

Appendix III

Use Support Methodology and Use Support Ratings

Introduction to Use Support

All surface waters of the state are assigned a classification appropriate to the best-intended uses of that water. Waters are assessed to determine how well they are meeting the classified or best-intended uses. The assessment results in a use support rating for the use categories that apply to that water.

Use Support Categories

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through the use of five use support categories: aquatic life, recreation, fish consumption, water supply, and shellfish harvesting. These categories are tied to the uses associated with the primary classifications applied to NC rivers and streams. Waters are Supporting if data and information used to assign a use support rating meet the criteria for that use category. If these criteria are not met, then the waters are Impaired. Waters with inconclusive data and information are Not Rated. Waters where no data or information are available to make an assessment are No Data. The table below specifies which use support categories apply to which primary classifications.

A single water may have more than one use support rating corresponding to one or more of the use support categories, as shown in the following table. For many waters, a use support category will not be applicable (N/A) to the classification of that water (e.g., shellfish harvesting is only applied to Class SA waters). A full description of the classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina* (15A NCAC 2b .0100 and .0200). Information can also be found at <http://h2o.enr.state.nc.us/wqs/>.

Use Support Categories

Primary Classification	Ecosystem Approach	Human Health Approach			
		Fish Consumption	Recreation	Water Supply	Shellfish Harvesting
C	X	X	X	N/A	N/A
SC	X	X	X	N/A	N/A
B	X	X	X	N/A	N/A
SB	X	X	X	N/A	N/A
SA	X	X	X	N/A	X
WS I – WS IV	X	X	X	X	N/A

Assessment Period

Data and information are used to assess water quality and assign use support ratings using a five-year data window that ends on August 31 of the year of basinwide biological sampling. For example, if biological data are collected in a basin in 2004, then the five-year data window for

use support assessments would be September 1, 1999 to August 31, 2004. There are occasionally some exceptions to this data window, especially when follow up monitoring is needed to make decisions on samples collected in the last year of the assessment period.

Assessment Units

DWQ identifies waters by index numbers and assessment unit numbers (AU). The AU is used to track defined stream segments or waterbodies in the water quality assessment database, for the 303(d) Impaired waters list, and in the various tables in basin plans and other water quality documents. The AU is a subset of the DWQ index number (classification identification number). A letter attached to the end of the AU indicates that the AU is smaller than the DWQ index segment. No letter indicates that the AU and the DWQ index segment are the same.

Interpretation of Data and Information

When interpreting the use support ratings, it is important to understand the associated limitations and degree of uncertainty. Although these use support methods are used for analyzing data and information and determining use support ratings, best professional judgment is applied during these assessments. Use support ratings are intended to provide an assessment of water quality using a five-year data window, to describe how well surface waters support their classified uses, and to document the potential stressors contributing to water quality degradation and the sources of these contributions.

Use support methods continue to improve over time, and the information and technology used to make use support determinations also continue to become more accurate and comprehensive. These improvements sometimes make it difficult to make generalizations comparing water quality between basin plans. However, technology and methods improvements result in more scientifically sound use support assessments.

Assessment Methodology

Introduction

Many types of data and information are used to determine use support ratings and to identify stressors and sources of water quality degradation. All existing data pertaining to a stream segment for each applicable use support category are entered into a use support database and may include its use support ratings, basis of assessment, biological and ambient monitoring data, stressors and potential sources. Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, swimming advisories and shellfish sanitation growing area classifications from the NC Division of Environmental Health (as appropriate), and available land cover and land use information.

The following describes the data and methodologies used to conduct use support assessments. These methods will continue to be refined as additional information and technology become available.

Basis of Assessment

Assessments are made on an overall basis of either monitored (M) or evaluated (E), depending on the level of information available. A monitored rating is based on the most recent five-year data window and site-specific data and is therefore treated with more confidence than an evaluated rating.

Rating Basis	Use Support Category	Assessment Applicability*
S/M	AL	Biological community data or ambient water quality parameters do not exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
S/M	REC	Ambient fecal bacteria parameter does not exceed criteria in AU or AU with RECMON sites is posted with advisories for 61 days or less during assessment period.
S/M	FC	AU does not have site-specific advisory and is not under a mercury advice or drains to areas within a mercury advice, or fish tissue data do not exceed criteria.
S/M	SH	AU is a DEH Approved shellfish growing area.
I/M	AL	Biological community data or ambient water quality parameters exceed criteria in AU during assessment period. Biological and ambient data are independently applied.
I/M	REC	Ambient fecal bacteria parameter exceeds criteria in AU or AU with RECMON sites is posted with advisories for more than 61 days during assessment period.
I/M	FC	Fish tissue data collected in AU during assessment period and basin are under mercury advice or site-specific advisory.
I/M	SH	AU is a DEH Conditionally-Approved, Prohibited or Restricted shellfish growing area.
NR/M	AL	Biological community is Not Rated or inconclusive, or ambient water quality parameters are inconclusive in AU during assessment period. Biological and ambient data are independently applied.
NR/M	REC	Ambient fecal bacteria parameter exceeds annual screening criteria, but does not exceed assessment criteria of five samples in 30 days in AU during assessment period.
S/E	AL	AU is a tributary to a S/M AU and land use is similar between AUs.
S/E	WS	AU is classified as WS, and DEH report notes no significant closures at time of assessment.
I/E	FC	AU is in basin under a mercury advice or drains to areas within a mercury advice and has no fish tissue data.
NR/E	AL	AU is tributary to I/M AU, or AU is in watershed with widespread and changing land use, or other information suggests negative water quality impacts to AU. Discharger in AU has noncompliance permit violations or has failed three or more WET tests during the last two years of the assessment period.
NR/E	REC	Discharger has noncompliance permit violations of fecal bacteria parameter during last two years of assessment period.
ND	AL, REC, FC, SH	No data available in AU during assessment period.

Note: S/M = Supporting/Monitored

I/M = Impaired/Monitored

NR/M = Not Rated/Monitored

S/E = Supporting/Evaluated

I/E = Impaired/Evaluated

NR/E = Not Rated/Evaluated

ND = No Data

AL = Aquatic Life

REC = Recreation

FC = Fish Consumption

SH = Shellfish Harvesting

WS = Water Supply

AU = Assessment Unit

WET = Whole Effluent Toxicity

DEH = Division of Environmental Health

* = for lakes assessments

Supporting ratings are extrapolated up tributaries from monitored streams when there are no problematic dischargers with permit violations or changes in land use/cover. Supporting ratings may also be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests and wildlife refuges, wilderness areas or state natural areas). Problem stressors or sources (except general NPS) are not generally applied to unmonitored tributaries. Impaired ratings are not extrapolated to unmonitored tributaries.

Stressors

Biological and ambient samplings are useful tools to assess water quality. However, biological sampling does not typically identify the causes of impairment, and ambient sampling does not always link water quality standards to a biological response. Linking the causes of impairment and the biological response are a complex process (USEPA, 2000) that begins with an evaluation of physical, chemical or biological entities that can induce an adverse biological response. These entities are referred to as stressors. A stressor may have a measurable impact to aquatic health. Not all streams will have a primary stressor or cause of impairment. A single stressor may not be sufficient to cause impairment, but the accumulation of several stressors may result in impairment. In either case, impairment is likely to continue if the stressor or the various cumulative stressors are not addressed. Use support assessments evaluate the available information related to potential stressors impacting water quality.

