EXECUTIVE SUMMARY

NORTH CAROLINA'S BASINWIDE APPROACH TO WATER QUALITY MANAGEMENT - PURPOSE OF HIWASSEE RIVER BASIN PLAN

Basinwide management is a watershed-based water quality management initiative being implemented by the North Carolina Division of Water Quality (previously Division of Environmental Management). The *Hiwassee River Basinwide Water Quality Management Plan* is the thirteenth basinwide water quality management plan prepared by the Division of Water Quality (DWQ) in a series of plans being prepared for all seventeen of the state's major river basins. DWQ uses the plans as guides in carrying out its water quality programs in each river basin.

The basinwide water quality management plans are not new regulatory documents. They are planning documents used to communicate the state's rationale, approaches and long-term water quality management strategies for each basin to policy makers, the regulated community and the general public. Each plan is completed and approved prior to the scheduled date for basinwide discharge permit renewals. The plans are then evaluated, based on follow-up water quality monitoring, and updated at five year intervals.

DWQ uses this approach as a means to report to the public on the current status of water quality in the basin, major water quality concerns and issues, projected trends in development and water quality, the long-range water quality goals for the basin, and recommended point and nonpoint source management options.

The *Hiwassee River Basinwide Water Quality Management Plan* was approved by the NC Environmental Management Commission in May 1997 and will be updated in 2002. Basinwide NPDES permitting is scheduled to commence in December 1997.

GOALS OF THE BASINWIDE APPROACH

The primary goals of DWQ's basinwide program are:

1) to identify and restore full use to impaired waters,
2) to identify and protect highly valued resource waters and biological communities of special importance, and
3) 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.

PUBLIC WORKSHOPS

A public workshop was held in the Hiwassee River basin in Murphy on November 8, 1995. The workshop, which was attended by approximately 40 people, was co-sponsored by the North Carolina Cooperative Extension Service and DWQ. The purpose of the workshops was to familiarize stakeholders in the basin with DWQ's basinwide approach and to solicit comments for the basin plan. Workshop participants were asked to comment on what they saw as the priority issues in the basin and how these issues could be addressed. A summary of the comments received from the workshop participants is provided in Chapter 6.

Priority issues identified at the workshop included:

1. Need to respect private property
2. Emphasize non-regulatory and localized water quality protection efforts over regulations
3. Recognize and address government misrepresentation and unfair implementation of contradictory regulations
4. Clean up wastewater treatment plant discharges as needed
5. Balancing water uses and future planning
6. Need to sample all streams

HIWASSEE RIVER BASIN OVERVIEW

The Hiwassee River basin is located in the southwestern corner of North Carolina in the Appalachian Mountains (Figure 1). Water flow in the Hiwassee River is regulated by the Tennessee Valley Authority (TVA) for the production of hydroelectric power. The river is impounded three times in North Carolina to form Chatuge Lake, Hiwassee Lake and Apalachia Lake. The headwaters of the Hiwassee River originate in North Carolina and northern Georgia. The waters of the basin flow north to northwest into Tennessee. The Hiwassee River is one of the major rivers flowing into the Tennessee River. The Tennessee River in turn flows into the Mississippi River and eventually into the Gulf of Mexico. The largest rivers in the basin are the Hiwassee River and its tributaries, the Valley and Nottely Rivers. Many of the streams in the basin are located within the Nantahala National Forest. Overall water quality in this basin is good as most of the streams drain undisturbed and undeveloped mountain areas.

Based on 1990 census data, the population of the basin was 26,723 people. The percent population growth over the ten year period from 1980 to 1990 was 7.1% versus a statewide average of 12.7%. The overall population density is 43 persons per square mile versus a statewide average of 123 persons per square mile. While the resident population may be low, the basin experiences significant seasonal population fluctuations from recreation and tourism. There is the potential for a significant increase in tourism and second home development associated with the opening of the gambling casino on the Cherokee Indian Reservation. The casino is expected to draw 1.2 million persons per year to the Reservation.

The basin is characterized by steep slopes and erodible soils. These steep slopes limit the amount of land area suitable for development and crop production. Much of the watershed is undeveloped or lies within the Nantahala National Forest. While most of the land is forested (approximately 45.6% private forest lands and 33.5% public forest lands), many retirement and second home developments are being built in the area. Most development occurs in river valleys and near streams due to the more level ground found in valleys. Development in or near stream corridors increases the chances for sedimentation and erosion problems.

