CHAPTER 4

WATER QUALITY IN THE CATAWBA RIVER BASIN

4.1 INTRODUCTION

This chapter provides a detailed overview of water quality and use support ratings in the Catawba River Basin.

Water Quality Monitoring and Assessment

- **Section 4.2** presents a summary of water quality monitoring programs conducted by the Environmental Sciences Branch of the Division of Environmental Management's (DEM's) Water Quality Section including consideration of information reported by researchers and other agencies within the Catawba River Basin. Seven monitoring programs are described.
- **Section 4.3** summarizes water quality based on analyses of chemical water quality data from ambient monitoring stations along the mainstem of the river and tributary stations.
- **Section 4.4** presents a narrative summary of water quality findings for each of the nine subbasins based on all of the monitoring approaches described in Section 4.2 Also included are subbasin maps which show the locations of monitoring sites.

Use-Support Ratings

- **Section 4.5** provides a brief introduction to the use-support concept. Using this approach, water quality for specific surface waters in the basin is assigned one of four ratings: fully supporting, fully supporting but threatened, partially supporting or not supporting uses. A detailed description of the methodology for developing use-support ratings is presented in Appendix III.
- **Section 4.6** presents the use support ratings for most of streams and lakes in the Catawba basin through a series of tables and figures along with a color-coded use support map of the basin.

4.2 WATER QUALITY MONITORING PROGRAMS

DEM's monitoring program integrates biological, chemical, and physical data assessment to provide information for basinwide planning. Below is a list of the seven major monitoring programs, each of which is briefly described in the following text.

- Benthic macroinvertebrate monitoring (Section 4.2.2 and Appendix II),
- Fish population and tissue monitoring(Section 4.2.3 and Appendix II),
- Lakes assessment (including phytoplankton monitoring) (Section 4.2.4 and Appendix II),
- Aquatic toxicity monitoring (Section 4.2.5),
- Special chemical/physical water quality investigations (Section 4.2.6),
- Sediment oxygen demand monitoring (Section 4.2.7), and
- Ambient water quality monitoring (covering the period 1988-1992) (Section 4.2.8).

4.2.1 Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrates, or benthos, are organisms that live in and on the bottom of rivers and streams. These organisms are primarily aquatic insect larvae. The use of benthos data has proven to be a reliable water quality indicator, as these organisms are relatively immobile and sensitive to subtle changes in water quality. Since many organisms in a community have life cycles of six months to one year, the effects of short term pollution (such as an oil or chemical spill) will generally not be overcome until the following generation appears. The benthic community also responds to and shows the effects of a wide array of potential pollutant mixtures.

Criteria have been developed to assign five bioclassifications ranging from Poor to Excellent to each benthic sample based on the number of taxa present in the pollution-intolerant groups Ephemeroptera, Plecoptera and Trichoptera (EPTs). Likewise, ratings can be assigned with a Biotic Index (Appendix II). This index summarizes tolerance data for all taxa in each collection. The two rankings are given equal weight in final site classification. Higher taxa richness values are associated with better water quality. These bioclassifications primarily reflect the influence of chemical pollutants. The major physical pollutant, sediment, is poorly assessed by a taxa richness analysis. Different criteria have been developed for different ecoregions (mountains, piedmont and coastal plain) within North Carolina.

4.2.2 Fisheries Monitoring

To the public, the condition of the fishery is one of the most meaningful indicators of ecological integrity. Fish occupy the upper levels of the aquatic food web and are both directly and indirectly affected by chemical and physical changes in the environment. Water quality conditions that significantly affect lower levels of the food web will affect the abundance, species composition, and condition of the fish population. Two types of fisheries monitoring are conducted by DEM and described briefly below. The first involves assessing the overall health of the fish community. This information can be used as an indicator of the quality of the water the fish inhabit. The second involves analyzing fish tissues to determine whether they are accumulating chemicals. This information is also useful as an indicator of water quality and can be used to determine whether human consumption of these fish poses a potential health risk.

Fish Community Assessment

The North Carolina Index of Biotic Integrity (NCIBI) is a modification of Karr's IBI (1981) which was developed as a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The index incorporates information about species richness and composition, trophic composition, fish abundance and fish condition. At this time there is no Index of Biotic Integrity calculated for fish populations in lakes.

The NCIBI summarizes the effects of all classes of factors influencing aquatic faunal communities (water quality, energy source, habitat quality, flow regime, and biotic interactions). While any change in a fish community can be caused by many factors, certain aspects of the community are generally more responsive to specific influences. Species composition measurements reflect habitat quality effects. Information on trophic composition reflects the effect of biotic interactions and energy supply. Fish abundance and condition information indicates additional water quality effects. It should be noted, however, that these responses may overlap. For example, a change in fish abundance may be due to decreased energy supply or a decline in habitat quality, not necessarily a change in water quality.

Fish Tissue Analysis

Since fish spend their entire lives in the aquatic environment, they incorporate chemicals from this environment into their body tissues. Therefore, by analyzing fish tissue, determinations about what chemicals are in the water can be made. Contamination of aquatic resources, including freshwater, estuarine, and marine fish and shellfish species 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. Thus results from fish tissue monitoring can serve as an important indicator of further contamination of sediments and surface water. Fish tissue analysis results are also used as indicators for human health concerns, fish and wildlife health concerns, and the presence and concentrations of various chemicals in the ecosystem.

In evaluating fish tissue analysis results, several different types of criteria are used. Human health concerns related to fish consumption are screened by comparing results with Federal Food and Drug Administration (FDA) action levels and U.S. Environmental Protection Agency (EPA) recommended screening values for contaminants.

The FDA levels were developed to protect humans from the chronic effects of toxic substances consumed in foodstuffs and thus employ a "safe level" approach to fish tissue consumption. A list of fish tissue parameters accompanied by their FDA criteria are presented in Appendix II. At present, the FDA has only developed metals criteria for mercury. Individual parameters which appear to be of potential human health concern are evaluated by the N.C. Division of Epidemiology by request of the Water Quality Section.

4.2.3 Lakes Assessment Program (including Phytoplankton)

Lakes are valued for the multiple benefits they provide to the public, including recreational boating, fishing, drinking water, and aesthetic enjoyment. The North Carolina Lakes Assessment Program seeks to protect these waters through monitoring, pollution prevention and control, and restoration activities. Assessments have been made at all publicly accessible lakes, at lakes which supply domestic drinking water, and lakes (public or private) where water quality problems have been observed. Data are used to determine the trophic state of each lake; a relative measure of nutrient enrichment and productivity, and whether the designated uses of the lake have been threatened or impaired by pollution.

Phytoplankton and Algal Bloom Program

Phytoplankton are microscopic algae found in the water column of lakes, rivers, streams, and estuaries. Phytoplankton populations respond to nutrient availability and other environmental factors such as light, temperature, pH, salinity, water velocity, and grazing by organisms in higher trophic levels. These algae may be useful as indicators of eutrophication and are often collected with ambient water quality samples from lakes. Prolific growths of phytoplankton, often due to high concentrations of nutrients, sometimes result in "blooms" in which one or more species of algae may discolor the water or form visible mats on top of the water. Blooms may be unsightly and deleterious to water quality causing fish kills, anoxia, or taste and odor problems. The Algal Bloom Program was initiated in 1984 to document suspected algal blooms with quantitative biovolume and density estimates. Usually, an algal sample with a biovolume larger than 5000 mm^3/m^3, density greater than 10,000 units/ml, or chlorophyll *a* concentration approaching or exceeding 40 µg/l (the North Carolina state standard) constitutes a bloom. These values are referred to as bloom threshold values. Bloom samples are collected often as a result of complaint investigations, fish kills, or during routine monitoring if a bloom is detected.

Algal Growth Potential Tests

Three of the 11 lakes sampled in the Catawba River Basin have historical data for Algal Growth Potential Tests (AGPT). These are Lake Hickory, Lake Wylie and Lake Rhodhiss. The objective of the AGPT is to assess a waterbody's potential for supporting algal biomass and to determine whether algal growth is limited by nitrogen, by phosphorus, or co-limited by both nutrients. When AGPT control growth rates are ≥ 5.0 mg/l, sufficient quantities of biologically available algal growth limiting constituents are present to support algal growth in excess of levels equivalent to 57 µg/l chlorophyll *a* (Raschke, 1989). A waterbody may be protected from nuisance algal blooms if an AGPT value is consistently less than 5 mg/l.

Duke Power Company Lakes Data

In addition to the monitoring efforts of the Division of Environmental Management, Duke Power Company has maintained surveillance of the eleven-impoundment, Catawba River system since 1959. The initial monitoring program included monthly temperature and dissolved oxygen from Lake Wateree in South Carolina to Lake James near the River's headwaters. Data collection was expanded in 1974 to include routine measurements of twenty-four physico-chemical variables at least semiannually. Duke Power's long term program on all the Catawba lakes has been designed to monitor changes in the main channel as well as immediately downstream of the hydroelectric facilities. Lake Norman, Mountain Island Lake, and Lake Wylie, comprising the most extensively developed sources of hydroelectric power on the Catawba River, have been monitored more intensively to address environmental commitments associated with steam generating activities. In addition to physico-chemical measurements, these lakes have also been monitored intensively for plankton, benthos, and fish populations. Duke Power has conducted many site specific environmental programs, but the present program on all of the Catawba Lakes includes a continuation of the historical semiannual data as well as quarterly forebay sampling to address trophic indices. Duke Power is presently conducting water quality monitoring on the following lakes in the Catawba River Basin:

Lake	Number of Sites	
Lake James:	7	
Lake Rhodhiss:	4	
Lake Hickory:	3	
Lookout Shoals:	2	
Lake Norman:	12	
Mt. Island Lake:	9	
Lake Wylie:	5	(in N.C., including South Fork Catawba River)

Specific water quality information collected by Duke Power on the Catawba River lakes can obtained by calling: **Chris Sekerak** (875-5303), **Ron Santini** (875-5229) or **Jon Knight** (875-54I7).

4.2.4 Aquatic Toxicity Monitoring

Acute and/or chronic toxicity tests are used to determine toxicity of discharges to sensitive aquatic species (usually fathead minnows or the water flea, *Ceriodaphnia dubia*). Results of these tests have been shown by several researchers to be predictive of discharge effects on receiving stream populations. Many facilities are required to monitor whole effluent toxicity by their NPDES permit or by administrative letter. Other facilities may be tested by DEM's Aquatic Toxicology ~~Laboratory. The Aquatic Toxicology Unit maintains a compliance summary for all facilities~~ required to perform tests and provides a monthly update of this information to regional offices and DEM administration. Ambient toxicity tests can be used to evaluate stream water quality relative to other stream sites and/or a point source discharge.

4.2.5 Chemical/Physical Characterizations

Water quality simulation models are often used for the purpose of constructing wasteload allocations. These models must adequately predict water body responses to different waste loads so that appropriate effluent limits can be included as requirements in National Pollutant Discharge Elimination System (NPDES) permits. Where large financial expenditures or the protection of water quality is at risk, models should be calibrated and verified with actual in-stream field data. Because sufficient historical data are often lacking, intensive water quality surveys are required to provide the field data necessary to accomplish model calibration and verification. Intensive water quality surveys are performed on water bodies below existing or proposed wastewater dischargers and usually consist of a time-of-travel dye study, flow measurements, physical and chemical samples, long-term biochemical oxygen demand (BOD_{lt}) analysis, water body channel geometry, and effluent characterization analysis.

4.2.6 Sediment Oxygen Demand

If oxygen depletion is suspected due to the characteristics of benthic sediments then sediment oxygen demand (SOD) studies may be performed. Each stream reach is divided into a series of model segments. The number of stream segments that must be evaluated with an intensive survey depends on the individual study and the spatial resolution desired. Intensive surveys and SOD evaluations are reported as a series of field data tables and summaries of laboratory analysis reports. For the purposes of this report, intensive surveys and SOD studies that have been performed within each subbasin will be listed in table format accompanied by a brief summary of surveys that have been performed within the last five years.

4.2.7 Ambient Monitoring System

The Ambient Monitoring System (AMS) is a network of stream, lake and estuarine (saltwater) water quality monitoring stations (about 380 statewide) strategically located for the collection of physical and chemical water quality data. The type of water quality data, or parameters, that are collected is determined by the waterbody's freshwater or saltwater classification and corresponding water quality standards. Table 4.1 summarizes the types of water quality data collection conducted at ambient stations. AMS data for the Catawba Basin are summarized Section 4.3. The presentation of data involves the use of graphs that utilize box and whisker plots. Box and whisker plots are explained in Figure 4.1.

Table 4.1. Ambient Monitoring System Parameters

C and SC WATERS (minimum monthly coverage for all stream stations)

- dissolved oxygen,
- pH,
- conductivity,
- temperature,
- salinity (SC),
- secchi disk (where appropriate),
- nutrients: total phosphorus, ammonia, total Kjeldahl nitrogen, nitrate+nitrite,
- total suspended solids,
- turbidity,
- hardness,
- fecal coliforms,
- metals: aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, silver, zinc

NUTRIENT-SENSITIVE WATERS

- Chlorophyll *a* (where appropriate)

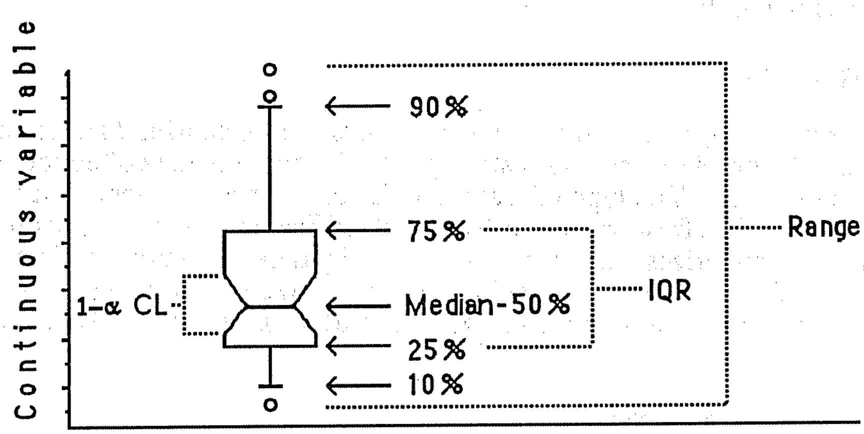
WATER SUPPLY

- chloride,
- total coliforms,
- manganese,
- total dissolved solids

PLUS any additional parameters of concern for individual station locations

Box and Whisker Plots

Box and whisker plot are useful for comparing sets of data comprised of a single variable by the visualization of selected order statistics. After the data have been ordered from low to high, the 10th, 25th, 50th, 75th, and 90th percentiles are calculated for plot construction. Box and whisker plots display the following important information: 1) the interquartile range (IQR) which measures the distribution and variability of the bulk of the data (located between the 25th and 75th percentiles), 2) the desired confidence interval (1-a CL) for measuring the statistical significance of the median (50th percentile), 3) indication of skew from comparing the symmetry of the box above and below the median, 4) the range of the data from the lowest to highest values, and 5) the extreme values below the 10th percentile and above the 90th percentile (depicted as dots).



Visual comparison of confidence level notches about the medians of two or more boxplots can be used to roughly perform hypothesis testing. If the boxplots represent data from samples assumed to be independent, then overlapping notches indicate no significant difference in the samples at a prescribed level of confidence. Formal tests should subsequently be performed to verify preliminary conclusions based on visual inspection of the plots.

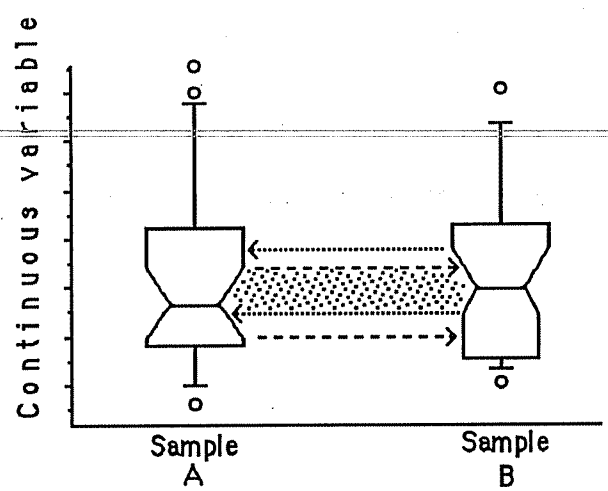


Figure 4.1 Explanation of Box and Whisker Plots

4.3 AMBIENT WATER QUALITY SUMMARY FOR THE CATAWBA RIVER MAINSTEM AND TRIBUTARY STATIONS.

AMS stations for the basin are listed in Table 4.2 below. The lower portion of the table are stations that were discontinued during this five-year basin period. The data for most of these stations stopped in 1991. There are a total of 39 stations within the basin and five discontinued stations. Of these stations, 11 are on the mainstem of the Catawba River and six are on the mainstem of the South Fork Catawba River (Figure 4.2).

Table 4.2 Ambient Monitoring System Stations within the Catawba River Basin.

STORET	1°Number	2° Number	Station Name	County	Subbasin
C0009000	**0213649985**	**CTB00M**	**CATAWBA RIVER AT SR 1273 NEAR OLD FORT, NC**	**McDowell**	**030830**
C0145000	**0213734850**	**CTB004D**	**CATAWBA RIVER AT SR 1240 NEAR GREENLEE, NC**	**McDowell**	**030830**
C0160000	**02137513**	**CTB005**	**CATAWBA RIVER AT I-40 NEAR OLD FORT, NC**	**McDowell**	**030830**
C0250000	**02137727**	**CTB008**	**CATAWBA RIVER AT SR 1221 NEAR PLEASANT GARDENS, NC**	**McDowell**	**030830**
C1210000	**02139036**	**CTB028A**	**CATAWBA RIVER AT SR 1147 NEAR GLEN ALPINE, NC**	**Burke**	**030830**
C2030000	**02141461**	**CTB040A**	**LAKE RHODHISS AT SR 1001 NEAR BATON, NC**	**Burke**	**030831**
C2600000	**02141840**	**CTB056A**	**LAKE HICKORY AT NC HWY 127 NEAR HICKORY, NC**	**Catawba**	**030832**
C3420000	**0214253319**	**CTB079A**	**CATAWBA RIVER AT SR 1004 NEAR MOORESVILLE, NC**	**Iredell**	**030832**
C3699000	**0214266050**	**CTB086B**	**MOUNTAIN ISLAND LAKE ABOVE GAR CREEK NEAR CROFT, NC**	**Gaston**	**030833**
C3900000	**02142808**	**CTB090**	**CATAWBA RIVER AT NC HWY 27 NEAR THRIFT, NC**	**Mecklenburg**	**030833**
C4220000	**02142938**	**CTB103**	**CATAWBA RIVER AT SOUTH BELMONT, NC**	**Mecklenburg**	**030834**
C7500000	**02145531**	**CTB178**	**LAKE WYLIE AT NC HWY 49 NEAR OAK GROVE, NC**	**Mecklenburg**	**030834**
C0550000	02138133	CTB013A	NORTH FORK CATAWBA RIVER AR SR 1552 NEAR HANKINS, NC	McDowell	030830
C1000000	02138500	CTB023A	LINVILLE RIVER AT NC HWY 126 NEAR NEBO, NC	Burke	030830
C1750000	02141245	CTB0341A	LOWER CREEK AT SR 1501 NEAR MORGANTON, NC	Burke	030831
C3860000	0214272204	CTB089A	DUTCHMAN'S CREEK AT SR 1918 AT MOUNTAIN ISLAND, NC	Gaston	030833
C1370000	02140304	CTB0311A	WILSON CREEK AT US HWY 221 NEAR GRAGG, NC	Avery	030831
C1385000	0214031250	CTB0314A	WILSON CREEK AT SR 1358 AT EDGEMONT, NC	Caldwell	030831
C2818000	02142000	CTB058J	LOWER LITTLE RIVER @ SR1313 NR ALL HEALING SPRINGS, NC	Alexander	030832
C4040000	02142900	CTB094	LONG CREEK AT SR 2042 NEAR PAW CREEK, NC	Mecklenburg	030834
C8896500	02146300	CTB202H	IRWIN CREEK AT IRWIN CREEK WWTP NEAR CHARLOTTE, NC	Mecklenburg	030834
C9050000	02146381	CTB208	SUGAR CREEK AT NC HWY 51 AT PINEVILLE, NC	Mecklenburg	030834
C9210000	02146530	CTB213D	LITTLE SUGAR CREEK @ NC HWY 51 @ PINEVILLE, NC	Mecklenburg	030834
C9370000	02146600	CTB219	MCALPINE CREEK AT SARDIS ROAD NEAR CHARLOTTE, NC	Mecklenburg	030834
C9680000	0214676115	CTB226H	MCALPINE CREEK AT SC SR 2964 NEAR CAMP COX, SC	SC-Lancaster	030834
C9790000	02146800	CTB230	SUGAR CREEK AT SC HWY 160 NEAR FORT MILL, SC	SC-Lancaster	030834
C9819500	02146900	CTB230D	TWELVE MILE CREEK AT NC HWY 16 NEAR WAXAHAW, NC	Union	030838
C9920000	02147126	CTB231B	WAXHAW CREEK AT SR 1103 NEAR JACKSON	Union	030838
C4300000	02143000	CTB107	HENRY FORK AT SR 1124 NEAR HENRY RIVER, NC	Catawba	030835
C4360000	02143027	CTB1110	HENRY FORK AT SR 1143 NEAR BROOKFORD, NC	Catawba	030835
C4370000	02143040	CTB1101A	JACOB FORK AT SR 1924 AT RAMSEY, NC	Burke	030835
C4380000	02143069	CTB110A	SOUTH FORK CATAWBA RIVER AT NC HWY 10 NR STARTOWN, NC	Catawba	030835
C6500000	02145112	CTB165	SOUTH FORK CATAWBA RIVER AT NC HWY 7 MCADENVILLE, NC	Gaston	030836
C7000000	02145442	CTB174	SOUTH FORK CATAWBA RIVER AT SR 2524 NR S BELMONT, NC	Gaston	030836
C4800000	02143260	CTB124	CLARK CREEK AT NORTH GROVE ST AT LINCOLNTON, NC	Lincoln	030835
C5170000	02143500	CTB131H	INDIAN CREEK AT SR 1252 NEAR LABORATORY, NC	Lincoln	030835
C5900000	02144000	CTB146	LONG CREEK AT SR 1456 NEAR BESSEMER CITY, NC	Gaston	030836
C7400000	02145524	CTB177	CATAWBA CREEK AT SR 2302 AT THE NC-SC STATE LINE	Gaston	030837
C8640000	02145633	CTB198	CROWDERS CREEK AT SR 2424 AT NC-SC LINE	Gaston	030837
C8660000	02145640	CTB198A	CROWDERS CREEK AT RIDGE ROAD NEAR BOWLING GREEN, SC	SC-York	030837
Stations discontinued within the five-year basin cycle					
C1190000	0213875850		HIGH SHOALS CREEK AT DYSARTSVILLE	McDowell	030830
C1380000	0214042720		NORTH HARPER CREEK AT USFS #58 NEAR KAWANA	Avery	030831
C3500180	0214253830		NORWOOD CREEK AT SR 1328 NEAR EAST MONBO	Iredell	030832
C9638500	02146750		MCAPLINE CREEK BELOW MCCULLEN CREEK NR PINEVILLE	Mecklenburg	030834

For this review the stations are divided into the Catawba River Mainstem stations, Catawba River tributaries and the South Fork Catawba River Basin (subbasins 35, 36 and 37).