A stressor identification process may be initiated after a stream appears on the 303(d) list in order to address streams that are Impaired based on biological data. Intensive studies are required to summarize and evaluate potential stressors to determine if there is evidence that a particular stressor plays a substantial role in causing the biological impacts. Intensive studies consider lines of evidence that include benthic macroinvertebrate and fish community data, habitat and riparian area assessment, chemistry and toxicity data, and information on watershed history, current watershed activities and land uses, and pollutant sources. These studies result in decisions regarding the probable stressors contributing to or causing impairment. The intensity of a stressor study may be limited due to a lack of resources. In these cases, it may still be appropriate to include stressors in use support assessments, but to also note where additional information is needed in order to evaluate other stressors.

Where an ambient parameter is identified as a potential concern, the parameter is noted in the DWQ database and use support summary table. Where habitat degradation is identified as a stressor, DWQ and others attempt to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools or riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Aquatic Life Category

The aquatic life category is an ecosystem approach to assessing the biological integrity of all surface waters of the state. The biological community data and ambient water quality data are used in making assessments in this category. These represent the most important monitoring data for making water quality assessments in the aquatic life category. Evaluation information such as compliance and whole effluent toxicity information from NPDES dischargers, land cover, and other more anecdotal information are also used to identify potential problems and to

refine assessments based on the monitoring data. The following is a description of each monitoring data type and the criteria used in assigning use support ratings. Criteria used to evaluate the other information and assign use support ratings are also described. Refer to page 14 for lakes and reservoir assessment methods as applied in the aquatic life category.

Biological Data

Benthic macroinvertebrate (aquatic insects) community and fish community samples are the best way to assess the biological integrity of most waterbodies. Unfortunately, these community measures cannot be applied to every stream size and are further limited by geographic region. These community measures are designed to detect current water quality and water quality changes that may be occurring in the watershed. However, they are only directly applied to the assessment unit where the sample was collected.

Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated for use support assessments. When two biological monitoring data types conflict, best professional judgment is used to determine an appropriate use support rating. Where both ambient monitoring data and biological data are available, biological data may be given greater weight; however, each data type is assessed independently.

Benthic Macroinvertebrate Criteria

Criteria have been developed to assign bioclassifications to most benthic macroinvertebrate samples based on the number of taxa present in the pollution intolerant aquatic insect groups of *Ephemeroptera*, *Plecoptera* and *Trichoptera* (EPTs); and the Biotic Index (BI), which summarizes tolerance data for all taxa in each sample. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored.

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will not be Not Rated until the second sample is obtained.

Use support ratings are assigned to assessment units using benthic macroinvertebrate bioclassifications as follows.

Waterbody Sample Type or Criteria	Bioclassification	Use Support Rating
Mountain, piedmont, coastal A	Excellent	Supporting
Mountain, piedmont, coastal A	Good	Supporting
Swamp ¹	Natural	Supporting
Mountain, piedmont, coastal A	Good-Fair	Supporting
Smaller than criteria but Good-Fair ²	Not Impaired	Supporting
Swamp ¹	Moderate Stress	Supporting
Mountain, piedmont, coastal A	Fair	Impaired
Swamp ¹	Severe Stress	Impaired
Mountain, piedmont, coastal A	Poor	Impaired
Criteria not appropriate to assign bioclassification	Not Rated	Not Rated

¹ Swamp streams for benthos sampling are defined as streams in the coastal plain that have no visible flow for a part of the year, but do have flow during the February to early March benthic index period.

² This designation may be used for flowing waters that are too small to be assigned a bioclassification (less than three square miles drainage area), but have a Good-Fair or higher bioclassification using the standard qualitative and EPT criteria.

Fish Community Criteria

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The NCIBI incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. Because these data represent water quality conditions with a high degree of confidence, use support ratings using these data are considered monitored. Use support ratings are assigned to assessment units using the NCIBI bioclassifications as follows:

<u>NCIBI</u>	<u>Use Support Rating</u>
Excellent	Supporting
Good	Supporting
Good-Fair	Supporting
Fair	Impaired
Poor	Impaired

If a Fair macroinvertebrate bioclassification is obtained under conditions (such as drought or flood conditions, recent spills, etc.) that may not represent normal conditions or is borderline Fair (almost Good-Fair), a second sample should be taken within 12-24 months to validate the Fair bioclassification. Such sites will not be given a use support rating until validation is obtained.

The NCIBI was recently revised (NCDENR, 2001), and the bioclassifications and criteria have also been recalibrated against regional reference site data (NCDENR, 2000a, 2000b and 2001a). NCIBI criteria are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamlico, French Broad, Hiwassee, Little Tennessee, New and Watauga. Additionally, the NCIBI criteria are only

applicable to streams in the piedmont portion of the Cape Fear, Neuse, Roanoke and Tar-Pamlico River basins. The definition of "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin -- all waters except for those draining the Sandhills in Moore, Lee and Harnett counties, and the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, except for the south and southwest portions of Johnston County and eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

NCIBI criteria have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, coldwater temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All nonwadeable and large streams and rivers throughout the state.

Ambient Water Quality Monitoring Criteria

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring Program statewide and NPDES discharger coalitions in some basins. All samples collected (usually monthly) during the five-year assessment period are used to assign a use support rating. Ambient water quality data are not direct measures of biological integrity, but the chemical/physical parameters collected can provide an indication of conditions that may be impacting aquatic life. Because these data represent water quality conditions with a high degree of confidence, use support ratings assigned using these data are considered monitored. Where both ambient data and biological data are available, each data type is assessed independently.

The parameters used to assess water quality in the aquatic life category include dissolved oxygen, pH, chlorophyll *a* and turbidity. Criteria for assigning use support ratings to assessment units with ambient water quality data of a minimum of ten samples are as follows:

<u>Ratings Criteria</u>	<u>Rating</u>
Numerical standard exceeded in ≤10% of samples	Supporting
Numerical standard exceeded in >10% of samples	Impaired
Less than 10 samples collected	Not Rated
DO and pH standard exceeded in swamp streams	Not Rated

Multiple Monitoring Sites

There are assessment units with more than one type of monitoring data. When the data from multiple biological data types are not in agreement, best professional judgment is used to assign a bioclassification and use support rating for that assessment unit. Biological monitoring is typically assessed independent of ambient monitoring data and either may be used to assign a use support rating for an assessment unit. Monitoring data are always used over the evaluation information; however, evaluation information can be used to lengthen or shorten monitored assessment units and to assign use support ratings on an evaluated basis to non-monitored assessment units.

NPDES Wastewater Whole Effluent Toxicity (WET) Information

Whole Effluent Toxicity (WET) tests are required for all major NPDES discharge permit holders, as well as those minor NPDES dischargers with complex effluent (defined as not being of 100 percent domestic waste). WET tests are evaluated to determine if the discharge could be having negative water quality impacts. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient water quality data, and that facility has failed three or more WET tests in the last two years of the assessment period, the assessment unit is Not Rated. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored. Problems associated with WET test failures are addressed through NPDES permits.