There are a number of high quality and outstanding resource waters in the basin. The Hiwassee River basin is well known for its trout fishery waters. The entire Fires Creek catchment has been designated as Outstanding Resource Waters and most of the Tusquitee Creek watershed is classified as High Quality Waters. The Fires Creek Wildlife Management Area is part of the Nantahala National Forest. Tributary streams in these watersheds that have received Excellent biological ratings include Big Tuni Creek, Johnson (Mill) Creek, Albone Creek, Coldspring Branch, Little Fires Creek and Leatherwood Branch.

There are eleven aquatic species in the Hiwassee River basin that are listed by North Carolina as either Endangered, Special Concern, or Significantly Rare.

Figure 1 General Map of the Hiwassee River Basin

The streams and rivers of the Hiwassee River basin are still generally of high water quality. However, there are signs of sedimentation problems occurring. Sources of sedimentation include agriculture, mining operations, development, and silviculture. The few water quality problems encountered in the Hiwassee River basin are due primarily to nonpoint source pollution and toxicity problems in Brasstown Creek and the Valley River. Further discussion on these waters can be found in the Recommended Management Strategies below.

ASSESSMENT OF WATER QUALITY IN THE HIWASSEE RIVER BASIN

An assessment of water quality information collected by DWQ and other agencies indicate that the Hiwassee River basin has generally good water quality. There are two streams that are impaired and three streams that are threatened. Below is a summary of some key monitoring data that reflect water quality in the basin. A more detailed presentation of this information can be found in Chapter 4.

Summary of DWQ Monitored Data

Benthic Macroinvertebrates - These are primarily bottom-dwelling aquatic insect larvae such as species of mayflies, stoneflies, and caddisflies that are used as biological indicators of water quality. Measurements of the number and diversity of these organisms at strategic sampling sites is an important means of assessing water quality.

Macroinvertebrate data were collected at 15 basin assessment sites during 1994 and a total of 37 sites (73 samples) have been rated since 1983. Water quality was Excellent at 9 sites, Good at 3 sites, Good-Fair at 2 sites, and Fair at 1 site (Brasstown Creek). Of the 73 samples collected since 1983, 66% were given an Excellent bioclassification.

Fish Tissue Analysis - Fish tissue samples were collected from Hiwassee River and Hiwassee Lake (13 observations) from 1981 to 1986. Fish tissue samples were analyzed for metals contaminants only. Results of fish tissue analyses indicated that mean levels of metals contaminants were non-detectable or present at levels below federal Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) criteria.

Lakes Assessments - There were three lakes in the Hiwassee River Basin sampled as part of the North Carolina Lakes Assessment Program. These lakes are: Chatuge Lake, Apalachia Lake and Hiwassee Lake. Hiwassee Lake was the only lake intensively monitored during the growing seasons of 1991 through 1993 as part of a state reference lake program. Each lake is individually discussed in the appropriate subbasin section in Chapter 4. These lakes are classified oligotrophic and are currently meeting their intended uses.

Ambient Monitoring - There are two ambient monitoring stations in the Hiwassee River basin where water quality samples are collected monthly by DWQ. Water quality at these stations infrequently exceeded state criteria. The most notable finding of the water chemistry data is low pH levels starting in the winter of 1991 and extending through 1994. Present pH levels appear to be more normal. This situation occurred throughout the Little Tennessee and French Broad River basins as well and is not readily explained. Atmospheric deposition may have contributed to the low pH levels during this time. In addition, elevated levels of fecal coliform were detected on Brasstown Creek.

Use-Support Ratings

Use-support ratings are a method to analyze water quality information and to determine whether the quality is sufficient to support the uses for which the waterbody has been classified by the

state. The word *uses* refers to activities such as swimming, fishing and water supply. All surface waters in the state have been assigned a classification (Appendix I).

DWQ has collected chemical and biological water quality monitoring data throughout the basin, some of which is summarized above. Available data for a particular stream segment has been assessed to determine the overall *use support* rating; that is, whether the waters are *fully supporting, support-threatened, partially supporting,* or *not supporting* their uses. Streams referred to as *impaired* are those rated as either partially supporting or not supporting their uses. Use support ratings in the Hiwassee River basin, described more fully in Chapter 4, are summarized below.

Of the 989 miles of streams and rivers in the Hiwassee River basin, use support ratings were determined for 81% or 797 miles with the following breakdown:

SUPPORTING.....78%
- Fully supporting (64%)
- Support-threatened (14%)

IMPAIRED.....3%
- Partially supporting (3%)
- Not supporting (0%)

NOT EVALUATED.....19%

The majority of the streams have good to excellent bioclassifications and very few standards were violated at the ambient stations. In fact, as noted above, there are only two impaired waters in the basin (Brasstown Creek and Valley Creek). However, although water quality is high in this basin, nonpoint source pollutants such as increased sedimentation, were evident at some of the sampling sites. Also, point source discharges in Georgia pose potential water quality concerns in the headwaters of the Hiwassee River. Those waters considered impaired or support threatened based on monitoring data are discussed below by subbasin.

