CHAPTER 6

MAJOR BASINWIDE WATER QUALITY CONCERNS AND RECOMMENDED MANAGEMENT STRATEGIES

6.1 INTRODUCTION

Major concerns for water quality in the Broad River basin include addressing impacts from wastewater treatment plants, controlling sedimentation, addressing nonpoint source impaired waters, assuring balanced growth and maintaining current high levels of water quality.

Relative to other basins in North Carolina, few waters in the Broad River basin (only 3 percent of the total number of stream miles) are considered impaired. The challenge during the next five years will be to maintain the quality of waters where data indicates that conditions are good, and to take strides to improve the quality of waters that are exhibiting degradation.

The long range mission of basinwide management is to provide a means of addressing the complex problem of planning for increased development and economic growth while protecting and/or restoring the quality and intended uses of the Broad River basin's surface waters. Sediment and other priority issues are discussed in Section 6.2, below. In striving towards its mission, DWQ's highest priority near-term goals are as follows:

- **To identify and restore impaired waters in the basin.** Section 6.3 discusses impaired and threatened waters and how these waters are prioritized for restoration and protection. Priority Issues and Recommended Management Strategies are presented for each subbasin in Section 6.4.
- **To identify and protect high value resource waters and biological communities of special importance.** Section 6.5 discusses management strategies for protecting important biological communities in the basin.
- **To manage the causes and sources of pollution so as to ensure the protection of those waters currently supporting their uses while allowing for reasonable economic growth.** Major water quality issues addressed under this topic in Section 6.6 include, management strategies for controlling sedimentation, nonpoint source pollution from agriculture, urban and industrial stormwater control, fecal coliform bacteria, toxic substances and oxygen-consuming wastes.

6.2 MAJOR WATER QUALITY CONCERNS AND PRIORITY ISSUES

6.2.1 Addressing Impacts From Wastewater Treatment Plants

Although much progress has been made in the treatment of wastewater over the past 20 years, three of the four streams in the basin that are impaired based on recent water quality sampling are impacted by point source discharges. In most of the cases, actions have been or will be taken in the foreseeable future to mitigate these impacts. However, it will be important during this basinwide planning cycle for DWQ to continue to work with the wastewater discharges of concern to make appropriate improvements to protect water quality.

6.2.2 Controlling Erosion and Sedimentation

Erosion, and the resulting sedimentation, are prevalent throughout the basin. Of the 48 miles of streams that are considered impaired, 15 are impacted by sediment. In addition, there are approximately 112 miles of streams that are considered threatened because of impacts from sediment. Workshop participants (Section 6.2.3) and Nonpoint Source Team members (Section 6.2.2) have expressed that an important priority issue for the basin is sedimentation. Many waters in the basin are thought to be impacted or impaired, at least in part, by sedimentation (Table 4.17 in Chapter 4). The sources of sedimentation are discussed in detail in Chapter 3, programs to address erosion and sedimentation are discussed in Chapter 5 and Appendix VI, some of the actions being taken at the local level are discussed in Chapter 5, Section 5.6. General management strategies for controlling sedimentation are presented in Section 6.5.

6.2.3 Addressing Nonpoint Source Impaired Waters

Pollution from nonpoint sources is identified as the major contributor to water quality impairment in the Broad River Basin. Ninety-five percent of the 48 miles of waters that are impaired are thought to be impacted, at least in part, by nonpoint sources of pollution. It is recognized that in some cases the information that DWQ has concerning nonpoint source contributions from land uses such as agriculture are dated and general. Accomplishments in managing runoff from agriculture and animal operations that have occurred during the last five years or so (such as Conservation Management Plans in compliance with the Farm Bill, or improved management of waste from animal operations in compliance with new regulations) are not reflected in this information. The reason for this is that the implementation of these programs is just beginning to occur or has occurred subsequent to the purview of water quality assessments available. However, agriculture remains prominent in the landscape of the river basin and it will be important to work toward further gains in this area in order to protect water quality.

In addressing nonpoint sources of pollution, it is important to acknowledge agency and local government resource constraints to taking actions to tackle these problems. The task of confirming and clearly identifying exact sources, developing management strategies, implementing best management practices and monitoring for water quality improvements is clearly beyond the current resources of DWQ, other agencies involved in managing nonpoint sources and local governments. Only limited progress can be expected unless substantial resources are put toward solving nonpoint source problems. Therefore, due to the lack of resources, this basinwide plan lacks specific strategies to address nonpoint source pollution.

As one means of addressing this problem, DWQ has formed a voluntary nonpoint source team for the basin. Working with the NPS Team (a knowledgeable team of local professionals and stakeholders) is an avenue for identifying NPS priorities as well as targeting and coordinating existing resources within a basin. The NPS Team for the Broad River Basin is currently working to develop a project proposal for funding through the federal NPS program (Section 319). The team members participate voluntarily within their existing resource constraints. Limited progress can be expected in restoring impaired waters through the team without additional resources.

The Broad River NPS Team is one of a number of teams that DWQ has begun setting up in each of the state's 17 major river basins. These teams have representatives from agriculture, urban stormwater, construction, mining, on-site wastewater disposal, forestry, solid waste, wetlands, groundwater, natural resource agencies, local governments, special interest groups and citizens. Team members are asked to 1) provide descriptions of current NPS management activities within a basin, 2) conduct assessments of NPS controls in targeted watersheds, 3) prioritize impaired waters for development and implementation (including funding) of restoration strategies and 4) prioritize NPS issues for remedial action. Each team is asked to develop five year action plans to reflect these priorities.

The Broad NPS Team has identified team goals for abating nonpoint source pollution in the river basin as well as the conditions needed to reach those goals. A summary of the results is presented in Table 6.1 below. DWQ will continue to work with the Team to refine these goals and incorporate them into a plan of action; however, limited progress is expected on restoring impaired waters without additional resources.

Table 6.1 Goals and Needs Identified by the Broad NPS Team

Category	Goal	Need
Recreation	Expand recreation use of local parks and natural areas, particularly around Green River and the Rocky Broad	More public access to recreational areas along rivers and streams
Public Education	Produce brochures to educate the public about public access to recreational areas around local rivers and streams	Non-threatening, repetitive public education
Sedimentation and erosion from development	Promote the adoption of sediment erosion control ordinances	A minimum standard for development (for human protection, sanitation, density, conservation easement, etc.).
General Public Involvement	Generate more environmental stewardship	An 'everyone is affected' attitude

6.2.4 Growth Management

Based on data from the USDA Natural Resources Conservation Service, the most significant land cover change between 1982 and 1992 was a 71% increase in the amount of urban land. In addition, census data from 1970 to 1990 indicates that the population of subbasin 03 (the upper Green River area) increased by 70% and the population of subbasin 05 (Buffalo Creek) increased by 26%. As the Charlotte area continues to grow and as people from a variety of areas continue to pursue second home development in the North Carolina mountains, the pressures of growth will continue in this region. Proactive planning efforts at the local level are needed to assure that development is done in a manner that preserves the quality of the basin's surface waters, and important resource for residents. These planning efforts will need to find a balance between water quality protection, natural resource management and economic growth. Growth management requires planning for the needs of future population increases as well as maintaining a strong tourism base. These actions are critical to water quality management and the quality of life for the residents of the basin. The recommendations in section 6.6.4 for urban stormwater control contain ideas that can help alleviate the impacts from growth.

6.2.5 Priority Issues and Recommended Actions Identified by Workshop Participants

Broad River Basinwide Planning Workshops were conducted on June 2 and 3 in Spindale, Lake Lure and Shelby, North Carolina. There were a total of 90 registered participants representing the following interests:

23 City and County Government
21 Business and Industry
17 Farmers and Landowners
17 State and Federal Government
7 Citizen Organizations
3 Academic Institutions
2 Cooperative Extension Service

Workshop participants divided into small discussion groups to address the question: "What are the priority water quality issues in the Broad River Basin?" Each participant was then given five votes to apply to those issues that they believed to be the most important on the list they generated. The following general categories were distilled from the information generated in the subgroups.

* *sedimentation* - identification of sources (agriculture, forestry, development), the need for regulation and education, and stream erosion
* *color* - color standards for industry, cost of treatment (problem in water supplies)
* *education* - public education and awareness on water quality issues, regulation, methods to avoid nonpoint source pollution
* *enforcement* - better enforcement needed for existing regulations, more staff needed
* *management of nonpoint source pollution*
* *the need for fair, equitable, common-sense regulations* - better enforcement of regulations is wanted, but participants stressed the need for fair, equitable, common-sense regulations that were effective but not overly costly

These categories and associated specific comments are presented in more detail in Table 6.2 along with reference to sections of this basinwide management plan where applicable. While each identified issue may not be directly responded to in the plan, an effort has been made to consider these issues within the framework of the basinwide approach. Where there has been some discussion about the category or specific comments within the plan, the table provides this reference.

Table 6.2. Priority Water Quality Issues Identified by Workshop Participants and Reference Sections in the Broad River Basinwide Water Quality Management Plan

General Category	Specific Comments	Reference Section
Sedimentation	Siltation from forestry operations, clear-cutting; DOT projects; Unpaved roads; Soil disturbance from new development; Disturbance from dredging; Bank erosion	3.2.1, 6.6.1
Color	Need for a standard; Effect on recreational uses of waters; Effect on water supply	3.2.3, 6.6.2
Education	About erosion control and sedimentation; For: golf course owners, politicians, homeowners, and others	6.6, Appendices V and VI
Enforcement	Need proper monitoring of point sources; Public notification about sedimentation and erosion control violations; Consistent application of sedimentation and erosion control laws; Need better enforcement of existing standards	5.6.2, 7.3.1
General Nonpoint Source Pollution	Growth; Urban runoff; Loss of buffers (filter land); Runoff from junkyards; Control of petroleum products, waste oil from nonpoint sources; Septic system concerns; Fertilizer runoff from lawns; Straight pipes; Trash and litter control needed	3.4, 3.4.6, 5.5
Common-sense and fair regulations	Need reasonable effluent standards for municipalities; Need to compensate the regulated community; Need reasonable regulations for livestock and agriculture; Make decisions based on science, not emotions; Don't unfairly regulate point sources when nonpoint sources are the problem	5.7
Natural resource preservation	Wildlife; Recreation and aesthetic values; Fisheries; Water supplies; Concern about secondary impacts of chip mills	7.2.2, 3.4.4, 2.6
Specific areas of concern	Second Broad River (sedimentation and point source pollution); Landfill near Moss Lake (need to continue close monitoring); Rutherford County needs county-wide sewage treatment; Spindale wastewater treatment plant does not accept septic tank waste because it contains mercury	6.4.2, 7.3.6

6.3 IDENTIFICATION AND RESTORATION OF IMPAIRED WATERS

6.3.1 What Are the Impaired Waters?

Impaired waters are those waters identified in Chapter 4 as partially supporting or not supporting their designated uses. Table 6.3 presents partially supporting (impaired) waterbodies in the Broad River basin based on monitored data. The table includes the probable source of impairment, a summary of the recommended management strategy and the section in Chapter 6 that discusses the issue in more detail. Table 6.4 is essentially the same, except these are waters that are considered impaired based on evaluated data. Waters that are impaired based on 'monitored' information have been assessed using recent data, while the evaluated information is older (> 5 years) and may not reflect current conditions. But, since it is the best information that is currently available, water

quality conditions may still be depressed and these areas warrant attention. Chapter 4 provides a detailed explanation of use support ratings.

