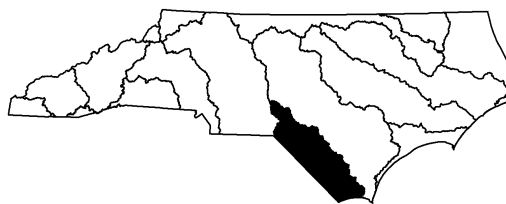
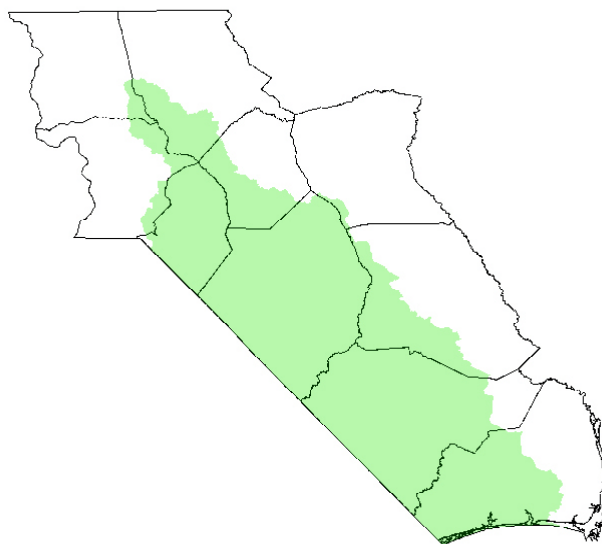




Lumber River Basinwide Water Quality Plan

March, 2010



Division of Water Quality
Planning Section



North Carolina Department
of
Environment and Natural Resources

Lumber River Basinwide Water Quality Plan

DRAFT

March, 2010

Prepared by:

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*This document was approved and endorsed by the NC Environmental Management Commission on **March 11**, 2010 to be used as a guide by the NC Division of Water Quality in carrying out its Water Quality Program duties and responsibilities in the Lumber River basin. This plan is the fourth five-year update to the Lumber River Basinwide Water Quality Plan.*

Executive Summary

The Lumber River Basin consists of four smaller subbasins belonging to the Pee Dee River Basin. Three of these subbasins eventually drain to the Pee Dee River in South Carolina before reaching the Atlantic Ocean, and the fourth subbasin drains directly to the Atlantic Ocean. The basin is located in the southeastern part of North Carolina along the border with South Carolina. The basin stretches from the sandhills through the coastal plain down to the ocean. It is home to two aquatic based state parks and many large wetland areas. This plan covers samples collected from January 2002 through December 2006 and includes all recent issues through 2008 related to water quality.

Challenges

There are two main and widespread water quality challenges in the Lumber Basin and both are related to human consumption of aquatic resources. One is the closure of shellfish waters due to elevated bacteria levels. The second is the issue of fish consumption advisories due to mercury. The shellfish industry provides a source of income and a local source of food to the people of North Carolina. This industry's resources are currently threatened by poor water quality due to high bacteria levels in stormwater runoff. All shellfishing waters in the basin are considered to be impaired because they are either permanently or frequently closed to shellfish harvesting. High levels of mercury found in fish tissue samples is the other major water quality problem in the basin. Ingesting mercury can lead to central nervous system damage in humans. A total daily maximum load (TMDL) for mercury has been developed for many waterbodies in the basin and a statewide TMDL is under development for the others.

Protecting water quality in areas of high population growth presents another challenge to the Division of Water Quality (DWQ) and the State. Some areas in the basin (Brunswick, Hoke, and Moore Counties) are experiencing very rapid growth. Proper planning, such as, stormwater management programs, wastewater treatment plant upgrades, and land conservation are required to protect water quality as the area grows. For activities such as stormwater controls, proactive implementation prior to development can save considerable costs compared to retrofitting. Brunswick County has a Build-out Scenario Study that if implemented could establish it as a national leader in design and implementation of low impact development and potentially aid in the reopening of adjacent shellfish waters.

Changes in Water Quality Assessment Ratings

Aquatic Life

There were no aquatic life impairments reported in any of the previous basinwide plans. However, this time there were three freshwater stream segments impaired due to benthic macroinvertebrate samples. Two are most likely due to nonpoint source pollution and the other one was related to problems with the Red Springs Wastewater Treatment Plant (WWTP). DWQ is working with the Red Springs WWTP to upgrade and improve performance at the facility. In addition to these three freshwater impairments, there are two saltwater streams impaired for exceeding aquatic life standards. Montgomery Slough is impaired because of low dissolved oxygen levels and Calabash River is impaired for copper. Both are also impaired for turbidity.

Shellfish Harvesting

Since the last basinwide water quality plan in 2003, the percent of shellfish waters meeting their uses has decreased from about 16 percent to zero percent due to high fecal coliform levels. This loss of use results from both automatic closures following rainfall and permanent closures.