RECOMMENDED MANAGEMENT STRATEGIES FOR RESTORING IMPAIRED WATERS AND PROTECTING THREATENED WATERS

Chatuge Lake and Hiwassee River (Subbasin 04-05-01)

Overall water quality in the subbasin is considered Excellent based on evaluation of benthic macroinvertebrate data collected since 1985 (refer to Chapter 4 for map of sampling sites). However, Brasstown Creek, located within this subbasin, is impaired based on ambient water quality data collections. In addition, Town Creek at Hayesville and the Hiwassee River downstream from Chatuge Lake Dam are Support Threatened.

Brasstown Creek

Brasstown Creek is rated Partially Supporting its designated uses and is therefore considered impaired. The creek originates in north Georgia and flows parallel to NC 66 for most of its length. The creek is affected by nonpoint source runoff from the highway and various land use activities. Brasstown Creek is also affected by elevated levels of fecal coliform bacteria relating to the effluent from the Young Harris Water Pollution Control Plant in Georgia.

The Southeastern Natural Resources Leaders Group (SENRLG) has chosen Brasstown Creek as a potential waterbody for conducting a survey of land use activities and identifying potential restoration projects. The efforts of SENRLG could have very positive benefits for Brasstown Creek.

Recommendations:
The State of North Carolina and DWQ need to work more closely with Georgia's EPD to assure that proper NPDES limits are established and maintained for those dischargers in the upper Hiwassee River watershed in Georgia as these streams enter North Carolina.

Town Creek at the Town of Hayesville
The Hayesville WWTP has experienced chronic compliance problems over the years with its BOD_5, fecal coliform, and flow permit limits. Operational problems and high waste flows were the primary cause. In January 1996, Clay County took over operation of the plant. In order to alleviate compliance problems, the county is planning to construct a new 0.3 MGD waste water treatment plant (WWTP) with an outfall to the Hiwassee River. The current plant discharges to Town Creek, which has limited assimilative capacity and is rated Support Threatened. The new WWTP is expected to produce a better quality effluent than the existing plant, in addition to providing capacity for future growth.

Recommendations:
With the additional wastewater treatment capacity, efforts should be made to identify failing septic tanks and connect them to the city/county sewer collection system.

Hiwassee River below Chatuge Dam
The Tennessee Valley Authority (TVA) operates Chatuge Dam on the Hiwassee River approximately 4.5 miles upstream of the proposed new Hayesville WWTP. The dam is used for flood control, recreation, and power generation. TVA has no minimum release requirement from the dam. A discontinued USGS gauging station located approximately 1.5 miles downstream of the dam repeatedly recorded monthly minimum stream flows of < 2.0 cfs over the last ten years of its operation (1965-1975). When water is being released from the dam maximum stream flows can be over 1000 cfs.

Since water used to generate electricity is drawn from near the bottom of Chatuge Lake, instream dissolved oxygen (DO) concentrations below the dam can be <1.0 mg/L. In order to minimize the wide fluctuations in streamflow as well as to increase the instream DO concentration, TVA constructed a reaeration weir approximately 0.8 mile downstream of the dam. The reaeration weir was put into service in November 1992. The weir is designed to maintain a minimum instream DO concentration of 5.0 mg/L and a minimum flow of 60 cfs from the weir pool.

Recommendations:
Given the potential for DO concentrations to be near the state standard of 5.0 mg/L immediately below the reaeration weir, it is recommended that Hayesville conduct instream DO monitoring once Clay County relocates the wastewater treatment outfall to the Hiwassee River.

Hiwassee River, Hiwassee Lake and Apalachia Lake (Subbasin 04-05-02)

While overall water quality in this subbasin is considered very good, the Valley River at Andrews is rated as impaired and other reaches of the river near Rhodo and Tomatla are rated as Support Threatened. Other Support Threatened waters include the Hiwassee River downstream of Murphy and Junaluska Creek near Andrews.

Valley River at the Town of Andrews
The Town of Andrews discharges to Valley River. A 1994 special study on the river by DWQ could not attribute the water quality problems in Valley River solely to the Andrews discharge since samples taken upstream of the discharge indicated water quality problems as well. The Andrews WWTP has had some compliance problems in the last four years with three toxicity

test failures in 1995. Since those three failures the town has passed its toxicity test the last four consecutive times.

Recommendations:
It is recommended that the Andrews municipal area be targeted for a nonpoint source survey to identify the sources of pollution that are contributing to water quality problems in the area.

