroinvertebrate community. The watershed restoration projects listed in the EEP local watershed plan and the UNRBA Upper Neuse Watershed Management Plan will help address these issues and improve the aquatic life and habitat in this watershed.

The EEP Little Lick Creek Watershed plan reported that the greatest potential water quality threats found in this watershed was from failing septic systems and sewer spills. This creek has the greatest density of sand filter type systems (approximately 444 systems) in the entire Upper Neuse Basin. These wastewater systems exhibit high rates of failure. These failures are going untreated for long periods of time because they discharge the raw, untreated sewage directly into streams. Even properly functioning sand filters systems export high concentrations of nutrients to streams. The level of urban development is projected to more than double in the long run. Restoring Little Lick Creek will be impossible without stronger approaches for preventing impacts from future land use changes like those recommended in this plan (EEP 2006, Little Lick Creek LWP).

Recommendations

DWQ recommends that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners as well as implementing the recommendations from the EEP Little Lick Creek Local Watershed Plan.

Water Quality Initiatives

A local watershed plan funded by the NC Ecosystem Enhancement Program (EEP) for Little Lick Creek was completed in December 2006. This was completed through an extensive stakeholder process which came up with nine comprehensive watershed management strategies for restoring the watersheds water quality and aquatic habitat in the short-term and protecting them in the long term. The recommendations need to be implemented by local, regional, and state-level watershed stakeholders. The nine recommendations where split into three categories and are as follows:

Watershed Restoration Projects

1. Stream Repair Projects
2. Riparian Buffer Restoration
3. Stormwater Retrofits

Strategies to Prevent Future Degradation

4. Critical Lands Protected
5. Better Site Design
6. Improved Enforcement of Existing Rules

Strategies to Increase Watershed Stewardship

7. Watershed Outreach and Education
8. Adopt-a-Stream Program
9. Stream and Watershed Monitoring.

The watershed plan can be found at http://www.nceep.net/services/lwps/little_lick/LittleLick_LWP.pdf and lists specific details for each of the plan recommendations.

Upper Neuse River Basin Association Initiative

The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

1.3.3 Lick Creek [AU# 27-11-(0.5) & 27-11-(1.5)]

2002 Recommendations

As part of the 303(d) list approach, DWQ will begin the process of identifying problem parameters that may be causing biological impairment in Lick Creek. DWQ will continue to support the City of Durham stormwater programs.

The impaired biological community in Lick Creek is typical of streams that run through urban areas.

Current Status

The DWQ did not assess Lick Creek during this assessment period. This creek was previously assessed three times (2000, 1995, and 1998) and was found to support a fair benthic community each time. The biologist noted during the last assessment that the habitat was poor with no riffles, severe erosion, a deeply entrenched channel, no effective riparian zone, little instream habitat and the benthic substrate composed mostly of sand. These are indicators of a major stormwater runoff problem in the area. Lick Creek [AU# 27-11-(0.5); WS-IV; NSW] from the source to Wake County SR1809 (6.5 miles) was added to the 303(d) list in 1998 for impaired biological integrity. The biological impairment was extended 0.7 miles down stream to Falls Lake (Lick Creek [AU# 27-11-(1.5); WS-IV; NSW; CA] from Wake County SR1809 to Falls Lake) during the last assessment period and added to the 2004 303(d) list.

The Lick Creek watershed is a relatively undeveloped watershed where the majority (80 percent) of the land use is currently classified as undeveloped (forestry, agriculture or protected lands). It

also falls into a unique geological zone know as the Triassic Basin which in turn results in a need for unique management strategies due to the erosive soil type and lack of flow during dry periods (Bain and Harvey, 1977). This watershed at present is impaired, which to the best of our knowledge is likely due to excessive runoff and increase streamflow volumes after rain events. This deposits excess sediment from the landscape as well as results in streambank erosion and scouring of the streambed which has a detrimental impact on the benthic macroinvertebrate communities. Stormwater runoff also carries excess nutrients and pollutants into the creek as well. These can negatively impact both humans and aquatic organisms in the watershed. Given the unique geological formation in this watershed, special ordinances may be required in order to accommodate future growth while protecting and improving water quality.

Due to the less than suitable soil type in this watershed, on-site sewage treatment using conventional septic systems is often not an option. Many of the treatment systems in this watershed are single family home sand filters (approximately 79 sand filter systems in this watershed). These systems are often not adequately maintained resulting in high fecal coliform and nutrient discharge, which ultimately ends up flowing into the creek.

Restoring Lick Creek will be impossible without stronger approaches for preventing impacts from future land use changes.

The Upper Neuse River Basin Association (UNRBA) received a 319 grant ($148,000) in October 2006 to develop a Lick Creek watershed restoration plan. This is a three-year project to develop and commence implementation of a watershed restoration plan to address the biological impairment in Lick Creek by improving water quality and habitat conditions. This process included monitoring of the watershed to help identify sources of the impairment and propose and prioritize management strategies to address those sources. The ambient water quality data collected during this project will be used to make use support ratings during the next assessment period (2008). The project also includes development of recommendations for a long-term monitoring program that may be implemented by the City of Durham Stormwater Services Division.

The Durham SWCD is participating in the Lick Creek Watershed Restoration Plan in association with the Upper Neuse River Basin Association.

The entire length of Lick Creek will remain on the 2008 303(d) list of impaired waters (Figure 3 and 4).

Recommendations

DWQ should assist UNRBA and local governments in implementing the management strategies recommended in the Lick Watershed Restoration Plan UNRBA and the watershed stakeholders are developing. These strategies might include stream and/or watershed restoration projects, retrofits of existing development, and code and/or local ordinance changes. DWQ should also work with the City of Durham's Stormwater Services to utilize their long-term data for use support in the future.

DWQ also recommends that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners.

Water Quality Initiatives
The SWCD has partnered with three local landowners and NCSU on a stream restoration and benthic macroinvertebrate count on a portion of Lick Creek. The District has received a NC Clean Water Management Trust Fund Grant of $539,000 for the project. The restoration site begins at Olive Branch Road and runs east for 4000 ft. One thousand feet of buffers will also be restored. The project started summer of 2007 and upon completion the District will hold a conservation easement on approximately 10-14 acres of buffers adjacent to the restoration. Pre and post benthic macroinvertebrate assessment will be completed by NCSU.

Upper Neuse River Basin Association Initiative
The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

1.3.4 Flat River [AU# 27-3-(1), 27-3-(8) & AU# 27-3-(9)]

2002 Recommendation
DWQ will work with the City of Durham to evaluate low dissolved oxygen releases from the dam. As part of the 303(d) approach, a management strategy will be developed to ensure that low dissolved oxygen from Lake Michie does not adversely impact the biological community in the Flat River. DWQ will continue to monitor the segment below Lake Michie to evaluate any changes in dam operation.

Current Status
Flat River [AU# 27-3-(1); WS-III; NSW (9.1 miles) from the source to a point 2.0 miles downstream of Durham County SR1614 is supporting aquatic life and recreational uses due to a Good benthic bioclassification at station JB9 and due to no criteria exceeded at ambient monitoring station JA4. The dissolved oxygen levels in this segment were below 4 mg/l and 5 mg/l in 3 and 7 percent of the samples tested respectively. The lowest recorded reading was 3.2 mg/l. Turbidity was above the state standard of 50 NTUs in 3 percent of the samples with the highest recorded reading of 120 NTUs. The benthic and ambient monitoring stations are co-located. This segment of the Flat River was rated Good in 2000 and 2005. The habitat at this location was good with fairly stable stream banks and only a few erosional areas seen. The biologist noted that this segment was slightly turbid with low flow conditions during their 2005 benthic collection.

The Flat River [AU# 27-3-(8); WS-IV; NSW (1.1 miles) & AU# 27-3-(9); WS-IV; NSW; CA (0.6 miles)] from the dam at Lake Michie to Falls Lake is Impaired for aquatic life due to low dissolved oxygen levels at ambient monitoring station JA5. DO levels were less than 4 mg/l and 5 mg/l in 27 and 37 percent of the samples respectively. The lowest recorded DO reading was 0.4 mg/l.

The whole segment below Lake Michie will be on the 2008 303(d) impaired waters list for low dissolved oxygen standard violation (Figure 3 and 4).

Recommendations
DWQ recommends that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners.

Water Quality Initiatives
The Durham SWCD initiated a project with a local landowner on a stream restoration of an unnamed tributary flowing into Lake Michie. The project is on a 2000 foot long reach with funding from the Clean Water Management Trust Fund, and buffer reforestation on the adjoining 13 acres with assistance from the Conservation Reserve Enhancement Program. In collaboration with the Triangle Greenway Council (TGC) and NC National Guard the initiative is being expanded to include a conservation easement on 225 acres that will continue agricultural use, protect water quality and avoid land use that would not be compatible with adjoining military training exercises. The Durham SWCD will hold and monitor the conservation easement. Funds for the expanded initiative have been pledged by the partners and are being sought through the Federal Farmland and Ranchland Preservation Program, State Agricultural Development and Farmland Preservation Trust Fund and the Upper Neuse Clean Water Initiative. This is the first project undertaken after the TGC's Riparian Corridor Conservation Plan identified the Flat River as one of several focus areas for attention. The Flat River Plan is currently being updated and refined to promote multiple purpose corridors.

Upper Neuse River Basin Association Initiative
The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

1.3.5 Knap of Reeds Creek [AU# 27-4-(1), 27-4-(6) & 27-4-(8)]

2002 Recommendations
As part of the 303(d) list approach, DWQ will begin the process of identifying problem parameters that may be causing biological impairment in Knap of Reeds Creek. DWQ will continue to monitor this segment to evaluate future improvements at the WWTP and upstream water quality. DWQ continues to recommend that Butner WWTP improve plant operations and collection systems as needed to reduce the potential for negative water quality impacts to Knap of Reeds Creek.