Fish Consumption

All waterbodies in the Lumber Basin are currently impaired for fish consumption as are all surface waters in North Carolina. Some of these impairments are based on direct data, while most are impaired on an evaluated basis. The only impairments in the Waccamaw subbasin are due to mercury levels in fish tissue. There have been no improvements in fish consumption ratings since the last plan. Mercury exceedances in fish tissue is a global problem, thought to result primarily from atmospheric pollution, and requires both a large scale solution and a long time to resolve.

Recreation

Recreational swimming advisories were announced only as a precaution during severe tropical weather events, which can often create a health hazard in coastal areas. No recreational areas were closed as the result of bacteria testing. Currently no waterbodies are impaired for loss of recreational use.

Current Initiatives to Protect and Restore Water Quality

Point Source Pollution

DWQ is working with several different groups and programs to restore and protect water quality. Point sources such as wastewater dischargers are working with DWQ and the Regional Council of Governments to upgrade their facilities by obtaining grants and loans. The division inspects these facilities and provides technical assistance on how to improve the operation of the facilities.

Nonpoint Source Pollution

Nonpoint source pollution is addressed by many programs at the federal, state, and local level. DWQ addresses nonpoint source pollution through the 319 grants program, as well as, through a number of permitting programs such as the Confined Animal Feeding Operations (CAFO), Stormwater, Biosolids, Onsite Wastewater, and 401 Certification programs. DWQ also coordinates with other divisions within the Department of Environment and Natural Resources (DENR) to identify and solve nonpoint source pollution problems. The Division of Soil and Water Conservation helps to educate the public and provide incentives. Coordination with the North Carolina Ecosystem Enhancement Program has been and will continue to be a means to identify and restore waterbodies. DWQ also addresses nonpoint source pollution by working with the Divisions of Land Resources, Environmental Health, Forest Resources, Marine Fisheries and Waste Management, as well as, the Clean Management Trust Fund and many other agencies and organizations.

The *Coastal Habitat Protection Plan* (CHPP) program is a good example of an effort that has brought DENR agencies together and is getting results. Together with the Division of Marine Fisheries, Wildlife Resources Commission and Division of Coastal Management; the Environmental Management Commission is implementing actions identified in the CHPP to improve coastal resources. The CHPP is being updated and additional action items will be identified. Completion of this update is scheduled for 2010.

Shellfishing waters have been heavily impacted by nonpoint source pollution. New coastal stormwater rules known as Session Law 2008-211, that went into effect on October 1, 2008, place stricter stormwater standards on Brunswick County and 19 other coastal counties. Upon implementation, these rules should limit the amount of fecal coliform bacteria loading to the estuaries from new development. In order to reduce existing fecal coliform in the estuaries retrofitting of existing development is necessary. Some of this is already underway as sewer service is provided to communities with aging and poorly functioning septic systems. The reduction of fecal coliform levels in the water is needed to ensure the survival of the shellfishing and related tourism industries in Brunswick County. The *North Carolina Coastal Nonpoint Source Program Plan* is being updated and the Division will be working on addressing any issues and implementation needs identified in that plan, especially those that would protect and improve shellfish waters. A Total Maximum Daily Load (TMDL) for fecal coliform bacteria is

currently being developed to identify needed bacteria reductions in the Lockwoods Folly River watershed and to set the stage for future reduction efforts.

Conservation

The Clean Water Management Trust Fund (CWMTF) provides competitive grant awards to purchase conservation easements that establish buffers along waterways. The North Carolina Division of Soil and Water Conservation have expanded the Conservation Reserve Enhancement Program (CREP) to the Lumber River basin. Recently there have been substantial purchases of conservation easements in the Waccamaw subbasin. However, there are many streams and rivers in need of buffers. The continued purchase of conservation easements by public and private groups is encouraged.

Education

The Waccamaw Riverkeeper® is working with stakeholders in the Waccamaw River subbasin to develop a Volunteer Water Quality Monitoring Program and a Muddy River Watch Program. In addition, a group of stakeholders is working to establish a paddle trail on Lake Waccamaw, the Waccamaw River and its tributaries to promote recreation and protection of its unique habitats. These actions should improve awareness and participation in addressing the watershed's water quality issues.

Monitoring and Assessment

The Division is continuing its biological and ambient monitoring and is further refining its assessment capabilities. Based on the 2002 to 2006 assessment, priorities for additional study include:

- Porter Swamp – Chapter 2 – impaired for biological integrity; possibly due to high flows at the time of sampling.
- Mill Branch – Chapter 2 – impaired for biological integrity; possibly due to agricultural runoff. This branch drains to a portion of the Lumber River currently rated Excellent.