NPDES Discharger Daily Monitoring Report Information

NPDES effluent data monthly averages of water quality parameters are screened for the last two years of the assessment period. If facilities exceed the effluent limits by 20 percent for two or more months during two consecutive quarters, or have chronic exceedances of permit limits for four or more months during two consecutive quarters, then the assessment unit is Not Rated if no biological or ambient monitoring data are available. If biological or ambient data are available, that data will be used to develop a use support rating for appropriate stream segments. Because this information is not a direct measure of water quality and the confidence is not as high as for monitoring data, this use support rating is considered evaluated rather than monitored.

Fish Consumption Category

The fish consumption category is a human health approach to assess whether humans can safely consume fish from a waterbody. This category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories or advice as issued by the NC Department of Health and Human Services (NCDHHS). The fish consumption category is different from other categories in that assessments are based on the existence of a DHHS fish consumption advice or advisory at the time of assessment. The advice and advisories are based on DHHS epidemiological studies and on DWQ fish tissue data, so a fish tissue monitoring site will constitute a monitored assessment unit (AU) and all other AUs will be evaluated. DWQ fish tissue data are used to inform DHHS of potential fish tissue toxicity. DHHS is responsible for proclaiming a fish tissue advisory for any waterbody. Fish tissue monitoring data are not used directly for assigning a use support rating in this category.

If a limited site-specific fish consumption advisory or a no consumption advisory is posted at the time of assessment, the water is Impaired. If there are no site-specific advisories posted or the stream is not in a basin where mercury advice is applied, then the assessment unit will be Supporting in this category.

The NCDHHS has developed regional fish consumption advice (all waters south and east of I-85) for certain fish species shown to have elevated levels of mercury in their tissue. DWQ applies the DHHS fish consumption advice for mercury on a basinwide scale rather than an AU scale in recognition that fish move up and downstream regardless of the presence of I-85. All AUs draining below or intersecting I-85 are Impaired in the fish consumption category. AUs with monitoring data are considered Impaired/Monitored, and AUs with no monitoring data are considered Impaired/Evaluated. When a DHHS site-specific advisory is in place for a parameter other than mercury, the assessment is based on that advisory and the mercury advice will take a lower ranking in the assessment. Therefore, when a site-specific advisory is in place in a basin with a mercury advice and the AU has fish tissue monitoring data, the AU will be considered Impaired/Monitored for the specific parameter, rather than Impaired/Evaluated for mercury.

Basins under the mercury advice are the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, White Oak and Yadkin-Pee Dee. All waters in these basins are Impaired in the fish consumption category, even when there is a site-specific advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

Only a small portion of the Catawba River basin is intersected by I-85 (lower Mecklenberg, Union and Gaston counties). Due to the presence of dams that impede fish travel throughout the Catawba River basin, only those waters draining to and entering the mainstem Catawba below I-85 and are not impeded by dams are considered Impaired/Evaluated.

Basins not under the mercury advice are the Broad, French Broad, Hiwassee, Little Tennessee, New, Savannah and Watauga. All waters in these basins are Supporting the fish consumption category if there is no site-specific advisory; waters are Impaired if there is a site-specific advisory. All waters are also considered Monitored or Evaluated, dependent upon the availability of monitoring data.

In order to separate this regional advice from other fish consumption advisories and to identify actual fish populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps.

Recreation Category

This human health related category evaluates waters for the support of primary recreation activities such as swimming, water-skiing, skin diving, and similar uses usually involving human body contact with water where such activities take place in an organized manner or on a frequent basis. Waters of the state designated for these uses are classified as Class B, SB and SA. This category also evaluates other waters used for secondary recreation activities such as wading, boating, and other uses not involving human body contact with water, and activities involving human body contact with water where such activities take place on an infrequent, unorganized or incidental basis. Waters of the state designated for these uses are classified as Class C, SC and WS.

 Use support ratings applied to this category are currently based on the North Carolina fecal coliform bacteria water quality standard where ambient monitoring data are available or on the duration of local or state health agencies posted swimming advisories. Use support ratings for the recreation category may be based on other bacteriological indicators and standards in the future.

DWQ conducts monthly ambient water quality monitoring that includes fecal coliform bacteria testing. The Division of Environmental Health (DEH) tests coastal recreation waters (beaches) for bacteria levels to assess the relative safety of these waters for swimming. If an area has elevated bacteria levels, health officials will advise that people not swim in the area by posting a swimming advisory and by notifying the local media and county health department.

The North Carolina fecal coliform bacteria standard for freshwater is: 1) not to exceed the geometric mean of 200 colonies per 100 ml of at least five samples over a 30-day period; and 2) not to exceed 400 colonies per 100 ml in more than 20 percent of the samples during the same period. The AU being assessed for the five-year data window is Supporting in the recreation category if neither number (1) nor (2) of the standard are exceeded. The AU being assessed is Impaired in the recreation category if either number (1) or (2) is exceeded. Waters without sufficient fecal coliform data are Not Rated, and waters with no data are noted as having No Data.

Assessing the water quality standard requires significant sampling efforts beyond the monthly ambient monitoring sampling and must include at least five samples over a 30-day period. Decades of monitoring have demonstrated that bacteria concentrations may fluctuate widely in surface waters over a period of time. Thus, multiple samples over a 30-day period are needed to evaluate waters against the North Carolina water quality standard for recreational use support. Waters classified as Class SA, SB and B are targeted for this extra sampling effort due to the greater potential for human body contact. Therefore, some waters will be Not Rated in this category based on a DWQ yearly screening of all waters where an AU is above 200 colonies per 100 ml, or more than 20 percent of samples are above 400 colonies per 100 ml, and where the extra sampling effort has not been conducted.

Waters with beach monitoring sites will be Impaired if the area is posted with an advisory for greater than 61 days of the assessment period. Waters with beach monitoring sites with advisories posted less than 61 days will be Supporting. Other information can be used to Not Rate unmonitored waters.

DWQ Ambient Monitoring Fecal Coliform Screening Criteria

As with other information sources, all available information and data are evaluated for the recreation category using the assessment period. However, DWQ conducts an annual screening of DWQ ambient fecal coliform data to assess the need for additional monitoring or immediate action by local or state health agencies to protect public health.

Each March, DWQ staff will review bacteria data collections from ambient monitoring stations statewide for the previous sampling year. Locations with annual geometric means greater than 200 colonies per 100 ml, or when more than 20 percent of the samples are greater than 400 colonies per 100 ml, are identified for potential follow-up monitoring conducted five times

within 30 days as specified by the state fecal coliform bacteria standard.  bacteria concentrations exceed either portion of the state standard, the data are sent to DEH and the local county health director to determine the need for posting swimming advisories. DWQ regional offices will also be notified.

Due to limited resources and the higher risk to human health, primary recreation waters (Class B, SB and SA) will be given monitoring priority for an additional five times within 30 days sampling. Follow-up water quality sampling for Class C waters will be performed as resources permit. Any waters on the 303(d) list of Impaired waters for fecal coliform will receive a low priority for additional monitoring because these waters will be further assessed for TMDL development.