Hiwassee River at the Town of Murphy
The Town of Murphy discharges to the Hiwassee River. The town has had no significant compliance problems nor has it failed any toxicity tests since 1992. However, the Asheville Regional Office has reported that the town has substantial inflow and infiltration (I&I) problems. The I&I problems have resulted in occasional raw wastewater discharges to the Hiwassee River. Currently the town is under a flow moratorium for additional sewer hookups. The Town of Murphy is working with an engineering consulting firm to alleviate the I&I problems as well as to investigate the possibility of an expansion. Long term instream dissolved oxygen problems are not anticipated as a result of this discharge.

Recommendations:
It is recommended that this facility continues to monitor its effluent for total phosphorus and total nitrogen in order to provide nutrient data for the future management of Hiwassee Lake.

Valley River
The Valley River is rated either Support Threatened or Partially Supporting its designated uses at the three DWQ sampling sites located 1) above Andrews, 2) near Rhodo and 3) near Tomatla.

Recommendations:
The Partially Supporting portion of the river is addressed above under discussion for the Town of Andrews. The entire length of the Valley River could become a focus of the Hiwassee NPS team in the future. A localized team effort will likely be needed to determine the sources of degradation to the Valley River and correct any problems.

Junaluska Creek
Junaluska Creek is bordered by SR 1505 from its headwaters to the Town of Andrews. It is likely that this road is contributing to its Support Threatened status.

Recommendations:
As a tributary of the Valley River, Junaluska Creek could also be investigated for potential sources of degradation by the Hiwassee NPS team.

POTENTIAL RECLASSIFICATIONS TO HIGH QUALITY WATERS OR OUTSTANDING RESOURCE WATERS

The Hiwassee River basin contains a large number of streams that have either ORW or HQW classifications, as well as trout (Tr) and water supply (WS) status. Britton Creek was reclassified to HQW in August 1992. Based on data collected from summer 1994 surveys, the following streams may qualify for ORW/HQW reclassification. However, there are no formal actions being undertaken at this time to reclassify these waters.

- Peachtree Creek
- Hanging Dog Creek
- Persimmon Creek
- Beaverdam Creek

MAJOR WATER QUALITY ISSUES AND RECOMMENDED MANAGEMENT STRATEGIES

A. GROWTH AND DEVELOPMENT

Growth Trends and Water Quality

There has been limited growth in the Hiwassee River basin, with growth occurring primarily in Clay County and near Hayesville. This trend is expected to continue. Impacts to water quality from growth and development can include sedimentation, streambank erosion and degradation from a variety of fertilizers, chemicals, and road salts.

Traditionally, growth and development within the basin has occurred mostly along streams and rivers where lands are less steep. Growth along waterways can have a significant negative impact on water quality if construction activities are not undertaken with proper care. Recently, construction activities have also occurred on mountain ridges and slopes to obtain views of valleys and ridges. Building on slopes can be particularly harmful to water quality if appropriate erosion and sedimentation control measures are not used. Slopes tend to have soil types that are more shallow and unstable than those in valleys. Often, driveways to home sites on slopes are greater than 12% slope, the recommended slope for reducing erosion potential (Willett, pers. comm.).

In recent years, there has been a wave of development from Atlanta, Georgia to the North Carolina state line. Parcels of property have sold rapidly throughout areas of the Hiwassee River basin. Clay County has seen an approximate doubling of land parcels over the last ten years (Willett, pers. comm) as land is subdivided. Clay County is especially attractive to developers because of the beauty of the area, easy access due to new multi-lane highways, close proximity to Atlanta and recreation opportunities on Chatuge Lake. To date, most of the land has not been built upon. Approximately 61% of the land parcels in Clay County are held by out-of-state developers that intend to subdivide these large parcels when the market is most receptive (Mike Decker, pers. comm). When these developers perceive that the timing is right for building out these parcels, the rate of growth within this basin will accelerate quickly and may be too fast for local governments to keep pace with (Willett, pers. comm). The basin also receives a tremendous seasonal population fluctuation.

While increases in tourism and development can be seen as very positive for this portion of the state with some of the lowest average per capita incomes in the state, it is also very important for local governments and community leaders to look towards the future and balance economic growth with protection of the natural resources that draw people to the area.

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. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Influence of the Cherokee Reservation Gambling Casino on Growth and Water Quality

The Cherokee Reservation gambling casino, the only legalized gambling casino in the Southeast, is geographically situated to become "...one of the primary gambling centers east of the Mississippi. It will be centrally located to many eastern cities and is within 500 miles of over half the U.S. population " (Willett and Eller, 1995). The development of the gambling casino on the Cherokee Indian Reservation is estimated to attract an additional 2 million visitors per year to the Reservation (Willett and Eller, 1995). It is expected that these visitors will tour surrounding areas.