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Introduction

North Carolina's Basinwide Approach to water quality planning is a nonregulatory watershed-based approach to restoring and protecting the quality of North Carolina's surface waters. Basinwide water quality plans are prepared by the NC Division of Water Quality (DWQ) for each of the 17 major river basins in the state. Each basinwide plan is revised at five-year intervals. While these plans are prepared by the DWQ, their implementation and the protection of water quality entail the coordinated efforts of many agencies, local governments and stakeholders in the state.

This document is the fourth five-year update of the Lumber River Basinwide Water Quality Plan. Previous basinwide plans for the Lumber River basin were completed in 1994, 1999, and 2003. This document has been designed to be used in conjunction with the *Supplemental Guide to Basinwide Planning* as well as the previous plans.

Goals of the Basinwide Approach

The goals of basinwide planning are to:

- Identify water quality problems and restore full use to Impaired waters.
- Identify and protect high value resource waters.
- Protect unimpaired waters yet allow for reasonable economic growth.

DWQ accomplishes these goals through the following objectives:

- Collaborate with other agencies to develop appropriate management strategies.
- Assure equitable distribution of waste assimilative capacity.
- Better evaluate cumulative effects of pollution.
- Improve public awareness and involvement.

Guide to this Document

Chapter 1 Lumber Basin Overview

This chapter provides a general description of the ecology and hydrology of the basin. It contains a summary of the current status of water quality in the basin based on results from the various monitoring programs. Also included are brief overviews of population, land use, special classifications, permits, and total daily maximum loads. Recommendations for restoring and protecting water quality are at the end of the chapter.

Chapters 2 thru 5

These chapters cover water quality status and issue by subbasin. Each chapter contains a general description of the subbasin and a summary of monitoring efforts. Local water quality issues are divided up by watersheds and discussed in detail. An update of incentive program activities and recommendations to protect and restore water quality are given.

Chapter 6 thru 10

General information about growth, development, forestry, water supplies, and water dependent resources are discussed in these chapters.

Chapters 11 thru 13

Provided in these chapters is information about programs working in the basin to restore and protect water quality, both within and outside the Division of Water Quality.

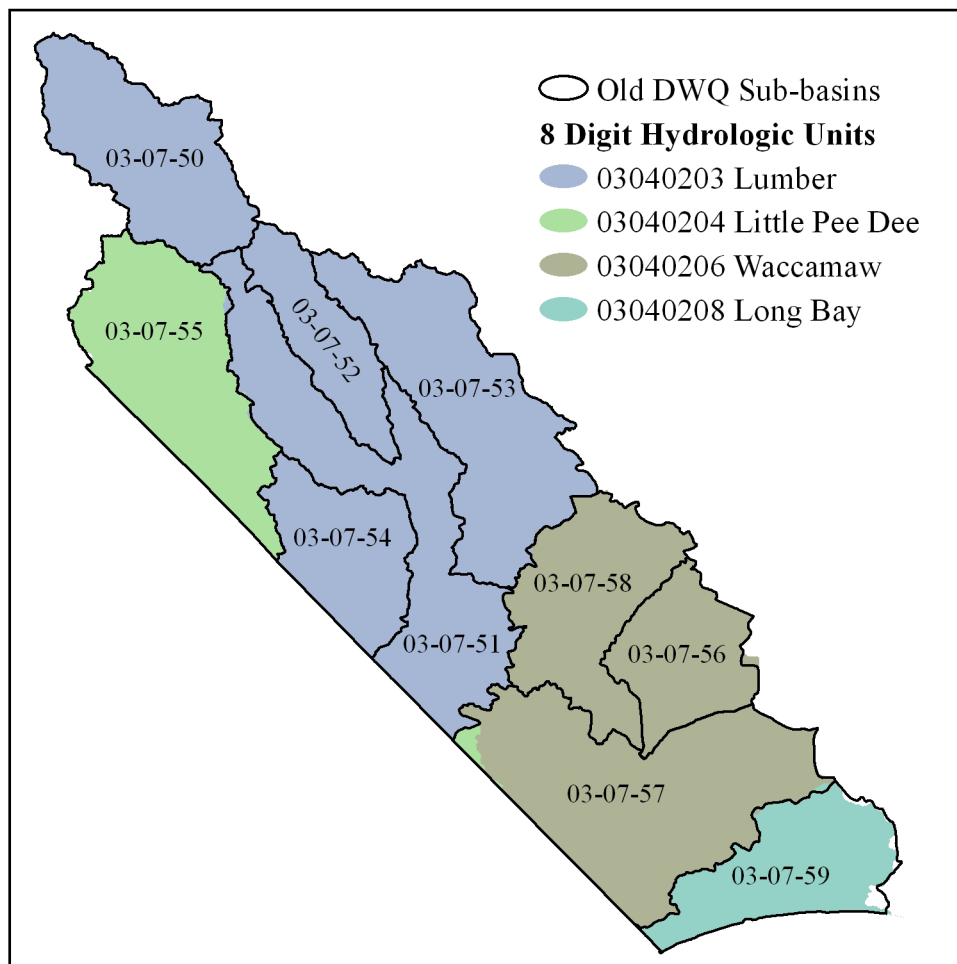
Basinwide Schedule

The next and fifth update to this plan is set to be completed in 2014. National Pollution Discharge Elimination System (NPDES) permits were issued in July and August of 2009 and will be renewed in July and August of 2014. Basinwide biological and lake sampling last occurred in the Lumber Basin in 2006 and will be conducted again in 2011.