DWQ attempts to determine if there are any swimming areas monitored by state, county or local health departments or by DEH. Each January, DEH, county or local health departments are asked to list those waters which were posted with swimming advisories in the previous year.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be commercially harvested and is therefore applied only to Class SA waters. The following data sources are used to assign use support ratings for shellfish waters.

Division of Environmental Health (DEH) Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. Estuarine waters are delineated according to DEH shellfish management areas (e.g., Outer Banks, Area H-5) which include Class SA, SB and SC waters. DEH samples growing areas regularly and reevaluates the areas by conducting shellfish sanitation surveys every three years to determine if their classification is still applicable. DEH classifications may be changed after the most recent sanitary survey. Classifications are based on DEH bacteria sampling, locations of pollution sources, and the availability of the shellfish resource. Growing waters are classified as follows.

DEH Classification	DEH Criteria
Approved (APP)	<p>Fecal Coliform Standard for Systematic Random Sampling: The median fecal coliform Most Probable Number (MPN) or the geometric mean MPN of the water shall not exceed 14 per 100 milliliters (ml), and the estimated 90th percentile shall not exceed an MPN of 43 MPN per 100 ml for a 5-tube decimal dilution test.</p> <p>Fecal Coliform Standard for Adverse Pollution Conditions Sampling: The median fecal coliform or geometric mean MPN of the water shall not exceed 14 per 100 ml, and not more than 10 percent of the samples shall exceed 43 MPN per 100 ml for a 5-tube decimal dilution test.</p>
Conditionally Approved-Open (CAO)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be open more frequently than closed.
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan. These areas tend to be closed more frequently than open.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data do not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to DWQ Class SA (shellfish harvesting) waters. It is important to note that DEH classifies all actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. This will result in a difference of acreage between DEH areas classified as CAC, PRO and RES, and DWQ waters rated as Impaired. For example, if DEH classifies a 20-acre area CAC, but only 10 acres are Class SA, only those 10 acres of Class SA waters are rated as Impaired.

The DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as Impaired.

Sources of fecal coliform bacteria are more difficult to separate out for Class SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by these sources. Therefore, in the past, DEH identified the same sources for all Class SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this information will continue to be used. A point source discharge is only listed as a potential source when NPDES permit limits are exceeded.

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting frequency of closures. In the interim, DWQ has been identifying the frequency of closures in Class SA waters using an interim methodology based on existing databases and GIS

shapefiles. There will be changes in reported acreages in future assessments using the permanent methods and tools that result from this project.

Past Interim Frequency of Closure-Based Assessment Methodology

The interim method was used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Percent of Time Closed within Basin Data Window	DEH Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	Supporting
Closed ≤10% of data window	Portion of CAO closed ≤10% of data window	Supporting
Closed >10% of the data window	Portion of CAO closed >10% of data window	Impaired
N/A	CAC and PRO/RES**	Impaired

* Approved waters are closed only during extreme meteorological events (hurricanes).

** CAC and P/R waters are rarely opened to shellfish harvesting.

For CAO areas, DWQ worked with DEH to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during the assessment period. For each growing area with CAO Class SA waters, DEH and DWQ defined subareas within the CAO area that were opened and closed at the same time. The number of days these CAO areas were closed was determined using DEH proclamation summary sheets and the original proclamations.

The number of days that APP areas in the growing area were closed due to preemptive closures because of named storms was not counted. For example, all waters in growing area E-9 were preemptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (CAO) was reopened September 30, 1996. This area was considered closed for ten days after the APP waters were reopened.

Current Assessment Methodology

Use support assessment for the 2005 Cape Fear River basin will be conducted such that only the DEH classification will be used to assign a use support rating. By definition, CAO areas are areas that DEH has determined do not, or likely do not, meet water quality standards and these areas will be rated Impaired, along with CAC and PRO/RES areas. Only APP areas will be rated Supporting.

Growing areas that have been reclassified by DEH during the assessment period from a lower classification to APP will be rated Supporting. Areas that are reclassified from APP to any other classification during the assessment period will be rated Impaired.

Over the next few years, DWQ, DEH, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to work together to better serve the public. Using the new

database with georeferenced areas and monitoring sites, DEH will be able to report the number of days each area was closed excluding closures related to named storms.



Water Supply Use Support

This human health related use support category is used to assess all Class WS waters for the ability of water suppliers to provide potable drinking water. Many drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven DEH regional water treatment plant (WTP) consultants. Each January, the WTP consultants are asked to submit a spreadsheet listing closures and water intake switch-overs for all water treatment plants in their region. This spreadsheet describes the length and time of the event, contact information for the WTP, and the reason for the closure or switch.

The WTP consultants' spreadsheets are reviewed to determine if any closures/switches were due to water quality concerns. Those closures/switches due to water quantity problems and reservoir turnovers are not considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are currently rated Supporting on an Evaluated basis. Specific criteria for rating waters Impaired are yet to be determined.

Use of Outside Data

DWQ actively solicits outside data and information in the year before biological sampling in a particular basin. The solicitation allows approximately 60 days for data to be submitted. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments.

The way the solicited data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the 303(d) report and shown in the table below. Level 1 data can be use with the same confidence as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and stressors. They may also be used to limit the extrapolation of use support ratings up or down a stream segment from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments			
Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

Lakes and Reservoir Use Assessment

Like streams, lakes are classified for a variety of uses. All lakes monitored as part of North Carolina's Ambient Lakes Monitoring Program carry the Class C (aquatic life) classification, and most are classified Class B and SB (recreation) and WS-I through WS-V (water supply). The surface water quality numeric standard specifically associated with recreation is fecal coliform. For water supplies, there are 29 numeric standards based on consumption of water and fish. Narrative standards for Class B and Class WS waters include aesthetics such as no odors and no untreated wastes. There are other numeric standards that also apply to lakes for the protection of aquatic life and human health. These standards also apply to all other waters of the state and are listed under the Class C rules.

When possible, lake use support assessments are made using standards based methodologies similar to those used for free-flowing waters. Parameters with sufficient (ten or more observations), quality-assured observations are compared to surface water quality standards. When standards are exceeded in more than 10 percent of the assessment period, portions or all of the waterbody are rated Impaired. However, in many cases, the standards based approach is incapable of characterizing the overall health of a reservoir.

For nutrient enrichment, one of the main causes of impacts to lakes and reservoirs, a more holistic or weight of evidence approach is necessary since nutrient impacts are not always reflected by the parameters sampled. For instance, some lakes have taste and odor problems associated with particular algal species, yet these lakes do not have chlorophyll *a* concentrations above 40 µg/l frequently enough to impair them based on the standard. In addition, each reservoir possesses unique traits (watershed area, volume, depth, retention time, etc.) that dramatically influence its water quality, but that cannot be evaluated through standards comparisons. In such waterbodies, aquatic life may be Impaired even though a particular indicator is below the standard. Where exceedances of surface water quality standards are not sufficient to evaluate a lake or reservoir, the weight of evidence approach can take into consideration indicators and parameters not in the standards to allow a more sound and robust determination of water quality.