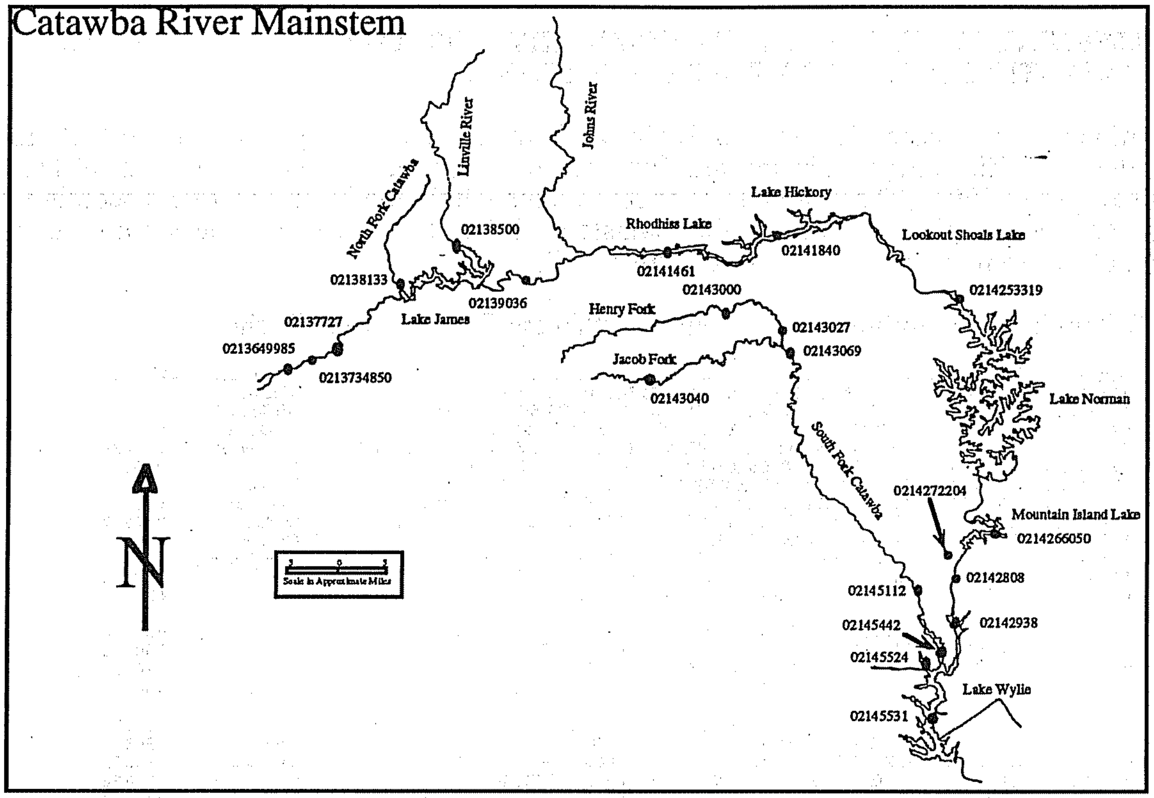


Figure 4.2 AMS Stations on the Catawba River Mainstem and Larger Tributaries.

4.3.1 Summary of AMS data for Catawba River Mainstem Stations

Adequate dissolved oxygen levels were found throughout the mainstem sites on the Catawba River. pH data were generally within DEM criteria with all median values between six and seven Standard Units. The lake stations were found to be more variable in pH with higher medians likely due to increased productivity at those locations. Nutrients in the mainstem are slightly higher entering the chain lakes, lower near Mountain Island Lake and higher again near the South Carolina border.

Long-term data were examined in response to water quality concerns in the Old Fort area upstream ~~from Lake James (Stations 0213649985, 0213734850, 02137513, 02137727). In summer 1987,~~ the low drops in dissolved oxygen during summer months of 1970, 1981, 1983 and 1986 were no longer found through the summer of 1993 (Figure 4.3). A notable decrease in total phosphorus can be seen in the long-term data during 1988 at the time of the Phosphate ban in the state (Figure 4.4). Metals data were examined and it was noted that copper levels were generally higher in the Old Fort area (02137513). Fecal coliform bacteria were at their consistently highest level near Old Fort. The median numbers at this station roughly coincided with the state standard of 200 MF/100 ml (figure 4.5)

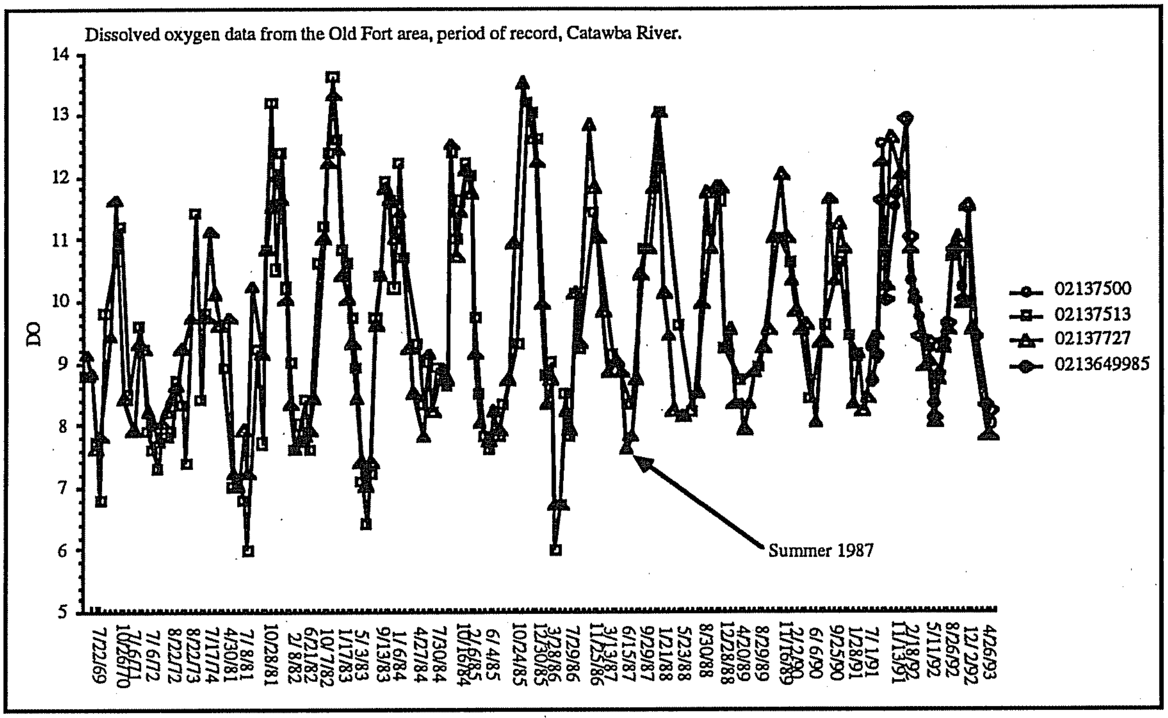


Figure 4.3 Dissolved Oxygen Data Trends in Catawba River from 4 AMS Stations near Old Fort

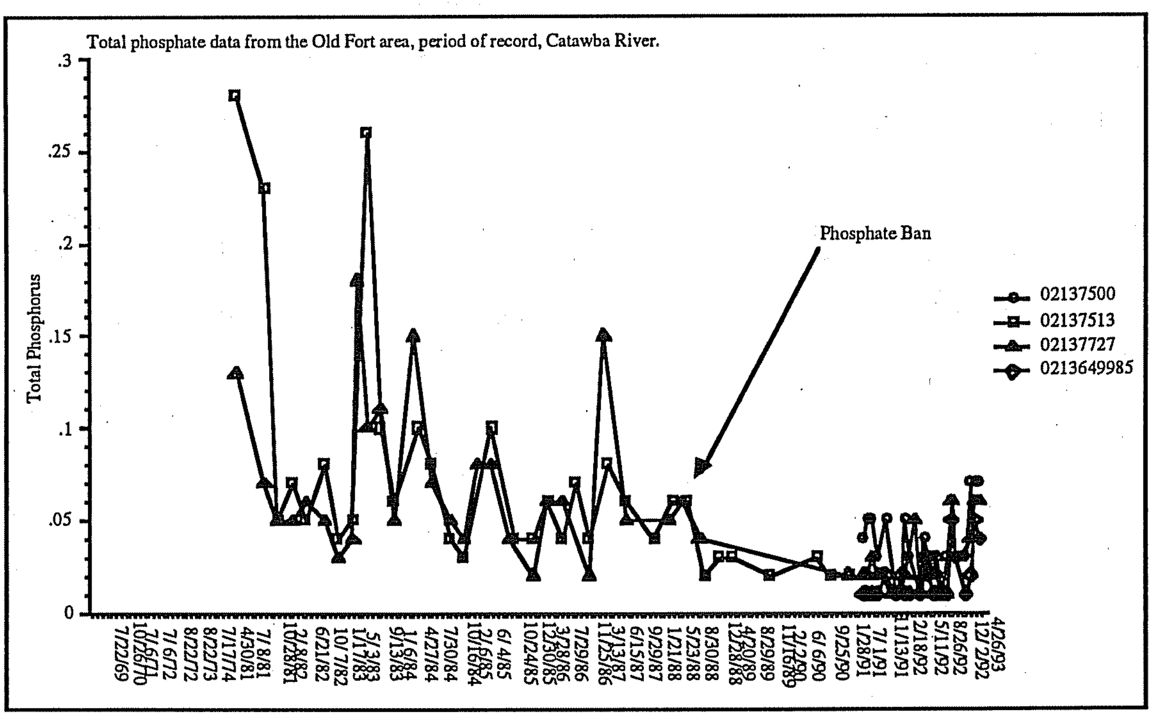


Figure 4.4 Total Phosphorus Trends in Catawba River from 4 AMS Stations near Old Fort

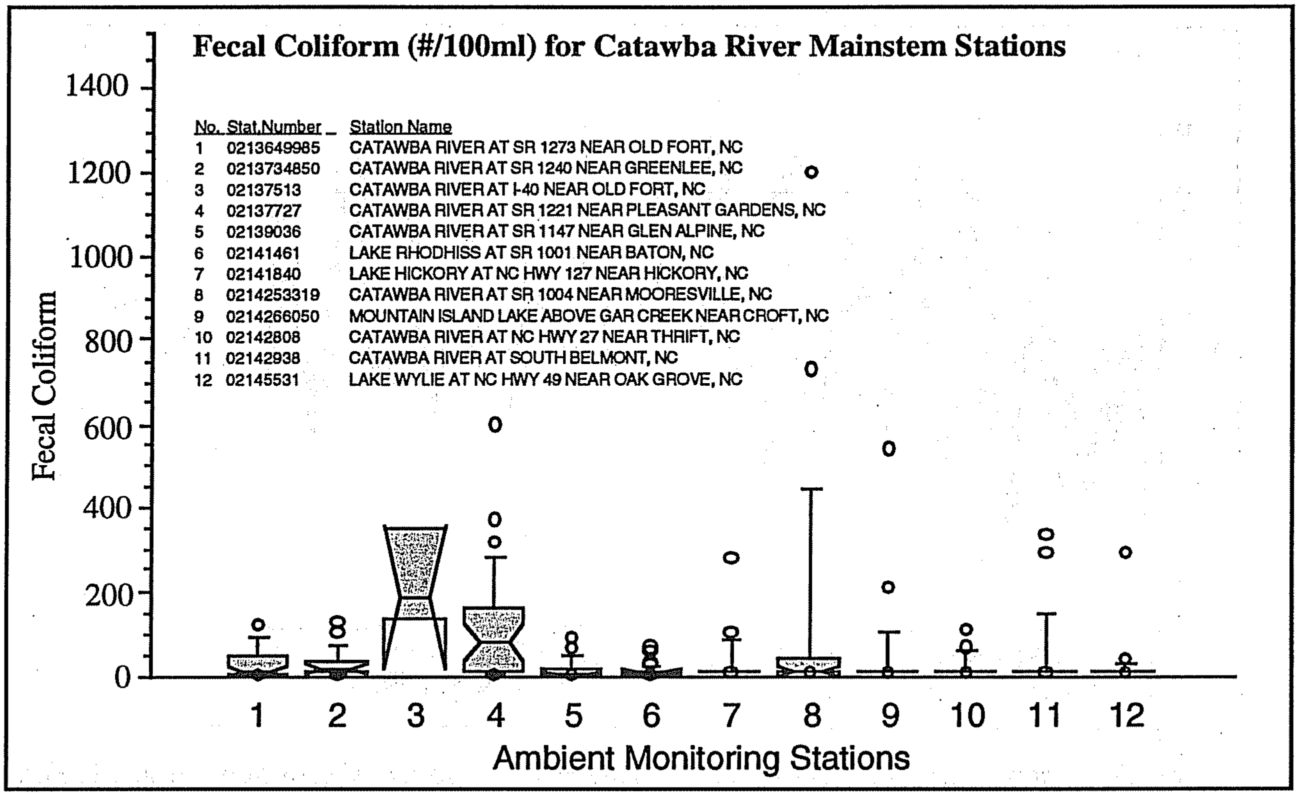


Figure 4.5 Fecal Coliforms at Catawba River Mainstem Stations

4.3.1 Summary of AMS data for Catawba River Tributary Stations

Adequate dissolved oxygen (DO) levels were found in the major tributaries of the Catawba River as in the mainstem (Linville River, North Fork Catawba, Lower Creek, Dutchman's Creek, and Catawba Creek). High pH samples were found in Catawba Creek and the North Fork Catawba station (not shown). Catawba Creek also had a high distribution of total phosphorus compared to the other major tributaries. Dutchman's Creek recorded two exceptionally high readings of total phosphorus. The nitrogen parameters show an elevated level at the Lower Creek and Catawba Creek stations. Metals data, in particular copper, are elevated in the lower tributaries (Dutchman's Creek and Catawba Creek).

AMS data for a number of the smaller tributaries are presented in the following figures. Dissolved oxygen in the smaller tributary stations tends to be lower in Sugar, Little Sugar and McAlpine Creeks (Charlotte area) (Figure 4.6). However, only a few samples were recorded below the DEM criterion. High pH levels were found in Irwin Creek (Figure 4.7). Low pH values were examined in more detail for the Wilson Creek stations (02140304 and 0214031250). The data show a slight increase in pH over the 1980's, although during the spring of 1990 and fall/winter of 1992 there were some precipitous drops in pH over several months Figure 4.7. The stations on tributaries in the upper subbasins (30 and 31) all recorded low pH distributions. Nutrient levels are elevated in all of the Charlotte-area Catawba River tributaries (Figures 4.8 - 4.10).

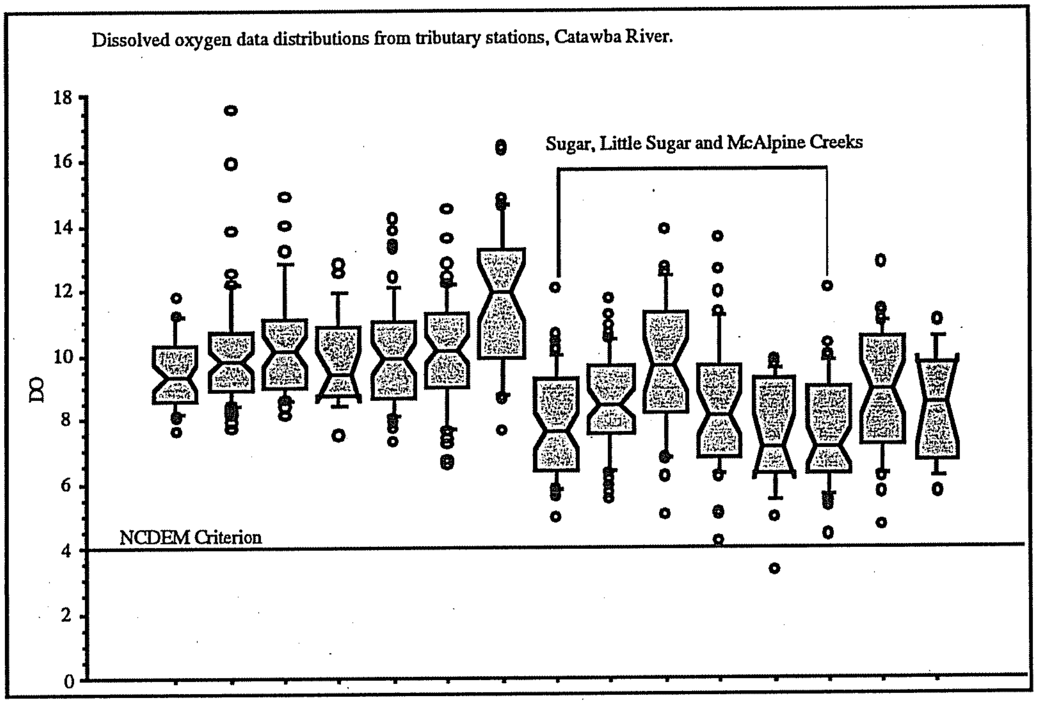


Figure 4.6 Dissolved Oxygen (mg/l) at Tributary AMS Stations of the Catawba River