River Basin Hydrologic Units

The Lumber River basin spans over 3,000 square miles making it necessary for planning purposes to divide the basin into subbasins. The Division of Water Quality is changing how these subbasins are grouped to conform to the federal system of basin management. Previously, DWQ had its own set of subbasins and numbering system, but will now be using the federal cataloging unit known as hydrologic unit codes (HUCs). This report is organized by chapters at the 8-digit HU or subbasin level. The conversion from DWQ subbasins to 8-Digit HUs is illustrated in Figure i.

FIGURE i: CONVERSION FROM OLD DWQ SUBBASINS TO 8 DIGIT HUS



Chapter 1 Lumber Basin Overview

Part of Hydrologic Unit Code 030402

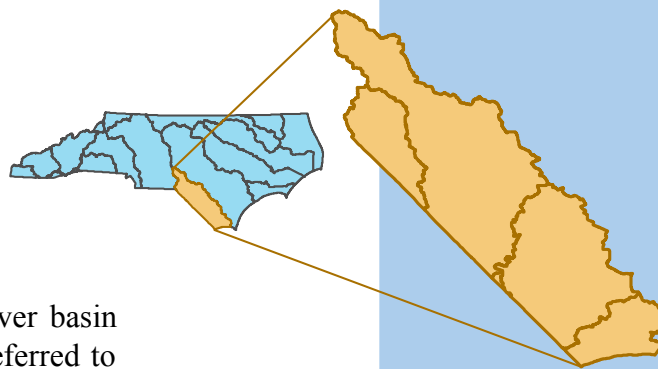
General Description

While this basin is actually part of the larger Pee Dee River basin (HUC 030402), for the purposes of this report it will be referred to as the Lumber River basin. This is because all convergence with the Pee Dee River occurs in South Carolina and this report pertains only the North Carolina portion of the Pee Dee River basin. All the rivers in this basin flow into South Carolina except for the Shallotte River and Lockwoods Folly River, which drain to the Atlantic Ocean. The Lumber River flows into the Little Pee Dee River about 10 miles after it crosses the state line. The Little Pee Dee River continues for several miles after this confluence eventually draining to the Pee Dee River. The Waccamaw River links to the Pee Dee River by forming a braided river system shortly before the two rivers discharge to Winyah Bay near Georgetown, SC (Figures 1-1 and 1-2).

The basin covers an area of approximately 3,329 square miles. It has approximately 2,222 miles of freshwater streams, 9,865 acres of freshwater lakes, and 4,680 acres of estuarine or saline waterbodies. In addition, there are 26 miles of coastline along the basin. Over 80 percent of all assessment units in the basin are supplementally classified as swamp waters and have different assessment standards than other waters. All assessment standards can be found in Appendix A Use Support Methodology.

The basin is made up of three main ecoregions: the sandhills, loam plains and Carolina flatwoods (Figure 1-3). The sandhills region is typically characterized by upland pine forest and wiregrass. Soils in the sandhills are well drained and provide a reliable source of groundwater recharge to the streams that run through the area. This is not the case in the loam plains and Carolina flatwoods regions where flow is often slow and ephemeral. This low flow contributes to the coastal plain being dominated by blackwater systems that often consist of braided streams, wide floodplains and pocosin wetlands. The water is usually absent of sediment but has a dark color due to tannins that are leached from organic matter. This tannic acid produces a pH that is naturally much lower than other river systems. Also these low flow streams and wetlands can have natural dissolved oxygen levels below the 5 mg/L freshwater standard.

A unique type of wetland known as Carolina bays can be found throughout much of the basin. Carolina bays are a type of isolated depressional wetland that range in size from a few acres to several hundred acres. They are found on the Atlantic Coastal Plain from



BASIN AT A GLANCE

COUNTIES

Bladen, Brunswick, Columbus, Hoke, Montgomery, Moore, Richmond, Robeson, Scotland

MUNICIPALITIES

Aberdeen, Bladenboro, Boardman, Boiling Spring Lakes, Bolivia, Bolton, Brunswick, Calabash, Candor, Carolina Shores, Cerro Gordo, Chadbourn, Clarkton, Dublin, East Laurinburg, Fair Bluff, Fairmont, Foxfire Village, Gibson, Hoffman, Holden Beach, Lake Waccamaw, Laurinburg, Lumber Bridge, Lumberton, Marietta, Maxton, McDonald, Norman, Oak Island, Ocean Isle Beach, Orrum, Parkton, Pembroke, Pinebluff, Pinehurst, Proctorville, Raeford, Raynham, Red Springs, Rennert, Rowland, Saint James, Saint Pauls, Shallotte, Southern Pines, Sunset Beach, Tabor City, Tar Heel, Varnamtown, Wagram, Whiteville

