Chapter 5
Roanoke River Subbasin 03-02-05
Including: Hyco Creek, Hyco Lake, Marlowe Creek, Mayo Creek and Mayo Reservoir

5.1 Subbasin Overview

Subbasin 03-02-05 at a Glance

Land and Water Area

Total area:	337 mi²
Land area:	322 mi²
Water area:	15 mi²

Population Statistics

2000 Est. Pop.:	28,648 people
Pop. Density:	85 persons/mi²

Land Cover (percent)

Forest/Wetland:	71.9%
Surface Water:	4.5%
Urban:	1.3%
Cultivated Crop:	2.4%
Pasture/ Managed Herbaceous:	19.8%

Counties

Caswell, Person, Granville, Alamance and Orange

Municipalities

Roxboro

Monitored Stream Statistics

Aquatic Life

Total Streams:	35.9 mi/7594.8 ac
Total Supporting:	12.5 mi/493.6 ac
Total Impaired:	23.4 mi
Total Not Rated:	7101.2 ac

Recreation

Total Streams:	28.5 mi
Total Supporting:	24.0 mi
Total Not Rated:	4.5 mi

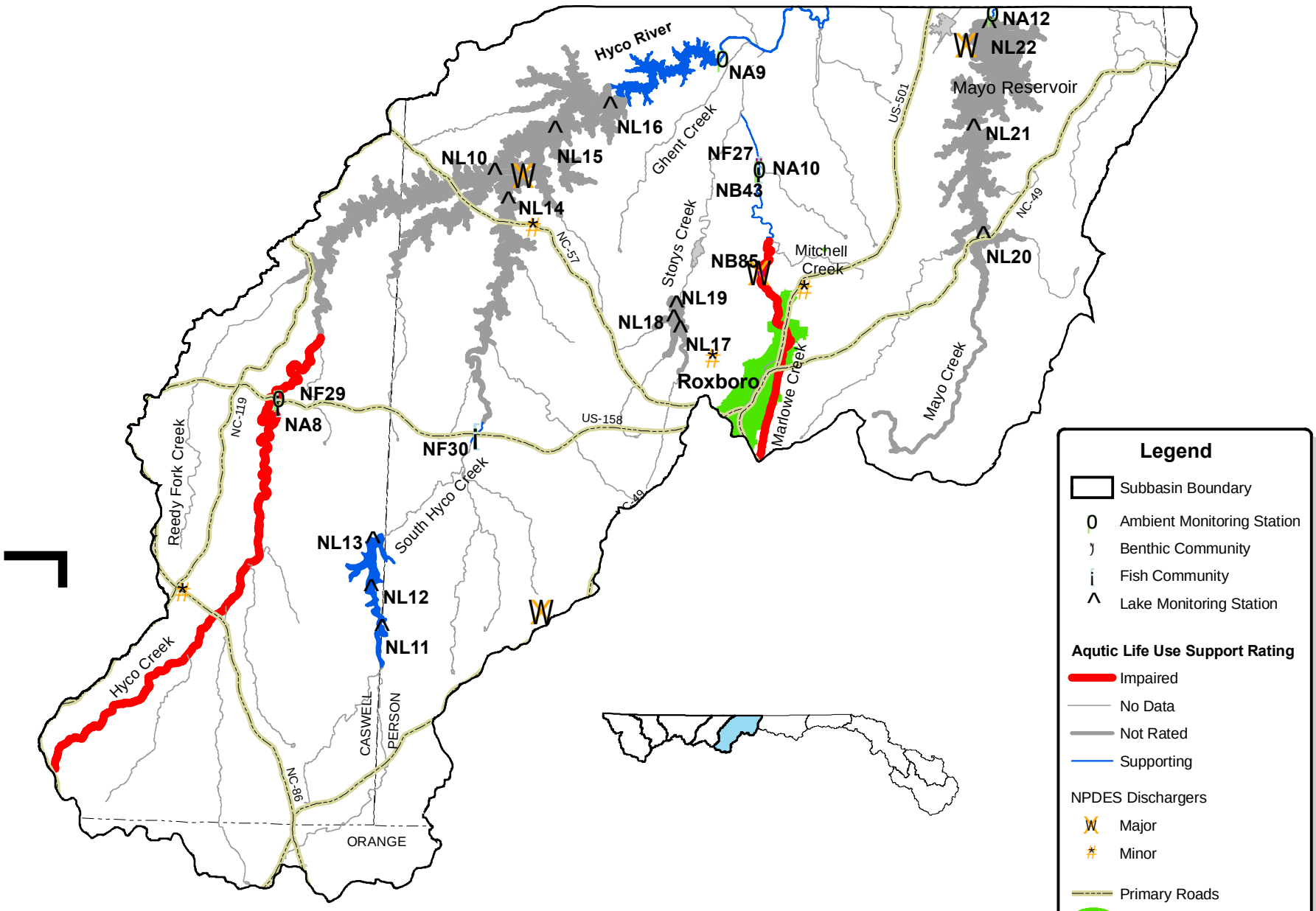
The entire Hyco River and Mayo Creek watershed including reservoirs, largely make up this subbasin. Other major tributaries include Storys Creek and Marlowe Creek. All major streams flow generally northward into Virginia. By the year 2020, populations throughout Caswell and Person counties are expected to increase by 16 percent and 22 percent, respectively. For more information regarding population growth and trends, refer to Appendix I.