Current Status
Knap of Reeds Creek [AU# 27-4-(6); WS-IV; NSW (5.6 miles) & AU# 27-4-(8); WS-IV; NSW; CA (0.6 miles)] from the dam at Butner Lake to Falls Lake, Neuse River is Impaired for aquatic life based on a Fair benthic bioclassification at sites JB11, JB12, and JB14. Sites JB11 and JB12

are above and below the WWTP (South Grandville Water and Sewer Authority (SGWASA)) respectively. Earlier samplings indicated a chronic problem with the discharge from the WWTP, which appears to have been corrected as both the upstream and downstream sites had similar benthic community in recent years. This is the only major discharger into this watershed and is permitted to discharge up to 5.5 MGD. As of January 2006, the Department of Health and Human Services turned over operation of this facility to the SGWASA (permit # NC0026824).

No Criteria were exceeded at ambient monitoring station JA6. The station is located at the WWTP outfall. While no criteria were exceeded, nutrients, conductivity and fecal coliform bacteria levels were elevated. The recorded maximum conductivity at this site was 681 µmhos/cm, nitrate/nitrite nitrogen was 9.4 mg/l, total phosphorus was 4.2 mg/l and the fecal coliform bacteria levels were above 400 CFU/100 ml in 8 percent of the samples. This segment of Knap of Reeds Creek is obviously impacted by point and nonpoint sources of pollution. This is the only ambient monitoring station on this creek.

A TMDL Stressor study was performed in April 2004 to address the 1998 303(d) listing for impaired biological integrity of this area. The potential sources at the time of the initial impairment were listed as unknown.

Site JB14 (SR1004) is approximately 1.1 miles downstream of the Lake Butner dam. It is largely an agricultural area. Largely embedded benthic surfaces, infrequent pools and riffles as well as a reduced riparian zone have resulted in limited instream habitat. Erosional areas upstream of the study area were also evident. This could be a result of water flow over at the dam. The results at this site suggest a moderately tolerant benthic community with some toxic influences.

Site JB11 (above WWTP) is approximately 4.6 miles down stream of the Lake Butner dam. Pools were frequent and varied, but no riffle areas were present. The water clarity was turbid at the time of sampling even though there had been a lack of precipitation in the area. This site appears to be neither declining nor recovering from its degraded condition. A tolerant macroinvertebrate community was dominant at this site.

Site JB12 (below WWTP) is approximately 100 meters downstream of the outfall of the WWTP. The benthic community has continued to improve to the point of mirroring the upstream WWTP site (JB11) possibly due to plant upgrades over the past decade. This area has improved from poor to fair since sampling began in 1982.

At this same time, a sample (JB13) was collected upstream of Lake Butner, below the confluence of Camp Creek [AU# 27-4-(1); WS-II; HQW; NSW]. This area is Supporting aquatic life due to an Excellent benthic bioclassification at this site JB13. This was the first time this site had been sampled by DWQ. The banks appeared stable with erosional areas confined to the outside of bends in the creek. The stream has good flow and did not appear to completely dry out in the summer months. However, excessive periphyton growth was observed in areas of full sunlight.

DWQ found low dissolved oxygen readings below the dam that were potentially caused by stagnate conditions due to the little to no flow coming down stream from the dam, lack of precipitation as well as from a wildlife impoundment. Data provided by NC Division of Water Resources (DWR) indicates that there are currently no minimum flow requirements for the Lake Butner Dam. It was reported that half the years on record contain months with zero flow occurrences, meaning that no water was flowing past the dam. DWR recommends a flow regime

in Knap of Reeds Creek, below the dam of 12.3 cubic feet per second (cfs) from March-May and 3 cfs from June to February.

A NCSU research dairy farm present near an upstream, unnamed tributary to Knap of Reeds Creek (SR1004) was found to be a potential source of nutrient into the creek. The cows had direct access to the creek. There have been historical water quality problems because of the dairy farm. This farm has since closed, and cattle are no longer in the creek. Direct water quality improvements should be seen at this location.

The dramatic differences between the benthic community at the upstream site (JB13) and the sites downstream of Lake Holt (Butner Lake) strongly suggest that the Lake Holt dam is one of the primary stressors in this section of the stream. The low flow conditions and resulting low DO levels due to the dam and the wildlife impoundment as well as the nutrient inputs from various sources in the watershed such as the dairy farm, non-point source runoff from the Town of Butner and the WWTP have all likely contributed to the biological impairment. Sedimentation due to impervious surfaces associated with the Town of Butner and the resulting flows after a rainfall as well as materials leaching from the unlined landfill in the headwaters of Picture Creek may also play a role in the biological impairment of Knap of Reeds Creek.

Knap of Reeds Creek will remain on the state's 303(d) list of Impaired waters for impaired biological integrity (Figure 3 and 4).

The Butner WWTP was assigned a total nitrogen allocation of 58,599 lbs/yr under the 1997 Neuse NSW strategy. In October 2003, the Butner purchased 6,113 lbs/yr of estuarine total nitrogen allocations/credits from the Bay River Metropolitan Sewerage District (BRMSD) for $1.68 million dollars. The BRMSD is located approximately 200 miles downstream in the lower Neuse Estuary, with the transportation factor, this allotted Butner an additional nitrogen allocation of 61,130 lb/yr (10 percent of the nitrogen from Falls Lake makes its way to the Neuse Estuary; transportation factor of 10). A great deal of concern surfaced about the ability of Fall Lake to handle the additional nitrogen load. Falls Lake appeared to be suffering from nutrient over enrichment prior to this nitrogen allocation transfer. This prompted DWQ to initiate the Fall Lake modeling study. This will allow DWQ to determine waste load allocations for the entire Fall Lake watershed. The WWTP has since sold 3,668 lbs/yr of the BRMSD total nitrogen allocation to Johnston County and holds the remainder in reserve pending the outcome of the Falls Lake TMDL. See section 1.3.7 for information on Falls Lake water quality.

The South Grandville Water and Sewer Authority (SGWASA) have had pretreatment issues resulting in antimony violations over the last few years. They also experienced total residual chlorine issues in 2003-2004. DWQ assessed a civil penalty for the continued pretreatment non-compliance issues. DWQ will work with the facility to correct these compliance issues.

Recommendations

DWQ will continue to monitor Knap of Reeds Creek and participate in the multiagency partnership dedicated to improving the waters in this area. Further nutrient reductions may be required for all dischargers (point and non-point) to Falls Lake. This information will be determined as result of the Falls Lake modeling study. The Town of Butner should work to reduce stormwater runoff to this creek.

DWQ recommends that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners.

Water Quality Initiatives
The Tar River Land Conservancy (TRLC) is working in partnership with the Town of Butner to protect, through conservation easement, the land immediately upstream from and adjacent to Lake Holt, to include portions of Knap of Reeds Creek. The project will ultimately result in a 1206 acre upland working farm/forest conservation easement along with approximately 450 acres of forested "no touch" riparian area immediately adjacent to Knap of Reeds Creek, several unnamed tributaries, and portions of the shore line of Lake Holt. The 1656 acre conservation easement will be conveyed by the State of North Carolina to the Town of Butner and the South Granville Water and Sewer Authority as co-holders of the easement. The purpose of the conservation easement is to protect water quality in Lake Holt which serves as the primary water supply for Butner and residents in southern Granville County through the South Granville Water and Sewer Authority. Water from Lake Holt also flows into Falls Lake which is the primary water supply for the City of Raleigh and surrounding municipalities.

Upper Neuse River Basin Association Initiative
The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

1.3.6 Upper Barton Creek [AU# 27-15-(1)]

Current Status
Upper Barton Creek [AU# 27-15-(1); WS-IV; NSW] from source to a point 0.5 miles upstream of Wake County SR 1844 (4.9 miles) is Impaired for aquatic life due to a Fair benthic community bioclassification at site JB28. The biologist found the sediment to be predominantly sand (60 percent) most likely due to the increasing development in the watershed. The channel in this section of the stream was more noticeably filled in and had fewer riffles and chutes in comparison to the 2000 basinwide sample. The benthic community structure is changing, suggesting a long-term water quality decline since it received a Good rating in 1991. There has been a reduction or loss of intolerant species and an increase in more tolerant taxa. The fish community has received a Good bioclassification rating over the last three basin cycles at site JF21.

Upper Barton Creek will be added to the 2008 303(d) list of impaired waters for impaired biological integrity (Figure 3 and 4).

The Wake County SWCD installed bank pins and scour chains in July, 2005, for a distance of approximately 4000 feet above Mt. Vernon Church Road. Initial measurements show significant

bank loss in the first 18 months ranging from 10 tons/100 linear feet to greater than 75 tons/100 linear feet for various reaches.

Recommendations
DWQ would encourage local resource agencies to consider installing stormwater BMPs to reduce the stormwater volume and velocity as well as stream bank stabilization measures on the creek to reduce to amount of sediment from washing downstream.

DWQ recommends that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners.

Further 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 Initiatives
Wake County received a 319 grant in 2005 to produce a Watershed Management Strategy for Falls Lake. An initial analysis using GIS will be made of all the tributaries within this region. Based on the initial analyses, more detailed analysis will take place in watersheds where problems are known. It is likely that Upper Barton Creek will have a more detailed analysis performed. It is likely that additional monitoring, including physical and biological, perhaps more, will be implemented with the Wake County 319 project.

Upper Neuse River Basin Association Initiative
The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

1.3.7 Falls Lake (Falls of the Neuse Reservoir) [AU# 27-(1) & 27-(5.5)]

2002 Recommendations
The upper part of the reservoir is periodically muddy and nutrient levels are unchanged from previous monitoring. Algal biomass was high in 1999. Low dissolved oxygen in the mid-reservoir and low mean Secchi depths (measure of clarity) indicate that the Falls Lake Reservoir experiences some water quality problems that are related to nutrient loading (algal activity) and sediment loading from the surrounding watershed. DWQ will continue to monitor the lake to evaluate any future degradation in water quality. The City of Raleigh should pursue measures to protect the watershed from land use activity that could increase nutrient and sediment loading.