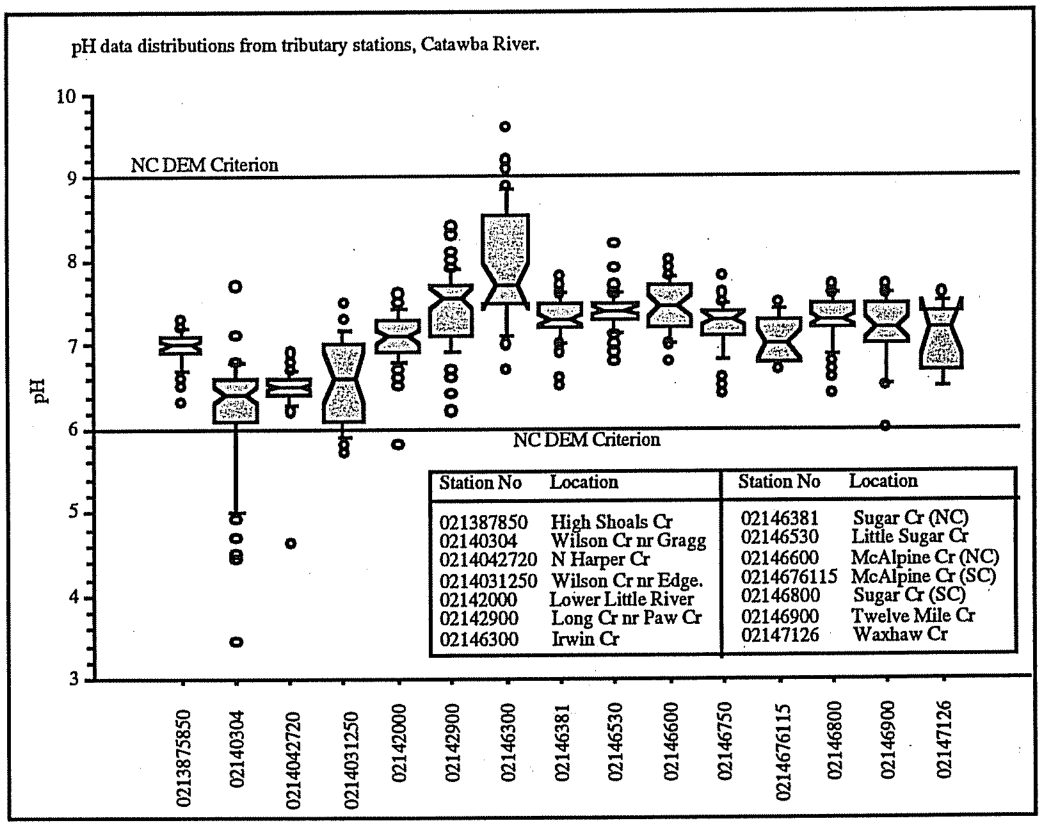


Figure 4.7 pH at Tributary AMS Stations of the Catawba River

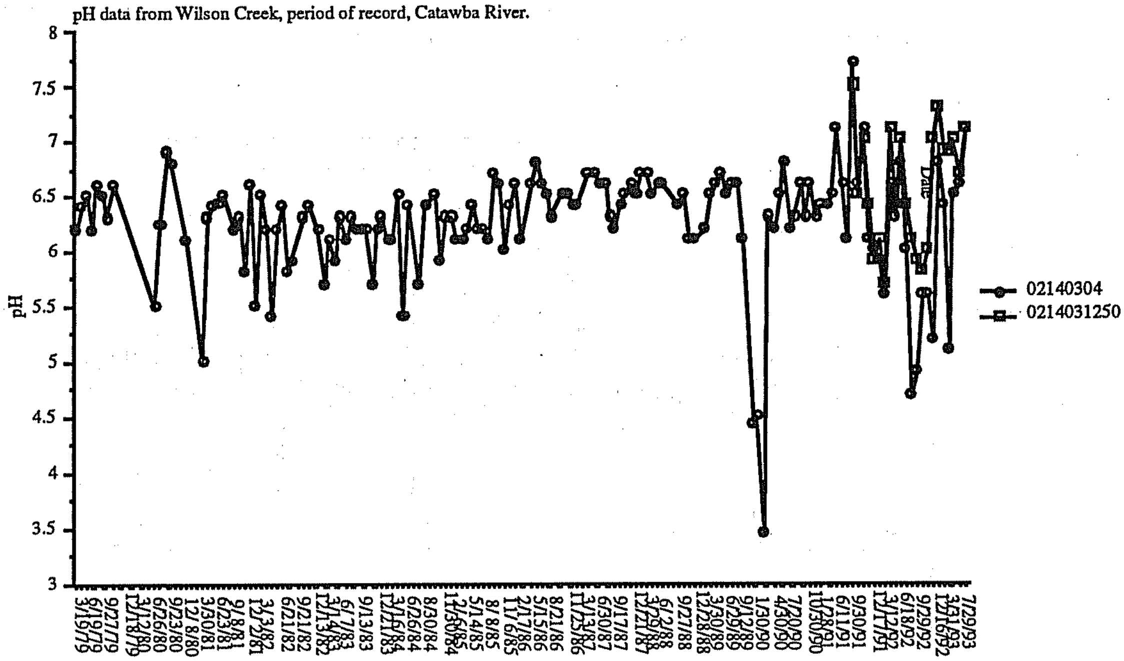


Figure 4.8 Long-term pH Readings at 2 AMS Stations on Wilson Creek

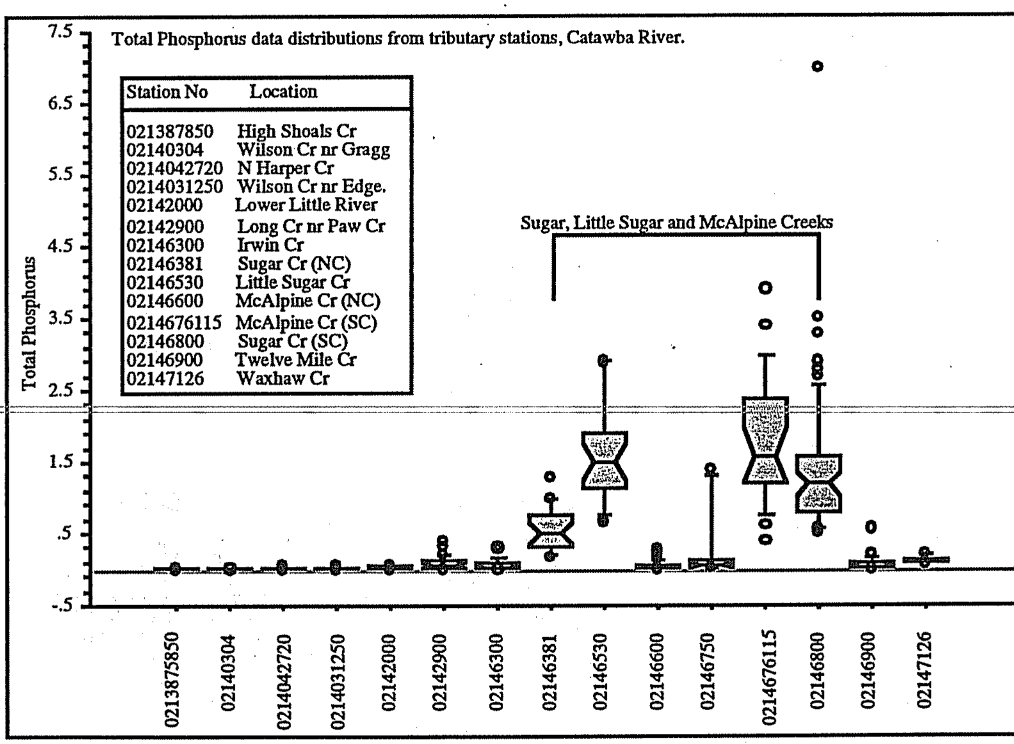


Figure 4.9 Total Phosphorus (mg/l) at Tributary AMS Stations of the Catawba River

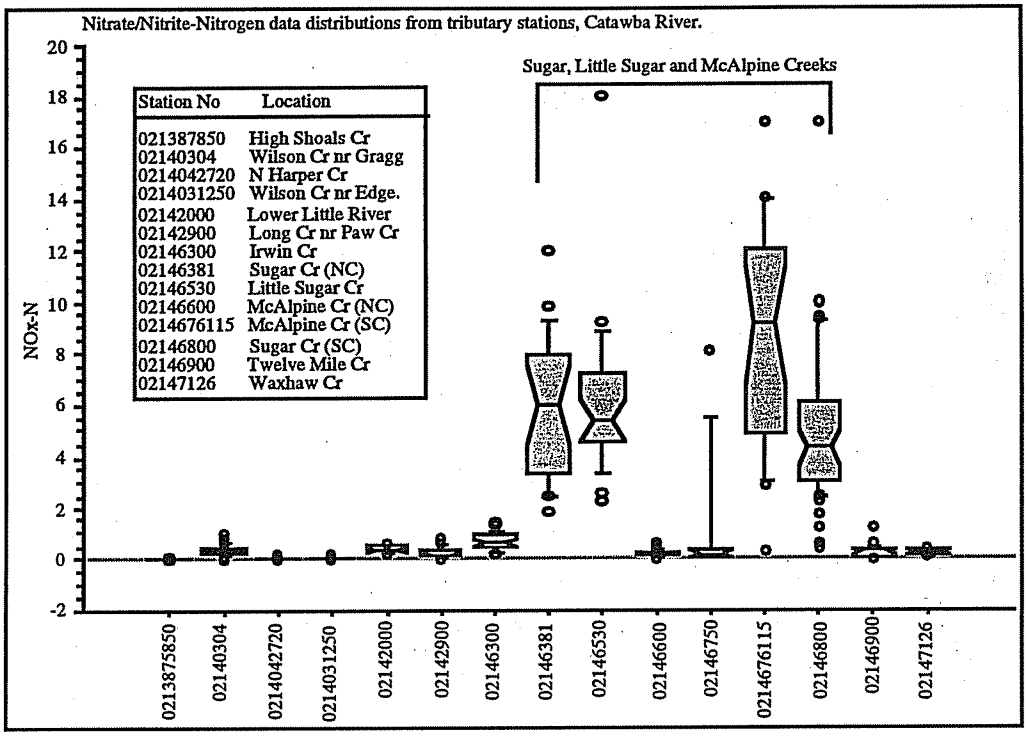


Figure 4.10 Nitrate/Nitrate-Nitrogen (mg/l) at Tributary AMS Stations of the Catawba River

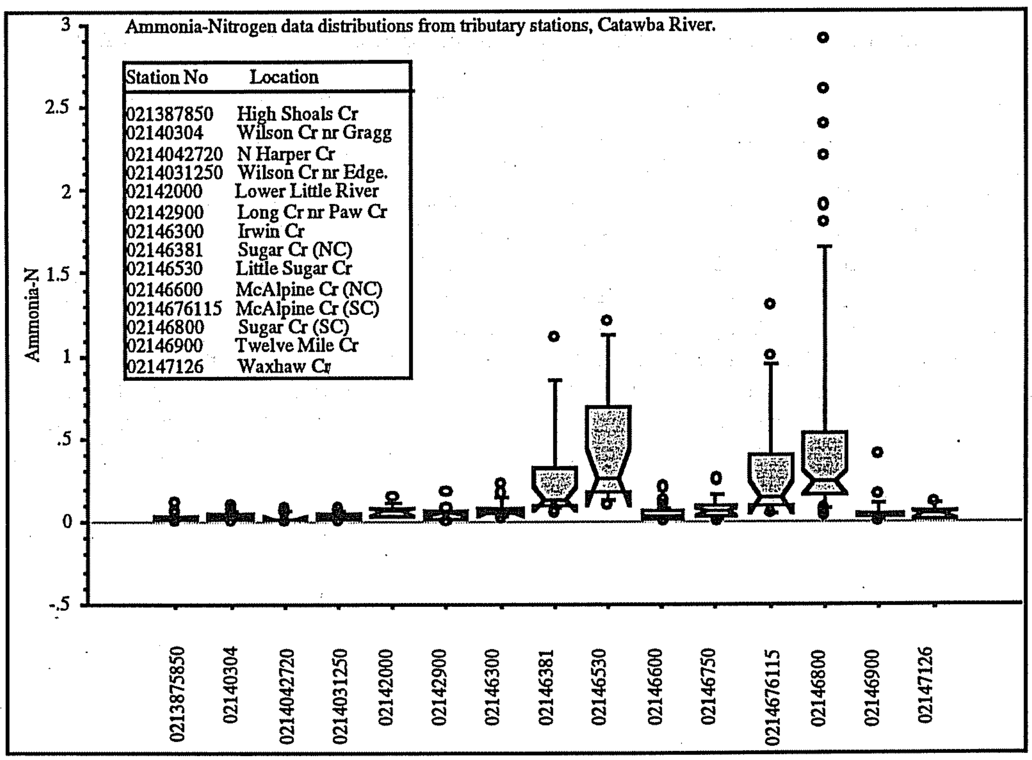


Figure 4.11 Ammonia-Nitrogen at Tributary AMS Stations of the Catawba River

Finally, creeks in the Charlotte area were chosen to examine effects of the Charlotte wastewater treatment plants and urban impacts. Stations on Irwin Creek (02146300), Sugar Creek (02146381, 02146800), Little Sugar Creek (02146530) and McAlpine Creek (02146600, 0214676115). Dissolved oxygen shows a general increasing trend from the lower levels in the 1970's (Figure 4.12) although summertime levels still occasionally fall below the state standard of 5 mg/l. Total phosphorus data reflects the effect of the 1988 phosphate ban . However, the phosphorus levels are beginning to raise again in 1992 and early 1993. Nitrate/nitrite-nitrogen exhibits a definite downstream trend. The levels of nitrate/nitrite-nitrogen show large differences in the most downstream stations McAlpine Creek at Camp Cox, SC (0214676115) and Sugar Creek at Fort Mill, SC (02146800). A recent trend in the recent data shows an increase in nitrate/nitrite-nitrogen as does the phosphorus data.

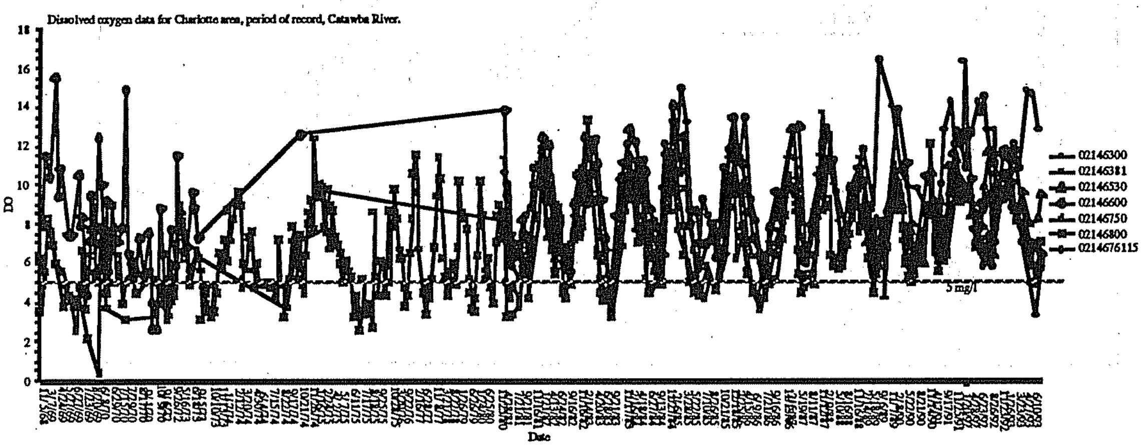


Figure 4.12 Dissolved oxygen data for Charlotte area, period of record, Catawba River.

Despite a dramatic decrease in fecal coliform levels over the past 20 years, largely as a result of disinfection of wastewater treatment plant effluent, recent fecal coliform data collected by both DEM and the South Carolina Department of Health and Environmental Control (SCDHEC) have revealed levels in the Sugar Creek watershed above the states' standard of 200/100 ml. SCDHEC conducted an intensive 30-day study in the watershed from June 7, 1993 to July 6, 1993 (SCDHEC, 1994). The study area included Little Sugar Creek, McAlpine Creek and Steele Creek. Data were collected from fourteen sampling locations, five of which were in North Carolina with nine in South Carolina. During the 30-day sampling program, all fourteen sites failed to meet applicable South Carolina fecal coliform standards. These standards are very similar to those use in North Carolina. The study also revealed violations of North Carolina and South Carolina dissolved oxygen water quality standards on McAlpine Creek (both above the McAlpine WWTP in North Carolina and below the plant in South Carolina) and Steele Creek (in South Carolina not far below the state line).

4.3.3 Summary of AMS Data for the South Fork Catawba Watershed

Dissolved oxygen and pH in the South Fork Catawba River area are adequate in all stations. Nutrient data in the South Fork Catawba mainstem tend to be high in the downstream Henry Fork station (02143027) and remains relatively high in the mainstem to a peak at the McAdenville station (02145112), Figures 4.13 - 4.15. Clark (02133260) and Indian (02143500) Creek stations have high distributions of nutrients and even the lowest of the tributary stations at Long (02144000) Creek is high compared to the mainstem (Figures 4.16 and 4.17).

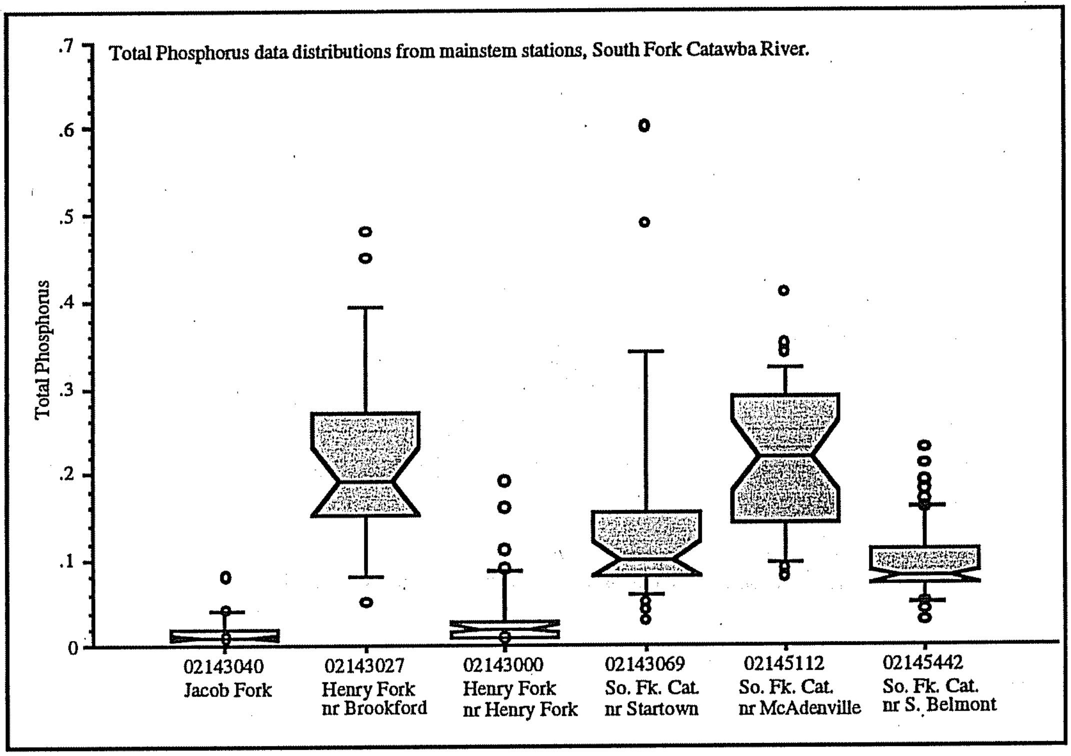


Figure 4.13 Total Phosphorus (mg/l) at AMS Stations on the South Fork Catawba River and Jacob and Henry Forks

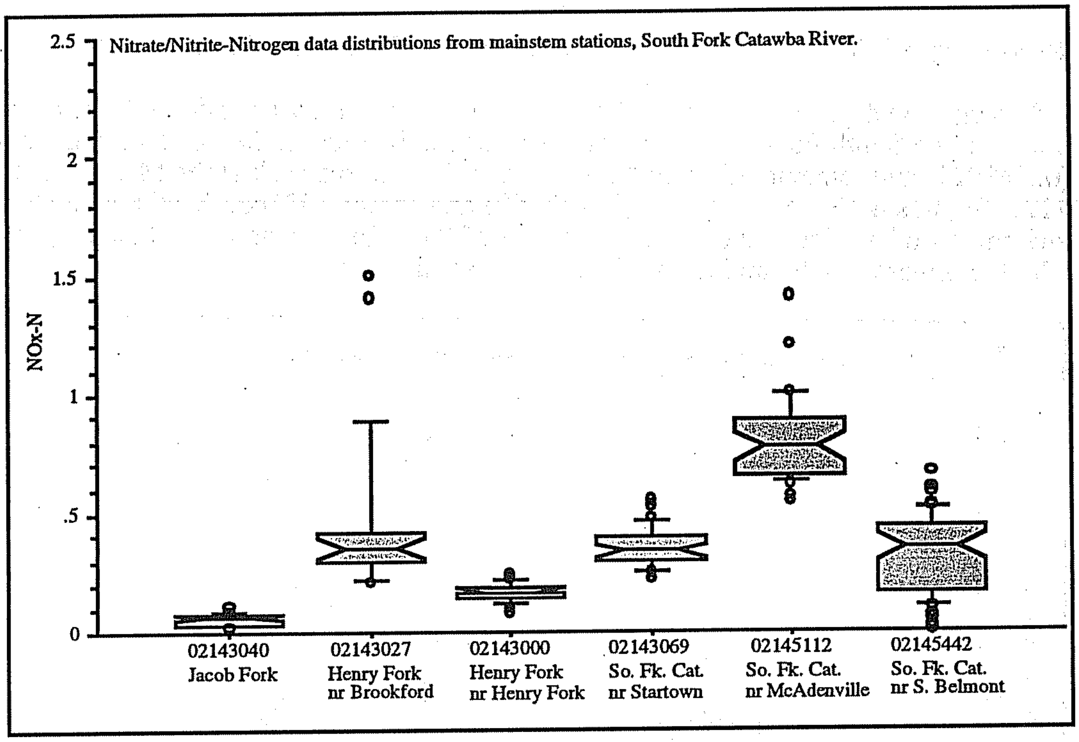


Figure 4.14 Nitrate/Nitrite-Nitrogen (mg/l) at AMS Stations on the South Fork Catawba River and Jacob and Henry Forks

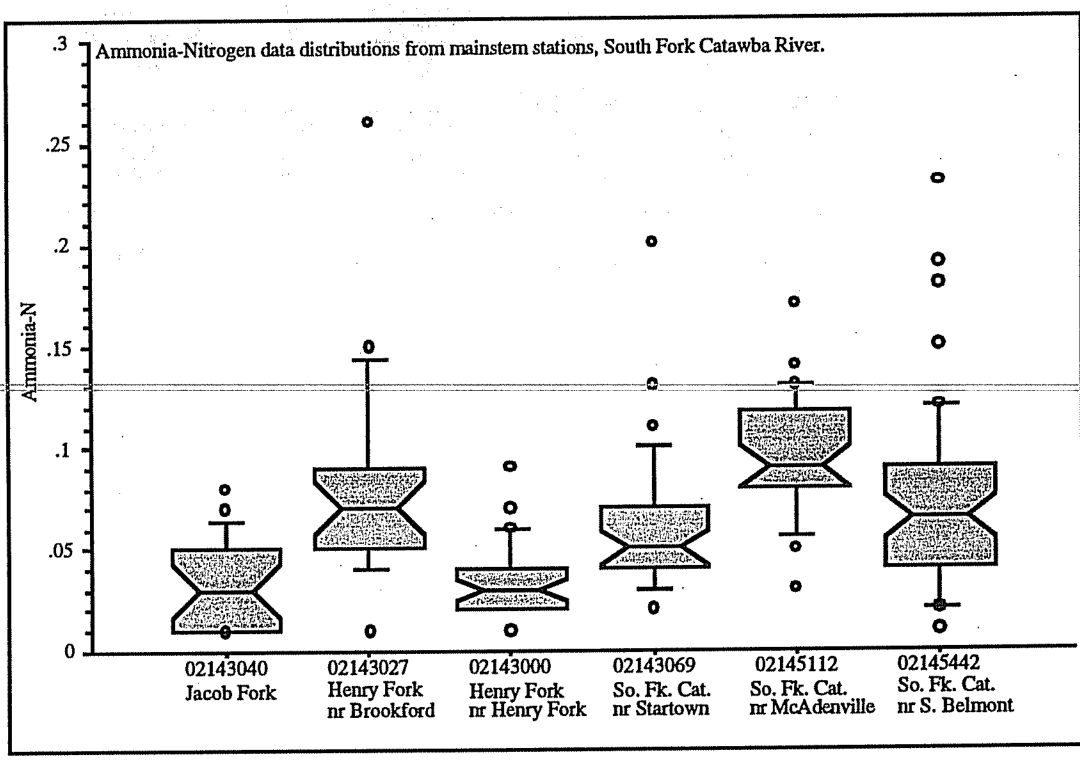


Figure 4.15 Ammonia-Nitrogen (mg/l) at AMS Stations on the South Fork Catawba River and Jacob and Henry Forks.