Several water quality improvement programs have been implemented in this subbasin. The NC Agriculture Cost Share Program (NCACSP), which helps reduce agricultural runoff by helping farmers implement best management practices, is one of these programs. The NCACSP provided $230,976 towards implementing sediment and nutrient reduction practices, animal waste management, and livestock stream access elimination within this subbasin. For more information on this and other programs, refer to watershed discussion throughout this chapter as well as in Chapters 16 and 20.

Seven individual NPDES wastewater discharge permits are issued in this subbasin with a total permitted flow of 26.0 MGD three are major dischargers. Four facilities are required to conduct whole effluent toxicity testing, all of which have been in compliance during this assessment period. Refer to Appendix VI for identification and more information on individual NPDES permit holders. Five registered animal operations (1 cattle and 4 swine) are located in this subbasin. Refer to Chapter 16 for more information regarding animal operations within this basin.

A map including the locations of NPDES discharges and water quality monitoring stations is presented in Figure 9. Table 7 contains a summary of assessment units and lengths, streams monitored, monitoring data types, locations and results, along with use support ratings for waters in this subbasin. Refer to Appendix IX for more information about use support ratings.

Figure 9 Roanoke River Subbasin 03-02-05



Division of Water Quality
Basinwide Planning Unit
May 30, 2006

Table 7 ROANOKE Subbasin 03-02-05

AU Number	Classification	Length/Area		Aquatic Life Assessment					Recreation Assessment				
Description				AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources
Hyco Creek (North Hyco Creek)													
22-58-1	C	16.8	FW Miles	I	NA8	NCE			S	NA8	NCE	Habitat Degradation	Agriculture
From source to Hyco Lake, Hyco River					NF29	P	'2004					Habitat Degradation	Impoundment
Hyco River													
22-58-(9.5)	C	6.8	FW Miles	S	NA9	NCE			S	NA11	NCE		
										NA9	NCE		
From dam of Hyco Lake to North Carolina-Virginia State Line, including all portions in North Carolina													
Hyco River, including Hyco Lake below elevation 410													
22-58-(0.5)	WS-V,B	4,297.9	FW Acres	NR	NL16	ID			ND				
					NL10	ID							
					NL15	ID							
					NL14	ID							
From source in Hyco Lake to dam of Hyco Lake, including tributary arms below elevation 410													
Marlowe Creek													
22-58-12-6a	C	6.6	FW Miles	I					ND			Habitat Degradation	Impervious Surface
From source to Mitchell Creek					NB85	F	'2004						
22-58-12-6b	C	4.5	FW Miles	S	NA10	NCE			NR*	NA10	CE	Fecal Coliform Bacteria	Unknown
From Mithcell Creek to Storys Creek					NB43	GF	'2004					Toxic Impacts	WWTP NPDES
					NF27	GF	'2004						
Mayo Creek (Maho Creek)													
22-58-15-(3.5)	C	0.5	FW Miles	S	NA12	NCE			S	NA12	NCE		
From dam of Mayo Reservoir to North Carolina-Virginia State Line													