A recent NC Division of Community Assistance study (Willett and Eller, 1995) suggests that western North Carolina will be permanently impacted by the development of the Cherokee Indian Reservation gambling casino. In addition to other effects not related to water quality, the region is likely to experience:

1) The need for additional state support for road improvements. Road improvements will entail construction and the potential for increased erosion and sedimentation, as well as the potential for increased effects of acid runoff to streams if Anakeesta rock formations are exposed (See Multi-Lane Highways discussion below);

2) Increased traffic which may result in increased water quality impacts through stormwater runoff and exhaust emissions that contribute to acid rain (See discussion on acid deposition below);

3) The need for higher taxes to pay for increased local government services (water and sewer improvements alone are estimated at $5.6 million); and

4) The diversion of dollars from existing businesses to gambling and displacement which occurs when non-gambling tourists travel to other areas to avoid increased traffic, lack of hotel accommodations, and avoidance of the gambling atmosphere (Willett and Eller, 1995).

The gambling casino may have effects on water quality as the outlying areas experience accelerated commercial activity due to displacement and spill-over. Commercial activity in these outlying areas will increase the demand for roads and services. In addition, strong economic activity may be viewed as an additional reason to build second homes or establish a new business by an outside entrepreneur. Construction of homes, commercial areas and roads increase stormwater runoff and sedimentation problems. This demand for goods, services and homes will need to be planned for and managed in order to reduce the potential for degradation of water resources. Refer to section 6.6 for recommended management strategies relating to proper planning for growth and development.

Multi-Lane Highways

The NC Division of Community Assistance report estimates an additional 1,040,000 vehicles each year along six major traffic routes in western North Carolina. This dramatic increase in traffic will require significant changes to traffic flow patterns throughout western North Carolina. At present, there are six major corridors (See Chapter 2) planned by the NC Department of Transportation for improving traffic flow. These thoroughfares are expected to relieve the present congestion experienced by travelers in the vicinity of the Cherokee Reservation and provide opportunities for easy access to rather remote areas of the state. Corridor 1, through the Hiwassee River basin, is expected to carry an additional 72,800 vehicles on US 19/129.

The development of the four-lane thoroughfare from Andrews to Almond (via Robbinsville) will provide access to Robbinsville and Graham county for economic development in the area (DOT 1996). This thoroughfare should also increase traffic flow across the mountains through the Hiwassee River basin, from Atlanta to the Great Smoky Mountains National Park and the Cherokee Indian Reservation gambling casino. Under the DOT Transportation Improvement Program, US Hwy 64 will be widened to a five lane highway from NC 69 to the Hiwassee River. NC Hwy 175 will be upgraded from the Georgia state line to the junction with US 64. The portion of US 64 from the Clay county line to Murphy is expected to be rerouted to a new location and developed to a two lane roadway, ultimately to become a four lane highway. NC 60 is planned to be developed to a four lane highway from the Georgia state line to US 64-74.

During road construction there are also increased risks for sediments to enter surface waters. Also, Anakeesta rock formations are sometimes found in this region of the state. These rock formations can also significantly impact water quality if not handled properly. Chapter 4 provides more detail on water quality problems associated with Anakeesta rock formations and Chapter 5, Section 5.6.2 describes the N.C. Department of Transportation road construction policies in areas with Anakeesta rock formations. When roads are built along streams or rivers, there is also the increased potential for toxic and synthetic substances to enter these waters as runoff.

Acid Rain/Deposition

The developments of thoroughfares will make it easier for tourists and developers to access and use the area. As traffic flow increases, the emission of nitrous oxides from vehicles to the atmosphere will increase. Nitrous oxides react with volatile organic compounds to create ozone. At times, ozone levels in the Great Smoky Mountains National Park can reach levels nearly double the average ozone level in Raleigh (News and Observer, Sept. 1, 1996). The man-made pollutants that trouble the peaks of the Smokies is creating more widespread problems throughout the Southern Appalachians, as noted by the Southern Appalachian Man and the Biosphere (SAMAB). The region of the GSMNP presently receives some of the most acidic deposition in the country. This high amount of deposition combined with low stream buffering ability and the fact that the capacity of the soils to absorb excess nutrients has been reached in many areas, has produced many low pH streams at higher elevations and higher stream nitrogen levels than in any other national park (News and Observer, Sept. 1, 1996). Refer to Chapter 4 for a more thorough discussion of the effects of acid deposition of high elevation streams in western North Carolina.