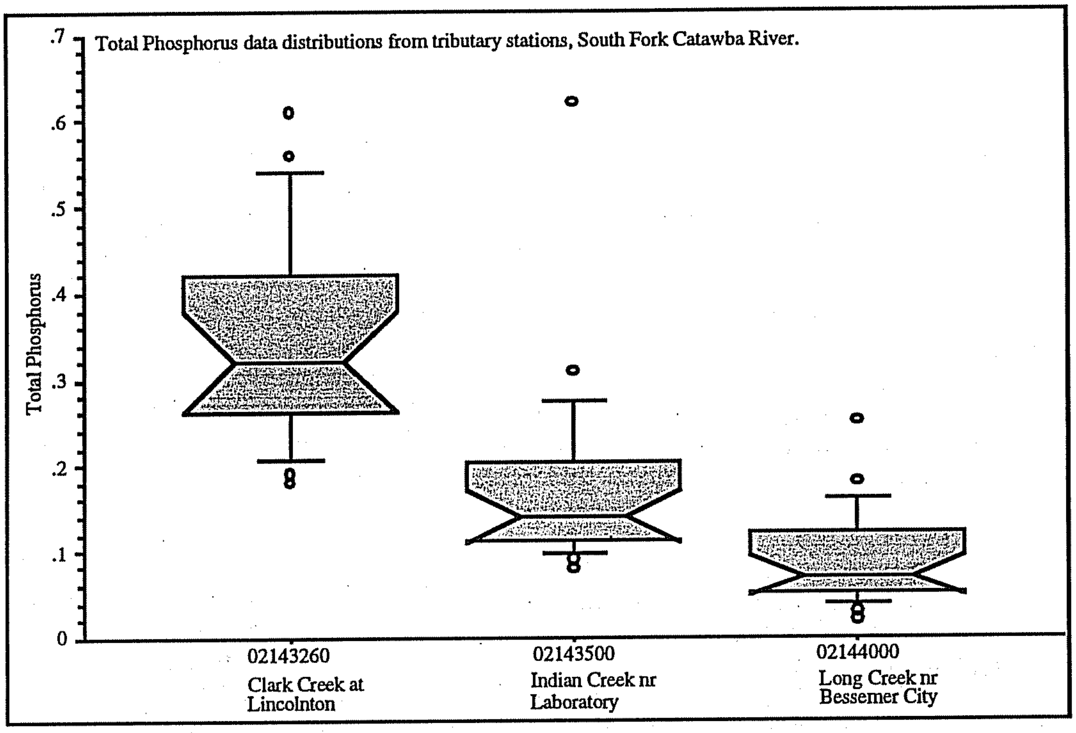


Figure 4.16 Total Phosphorus (mg/l) at Tributary Stations on the South Fork Catawba River

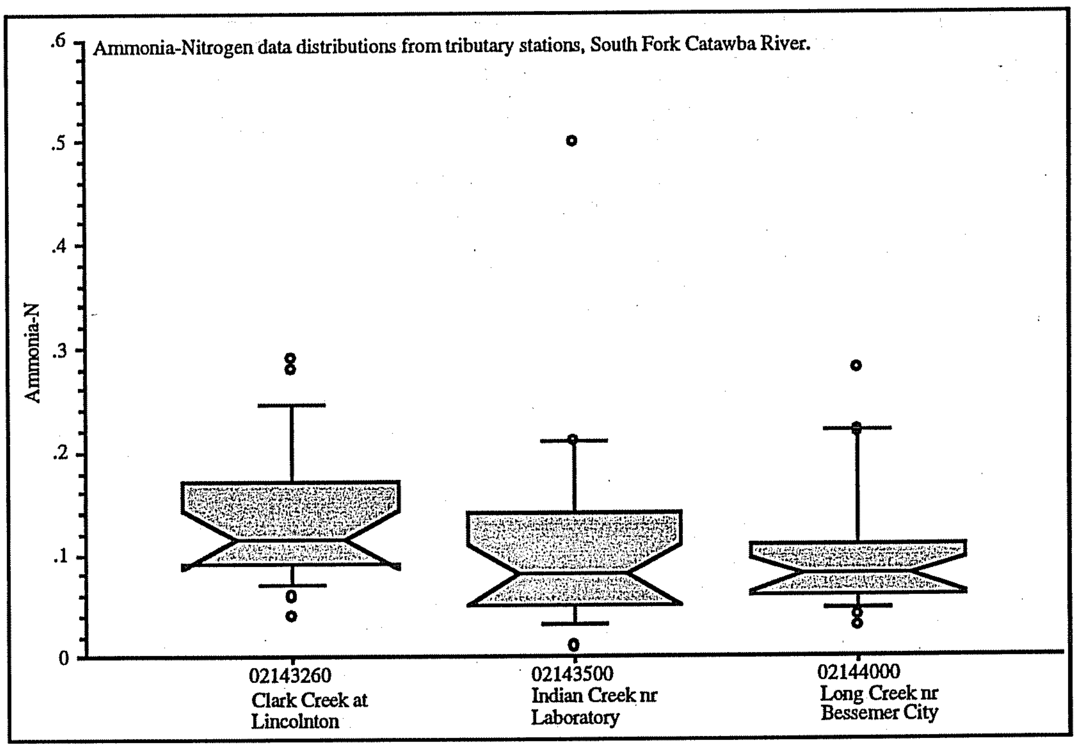


Figure 4.17 Ammonia-Nitrogen (mg/l) at Tributary Stations on the South Fork Catawba River

4.4 NARRATIVE WATER QUALITY SUMMARIES BY SUBBASIN

4.4.1 Subbasin 30 - Catawba Basin Headwaters (upstream from Morganton)

Description

Catawba subbasin 30 contains the headwater reaches of the Catawba River from its source near Old Fort to near the confluence with Silver Creek in Burke county. This is approximately a 25 river mile reach of the upper Catawba River and includes the entire watershed of Lake James. Approximately one half of the land use within this subbasin is contained within the Pisgah National Forest. This portion of the watershed is, therefore, protected from most land disturbing activities and has a limited number of point source discharges. The Catawba River flows generally eastward with major tributaries, such as the North Fork Catawba and the Linville Rivers, flowing south from mountainous headwaters. These streams are typically swift-flowing, cold-water stream systems capable of supporting trout populations. Several other smaller tributaries, such as Crooked and Muddy Creeks, flow north to the Catawba River from less mountainous and more developed catchments.

Overview of Water Quality

Fish and benthic macroinvertebrate community investigations have been conducted at 35 monitoring locations within subbasin 30 since 1983 (Figure 4.18). These investigations were conducted to assess the effects of both point and nonpoint sources of pollution. Ambient monitoring system information is currently being collected from seven active locations in the headwater area and five of these locations are on the mainstem of the Catawba River. These data generally indicate good water quality, with very few violations of water quality standards. However, data collected prior to 1988 at the Catawba River at I-40 and the Catawba River at Pleasant Gardens, noted consistent violations in several parameters including copper, zinc, and nitrate-N, with high total phosphorus values. Fecal coliform concentrations were also very high. Better water quality and biological integrity has been noted at these two ambient locations since 1988. Ambient chemistry data has shown higher dissolved oxygen values in the summer in the Old Fort area, as well as a notable decrease in total phosphorus values beginning in 1988, at the time of the phosphate ban in the state. Benthos ratings for the Catawba River below Old Fort have improved from Fair in 1985 to Excellent in 1992. Improvements in water quality are a likely response to the Old Fort Finishing plant ceasing discharge and improvements to effluent quality at the Old Fort WWTP, which discharges to Curtis Creek. The Pleasant Gardens site has improved from Good-Fair to Good, but this station had elevated levels of turbidity and suspended solids, especially during times of high flow, suggesting nonpoint source runoff may affect this portion of the Catawba River.

The tributaries of the upper Catawba River flowing south, such as the North Fork Catawba River and the Linville River, are often swift-flowing, cold-water streams originating in the steep terrain of the mountains. The majority of benthic macroinvertebrate investigations within this area have noted Good or Excellent bioclassifications. Some enrichment in streams below trout farming facilities was indicated by benthos sampling. Several tributary catchments, totaling 20.1 stream miles, flowing south from the Blue Ridge Parkway have been reclassified as High Quality Waters (upper Jarrett and Lost Cove Creeks, Mackey Creek and tributaries, Armstrong Creek, and the Linville River below Linville Falls), based either on an Excellent bioclassification or designation as native or special native trout waters. A benthos site on the Linville River just above where it enters Lake James, has consistently been rated Excellent since 1983. Good/Fair water quality conditions were noted in the upper Linville River due to nonpoint sources of runoff.

Several other smaller tributaries, such as Crooked, Corpening and North and South Muddy Creeks, flow north to the Catawba River from less mountainous and more developed catchments.

Catawba River Basin
030830

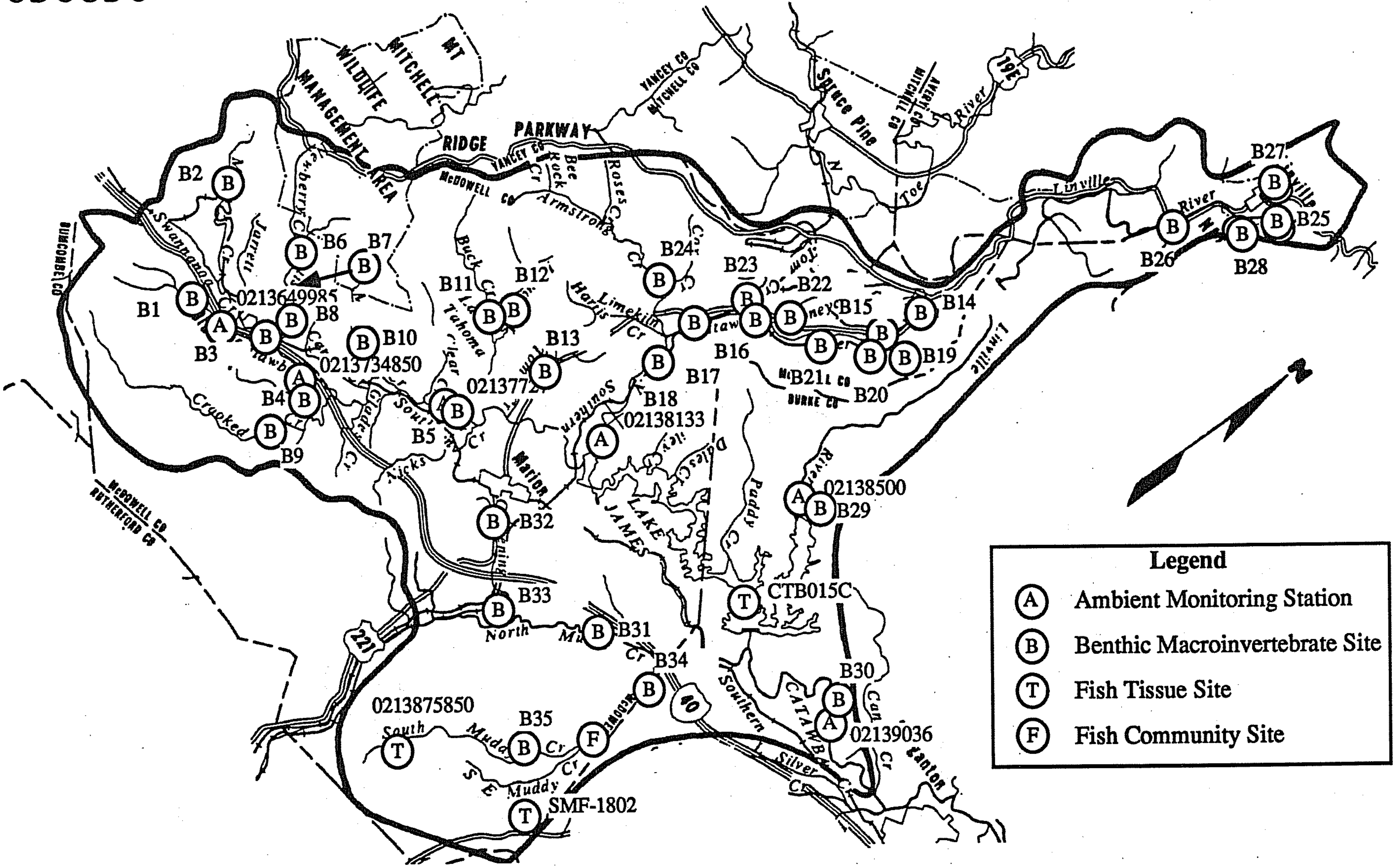


Figure 4.18 Water Quality Monitoring Stations in Subbasin 03-08-30, Catawba River Headwaters

The Marion WWTP was found, in 1990, to impact Corpening Creek as the benthos rating changed from Fair upstream to Poor downstream. Crooked Creek and North Muddy Creek received Good bioclassifications in 1992, while South Muddy Creek was rated Good-Fair.

Fish tissue samples have been collected from two locations in the subbasin (High Shoals Creek and Lake James near Bridgewater). Metal samples from High Shoals Creek were all lower than FDA and EPA criteria and organic results were all lower than detection levels. A total of nine samples were collected from the Lake James location. All metals were lower than FDA criteria. One sample contained dieldrin.

Assessments have been made of Lake Tahoma and Lake James. Lake Tahoma, which is privately owned, has a phytoplankton population dominated by oligotrophic indicators, suggesting that this lake fully meets it designated uses. Lake James, which is owned by Duke Power Company, is the most upstream of the major impoundments of the Catawba chain lakes system. The catchment is primarily forested and characterized by rolling hills. Water quality and phytoplankton data from Lake James have indicated that the lake is fully meeting all of its designated uses.

Potential ORW/HQW Streams

Based on DEM surveys in 1992, the following stream segments may be eligible for HQW designation:

1. Mill Creek above Graphite (above RR bridge).
2. Little Buck Creek (all)
3. Armstrong Creek above the confluence with Three-mile Creek. Presently only a small headwater section has received special designation.
4. Toms Creek was rated Excellent, but was sediment impacted.

4.4.2 Subbasin 31 - Upper Catawba Basin (Rhodhiss Lake)

Description

Catawba subbasin 31 is located in the mountain ecoregion, and contains the cities of Morganton, Lenoir, Drexel and Granite Falls (Figure 4.19). The Catawba River (including Lake Rhodhiss) flows generally eastward, with major tributaries flowing south, especially Warrior Fork and the Johns River. Portions of these stream's headwater tributaries are designated as HQW because they are native trout waters. Portions of this catchment are within the Pisgah National Forest, including Wilson Creek, and have received ORW designation. The Johns River catchment also contains some high quality areas, but this area has widespread agricultural land use, especially cultivation of ornamental shrubs and trees.

Overview of Water Quality

Benthos data indicate very good water quality in areas within the Warrior Fork and Johns River watersheds. Portions of these watersheds are within the Pisgah National Forest. Both Upper Creek in the Warrior Fork watershed, and Wilson Creek in the Johns River watershed have received Excellent bioclassifications since 1983.

Point source discharges in the Lenoir area appear to have impacted water quality in Lower Creek. This creek received a Fair benthos rating and a Fair-Good NCIBI (fish) rating. Fecal coliform bacteria exceeded the state criterion 8 times (36%) at the Lower Creek ambient monitoring station.

Benthos collections indicated sedimentation problems in Silver Creek, Canoe Creek, McGalliard Creek and Bailey Fork. Good-Fair bioclassifications were assigned to them. Fish community assessment of Canoe Creek indicated a NCIBI score of Fair, while McGalliard Creek received a Poor-Fair NCIBI rating.

Catawba River Basin
030831

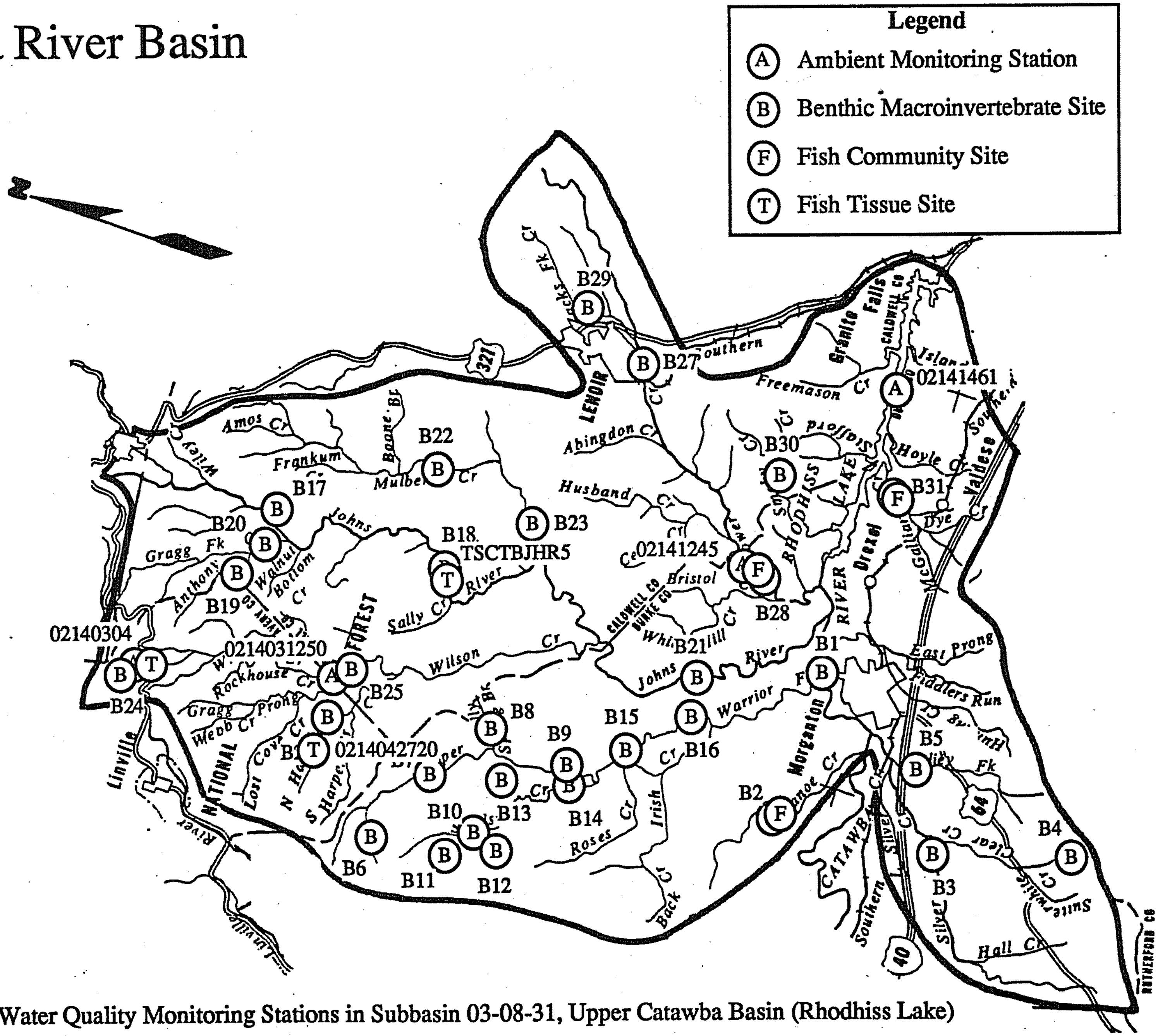


Figure 4.19 Water Quality Monitoring Stations in Subbasin 03-08-31, Upper Catawba Basin (Rhodhiss Lake)

Lake Rhodhiss has a surface water classification of WS-IV B CA and a trophic state index of eutrophic. Algal bloom conditions in the lake were present in April 1990 and November 1991.

4.4.3 Subbasin 32 - Mid Catawba Basin (Rhodhiss Lake to Lake Norman Dam)

Description

Catawba subbasin 32 is located in the Upper Piedmont ecoregion (Figure 4.20). Highly erodable soils and moderate gradients contribute to the large amounts of sediment into the Little Rivers (Upper, Middle and Lower) and their tributaries. This subbasin contains portions of the cities of Hickory, Conover, and Newton, although most dischargers in these cities are located in subbasin 35. The Catawba River has been dammed to form a series of four lakes, (Lake Hickory, Lookout Shoals Lake, and Lake Norman). A fourth lake, Little River Dam Lake, is located northwest of Lake Hickory on Upper Little River.