PERMITTED FACILITIES

NPDES Discharge

Major:	12
Minor:	32

NPDES Nondischarge: 30

NPDES Stormwater

General:	137
Individual:	5
State:	181

Animal Operations: 201

AQUATIC LIFE SUMMARY

Monitored: 652 Miles
10,763 Acres

Total Supporting: 557 Miles
10,146 Acres

Total Impaired: 31 Miles
18 Acres

Total Not Rated: 64 Miles
599 Acres

FIGURE 1-1: ENTIRE YADKIN-PEE DEE RIVER BASIN IN NC, SC, AND VA



FIGURE 1-2: LUMBER RIVER BASIN WITHIN THE PEE DEE RIVER BASIN

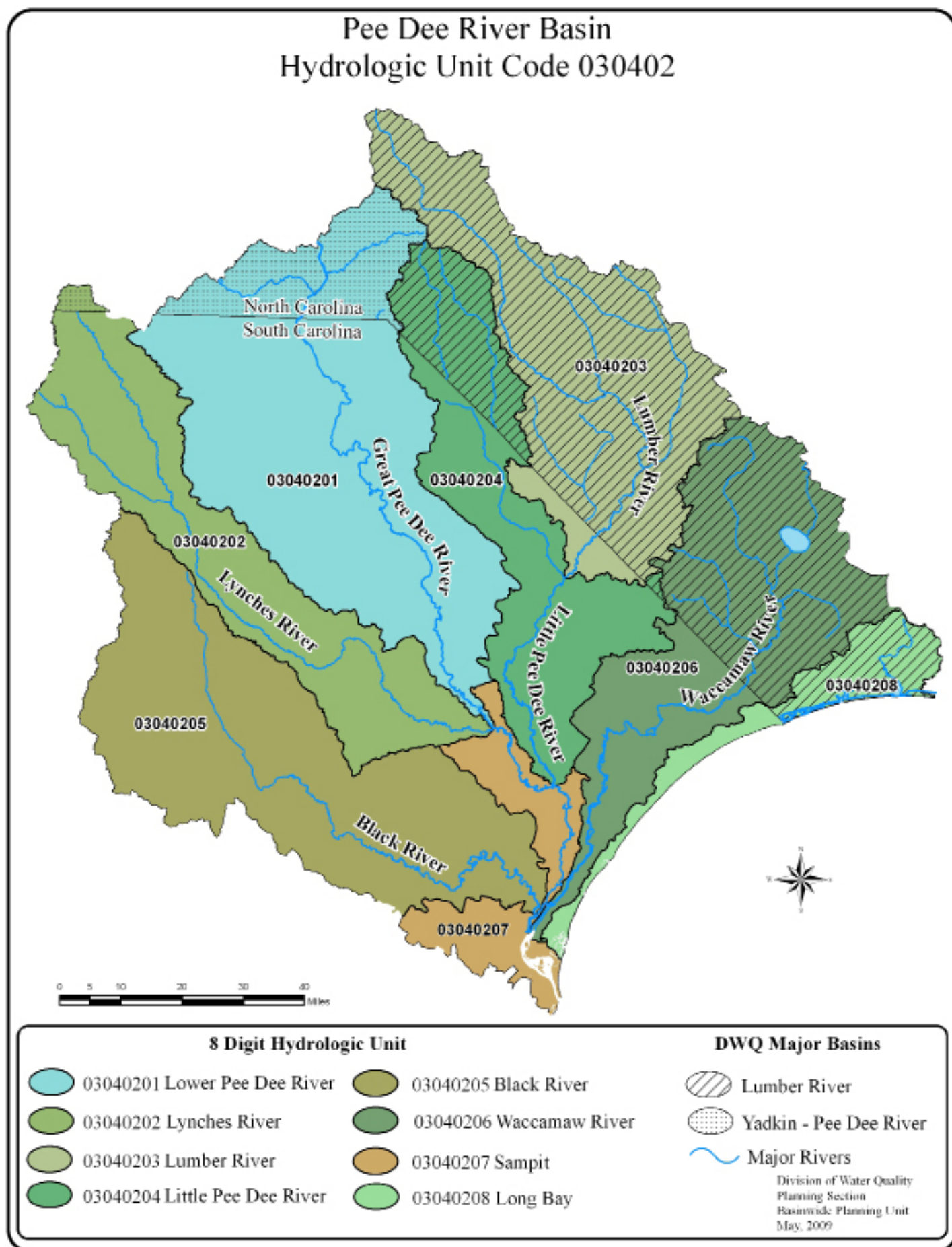