Current Status

Falls of the Neuse Reservoir (Figure 4) is a multi-purpose impoundment of the Neuse River located in the Upper Neuse River basin. The various uses authorized for the reservoir include: water supply, flood control, recreation, wildlife enhancement and augmentation of low flows for purposes of pollution abatement and water quality control in the Neuse River basin. The reservoir is the primary water supply source for the City of Raleigh with a capacity of 100 MGD allocated for drinking water. The Cities E.M. Johnson Water Treatment Plant generally treats approximately 47 MGD, however an early 2007 summer 30-day average was up to 62.6 MGD. The City of Raleigh is a regional provider of drinking water and wastewater services to the Towns of Garner, Knightdale, Rolesville, Wake Forest, Wendell and Zebulon, in addition to its own service area.

The Falls of the Neuse Reservoir dam was constructed and filled by 1983 and is currently operated by the United States Army Corps of Engineers (USACE). The reservoir extends 28 miles up the Neuse River to just above the confluence of the Eno and Flat Rivers. At normal pool elevation, the lake has a surface area of 11,310 acres. It drains a watershed area of 494,600 acres or approximately 770 square miles including parts of 6 counties (Person, Orange, Franklin, Durham, Wake and Granville). The entire Falls of the Neuse Reservoir watershed is classified nutrient sensitive waters (NSW).

Falls of the Neuse Reservoir was monitored by DWQ a total of 42 times between March 2005 and December 2006. This lake has been sampled numerous times since 1983; however, no samples were taken by the Division between September 2001 and March 2005. Dr. JoAnn Burkholder, a researcher at North Carolina State University, Center for Applied Aquatic Ecology, provided chlorophyll *a* data for the summers of 2004, 2005 and 2006. This data was used in evaluating chlorophyll *a* in the lake based on confidence in Dr. Burkholder's collection and analysis methodologies.

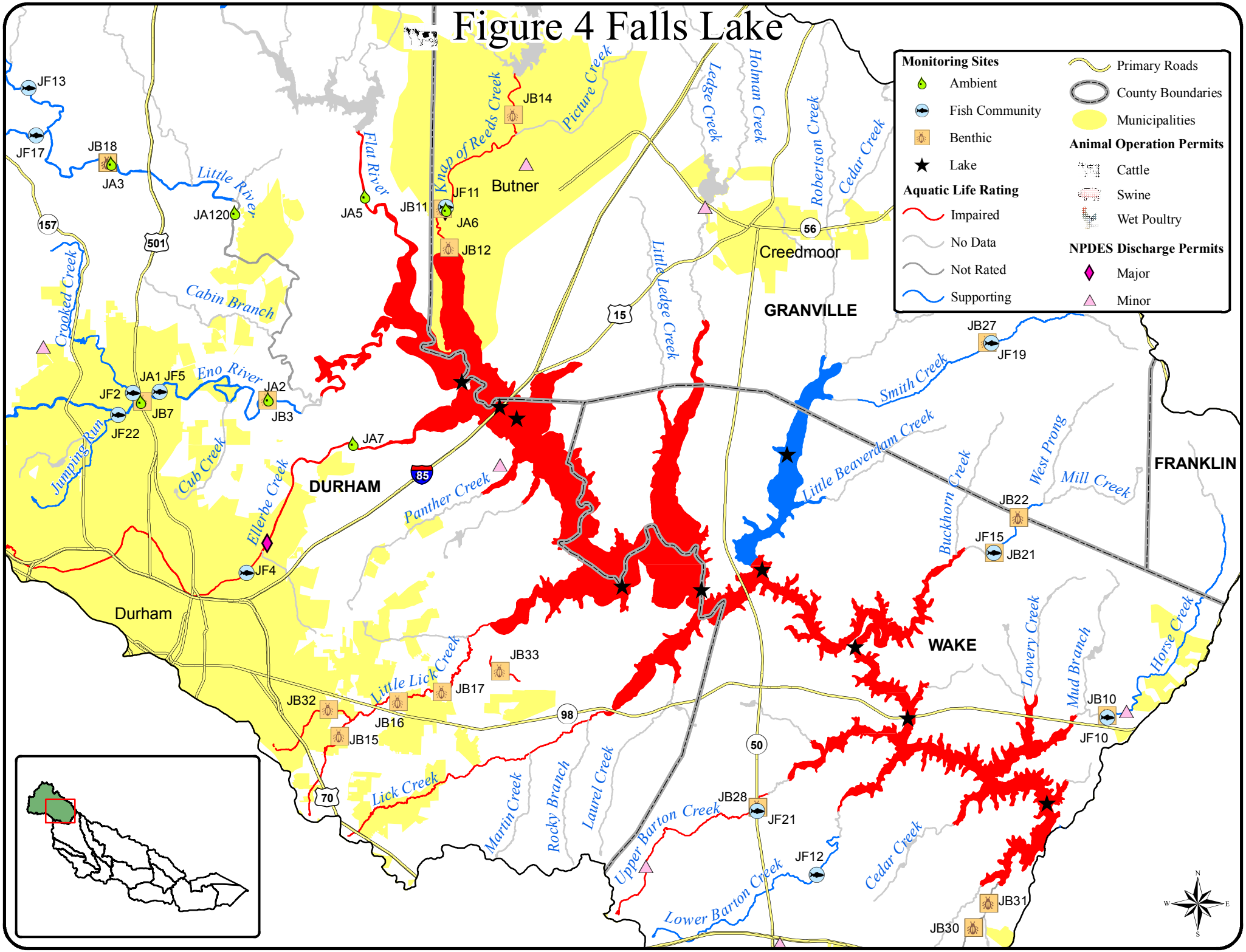
Percent dissolved oxygen saturation values were elevated (>120 percent). These high values indicate biological productivity due to algal photosynthesis; as evidenced by the high phytoplankton populations found in the most upstream section of the reservoir, near Interstate 85.

Three ambient monitoring stations, one on the upper end, one in the middle and one in the lower end, were assessed for phytoplankton. Phytoplankton sampling occurred during March, July and October of 2005. Mild blooms of cryptomonads and the green alga *Ankistrodesmus* were found in March. Cryptomonads and green algae commonly dominate spring flora. *Ankistrodesmus* is a unicellular green alga frequently found in lakes, ponds and reservoirs throughout the state. Although these taxa can form blooms that discolor waters and may cause taste and odors in drinking waters, these algae are generally considered a good food source and pose no known environmental health risks.

The phytoplankton assemblage shifted to small filamentous blue-greens in July and October that formed moderate to severe blooms throughout the lake. Blue-green blooms may also discolor water and cause taste and odor problems. They are common indicators of eutrophication and some taxa, such as *Cylindrospermopsis*, can produce toxins. No known adverse human health effects associated with blue-green algal toxins (cyanotoxins) have been reported in North Carolina waters. Sampling being conducted by the City of Raleigh for cyanotoxins found very low concentrations during summer. These concentrations were below the World Health Organization's suggested human health criteria for cyanotoxins.

DWQ chlorophyll *a* concentrations were only available for March through mid-April 2005 and October 2005 through December 2006. By mid-April 2005 and early February 2006, chlorophyll *a* concentrations above the I-85 bridge exceeded the standard of 40 µg/l. The chlorophyll *a* concentrations remained high into November of each year. In addition to the DWQ chlorophyll *a* data, data from NCSU were included from July of 2004 and June, July and August of 2005 and 2006. These data were averaged in with DWQ data.

Figure 4 Falls Lake



Nutrient concentrations in 2005 were generally moderate to high for total Kjeldahl nitrogen, total organic nitrogen, and total phosphorus, confirming a potential for high biological productivity. Total Kjeldahl nitrogen ranged from 0.37 mg/l to 1.5 mg/l, total organic nitrogen from 0.36 mg/l to 1.5 mg/l and total phosphorus from <0.02 mg/l to 0.23 mg/l. Additionally, 2005 nitrite + nitrate values were high until the end of April, when they dropped to lower levels through September of 2005. This phenomenon indicated uptake of this nutrient by algae at the start of the growing season. Data from NCSUs study indicated similar concentrations. With the assistance of EPA's Athens Laboratory, algal growth potential tests (AGPT) were conducted at seven stations on the reservoir. AGPT is used to determine the potential of the waterbody to grow algae and the nutrient that is controlling algal growth. In this reservoir only the station above the I-85 bridge had an AGPT without nutrient additions above 10 mg/l (13.3 mg/l). This demonstrates that this location in the reservoir already has more than sufficient nutrients to support severe algal blooms.

High turbidity and corresponding low secchi depths were frequently recorded in the reservoir during 2005 and 2006. Turbidity values exceeded the state standard of 25 NTU for reservoirs in 72 percent of the samples in the upper portion (above I-85) of the reservoir. Below the I-85 bridge all stations values were pooled to get a single sampling trip/daily average. Of these, only a single daily average exceeded the standard, totaling a 2 percent exceedance which occurred on December 7, 2005 with a daily average of 41 NTUs. The turbidity at the upper most station below the I-85 bridge, however exceeded the standard in 62 percent of the samples with an overall average for the 42 samples collected of 33 NTUs. This station was above the standard as a result of mixing with the more turbid upstream waters. The most likely cause of the elevated turbidity appeared to be sediment loading above this portion of the lake.

There are a variety of sampling programs being conducted on Falls of the Neuse Reservoir. They include sampling funded by the City of Raleigh focused on non-regulatory source water characterization to meet the EPA Interim Enhanced Surface Water Treatment Rule, sampling by researchers at the NCSU focused on cyanotoxins and water quality (funded by the Department of Health and Human Services), and sampling being conducted by the USGS for the Upper Neuse River Basin to document surface water supply quality. Sampling by researchers and contractors documented similar turbidity, nutrient and chlorophyll *a* concentrations to those recorded by DWQ. However, the data collected by these researchers and contractors was not submitted to the Division for use in this evaluation.

Upper Falls Lake (above I-85)

The data indicate that Falls Lake [AU# 27-(1); WS-IV, NSW, CA] from the source (confluence of Eno River Arm of Falls Lake and Flat River Arm of Falls Lake) to the I-85 bridge (2,703.6 acres) is Impaired for aquatic life due to elevated chlorophyll *a* and turbidity levels (this also includes the NCSU-CAAE station above I-85).