As mentioned in section 6.2.2, it is recognized the information that DWQ has regarding probable sources of impairment from nonpoint source contributions are imperfect. Tables 6.3 and 6.4 indicate that most of the waters are impaired due to some type of nonpoint source pollution. It is important to acknowledge that these represent the best information available at this time. It is understood that this information may not reflect significant management accomplishments that have been made in recent years. For example, in the agricultural sector, farmers have made important advances in managing runoff from crops and animal operations (through the implementation Conservation Management Plans in compliance with the Farm Bill, or improved management of waste from animal operations in compliance with new regulations). These advances may be reflected in the results of water quality sampling, but, where impairment still exists (as reflected in the following tables), staff rely on available information to identify a probable source of the problem. The NPS Team may be able to help update this information.

Table 6.3 Recommended Management Strategies for *Monitored Impaired Waters in the Broad River Basin

Waterbody (subbasin)	Use Support Rating	Probable Source of Impairment	Recommended Management Strategy	Chapter 6 Reference Section
Walnut Creek (030802)	PS	nonpoint source(s) (possibly agricultural runoff)	The landuse in the immediate vicinity of the monitoring location is primarily fallow agricultural fields. DWQ should work with the local agricultural agencies to help farmers in this watershed ensure that appropriate measures are taken to minimize runoff into surface waters from agricultural activities (resources permitting**).	6.4.2
Catheys Creek (030802)	PS	point source (Spindale) and nonpoint source(s) (possibly agricultural runoff)	DWQ will continue to work with point sources to ensure protection of the surface waters through compliance with effluent limits. DWQ should also work with local experts to assess NPS contributions to impairment (resources permitting**).	6.4.2
Beaverdam Creek (030804)	PS	point sources (four small discharges) and nonpoint sources (erosion, sand dredging)	DWQ will require that four discharges upstream of the monitoring site conduct instream monitoring to determine to what extent they are contributing to impairment. DWQ should also work with local experts to assess NPS contributions to impairment as well as the impact of the dredging project (resources permitting**).	6.4.4
Lick Branch (030805)	PS	point source (New Minnette Textiles)	DWQ will monitor the stream for progress since improvements were made to point source situation in late 1995.	6.4.5

** Based on monitored data collected between 1992 and 1996.*
*** Only limited progress towards developing and implementing nonpoint source strategies for these impaired waters can be expected without additional resources.*

Table 6.4 Recommended Management Strategies for Impaired Waters in the Broad River Basin Based Evaluated Information

Waterbody (subbasin)	Use Support Rating	Probable Source of Impairment	Recommended Management Strategy	Chapter 6 Reference Section
Hollands Creek (030802)	NS	point source(s)	Spindale should continue to pursue its efforts to move its outfall from Hollands Creek to Catheys Creek.	6.4.2
Brushy Creek (lower portion) (030804)	PS	point sources and nonpoint sources	Resources permitting, DWQ will update the water quality information at the lower end of the creek during the next basinwide cycle to more clearly determine whether the stream is still impaired and, if so, what are the causes and sources of the impairment.	6.4.4
Hickory Creek (030804)	PS	point source and nonpoint sources	DWQ will conduct follow-up monitoring, resources permitting, to determine current status of water quality since the removal of an effluent source from the stream. Contributions from nonpoint sources (particularly urban) should also be investigated.	6.4.4
Buffalo Creek (030805)	PS	point source and nonpoint sources	DWQ will conduct follow-up monitoring, resources permitting, to determine current status of water quality in this section of the creek. This effort should include the identification of activities influencing water quality.	6.4.5

6.3.2 What are the "Threatened Waters"?

Some waters in the basin have notable water quality problems but the impact of the problem is not severe enough to cause the stream to be considered impaired under the state use-support designation described in Chapter 4. These waters are rated Support-Threatened. Twenty-six percent of the surface waters in the Broad River basin are Support-Threatened (see Table 4.17 and Figure 4.20). The identification of Support-Threatened waters can be used to determine the sources and causes of degradation and to determine if management strategies can be used to reduce or eliminate the causes of pollution before impairment occurs.

6.3.3 How are Waters Prioritized for Restoration or Protection?

There are several different ways that waters are prioritized for restoration and protection depending upon the purpose of the prioritization. The three primary methods strategies for prioritization of waters based on water quality concerns are described below.

Priority Waters for Nonpoint Source (NPS) Management Strategies

DWQ has developed criteria to help NPS Teams to prioritize NPS-impaired waterbodies for management actions. This prioritization process will help the Teams as well as other agencies and groups allocate financial, technical and educational assistance to NPS efforts. These prioritization criteria are discussed in Appendix IV in the discussion of NPS Teams and can be summarized as follows:

- highly valued resource waters in need of restoration or protection from NPS pollution, and
- waters with impaired water quality as a result of NPS pollution.

Waters prioritized for action should have a high likelihood for successful restoration or protection.

The Broad River basin NPS Team has also worked to identify specific criteria that they consider important in targeting their efforts. The criteria developed by the Broad River NPS Team is as follows:

- Water quality impairment
- Recreational value
- Community concern/'buy-in'
- Use as a demonstration to others
- Presence of existing programs or initiatives
- Long-term risk of losing creek/stream to development, erosion, etc.
- Measurable improvement (to water quality, public education, etc).
- The existence of local resources (technical assistance, for instance)
- Basin-wide benefit
- Lasting effect on water quality

Waters that meet the above criteria will form a list of potential candidates for targeting by the NPS team. The team will be working with the list of impaired waterbodies presented in Tables 6.3 and 6.4 in conjunction with the criteria presented to determine where their efforts should be targeted.

Section 303(d) of the Clean Water Act (CWA)

States are required to develop a list of waters not meeting water quality standards or which have impaired uses (Partially Supporting or Not Supporting) under Section 303(d) of the Clean Water Act. Waters may be excluded from the list if existing control strategies are expected to achieve the standards or uses. Management strategies may be both point or nonpoint programs. Waterbodies which are listed must be prioritized and a management strategy or Total Maximum Daily Load (TMDL) must be developed.

Use support ratings for the 303(d) list are based on monitoring data collected in the last five years. Further information on the 303(d) program and a complete list of 303(d) waters in the Broad River basin can be found in Appendix VII. The list includes use support ratings, major causes and sources of impairment, descriptions of potential sources of pollution and the stream priority rating.

6.4 PRIORITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES BY SUBBASIN

6.4.1 Subbasin 030801 - Upper Broad River basin (including Lake Lure and Cove Creek)

Rivers and streams in this subbasin have generally good water quality with very few violations of chemical water quality standards. Both the Broad River above Lake Lure and a downstream site on Cove Creek received Excellent bioclassifications in 1995. All monitored waters in this subbasin are considered to be fully supporting their uses.

Issues and Recommended Management Strategies

Although water quality in this subbasin is considered high, there is evidence that sedimentation is an issue. Problems with sedimentation in Lake Lure have led the town to spend $1,232,000 to dredge the lake. Information provided in Chapter 3 of this basin plan indicate that sedimentation rates throughout the Broad River basin, including the Cove Creek area, are relatively high.

Recommendations:
Measures to address sedimentation in this subbasin are needed. One of the goals identified by the NPS Team (Table 6.1) is the promotion of the adoption of local erosion control ordinances. Workshop participants identified the need for local education about erosion control and sedimentation. Local citizens and governments should consider pursuing such efforts.

In addition, because water quality in this subbasin is generally high, it is important to take actions to maintain these high levels. Some areas may qualify for a more protective surface water classification such as High Quality Waters. This is discussed in more detail in section 6.5.

6.4.2 Subbasin 030802 - Middle portion of the Broad River, including Walnut Creek, Mountain Creek, the lower Green River and the Second Broad River

This subbasin includes an approximately 35-mile portion of the Broad River watershed (from about 5 miles below the dam at Lake Lure to the confluence of the Second Broad River near the Cleveland/Rutherford County line), the entire Second Broad River drainage, and the lower drainage of the Green River. Other significant tributary catchments of the Broad River include Mountain, Cleghorn, and Floyd Creeks. Large tributary systems of the Second Broad River include Catheys Creek and Robinson Creek. Water quality, based on benthic macroinvertebrate information, generally ranges from Good to Good/Fair in this subbasin, although some streams are considered impaired. Problem areas are specifically addressed below.

Issues and Recommended Management Strategies

Walnut Creek
Walnut Creek, a tributary to the Green River, was sampled in 1995 as part of the Broad basinwide assessment. This site received a low bioclassification (Fair) and a low habitat score. Based on these results, this stream has received a use support rating of Partially Supporting. The field team noted unstable banks with breaks in the riparian zone and a heavily embedded substrate. The landuse in the immediate vicinity of the monitoring location is primarily fallow agricultural fields.

Recommendation:
There is a need in this watershed to more clearly identify the source (or sources) of impairment in order to determine what measures can be taken to improve water quality. DWQ should work with the local agricultural agencies to help farmers in this watershed ensure that appropriate measures are taken to minimize runoff into surface waters from agricultural activities (resources permitting). In addition, it is recommended that the NPS Team consider this area as a possible target of their efforts, resources permitting.

Catheys Creek and Hollands Creek
Catheys Creek has been given a use support rating of Partially Supporting based on three benthic macroinvertebrate surveys conducted between 1988 and 1995. The bioclassification has been borderline between Good/Fair or Fair using mountain classification criteria during all three surveys. The creek is impacted by the Spindale wastewater treatment plant. Based on nonpoint source workshops held in 1988, it was also indicated that the stream was receiving nonpoint source runoff from agricultural areas. Hollands Creek (which flows into Catheys Creek) is rated as Not Supporting based on data that is greater than five years old, but it is the receiving stream for the Spindale wastewater treatment plant.

The Spindale WWTP currently discharges 6.0 MGD of domestic and industrial wastewater into Hollands Creek. Historic macroinvertebrate data collected by DWQ determined this creek was not supporting its designated uses due to point source inputs. The Spindale WWTP with an instream waste concentration of 73% has had problems passing its whole effluent toxicity test. In order to maintain compliance with its NPDES permit limitations and to relieve stress on the receiving stream, Spindale has elected to relocate its outfall to Catheys Creek, a larger receiving stream

approximately 1 mile from its existing discharge point. In Catheys Creek, Spindale's effluent will be 32% of the streamflow and should be able to pass its toxicity test. Hollands Creek should begin recovery once the Spindale outfall is relocated.