Recommendations for Addressing Growth Issues in Western North Carolina

Proactive planning efforts at the local level are needed to assure that development is done in a manner that maintains the high water quality that is presently attracting people to the area. Local governments are responsible for the institution of programs and initiatives to balance economic growth with water quality protection. The following strategies are examples of a few of the initiatives local governments could pursue.

- Develop a Regional Organization. It has been suggested for western North Carolina that a regional organization be developed representative of the eight counties (covering the Hiwassee, Little Tennessee, Savannah and French Broad River basins) that will be affected the most by the gambling casino (Willett and Eller, 1995). While the focus of this group would primarily be aimed at economic development, a separate task force should be developed to conduct an analysis of the impacts of the casino on natural resources. Several economic development organizations are already in existence in the region.

- Develop a variety of land use management tools. Land use management issues will need to be addressed either by the local governments or by the natural resource task force of the regional organization. The lack of land use planning can have long-term negative impacts on water quality. Chapter 5, Section 5.6.3 presents information on local governments that have some land use planning in effect.

  Each of the 5 counties within the Little Tennessee River basin should have a Sedimentation and Erosion Control Ordinance, Pre-Development Ordinance (or subdivision ordinance) and a Land Use Plan in effect. The development of a Land Use Guidance System (LUGS) may be a feasible system to enact within these counties. LUGS is a systematic land use planning and management tool that allows for land use decisions to be made on a site specific basis.

The concept behind LUGS is that projects are heard case-by-case, often based on a pre-existing growth guidance assessment. A committee reviews the project for its compatibility with the growth guidance assessment. Anyone from the surrounding area that may be affected by the project is invited to attend review meetings. The Board of Commissioners typically makes a final decision on the project. This process is less generic in its approach than zoning and yet allows for protection of the integrity of the community.

- Pursue Funding for Local Water Quality Protection Projects. The Clean Water Management Trust Fund (see Chapter 5, Section 5.8) may be a source of funding to assist local governments in obtaining a balance between economic growth and protecting surface waters of the state. Local governments will need to take responsibility for planning for the additional tourists and growth and development. This region of the state typically has a lower tax base than other areas of the state. Problems with aging infrastructure are also typical, especially for the small towns in the region. The Clean Water Management Trust Fund can be used for many purposes including: acquiring land for conservation easements and riparian buffers, restoring degraded lands to protect water quality, repairing failing waste treatment systems and septic tank systems and improving stormwater management. Local governments and regional organizations should consider pursuing funding through the Clean Water Management Trust Fund as a means to upgrade infrastructure and manage land to protect water quality. Contact the Executive Director, Dave McNaught at 919-974-5497 for more information.

- Support Local Initiatives for Water Quality Protection. Local governments and regional organizations can also support local efforts to protect areas by developing greenways, bikeways and monitoring efforts conducted by citizen volunteers and protection of lands near surface waters and wetlands.

- Encourage participation in the Straight Pipe Elimination Amnesty Program. This program is described further in Appendix VI.

At the state level, it may be possible to develop an incentive program for local governments to encourage the development and implementation of land use plans. This incentive policy has been applied in other states. The premise of an incentive program is to provide partial funding to staff the program if a local government develops a land use plan and then enforces its plan. If the land use plan is not developed or enforced, no funding would be available. Such a program has not yet been developed in North Carolina.

B. URBAN AND INDUSTRIAL STORMWATER CONTROL

Urban stormwater runoff can be a significant contributor to water quality problems. In the Hiwassee River basin, urban development is relatively limited at present. 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 Towns of Andrews, Murphy and Hayesville, and any high density developments that may arise. There are no municipalities in the Hiwassee River Basin required to obtain permits to manage stormwater runoff within their jurisdiction.

Recommendations

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. The following is a list of recommendations for local governments, citizens, businesses, developers, and state agencies.

- Mapping of the municipal storm sewer systems and outfall points, and developing procedures to update this information.
- Evaluating existing land uses in the local government's jurisdictional area to determine where sources of stormwater pollution may exist. In addition, local government activities and programs could be evaluated to determine where existing activities address stormwater management in some way, or could be modified to do so.
- Developing educational programs to inform citizens of activities that may contribute pollutants to stormwater runoff (dumping oil, paint or chemicals down storm drains) and offering ways of carrying out such activities in an environmentally sound manner. Storm drain stenciling is a good example of a low cost educational tool.
- Developing programs to locate and remove illicit connections (illegal discharge of non-stormwater materials) to the storm sewer system. These often occur in the form of floor drains and similar connections.
- Reviewing local ordinances pertaining to parking, curb and gutter and open space requirements. Many of these local ordinances could be modified to enhance water quality protection from urban stormwater runoff impacts. Maintaining riparian buffer strips along streams is an example.
- Creating wetlands along streams in urbanized areas of the watershed to receive stormwater runoff can be an effective way to remove pollutants by burial, chemical breakdown, and/or assimilation into plant tissue. Careful design of these systems is needed in order to adequately handle the altered hydraulics of urban areas.