Lower Falls Lake (below I-85)

The data indicate that Falls Lake [AU# 27-(5.5); WS-IV; B; NSW; CA] from I-85 bridge to the dam at Falls Lake (9,530.3 acres) is Impaired for aquatic life due to elevated chlorophyll *a* levels at the lower lake stations.

Both sections of the lake were added to the 2008 303(d) list of impaired waters; the upper portion for chlorophyll *a* and turbidity standard violations, and the lower portion for chlorophyll *a* standard violations only.

Recommendations
DWQ is strongly recommending that the 2003 UNRBA Upper Neuse Watershed Management Plan be implemented by the UNRBA members and partners.

Water Quality Initiatives
Due to a great deal of public concern over the ability of Fall Lake to handle the additional nitrogen load from the 2003 Butner WWTP nitrogen trade (see section 1.3.5 for more detail), DWQ initiated a special study in 2005 in order to develop a model/TMDL for Falls Lake. The results of this study, as reported above, found Falls Lake to be suffering from nutrient over enrichment and elevated sedimentation. This resulted in placement on the 2008 303(d) list of impaired waters. Implementation of a nutrient management strategy will follow the development of the model. Details on this process can be found in section 1.5.5.

Upper Neuse River Basin Association Initiative
The UNRBA has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts. The watershed management plan recommends a comprehensive suite of management strategies covering new development, monitoring and enforcement, watershed stewardship and agricultural measures, watershed restoration and point sources.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. Information on the Upper Neuse Watershed Management Plan can be found in section 1.5.2 or at the UNRBA website http://www.unrba.org/mgmtplan.htm.

See section 1.5.3, Upper Neuse Clean Water Initiative and section 1.5.4, Riparian Corridor Conservation Program for information on the other water quality protection initiatives in the Falls Lake watershed.

1.4 Status and Recommendations for Waters with Noted Impacts

Based on DWQs most recent use support methodologies, 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 number. Refer to Section 1.1 for more information about AU#. Nonpoint source program agency contacts are listed in Appendix IV.

1.4.1 West Fork Eno River Reservoir [AU# 27-2-2a]

Eno River Watershed Map (Figure 5)

Current Status

West Fork Eno River Reservoir [AU# 27-2-2a; WS-II; HQW; NSW] from source to reservoir dam (204 acres) is currently Not Rated for aquatic life due to insufficient number of samples within the assessment period. West Fork of the Eno River Reservoir is a water supply reservoir for the Town of Hillsborough. Construction of the reservoir began in 1999 and was completed in 2000. The drainage area surrounding this lake consists of forested and rural areas with agricultural fields, pastureland and residences. This reservoir was sampled for the first time by DWQ in 2005. DWQ samples four different stations on eight different dates between May and September. Nutrient concentrations were within the usual range for a Piedmont reservoir. Secchi depths ranged from 0.5 to 2.0 meters, indicating fair to good water clarity. Analysis of phytoplankton samples indicated the presence of mild to moderate algal blooms throughout the summer. Although, West Fork Eno River Reservoir is currently Not Rated it appears to be supporting its designated uses at this time based on the limited number of samples analyzed. DWQ will continue to monitor this reservoir for potential changes related to increasing productivity in the future.

1.4.2 Eno River Watershed [AU# 27-2-(1); 27-2-(3.5); 27-2-(7); 27-2-(10); 27-2-(19); 27-2-(19.3); & 27-2-(19.5)]

Eno River Watershed Map (Figure 5)

Current Status

The Eno River [AU# 27-2-(1); WS-II; HQW; NSW], from the source to a point 0.4 miles upstream of Dry Run (2.2 miles) is Supporting aquatic life due to a Good-Fair benthic bioclassification rating at JB4 and an Excellent fish rating at a concurrent fish site JF6. The benthic rating dropped from Good in the last assessment period while the fish rating remained constant over this same time period. The stream bank erosion was classified as moderate while the riparian zone was wide and intact.

Eno River (Corporation Lake, Lake Ben Johnson) [AU# 27-2-(3.5); WS-II; HQW; NSW; CA] from a point 0.4 miles upstream of Dry Run to the dam at Lake Ben Johnson is rated as No Data since DWQ did not collect any samples on this lake during this assessment period.

Eno River [AU# 27-2-(7); C; NSW] from dam at Lake Ben Johnson to Orange County SR 1561 (8.2 miles) is Supporting aquatic life due to a Good fish community bioclassification at site JF7 and JF9.

The Eno River [AU# 27-2-(10); WS-IV; B; NSW (16.2 miles) and AU# 27-2-(19); WS-IV; NSW (1.6 miles)], from Orange County SR 1561 to a point 0.5 miles upstream of City of Durham emergency pumping facility raw water intake is Supporting aquatic life based on a Good (JB6) and a Good-Fair (JB5 and JB7) benthic and an Excellent fish community bioclassification (JF8 and JF5). The benthic ratings at site JB6 and JB7 are down from an Excellent bioclassification in 2000. Site JB5 was assessed for the first time in 2005 and received a Good bioclassification rating. The rating dropped at this site to a Good-Fair in 2006. This site also had the highest conductivity (129 µmhos/cm) during the 2006 evaluation. The Riparian zones were intact but narrow and the stream bank had a few areas of erosion with diverse trees, shrubs, and grasses that provided partial shading at site JB7.

No Criteria were exceeded at the ambient monitoring station JA1. Turbidity levels were above the standard of 50 NTUs in 2 percent of the samples, pH was below the standard of 6 in 4 percent of the samples and fecal coliform bacteria levels were elevated above the 400 CFU/100ml in 14 percent of the samples. Conductivity was also high, with a maximum recorded reading of 293 µmhos/cm.

These sites are down stream from one major and five minor NPDES dischargers. The Hillsborough WWTP (NC0026433) is located approximately four miles above site JB6, discharging into the Eno River. The Orange-Alamance Water System WTP (NC0082759), a minor discharger, is also located seven miles upstream of this site. This facility has had chronic limit violations for total residual chlorine since May 2005. This could potentially be impacting the benthic community in this stretch of the Eno River.

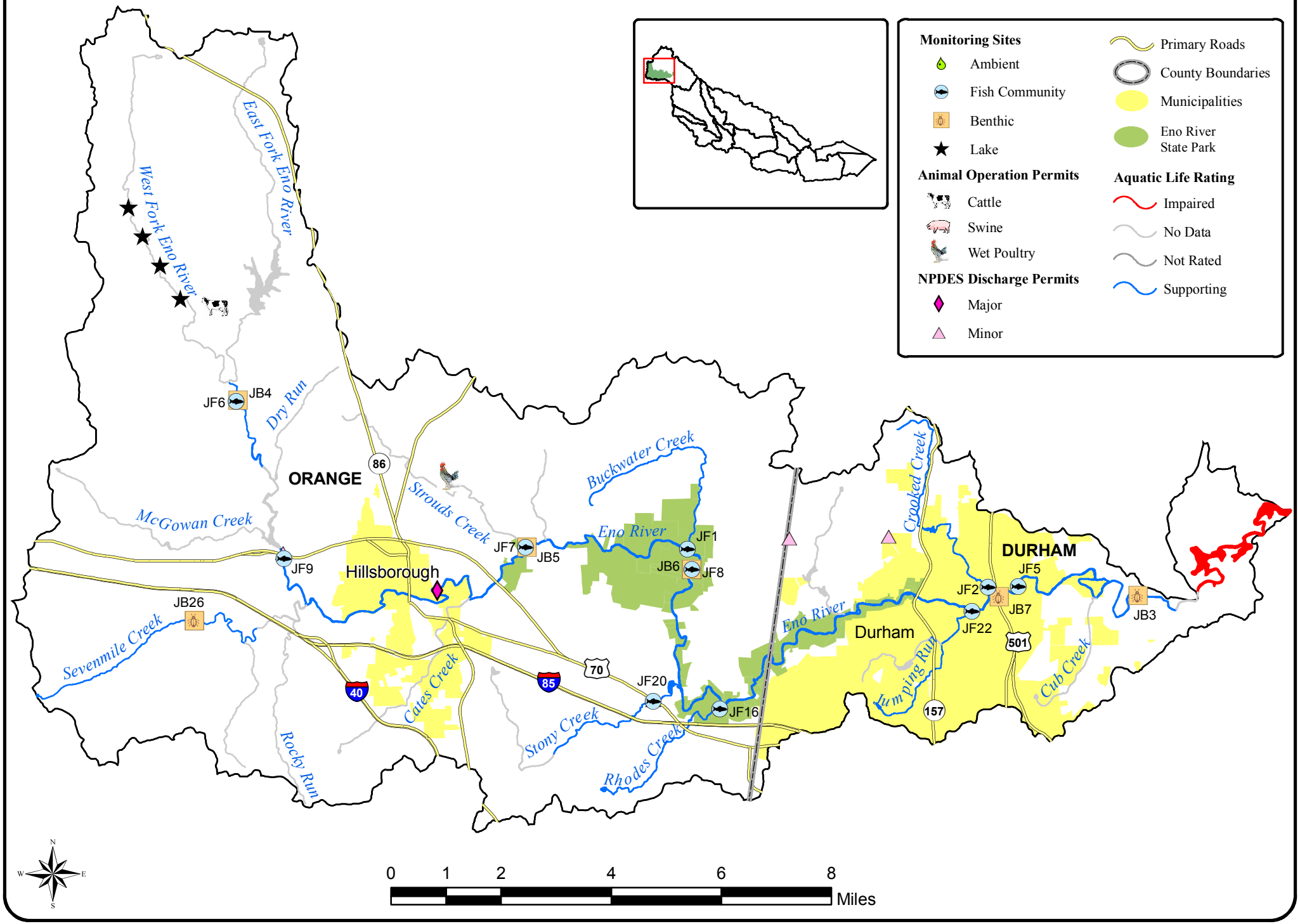
Eno River [AU 27-2-(19.3); WS-IV; CA; NSW] from a point 0.5 miles upstream of Durham emergency pumping facility raw water intake to Durham emergency pumping facility raw water intake (0.4 miles) and the Eno River [AU# 27-2-(19.5); WS-IV; NSW] from the intake to a point 0.5 mile upstream of Little River (4.3 miles) is Supporting aquatic life and recreation due to a Good-Fair benthic community bioclassification at site JB3 and due to No Criteria Exceeded at ambient monitoring station JA2. This site decreased from a Good bioclassification rating during the last assessment period. The Stream banks were stable and the riparian zone appeared to be undisturbed. A more tolerant benthic community was found during this assessment as compared to those found in the past.