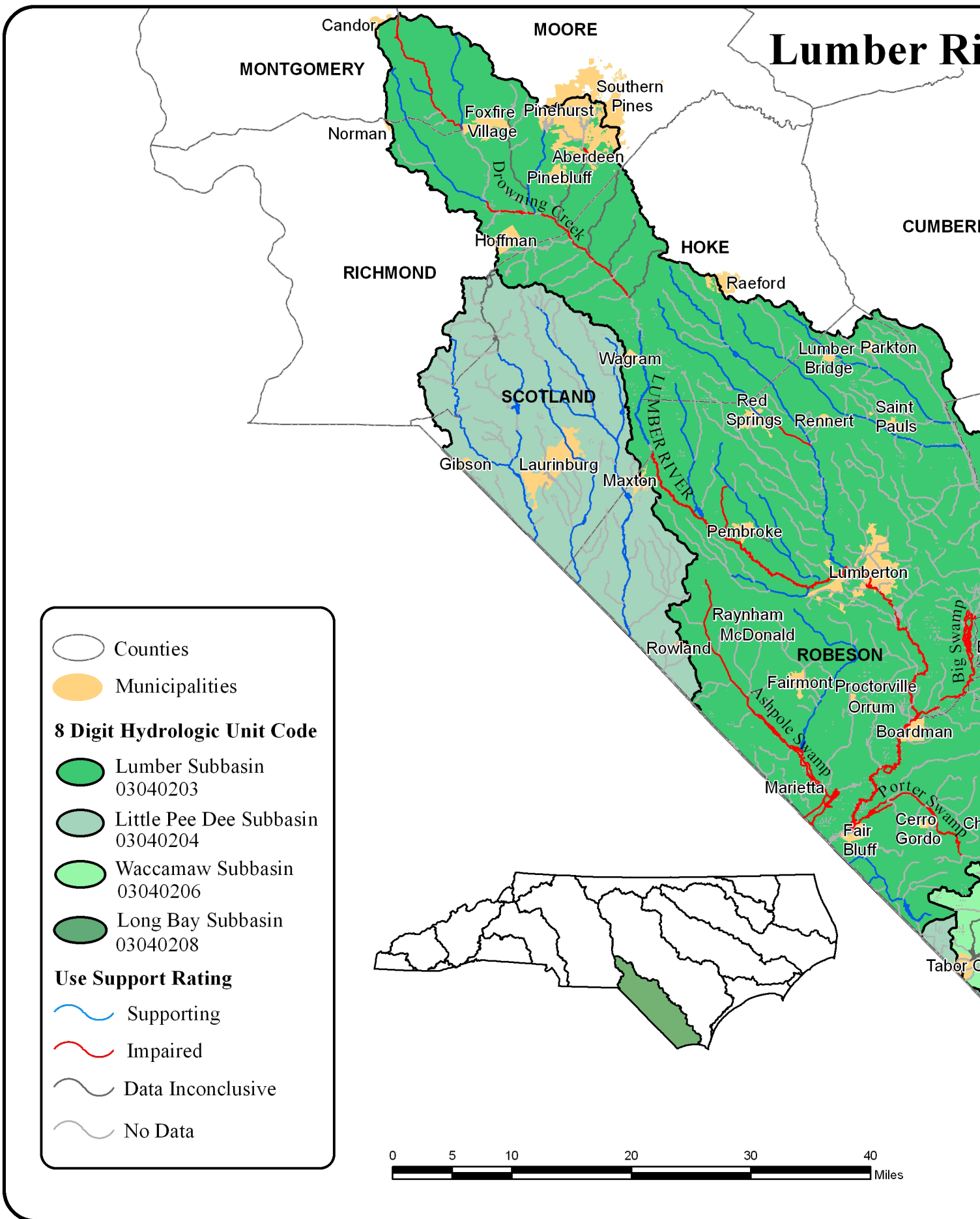


FIGURE 1-3: GENERAL MAP OF THE LUMBER BASIN WITH AN INSET OF ECOREGIONS



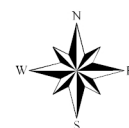
ver Basin

LAND



EPA Level IV Ecoregions

- Subbasin Boundaries
- Sand Hills
- Carolina Flatwoods
- Atlantic Southern Loam Plains
- Carolinian Barrier Islands and Coastal Marshes
- Mid-Atlantic Floodplains and Low Terraces
- Southeastern Floodplains and Low Terraces
- Swamps and Peatlands



Division of Water Quality
Planning Section
Basinwide Planning Unit
September, 2008