Throughout the Hiwassee River basin, various types of industrial activities with point source discharges of stormwater are required to be permitted under the federally mandated National Pollutant Discharge Elimination System (NPDES) stormwater program. These include activities related to manufacturing, processing, materials storage areas and construction activities with greater than five acres of disturbance. These dischargers must develop Stormwater Pollution Prevention Plans (SWPPP) to minimize and control pollutants discharged from their stormwater systems. These SWPPPs are subject to review and modification by the permitted facilities and DWQ to assure that management measures are appropriate.

C. EROSION AND SEDIMENTATION

Sedimentation has been identified as a source of water quality degradation in streams in the basin. Sedimentation is a widespread nonpoint source-related water quality problem that results from erosion of disurbed lands. land-disturbing activities include land clearing, agriculture and development (e.g., highways, shopping centers, and residential subdivisions). Construction activities can be especially harmful in the mountains where slopes are steep and rainfall is frequent.

Since the mountain counties are 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. Improperly designed, constructed, and maintained private access roads are a significant source of sediment in the mountains. After construction is complete, poorly designed roads, trails, and driveways may continue to erode into water bodies. Also, the increased impervious surface areas in developed watersheds increases the rate and volume of runoff after storms which can increase erosion of stream banks.

The degree of sedimentation affects both the habitat of aquatic macroinvertebrates and the quality and amount of fish spawning and rearing habitat. Sedimentation is one of the main factors limiting trout production in western North Carolina. Inorganic sediments can affect trout productivity in three ways: direct effects - impairment of respiration, feeding habits, and migration patterns; reduced egg hatching and emergence due to decreased water velocity and dissolved oxygen; and, trophic effects - reduction in prey (macroinvertebrates). As fine suspended solids increase in the waters, the dissolved oxygen, permeability, and apparent velocity decrease (West, date unknown). Erosion and sedimentation resulted in lower hatching and emergence success of trout embryos, reduced trout biomass and growth rates when comparing two streams in western North Carolina (West et. al, 1982).

Sedimentation impacts streams in several other ways. Eroded sediments may gradually fill lakes and navigable waters and may increase drinking water treatment costs. Sediment also serves as a carrier for other pollutants including nutrients (especially phosphorus), toxic metals, pesticides, and road salts.

Recommendations:

For each of the 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 6.5 and are briefly described in Appendix VI.

It is also important to note that non-government interests such property owners, developers and contractors need to accept responsibility for controlling erosion. Chapter 6 contains numerous recommendations for minimizing erosion and sedimentation from construction activities, private access roads, and state road construction. The responsibility for controlling sediment from these activities falls on many shoulders as shown in Table 1, below. The parties with the greatest responsibility include: homeowners, developers/contractors, local governments, the NC Division of Land Resources and the NC Department of Transportation.

Table 1. Sediment Related Activities and Groups with Greatest Responsibility

Activity	Responsibility Groups	Chapter 6 Table Reference (with Recommended Measures)
Construction	Homeowners Developers Contractors Local Governments NC Division of Land Resources	Table 6.6
Private Roads	Homeowners Local Governments State/Federal Agencies	Table 6.7
State Roads	NC Department of Transportation	Table 6.8

D. 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.

There are no monitored waterbodies in the Hiwassee River basin where fecal coliform bacteria standards have been exceeded in at least 25% of the samples taken by DWQ. However, Brasstown Creek has had some problems with elevated fecal coliform bacteria due to effluent form the Young Harris Water Pollution Control Plant. The Hiwassee River and the Valley River have had occasional elevated levels of fecal coliform bacteria.

Recommendations:
Several general management strategies for addressing fecal coliform contamination include:

- Proper maintenance and periodic inspections of onsite waste disposal systems such as septic tanks.
- Maintenance and repair of sanitary sewer lines by WWTP authorities.
- Elimination of direct unpermitted 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 6.12.

E. TOXIC SUBSTANCES

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

The waters of the Hiwassee River basin need to be protected from immediate acute effects and the residual chronic effects of toxic substances. Toxic limitations for point source discharges are based on the volume of the effluent released and the 7Q10 flow condition of the receiving stream. In the Hiwassee River basin, four point source discharges are required to conduct whole effluent toxicity testing (The Towns of Hayesville, Andrews, and Murphy and Clifton Precision South Division). Violations have occurred for the Towns of Hayesville and Andrews, as well as Clifton Precision. Refer to Section 6.3 for recommended control strategies for these NPDES permit holders.