Turbidity levels were above the standard of 50 NTUs in 5 percent of the samples, DO was below the standard of 4 mg/l in 2 percent and fecal coliform bacteria were elevated above the 400 CFU/100ml in 16 percent of the samples. Conductivity was also high, with a maximum recorded reading of 450 µmhos/cm.

The second largest sewage spill in the Research Triangle area since 1995 occurred in May 2006 when a 21-inch diameter sewer line failed resulting in 8 million gallons of raw sewage spilling into wetlands and a small creek, which drains into this segment of the Eno River. The spill went undetected for 17 days. DWQ levied a civil penalty on the town for $33,431. It is important for municipalities to perform the required annual inspection on their wastewater systems. This sewer line had not been inspected in nearly two years.

Largemouth bass, sunfish, and catfish samples were collected from the Eno River near Durham during 2003 and analyzed for mercury contamination. These samples were collected as part of an eastern North Carolina mercury assessment. All largemouth bass, (8 of 16 total samples) contained mercury concentrations exceeding the state criteria of 0.4 ppm. Mercury levels in all samples ranged from 0.11 to 1.3 ppm (see the 2006 Basinwide Assessment Report Neuse River http://h2o.enr.state.nc.us/esb/Basinwide/Neuse06BasinReportFinal.pdf for more details). All waters of the state are impaired on an evaluated basis due to a Department of Health and Human Services (DHHS) statewide fish consumption advisory for largemouth bass (see section 1.5.6 for more details).

Figure 5 Eno River Watershed



DWQ biologist ran a special macroinvertebrate study in 2006 and found that every site tested (other than JB6) produced either the lowest or second lowest historic EPT diversity levels, suggesting that the water quality throughout most of the Eno River is declining. This conclusion was particularly pronounced at the lower Eno River locations in central Durham County where historic conductivity trends have been increasing since 1974 and are statistically higher relative to nearby less impacted locations on the Little River (Orange County) and Flat River (northern Durham County) over the same time period (DWQ, Eno River reclassification special study memorandum, July 25, 2006).

Eno River Trend Analysis

DWQ conducted a trends and annual load analysis at several stations throughout the basin. The stations chosen for assessment were those in close proximity to a USGS gauging station. All trends were assessed using flow and seasonal adjustments.

Station JA1 was chosen due to the close proximity of the USGS gauging station (#02085070) at US 501 near Durham. Trends were done on data collected between 1990 and 2000. The analysis included trends on total nitrogen (TN), defined as the sum of total Kjeldahl nitrogen and nitrate-nitrogen, total phosphorus (TP) and temperature. A trend analysis was not possible for TN and TP for the current use support assessment window due to a decrease in nutrient sampling frequency at site JA1 starting in 2001. Care should be taken when interpreting these results since it is not known if this trend has continued, reversed or leveled off after 2000.

The results of the Seasonal Kendell trends analysis indicated that there was a significant decrease in TP concentration in the Eno River at station JA1. The average decrease in TP concentration per year was 0.002 mg/l during the period of 1990 through 2000. This corresponds to a 3.4 percent average decrease in the median TP concentration per year.

No other parameters exhibited a significant trend at this site. Water temperature followed a seasonal cycle, peaking in July and TN concentrations typically peaked in June and November.

Recommendations

Much of the Eno River is being affected by increased stormwater runoff resulting in sedimentation and stream bank erosion as well as increased nutrient loading to the system. The DWQ recommends stream bank protection measures and installation of stormwater BMPs. The new SWCD Community Conservation Assistance Program (CCAP) was developed to focus restoration efforts on stormwater retrofits to existing non-agricultural lands. This program should be utilized in this watershed in order to improve water quality.

The East and West Fork of the Eno were not assessed during this assessment period, however there are two dry litter operations in this area that do not have proper storage for their animal waste. Producers are encouraged to build dry stacks to prevent waste runoff.

Water Quality Initiatives

On the East and West Fork of the Eno, the Orange County SWCD used funds from the NC Foundation of Soil and Water to close one waste impoundment, and six heavy use areas were installed to prevent sediment erosion by the EQIP program. Fifty six acres of cultivated cropland were taken out of production and established into native buffers under the USDA Continuous Conservation Reserve Program (CRP) of CP-33 Upland Bird Habitat Buffers.

The Durham SWCD is partnering with local landowners and the NC Department of Transportation on a bank stabilization project in the Eno River Watershed, north of the river. The District has received a grant for $125,000 to redesign and construct an earthen dam at a neighborhood pond. Flooding and erosion had weakened the pre-existing dam and is a threat to nearby homes and roads. Sediment runoff from the eroded dam was a concern to the Eno River. The project is to be completed spring of 2007.

1.4.3 Sevenmile Creek [AU# 27-2-6-(0.5)]

Current Status
Sevenmile Creek [AU # 27-2-6-(0.5); WS-II, HQW; NSW] from the source to a point 0.4 miles upstream of I-85 (5.8 miles) is Supporting aquatic life due to a Good-Fair benthic community bioclassification at JB26. The rating for this stream remained the same as the 2000 bioclassification. Sevenmile Creek is a tributary to the Eno River just west of Hillsborough (Figure 5). The land cover surrounding this site was mainly forested. The stream banks were stable with diverse trees, shrubs and grasses. The riparian zone was wide and intact.

Water Quality Initiatives
The Orange County SWCD installed 328 linear feet of stock trail, 428 linear feet of livestock exclusion, 1 heavy use area and closed one waste impoundment using funds from the EQUIP program.

1.4.4 Little River Watershed (Little River Reservoir) [AU# 27-2-21-(1), 27-2-21-(3.5) & 27-2-21-(6)]

2002 Recommendations
The Little River Reservoir experiences periodic low dissolved oxygen that may be related to elevated nutrient inputs increasing the potential for algal blooms. DWQ will continue to monitor the lake to evaluate any future degradation in water quality. As the lake is a water supply, Durham should pursue measures to protect the watershed from land use activity that could increase nutrient loading.

Current Status
Little River [AU# 27-2-21-(1); WS-II; HQW; NSW] from source to a point 0.1 mile upstream of Durham County SR 1416 (2.3 miles) and Little River Reservoir [AU# 27-2-21-(3.5); WS-II; CA; HQW; NSW] from SR1416 to the dam at Little River Reservoir (32.4 acres) is Supporting aquatic life and recreational uses due to a Good benthic bioclassification at site JB18 and due to No Criteria Exceedances at ambient monitoring station JA3.

Land cover surrounding the site JB18 was all forest. The instream substrate was moderately embedded. The stream banks were stable with diverse trees, shrubs, and grasses that provided minimal shading with breaks for light penetration. The riparian zone was wide and intact and the instream habitat was limited mostly to rocks and macrophytes.

This site has been rated between Good-Fair and Excellent since it was first sampled in 1989. In 2000, this site received an Excellent bioclassification and in 2005, it received a Good bioclassification. An extremely intolerant stonefly that was common in the 2000 sample was absent in 2005 sample.

No Criteria were exceeded at the ambient monitoring station which is located at the head waters of the reservoir. The Little River Reservoir was noted as having periods of low dissolved oxygen in the past. However, during this assessment period the dissolved oxygen fell below the instantanious state standard of 4 mg/l in 4 percent of the readings with the lowest recorded reading of 3.8 mg/l. Turbidity was elevated in 9 percent of the samples with a maximum recorded value of 120 NTU's. The conductivity was also high with readings ranging from 50 to 160 µmhos/cm.

The fecal coliform bacteria levels were below the state standard; however they were elevated above 400 CFU/100ml in 16 percent of the samples.

Little River [AU# 27-2-21-(6); WS-IV; NSW] from dam at Little River Reservoir to a point 0.9 miles upstream of mouth (6.5 miles) is currently Not Rated. There was only a single sample collected that this location (JA120) during this assessment window. Previously, this segment of the Little River experienced low dissolved oxygen levels.

Little River Trend Analysis

DWQ conducted a trends and annual load analysis at several stations throughout the basin. The stations chosen for assessment were those in close proximity to a USGS gauging station. All trends were assessed using flow and seasonal adjustments.

Station JA3 was chosen due to the close proximity of the USGS gauging station (#0208521324) at SR 1461 near Orange Factory. Trends were done on data collected between 1990 and 2000. The analysis included trends on total nitrogen (TN), defined as the sum of total Kjeldahl nitrogen and nitrate-nitrogen, total phosphorus (TP), total suspended solids (TSS) and temperature. A trend analysis was not possible for TN, TP and TSS for the current use support assessment window due to a decrease in nutrient sampling frequency that site JA3 starting in 2001. Care should be taken when interpreting these results since it is not known if this trend has continued, reversed or leveled off after 2000.

The results indicated that there was a significant decrease in TP concentration in the Little River at station JA3. This trend suggests that the average decrease in TP concentration per year was 0.002 mg/l, which corresponds to an average median TP concentration decrease of 4.8 percent per year during the time period of 1990 through 2000.

In addition to TP, there was also a significant decrease in TSS concentration in the Little River. The average decrease in TSS concentration per year was 0.33 mg/l corresponding to the median TSS concentration decreasing by an average of 4 percent per year during the same time period (1990-2000).

Temperature and TN did not show a significant trend for this time period.

Recommendations

DWQ needs to insure that the sampling frequency at site JA3 (once a month) is maintained so that trend analysis can be done at this station, a minimum of 9 samples/yr are required in order to do tend analysis.

1.4.5 South Flat River [AU# 27-3-3a & 27-3-3b]

2002 Recommendations
DWQ will continue to monitor the South Flat River to evaluate potential impacts from agricultural operations in the watershed as well as from any future development. DWQ will contact Division of Soil and Water Conservation (DSWC) to evaluate the potential for installation of agricultural BMPs that would protect water quality and aquatic habitat in the South Flat River. Because the South Flat River is in a water supply watershed and has noted water quality impacts, the NCWRP has targeted this local watershed. Triangle J Council of Governments has also prioritized this watershed for buffer protection.