In addition to relocation of the outfall, plant improvements will be made including the addition of a dissolved flotation unit and replacement of weirs and baffles in the final clarifiers. These improvements will enhance the operation of the plant and reduce the cost of sludge disposal. DWQ recommends that Spindale continue toxicity reduction evaluation efforts and seek cooperation from industrial contributors in order to obtain and maintain compliance with toxicity limits in Cathey's Creek.

Recommendation:
It is recommended that Spindale continue to pursue its efforts improve its wastewater treatment and to relocate its treatment plant outfall to Catheys Creek. This should relieve conditions on Hollands Creek and DWQ will monitor impacts on Catheys Creek. In addition, DWQ should work with local experts to assess NPS contributions to impairment and it is recommended that the NPS Team consider the Catheys Creek watershed as a possible target of their efforts, resources permitting.

Second Broad River
The relocation of the Spindale discharge into Catheys Creek could cause some water quality problems in the Second Broad River because of interaction with existing municipal and industrial dischargers located downstream. Major downstream dischargers include Forest City WWTP (4.95 MGD), Burlington – J.C. Cowan Plant (2.5 MGD), and Cone Mills (1.75 MGD).

The Forest City WTP has a water withdrawal of 8 MGD on the Second Broad River approximately 0.1 mile above the confluence of Catheys Creek. Historically, the streamflow inputs in the water quality models developed on the Second Broad River did not account for the water withdrawal of 8 MGD by the Forest City Water Treatment Plant (WTP). The 7Q10 low flow inputs to the model for this segment of the river were equal to 32 cfs. Updated information from the Division of Water Resources indicated that the 7Q10 on the Second Broad River above Cathey's Creek should be revised to 13 cfs based on the withdrawal. This revision is a 59% reduction in the flow input. New modeling results predicted that the assimilative capacity in the Second Broad River just below the Burlington - J.C. Cowan plant was nearly depleted (approaching the water quality standard of 5.0 mg/l) under 7Q10 conditions. Increased water withdrawal from the Forest City WTP due to future expansion will further modify the 7Q10 of the Second Broad River below the WTP. Previously developed effluent limits have been assigned to major dischargers to the river based on a much higher streamflow.

Recommendation
Modeling results indicate wasteflow interaction between the Spindale and Forest City plants results in predicted instream dissolved oxygen (DO) violations. The Division has determined that for the protection of the Second Broad River, equivalent limits should be assigned to the Forest City and Spindale WWTPs. New effluent limits have been developed for Forest City and Spindale that have accounted for the water plant withdrawals of 8 MGD and a proposed expansion to 12 MGD. In addition, based on these modeling results, the other facility affected is the industrial discharge of Burlington-J.C. Cowan. Preliminary model results indicated that in order to protect for predicted DO contravention; the J.C. Cowan plant will have to be held at its existing BOD5 loading for any future expansions.

Upon initiation of increased water withdrawal from the Second Broad River resulting from the expansion of the Forest City Water Treatment Plant, the NPDES permits for Spindale and the Forest City WWTP may be modified to incorporate more stringent effluent limitations for the oxygen consuming constituents, BOD5 and NH3 as N, to protect the downstream dissolved oxygen standard. Other permitted parameters may also be modified if necessary. If there is

documentation of instream water quality standard violations as a result of the decrease in the 7Q10 flow in the Second Broad River; effluent limits for Spindale, Forest City and Burlington – J.C. Cowan will have to be modified. Any plant expansions of these three dischargers will also result in the modification of permit limits.

In order to gain a better picture of the system, DWQ has developed a study plan for the Second Broad River to collect data to calibrate a QUAL2E model. Data was scheduled to be collected in 1996, however flow conditions and extreme weather, especially Hurricane Fran, did not allow for completion of the field studies. The study and a QUAL2E model will be completed by the next Broad basin plan, if resources allow it. The model results will be helpful in developing adequate wasteload allocations for the Second Broad River dischargers.

Another issue to be addressed in the Second Broad River is color. Citizen complaints about the aesthetics of the receiving stream due to dischargers' colored effluent have always been a topic of concern within DWQ. There has been some reduction of color inputs into the Second Broad River. In 1995, Cone Mills voluntarily implemented color removal by polymers through a flocculation and filtration system. Site visits by DWQ staff to the plant have shown marked improvement in the quality of the effluent. The Division's management strategy will include informational seminars in 1998 to provide technical assistance to dischargers for the removal of color. It is recommended that facilities voluntarily remove or reduce color so that numerical standards and effluent limits will not have to be assigned.

6.4.3 Subbasin 030803 - Green River drainage above Lake Adger

Subbasin 030803 contains the headwater reaches of the Green River and streams within this subbasin are in the mountain physiographic region. This section of the Green River has been dammed at two locations to form Lake Summit and Lake Adger. The Hungry River is the only large tributary catchment.

Issues

Water quality in this subbasin is generally high. All waters are fully supporting their uses although the Hungry River, which is supporting its uses, is considered threatened due to sedimentation problems.

The upper Green River watershed has been determined to qualify for classification as High Quality Waters as well as Class B (primary recreation). DWQ intends to pursue the reclassification of the upper portion of the river, but due to the lengthy nature of the rule-making process, it is not clear when this will occur. This action, if successful, will help to preserve the high quality nature of these waters. The HQW classification is described in more detail in section 6.5.

6.4.4 Subbasin 030804 - First Broad River and lower portion of Broad River in NC

Subbasin 04 contains the First Broad River and its tributaries, as well as the lowest portion of the mainstem of the Broad River before it enters South Carolina. This geographic area is a transitional zone between ecoregions, with some streams exhibiting mountain characteristics, while other streams are more piedmont in nature. Recent macroinvertebrate data indicated Good water quality in the First Broad River in the area near Casar with a slight decrease to Good-Fair near Earl. Excellent water quality was documented in the North Fork First Broad River, a headwater tributary to the First Broad in 1995. Many tributary streams have Good or Good-Fair water quality. The only recent data indicating Fair water quality was from Beaverdam Creek below some small dischargers. Some streams are considered impaired. Problem areas are specifically addressed below.

Issues and Recommended Management Strategies

Beaverdam Creek

Beaverdam Creek has been assigned a use support rating of Partially Supporting based on benthic macroinvertebrate sampling conducted in 1995. The site was given a Fair bioclassification. Water quality in the stream is potentially affected by several small dischargers and nonpoint runoff in the catchment. The stream was eight meters wide with severely eroded banks and a shifting sand bottom at the collection site. A sand dredging operation was adjacent to the site. Effluent from the discharging facilities, nonpoint runoff, and habitat degradation probably all contributed to the low rating.

There are four small ($\leq$ 0.020 MGD) dischargers located in the range of 2 - 5 miles upstream of Beaverdam Creek at Highway 150. Jefferson Smurfit Corporation (also know as Container Corp.), Specialty Lighting and Crest High School all discharge to an unnamed tributary to Beaverdam Creek (also known as East Fork Beaverdam Creek). Crest Junior High School is a direct discharger to Beaverdam Creek about 0.1 mile upstream of the aforementioned unnamed tributary to Beaverdam Creek. Modeling results predict that the dissolved oxygen standard will be protected downstream of these dischargers. In mid-1994 and once in April 1995, Jefferson Smurfit was having problems meeting its whole effluent toxicity test. However since May 1995, the facility has passed all toxicity tests.

Benthic macroinvertebrate data collected in 1995 rated Beaverdam Creek as "fair". Based on this information, Beaverdam Creek had an overall rating as partially supporting its designated use and is listed on the 303(d) impaired streams list. Potential causes for this rating are from point and nonpoint sources.

Recommendation

DWQ will require that the four discharges mentioned above conduct instream monitoring to determine if and to what extent these facilities are contributing to the impairment of Beaverdam Creek further downstream. In addition, DWQ, resources permitting, will work with local professionals and stakeholders to assess possible contributions to the impairment from nonpoint sources.

Brushy Creek

A sampling site at the lower end of Brushy Creek was given a Fair biological rating in 1985 and 1988. Comments provided at a nonpoint source workshop in 1988 attributed the impairment, at least in part, to runoff from agricultural areas, however at the time, point sources were also thought to be contributing to impairment. Although a site further upstream was sampled in 1995 and was found to have a Good rating, the lower site was not updated. As a result, it is unclear whether the lower section of the creek is still impaired.

Recommendation

Resources permitting, DWQ will update the water quality information at the lower end of the creek during the next basinwide cycle to more clearly determine whether the stream is still impaired and, if so, what are the causes and sources of the impairment.

First Broad River

The City of Shelby WWTP, PPG Industries, and Ora Mills discharge to the First Broad River watershed. In 1990, Shelby relocated its discharge to the mainstem of the First Broad River from Hickory Creek. The portion of Hickory Creek that Shelby had been discharging to was rated as "poor" (based on 1987 data) and therefore considered impaired. (The First Broad River which is currently receiving their waste is not considered impaired.) In 1993, Shelby requested speculative limits for expansion to 8.5 MGD. PPG Industries discharge 1.3 MGD to Brushy Creek, a tributary of the First Broad River upstream of Shelby. Brushy Creek below PPG has been rated fair in the past. The Shelby WTP withdraws 12 MGD from the First Broad River above Brushy

Creek. This withdrawal was not accounted for in previous models. A calibrated model will allow better wasteload allocations and provide a modeling tool for basinwide management.

Recommendation
In order to gain a better picture of the system, DWQ has developed study plan for the First Broad River to collect data to calibrate a QUAL2E model. Data collection was scheduled in 1996 however flow conditions and extreme weather, especially Hurricane Fran, did not allow for completion of the field studies. If resources and weather conditions allow it, the study and model will be completed before the next Broad River Basin plan update.

Hickory Creek
Hickory Creek is rated as Partially Supporting based on sampling done in 1987 to determine whether or not the Shelby wastewater treatment plant had an impact on the stream. The data indicated that the wastewater treatment plant, in addition to nonpoint source pollution, was having an impact on the stream. Since this sampling event, the City of Shelby has moved its discharge to the First Broad River.

Recommendation
Follow-up monitoring is needed to determine what effect removal of the plant has had, and whether urban runoff is causing impairment in the stream. Improvements to the City of Shelby's wastewater treatment plant, which included the removal of the discharge point on Hickory Creek, have likely lead to an improvement in water quality at this site. However, it is unclear to what extent this is the case due to the potential influence of nonpoint sources of pollution. The NPS team may also consider this area for targeting of their efforts if resources are available, but as a lower priority than streams in the basin that are impaired based on monitored information. DWQ will update the water quality information in the creek during the next basinwide cycle, resources permitting.