Table 7 ROANOKE Subbasin 03-02-05

AU Number	Classification	Length/Area		Description	Aquatic Life Assessment						Recreation Assessment				
					AL Rating	Station	Result	Year/ Parameter	% Exc		REC Rating	Station	Result	Stressors	Sources
Mayo Creek (Maho Creek) (Mayo Reservoir)															
22-58-15-(0.5)	WS-V	2,613.8	FW Acres		**NR**	NL22	ID				ND				
						NL20	ID								
						NL21	ID								
				From source to dam of Mayo Reservoir											
South Hyco Creek															
22-58-4-(3)	WS-II;HQW,CA	0.7	FW Miles		**S**						ND				
				From a point 0.6 mile downstream of Double Creek to Hyco Lake, Hyco River (City of Roxboro water supply intake)		NF30	G	'2004							
South Hyco Creek (Lake Roxboro)															
22-58-4-(1.4)	WS-II,B;HQW	493.6	FW Acres		**S**	NL13	NCE				ND				
						NL12	NCE								
						NL11	NCE								
				From backwaters of Lake Roxboro to dam at Lake Roxboro											
Storys Creek [Roxboro City Lake (Lake Issac Walton)]															
22-58-12-(1.5)	WS-II;HQW,CA	189.5	FW Acres		**NR**	NL19	ID				ND				
						NL18	ID								
						NL17	ID								
				From a point 0.9 mile downstream of N.C. Hwy. 57 to Roxboro City Lake Dam											

Table 7 ROANOKE Subbasin 03-02-05

AU Number / Description	Classification	Length/Area	Aquatic Life Assessment					Recreation Assessment				
			AL Rating	Station	Result	Year/ Parameter	% Exc	REC Rating	Station	Result	Stressors	Sources

Use Categories:	**Monitoring data type:**	**Results:**	**Use Support Ratings 2005**:
AL - Aquatic Life	NF - Fish Community Survey	E - Excellent	S - Supporting, I - Impaired
REC - Recreation	NB - Benthic Community Survey	G - Good	NR - Not Rated
	NA - Ambient Monitoring Site	GF - Good-Fair	NR*- Not Rated for Recreation (screening criteria exceeded)
	NL- Lake Monitoring	F - Fair	ND-No Data Collected to make assessment
		P - Poor	
		NI - Not Impaired	
Miles/Acres	m- Monitored	N- Natural	**Results**
FW- Fresh Water	e- Evaluated	M - Moderate	CE-Criteria Exceeded > 10% and more than 10 samples
		S-Severe	NCE-No Criteria Exceeded
			ID- Insufficeint Data Available

Aquatic Life Rating Summary

S	m	12.5	FW Miles
I	m	23.4	FW Miles
S	m	493.6	FW Acres
NR	m	7,101.2	FW Acres
ND		147.7	FW Miles

Recreation Rating Summary

S	m	24.0	FW Miles
NR*	m	4.5	FW Miles
ND		155.1	FW Miles
ND		7,594.8	FW Acres

Fish Consumption Rating Summary

I	e	183.6	FW Miles
I	e	7,594.8	FW Acres

Two benthic macroinvertebrate community samples, three fish community samples (Figure 9 and Table 7) and one fish tissue sample were collected during this assessment period. Data were collected from five ambient monitoring stations and four lakes. Refer to the *2005 Roanoke River Basinwide Assessment Report* at http://www.esb.enr.state.nc.us/bar.html and Appendix IV for more information on monitoring.

Waters in the following sections are identified by assessment unit number (AU#). This number is used to track defined segments in the water quality assessment database, 303(d) Impaired waters list, and the various tables in this basin plan. The assessment unit number 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 assessment unit and the DWQ index segment are the same.

5.2 Use Support Assessment Summary

Use support ratings were assigned for waters in subbasin 03-02-05 in the aquatic life, recreation, fish consumption and water supply categories. All waters are Impaired on an evaluated basis in the fish consumption category because of fish consumption advice that applies to the entire basin. In the water supply category, all waters are Supporting on an evaluated basis based on reports from DEH regional water treatment plant consultants.

There were 35.9 stream miles (19.6 percent) and 7,594.8 freshwater acres (100 percent) monitored during this assessment period in the aquatic life category. Of these, 12.5 stream miles (6.8 percent) and 493.6 freshwater acres (6.5 percent; Lake Roxboro) were supporting. There are 23.4 miles (12.8 percent) Impaired in this same category. Of the 28.5 steam miles (15.5 percent) monitored in the recreation category, 24.0 miles (13.1 percent) were classified as supporting. Refer to Table 7 for a summary of use support ratings for waters in subbasin 04-03-05.