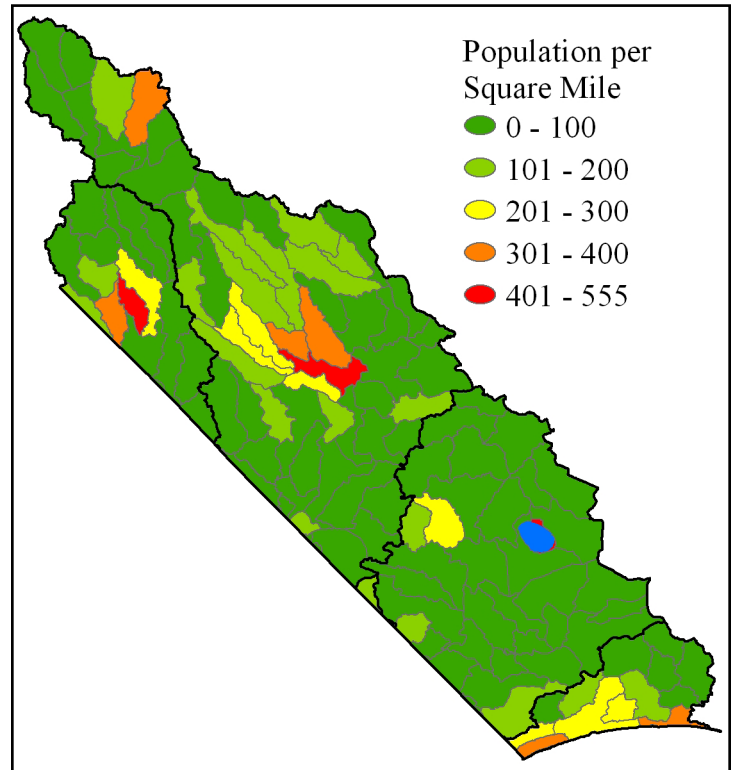
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northern Florida to southern New Jersey, but are most highly concentrated in southeastern North Carolina and northeastern South Carolina. These depressional wetlands are distinguished from other wetlands by their elliptical shape, orientation, and an eolian sand rim that is most pronounced along the southeastern shoreline. Many of these wetlands, especially the smaller ones, are ephemeral and provide an ideal habitat for amphibians. They have a very high degree of biodiversity due mainly to varying amounts of soil moisture from inundated in the center to increasingly drier at the edges. Since these wetlands are often isolated from interaction with other surface waters rare or endemic species can be found in and around many of them.

Population and Land Use

The estimated population for the basin is just over 315,000 people based on the 2000 census. The majority of the population growth is occurring in Brunswick, Hoke, and Moore counties. These areas are experiencing rapid growth while the rest of the basin is undergoing small, neutral, or even negative growth. Land use seems to mirror population, thus as areas become more populated there is a greater percentage of impervious surfaces. An increase in impervious surfaces leads to an increase in runoff which correlates to an increase in pollution and habitat degradation. Low impact development can offset some of these impacts and reduce the amount of stormwater that reaches surface waters. Figure 1-4 depicts the population density by subwatershed based on the 2000 census. The data in Figure 1-4 does not depict the seasonal increases in population along the Atlantic coast of Brunswick County nor the rapid growth that has occurred since 2000. A detailed summary of population and land use can be found in the Population and Land Cover chapter of this document.

FIGURE 1-4: POPULATION DENSITY BY SUBWATERSHED



Current Status

This report covers biological and ambient data that was collected between January 1, 2002 and December 31, 2006. However, other issues that have occurred after December 31, 2006 pertaining to water quality are also included. The majority of the problem areas in this basin can be found along the coast while the highest quality waters are located in the sandhills ecoregion, Waccamaw River Headwaters and portions of the Lumber River. Table 1-1 provides a summary of the use support ratings for all waterbodies that have been assigned an assessment unit number. It does not include all waterbodies in the basin. Table 1-4 at the end of this chapter lists all impaired waterbodies and the cause for the impairment.