Potential HQW/ORW Classification of North Fork First Broad
The North Fork First Broad River received an Excellent bioclassification in 1995, and the fish community had a Good-Excellent NCIBI in same year. If petitioned, a follow-up survey could be conducted to determine if the stream and its tributaries qualify to be reclassified to HQW or ORW (see section 6.5).

6.4.5 Subbasin 030805 - Buffalo Creek

Subbasin 05 consists of Buffalo Creek and its tributaries. Although a few streams in the northern portion of the subbasin exhibit some montane characteristics, this subbasin is considered to be in the piedmont ecoregion. The subbasin includes two lakes - Kings Mountain Reservoir (Moss Lake) and Lake Montonia. Water quality in this subbasin ranges from Fair to Good. Impaired waters are addressed specifically below.

Issues and Recommended Management Strategies

Lick Branch
This site on Lick Branch is located below the New Minnette Textiles discharge. Although there has been improvement in the Biotic Index since 1983, the Fair bioclassification in 1995 indicated that the effluent from the mill was still impacting the stream fauna.

New Minnette Mills (NC0004235), a textile plant that produces woven bedspreads and blankets, currently discharges 0.262 MGD of wastewater into Lick Branch. Due to the small size of the receiving stream, New Minnette's discharge yields an instream waste concentration of 78%. The discharge has had long-term problems with compliance of its whole effluent toxicity test.

Until late 1995, the New Minnette plant also discharged wastewater from another textile mill, Grover Industries. In 1994, Grover Industries had initially requested an individual outfall into Lick Branch, however DWQ denied this request based on the poor biological condition of the stream. In 1995, Grover Industries opted for another alternative and constructed an outfall into the much larger Buffalo Creek, approximately three miles downstream. Although, it is preferred that toxicity problems be solved though reduction evaluation studies, the discharge site into Buffalo Creek was approved because of large dilution and capacity of stream to assimilate the wastewater. New Minnette's toxicity testing results have improved since Grover Industries removed its discharge. Grover Industries is also consistently passing its toxicity limits for its discharge to Buffalo Creek. The option of New Minnette relocating their outfall to Buffalo Creek has also been considered by the facility, however with improvements in the toxicity results, it is unknown whether this option will still be exercised.

Recommendation
It is recommended that conditions in the stream continue to be monitored to determine whether the removal of the waste from Grover Industries is sufficient to protect instream water quality.

Buffalo Creek
A small portion of Buffalo has been assigned a use support rating of Partially Supporting below Kings Mountain Reservoir based on data that is greater than five years old. Possible contributors to impairment include point sources and general nonpoint sources based on nonpoint source workshops conducted in 1988.

Recommendation
DWQ should update the water quality information in this portion of the creek during the next basinwide cycle, resources permitting.

6.4.6 Subbasin 030806 - NC Portion of the North Pacolet River

Broad River subbasin 030806 contains the North Carolina section of the North Pacolet River which flows into the Broad River in South Carolina. Streams within this subbasin are in the mountain ecoregion. This is a very small subbasin containing approximately 10 river miles of the North Pacolet River and many small tributaries.

Issues and Recommended Management Strategies
Very little water quality information has been collected in this subbasin. Benthic macroinvertebrates have been collected from three locations on the North Pacolet River and they have been assigned Good and Good/Fair bioclassifications. The North Pacolet River near the North Carolina/South Carolina state line is a very sandy stream (80%) suggesting that sedimentation is a significant water quality problem. As a result, many waters in this subbasin are considered support-threatened.

Recommendation
Measures to address sedimentation in this subbasin are recommended. One of the goals identified by the NPS Team (Table 6.1) is the promotion of the adoption of local erosion control ordinances. Workshop participants identified the need for local education about erosion control and sedimentation. Local citizens and governments should consider pursuing such efforts.

6.5 IDENTIFICATION AND PROTECTION OF HIGHLY VALUED RESOURCE WATERS

6.5.1 Overview of High Quality and Outstanding Resource Waters as well as Special Classifications and Habitats

Waters considered to be biologically sensitive or of high resource value may be given protection through reclassification to HQW (high quality waters), ORW (outstanding resource waters), Tr (trout) or WS (water supply), or they may be protected through more stringent NPDES permit conditions. Waters eligible for reclassification to HQW or ORW may include wild trout waters, designated critical habitat for threatened or endangered species (as designated by the NC Wildlife Resources Commission), waters classified for domestic water supply purposes (WS I and II), or waters having Excellent water quality based on DWQ biological monitoring. Based on DWQ monitoring, a few waters received an Excellent biological rating and may be considered eligible for HQW or ORW (Table 6.5). As mentioned earlier in this chapter, DWQ has completed a study of the upper Green River intends to pursue reclassification to B HQW in the future. In addition, DWQ has been requested to consider Lake Montonia for HQW reclassification, and studies are underway to determine whether or not it qualifies for this change. The two other areas in the table have been shown to have excellent water quality, and could possibly qualify for the HQW or ORW classification if a request were received by DWQ. The HQW, ORW and WS classifications generally require more stringent point and nonpoint source pollution controls than do basic water quality classifications such as C. Refer to Chapter 2 for more information on classifications and standards.

Table 6.5 Potential HQW/ORW Waters for the Broad River Basin

Subbasin	Waterbodies
030801	Broad River (upstream of Lake Lure) and Cove Creek
030803	upper Green River (from source to Rock Creek - not including tributaries, and Rock Creek and tributaries)
030804	North Fork First Broad River
030805	Lake Montonia

According to the NC Natural Heritage Program, there are four rare aquatic and wetland-dwelling animals found in the Broad River. These species are given special protection status by the North Carolina Wildlife Resources Commission and/or the North Carolina State Endangered Species Act (G.S. 113-331 to 113-337). The species and the status of each can be found in Chapter 2.

Where waters are known to support state or federally listed endangered or threatened species or species of concern, consideration will be given during the NPDES permitting process to minimize impacts to habitat areas consistent with the requirements of the federal Endangered Species Act and North Carolina's endangered species statutes. Possible protection measures may include but are not limited to dechlorination or alternative disinfection, tertiary or advanced tertiary treatment, outfall relocation, and backup power provisions to minimize accidental plant spills. The need for special provisions will be determined on a case-by-case basis during review of individual permit applications and take into account the degree of impact and the costs of protection.

6.5.2 Strategies for Controlling Discharges to High Quality Waters (HQWs) and Outstanding Resource Waters (ORWs)

A. High Quality Waters (HQWs)

In the Broad River basin, two streams near Tuxedo are classified as high quality waters. In addition, as described above, there are some streams that either do qualify for or may qualify for

HQW classification in the future. For HQWs, a distinct set of management strategies applies to wastes discharged from a facility. New discharges and expanding discharges that have an increase in pollutant load to HQW streams are subject to the following management strategies adopted by DWQ pursuant to 15A NCAC 2B.0224 (1) and 15A NCAC 2B .0224 (1)(b)(vii):

- Discharges from new single family residences will be prohibited. Those that must discharge must install a septic tank, dual or recirculating sand filters, disinfection and step aeration. (15A NCAC 2B.0224 (1)(a)).

- All new or expanded wastewater discharges (except single family residences) will be required to meet effluent limitations for oxygen consuming wastes as follows: BOD_5 = 5 mg/l, NH_3-N = 2 mg/l, and DO = 6 mg/l. More stringent limitations will be set, if necessary, to ensure that the cumulative pollutant discharge of oxygen consuming wastes will not cause the DO of the receiving water to drop more that 0.5 mg/l below background levels, and in no case below the standard. Where background information is not readily available, evaluations will assume a percent saturation determined by staff to be generally applicable to that hydroenvironment. (15A NCAC 2B .0224 (1)(b)(i)).

- Emergency Requirements: Failsafe treatment designs will be employed (except single family residences), including stand-by power capability for entire treatment works, dual train design for all treatment components, or equivalent failsafe treatment designs. (15A NCAC 2B .0224 (1)(b)(iv).

- Volume: The total volume of treated wastewater for all discharges combined will not exceed 50 percent of the total instream flow under 7Q10 conditions. (15A NCAC 2B 0.224 (1)(b)(v)).

- Toxics: In cases where complex wastes (those containing or potentially containing toxicants) may be present in a discharge, a safety factor will be applied to any chemical or whole effluent toxicity allocation. The limit for a specific chemical constituent will be allocated at one half of the normal standard at design conditions. Whole effluent toxicity will be allocated to protect for chronic toxicity at an effluent concentration equal to twice that which is acceptable under design conditions. In all instances there may be no acute toxicity in an effluent concentration or 90 percent. Ammonia toxicity shall be evaluated according to EPA guidelines promulgated in "Ambient Water Quality Criteria for Ammonia - 1984"; EPA document number 440/5-85-001; NTIS number PB85-227114; July 29, 1985 (50 FR 30784).

- North Carolina does not have a numeric water quality standard for suspended solids. Discharges to high quality waters (HQW) must meet a total suspended solids (TSS) limit of 10 mg/l for trout waters and primary nursery areas and 20 mg/l for all other HQWs.

B. Outstanding Resource Waters (ORWs)

Currently, no waters in the Broad River basin have been designated as ORW. If any of the waters that have been shown to have excellent water quality also have an associated outstanding resource, they could qualify for this designation. No new discharges nor expansions of existing discharges directly to waters classified as ORW are permitted in accordance with 15 NCAC 2B .0225 (c)(1). Those existing discharges will be handled on a case-by-case basis following standard operating procedures.

6.6 GENERAL MANAGEMENT STRATEGIES FOR PROTECTING WATER QUALITY IN THE BASIN

6.6.1 Management Strategies for Controlling Sedimentation.

Sedimentation is widespread in the Broad River basin. Of the 48 miles of streams that are considered impaired, 15 are impacted by sediment. In addition, there are approximately 112 miles of streams that are considered threatened because of impacts from sediment. While sedimentation has caused widespread water quality degradation, serious impairment is apparent in relatively few streams. However, the designated uses of numerous waterbodies are threatened by sedimentation.

Since this basin is an increasingly popular areas for home, commercial and golf course construction, there is the potential for greater sediment loads to enter streams during land clearing and construction activities. After construction is complete, poorly designed roads, trails, and driveways may continue to erode into water bodies.

Sedimentation is a widespread nonpoint source-related water quality problem that results from land-disturbing activities. The most significant of these activities include agriculture and land development (e.g., highways, shopping centers, and residential subdivisions). For each of these major types of land-disturbing activities, there are programs being implemented by various government agencies at the state, federal and/or local level to minimize soil loss and protect water quality. Some of these programs are listed in Table 6.6 and are briefly described in Appendix VI.