5.3 Status and Recommendations of Previously and Newly Impaired Waters

The following waters were either identified as Impaired in the previous basin plan (2001) 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 assessment unit number (AU#). Information regarding 303(d) listing and reporting methodology is presented in Appendix VII.

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

2001 Recommendations

DWQ, in cooperation with Carolina Power & Light Company, will continue to monitor Hyco Lake and the permitted discharge to insure a continued decline in selenium concentrations. DWQ will work closely with the Department of Health and Human Services to lift the advisory when there is no longer a risk to human health from consumption of fish from Hyco Lake.

Current Status

Hyco River (Hyco Lake), from source in Hyco Lake to dam of Hyco Lake, including tributary arms below elevation 410 (4,297.9 acres), is Not Rated for aquatic life due to insufficient number of samples within the assessment period; however, data indicate a healthy aquatic system. Hyco Lake was monitored by DWQ in June, July, and September of 2004 at sites NL10, NL14, NL15 and NL16. Low concentrations for most nutrient parameters and chlorophyll *a* were generally found each month. Assessment of parameters related to biological productivity indicated moderate biological productivity and mesotrophic conditions.

Progress Energy has conducted water quality sampling of Hyco Lake applicable to the basinwide schedule and has published reports for this data (Progress Energy 2001, 2002, 2003, 2004). Historical problems of selenium accumulation due to the power plant discharge were addressed in 1990 with a conversion to a dry fly ash handling system. Work is underway to determine if Progress Energy's sampling meets the quality assurance objectives for use in 303(d) reporting. If it does, that data will be used in the future to assist with use assessments on their reservoirs.

This same segment is no longer Impaired in the fish consumption category for selenium, although it is still Impaired for fish consumption on an evaluated basis due to the NC Department of Health and Human Services (NCDHHS) fish consumption advice for mercury that encompasses the entire Roanoke basin (see section 13.4). NCDHHS rescinded the selenium advisory in August 2001. The advisory, enacted by the State Health Director in 1988, had advised the public to limit consumption of fish from the lake due to elevated selenium levels. The advisory was partially rescinded in 1994 to include only carp, white catfish and green sunfish and was further modified in 1999 to include only carp. The order to remove the advisory followed several years of fish tissue sampling. The tests showed that the average selenium levels for carp and other fish were safe. Visit the NCDHHS website for more information at www.epi.state.nc.us/epi/fish.

In addition, three largemouth bass samples were collected from Hyco Reservoir during 2004 and analyzed for pesticide and polychloratinated biphenyls (PCB) contaminants at site NT1. The samples were collected as part of an ongoing statewide organics assessment. Two bass samples contained trace amounts of dichlordiphenylethylene (DDE), a DDT metabolite, but concentrations were well below US EPA, US FDA, and State of North Carolina criteria. PCB contaminants were not detected in any samples.

2006 Recommendations

DWQ will continue to monitor Hyco Lake for lakes assessment and fish tissue. Hyco Lake will be removed from the 303(d) list for selenium.

Water Quality Initiatives

The NCEEP is working with a landowner to place a conservation easement with 300 foot buffers along 12,333 feet of unnamed tributaries to Hyco River (22-58-(0.5)).

5.3.2 Hyco Creek (North Hyco Creek) [AU # 22-58-1]

Current Status and 2006 Recommendations
Hyco Creek (North Hyco Creek), from source to Hyco Lake, Hyco River (16.8 miles), is Impaired for aquatic life due to a Poor fish community bioclassification at site NF29. This site received the lowest score of any stream in the basin in 2004. The watershed drains an area of rural southeastern and eastern Caswell County. It was recommended that this creek and others within it's watershed be resampled to verify the 2004 results and to identify, if possible, the factors causing the low fish community rating. However, due to drought conditions in 2005 and 2006 a re-evaluation could not be done. DWQ will reassess this watershed during the next basinwide assessment period.

This section of Hyco Creek will be added to the 2008 303(d) list of Impaired waters.

This same section of Hyco Creek is Supporting in the recreation category due to no criteria exceeded at site NA8.