Overview of Water Quality

Benthic macroinvertebrates were sampled at eight basin assessment sites in 1992. Ratings were mainly Good (Upper, Middle and Lower Little River sites and Lyle Creek), or Good-Fair (Duck Creek, an upstream site on Muddy Creek and Elk Shoals Creek). Another benthos site on Muddy Fork below Schneider Mills was rated Fair. Most of these stream sites contained large amounts of sand. A long term benthos monitoring site located on Lower Little River at SR 1313 has improved from Fair to Good-Fair. Older benthic studies found discharges from Huffman Finishing to Huffman Branch and the Troutman WWTP to Big Branch were highly toxic, resulting in greatly diminished macroinvertebrate biodiversity and Poor bioclassifications. Muddy Fork, (Schneider Mills) was rated Good-fair at an upstream site and Fair below the discharge.

Fish community structure sampling NCIBI ratings in 1993 ranged from Good at Lyle Creek, to Fair at sites on Middle Little River, Duck Creek and Elk Shoals Creek, to Poor, at an upstream site on the Lower Little River. Comparing sites sampled by both fish and benthos, fish data produced lower ratings for two out of five sites. This may suggest that sediment may be the major pollutant. Results of fish tissue monitoring from four sites indicated minor accumulations of metals, (copper, zinc, chromium, and mercury). However, levels were not above FDA action levels.

Four lakes were monitored within this subbasin (Lake Hickory, Lookout Shoals Lake, Lake Norman and Little River Dam Lake). Trophic states range from eutrophic, (Lake Hickory and Lookout Shoals Lake), to mesotrophic, (Little River Dam Lake), to oligotrophic, (Lake Norman). Chlorophyll *a* levels higher than the state standard of 40 µg/l were detected in Lake Hickory.

Chemical monitoring was conducted at four ambient stations in the basin. Two of these stations, (Lake Hickory at NC Hwy 127 and Catawba River at SR 1004), are on the Catawba River. One fecal coliform and three iron measurements at these two sites were higher than the state criteria. One turbidity measurement at the Catawba River at SR 1400 site was higher than the state action level criteria. Maximum fecal coliforms, iron, and mercury were higher at Little Lower River at SR 1313 than the state action level for these parameters. Of the parameters monitored at Norwood Creek at SR 1328, three sample readings for iron and one for copper exceeded the state action level.

The Western Piedmont Council of Governments (WPCOG) has two ongoing studies which involve both Lake Hickory and Lookout Shoals. In 1992 the WPCOG and the Tennessee Valley Authority (TVA) initiated a study to monitor the health of largemouth bass in both reservoirs. Results of the study showed that a majority of the fish contained Protocephalus ambloplites (bass tapeworm), an internal parasite. It was determined that the parasite has had no major effect on the fish and, for the most part, the fish are in good health (Brown, 1993). Testing for fecal coliform bacteria has also been conducted by the WPCOG. Fecal coliform bacteria values were within the limits for North Carolina water quality standards.

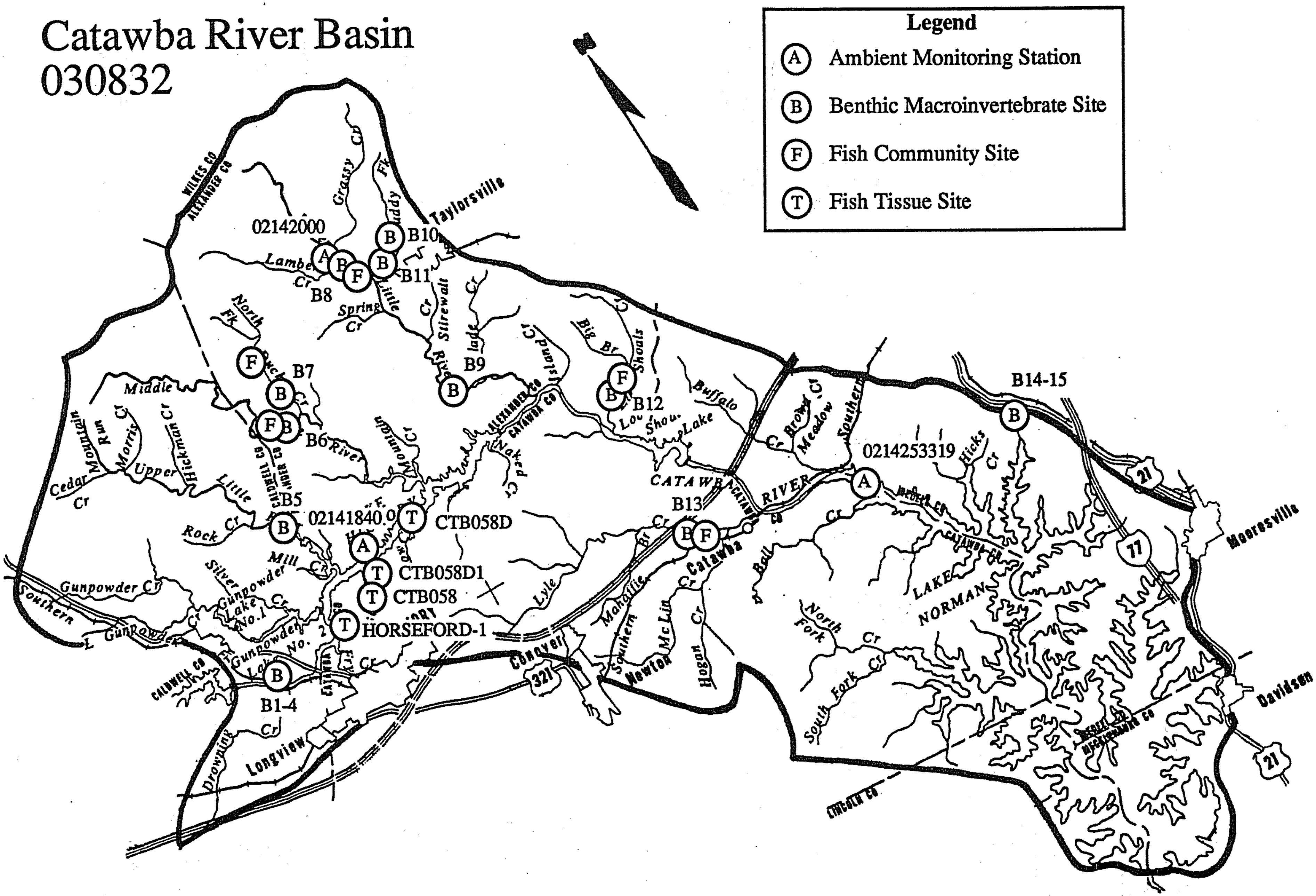


Figure 4.20 Water Quality Monitoring Stations in Subbasin 03-08-32, Mid Catawba River (Lake Hickory to Lake Norman)

4.4.4 Subbasin 33 - Lower Catawba (Mountain Island Lake and Dutchman's Creek)

Description

This subbasin is located in the inner Piedmont ecoregion of the state. Impoundment of the Catawba River in this area forms Mountain Island Lake (Figure 4.21). The Dutchman's Creek watershed is the largest in this subbasin. Streams in this subbasin are often sandy, low gradient streams with predominately silt and clay substrates. Land use is primarily agricultural, with recreational and residential use near the lakes.

Overview of Water Quality

Water quality ratings from benthos data collected in 1992 were Excellent (Killian Creek and Dutchman's Creek) or Good (Gar Creek). Older benthos data indicated Good-Fair and Fair water quality for McDowell Creek, and Excellent water quality for Leepers Creek. Fish community structure sampling indicated Good water quality for Leepers Creek, Fair-Good water quality for Dutchman's Creek, and Good water quality for Killian Creek.

Mountain Island Lake is the only large lake in this subbasin. The whole lake TSIs for 1982 and 1986 suggest the lake was mesotrophic. However, the 1992 TSI demonstrated the lake to be oligotrophic. During 1992, a powdery surface algal bloom was observed within the McDowell Creek Cove. The lake is currently under study by the Mecklenburg County Department of Environmental Protection and DEM. An increase in algal blooms in McDowell Creek Cove has raised concerns about water quality in the lake and impacts from increasing watershed development. The lake receives treated effluent from the McDowell Creek wastewater treatment plant via McDowell Creek. The study will attempt to identify potential sources of point and non-point pollution in McDowell Creek and McDowell Creek Cove from May through October 1993 and 1994.

4.4.5 Subbasin 34 - Catawba River (Catawba arm of Lake Wylie and Charlotte Area Watersheds)

Description

This subbasin is located in the inner Piedmont ecoregion and includes the city of Charlotte (Figure 4.22). The major tributary within this subbasin is Sugar Creek (262 square miles at Fort Mill, S.C.), but it also includes parts of Lake Wylie. This is the most heavily developed portion of the Catawba River basin, with urban, residential and agricultural land use.

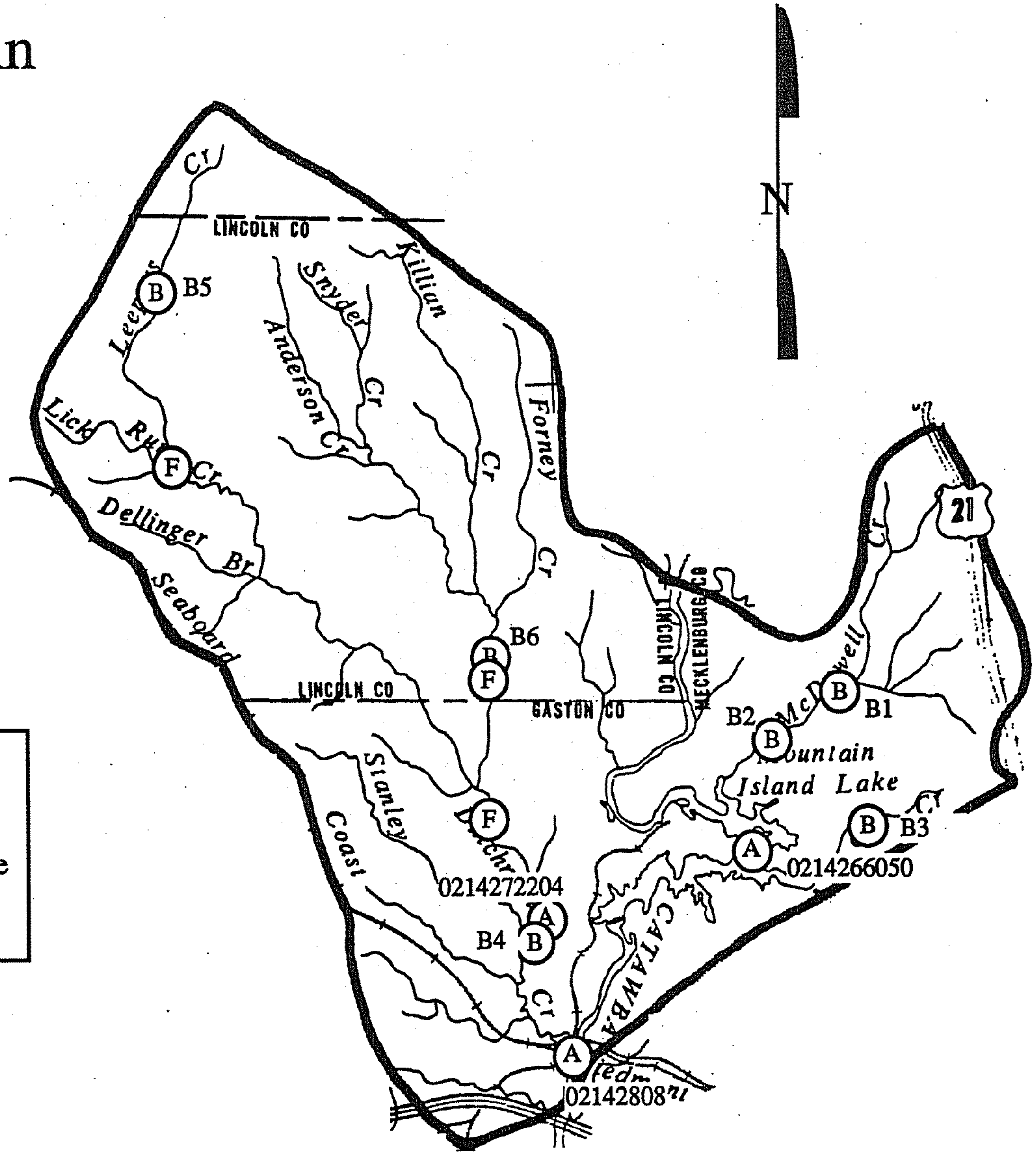
Overview of Water Quality

Historical data indicate that Sugar Creek was one of the most severely polluted streams in North Carolina. Fisheries collections in the 1960's and 1970's usually recorded "no fish" in Sugar Creek. Both urban runoff and several large wastewater treatment plants contributed to these problems. While this area is still characterized by Fair to Poor water quality, there have been significant improvements in water quality, especially between 1988 and 1992.

There are currently over 50 permitted dischargers in this subbasin and attempts to improve water quality have focused on wastewater treatment facilities. The three largest dischargers are the Charlotte/Mecklenburg Utilities Department (CMUD) wastewater plants, which are permitted to discharge about 70 million gallons/day into Sugar Creek and its tributaries. All CMUD wastewater plants have undergone upgrades during the last 5 years. Some success from these upgrades can be seen through self-monitoring effluent toxicity data, water chemistry from ambient sites, and DEM's collection of fish and benthic macroinvertebrates.

Summer benthic macroinvertebrate collections from Sugar Creek near Fort Mill (near the NC/SC border) should measure the effects of this reduction in toxicity, as well as integrating the effects of

Catawba River Basin
030833



Legend

- (A) Ambient Monitoring Station
- (B) Benthic Macroinvertebrate Site
- (F) Fish Community Site

Figure 4.21 Water Quality Monitoring Stations in Subbasin 03-08-33, Mt. Island Lake and Dutchman's Creek

Catawba River Basin
030834

Legend

- (A) Ambient Monitoring Station
- (B) Benthic Macroinvertebrate Site
- (F) Fish Community Site
- (T) Fish Tissue Site

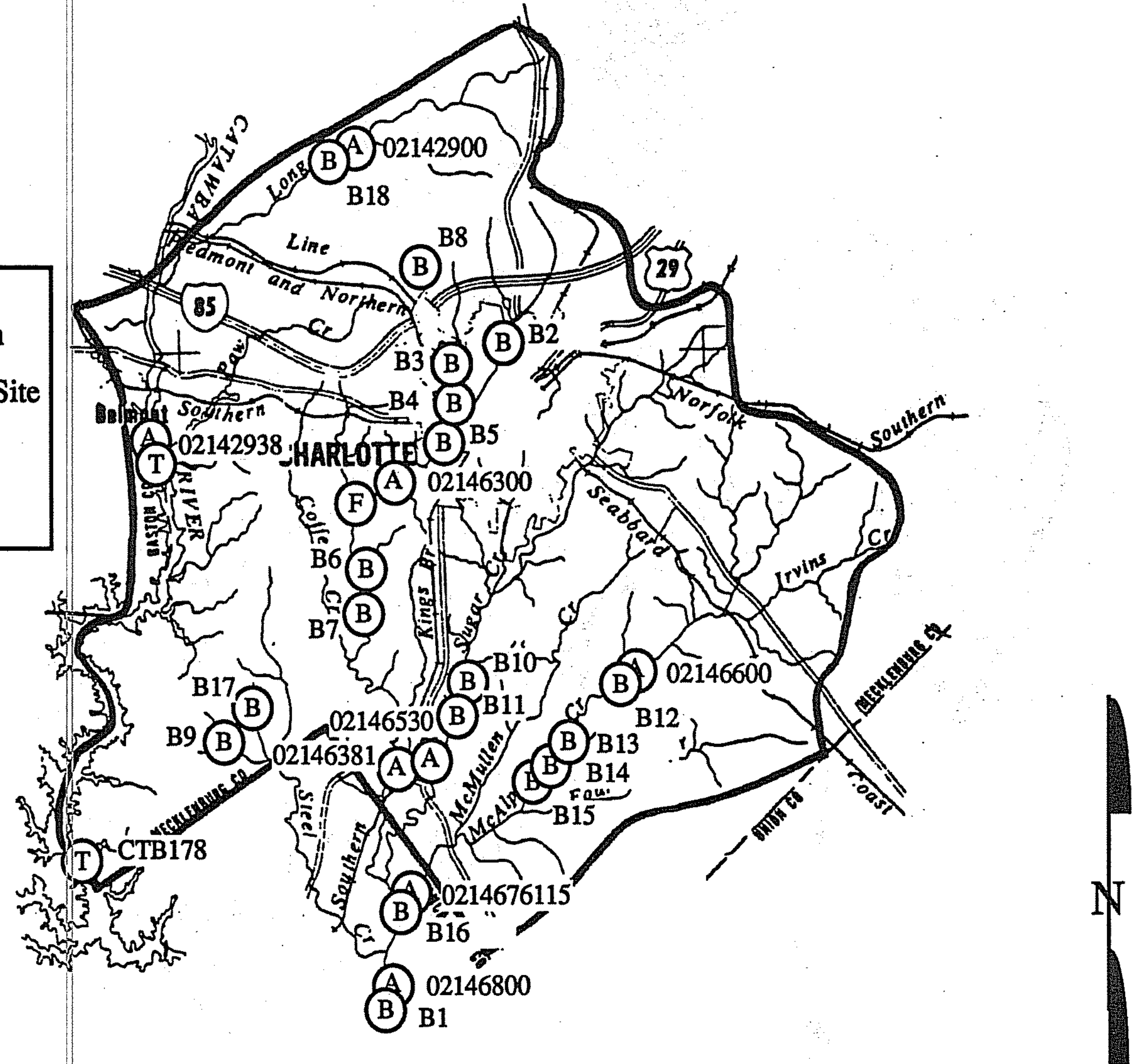


Figure 4.22 Water Quality Monitoring Stations in Subbasin 03-08-34, Sugar Creek (Charlotte Region)

other point and nonpoint-source problems. Benthos samples at this site consistently indicated a Poor rating between 1983 and 1988, but it improved to Fair in 1990/1991, and to Good-Fair in 1992. A site on lower McAlpine Creek also improved from Poor in 1987 to Fair in 1992. These changes were associated with decreased concentrations of copper, zinc and total phosphorus. Despite findings of occasional dissolved oxygen concentration measurements below state standards, as noted above in Section 4.3.2, overall dissolved oxygen concentrations have steadily increased in Sugar Creek at Fort Mill, averaging 6.1 mg/l in the 1970's, 6.9 mg/l in the 1980's and 7.7 mg/l from 1990-1992. Elevated fecal coliform concentrations in this area are of concern, again as noted in Section 4.3.2, although these concentrations are vastly improved since the 1970s.

Invertebrate samples at other locations indicated Fair or Poor ratings for other streams in the Sugar Creek catchment. Fair ratings are most likely to be found in the less developed headwater areas. Recent fisheries collections were limited to a single sample from the middle section of Sugar Creek (SR 1156). This fish collection produced a Poor rating with four species of fish, but this is probably an improvement over earlier "no fish" collections. Benthos samples from this site also produced a Poor rating in 1992.

Lake Wylie was the subject of a special study conducted jointly by the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR) and the South Carolina Department of Health and Environmental Control (SCDHEC) from April 1989 to September 1990 to identify nutrient loading patterns in the watershed, the assimilative capacity of the lake, and to identify control strategies to protect the lake as a water source for North and South Carolina. Lake Wylie is threatened by eutrophic conditions, especially in the embayments and tributary arms where algal blooms and fish kills have been observed. Nutrient loading in the lake has been linked to both point and nonpoint source loading, with high nutrient levels in several tributaries: South Fork Catawba River, Catawba Creek and Crowders Creek. The Catawba Creek arm of the lake consistently demonstrated eutrophic conditions, and both Catawba Creek and Crowders Creek demonstrated algal blooms, elevated nutrient concentrations, and violations of the North Carolina chlorophyll *a* water quality standard (greater than 40 µg/l in lakes). Modeling analysis results indicated that control of both point and non-point sources would be needed to reduce nutrient loading to the lake.

The designated uses of Lake Wylie are threatened within the embayments and tributary arms by eutrophic conditions which have led to algal blooms and fish kills. Because Lake Wylie serves as a water supply in both North and South Carolina and exhibits symptoms of water quality degradation, a joint study was conducted by DEM and the South Carolina Department of Health and Environmental Control (SCDHEC) (Water Quality Investigation of Lake Wylie, April 1989 - September 1990, DEM Report No. 92-04) to identify nutrient loading patterns in the watershed and the assimilative capacity of the lake. Control strategies to protect the water quality of the lake were also determined.

The South Fork Catawba River, Catawba Creek, and Crowders Creek were found to be major contributors of nutrients into Lake Wylie. The heavy sediment load of the South Fork Catawba River, which frequently visually appears as a mud line in the lake arm, carries large amounts of nutrients into the lake. The Catawba Creek arm of the lake consistently demonstrated eutrophic conditions, and both Catawba Creek and Crowders Creek demonstrated algal blooms, elevated nutrient concentrations, and violations of the North Carolina chlorophyll a water quality standard (greater than 40 µg/l in lakes). Modeling analysis results indicated that control of both point and non-point sources would be needed to reduce nutrient loading to the lake. Point source controls would require state-of-art nutrient removal technology improvements for new and existing discharges into the lake to meet limits of 1.0 mg/l total phosphorus and 6.0 mg/l monthly average year round. Non-point sources would be targeted through agricultural cost share funds for implementation of best management practices (BMPs), with the South Fork Catawba River watershed receiving the highest priority.