Table 6.6 State and Federal Sediment Control-Related Programs

Agricultural Nonpoint Source (NPS) Control Programs	North Carolina Agriculture Cost Share Program NC Cooperative Extension Service and Agricultural Research Service Watershed Protection and Flood Prevention Program (PL 83-566) Food Security Act of 1985 (FSA) and the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA). (Includes Conservation Reserve Program, Conservation Compliance, Sodbuster, Swampbuster, Conservation Easement, Wetland Reserve and Water Quality Incentive Program)
Construction, Urban and Developed Lands	Sediment Pollution Control Act Federal Urban Stormwater Discharge Program Water Supply Protection Program ORW and HQW Stream Classification
Forestry NPS Programs	Forest Practice Guidelines National Forest Management Act Forest Stewardship Program Forestry Best Management Practices Forest Management Program Services
Mining	The Mining Act of 1971
Wetlands Regulatory NPS Programs	Section 10 of the Rivers and Harbors Act of 1899 Section 404 of the Clean Water Act Section 401 of the Water Quality Certification (from CWA) North Carolina Dredge and Fill Act (1969)

Construction activities, private access roads, state road construction and agriculture are sources of sediment and are discussed below. Golf courses and urban stormwater are other potential sources of sediment that are discussed in separate sections.

Before action is taken to restore a stream channel and riparian area, it is essential to understand the cause and nature of the problem. For example, if a landowner notices that excess gravel is accumulating in the stream on their property, they should first investigate the causes on their property and, if necessary, throughout the watershed. Stabilizing a streambank can result in an expense of time and money which will have to be repeated until the underlying cause is addressed. It is important to understand that a streambank may erode for many different reasons and the cause is not always obvious. Underlying causes might be as simple as a lack of bank vegetation to hold the soil in place or as complex as changes in runoff caused by urban runoff, poor logging or farming practices or other activities in the watershed.

Also, watershed inventories should not focus solely upon problem areas. Without advance planning and protection, sensitive resources, highly productive resource or critical components of natural systems are easily degraded or lost through development or overuse. Riparian buffers, wetlands, floodplains, animal movement corridors and rare species should be identified and their protection incorporated into watershed planning and management efforts.

Proven Techniques for Controlling Sediment and Protecting Streams

The following techniques are proven to be effective at controlling sedimentation to streams, thereby protecting the water quality of streams.

- Avoid disturbance of streams and the riparian zone. Protect existing riparian forest buffers. Restore vegetation that has been cleared from the riparian zone.
- Use BMPs for erosion and sediment control. A wide variety of agricultural BMPs have proven effective for sediment control. These include conservation tillage/residue management, filter strips and field borders, and cover crops.
- Maintain natural channels or, if modification is unavoidable, design channels based on the stability and behavior of natural stream channels. Channel designs based on natural stability principles will be less susceptible to erosion, dissipate energy more effectively, remain more stable, and provide more habitat than traditional engineered channel designs.
- Maintain pre-development peak flows, flow velocities, and flow timing to the extent possible through the use of stormwater management techniques and appropriate BMPs.

The Use of Riparian Buffers to Protect Stream Quality and Integrity

A stream and its riparian area function as one. The condition of the riparian area and its vegetation play a central role in determining the integrity of stream channels and water quality. Although streamside vegetation of any kind is desirable, forests provide the greatest amount of benefit and highest potential for meeting both water quality and habitat restoration objectives. A sound scientific foundation exists to support the sediment reduction, nutrient reduction, and ecological values and functions of riparian forest buffers. The use of riparian buffers as a management tool should be promoted.

Riparian Forest Buffers are streamside ecosystems, managed for the protection of water quality through control of nonpoint source pollution and maintenance of the stream environment. Riparian Forest Buffer Systems are typically managed as three integrated streamside zones which are designed to intercept surface runoff and subsurface flow. They comprise an area of trees, usually accompanied by shrubs and other vegetation, that is adjacent to a body of water. The Riparian Forest Buffer is managed to:

- maintain the integrity of stream channels and shorelines,
- reduce the impact of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals, and
- supply food, cover, and thermal protection to fish and other wildlife.

Construction Activities and Sedimentation

Construction activities can dramatically increase the sediment delivered to streams. Construction activities are controlled under the Sedimentation and Erosion Control Act administered by the NC Division of Land Resources (DLR). This act requires anyone disturbing more than one acre of land to submit a Sedimentation and Erosion Control Plan to DLR. One of the major requirements is that there are adequate erosion control measures to retain all sediment on a development site during the 25-year storm. Generally, a land owner must install acceptable Best Management Practices (BMPs) when the land is disturbed by construction or development activities. Management practices may include barriers, filters, or sediment traps to reduce the amount of sediment that leaves a site. Under this act, local governments may take responsibility for reviewing and enforcing the Sedimentation and Erosion Control Program within their jurisdiction; however, their program must be at least as stringent as DLR's.

In the Broad River basin, development pressure will increase. In order to match the pace of land disturbing activity, more staff hours will be needed within the DLR in order to effectively administer and fully enforce the provisions of the Act. At present, planning and inspection staff are stretched thinly across large geographic areas and a wide variety of projects. Careful planning prior to construction, perhaps the most important part of erosion control, may often be neglected due to lack of available staff time.

The responsibility for controlling sediment from construction activities falls on many shoulders. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, and the NC Division of Land Resources. Table 6.7 presents actions that will help to address sediment problems associated with construction activities. No sediment control measures are 100% effective so some level of sedimentation will occur with land-disturbing activities. Education and promotion of stewardship are keys to reducing sedimentation, along with judicious strengthening of regulations and enforcement.

References/Resources:

- The following can be ordered from the NC Division of Land Resources at P.O. Box 27687, Raleigh, NC 27611, (919)733-3833:
  1) *NC Erosion and Sediment Control "Planning and Design Manual"* ($55 for in-state, $75 for out-of-state)
  2) *NC Erosion and Sediment Control "Inspector's Guide"* ($20 for in-state or out-of-state)
  3) *NC Erosion and Sediment Control "Field Manual"* ($20 for in-state or out-of-state)
  4) *NC Erosion and Sediment Control "Video Modules"* ($15 for in-state, $50 for out-of-state)
- Asheville Regional Office of the Division of Land Resources at (704)251-6208.
- Mooresville Regional Office of the Division of Land Resources at (704)663-1699.

Table 6.7 Recommended Actions to Address Construction-Related Sediment Problems

Homeowners	Know and follow state and local erosion and sedimentation ordinances. Fit the development to existing site conditions. Follow natural contours and avoid flood plains and highly erodible soils to control erosion and sedimentation. Establish, maintain, and protect vegetation beside streams on your property. Buffers provide a filter for sediment and other pollutants. Carefully monitor the construction process. Ensure permanent vegetation is established and maintained on construction site ASAP. Continue to control sediment after construction is complete.
Developers/ Contractors	Fit the development to existing site conditions. Development that follows natural contours and avoids flood plains and highly erodible soils is much easier to control erosion and sedimentation. Minimize the extent and duration of exposure. Schedule construction according to weather and season. Try to pick dry times. Protect areas to be disturbed from stormwater runoff. Use dikes, diversions, and waterways to intercept runoff and divert it away from cut-and-fill slopes or other disturbed areas. To reduce erosion, install these measures before clearing and grading. Keep runoff velocities low. Convey stormwater away from steep slopes to stabilized outlets, preserving natural vegetation when possible. Inspect and maintain control structures during the construction process. If not properly maintained, some erosion control measures can cause more damage than they correct. Retain sediment onsite. Protect low points below disturbed areas. Build barriers to reduce sediment loss. When possible, construct sediment traps before other land disturbing activities. Stabilize disturbed areas as soon as possible after construction. Apply mulch and vegetation to land and line channels for protection. Consider future repairs and maintenance of these measures. Train equipment operators to execute erosion and sediment control practices.
Citizens	Report any serious sediment problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls.
Local Govts. Without Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control before they begin construction activities and ensure they understand their responsibilities under the State Sedimentation Pollution Control Act. Report any serious problems on construction sites. This would include bare soil that has not been stabilized within 30 days, brown or red runoff during a storm, or obviously malfunctioning erosion/sediment controls. If your resources allow, consider taking responsibility for sediment and erosion control in your jurisdiction. This will allow greater control over implementation and enforcement of the program. It will also offer the opportunity to require sediment control on developments disturbing under one acre. Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land.

Table 6.7 Recommended Actions to Address Construction-Related Sediment Problems (Cont'd)

Local Govts. With Delegated Sediment/ Erosion Control Programs	Educate citizens as to the importance of erosion and sediment control. Maintain publicly-owned open space. Will prevent sediment loss from certain tracts of land. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts.
NC Div. of Land Quality	Continue to promote effective implementation and maintenance of erosion and sediment control measures on construction sites. Research innovative new ways to control sediment on construction sites. Evaluate the effectiveness of current sediment control enforcement. Identify staff resource needs. When possible, coordinate efforts with other agencies such as the Dept. of Transportation, Div. of Forest Resources, and Soil and Water Conservation Districts. Encourage more delegated programs by local governments where resources allow, especially in rapidly developing areas.

Private Access Road Construction

Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. Often, landowners do not realize the importance of building driveways for lasting service. Some landowners depend entirely on their contractor to design the road. Others try to design it themselves without consulting a reputable source. The consequences of not paying attention to an access road as it is designed and constructed can be serious. In addition to losing the road and potentially losing land and property, the washed-out road can damage water quality. Table 6.8 offers suggestions for addressing these issues.

Most of the responsibility for an access road rests on the landowner. However, local governments, citizens, and state/federal agencies can also make their contribution to solving this problem.

References/Resources:

- *Guidelines for Drainage Studies,* NCDOT Hydraulic Design Unit (1995). To obtain, call NCDOT at (919)250-4128.
- *Final Report: Timbered Branch Demonstration/BMP Effectiveness Monitoring Project* by Richard Burns, USDA Forest Service (1994). To obtain, call USDA at (704)257-4214.
- *The Laymen's Guide to Access Road Construction in the Southern Appalachian Mountains*, USDA-SCS, USDA-Forest Service, Tennessee Valley Authority; July 1985. Copies are available from NC DFR Central Office by calling (919) 733-2162, ext. 255.
- Asheville Regional Office of the Division of Land Resources, (704)251-6208.
- Mooresville Regional Office of the Division of Land Resources at (704)663-1699.

State Road Construction

Like any impervious surface, roadway systems have the potential to generate stormwater runoff problems. Various types of pollutants from the road surface can be carried to surface waters by rainfall. In addition, roadway construction, roadside vegetation management and roadway operation and maintenance activities can contribute to stormwater pollution problems.