Current Status
South Flat River [AU# 27-3-3a; WS-III; NSW] from the source to SR 1009 (3 miles) is Not Rated for aquatic life due to the rating at benthic site JB24. South Flat River [AU# 27-3-3b; WS-III; NSW] from SR 1009 to Flat River (14.2 miles) is Supporting aquatic life due to a Good-Fair benthic (JB25) and a Good fish (JF18) community bioclassification. Site JB24 could not be rated because the watershed drainage area was less than three square miles and can no longer be rated per the current BAUs (Biological Assessment Unit) standard operating procedures. For future basin sampling, site JB25 is replacing JB24. Severe bank failure and erosion characterized occurred at all three sites.

A stressor study was performed in May 2004 and found high nutrient concentrations indicating possible enrichment from fertilizers used on agricultural fields in the area. Analyst noted that there were many agricultural fields observed throughout the small watershed and they appeared to have been freshly planted with crops. Chlorinated pesticides, organophosphate pesticides, and semi-volatile compounds were also found in a sediment sample taken in the headwater of South Flat River. This may also be due to the use of these compounds on agricultural field in the area.

Non-point sources runoff from numerous agricultural fields may also be contributing significant amounts of sediment into the system after rainfall events. All of these stressors can contribute to a lower biological bioclassification or biological impairment.

Recommendations
DWQ would recommend the use of BMP to reduce the amount of runoff from agricultural fields, thereby reducing the amount of nutrients, pesticides and sediment making there way into the stream.

Further recommendations on how to protect and reduce water quality impacts from agricultural practices in the watershed can be found in Chapter 6 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm).

Water Quality Initiatives
Many agricultural related BMPs have been installed in this watershed over the last several years. These will all help to reduce to amount of nutrients, pesticides and sediment from getting washed into this watershed. See Table 5 for a list of the BMPs installed in this watershed from 2000-2006. These BMPs affected 1,779 acres, saved 7,489 Tons of soil per year, saved 31,464 pounds of nitrogen and 1,093 pounds of phosphorus per year at a cost to the NC ACSP of $130,276. Five acres of Upland Bird Habitat Buffers CP-33 were installed using funds from the USDA Continuous CRP Program.

Table 5 List if Agricultural BMPs installed in the South Flat River watershed between 2000 and 2006.

Number of Acres	Agricultural BMP
42 Acres	3 year conservation tillage
339.2 acres	long term no till
54.6 acres	sod based rotation
90.5 acres	cropland conversion to grass
1,942 feet	diversions
2,297 feet	terraces
15.95 acres	grassed waterway
11.87 acres	field borders
0.1 acre	filter strip
321.8 acres	nutrient management
1	waste impoundment closure

1.4.6 Smith Creek [AU# 27-12-2-(2)]

Current Status
Smith Creek [AU# 27-12-2-(2); WS-III; NSW] from a point 0.5 miles downstream of Granville County SR 1711 to a point 0.4 miles upstream of mouth (5.7 miles) is Supporting aquatic life due to a Good-Fair benthic and fish community bioclassification at sites JB27 and JF19 (Figure 3 and 4). The aquatic communities essentially remained the same since the last assessment done in 2000, suggesting no major change in water quality. There were areas of bank erosion seen, although the riparian zone was broad on both sides of the stream with no obvious breaks.

1.4.7 Beaverdam Reservoir [AU# 27-12-(0.7)]

Current Status
Beaverdam Reservoir [AU# 27-12-(0.7); WS-IV, B; NSW, CA] from the backwaters of Beaverdam Creek Reservoir to the dam at Beaverdam Creek Reservoir (at backwaters of Falls Lake) (974.4 Acres) is Supporting aquatic life based on samples taken at site JL16 (Figure 3 and 4). Beaverdam Lake flows directly into Falls Lake and is used as a back-up water supply for the City of Raleigh. The watershed is composed primarily of urban and forested areas with a state park surrounding much of the reservoir.

Beaverdam Reservoir was monitored by DWQ 42 times at a single location from March 2005 through December 2006. Chlorophyll *a* data was only available between October 2005 and December 2006 (n = 29). This lake was previously monitored by DWQ in 1983.

Of the 29 chlorophyll *a* readings, a single sample was above the state standard of 40 µg/l, however most of the samples collected between March and September 2006 were above 25 µg/l. The overall chlorophyll *a* average for all 29 samples collected was 20.4 µg/l and ranged between 2 and 54 µg/l. Two turbidity reading taken were above and one was at the state standard of 25 NTU in reservoirs. The readings ranged between 6.5 and 31 NTUs, with an average of 14.4 NTU for all 42 samples.

Nutrient concentrations in 2005 were generally high for total phosphorus (range of 0.04 mg/l to 0.08 mg/l), total Kjeldahl nitrogen (range of 0.47 mg/l to 0.92 mg/), and total organic nitrogen (range of 0.46 mg/l to 0.91 mg/l) indicating a potential for biological productivity.

Analyses of phytoplankton samples collected in March, July and October of 2005 indicated low assemblages of diatoms in March. Diatoms are adapted to cooler waters and low light and are generally considered beneficial. Blue-green algae blooms were found in July and October. The blue-green algae blooms were most severe in July and consisted of the blue-green alga *Cylindrospermopsis*. Blue-green algae can discolor water and cause taste and odor problems and are common indicators of eutrophication. Some taxa, including *Cylindrospermopsis* may produce toxins, although there have been no known adverse effects associated with blue-green algal toxins reported in these waters. An increase in euglenoids was also found in October that indicates organic enrichment and stagnant conditions due to the low flow conditions present in the fall of 2005.

Beaverdam Reservoir continues to support its designated uses.

1.4.8 New Light Creek [AU# 27-13-(0.1)]

2002 Recommendations
DWQ will continue to monitor New Light Creek to evaluate potential impacts from agricultural operations in the watershed as well as any future development. DWQ will contact Division of Soil and Water Conservation (DSWC) to evaluate the potential for installation of agricultural BMPs that would protect water quality and aquatic habitat in New Light Creek. New Light Creek is a NCWRP targeted local watershed.

Current Status
New Light Creek [AU# 27-13-(0.1); WS-IV; NSW], from the source to Wake County SR1911 (1.8 miles), is Supporting aquatic life due to a Good-Fair benthic (JB21 and JB22) and Good fish community bioclassification (JF15). The rating at station JB22 decreased from a Good bioclassification rating in 2000 and 2001 to a Good-Fair in 2005. At station JB22 the instream habitat is sparse with only a few riffle areas and eroded stream banks. There is an agricultural field within 12 meters of the left bank and the stream was very turbid in this area. Stations JB21 and JF15 are located in the Falls Lake Gamelands resulting in a better instream habitat, however despite an extensive riparian corridor at this location, the canopy was open in this part of the stream.

Recommendations
DWQ should continue to sample this stream during the next assessment period in order to assess changes occurring in this watershed.

Additional monitoring of New Light Creek including physical and biological, may be implemented with the Wake County 319 project (Fall Lake Watershed Management Plan).

Water Quality Initiatives
A single heavy use area protection BMP was installed within this predominately agricultural watershed. This is an area that is intensively used by animals and has undergone surface stabilization using suitable materials to improve water quality. This was a $2,637 Agriculture Cost Share Program funded project which affected 8 acres and saved 40 tons of soil erosion per

year. Several agricultural BMPs have been installed over the last 20 years. These systems include intensive grazing systems, critical area plantings, waterers, and nutrient management.

1.4.9 Horse Creek [AU# 27-17-(0.7)]

Current Status
Horse Creek [AU# 27-17-(0.7); WS-IV; NSW] from a point 0.3 miles upstream of Franklin County SR 1139 to a point 0.1 miles downstream of Wake County SR1923 (6.0 miles) is Supporting due to a Good-Fair benthic and a Good fish community bioclassification at JB10 and JF10 (Figure 3 and 4). This watershed is mostly forested and has an intact riparian zone that is a minimum of 12 meters wide. The stream channel is deeply entrenched with steep and eroding banks. Horse Creek declined from Good to Fair after Hurricane Fran in 1996, however this benthic site improved to Good-Fair in 2001. The fish assessment was done for the first time in 2004. This site supported a diverse assemblage of fish, represented by 25 different species and the community was rated Good.

Recommendations
DWQ should collect a benthic sample at this location during the next assessment period to assess the changes occurring in this watershed.

Additional monitoring of New Light Creek including physical and biological, may be implemented with the Wake County 319 project (Fall Lake Watershed Management Plan).

1.4.10 Unnamed Tributary at Camp New Life [AU# 27-20.5-(2) UT1 & 27-20.5-(3)

Current Status
Unnamed Tributaries at Camp New Life (UT to Falls Lake) at Bentham Driver [AU# 27-20.5-(2) UT1; WS-IV, NSW] and SR 2002 [AU# 27-20.5-(3); WS-IV, CA, NSW] are currently Not Rated for aquatic life. These streams could not be rated at this time because currently DWQ assessment techniques do not permit assigning a bioclassification to Piedmont streams with a drainage area of less than three square miles (other than Not Impaired or Not Rated). These sites were assessed in August of 2002 and 2005 as well as in January of 2006. The results fluctuated between the 2002 and 2005 assessment but returned to similar 2002 levels in 2006.

The stream at site JB30 (Bentham Dr.) is very shallow and narrow and has a watershed area of 0.98 square miles. This site is above the City of Raleigh's EM Johnson WTP outfall. Sediment from eroding banks filled the channel. There was a high degree of embeddedness and a limited amount of instream habitat. The riparian zone on the western stream bank has been altered. These alterations may have contributed to runoff and the sedimentation problems seen at this site. The macroinvertebrate community has been rather stable, though somewhat pollution tolerant.