Toxics from nonpoint sources of pollution typically enter streams during storm events through runoff from roads, parking lots, agricultural lands or golf courses. In the Little Tennessee River basin, low pH levels have been observed in many high elevation streams. These low pH levels have been attributed to chronic acid deposition and the low buffering capacity of high elevation

streams in the basin. With continued chronic input of acid deposition over the mountain region, there is potential for surface water degradation to occur in the Hiwassee River basin. This issue is discussed further in Chapter 4.

Recommendations:
Continued research and monitoring will be important to fully understand the relationship between acid deposition and water quality and for furthering the development of policies to reduce impacts to surface waters from the chronic introduction of atmospheric pollution.

For wastewater treatment plants, DWQ will continue to require toxicity testing at qualifying facilities and to correct problems as necessary.

Chapter 6 also includes recommendations for residents to play their part in keeping toxic substances out of streams and lakes. Tables 6.10 and 6.11 in Chapter 6 contain environmentally-friendly recommendations for lawn, automobile and home care.

FUTURE INITIATIVES IN THE HIWASSEE RIVER BASIN

Nonpoint Source Control Strategies and Priorities/Nutrient Reduction Efforts

Improving our knowledge of and controlling nonpoint source pollution will be a high priority over the next five years. Nonpoint source pollution accounts for some of the threatened waters in the Hiwassee River Basin. The following initiatives are underway to address the protection of surface waters from nonpoint sources of pollution.

- Establishment of nonpoint source basin teams in each basin. DWQ has begun to establish a nonpoint source team in each of the state's 17 major river basins. A nonpoint source team has been established in the Hiwassee River basin. Refer to Chapter 7 for further description.
- Interagency Water Quality Monitoring. DWQ has begun the process of coordinating with other natural resource agencies on the idea of interagency water quality monitoring across the state. Refer to Section 7.2.3 of Chapter 7 for more information.
- Development of a Use Restoration Waters (URW) Program. DWQ is developing a Use Restoration Waters (URW) Program. If approved, this program would include voluntary and regulatory management strategies to control the specific parameters of concern in selected impaired watersheds. Refer to Chapter 7 for more details.

National Pollutant Discharge Elimination System (NPDES) Program

In the next five years, efforts will be continued to:

- improve compliance with permitted limits;
- improve pretreatment of industrial wastes to municipal wastewater treatment plants so as to maintain reduced toxicity in effluent wastes;
- encourage pollution prevention at industrial facilities in order to reduce the need for pollution control;
- require dechlorination of chlorinated effluents or the use of alternative disinfectants;
- require multiple treatment trains at wastewater facilities; and
- require plants to begin plans for expansion well before they reach capacity.

Longer-term objectives will include refining overall management strategies after obtaining feedback on current management efforts during the next round of water quality monitoring. Long-term point source control efforts will stress reduction of wastes entering wastewater treatment plants, seeking more efficient and creative ways of recycling byproducts of the

treatment process (including nonpotable reuse of treated wastewater), and keeping abreast of and recommending the most advanced wastewater treatment technologies.

Use of Discharger Self-Monitoring Data

DWQ will continue to explore the possibilities of using discharger self-monitoring data to a greater degree to augment the data it collects through the programs described in Chapter 4. Quality assurance, timing and consistency of data from plant to plant would have to be addressed. Also, a system would need to be developed to enter the data into a computerized database for later analysis. One method of data collection that is currently being explored includes developing a comprehensive list of monitoring sites for the basin that would be monitored by an association of NPDES dischargers with data input to STORET. A basinwide sampling program has been established for dischargers in the Neuse River Basin and to date appears to be successful.

Coordinating Basinwide Management With the Construction Grants and Loans Program

The potential exists to use the basinwide planning process to identify and prioritize wastewater treatment plants in need of funding through DWQ's Construction Grants and Loan Program. Completed basin documents are provided to this office for its use.

Improved Data Management and Expanded Use of Geographic Information System (GIS) Computer Capabilities

DWQ is in the process of centralizing and improving its computer data management systems. Most of its water quality program data including permitted dischargers, effluent limits, compliance information, water quality data and stream classifications, will be put in a central data center which will be made accessible to most staff at desktop computer stations. Much of this information is also being entered into the state's GIS computer system. As all this information is made available to the GIS system, including land use data from satellite or air photo interpretation, and as the system becomes more user friendly, the potential to graphically display the results of water quality data analysis will be tremendous.