The Division of Water Quality is currently working with the NC Department of Transportation (DOT) to finalize a stormwater management permit for DOT activities. This permit will address

pollution from stormwater runoff related to roadways, road construction, vegetation management, operation and maintenance and other related DOT activities throughout the state. The major permit

Table 6.8 Recommended Actions to Address Problems Associated with Private Access Roads

Homeowners	Know the state and local laws, ordinances and regulations about access road construction. Be prepared to pay the cost of constructing a good road that will last. The cost of constructing a road will vary greatly from site to site. The cost may increase due to steep or rocky land, low stability soils, or drainage needs. In the long run, it does not pay to skimp. Avoid steep grades. Sustained grades should not exceed 10% for gravel or crushed stone roads. Make sure the road has adequate drainage. Adequate drainage is necessary to control erosion. The following water sources must be considered: rainfall on the roadbed and cut/fill slopes, overland storm flows from the watershed above the road, and springs or streams intercepted by the road. Use drainage methods that protect water quality. These methods include capture areas to treat runoff and routing runoff parallel to streams. Avoid grading access road drainage ditches directly to streams. Inspect the road periodically. Check for ruts and dips in the road, the condition of the drainage outlets, and the general condition of the cut and fill slopes. Repair any problems immediately. Any problems with ruts, drainage outlets, bare areas, etc. should be repaired before a small problem turns into a large problem.
Contractors	Watch for signs of subsurface drainage problems before, during, and after construction. Some things to look for include: soils that are gray in color, areas with springs or seeps, low areas, and areas dominated by water-tolerant plants such as alders, black walnut, poplar, cattails, reeds, etc. Road and ground cover should be applied as soon as possible after construction.
Citizens	Report any serious problems with access roads. Some problems to look for include big ruts in the roadway, wash-outs, and clogged drainage outlets. You can report problems to your local government officials. If they are not able to help, contact the regional office of the NC Division of Land Resources.
Local Governments	Require properly designed and constructed roads as part of the building permit process. Institute ordinances requiring proper maintenance of private access roads.
State and Local Agencies	Provide citizens with information about how to properly construct private access roads. Investigate innovative new ways of constructing private access roads while protecting water quality.

requirements are the implementation of a comprehensive stormwater management program, monitoring programs to direct the stormwater program and annual reports to outline the effectiveness and direction of the program.

The initial emphasis of the stormwater programs will be on high volume roadway segments in sensitive water areas such as coastal areas and water supply watersheds. The stormwater management programs will try to locate and characterize pollutant problems and to develop and implement appropriate best management practices to protect surface waters.

DOT is responsible for its own sedimentation and erosion control program. DOT has a number of projects with effective sedimentation and erosion control in mountain areas. Table 6.9 presents recommended road construction measures.

Table 6.9 Recommended Sediment Control Measures for State Road Construction

NC Dept. of Transportation	Know the state and local laws, ordinances and regulations about construction. Implement high quality sediment and erosion control. This is extremely important in areas with steep slopes. Increase training for DOT staff to ensure that sedimentation and erosion control devices are properly sized and installed. It is also important to include specific instructions for sediment and erosion control and phasing on the plans so that contractors can understand their responsibility. Inspect sedimentation and erosion control devices frequently. This is particularly important when contractors are responsible for the work. Implement pre-, during, and post-construction water quality monitoring at selected sites. This is the only way to tell for sure if sediment and erosion controls are working effectively. Reduce the threshold of exposed area when roads are constructed on steep slopes.
Citizens and Local Governments	Contact the district DOT office if you observe sediment problems at a road construction site. Some things to watch out for include: bare soil that is not mulched and/or planted within 30 days, washed-out sediment basins and filter cloths, and soil disposal sites that are placed in or directly adjacent to creeks.

References/Resources: Dan Martin, District Office of DOT, (704)586-2141.

6.6.2 Management Strategies for Controlling Color

North Carolina regulations specify that colored wastes may be discharged only in such amounts "as will not render the receiving waters injurious to public health, secondary recreation, or to aquatic life and the wildlife or adversely affect the palatability of fish, aesthetic quality or impair the waters for any designated uses" [NCAC 15A 2B .0211 (3)(f)]. Colored discharges are generally not toxic. Potential toxicity is managed by the regulation of specific chemical constituents and by whole effluent toxicity (WET) testing. The primary issue in the regulation of color is the aesthetic quality of receiving waters and the implication of this aesthetic quality for the designated uses of those waters.

The practical application of the above regulation must take into account the various ways in which color manifests itself in the environment. Color in natural waters is rarely the result of one specific chemical. Rather, a mixture of many dissolved and suspended constituents contributes to color. The stream bed and sediments may also contribute to color. Because color is perceived differently by different people and in different light conditions, no general definition of color impairment can be specified by a simple set of criteria and enforcement of the current narrative color standard can be very subjective.

In the Broad basin, discharges with a high degree of color come primarily from certain industrial facilities and from municipal dischargers receiving highly colored industrial effluent. While colored effluent can be discharged by a number of industries, textile firms constitute the most significant source of color in the Broad basin.

Division staff have researched the implementation of a numeric standard, or a set of numeric water quality standards. The Division would prefer, however, that dischargers remove color on their own initiative. If such efforts are not successful, the Division may proceed with the development of a numeric color standard.

In order to address the problem of discolored waterbodies and to assist facilities that are attempting to reduce color in their effluent, the Division is developing a statewide voluntary program in

cooperation with the Division of Pollution Prevention and Environmental Assistance (DPPEA). The program will focus on reducing the discharge of colored wastewater from textile manufacturing and related industries, with a goal of reducing instream color to the point where color-related complaints for surface waters are nonexistent. The program will be based on building a cooperative network between facilities with highly colored effluent and a "mentor" group. The mentors will include color removal experts, textile industry associations, facilities that are already implementing color removal, and DENR staff members. Although color in its elf is not a toxicant, dischargers removing color from their effluent may receive the added benefit of reducing salts, BOD and metals. DWQ and DPPEA staff are currently involved in data collection and the evaluation of various color removal proposals. Statewide workshops and conferences will be held in early 1998 to publicize the effort and obtain feedback on the design of the program.

6.6.3 Management Strategies for Controlling Nonpoint Source Pollution from Agriculture

Agricultural nonpoint source (NPS) pollution is reported as the leading probable source of water quality impacts to surveyed rivers and lakes, and the third largest probable source of impairments to surveyed estuaries. And it is also a major contributor to ground water contamination and wetlands degradation. Agricultural activities that may cause NPS pollution include confined animal facilities, grazing, plowing, stream access, pesticide spraying, irrigation, fertilizing, planting and harvesting. The major agricultural NPS pollutants that result from these activities are sediment, nutrients, pathogens, pesticide, and salts. Agricultural activities also can damage habitat and stream channels. Agricultural impacts on surface and groundwater can be minimized by properly managing activities the can cause NPS pollution. Table 6.10 is a list of recommendations for state and federal agencies, and farmers.

Streambank Fencing and Alternative Livestock Water Supply

Streambanks trampled by livestock can be a significant source of sediment. Streambank fencing and livestock watering facilities outside the riparian zone can help maintain the vegetation necessary for stabilizing streambanks and preventing erosion. The water quality benefits of streambank fencing have been well documented. Fencing and exclusion can create vegetative buffer strips along streams that trap sediment and reduce pesticide and nutrient runoff before they enter the stream. Streambank fencing also provides food, cover, and nesting sites for upland and aquatic wildlife. Allowing natural vegetation to re-establish can not only provide better habitat within the stream but also create a corridor for wildlife movement and a connection with other habitat.

Livestock exclusion may also improve water quality by preventing manure deposition in the stream. For example, according to Penn State University, one cow produces approximately 5.4 billion fecal coliform bacteria per day. At this rate, unrestricted access of fifty cows to a stream for a 24 hour period could contaminate the equivalent of one day's untreated water supply for a city the size of Baltimore.

Table 6.10 Recommended Actions to Address NPS Pollution from Agriculture

State and Federal Agencies	Target funds to control agricultural NPS pollution. State and federal agencies should work with the Nonpoint Source Team to target funds toward the areas where they are most needed and would be most effective. Promote agricultural best management practices (BMPs). State and federal agencies should increase programs which provide cost-share, technical assistance, and economic incentives to implement agricultural BMPs. Generate more "on-the-ground" water quality improvement demonstration projects. These projects will help to generate enthusiasm for more cooperative effects between farmers and various agencies. Create education programs. These programs increase farmers awareness of water quality impact of agricultural NPS pollution. And the programs also provide farmers a set of tool to control agricultural NPS pollution. Topics can include environmentally sound BMPs for agriculture and numerous field days for local and regional interests.
Farmers	Participate in the NPS team process. The NPS team process will provide a good opportunity to influence state policy in basinwide planning. The NPS team will describe current water quality initiatives, identify priority NPS-impaired waterbodies and implement solutions addressing these waterbodies. Participate in North Carolina Agricultural Cost Share program. The North Agricultural Cost Share program provides technical assistance and cost sharing to landowners in implementing BMPs. Practice a number of cost effective agricultural BMPs through the basin.

Exclusion from the riparian area may also improve the health of livestock. Bacteria and other disease-causing organisms entering the stream can transmit diseases between and within livestock herds. Streambank fencing reduces contact with disease-causing organisms that thrive in these environments. For example, environmental mastitis is most commonly caused by coliform bacteria which enter teats as cows wade in streams. The first recommendation in any mastitis prevention program is to provide a clean, dry environment for the cows. Streambank fencing also reduces the risk of foot and leg injuries and can be part of an effective lameness prevention program.

Waste from Animal Operations

DWQ is currently pursuing a number of efforts to improve the management of waste generated from animal production operations. These efforts, which are being coordinated with the Soil and Water Conservation Districts, Natural Resources Conservation Service and the Division of Soil and Water Conservation, are both new and ongoing and will work toward the goal of eliminating the contribution of animal waste into North Carolina's surface waters. They include the implementation and enforcement of animal waste regulations and the training and certification of operators of animal waste systems. Detailed descriptions of these programs are provided in Appendix VI. DWQ will continue to implement these efforts, some of which were precipitated by a number of lagoon failures in coastal basins in 1995.

References/Resources:
Nonpoint Source Planning Group of the Division of Water Quality at (919)733-5083

6.6.4 Management Strategies For Urban and Industrial Stormwater Control

Industrial Stormwater

Within the Broad basin various types of industrial activities with point source discharges of stormwater are required to be permitted under the NPDES stormwater program. These include

facilities engaged in construction; mining/borrow pits; metal waste recycling and manufacture of metal products and equipment; manufacture of timber products; apparel, printing, paper, leather, and rubber products manufacturing; vehicle maintenance, transportation, and postal service activities, public warehousing and petroleum bulk stations and terminals; used automobile parts and scrap yards; ready mixed concrete production; manufacture of asphalt paving mixtures and blocks; production of textile mill products; ship and boat building/repairing and marinas.