Site JB31 (SR2002) is 1.5 mile downstream of the Bentham Drive site JB30 and is also downstream of the unnamed tributary in which the EM Johnson WTP discharges to. The stream at this site is deeper and wider and has an increased flow consistent with the larger drainage area of 1.35 square miles. The banks appear more stable and the riparian zone was very healthy. There was a greater diversity of instream habitat found at this site, however it did not correlate with added benthic diversity or a healthier benthic community. Extremely low densities of aquatic macroinvertebrates were observed here in 2006. This site had many more species and a greater overall density in August of 2005. The dramatic decline in a 5 month period is

concerning, however the 2006 values were similar to those in 2002. The decline could possibly have been due to drought conditions experienced in this part of the watershed in the fall and winter of 2005 and early 2006. The habitat scores for both sites were indicative of suburban environments.

Bank pins were installed on this segment of the creek in the summer 2005. Initial data shows evidence of bank erosion, with additional evidence of mass wasting. Early data shows 25 tons per 100 linear feet. It is likely that additional monitoring, including physical and biological, perhaps more, will be implemented with the Wake County 319 project (Falls Lake Watershed Management Plan).

The Raleigh EM Johnson WTP (NC0082376) began monitoring for whole effluent toxicity (WET) in September of 2002. The facility's effluent produced toxicity at its target discharge concentration (90 percent) in 17 of 27 tests through August of 2006. Many failures appeared to have been associated with total residual chlorine. The facility implemented effluent dechlorination in 2004. The facility also identified a polymer associated with operation of its filter press as a source of toxicity. That filter press effluent is now discharged to the sanitary sewer system. The facility has passed its most recent tests, dating from May 2005. As of February 2006, the facility began to recycle its filter backwash. This results in wastewater discharge to this creek for only about two weeks per year. WET testing will occur during these discharges events. It is recommended that a WET test limit be incorporated into the next NPDES permit.

A review of the effluent data indicated an elevated level of manganese in excess of 200 µg/l, which is the water quality standard for water supply waters. It is recommends that a manganese effluent discharge limit be added to the next NPDES permit which will be renewed in 2008. An instream monitoring study in 2002 found that samples collected downstream from the discharge site had a concentration of manganese at 1,400 µg/L, which was 21.5 times higher than the upstream sampling site (65µg/L). If this downstream concentration was readily bioavailable, it could potentially cause chronic toxicity to aquatic organisms. Several other downstream metal concentrations were elevated over upstream values, including copper, calcium, magnesium and sodium.

A sediment study was also done at these two sites in January 2006. This study is a component of DWQs watershed toxicity assessment panel, which includes a suite of toxicity assays employing multiple organisms and endpoints to assess potential toxicity to aquatic organisms in water column and sediment matrices. The results from this study indicate that there is a significant increase in sub-lethal toxicity at the downstream sediment collection site relative to the upstream site. Ambient water column samples did not result in acute toxicity at either of these two sites on this date.

The Raleigh Regional Office did an inspection of the facility in August of 2006 as result of a citizen complaint concerning a substance covering the rocks downstream of the facility. The substance covering the rocks was determined to be a naturally occurring biofilm. This does not necessarily indicate a water quality problem; however it could indicate an unnatural balance of the chemical constituents in the aquatic environment.

Recommendations
As stated above, it is recommended that manganese and WET limits are added to the NPDES permit when renewed in 2008. These will assure the continual improvement of the aquatic organism in the receiving stream.

Further recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas are discussed in the in Chapter 12 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm).

1.5 Additional Water Quality Issues and Information within Subbasin 03-04-01

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.

This section also discusses several water quality initiatives that are occurring within this basin to preserve, protect and improve water quality. Surface waters identified as having Excellent bioclassification, are also discussed and are eligible for reclassification to a High Quality Water (HQW) or and Outstanding Resource Water (ORW). These classifications allow for additional water quality protections. For more information about water quality standards and reclassification, see Chapter 15.

1.5.1 Water Quality Threats to Streams in Urbanizing Watersheds

Many of the streams in this subbasin that are not already impaired from urban stormwater runoff are threatened by development pressure throughout this subbasin. In order to prevent aquatic habitat degradation and impaired biological communities, protection measures must be put in place immediately. For recommendations to protect streams in urbanizing areas and to restore streams in existing urban areas see Chapter 12 of the *Supplemental Guide to North Carolina's Basinwide Planning* document (http://h2o.enr.state.nc.us/basinwide/SupplementalGuide.htm).

1.5.2 Upper Neuse Watershed Management Plan

The Upper Neuse River Basin Association (UNRBA) has developed a watershed management plan that would help protect all waters in subbasin 03-04-01 from the increasing potential for sediment and nutrient impacts.

The UNRBA is a local partnership which includes 13 of the 14 local governments with land area in the watershed, county Soil and Water Conservation Districts and South Granville Water and Sewer Authority. If implemented, the plan would help protect the quality of the drinking water reservoirs, surface waters, and aquatic habitats in the Upper Neuse Basin.

In order to protect these resources, the plan recommends five types of watershed management techniques:

1. New development site management strategies to control the quality and amount of water running off future development sites.

2. Monitoring and enforcement strategies to ensure proper system performance and gauge how well the management techniques are working.
3. Education and citizen stewardship programs to increase awareness of and participation in watershed management efforts.
4. Management and control of point sources to upgrade existing wastewater treatment facilities and to phase out older facilities.
5. Restoration planning to restore the natural functions and characteristics of impaired water bodies.

UNRBA is in the process of developing a detailed implementation plan describing the roles and responsibilities of UNRBA members and partners and area of the basin where particular management strategies are most urgently needed. For information on the Upper Neuse Watershed Management Plan see website at http://www.unrba.org/mgmtplan.htm.

1.5.3 Upper Neuse Clean Water Initiative

Overview of the Upper Neuse Clean Water Initiative:
The Upper Neuse Clean Water Initiative is a partnership effort to prioritize and, through voluntary actions, protect those lands most critical for the long-term safety and health of all drinking water supplies for the communities in the Upper Neuse River Basin (UNRB). The project prioritized lands that meet water supply protection goals, but also considers local land conservation goals, such as recreation and natural lands protection, as well as stormwater retention.

The Initiative has three major components: comprehensive conservation planning; outreach to landowners, local governments, and the public; and acquisition through the purchase or donation of land or conservation easements from willing sellers of properties identified in the plan as high priority. Land conservation provides a voluntary, non-regulatory option for protecting water supplies and is one of the most cost-effective tools for ensuring safe drinking water.

Conservation Planning Methods and Results:
With funds from the City of Raleigh and other partners, Triangle J Council of Governments (TJCOG), in collaboration with The Trust for Public Land (TPL), used Geographic Information System (GIS) technology and computer modeling to identify properties within the UNRB that offer the greatest protection value for the Basin's water quality. TPL and TJCOG assembled a Technical Advisory Team of local experts in water quality, water resources management, and GIS to help develop and weight model criteria and identify the highest quality data. The final model included data on land use cover, hydrology, elevation, headwater catchments, parcel data, groundwater wells, vertical hydraulic conductance, critical catchment areas, and soil type. Priority tracts are typically found along streams or water bodies, at headwater areas, and/or contain wetland areas. Because the model considers parcels throughout the 770 square mile Basin and considered all of the Basin's nine drinking water supplies equally, the priority parcels are scattered throughout the Basin. For more detailed information and specific parcel priorities, contact Conservation Trust for North Carolina at (919) 828-4199 or www.ctnc.org.

Local governments, land trusts, watershed associations and others have been working for years to conserve sensitive lands in the Upper Neuse River Basin. As a result of these efforts, over 50,000 acres of land have been permanently protected (as of 5/06) which are park lands and nature preserves; lands managed for preservation by local/regional land trusts; and privately owned lands protected by conservation agreements. Of UNRB lands not already protected, the model identified

approximately 24,000 acres as high priority for conservation to protect water quality. Together, these high-priority acres represent fewer than 5 percent of the Upper Neuse River Basin.

Continuing their collaborative work, state and local government programs, the Ellerbe Creek Watershed Associations, Upper Neuse River Basin Association, Eno River Association, Tar River Land Conservancy, Triangle Greenways Council, Triangle Land Conservancy, Trust for Public Land, willing landowners, and other critical partners utilize a variety of conservation options including conservation easements/agreements, fee-simple purchase, donations, bargain sales, etc to protect the Upper Neuse water resources.

Due to population growth and development however, the opportunities for protecting these priority tracts may be short-lived. Most experts agree there is a threshold ratio of impervious surface to natural land which, when crossed, results in a measurable decline in water quality in the watershed. Many believe the threshold occurs when the watershed is 10 percent impervious. Based on the region's current rate of population growth, more than one-third of the sub-watershed in UNRB will exceed the 10 percent threshold by 2025.

Additionally, a report released by Triangle Green Print Project (2002), the current rate of land protection in the region must double to increase protected land from 8 percent to a region-wide goal of 15 percent within 25 years.

Current status of the Upper Neuse Clean Water Initiative:
Since the inception of the Upper Neuse Clean Water Initiative, 17,000 acres and 17 miles of streams that drain to area reservoirs have been preserved. They are currently negotiating the purchase of another 26 tracts which would preserve and additional 3,900 acres along more than 39 miles of streams.

For a copy of the plan and additional information on the Upper Neuse Clean Water Initiative please go to: http://www.ctnc.org/site/PageServer?pagename=prot_upperneuse.

1.5.4 Riparian Corridor Conservation Program

An additional source of information on the Basin's land conservation priorities are riparian corridor conservation plans. The Clean Water Management Trust Fund (CWMTF) – Conservation Trust for North Carolina (CTNC) Riparian Corridor Conservation Program facilitates the identification and establishment of integrated networks of protected areas and forested riparian corridors. More specifically, the program involves pass through funding from CWMTF, through CTNC, to the state's 24 local and regional land trusts to develop conservation plans with detailed analysis of a defined project area and prioritization of waterfront parcels for protection and restoration based on each property's impacts on water quality in a targeted stream segment. Additionally the program funds implementation of existing plans in which land trusts undertake landowner outreach, education (often in the form of workshops), easement negotiations, acquisition negotiations and other recommendations laid out in previously established riparian corridor conservation plans. This statewide coordinated effort to protect and restore riparian buffers and greenways represents one of the most cost-effective and long-term means of protecting water quality.