DWQ conducted a trends and annual load analysis on data collected from 1990 to 2004 at site NA8. The analysis included trends on total nitrogen (TN), defined as the sum of total Kjeldahl nitrogen and nitrate-nitrogen, total phosphorus (TP), water temperature, turbidity and total suspended solids (TSS). Results showed that average TN and TP concentrations peaked in July and decreased to a low in October. TSS and turbidity both exhibited increased levels in February and July. Water temperature followed a seasonal cycle, peaking in July. Results indicated a statistically significant negative trend in flow-adjusted TN. There were no other significant trends at the 95 percent confidence level.

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

2001 Recommendations
DWQ will continue to work with the Town of Roxboro's WWTP and Cogentrix to correct remaining problems at these facilities and Roxboro's collection system. However, it is possible that aquatic life will remain impaired because of significant habitat degradation in the stream. The Town of Roxboro should begin to install urban stormwater controls and best management practices to prevent further degradation by runoff from urban areas and construction sites. DWQ will continue to monitor the stream and work with local NPS agencies to restore water quality.

Current Status
Marlowe Creek [22-58-12-6a], from source to Mitchell Creek (6.6 miles) is Impaired for aquatic life due to a Fair benthic community bioclassification at site NB85. Upgrades were made to the Roxboro WWTP in 2003, and more intensive sampling of Marlowe Creek was conducted to determine if improvements at the facility resulted in improvements in the benthic community. An upstream site was located at SR 1351, site NB85, above the WWTP, (approximately 300 meters) to compare to results at the basin site (NB43) at SR 1322 (approximately 3 miles downstream of the facility). Due to the fact that the headwaters of Marlowe Creek originate in the center of Roxboro, any benthic community improvements may be masked by urbanized impacts following the upgrades at the Roxboro WWTP. While urban effects are evident at the upstream location, downstream the cumulative effect of the influences of Roxboro and the

WWTP may be difficult to separate. However, during this assessment period, Roxboro did frequently experience sewer system collection overflows. This segment [22-58-12-6a] will remain on the 2008 303(d) list of Impaired waters for Impaired Biological Integrity.

Marlowe Creek [22-58-12-6b], from Mitchell Creek to Storys Creek (4.5 miles) is Supporting aquatic life due to Good-Fair fish and benthic community bioclassifications at sites NF27 and NB43. This site showed water quality improvement from the 2001 basin plan. Previously this site received a Fair benthic bioclassification. Several impacts were noted during benthic sampling, such as eroding banks, marginal instream habitat, which includes undercut banks and exposed root mats, few pools, and unproductive riffles. Riparian areas were intact and bank vegetation was generally healthy. Cogentrix-Roxboro completed a Special Order of Consent for rectifying toxicity issues in 2003 and have been in compliance. This segment [22-58-12-6b] will be removed from the 303(d) list.

Marlowe Creek [22-58-12-6b], from Mitchell Creek to Storys Creek (4.5 miles) is Not Rated for recreation due to bacteria screening criteria exceeded at site NA10. Further assessment of the standard was not conducted due to lack of resources.

2006 Recommendations
DWQ will continue to monitor Marlowe Creek. It is recommended that Roxboro work towards implementing a stormwater program.

Water Quality Initiative
The city of Roxboro received a State Emergency Loan (SEL) from the DWQ Construction, Grants and Loans Section in 2001. The purpose of the project is for sewer rehabilitation in replacing sewer pipes.

5.4 Status and Recommendations for Waters with Noted Impacts

The surface waters discussed in this section 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. Nonpoint source program agency contacts are listed in Appendix VIII.

5.4.1 Mayo Creek (Maho Creek) [AU # 22-58-15-(3.5)]

Current Status and 2006 Recommendations
Mayo Creek, from dam of Mayo Reservoir to North Carolina-Virginia State Line (0.5 miles) is Supporting aquatic life and recreation due to no criteria exceeded at site NA12.

DWQ conducted a trends and annual load analysis on data collected from 1990 to 2004 at site NA12. The analysis included trends on total nitrogen (TN), defined as the sum of total Kjeldahl nitrogen and nitrate-nitrogen, total phosphorus (TP), water temperature, turbidity and total

suspended solids (TSS). Results showed that the distributions of TN and TP did not show a high degree of seasonality. Average TSS concentrations were generally lower in summer months and peak in March. Average turbidity peaked in December. Water temperature followed the standard seasonal trend, with peak average temperature in August. There were no trends significant at the 95 percent confidence level.