Surface waters can be significantly impacted by stormwater runoff from industrial facilities, particularly those that store or transfer materials out of doors. The types of chemicals, industrial operations and various ancillary sources influence the pollution potential of each individual facility. As such, industrial facilities can reduce stormwater impacts by developing a comprehensive site-specific Stormwater Pollution Prevention Plan (SPPP or Plan) which is based on an accurate understanding of the pollution potential of the site. The Plan provides a flexible basis for developing site-specific measures to minimize and control the amounts of pollutants in stormwater runoff by implementing best management practices (BMPs). With respect to stormwater, the ultimate BMP is the elimination of exposure of any significant materials to rainfall or runoff.

Recommendations

Facilities subject to NPDES stormwater permitting are required to develop and implement a SPPP. The SPPP approach focuses on two major objectives: 1) to identify sources of pollution potentially affecting the quality of stormwater discharges from the facility; and 2) to describe and ensure that practices are implemented to minimize and control pollutants in stormwater discharges from the facility. The basic components of a SPPP include a site plan detailing the facility layout and locations of potential pollutant sources, a stormwater management plan describing materials management practices and feasibility of employing best management practices, a spill prevention and response plan, a preventive maintenance and housekeeping plan, annual employee training and semi-annual facility inspections. The facility SPPP must be periodically reviewed and updated to reflect changes at the facility.

In addition to the SPPP, all permitted facilities are required to perform qualitative monitoring. This monitoring requires the periodic visual inspection of each stormwater outfall. Inspections are performed for parameters including color, odor, clarity, floating and suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollution. Facilities with significant stormwater pollution potential are also required to perform quantitative analytical monitoring.

Urban Stormwater Control

Urban stormwater runoff can be a significant contributor to water quality problems. In the Broad basin, urban development is spread thinly across the basin, with larger areas being in the eastern portion. As land is converted to impervious surfaces with construction of housing developments and commercial areas, careful attention to stormwater control will be more important. Stormwater problems are likely to be centered around the urban areas in the basin. There are no municipalities in the Broad River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

The best time to address urban stormwater impacts are when it is most effective and least costly to do so -- before development occurs. Numerous studies have demonstrated a serious decline in the health of receiving waters when 10 to 15 percent of a watershed is turned into impervious surfaces (Schueler 1995).

The entire community plays a role in controlling the quality and quantity of urban stormwater. Table 6.11 is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.

Table 6.11 Recommendations for Urban Stormwater Control

Local governments	Create public education programs. These programs advise citizens about how to care for their homes, businesses, and neighborhoods while minimizing stormwater pollution. Topics that can be covered include environmentally sensitive methods of caring for lawns and vehicles. Support stream clean-up programs. Clean-up programs such as Big Sweep remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. Create and enforce strict penalties for improper waste disposal. In addition, local governments should protect dumpsters by fencing around them and cleaning them regularly. Institute land use planning to protect water quality. Through planning, local governments can reduce flooding by limiting the total area of impervious surfaces and directing runoff into vegetated areas or stormwater control devices. In addition, planning can be used to protect surface waters by directing growth away from sensitive areas/waters such as floodplains, steep slopes, wetlands, high quality waters, and water supplies. Review local ordinances pertaining to parking and curb and gutter. Local ordinances often require larger parking lots than are needed. Parking lots should be designed to handle the average parking needs with overflow areas in grass. When possible, it is best to eliminate curbs and gutters to allow runoff to flow off the street or parking lot in sheet flow. Protect open spaces and streamside buffers in and around urban areas. This will preserve recreational areas and significant natural resources near the town or city. Attend stormwater workshops for local government officials. Various agencies like DWQ offer workshops on stormwater management or reference materials. For more information, contact the DWQ stormwater group at (919)733-5083. Map the storm sewer system. If local governments map the inlets, pipes, and outlets that make up their storm drain system, they will be well equipped to identify the source of any observed stormwater problems. Offer hazardous waste collection days.
Citizens	Participate in stream clean-up programs. Clean-up programs remove harmful debris from streams and instill a sense of pride that will protect the waterbody in the long-term. An annual Big Sweep event is held each year in September. Stream clean-up is a great service activity for groups such as Scouts, 4-H, Rotary Clubs, etc. Practice environmentally-friendly lawn care. Table 6.12 has a list of suggestions for keeping a green lawn while minimizing harm to the environment. When possible, use less-harmful substances in the home for cleaning or painting. Any time hazardous substances are used, there is a risk that they can enter the water by interfering with the proper functioning of septic tanks, leaking out of sanitary sewers, etc. When possible, use less hazardous substances such as latex instead of oil paint (see Table 6.13). Educate adults and children about how to protect water quality. Educational materials can be obtained from the NC Office of Environmental Education, (919)733-0711. Utilize hazardous waste collection centers for paints, petroleum products, and other chemicals. Never dispose of oil, yard wastes, or other materials in storm drain inlets or dump these materials on lands. Storm drains connect directly to nearby streams without any treatment of the water. Maintain and protect riparian buffers on private property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove a wide array of pollutants, including sediment, nutrients, and toxic substances. They can also increase property value. Support your local government's land use planning initiatives.
Developers	Incorporate stormwater management in the planning of projects. Plan developments to reduce impervious areas (roads, driveways, and roofs). Do not build in environmentally sensitive areas such as floodplains and wetlands. (This is also a flood insurance policy.) Maintain natural drainageways and buffers along streams.

Table 6.11
Continued:

Businesses	Maintain and protect riparian buffers on commercial property. Buffers provide a critical right of way for streams during storms. When buffers contain the 100-year floodplain, they are an extremely cost-effective form of flood insurance. Buffers remove sediment, nutrients, and toxic substances. Cover and contain waste materials. This will prevent runoff from the disposal area from becoming contaminated and polluting the receiving water. Practice good housekeeping. A clean and litter-free facility will promote good water quality. Institute hazardous waste collection sites. Automobile service centers, hardware stores, and other pertinent businesses can institute hazardous waste collection sites for used oil, antifreeze, paint, and solvents.
State and Federal Agencies	Provide technical information about urban stormwater. State and federal agencies should strive to increase their communication with local governments, businesses, and citizens. Create and maintain stormwater wetlands along streams. Like buffers, stormwater wetlands treat stormwater and reduce flows. Stormwater wetlands must be designed and maintained properly to be effective.

Table 6.12 How to Take Care of Your Lawn and Car and Protect Water Quality

If you are caring for...	This is the environmentally-friendly practice.
your lawn	• Use only fertilizers that are needed, based on soil tests and plant needs. • Keep fertilizers off driveways and sidewalks. • Avoid using fertilizers within 75 feet of any waterbody. • If you use a lawn service, request natural rather than chemical management. • Plant hardy, native species that do not require chemical inputs. • Contact your Cooperative Extension Agent for more information.
your vehicle	• Maintain motor vehicles and repair leaks promptly. • Dispose of used motor oil and antifreeze in recycling centers. • Avoid gas tank overflows during refueling.

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

Table 6.13 Substitutions for Household Hazardous Substances

Instead of...	Try...
• Ammonia-based Cleaners	• Vinegar + Salt + Water
• Abrasive Cleaners	• Lemon Dipped in Borax or Salt + Baking Soda
• Furniture Polish	• Lemon Juice + Olive Oil
• Toilet Cleaner	• Baking Soda + Toilet Brush
• Oven Cleaner	• Liquid Soap + Borax + Warm Water
• Drain Cleaners	• Boiling Water + Baking Soda + Vinegar
• Upholstery Cleaners	• Dry Cornstarch
• Mothballs	• Cedar Chips or Lavender Flowers
• Window Cleaner	• White Vinegar + Water
• Oil-Based Paints and Stains	• Water-based Paints and Stains

from S.C. Dept. of Health and Environmental Control, "Turning the Tide" (1995)

References/Resources for Urban Stormwater:

- *Stormwater Management Guidance Manual*, 1993, Cooperative Extension Service
- *Stormwater Management in North Carolina: A Guide for Local Officials*, 1994, Land-of-Sky Regional Council, Asheville, NC (Eaker 1994)
- Stormwater Fact Sheets by Land-of-Sky Regional Council, 1994
  1. *Stormwater Problems and Impacts: Why all the Fuss?*
  2. *Stormwater Control Principles and Practices*
  3. *Stormwater Management Roles and Regulations*
  4. *Local Stormwater Program Elements and Funding Alternatives*
  5. *Municipal Pollution Prevention*
  6. *Managing Stormwater in Small Communities: How to Get Started*
  7. *Maintaining Wet Detention Ponds*
  8. *Plan Early for Stormwater in Your New Development*
  9. *How Citizens Can Help Control Stormwater Pollution*
- *Stormwater Best Management Practices*, 1995, NC Division of Environmental Management.
- Asheville Regional Office of DWQ, Stormwater Group: (704)251-6208.
- Mooresville Regional Office of DWQ, Stormwater Group at (704)663-1699

6.6.5 Management Strategies for Controlling Fecal Coliform Bacteria

Fecal coliform bacteria are typically associated with the intestinal tract of warm-blooded animals and are widely used as an indicator of the potential presence of disease-causing bacteria and viruses. They enter surface waters from a number of sources including failing onsite wastewater systems, broken sewer lines, improperly treated discharges of domestic wastewater, pump station overflows, straight piping and runoff carrying livestock and wildlife wastes.

In the Broad River basin, there are four sampling sites where fecal coliform bacteria standards have been exceeded in more than 25% of the samples taken by DWQ. These are:

- the Broad River near Boiling Springs (subbasin 04)
- the First Broad River near Earl (subbasin 04)
- Sugar Branch near Boiling Springs (subbasin 04)
- Buffalo Creek near Grover (subbasin 05)

Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and annual inspections of onsite waste disposal systems such as septic tanks (see Table 6.14 for maintenance recommendations).
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Maintenance and establishment of riparian vegetative buffers.
- Maintenance of natural drainage patterns to maximize filtration and minimize runoff.
- Elimination of direct illegal discharges of domestic waste (also known as "straight piping").
- Proper management of livestock to keep wastes from reaching surface waters.
- Encouragement of local health departments to routinely monitor waters known to be used for body contact recreation (e.g., swimming and tubing).

The 1996 General Assembly established a program designed to eliminate domestic sewage or wastewater discharges from both direct (straight pipe) and from overland flow of failing septic systems. The focus of the program contains three components:

1) the identification and elimination of domestic sewage discharges into streams proposed or currently used for public water supplies,
2) an amnesty period to end December 31, 1997 during which time violations for identification of domestic dischargers will not be incurred, and
3) a public education program about the amnesty period will be implemented. The majority of the funds allocated to this program are recurring funds.

Septic tanks are used widely throughout this basin, particularly since many citizens live outside of the service area of a regional wastewater treatment plant. Unfortunately, many citizens are not aware of how to care for their septic tanks. Some of the actions that homeowners, local governments, and state and federal agencies can take to reduce pollution from septic tanks are listed in Table 6.14.