4.4.6 Subbasin 35 - Upper South Fork Catawba River

Description
This subbasin is located in the inner Piedmont ecoregion of the state and includes the South Fork Catawba River and its tributaries (Figure 4.23). Two of these tributaries, Jacob Fork and Henry Fork, drain sections of the South Mountains State Park. Other major tributaries include Clark Creek and Indian Creek. Land use in this subbasin is primarily agriculture and urban.

Overview of Water Quality
The upper reaches of Jacob Fork and Henry Fork have Excellent water quality and have been designated ORW. Jacob Fork and Henry Fork are classified using mountain ecoregion criteria, but they exhibit characteristics of both mountain and piedmont streams. The lower reaches of these streams generally have Good water quality. These areas of the streams receive nonpoint source runoff and effluent from permitted dischargers. The Hickory WWTP, on the lower end of Henry Fork, is the largest of the dischargers. The Hickory facility has been cited and fined for noncompliance with their whole effluent toxicity limit. Ambient water chemistry data for Henry Fork indicate higher nutrient levels and slightly lower DO levels below the WWTP outfall.

Bioclassifications for the South Fork Catawba River near Startown have been Good-Fair to Fair for the past few years. This site appears to be affected by upstream dischargers to varying degrees depending on stream flow. Nutrient levels here are below those for Henry Fork near Brookford, but higher than those recorded for Henry Fork near Henry River.

Point source dischargers seem to be a major problem in some of the Clark Creek watershed. However, there is a gradual downstream recovery and no negative effects of the water from Clark Creek entering the South Fork Catawba were found in 1984. Fish and macroinvertebrate data from Clark Creek near Lincolnton indicate a Fair rating.

Indian Creek flows into the South Fork Catawba River below Lincolnton. Long term macroinvertebrate data from SR 1252 indicate an improvement in water quality for the stream from Fair in 1983 to Good in 1992. Water chemistry data also indicate some improvement at this location with a slight decrease in nutrient levels. These improvements are believed to be due to better operation of the upstream Cherryville WWTP.

The only lake sampled in this subbasin is Lake Maiden, an impoundment of Maiden Creek, which is a tributary of Clark Creek. The lake is currently classified WS-II CA. Nutrient levels are moderate in the lake, and phytoplankton blooms were documented in 1990, but not in 1992.

Eleven facilities in this subbasin currently monitor effluent toxicity as per permit requirements. At least two others will be recommended for monitoring requirements in their next permit renewal. None of the facilities in this subbasin have obtained regulatory relief for toxicity limits through a special or judicial order.

POTENTIAL HQW/ORW STREAMS
Carpenter Creek received an Excellent bioclassification in 1984 and may qualify for HQW/ORW designation.

Catawba River Basin
030835

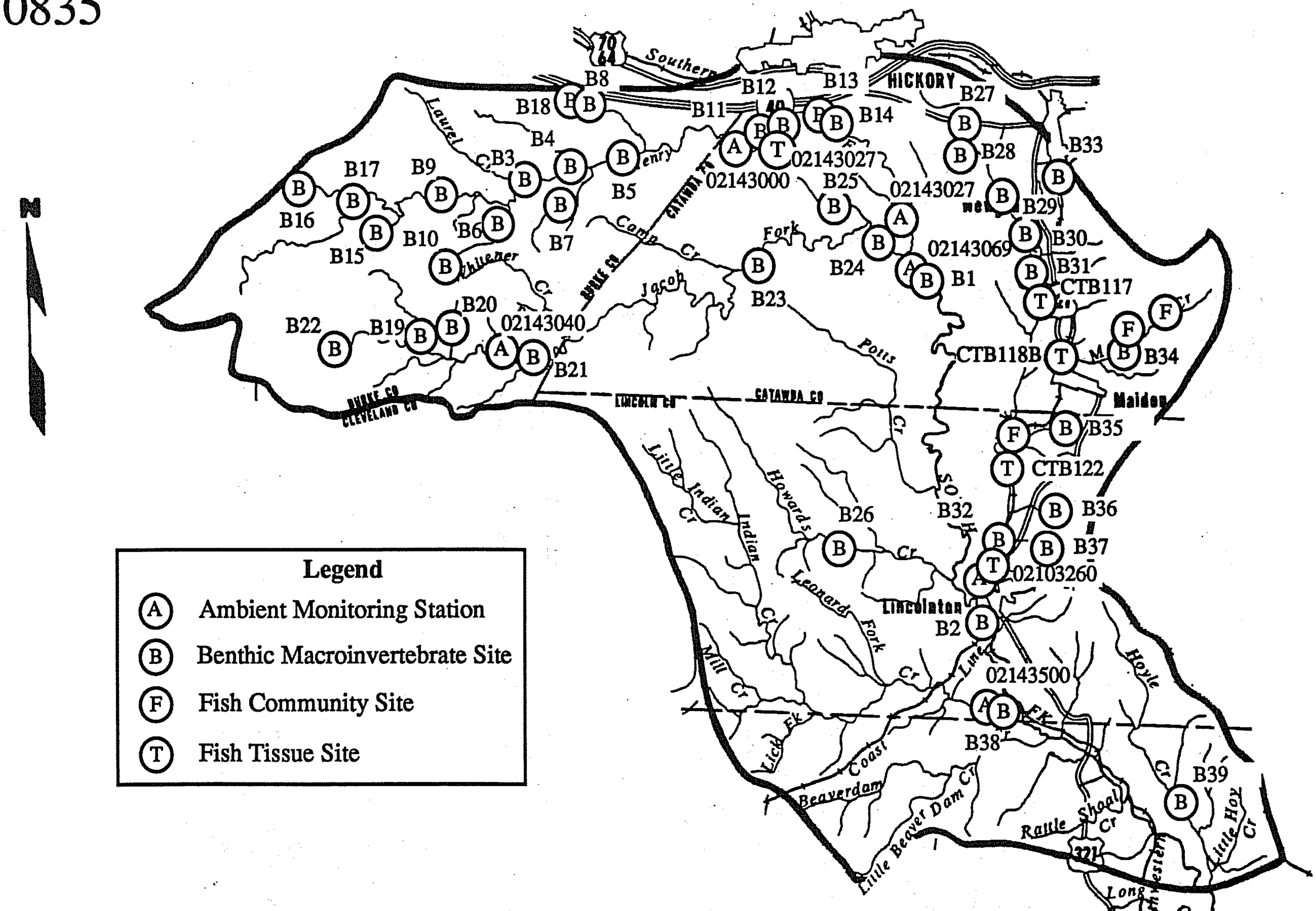


Figure 4.23 Water Quality Monitoring Stations in Subbasin 03-08-35 (Upper South Fork Catawba)

4.4.7 Subbasin 36 - Lower South Fork Catawba River

DESCRIPTION
Catawba subbasin 36 is located in the Piedmont ecoregion, and includes Gastonia and parts of Bessemer City (Figure 4.24). This small subbasin includes Long Creek and the lower portion of the South Fork Catawba River. Most streams are very sandy due to erosion problems throughout the area.

OVERVIEW OF WATER QUALITY
There are many dischargers in this highly industrialized area, and most are located near the South Fork Catawba River. Long Creek is primarily affected by agricultural runoff and attempts are being made to control erosion in the Long Creek catchment. Fecal coliform counts in the Long Creek catchment have exceeded North Carolina criteria in eighteen out of twenty observations between 1991 and 1993. Long Creek near Bessemer City was given a Good-Fair bioclassification based on benthos data between 1984 and 1992. Fish community sampling occurred in 1993 and indicated a NCIBI rating of Poor-Fair. The lower fish rating suggests sediment problems in Long Creek. Long Creek below the Gastonia WWTP received a Fair bioclassification in 1990, based on benthos data.

The South Fork Catawba River has shown improved water quality according to benthos data. Benthos samples collected near McAdenville resulted in bioclassifications changing from Poor to Good-Fair between 1983 and 1992. Fish tissue samples collected in the South Fork of the Catawba near Cramerton showed dieldrin, DDE, and heptachlor epoxide exceeding EPA screening values. Fish tissue metals samples collected near Belmont from 1984 to 1986 showed no exceedances in FDA or EPA criteria. Bessemer City Lake was the only lake sampled within this subbasin and results have indicated good water quality. Bessemer City Lake is currently classified as WS-II CA.

4.4.8 Subbasin 37 - Crowders and Catawba Creeks

Description
Catawba subbasin 37 is the smallest in the basin (Figure 4.25). It is located in the Piedmont ecoregion, and includes portions of Bessemer City and Gastonia. Crowders Creek and Catawba Creek are the principle streams. This heavily developed area includes many permitted dischargers.

Overview of Water Quality
Catawba Creek is severely affected by the Gastonia WWTP (Poor bioclassification), with no improvement seen between surveys in 1985 and 1990. Phosphorous concentrations in Catawba Creek were sufficient enough to cause blooms in Lake Wylie and any increase in nitrogen in this drainage will lead to higher algal growth according to Algal Growth Potential Tests (AGPT).

Dischargers in the Crowders Creek drainage cause Poor or Fair ratings in McGill Creek, Abernathy Creek, several unnamed tributaries, and Crowders Creek itself. Because of the many dischargers, it is often difficult to examine the effects of individual dischargers. Lower Crowders Creek improved from Poor in 1988 (after a spill) to Fair in 1989, based on benthos data.

Catawba River Basin
030836

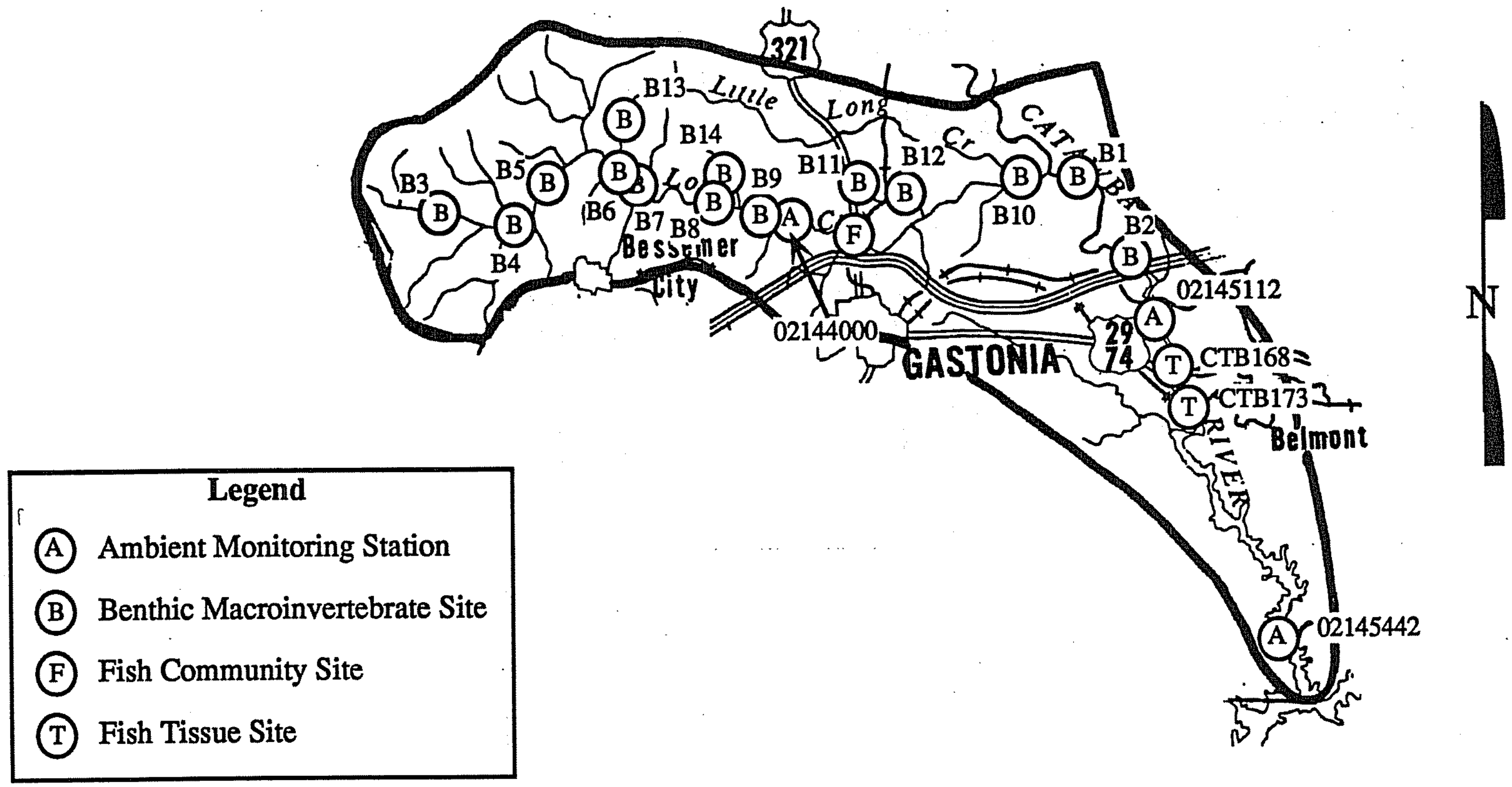


Figure 4.24 Water Quality Monitoring Stations in Subbasin 03-08-36 (Lower South Fork Catawba and Long Creek)

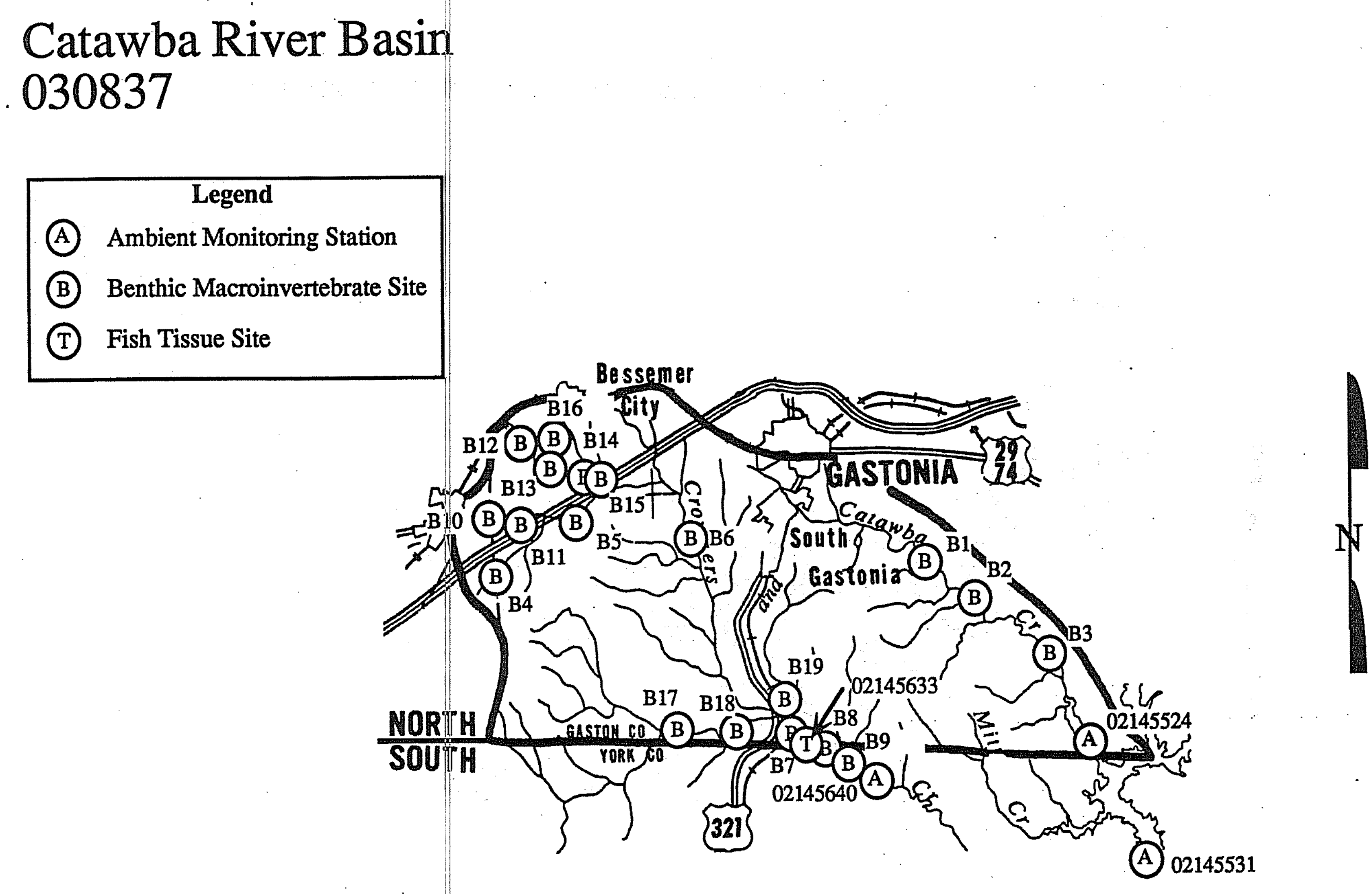


Figure 4.25 Water Quality Monitoring Stations in Subbasin 03-08-37 (Crowders and Catawba Creeks)

4.4.9 Subbasin 38 - Waxhaw Creek

Description

Catawba subbasin 38 is located in the Piedmont ecoregion of North Carolina, and includes portions of two geologic regions: the Charlotte Belt and the Carolina Slate Belt (Figure 4.26). This small subbasin includes Sixmile Creek, Waxhaw Creek, and Twelvemile Creek. These streams have very low flows during summer drought periods.

Overview of Water Quality

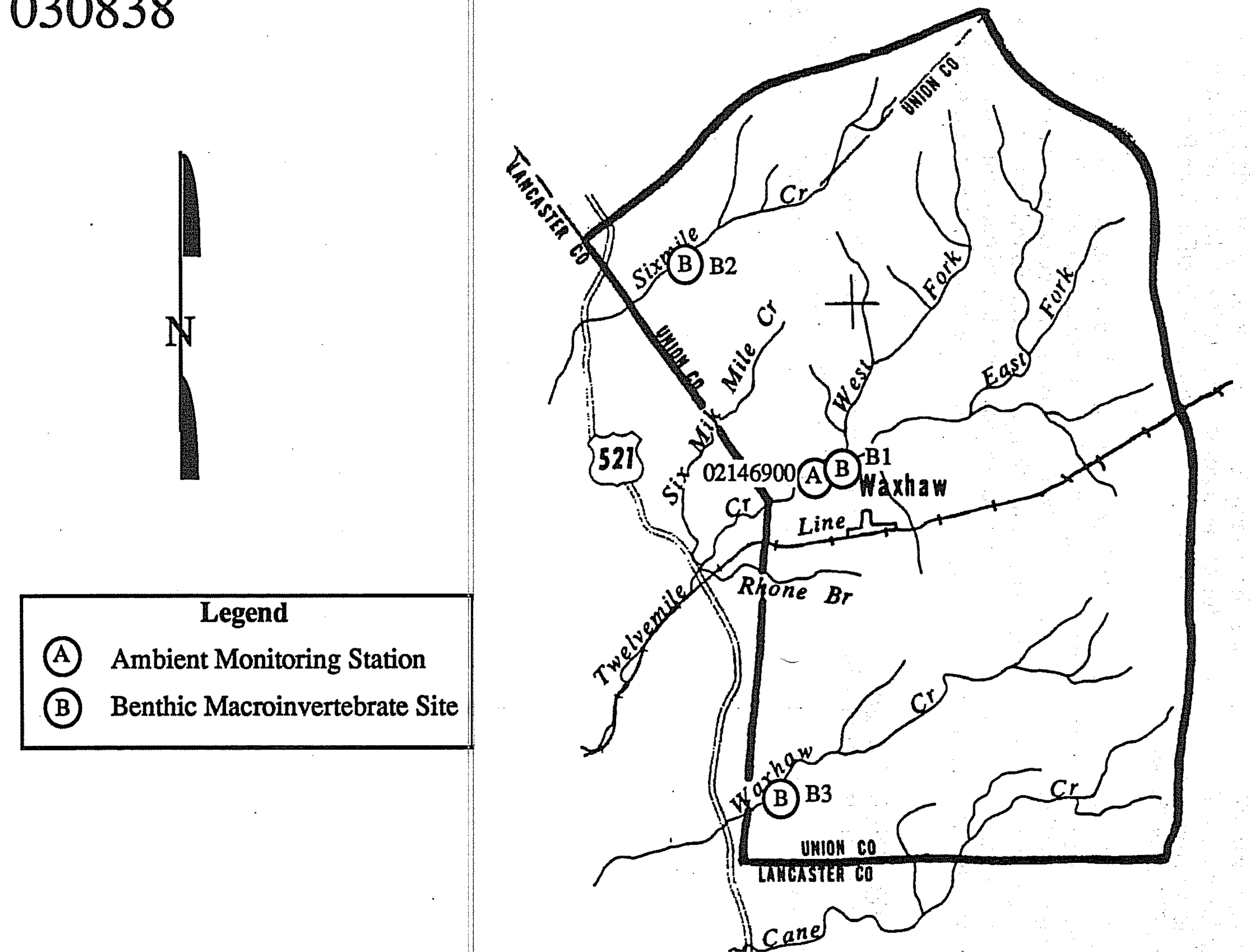
Nonpoint source runoff (agriculture) is the principle source of water quality degradation in this subbasin, although low flow conditions during the summer also limit the diversity of stream fauna. Three benthic macroinvertebrate sites have indicated Good-Fair bioclassifications for Twelvemile, Sixmile and Waxhaw Creeks.