The weight of evidence approach uses the following sources of information to determine the eutrophication (nutrient enrichment) level as a means of assessing lake use support in the aquatic life category:

- Quantitative water quality parameters - dissolved oxygen, chlorophyll *a*, pH, etc.
- Algal bloom reports
- Fish kill reports
- Hydrologic and hydraulic characteristics – watershed size, lake volume, retention time, volume loss, etc.
- Third party reports – citizens, water treatment plant operators, state agencies, etc.
 - Taste and odor
 - Sheens
 - Odd colors
 - Other aesthetic and safety considerations

One of the major problems associated with lakes and reservoirs is increasing eutrophication related to nutrient inputs. Several water quality parameters help to describe the level of eutrophication. In implementing the weight of evidence approach for eutrophication, more consideration is given to parameters that have water quality standards. Each parameter is assessed for percent exceedance of the state standard. The eutrophication-related parameters and water quality indicators without numeric standards are reviewed based on interpretation of the narrative standards in 15A NCAC 2B .0211(2) and (3). The following table lists the information considered during a lake/reservoir use assessment, as well as the criteria used to evaluate that information.

A modification to lake use assessment is the evaluation and subsequent rating of a lake or reservoir by segments. In some portions of a waterbody, such as shallow coves, there may be documented water quality problems while other areas of that waterbody do not demonstrate significant problems. In such cases, the portion with documented problems (sufficient data, ambient data above standards, and supporting public data) will be rated as Impaired while the other portions are rated as Supporting or Not Rated. The following table highlights the weight of evidence approach for assessing lake water quality.

References

- Fels, J. 1997. *North Carolina Watersheds Map*. North Carolina State University Cooperative Extension Service. Raleigh, NC.
- North Carolina Department of Environment and Natural Resources (NCDENR). 2000a. *Fish Community Metric Re-Calibration and Biocriteria Development for the Inner Piedmont, Foothills, and Eastern Mountains (Broad, Catawba, Savannah, and Yadkin River Basins)*. September 22, 2000. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. Raleigh, NC.
- _____. 2000b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Outer Piedmont (Cape Fear, Neuse, Roanoke and Tar River Basins)*. October 17, 2000. *Ibid*.
- _____. 2001a. *Standard Operating Procedure. Biological Monitoring. Stream Fish Community Assessment and Fish Tissue*. Biological Assessment Unit. Environmental Sciences Branch. Water Quality Section. Division of Water Quality. Raleigh, NC.
- _____. 2001b. *Fish Community Metric Re-Calibration and Biocriteria Development for the Western and Northern Mountains (French Broad, Hiwassee, Little Tennessee, New and Watauga River Basins)*. January 05, 2001. *Ibid*.
- USEPA. 2000. *Stressor Identification Guidance Document*. EPA/822/B-00/025. Office of Water. Washington, DC.

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Abernethy Creek	11-135-4b	From First Creek to Crowders Creek	C	03-08-37	1.8 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Abernethy Creek	11-135-4a	From source to First Creek	C	03-08-37	3.2 mi.	S	M		
Abingdon Creek	11-39-6	From source to Lower Creek	C	03-08-31	5.6 mi.	S	M		
Armstrong Creek	11-24-14-(1)	From source to Hickory Botton Creek	C Tr HQW	03-08-30	10.8 mi.	S	M		
Beaverdam Creek	11-129-9-(0.7)	From a point 0.3 mile upstream of Gaston County SR 1626 to South Fork Catawba River	WS-IV	03-08-35	8.3 mi.	S	M		
Blackwood Creek	11-135-7	From source to Crowders Creek	C	03-08-37	4.4 mi.	NR	M		
Blair Fork	11-39-3-1	From source to Spainhour Creek	C	03-08-31	2.6 mi.	NR	M		
Bristol Creek	11-39-8	From source to Lower Creek	WS-IV	03-08-31	5.6 mi.	NR	M		
Buck Creek (Lake Tahoma)	11-19-(1)	From source to Dam at Lake Tahoma	WS-II & B Tr	03-08-30	166.4 ac.	S	M		
Canoe Creek	11-33-(2)	From Burke County SR 1248 to Catawba River	WS-IV	03-08-30	5.6 mi.	S	M		
Carpenter Creek (Horseshoe Lake)	11-129-5-9	From source to Clark Creek	C	03-08-35	3.6 mi.	NR	M		
Catawba Creek	11-130c	From SR 2439 to Lake Wylie	C	03-08-37	4.9 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
CATAWBA RIVER	11-(1)	From source to Old Fort Finishing Plant Water Supply Intake	C Tr	03-08-30	7.6 mi.	S	M		
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	From Dam at Old Fort Finishing Plant Water Supply Intake to North Fork Catawba River	C	03-08-30	23.5 mi.	S	M		
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	From a point 0.6 mile upstream of Muddy Creek to a point 1.2 mile upstream of Canoe Creek	WS-IV	03-08-30	9.8 mi.	S	M		
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(32.7)	From a point 0.7 mile upstream of Canoe Creek to a point 0.6 mile upstream of Warrior Fork	WS-IV	03-08-31	3.9 mi.	S	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(51)	From Rhodhiss Dam to US Highway 321 Bridge	WS-IV & B CA	03-08-32	263.1 ac.	NR	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	From US Highway 321 Bridge to NC Highway 127	WS-IV & B CA	03-08-32	1232.8 ac.	NR	M		
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	From NC Highway 127 to Oxford Dam	WS-V & B	03-08-32	2093.6 ac.	NR	M		
CATAWBA RIVER (Lake James below elevation 1200)	11-(23)	From North Fork Catawba River to Bridgewater Dam	WS-V & B	03-08-30	2040.9 ac.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
CATAWBA RIVER (Lake James below elevation 1200)	11-(27.5)	From North Fork Catawba River to Bridgewater Dam	WS-V & B	03-08-30	3769.5 ac.	S	M		
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	From Lookout Shoals Dam to Lyle Creek	WS-IV CA	03-08-32	265.3 ac.	S	M		
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	From Lyle Creek to Cowan's Ford Dam	WS-IV & B CA	03-08-32	31331.6 ac.	S	M		
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont	WS-IV CA	03-08-33	375.3 ac.	NR	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	From I-85 bridge to the upstream side of Paw Creek Arm of Lake Wylie, Catawba River	WS-IV & B CA	03-08-34	601.1 ac.	I	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	From the upstream side of Paw Creek Arm of Lake Wylie to North Carolina-South Carolina State Line	WS-V & B	03-08-34	3418.5 ac.	I	M	Organic Enrichment	Source Unknown
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(67)	From Oxford Dam to a point 0.6 mile upstream of mouth of Lower Little River	WS-IV	03-08-32	182.7 ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(68.5)	From a point 0.6 mile upstream of mouth of Lower Little River to Elk Shoal Creek (East Side)	WS-IV CA	03-08-32	95.4 ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(72)	From Elk Shoal Creek (East Side) to a point 0.5 mile upstream of Lookout Shoals Dam	WS-IV & B CA	03-08-32	577.8 ac.	S	M		
CATAWBA RIVER (Lookout Shoals Lake below elevation 845)	11-(73.5)	From a point 0.5 mile upstream of Lookout Shoals Dam to Lookout Shoals Dam	WS-IV & B CA	03-08-32	175.4 ac.	S	M		
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(112)	From Cowan's Ford Dam to Water Intake at River Bend Steam Station	WS-IV CA	03-08-33	389.4 ac.	S	M		
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	From Water Intake at River Bend Steam Station to Mountain Island Dam (Town of Mount Holly water supply intake)	WS-IV & B CA	03-08-33	1937.1 ac.	S	M		
CATAWBA RIVER (Rhodhiss Lake below elevation 995)	11-(37)	From Johns River to Rhodhiss Dam	WS-IV & B CA	03-08-31	1848.5 ac.	I	M	Organic Enrichment	Source Unknown