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

Current Status and 2006 Recommendations

Mayo Reservoir, from source to dam of Mayo Reservoir (2,613.8 acres), is Not Rated for aquatic life due to the small number of samples taken during this assessment period. However, water quality appears to be good and improving over previous years although the presence of *Hydrilla* is a concern. DWQ sampled Mayo Reservoir in June, July and August 2004 from sites NL20, NL21 and NL22. Water quality sampling indicated low to moderate nutrient and chlorophyll *a* concentrations. Assessment of parameters related to biological productivity confirmed moderate biological productivity with a mesotrophic status. Mayo Reservoir has generally rated as oligotrophic (low biological productivity) in historical sampling. Water clarity was very good. The aquatic weed *Hydrilla* was observed in the lake, especially in the cove areas, but not yet at problematic conditions. No aquatic weed control measures are currently in place. A Progress Energy power plant is located near the dam at this lake and most of the shoreline was forested.

Progress Energy has conducted water quality sampling applicable to the basinwide schedule and has published reports for this data (Progress Energy 2001, 2002, 2003, 2004). In general, concentrations of most variables were highest near the power plant ash pond discharge and decreased rapidly with distance away from the discharge. All trace element concentrations were below the state water quality standards except for arsenic values near the ash pond discharge in 2000, 2002 and 2003. Selenium concentrations in fish tissues were also higher at the station near the ash pond discharge. Arsenic concentrations in fish tissue decreased from 2000 through 2003, with no significant concentrations found in 2003. The fish community composition was determined to be typical of a southeastern reservoir from 2000 through 2003. Work is underway to determine if Progress Energy's sampling meets the quality assurance objectives for use in 303(d) reporting. If it does, that data will be used in the future to assist with use assessments on their reservoirs.

5.4.3 Storys Creek (Roxboro City Lake) (Lake Isaac Walton) [AU # 22-58-12-(1.5)]

Current Status

Roxboro City Lake (Lake Issac Walton), from a point 0.9 mile downstream of N.C. Hwy. 57 to Roxboro City Lake Dam (189.5 acres), is Not Rated for aquatic life because of insufficient number of samples taken during this assessment period. DWQ monitored Roxboro City Lake at sites NL17, NL18 and NL19 in June, July, August and September of 2004. Moderate nutrient and chlorophyll *a* concentrations were generally found in the lake each month. Assessment of parameters related to biological productivity indicated slightly eutrophic conditions.

5.4.4 South Hyco Creek (Lake Roxboro) [AU # 22-58-4-(1.4)]

Current Status
Lake Roxboro, from backwaters of Lake Roxboro to dam at Lake Roxboro (493.6 acres), is Supporting aquatic life due to lakes assessments data from sites NL11, NL12 and NL13. DWQ monitored Lake Roxboro in 2000, 2001, 2002, and 2004. This water quality monitoring indicated moderate to elevated nutrient and chlorophyll *a* concentrations. Some exceedances of the state standard for chlorophyll *a* were found at this reservoir; however, in-lake averages were never above the standard. Assessment of parameters related to biological productivity indicated eutrophic conditions and high biological productivity. High dissolved oxygen saturation values (9 percent) were also found confirming algal activity. Algal analyses of samples collected in the summer of 2004 indicated moderate algal blooms all three months. These blooms were composed of a diverse assemblage and included species associated with agricultural runoff and species that may cause taste and odor problems in drinking water.

5.4.5 Hyco River [AU # 22-58-(9.5)]

Current Status and 2006 Recommendations
Hyco River, from dam of Hyco Lake to North Carolina-Virginia State Line, including all portions in North Carolina (6.8 miles) is Supporting aquatic life at site NA9 and recreation at sites NA9 and NA11due to no criteria exceedances at these sites.

DWQ conducted a trends and annual load analysis on data collected from 1990 to 2004 at site NA9. The analysis included trends on total nitrogen (TN), defined as the sum of total Kjeldahl nitrogen and nitrate-nitrogen, total phosphorus (TP), water temperature, turbidity and total suspended solids (TSS). Results indicated that the distributions of TN and TP concentrations showed some seasonality, with both nutrients peaking in average concentration in November. Average concentrations of TSS peak in January at a much higher concentration than for any other month. The monthly distribution of turbidity indicated peak turbidity in March with a gradual decline in turbidity until October when turbidity begins to increase. Water temperature followed the standard seasonal trend, with peak average temperature in August. There were no trends significant at the 95 percent confidence level.