Water chemistry data was collected on both Twelvemile Creek and Waxhaw Creek. Values for fecal coliforms were exceeded six times or in 30% of the samples collected from Twelvemile Creek. Turbidity violations in Twelvemile and Waxhaw Creeks were detected in nine and 31% of the samples, respectively. Elevated levels of total phosphorus were found in both creeks, most likely because of non-point source contributions. Both creeks contained concentrations of copper and iron greater than the action levels, although these elements are naturally occurring in piedmont soils.

Potential HQW/ORW Streams

Although streams in this subbasin support some unusual mussels, DEM sampling has not identified any ORW/HQW sites. Waxhaw Creek has been suggested as critical habitat for the Carolina Heelsplitter (Lasmigona decorata), a federally and state-listed endangered mussel species.

Catawba River Basin
030838



Legend

- (A) Ambient Monitoring Station
- (B) Benthic Macroinvertebrate Site

Figure 4.26 Water Quality Monitoring Stations in Subbasin 03-08-37, Waxhaw Creek (Union County region)

4.5 USE-SUPPORT: DEFINITIONS AND METHODOLOGY

4.5.1 Introduction to Use Support

Determining the *use support* status of a waterbody, that is how well a waterbody supports its designated uses, is another important method of interpreting water quality data and assessing water quality. Use support assessments are presented in Section 4.6 using figures, tables and maps for freshwater streams and lakes within the Catawba River Basin. The methodology used in determining use support is presented in Appendix IV.

Surface waters (e.g. streams, lakes and impoundments) are rated as either *fully supporting* (S), *support-threatened* (ST), *partially supporting* (PS), or *nonsupporting* (NS). The terms refer to whether the classified uses of the water (such as water supply, aquatic life protection and swimming) are being fully supported, partially supported or are not supported based on assessment of water quality. The support-threatened category for freshwater rivers and streams refers to those waters classified as Good-Fair based on water quality data, in contrast to Excellent or Good which are considered fully supporting. An overall support rating, however, does include both fully supporting and support-threatened waters. Streams which had no data to determine their use support were listed as non-evaluated (NE).

For the purposes of this document, the term *impaired* refers to waters that are rated either partially supporting or not supporting their uses based on specific criteria discussed more fully below. There must be a specified degree of degradation before a stream is considered impaired. This differs from the word impacted, which can refer to any noticeable or measurable change in water quality, good or bad.

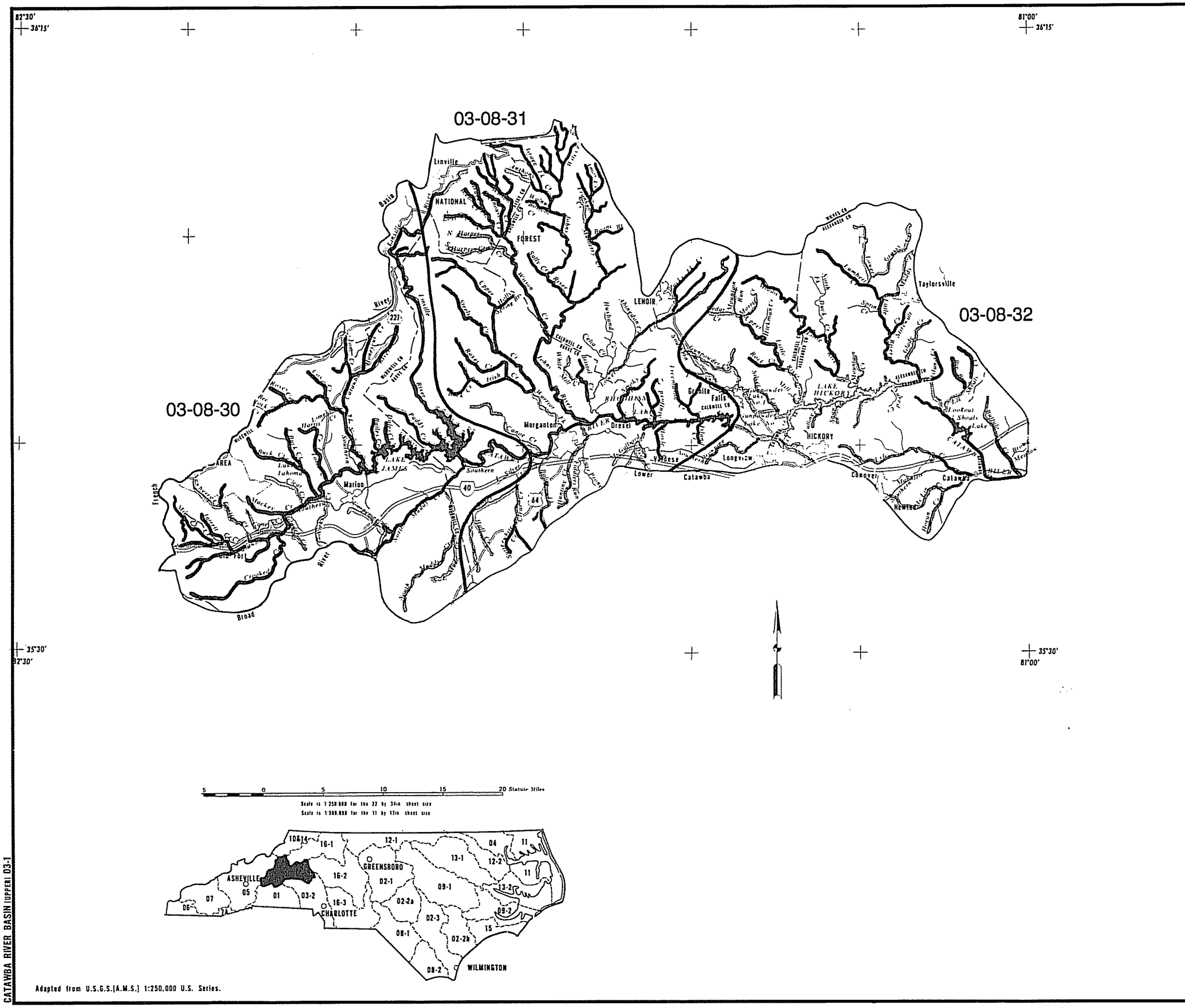
4.6 USE SUPPORT RATINGS FOR THE CATAWBA BASIN

Use support ratings and background information for all monitored stream segments are presented in Table 4.3. Ratings for all monitored and evaluated surface waters are presented on color coded maps in Figures 4.27 and 4.28.

4.6.1 Freshwater Streams and Rivers

Of the 3042 miles of freshwater streams and rivers in the Catawba basin, use support ratings were determined for 90% or 2737 miles with the following breakdown: 52% were rated fully supporting, 22% support-threatened, 12% partially supporting, four percent not supporting, and 10% nonevaluated. Table 4.4 and Figure 4.29 present the use support determinations by subbasin. In general, subbasins 30, 31, 32, 33, 35 and 36 had a majority of their streams which were either supporting or support-threatened. While subbasins 34, 37 and 38 had a larger percentage of streams which were partially supporting or not supporting.

Probable causes and sources of impairment were determined for about 90% of the impaired streams with the information summarized in Table 4.5 and 4.6. When a stream segment had more than one cause or source listed, the total stream segment information was added to each cause or source. This means that the miles of stream impaired by the combination of all sources or all causes may be more than the total miles of partially and not supporting streams presented in Table 4.5 Where the sources of impairment could not be identified, no mileage for that segment was entered into the table. Sediment was the most widespread cause of impairment, followed by fecal coliform bacteria, turbidity, and metals.

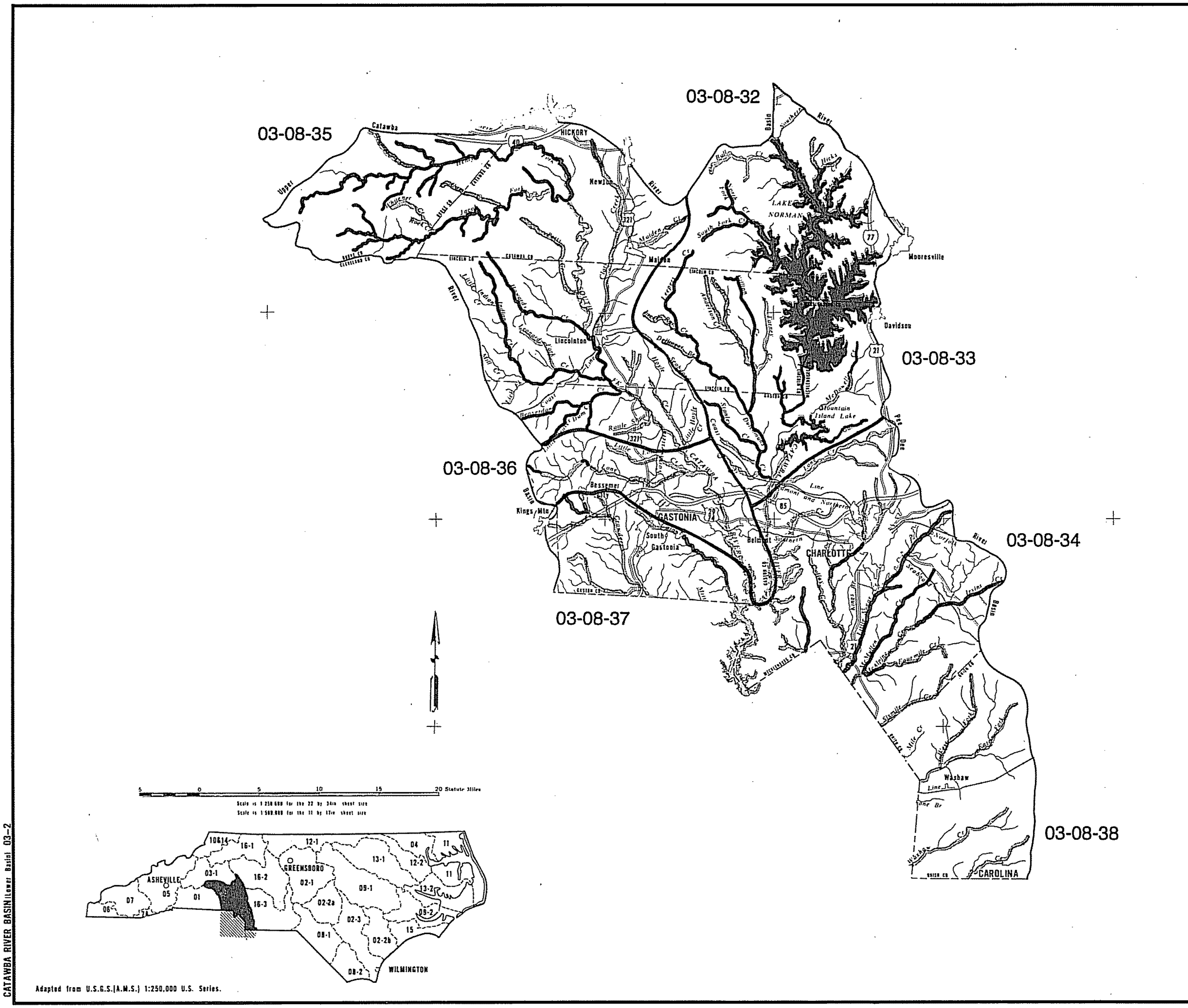


Catawba River Basin #1

Figure 4.27 Use Support Map for the Upper Catawba River Basin

N.C. Department of Environmental, Health, and Natural Resources

Division of Environmental Management Water Quality Section



Catawba River Basin #2

Figure 4.28 Use Support Map for the Lower Catawba River Basin

N.C. Department of Environmental, Health, and Natural Resources

Division of Environmental Management Water Quality Section

Table 4.3 Monitored Stream Segments in the Catawba River Basin (1988-1992) (1 of 3)

Station Number	Station Location	WQ Class.	Index No.	Miles	Chem Rating 89-93	Biological Rating 88	89	90	91	92	Problem Param.	Overall Rating	Source
SUBBASIN 30													
0213649985	Catawba River at SR-1273	C Tr	11-(1)	7.5	S							S	
	Mill Cr at Graphite ab RR bridge, McDowell	C Tr	.	8.2						E		S	
0213734850	Catawba Rv at 1234	C	11-(8)b	1.0	S			G		E		S	
02137513	Catawba R at I-40 near Old Fort, McDowell Co	C	11-(8)c	1.3	NS						Hg(30)	NS	
02137727	Catawba River near Pleasant Gardens, SR-122	C	11-(8)d	13.7	PS	G-F		E		G	Fecal(14.3)	S	P
	Catawba Cr be Newberry Cr, McDowell	C Tr	11-10a	5.0						G		S	
	Crooked Cr, SR 1135, McDowell	C	11-12	15.6						G		S	NP
	Mackey Cr, SR 1453, Mcdowell	C HQW	11-15-(2)	0.3						E		S	NP,P
	Buck CrNC 80, ab Lake Tahoma McDowell	WS-II B Tr	11-19-(1)a	5.4						G		S	
	Little Buck Creek SR 1436McDowell Co.	WS-II B Tr	11-19-11	3.8					E	E		S	
	Toms Cr, SR 1434 McDowell Co.	C	11-21-(2)	5.5						E		S	P
	North Fork Catawba River at Linville Caverns	C Tr	11-24-(1)a	3.5					G			S	NP
	North Fork Catawba at NC 221, McDowell Co	C Tr	11-24-(1)b	3.3					G			S	
	North Fork Catawba at SR-1573, McDowell Co	C Tr	11-24-(1)c	5.4					G			S	
	North Fork Catawba at SR-1560, McDowell Co	C Tr	11-24-(1)d	3.0					E	E		S	
	Laurel Branch at NC 221, McDowell	C Tr	11-24-3	2.3					G			S	NP
	Pond Branch at SR-1560, McDowell Co.	C Tr	11-24-4	2.3					G			S	NP
	Stillhouse Br, SR 1560, McDowell	C Tr	11-24-6	2.2					G			S	NP
	Honeycutt Creek at SR 1568 McDowell	C Tr	11-24-8	4.7					G			S	
	Pepper Creek at NC 221	C Tr	11-24-10	3.9					G			S	NP
02138133	N. Fk Cataw SR 1552 nr Hankins, McDowell	C	11-24-(13)	6.6	S							S	NP
	Armstrong Cr, end of FS Rd, McDowell	WS-II Tr	11-24-14-(1.	8.7						E		S	
	Linville River nr Brier Knob	C Tr	11-29-(1)a	3.7			G-F					ST	NP
	Linville River NC 221, Avery Co.	C Tr	11-29-(1)b	34.6			G-F			G		S	NP,P
	W. Fork Linville River at SR-1349, Avery Co.	C Tr	11-29-4	3.6			G					S	
	Granmother Creek at SR,1511 Avery	B Tr	11-29-5-(1)	4.0			G					S	
02138500	Linville River near Nebo, NC Hwy 126	WS-V B H	11-29-(23)	0.7	S		E	E	E	E		S	NP
02139036	Catawba River near Glen Alpine, SR-1147	WS-IV	11-(31)	10.8	S	G						S	
	Coperning Creek at SR-1819	C	11-32-1-4a	4.2				F				PS	NP
	Coperning Creek at SR-1794	C	11-32-1-4b	0.5				P				NS	NP
	North Muddy Creek at SR-1750	WS-IV	11-32-1-(10.	2.2						G		S	NP
0213875850	High Shoals Creek at Dysartsville	C	11-32-2-6	2.6	NS						Hg(27.3)	NS	
	S Muddy Cr, SR 1764 McDowell	WS-IV	11-32-2-(8.5	4.8						G-F	Sed	ST	NP
SUBBASIN 31													
	Catawba R, NC 181 Burke	WS-IV	11-(32.7)	3.8						G		S	
	Canoe Cr SR 1250, Burke	WS-IV	11-33-(2)	5.3						G-F	Sed	ST	NP
	Silver Cr SR 1149, Burke	C	11-34-(0.5)	13.7						G-F	Sed	ST	NP
	Clear Cr., ab Hospital Res., Burke Co.	C HQW	11-34-6-(1)	2.0					G		Sed	S	NP
	Bailey Fk, SR 1102, Burke	WS-IV	11-34-8-(3)	2.0						G-F	Sed	ST	NP
	Upper Creek at NC 181, Burke Co.	WS-III Tr C	11-35-2-(1)a	1.5		E						S	NP
	Upper Cr at Grntn Jeep Tr., Burke Co.	WS-III Tr C	11-35-2-(1)b	8.1		G	G					S	
	Timbered Branch at USFS Rd 928, Burke Co.	WS-III Tr H	11-35-2-9	2.3		G-F						ST	
	Upper Creek Ab Optimists Park, Burke Co.	WS-III B T	11-35-2-(10)	3.9		E						S	NP
	Steels Cr, Little Frk USFS Rd 128	WS-III Tr C	11-35-2-12-(	5.8		E		E				S	
	Gingercake Creek at USFS Rd 496, Burke Co.	WS-III Tr C	11-35-2-12-3	2.5		E		E				S	
	Buck Creek at USFS Rd.	WS-III Tr C	11-35-2-12-4	2.3				E				S	
	Steels Creek Above NC 181, Burke Co.	WS-III B T	11-35-2-12-(	2.8		G		E				S	
	Little Fork at USFS Rd 128, Burke Co	WS-III Tr C	11-35-2-12-6	3.1		E						S	

Table 4.3 Monitored Stream Segments in the Catawba River Basin (1988-1992) (2 of 3)

Station Number	Station Location	WQ Class.	Index No.	Miles	Chem Rating 89-93	Biological Rating 88	89	90	91	92	Problem Param.	Overall Rating	Source
	Upper Creek at SR-1407,	WS-III B T	11-35-2-(13)	1.6		G						S	
	Upper Creek at SR 1439	WS-III B T	11-35-2-(13)	3.9		G						S	
	Johns River at SR -1367, Caldwell	B	11-38-(9)	10.2			G			E		S	NP
	Anthony Cr, Avery/Caldwell Co.,ab Gragg	C Tr	11-38-10-3a	1.8			G-F					ST	NP
	Anthony Creek, SR 1362, Caldwell	C Tr	11-38-10-3b	2.8			G					S	NP
	Johns River, SR 1356 Caldwell Co	C	11-38-(28)	22.3			G			E		S	NP
	Mulberry Cr, SR 1368, Caldwell	B HQW	11-38-32-(1	2.4			E					S	
	Mulberry Cr, SR 1310, Caldwell	C	11-38-32-(1	5.3			G					S	
02140304	Wilson Cr nr Gragg, US 221, Avery	B Tr ORW	11-38-34a	0.6	PS	E		E			pH(25)	S	
0214031250	Wilson Cr at SR1358, Edgemont, NC, Cald.	B Tr ORW	11-38-34b	22.5	PS		E		E		pH(20)	S	
0214042720	N. Harper Cr near Kawana, USFS #58	C Tr ORW	11-38-34-14	6.1	PS						Hg(20)	PS	
	Johns River at SR-1438,Burke Co.	C HQW	11-38-(34.5)	4.8			E					S	
02141245	Lower Creek near Morganton, SR-1501	WS-IV	11-39-(6.5)	6.6	NS			F		F	Fecal, Sed	PS	NP,P
	Smokey Cr, SR 1515 Burke Co	WS-IV	11-41-(1)	7.4						G	Sed	S	NP
	McGilliard Cr, Church St, Burke Co	WS-IV	11-44-(0.5)	4.3						G-F	Sed	ST	NP
SUBBASIN 32													
	Upper Little R, SR 1744, Caldwell	WS-IV	11-58-(5.5)	7.9						G		S	NP
	Middle Little R, SR 1153, Alexander	C	11-62	21.5						G		S	
	Duck Cr, NC 127, Alexander	C	11-62-2-(4)	4.6						G-F	Sed	ST	NP
02142000	Lower Little R at Sr1313 nr All Healing Sprgs	C	11-69a	8.2	NS	G-F					Fecal,Sed	ST	NP
	Lower Little River at Sr-1131	C	11-69b	15.8						G	Sed	S	NP
	Muddy Fk, ab Schneider Milss Alexander	C	11-69-4a	5.5						G-F	Sed	ST	NP
	Muddy Fk, be Schn. Mills, NC 16, Alexander	C	11-69-4b	1.6						F	Sed	PS	NP,P
	Elk Shoal Cr, SR 1605, Alexander	WS-IV	11-73-(1.5)	4.8						G-F	Sed	ST	NP
	Lyle Cr, NC 64/70, Catawba Co	WS-IV	11-76-(3.5)	6.4						G	Sed	S	NP
0214253830	Norwood Creek near East Monbo, SR-1328	WS-IV CA	11-82-(3)	0.6	S						Sed	S	NP
SUBBASIN 33													
	McDowell Creek at SR-2136, Mecklenburg	WS-IV	11-115-(1.5)	5.0				F			Sed	PS	
	McDowell Creek at SR-2128, Mecklenburg	WS-IV	11-115-(1.5)	3.0				G-F			Sed	ST	
	Gar Cr, SR 2074, Mecklenburg	WS-IV	11-116-(1)	3.5						G		S	
02142808	Catawba R, Near Thrift/NC-27,Meck.	WS-IV CA	11-(117)	5.9	S							S	
0214272204	Dutchmans Cr at Mt. Island, SR-1918	WS-IV	11-119-(0.5)	7.2	PS	E				E	Turb,Fecal	S	NP
	Killian Cr, SR 1511, Lincoln Co	C	11-119-2-(0.	14.7						E		S	NP,P
SUBBASIN 34													
02142900	Long Creek near Paw Creek, SR-2042	WS-IV	11-120-(2.5)	8.4	PS		G-F				Fecal,Turb	ST	
	Sugar Cr bel. WWTP, SR 1156, Meck.	C	11-137a	0.2						P	Sed	NS	NP
02146381	Sugar Creek at NC HWY 51 at Pineville, NC	C	11-137b	11.9	PS						Fecal, Sed	PS	NP, P
02146800	Sugar Creek near Fort Mill, SC Hwy 160	C	11-137c	8.8	NS	P		F	F	G-F	Fecal,Turb,Se	ST	NP
	Irwin Cr at NC 21/SR 2523, Meck.	C	11-137-1a	7.3				G-F				ST	NP,P
02146300	Irwin Cr nr Charlotte & ab WWTP, Meck.	C	11-137-1b	4.5	NS					P	Fecal,Turb(1	NS	NP
	Stewart Creek at SR 2050, Mecklenburg	C	11-137-1-2	0.6				F				PS	NP
	McCullough Br at NC 51, Mecklenburg Co.	C	11-137-7	2.6				P				NS	P
02146530	Little Sugar Creek at Pineville, US Hwy 51	C	11-137-8b	4.6	NS					P	Fecal,NH3,Se	NS	NP
02146600	McAlpine Creek at SR 3356	C	11-137-9a	8.3	NS						Fecal,Turb,Se	NS	NP
02146750	McAlpine Creekat NC 51, Meck	C	11-137-9b	6.3	S					F	Sed	PS	NP
0214676115	McAlpine Cr at Dorman Rd, SC (SR 2964)	C	11-137-9d	1.1	NS					F	Fecal,NH3,Se	PS	NP
	Walker Branch at NC 49, Mecklenburg Co.	C	11-137-10-1	3.2				G-F				ST	
SUBBASIN 35													
02143069	S Fork Cataw R near Startown, NC Hwy 10	WS-IV	11-129-(0.5)	16.5	NS	G-F		F		G-F	Fecal, Turb, S	ST	NP