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Celia Creek	11-39-7-1-(2)	From a point 0.5 mile upstream of Caldwell County SR 1325 to Husband Creek	WS-IV	03-08-31	1.3 mi.	NR	M		
Clark Creek	11-129-5-(9.5)	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba River	WS-IV	03-08-35	1.8 mi.	I	M	Copper	Industrial Point Sources
Clark Creek (Shooks Lake)	11-129-5-(0.3)b	Source to Sweetwater Rd	C	03-08-35	14.3 mi.	I	M	Unknown toxicity	Industrial Point Sources
Clark Creek (Shooks Lake)	11-129-5-(0.3)a	From source to Miller Branch	C	03-08-35	3.3 mi.	NR	M		
Cline Creek	11-129-5-2	From source to Clark Creek	C	03-08-35	3.1 mi.	S	M		
Crooked Creek	11-12	From source to Catawba River	C	03-08-30	16.0 mi.	S	M		
Crowders Creek	11-135b	From State Route 1118 to State Route 1122	C	03-08-37	3.1 mi.	S	M		
Crowders Creek	11-135a	From source to SR 1118	C	03-08-37	1.9 mi.	NR	M		
Crowders Creek	11-135g	South Carolina State Line	C	03-08-37	1.5 mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Crowders Creek	11-135c	From State Route 1122 to State Route 1131	C	03-08-37	3.3 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Crowders Creek	11-135d	From State Route 1131 to State Route 1108	C	03-08-37	7.3 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Curtis Creek	11-10	From source to Catawba River	C Tr	03-08-30	9.7 mi.	S	M		
Duck Creek	11-62-2-(4)	From NC Highway 90 to Middle Little River	C	03-08-32	4.4 mi.	S	M		
Dutchmans Creek	11-119-(0.5)	From source to a point 0.8 mile downstream of Taylors Creek	WS-IV	03-08-33	7.4 mi.	S	M		
Elk Shoal Creek (East Side)	11-73-(0.5)	From source to a point 1.4 miles upstream of mouth	WS-IV	03-08-32	7.8 mi.	S	M		
Gragg Prong	11-38-10	From source to Johns River	C Tr	03-08-31	4.0 mi.	S	M		
Greasy Creek	11-39-4	From source to Lower Creek	C	03-08-31	4.6 mi.	NR	M		
Gunpowder Creek (Old Mill Pond)	11-55-(1.5)	From a point 0.5 mile downstream of Caldwell County SR 1127 to a point 0.8 mile downstream of Billy Branch	WS-IV	03-08-32	13.4 mi.	S	M		
Harper Creek	11-38-34-14	From source to Wilson Creek	C Tr ORW	03-08-31	9.1 mi.	S	M		
Henry Fork	11-129-1-(2)	From Morganton Water Intake to Laurel Creek	C ORW	03-08-35	19.5 mi.	S	M		
Henry Fork	11-129-1-(12.5)a	From Laurel Creek to State Route 1124	C	03-08-35	10.3 mi.	I	M		
Henry Fork	11-129-1-(12.5)c	From State Route 1143 to Jacob Fork	C	03-08-35	8.6 mi.	S	M		
Henry Fork	11-129-1-(12.5)b	From State Route 1124 to State Route 1143	C	03-08-35	4.8 mi.	S	M		
Horseford Creek	11-54-(0.5)	From Frye Creek to a point 0.7 mile upstream of mouth	WS-IV	03-08-32	0.4 mi.	I	M	Unknown toxicity	Urban Runoff/Storm Sewers
Howards Creek	11-129-4	From source to South Fork Catawba River	C	03-08-35	13.8 mi.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Hoyle Creek	11-129-15-(6)	From a point 0.2 mile downstream of Mauney Creek to South Fork Catawba River	WS-IV CA	03-08-35	0.5 mi.	S	M		
Hunting Creek	11-36-(0.7)	From a point 1.0 mile upstream of Burke County SR 1940 to a point 0.4 mile downstream of Pee Dee Branch	WS-IV	03-08-31	7.4 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Husband Creek	11-39-7-(1)	From source to a point 0.5 mile upstream of Celia Creek	C	03-08-31	6.0 mi.	S	M		
Indian Creek	11-129-8-(6.5)	From a point 0.3 mile upstream of Lincoln County SR 1169 to South Fork Catawba River	WS-IV	03-08-35	6.0 mi.	I	M	Cause Unknown	
Irish Creek	11-35-3-(2)b	From Roses Creek to Warrior Fork	WS-III	03-08-31	3.0 mi.	I	M	Habitat degradation	Crop-related Sources
Irwin Creek	11-137-1	From source to Sugar Creek	C	03-08-34	11.8 mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Jacktown Creek	11-32-1-4-1	From source to Youngs Fork	C	03-08-30	2.4 mi.	I	M	Cause Unknown	Land Development
Jacob Fork	11-129-2-(4)	From Little River to Camp Creek	WS-III ORW	03-08-35	6.8 mi.	S	M		
Johns River	11-38-(35.5)	From a point 0.5 mile upstream of Sims Branch to a point 0.7 mile downstream of NC Highway 18	WS-IV HQW	03-08-31	6.9 mi.	S	M		
Killian Creek	11-119-2-(0.5)b	From Anderson Creek to a point 1.2 miles upstream of mouth	C	03-08-33	3.2 mi.	I	M	Cause Unknown	Land Development
Killian Creek	11-119-2-(0.5)a	From source to Anderson Creek	C	03-08-33	11.6 mi.	S	M		
Limekiln Creek	11-129-16-2	From source to Long Creek	WS-II	03-08-36	1.9 mi.	S	M		
Linville River	11-29-(4.5)	Falls	B Tr	03-08-30	15.3 mi.	S	M		
Linville River	11-29-(19)	From southern Boundary of Daniel Boone Wildlife Management Area to Lake James, Catawba River	B HQW	03-08-30	7.1 mi.	S	M		
Little Buck Creek	11-19-11	From source to Lake Tahoma, Buck Creek	WS-II & B Tr	03-08-30	4.4 mi.	S	M		
Little Sugar Creek	11-137-8b	From Arcdale Road to NC 51	C	03-08-34	5.5 mi.	I	M	Fecal Coliform	Urban Runoff/Storm Sewers
Long Creek	11-120-(2.5)	From a point 0.6 mile downstream of Mecklenburg County SR 2074 to a point 0.4 mile upstream of Mecklenburg County SR 1606	WS-IV	03-08-34	11.3 mi.	I	M	Habitat degradation	Breached Mill Dam
Long Creek	11-129-16-(4)	From Mountain Creek to South Fork Catawba River	C	03-08-36	15.3 mi.	S	M		
Lower Creek	11-39-(0.5)a	From source to Zack's Fork	C	03-08-31	8.8 mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers
Lower Creek	11-39-(0.5)b	From Zack's Fork to Caldwell County SR 1143	C	03-08-31	5.1 mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers
Lower Creek	11-39-(6.5)	From Caldwell County SR 1143 to a point 0.7 mile downstream of Bristol Creek	WS-IV	03-08-31	6.8 mi.	I	M	Habitat degradation	Urban Runoff/Storm Sewers