Table 6.14 Recommended Actions for Proper Maintenance of Septic Tanks

Homeowners	Do not put harmful substances in your septic tank. These substances include: cooking grease, oils, fats, pesticides, paints, solvents, disinfectants, and other household chemicals. These substances can kill the microorganisms that help purify the groundwater and can themselves pollute groundwater. Know the location of your system and keep heavy vehicles and plant roots away from drain field pipes. These things can compact soils and inhibit the proper functioning of the system. Conserve water and stagger intensive uses. Some intensive water uses include showers, laundry, dishwasher, etc. Look for ways to reduce (e.g.., full loads) and to not use all at once. Have the septic system inspected annually and pumped out every three to five years. This is a small price to pay to ensure that your household has functioning wastewater treatment. Look for "greener grass over the septic tank." This could be a sign that the septic tank is failing. Divert overland runoff from your property away from the drainfield area. This will reduce the likelihood of saturating the soil and causing malfunctions.
County Health Departments	Require regular inspections of septic systems. Enforce severe penalties for uncorrected septic system malfunctions. Ensure that citizens understand how to maintain their septic tank when they first obtain property in the county.
NC Div. of Environmental Health	Provide leadership to county health offices. Encourage county health offices to require regular inspections. Provide public education materials.

References/Resources:

Please contact the local county heath department for more specific advice.

6.6.6 Management Strategies For Controlling Toxic Substances

Toxic substances, or toxicants, routinely regulated by DWQ include dioxin, metals, organics, chlorine, and ammonia, as described in Chapter 3.

North Carolina has adopted standards and *action levels* for several toxic substances. These are contained in 15A NCAC 2B .0200. Usually, limits are not assigned for parameters which have action levels, such as copper, unless monitoring indicates that the parameter may be causing

toxicity or federal guidelines exist for a given discharger for an action level substance. This process of determining action levels exists because these toxic substances are generally not bioaccumulative and have variable toxicity to aquatic life because of chemical form, solubility, stream characteristics and/or associated waste characteristics. Water quality-based limits may also be assigned to a given NPDES permit if data indicate that a substance is present for which there is a federal criterion but no state water quality standard.

Whole effluent toxicity (WET) testing is required on a quarterly basis for all major dischargers (≥1 MGD) and any discharger releasing complex (industrial) wastewater. There are 22 such dischargers in the Broad River Basin. This test shows whether the effluent from a treatment plant is toxic, but it does not identify the specific cause of toxicity. If the effluent is found to be toxic, further testing is done to determine the specific cause. This follow-up testing is called a *toxicity reduction evaluation* (TRE).

Metals

Municipal and industrial dischargers along with urban runoff, and possibly atmospheric deposition, are the main sources of metals contamination in surface water. North Carolina has stream standards for many heavy metals. The most common metals limited in municipal permits are cadmium, chromium, nickel, lead, mercury, silver and zinc. Each of these is monitored at the 21 ambient monitoring stations in the basin along with aluminum and arsenic. Point source discharges of metals are controlled through the NPDES permit process. Mass balance models (Appendix III) are employed to determine appropriate limits. Municipalities with significant industrial users discharging wastes to their treatment facilities limit the heavy metals coming to them from their industries through their *pretreatment program.* Source reduction and wastewater recycling at WWTPs also reduces the amount of metals being discharged to a stream. Nonpoint sources of pollution are controlled through best management practices.

Chlorine

Chlorine is commonly used as a disinfectant at NPDES discharge facilities which have a domestic (i.e., human) component. These discharges are a major source of chlorine in the State's surface waters. Chlorine dissipates fairly rapidly once it enters the water, but it can have significant toxic effects on sensitive aquatic life such as trout and mussels. North Carolina has adopted a freshwater standard for trout waters of 17 ug/l (micrograms per liter). For all other waters an action level of 17 ug/l is applied to protect against chronic toxicity. It is recommended that new and expanding discharges provide dechlorination or alternate disinfection of wastewater. A total residual chlorine limit is assigned based on the freshwater action level of 17 ug/l or a maximum concentration of 28 ug/l for protection against acute effects in the mixing zone. Federal guidelines for residual chlorine of 8 ug/l for chronic effects and 13 ug/l for acute effects are used in saltwaters. In 1993, letters were sent to existing facilities with chlorine monitoring requirements. These letters encouraged permittees to examine their effluent chlorine levels and noted that limits may be implemented in the future. At this time, the State requires chlorine limits for all trout waters and any new or expanding facilities using chlorine for disinfection.

Ammonia (NH_3)

Point source dischargers are one of the major sources of ammonia. In addition, decaying organisms which may come from nonpoint source runoff and bacterial decomposition of animal waste products also contribute to the level of ammonia in a waterbody. At this time, there is no numeric standard for ammonia in North Carolina. However, DWQ has agreed to address ammonia toxicity through an interim set of instream criteria of 1.0 mg/l in the summer (April - October) and 1.8 mg/l in the winter (November - March). Currently, limits will be given no less than 2 mg/l in summer and 4 mg/l in winter, unless dissolved oxygen problems or modeling analysis dictate stricter limits. These interim criteria are under review, and the State may adopt a standard in the future.

Assimilative Capacity

The assimilative capacity (that is, the amount of a substance a waterbody can assimilate under designated flow conditions) available for toxicants in the Broad basin varies from one waterbody to another. In streams, the 7Q10 is used as the flow condition for aquatic life based standards, while average flow is used for carcinogens. In larger streams where more dilution flow exists there is more assimilative capacity for toxics. In areas with little dilution, facilities will receive chemical specific limits which are close to the water quality standard. In estuarine waters assimilative capacity can be difficult to determine since it is generally dependent on tidal forces, wind-driven mixing and proximity to inlets and not primarily on freshwater discharge. Toxics from nonpoint sources typically enter a waterbody during storm events. All waters must be protected from both immediate acute impacts and longer term chronic effects.

Control Strategies

Chemical specific toxics limits and monitoring requirements for point source dischargers will be determined using the techniques discussed in the Modeling Unit's Standard Operating Procedures manual and discussed in Appendix III of this report. These methods utilize an EPA recommended approach which considers the maximum predicted effluent concentration and the amount of variation in effluent monitoring data. Whole effluent toxicity limits are assigned to all major dischargers and to any discharger of complex wastewater.

Nonpoint source strategies being implemented through the industrial NPDES stormwater program should also be helpful in reducing toxic substance loading to surface waters. Agricultural BMPs implemented to reduce nutrient and sediment loading from cropland are likely to result in lower pesticide inputs.

6.6.7 Management Strategies For Oxygen-Consuming Wastes

Maintenance of dissolved oxygen (DO) is critical to the survival of aquatic life and to the general health of surface waters. The daily average dissolved oxygen standard for most waters in the state, except for waters classified as trout and swamp waters, is 5.0 mg/l. In trout waters the standard is 6.0 mg/l. Approximately 30% of the surface waters in the Broad basin have been supplementally classified as trout waters.

Biochemical oxygen demand (BOD) and ammonia nitrogen (NH_3-N) associated with wastewater treatment plants are generally the types of oxygen-consuming wastes of greatest concern. During summertime conditions, when temperature is high and stream flow is low, point source BOD and NH_3-N have the greatest impact on instream dissolved oxygen concentrations. NPDES permits for wastewater facilities generally limit BOD_5 (or $CBOD_5$) and NH_3-N in point source discharge effluents to ensure protection of the DO standard during warm, low flow conditions. Under these conditions, nonpoint source pollution input, which typically occurs as a result of rainfall events, has a minor impact.

Where residual BOD is significant, management of nonpoint sources to reduce loading is recommended by implementation of best management practices. Additionally, constructed wetlands can be strategically engineered and positioned in the landscape to reduce the input of oxygen demanding wastes. Constructed wetland treatment systems can remove between 50% and 90% of the BOD_5 from primary effluent (Bastian and Benforado 1988).

BOD/DO models are used by DWQ to determine NPDES permit limits for oxygen-consuming wastes. The choice of model in free-flowing streams, North Carolina's desktop empirical model (Level B) or the field calibrated, QUAL2E model, is determined by the amount of data available for a given stream reach (Appendix III). Modeling is not conducted in some instances, such as for discharges into zero flow streams and HQW stream segments where NPDES permit limitations are determined by special procedures and regulations.

Discharges to Low Flow Streams

Many low flow streams exist across the state. In 1980 studies were performed on zero flow streams (7Q10 and 30Q2 = 0 cfs) to determine the effect of wastewater discharges to these waterbodies. The studies concluded that:

- steady-state models do not apply to zero flow streams, particularly those receiving waste from small discharges;
- the pool/riffle configuration of these small streams results in violations of the DO standard even when the wastewater is well treated;
- small streams receiving wastes from schools, mobile home parks, subdivisions, etc. flow through populated areas where children have easy access to the streams;
- noxious conditions were found in the low flow streams that were part of the study.

As a result of the study, regulations were developed that prohibit new or expanded discharges of oxygen-consuming wastes to zero flow streams. Existing facilities discharging to zero flow streams were evaluated for alternatives to discharge. Many facilities found alternatives to a surface water discharge and some facilities built new treatment plants to meet advanced tertiary limits for BOD_5 and NH_3-N. Facilities that currently discharge to a zero flow stream but which have not yet been evaluated will receive the following language in their NPDES permit:

> *Removal of the discharge will be required if a more environmentally sound and economically achievable alternative is available.* ***An engineering report evaluating alternatives to discharge is due 180 days prior to permit expiration along with the permit renewal application.*** *As part of the report, the cost of constructing a treatment facility to meet limits of 5 mg/l BOD_5, 2 mg/l NH_3-N, 6 mg/l dissolved oxygen and 17 ug/l chlorine must also be included if there are no alternatives to a surface water discharge. Upon review of the results of the engineering report, the Division may reopen and modify this NPDES permit to require removal of the discharge, modified treatment designs, and/or revised effluent limitations within a specified time schedule.*

This policy typically covers small discharges, i.e., schools, mobile home parks, rest homes, subdivisions, etc. which discharge to zero flow streams in headwater areas. While these discharges may not cause severe water quality problems in mainstem reaches of the Broad Basin they can cause localized problems in their low flow receiving streams.

The results of the 1980 study were extrapolated for facilities discharging to low flow streams with a 7Q10 = 0 and a 30Q2 > 0 since similar adverse impacts are expected in the receiving streams. Regulations were developed to set effluent limitations for new and expanded discharges of oxygen consuming waste at 5 mg/l BOD5, 2 mg/l NH3-N, and 6 mg/l DO, unless it is determined that these limitations will not protect water quality standards.

REFERENCES CITED: CHAPTER 6

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