Riparian Corridor Conservation Plans developed thus far in the Upper Neuse River Basin include:

- Upper and Lower Eno River watershed– written by the Eno River Association (919) 620-9099
- Little River watershed (Orange & Durham Counties) - written by the UNRBA on behalf of the Eno River Association (919) 620-9099
- Upper Neuse River Basin – written by Triangle Greenways Council (www.trianglegreenways.org).

1.5.5 Falls Lake Nutrient Management Strategy Overview

Background

In 2005 the NC General Assembly passed Senate Bill 981, which tasks the Environmental Management Commission (EMC) to develop and implement a Nutrient Management Strategy (NMS) for certain drinking water supply reservoirs that are impaired or that may become impaired within five years of adoption of the bill. Based on water quality data collected between 2002 and 2006, Falls Lake will be listed on the EPA 303(d) list in 2008 for chlorophyll *a*. The portion of the lake above I-85 will also be listed for turbidity. The current deadline for adoption of the Falls Lake NMS is July 2009 as established in Session Law 2006-250. However in light of the lengthy modeling process required and to allow adequate time for a public stakeholder process, DWQ met with the sponsors of the original bill in late 2007 and early 2008 to discuss the need to extend the timeline. In November 2008 DWQ submitted a request to the North Carolina General Assembly to extend the deadline for EMC adoption of the strategy to September 2010.

Modeling Plan

A Falls Lake Technical Advisory Committee (TAC) was formed in July 2005. The role of the TAC was to assist DWQ with the development of mathematical tools for the management of nutrients in Falls Lake including review and modification of the monitoring strategy and developing levels of confidence for decision making associated with the monitoring and modeling activities conducted to develop the TMDL. The field study data collection process was completed in the fall of 2007. Development of the lake and watershed model was started in January 2007 and completed by DWQ staff in November 2008. The output of the watershed model is currently being reviewed by the TAC and is scheduled to be presented to the stakeholders in January 2009. The lake model is scheduled for completion by February 2009.

Stakeholder Process

A stakeholder process began in August 2008 and is scheduled to include eleven meetings that will run through October 2009. This process will provide a comprehensive stakeholder group the opportunity to work with the DWQ in developing the nutrient management strategy for Falls Lake and its watershed. This collaboration will provide stakeholders and DWQ staff the opportunity to exchange ideas on how to best develop and implement a successful nutrient management strategy for Falls Lake. In addition to addressing specific questions and/or concerns from individual stakeholders, this process will provide a public forum to do the following:

- Discuss the results from the modeling process
- Receive input on stakeholder interests and expectations
- Develop alternatives and preferred solutions identified by the stakeholders

- Receive input from stakeholders on the potential nutrient reduction rules, fiscal analysis data, and accounting tool development
- Incorporate stakeholder advice and recommendations into the decision making process to the maximum extent possible

Rulemaking Process

- Draft rule text (coincides with the stakeholder process)
- Draft fiscal analysis (overlaps with the stakeholder process)
- Take draft rules and fiscal analysis to WQC and EMC for approval to go to public comment
- Public Comment Period
- EMC Hearing Officers Deliberate
- Take rules to EMC for approval
- Approved rules go to Rules Review Commission (RRC)
- Rules are adopted unless the RRC receives ten or more letters contesting the rules
    - If ten or more letters are received by the RRC then the rules go to the N.C. General Assembly for further consideration

Potential Rules

Although the specific rules that will eventually be developed are dependent upon the outcomes of the modeling and stakeholder process, the nutrient management strategy will in all likelihood address point and nonpoint sources of nutrients into the Falls Lake watershed. The framework and accounting tools will be similar to those used in the current Neuse nutrient reduction strategy and may include:

- New development stormwater nutrient export goals
- Existing development stormwater controls
    - Stormwater retrofits for existing development
    - Pet waste program
    - Residential fertilizer application education outreach program
- Reductions in effluent nutrient loads from wastewater treatment plants
- Load reductions from agricultural practices

1.5.6 Mercury Contamination – Fish Tissue Assessment

The DWQ 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.

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. For more information about DHHS fish consumption advisories go to http://www.epi.state.nc.us/epi/fish/current.html.

1.5.7 ORW reclassification of Deep Creek [AU# 27-3-4] and Rocky Fork Branch [AU# 27-3-4-1]

Deep Creek [AU# 27-3-4; WS-III; NSW] from source to Flat River (16.3 miles) is currently Supporting aquatic life due to a Good benthic (JB1) and an Excellent fish community bioclassification (JF3). Stream banks were stable with some erosional areas present at site JB1. This stream has been rated either Excellent or Good since first sampled for benthos in the spring of 1990. However, since July 1995 this site has received a Good bioclassification. No major changes in water quality have been indicated since 1995. EPT taxa richness has been similar for the 1995, 2000, and 2005 samples collected at this site.

The high quality watershed characteristics associated with the fish site qualifies it as a regional fish community reference site. This is the fourth time in which this stream site (JF1) has been rated Excellent based on its fish community. Deep Creek was classified to Outstanding Resource Water (ORW), based on these four Excellent fish community ratings.

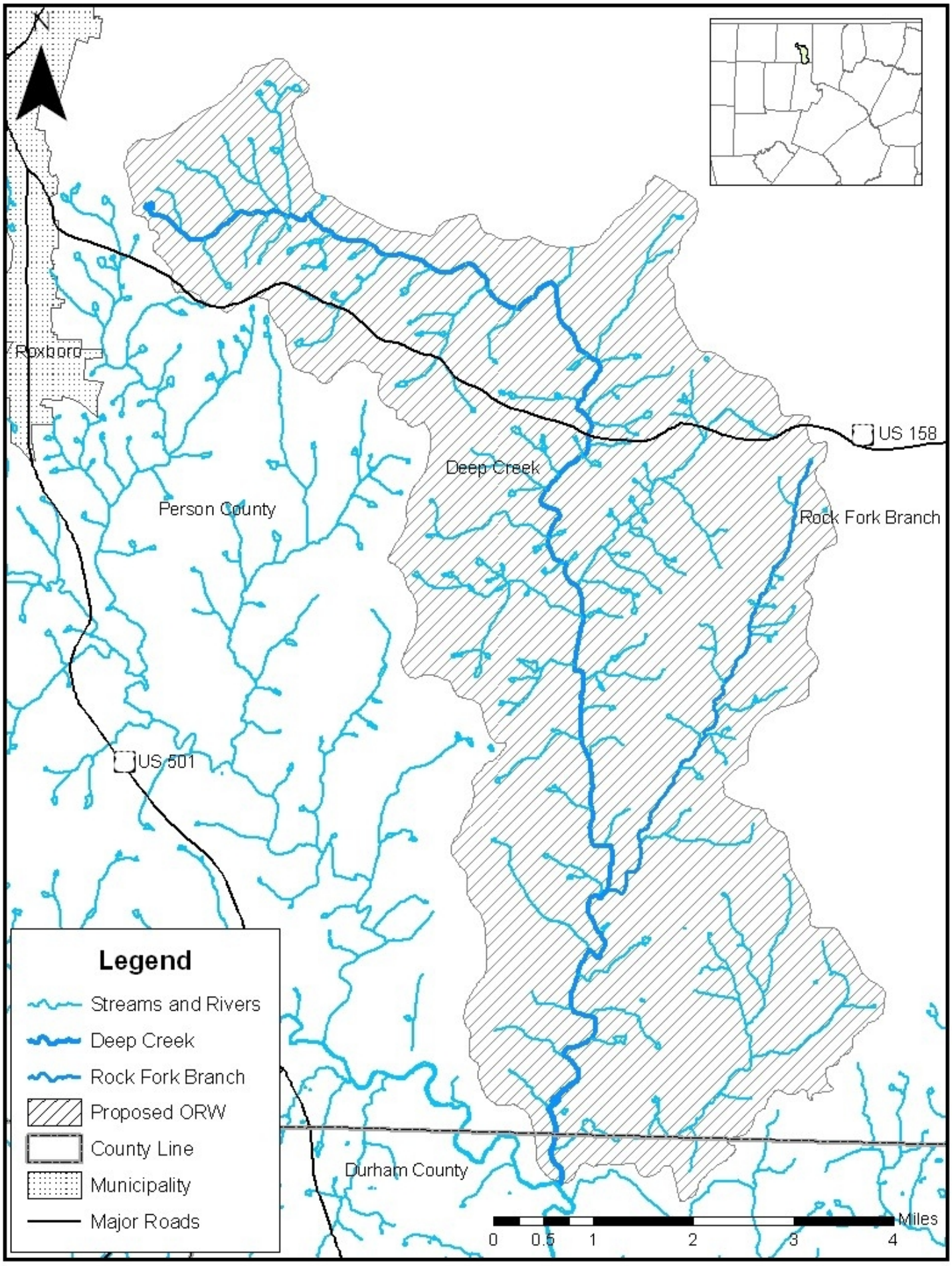
The Deep Creek watershed reclassification was from Water Supply-III (WS-III), Nutrient Sensitive Waters (NSW) to WS-III, Outstanding Resource Waters (ORW), and NSW. The reclassification consists of the entire watershed of Deep Creek, from its source to Flat River including Rocky Fork Branch (Figure 6).

The ORW reclassification area is relatively undeveloped and mostly forested with a small amount of pastureland, row crops and residences. The reclassification area measures approximately 23,660 acres and approximately 22 miles of named stream length.

The ORW supplemental classification is a designation intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. The lower reaches of the Deep Creek watershed (from its mouth to SR 1734) are included in the North Carolina Natural Heritage Program's Flat River Aquatic Habitat, a state-significant site that is home to rare and endangered mussels, amphibians and fish (NCDEHNR, 1993). The fish site JF3 also serves as a DWQ fish community regional reference site because of the high quality instream and riparian habitat characteristics.

In November 2006, DWQ staff received permission from the NC EMC to proceed to public hearing on the Deep Creek watershed ORW reclassification. The reclassification was then approved by the NC EMC in September 2007 and took effect November 1, 2007.

Deep Creek Proposed ORW, Neuse River Basin



27-3-4_ProposedORWBW

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