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Lower Little River	11-69-(0.5)	From source to a point 0.5 mile upstream of mouth of Stirewalt Creek	C	03-08-32	14.0 mi.	I	M	Habitat degradation	Source Unknown
Lower Little River	11-69-(5.5)	From a point 0.5 mile upstream of mouth Stirewalt Creek to a point 0.8 mile upstream of mouth	WS-IV	03-08-32	8.6 mi.	S	M		
Lyle Creek	11-76-(3.5)	From Bakers Creek to US Highways 64 and 70	WS-IV	03-08-32	6.3 mi.	S	M		
Mackey Creek	11-15-(3.5)a	From Laurel Fork Creek to US 70	C	03-08-30	1.8 mi.	S	M		
Mackey Creek	11-15-(3.5)b	From US 70 to Catawba River	C	03-08-30	0.8 mi.	S	M		
Maiden Creek	11-129-5-7-2-(1)	From source to a point 0.7 mile upstream from backwaters of Maiden Reservoir	WS-II	03-08-35	4.9 mi.	I	M	Cause Unknown	
McAlpine Creek (Waverly Lake)	11-137-9c	From NC 51 to NC 521	C	03-08-34	4.6 mi.	I	M	turbidity	Urban Runoff/Storm Sewers
McDowell Creek	11-115-(1.5)b	From SR 2136 Mecklenburg Co to a point 0.7 mile upstream of mouth	WS-IV	03-08-33	2.9 mi.	I	M	Cause Unknown	Land Development
McDowell Creek	11-115-(1.5)a	From US Highway 21 to SR 2136 Mecklenburg Co	WS-IV	03-08-33	4.4 mi.	I	M	Cause Unknown	Land Development
McGalliard Creek	11-44-(3)	From a point 0.6 mile upstream of mouth to Rhodhiss Lake, Catawba River	WS-IV CA	03-08-31	3.9 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
McLin Creek	11-76-5-(3)	From a point 0.2 mile upstream of Catawba County SR 1722 to Lyle Creek	WS-IV CA	03-08-32	0.7 mi.	S	M		
Middle Little River	11-62	From source to Duck Creek	C	03-08-32	21.5 mi.	S	M		
Mill Creek	11-7-(0.5)	From source to Swannanoa Creek	C Tr HQW	03-08-30	5.0 mi.	S	M		
Muddy Fork	11-69-4	From source to SR 1409	C	03-08-32	6.8 mi.	S	M		
Mulberry Creek	11-38-32-(15)	From Dam at Mulberry Beach to Johns River	C	03-08-31	5.4 mi.	S	M		
North Fork Catawba River	11-24-(2.5)a	From mouth of Laurel Branch to Stillhouse Branch	B Tr	03-08-30	7.1 mi.	S	M		
North Fork Catawba River	11-24-(2.5)b	From Stillhouse Branch to Armstrong Creek	B Tr	03-08-30	3.5 mi.	I	M		
North Fork Catawba River	11-24-(13)	From Armstrong Creek to Lake James, Catawba River	C	03-08-30	7.0 mi.	NR	M		
North Muddy Creek	11-32-1	From source to Muddy Creek	C	03-08-30	18.4 mi.	S	M		
Paddy Creek	11-28	From source to 1.5 mi upstream of Lake James	C Tr	03-08-30	4.6 mi.	S	M		
Pinch Gut Creek	11-129-5-7	From source to Clark Creek	C	03-08-35	7.2 mi.	S	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Pott Creek	11-129-3-(0.7)	From a point 0.3 mile upstream of Lincoln County SR 1217 to South Catawba Fork River	WS-IV	03-08-35	3.2 mi.	S	M		
Silver Creek	11-34-(0.5)	From source to a point 1.3 miles downstream of Clear Creek	C	03-08-31	15.4 mi.	S	M		
Silver Creek	11-56-(2)	From a point 0.7 mile upstream of mouth to Lake Hickory, Catawba River	WS-IV CA	03-08-32	0.8 mi.	S	M		
Sixmile Creek	11-138-3	From source to North Carolina-South Carolina State Line	C	03-08-38	8.8 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Smoky Creek	11-41-(1)	From source to a point 0.6 mile upstream of mouth	WS-IV	03-08-31	7.5 mi.	S	M		
South Fork Catawba River	11-129-(0.5)	From source to Catawba-Lincoln County Line	WS-V	03-08-35	8.4 mi.	S	M		
South Fork Catawba River	11-129-(15.5)	From a point 0.4 mile upstream of Long Creek to Cramerton Dam and Lake Wylie at Upper Armstrong Bridge	WS-V	03-08-36	18.1 mi.	S	M		
South Fork Crowders Creek	11-135-10	North Carolina Portion	C	03-08-37	5.7 mi.	NR	M		
South Muddy Creek	11-32-2	From source to Muddy Creek	C	03-08-30	16.1 mi.	S	M		
Spainhour Creek	11-39-3	From source to Lower Creek	C	03-08-31	4.7 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Sugar Creek	11-137a	From source to below WWTP, SR 1156, Mecklenburg	C	03-08-34	0.3 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Sugar Creek	11-137b	From SR 1156 Mecklenburg to Highway 51	C	03-08-34	10.9 mi.	NR	M	Cause Unknown	Urban Runoff/Storm Sewers
Swannanoa Creek	11-7-9	From source to Mill Creek	C Tr	03-08-30	3.2 mi.	S	M		
Toms Creek	11-21-(2)	From Harris Creek to McDowell County SR 1434	C HQW	03-08-30	6.6 mi.	S	M		
Town Creek	11-129-5-4	From source to Clark Creek	C	03-08-35	3.8 mi.	S	M		
Twelvemile Creek	11-138	From source to North Carolina-South Carolina State Line	C	03-08-38	3.0 mi.	S	M		
Upper Creek	11-35-2-(13)	From Dam at Clear Water Beach Lake to Warrior Fork	WS-III Tr HQW	03-08-31	4.3 mi.	S	M		
Upper Little River (Cedar Creek)	11-58-(5.5)	From Morris Creek to a point 0.5 mile upstream of mouth	WS-IV	03-08-32	9.8 mi.	S	M		
Warrior Fork	11-35-(1)	From source to a point 0.6 mile upstream of City of Morganton water supply intake	WS-III	03-08-31	4.9 mi.	S	M		
White Mill Creek	11-39-8-1-(2)	From a point 0.6 mile downstream of Burke County-Caldwell County Line to Bristol Creek	WS-IV	03-08-31	3.4 mi.	NR	M		

Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis	Problem Parameters	Potential Sources
Wilson Creek	11-38-34	From source to Johns River	B Tr ORW	03-08-31	23.3 mi.	S	M		
Youngs Fork (Corpening Creek)	11-32-1-4a	From source to Marion WWTP	C	03-08-30	3.6 mi.	I	M	Cause Unknown	Major Municipal Point Source
Youngs Fork (Corpening Creek)	11-32-1-4b	From Marion WWTP to North Muddy Creek	C	03-08-30	1.9 mi.	I	M	Cause Unknown	Urban Runoff/Storm Sewers
Zacks Fork Creek	11-39-1	From source to Lower Creek	C	03-08-31	8.0 mi.	S	M		

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Name	Assessment Unit Number	Description	Class	Subbasin	Length / Area	Rating	Basis
CATAWBA RIVER (including backwaters of Lake James below elevation 1200)	11-(8)	From Dam at Old Fort Finishing Plant Water Supply Intake to North Fork Catawba River	C	03-08-30	23.5 mi.	S	M
North Fork Catawba River	11-24-(13)	From Armstrong Creek to Lake James, Catawba River	C	03-08-30	7.0 mi.	S	M
Linville River	11-29-(19)	From southern Boundary of Daniel Boone Wildlife Management Area to Lake James, Catawba River	B HQW	03-08-30	7.1 mi.	S	M
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31)	From Bridgewater Dam (Linville Dam) to a point 0.6 mile upstream of Muddy Creek	WS-V	03-08-30	1.1 mi.	S	M
CATAWBA RIVER (including backwaters of Rhodhiss Lake below elevation 995)	11-(31.5)	From a point 0.6 mile upstream of Muddy Creek to a point 1.2 mile upstream of Canoe Creek	WS-IV	03-08-30	9.8 mi.	S	M
Wilson Creek	11-38-34	From source to Johns River	B Tr ORW	03-08-31	23.3 mi.	S	M
Lower Creek	11-39-(6.5)	From Caldwell County SR 1143 to a point 0.7 mile downstream of Bristol Creek	WS-IV	03-08-31	6.8 mi.	NR	M
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(53)	From US Highway 321 Bridge to NC Highway 127	WS-IV&B CA	03-08-32	1232.8 ac.	S	M
CATAWBA RIVER (Lake Hickory below elevation 935)	11-(59.5)	From NC Highway 127 to Oxford Dam	WS-V&B	03-08-32	2093.6 ac.	S	M
Lower Little River	11-69-(0.5)	From source to a point 0.5 mile upstream of mouth of Stirewalt Creek	C	03-08-32	14.0 mi.	NR	M
CATAWBA RIVER (Lake Norman below elevation 760)	11-(74)	From Lookout Shoals Dam to Lyle Creek	WS-IV CA	03-08-32	265.3 ac.	S	M
CATAWBA RIVER (Lake Norman below elevation 760)	11-(75)	From Lyle Creek to Cowan's Ford Dam	WS-IV&B CA	03-08-32	31331.6 ac.	S	M
CATAWBA RIVER (Mountain Island Lake below elevation 648)	11-(114)	From Water Intake at River Bend Steam Station to Mountain Island Dam (Town of Mount Holly water supply intake)	WS-IV&B CA	03-08-33	1937.1 ac.	S	M
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(117)	From Mountain Island Dam to Interstate Highway 85 Bridge at Belmont	WS-IV CA	03-08-33	375.3 ac.	S	M
Dutchmans Creek	11-119-(0.5)	From source to a point 0.8 mile downstream of Taylors Creek	WS-IV	03-08-33	7.4 mi.	S	M

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Long Creek	11-120-(2.5)	From a point 0.6 mile downstream of Mecklenburg County SR 2074 to a point 0.4 mile upstream of Mecklenburg County SR 1606	WS-IV	03-08-34	11.3 mi.	NR	M
CATAWBA RIVER (Lake Wylie below elevation 570)	11-(122)	From I-85 bridge to the upstream side of Paw Creek Arm of Lake Wylie, Catawba River	WS-IV&B CA	03-08-34	601.1 ac.	S	M
CATAWBA RIVER (Lake Wylie below elevation 570) North Carolina portion	11-(123.5)	From the upstream side of Paw Creek Arm of Lake Wylie to North Carolina-South Carolina State Line	WS-V&B	03-08-34	3418.5 ac.	S	M
South Fork Catawba River	11-129-(0.5)	From source to Catawba-Lincoln County Line	WS-V	03-08-35	8.4 mi.	S	M
Henry Fork	11-129-1-(12.5)c	From State Route 1143 to Jacob Fork	C	03-08-35	8.6 mi.	S	M
Henry Fork	11-129-1-(12.5)b	From State Route 1124 to State Route 1143	C	03-08-35	4.8 mi.	S	M
Clark Creek	11-129-5-(9.5)	From a point 0.9 mile upstream of Walker Creek to South Fork Catawba River	WS-IV	03-08-35	1.8 mi.	NR	M
Indian Creek	11-129-8-(5)	From a point 0.4 mile upstream of mouth of Lick Fork to a point 0.3 mile upstream of Lincoln County SR 1169	C	03-08-35	2.6 mi.	S	M
South Fork Catawba River	11-129-(15.5)	From a point 0.4 mile upstream of Long Creek to Cramerton Dam and Lake Wylie at Upper Armstrong Bridge	WS-V	03-08-36	18.1 mi.	S	M
Long Creek	11-129-16-(4)	From Mountain Creek to South Fork Catawba River	C	03-08-36	15.3 mi.	NR	M
Crowders Creek	11-135e	From State Route 1108 To NC 321	C	03-08-37	1.5 mi.	I	M
Crowders Creek	11-135b	From State Route 1118 to State Route 1122	C	03-08-37	3.1 mi.	I	M
Crowders Creek	11-135a	From source to SR 1118	C	03-08-37	1.9 mi.	I	M
Crowders Creek	11-135g	South Carolina State Line	C	03-08-37	1.5 mi.	I	M
Crowders Creek	11-135f	From State Route 321 to State Route 2424	C	03-08-37	1.4 mi.	I	M
Crowders Creek	11-135c	From State Route 1122 to State Route 1131	C	03-08-37	3.3 mi.	I	M
Crowders Creek	11-135d	From State Route 1131 to State Route 1108	C	03-08-37	7.3 mi.	I	M
Blackwood Creek	11-135-7	From source to Crowders Creek	C	03-08-37	4.4 mi.	I	M
Sugar Creek	11-137a	From source to below WWTP, SR 1156, Mecklenburg	C	03-08-34	0.3 mi.	NR	M

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Sugar Creek	11-137b	From SR 1156 Mecklenburg to Highway 51	C	03-08-34	10.9 mi.	NR	M
Irwin Creek	11-137-1	From source to Sugar Creek	C	03-08-34	11.8 mi.	NR	M
Little Sugar Creek	11-137-8b	From source to Arcdale Road	C	03-08-34	5.5 mi.	NR	M
McAlpine Creek (Waverly Lake)	11-137-9a	From source to SR 3356, (Sardis Road)	C	03-08-34	8.5 mi.	NR	M
Twelvemile Creek	11-138	From source to North Carolina-South Carolina State Line	C	03-08-38	3.0 mi.	NR	M

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