Table 4.3 Monitored Stream Segments in the Catawba River Basin (1988-1992) (3 of 3)

Station Number	Station Location	WQ Class.	Index No.	Miles	Chem Rating 89-93	Biological Rating 88	89	90	91	92	Problem Param.	Overall Rating	Source
	Henry Fork, be He Cr, and SR 1922	C ORW	11-129-1-(2)	7.2		E						S	NP
	He Cr, source to Morganton Water Supply	WS-I ORW	11-129-1-4-(	2.6		E						S	NP
	Ivy Creek, source to Henry Fork,SR-1919	C Tr +	11-129-1-6	2.1		G						S	NP
	Long Branch at SR-1917	C ORW	11-129-1-8	3.6		E						S	NP
	Rock Creek SR 1915, Burke	C +	11-129-1-12	4.8		G						S	NP
	Henry Fork , NC 18 Burke Co	C	11-129-1-(2)	14.7		E						S	
02143000	Henry Fk nr Henry R, SR-1124, Catawba Co	C	11-129-1-(12	10.2	PS		G			G	Fecal(19)	S	
02143027	Henry Fk, SR1143 nr Brookford, Cataw Co	C	11-129-1-(12	8.0	NS						Fecal,Turb	NS	NP
	Jacob Fork at SR1904 Burke and In Park	WS-III Tr O	11-129-2-(1)	7.8				E				S	
	Shinny Creek at In Park, Burke Co.	WS-III Tr O	11-129-2-3	3.5				E				S	NP
02143040	Jacob fork at Sr 1924 at Ramsey, NC	WS-III ORV	11-129-2-(4)	6.6	S			E		E		S	
	Howard Cr SR 1200 Lincoln Co	WS-IV	11-129-4	13.3						G		S	NP
	Clark Cr SR 1149 Catawba	C	11-129-5-(0.	2.7						G-F		ST	NP
	Clark Creek at SR-2014, Catawba Co.	C	11-129-5-(0.	3.6				F				PS	NP
	Clark Creek at SR-2012, Catawba Co.	WS-IV	11-129-5-(4.	1.0				F				PS	NP
02143260	Clark Creek at Lincolnton, at Grove Street	WS-IV	11-129-5-(4.	5.5	NS	F				F	Cu,Turb,Fecal	PS	NP, P
02143500	Indian Creek near Laboratory, SR-1252	WS-IV	11-129-8-(5)	8.4	NS			G-F		G	Fecal,Turb, S	S	P
SUBBASIN 36													
02145112	S Fork Catawba River at McAdenville, NC 7	WS-V	11-129-(15.5	9.3	NS		G-F			G-F	Fecal,Turb	ST	NP
	Long Creek at SR-1408, Gaston Co.	WS-II CA	11-129-16-(2	0.7						G		S	NP
	Long Creek at SR-1405, Gaston Co.	WS-II CA	11-129-16-(2	1.1					G	G-F		ST	NP
	Long Creek at NC 274, Gaston Co.	C	11-129-16-(4	0.4					G-F	G-F		ST	
	Long Creek at SR-1446, Gaston Co.	C	11-129-16-(4	2.8					Goo	G-F		ST	
	Long Creek at SR-1448, Gaston Co.	C	11-129-16-(4	0.5					G	G		S	
02144000	Long Crk Near Bessemer City, NC 1456	C	11-129-16-(4	2.7	NS			G-F			Fecal(90)	ST	
	Long Cr at NC 275	C	11-129-16-(4	0.7					G-F	G-F		ST	
	Long Cr bel WWTP & at SR2003, Gaston	C	11-129-16-(4	7.7				F				PS	NP,P
	Dalls Br, ab Dallas WWTP, Gaston	C	11-129-16-7a	1.1						G-F		ST	NP
	Dallas BR, be Dallas WWTP, SR 2275, Gaston	C	11-129-16-7b	0.8						F		PS	NP
SUBBASIN 37													
	Catawba Creek at SR-2446	C	11-130a	6.1				F			Sed	PS	NP
	Catawba Creek at SR-2439	C	11-130b	2.9				P				NS	NP,P
02145640	Crowders Cr, Bowling Grn, SC <SR2424	C	11-135g	7.2	NS	P	F			G-F	Fecal, Sed	ST	NP
	Crowders Creek at SR-1118, Gaston Co.	C	11-135a	1.8			G-F					ST	NP
	Crowders Creek at SR-1125, Gaston Co.	C	11-135b	1.7			F					PS	NP
	Crowders Creek at SR-1131, Gaston Co.	C	11-135c	4.5			F					PS	NP
	Crowders Creek atNC 321, Gaston Co.	C	11-135e	1.4			F					PS	NP
	Crowders Creek at SR 2424	C	11-135f	1.4			F					PS	P
	McGill Creek above and below WWTP	C	11-135-2	2.4			P					NS	
	Abernathy Cr above Lithium Corp disch	C	11-135-4a	2.2			F					PS	NP
	Abernathy Cr bel Lithium Corp disch	C	11-135-4b	2.2			P					NS	P
	UT to Crowders Creek at SR-2416	C	11-135-8.5	0.4			F					PS	
	S Fk Crowders Cr at SR-1109, Gaston	C	11-135-10-1	4.5			G-F					ST	
SUBBASIN 38													
02146900	Twelvemile Cr nr Waxhaw, NC Hwy 16	C	11-138a	2.8	NS		G-F	G-F			Fecal(30)	ST	NP
	Sixmile Cr,m SR 3445, Mecklenburg	C	11-138-3	9.2							Sed	PS	NP, P
02147126	Waxhaw Creek near Jackson, SR-1103	C	11-139	16.0	NS					G-F	Turb,Cu	ST	NP

Table 4.4 Use Support Ratings for Freshwater Streams by Subbasin

USE SUPPORT STATUS FOR FRESHWATER STREAMS (MILES) (1988-1992)						
Subbasin	S	ST	PS	NS	NE	Total Miles
30830	535.5	65.6	25.1	4.4	18.9	649.5
30831	481.2	79.9	68.8	0.6	54.9	685.4
30832	179.4	188.5	69.3	14.6	32.1	483.9
30833	106.5	21.3	21.7	0	17.9	167.4
30834	0	107.6	39.7	78.3	31.9	257.5
30835	254.1	104.5	70.3	12.1	55.3	496.3
30836	8.3	52.6	8.5	0	0	69.4
30837	0	24.2	21.9	14	21.3	81.4
30838	0	36.3	42.4	0	72.5	151.2
TOTAL	1565	680.5	367.7	124	304.8	3042
PERCENTAGE	52	22	12	4	10	

Freshwater Use Support (1988-1992)

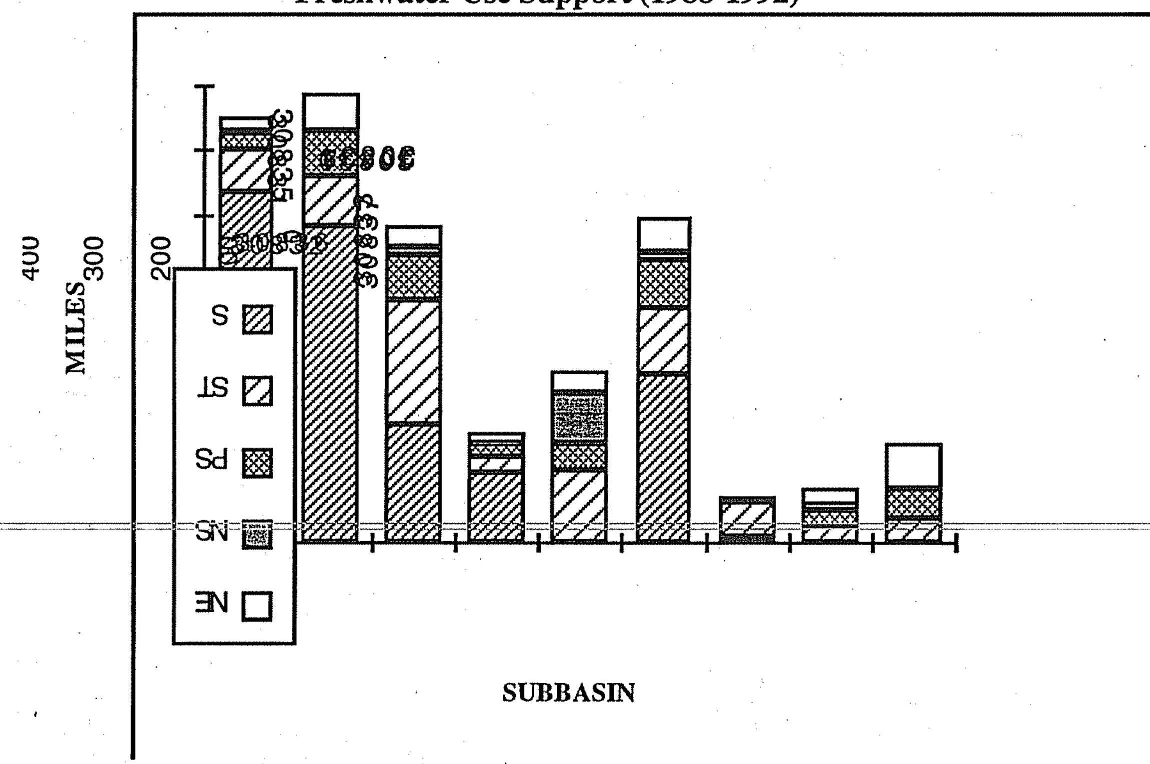


Figure 4.29 Bar Graph Showing Freshwater Use Support Distribution by Subbasin

Table 4.5 Sources of Use Support Impairment in Freshwaters of the Catawba Basin

PROBABLE SOURCES OF USE SUPPORT IMPAIRMENT (MILES)										
Subbasin	Non-Point Source	Point Source	Agriculture	Forestry	Constr.	Urban	Mining	Land Disposal	Unknown	Other
30830	21.7	0	6.1	0	0	4.2	0	0	11.4	0
30831	61.2	6.6	55	17.9	33.6	11.7	0	11.1	0	17.9
30832	71.8	18	63.2	0	8.4	4.2	0	4.2	4.4	0
30833	16.7	0	16.7	0	0	0	0	0	0	0
30834	114.8	11.9	6	0	73.1	64.4	0	10.8	0	8.8
30835	76.7	20.7	73.9	15.8	0	11.9	0	12.1	34.2	0
30836	8.5	7.7	8.5	0	0	0.8	0	0	0	0
30837	27.5	4.3	0	0	0	14	0	13.5	0	0
30838	42.4	9.2	15.4	0	22.4	0	13.8	0	0	0
Total Miles	441.3	78.4	244.8	33.7	137.5	111.2	13.8	51.7	50	26.7
% of PS and NS	90	16	50	7	28	23	3	11	10	5

* **Total Miles** = miles of impaired streams where a probable source has been identified.
** **PS** = Partially supporting; **NS** = Not supporting; PS and NS = Impaired streams.
Total miles of impaired streams (PS+NS) = 492 miles

Table 4.6 Major Causes of Use Support Impairment in Freshwaters in the Catawba Basin

CAUSES OF USE SUPPORT IMPAIRMENT (MILES)					
Subbasin	NH3	Fecal	Sediment	Turbidity	Metals
30830	0	0	14.7	0	3.9
30831	0	6.6	48.8	0	6.1
30832	0	0	77.1	0	0
30833	0	0	21.7	0	0
30834	5.7	30.4	109.7	12.8	0
30835	0	13.5	51.4	13.5	5.5
30836	0	0	0	0	0
30837	0	0	10.6	0	0
30838	0	0	42.4	0	0
Total Miles	5.7	50.5	376.4	26.3	15.5
% of PS and NS	1	10	77	5	3

Information on sources of impairment for stream miles rated partially or not supporting indicated that 441 stream miles were impaired by nonpoint sources, and 78 stream miles were impaired by point sources. Agriculture was the most widespread nonpoint source, followed by construction, and urban runoff. Subbasins 35 and 32 had the highest number of streams thought to be impaired by agriculture and subbasins 34 and 31 had the highest number attributed to construction.

4.6.2 Lakes

Twelve lakes in the Catawba Basin, totaling 46,985 acres, were monitored and assigned use support ratings (Table 4.7). Of these 12, nine are fully supporting their uses, and three are support-threatened. Following is a brief summary of the lakes and their use support information.

Lake James fully supported all designated uses as of 1992. Portions of Lake James include WS-V, B, and C classifications. The lake continues to provide the local area with a valuable resource for recreation and source of water supply. However, controversy currently exists concerning the development of the watershed and potential impacts this development may have on the aesthetic beauty and water quality in the future.

Lake Tahoma fully supported all designated uses as of 1992. Lake Tahoma is currently classified WS-I, B-Tr, and is used for recreation. It was sampled in 1990 and 1992, which showed that nutrients and chlorophyll a were low and the water column was stratified and slightly acidic.

Lake Rhodhiss fully supported all designated uses as of 1992. It is currently classified as WS-IV, B CA, and is used for recreation and for the generation of hydroelectric power. At the time DEM sampled Lake Rhodhiss in 1989 and 1992, the lake was moderately stratified with partial mixing at the shallow upper reaches with more defined stratification at the deeper, lower end of the impoundment. Lake Rhodhiss has a trophic status of eutrophic, and in 1992 the upper end of the lake had elevated nutrient levels. AGPT results from August 1985 indicated that the lake was co-limited by nitrogen and phosphorus. The Town of Valdese and the Morganton wastewater treatment plant and the Town of Lenoir water treatment plant discharge directly into Lake Rhodhiss.

Lake Hickory is support threatened for its overall use as of 1992. It is currently classified as WS-IV, B CA, is used primarily for hydroelectric power, and is also used for recreation and as a water supply source. Results of the most recent sampling in 1992 show some elevated levels of chlorophyll a and total phosphorus (TP). Despite consistent TSI's at eutrophic levels, Lake Hickory is ranked as mesotrophic. This is due to the short retention time of the lake and low estimates of phytoplankton density and biovolume.

Little River Dam Reservoir fully supported all designated uses as of 1992. It is classified as WS-IV, and is used primarily for fishing. From sampling in 1990 to 1992, a decrease in chlorophyll a concentration indicated lower phytoplankton productivity, and significant decreases were also observed in all nutrient levels. There was also a substantial increase in the Secchi disk transparency. Changes observed in the 1992 samples resulted in a trophic status change from eutrophic in 1990, to its current status of mesotrophic.

Lookout Shoals Lake fully supported all designated uses as of 1992. The lakes classification ranges from WS-V from Oxford Dam to Island Creek, to WS-IV, B CA from Lookout Shoals Dam to half-mile upstream of the dam. It is used for generation of hydroelectric power and recreation. Sampled in 1989 and 1992, the past years TSIs of the lake have been borderline between mesotrophic and eutrophic. With its latest TSI of 0.7, Lookout Shoals Lake is currently ranked as eutrophic.

Table 4.7 Lakes Use Support Status and Causes and Sources of Impairment

LAKE NAME	County	SIZE (Acres)	CLASS	Overall Use	Fish Con sump	Aq. Life Second Cont	Swim ming	Drink ing Water	Trophic Status	Problem Parameters
Subbasin 30830										
LAKE JAMES	Burke	6510	WS,B,C	S	S	S	S	S	MESO	
LAKE TAHOMA	MdDowell	161	WS,B-Tr	S	S	S	S	n/a	OLIGO	
Subbasin 30831										
LAKE RHODHISS	Burke/Cald	3515	WS,B-CA	S	S	S	S	S	EUTRO	
Subbasin 30832										
LAKE HICKORY	Alex/Cataw	4100	WS,B-CA	ST	S	ST	S	S	EUTRO	
LAKE NORMAN	Meckl/Linc	32510	WS,B	S	S	S	S	S	OLIGO	
LITTLE RIVER DAM (Icard)	Alexander	162	WS-CA	S	S	S	n/a	S	MESO	
LOOKOUT SHOALS LK.	Cataw/Irede	1270	WS,B	S	S	S	S	S	EUTRO	
Subbasin 30833										
MOUNTAIN ISLAND LK.	Meckl/Gasto	3235	WS,B	S	S	S	S	S	OLIGO	
Subbasin 30834										
LAKE WYLIE (NC)	Meckl/York	6000	WS,B	ST	S	ST	S	S	EUTRO	NUTR.,EUTR.
Subbasin 30835										
MAIDEN LAKE	CATAWBA	23	WS	ST	S	ST	n/a	S	MESO	TURB.,NUTR.
NEWTON CITY LAKE	CATAWBA	17	WS-CA	S	S	S	n/a	S	OLIGO	
Subbasin 30836										
BESSEMER CITY LAKE	GASTON	15	WS	S	S	S	n/a	S	OLIGO	

Lake Norman fully supported all designated uses as of 1992. It is classified as WS-IV, B CA, and is used to power hydroelectric generators at Cowans Ford Dam and to cool the steam that powers the turbines at the Marshall Steam Station and McGuire Nuclear Station. It is also used as a water supply source and for recreation. Lake Norman has a trophic status of oligotrophic as a result of the most recent sampling in 1992.

Mountain Island Lake fully supported all designated uses as of 1992 although recent data collected by Duke Power and Mecklenburg County have shown elevated levels of nutrients entering the lake from McDowell Creek. A study is currently being conducted by DEM and the County to determine the sources. The lake is classified as WS-IV, B, CA and serves as a water supply for the City of Charlotte and as a hydroelectric power source for two power stations. The 1992 TSI showed the lake to be oligotrophic, although previous years TSIs suggested a ranking of mesotrophic.

Lake Wylie is support threatened for its overall use as of 1992 due to conditions related to eutrophication primarily in the Catawba Creek, Crowders Creek and South Fork Catawba River arms. The lake is used for hydroelectric power, recreation, and water supply. DEM has sampled Lake Wylie from 1981 through 1992, and the trophic status has always been eutrophic. High nutrient levels, periodic algal blooms, and fish kills in many of the tributary embayments have been reported. In 1992, the highest nutrient and chlorophyll *a* values were found in the South Fork Catawba River arm. This arm receives discharges from industrial, municipal and private wastewater treatment plants as well as nutrients from nonpoint sources. Nutrient loadings from the Catawba River mainstem arm have been relatively low and water quality standards have been met consistently over the past five years. One algae bloom was observed in 1989.

Maiden Lake is support threatened for its overall use as of 1992. It is classified as WS-II CA and serves as a water supply for the town of Maiden. The lake was sampled in 1990 and 1992, and showed moderate nutrient levels in both sampling years, but chlorophyll *a* concentrations and turbidity levels were low in 1992. This decrease in chlorophyll a concentrations and turbidity levels in 1992 signified decreased algal growth. The trophic status was changed from eutrophic in 1990, to mesotrophic in 1992.

Newton City Lake fully supported all designated uses as of 1992. It is classified as WS-CA. This lake was sampled in 1992, and results indicated a trophic status of oligotrophic.

Bessemer City Lake fully supported all designated uses as of 1992. It is classified as WS-II and serves as the primary water supply for Bessemer City in Gaston County. Chlorophyll *a* measured in 1992 was low indicating minimal phytoplankton activity. Low turbidity measurements and high Secchi readings indicated good water quality. Trophic status changed from mesotrophic in 1990, to oligotrophic in 1992, which is its current status.

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