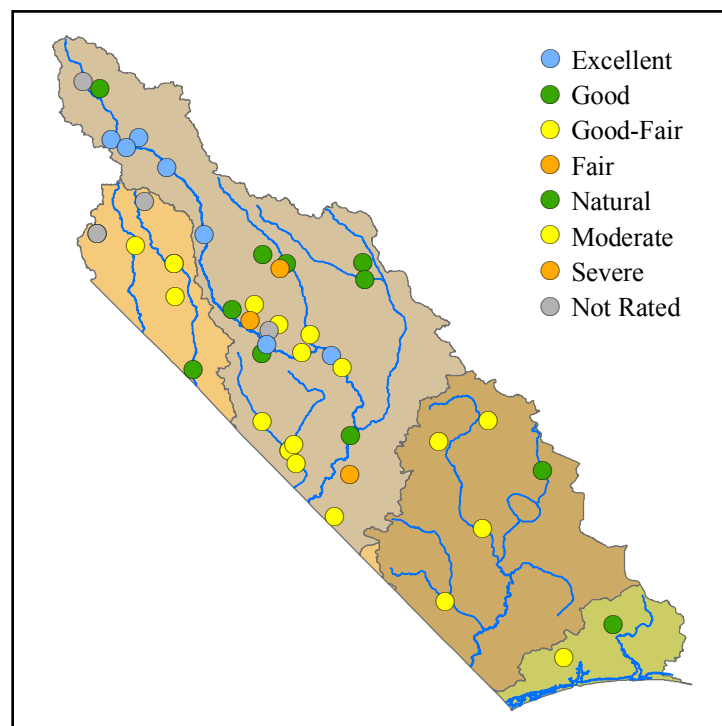
TABLE 1-1: SUMMARY OF USE SUPPORT IN THE LUMBER RIVER BASIN

	TOTAL (MILES/ACRES)	MONITORED (MILES/ACRES)	PERCENT MONITORED	PERCENT IMPAIRED	PERCENT SUPPORTING	PERCENT NOT RATED
Freshwater Miles	2,221.2	693.0	31.2	12.0	16.9	2.2
Coastline Miles	25.6	25.6	100.0	100.0	0.0	0.0
Total Miles	2,246.8	719.0	32.0	13.0	16.7	2.2
Freshwater Acres	9,864.5	9,001.3	91.2	90.0	0.0	0.4
Saltwater Acres	4,848.4	4,692.5	96.8	94.2	0.0	2.5
Total Acres	14,712.9	13,693.8	93.1	92.1	0.0	1.1

Biological Sampling

The Biological Assessment Unit of the Environmental Sciences Section collects information on benthic macroinvertebrates, stream habitats, fish communities, and fish tissue data for the Division of Water Quality (DWQ). Forty-three locations were sampled for benthic macroinvertebrates and assessed for habitat during the 2002-2006 data window (Figure 1-5). Seven of these 43 sites received a lower rating than the previous report and one site's rating improved. Thirteen of the sites were sampled for the first time. Nine of those sites were sampled as part of DWQ requested special studies and four sites were sampled for an Ecosystem Enhancement Program local watershed plan. During the same period 13 fish community sites were observed but not rated, although it was noted that the fish communities appeared to be healthy. Most sites sampled for fish communities contained rare and pollution intolerant species; however, only the Lumber River subbasin and the Little Pee Dee subbasin were sampled. Refer to the [Lumber River Basinwide Assessment Report](#) for more information about benthic macroinvertebrate sampling sites.

FIGURE 1-5: MOST RECENT BIOCLASSIFICATION RATING FOR BENTHOS SAMPLE TAKEN BETWEEN 2002-2006.



Ambient Sampling

The Division of Water Quality's Ambient Monitoring System (AMS) collected data from 30 monitoring sites between 2002 and 2006 to measure chemical and physical parameters. Stations are monitored for dissolved oxygen, pH, conductivity, turbidity, and fecal coliform bacteria. Nutrients were monitored at 14 of the sites. These sites are maintained permanently to gauge long term local trends in water quality. Six of the 30 sites were discontinued in July, 2002 and another one was discontinued in September, 2003. A new Random Ambient Monitoring System (RAMS) was started in January 2007, but sampling at the first RAMS site in the Lumber basin began in January of 2009. This program will create new temporary monitoring sites that will measure a wider range of parameters in order to obtain a broader understanding of water quality throughout the entire state. Two RAMS sites are scheduled for collection during the 2009-2010 cycle. Refer to the [Lumber River Basinwide Assessment Report](#) for more information about the ambient monitoring system.

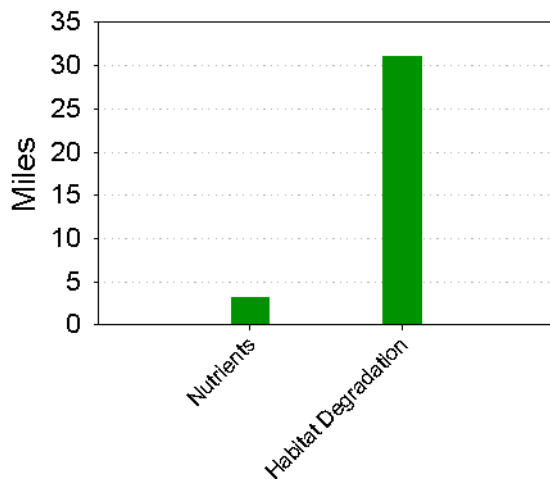
Lakes Assessment

The Intensive Survey Unit of the Environmental Sciences Section tests and reports on the water quality of lakes and reservoirs. Three lakes were sampled during the data window: Pages Lake, Lake Tabor, and Lake Waccamaw. All three of these lakes are currently on the 303(d) list for mercury levels found in fish. Pages Lake has some minor problems with aquatic plant growth due to eutrophication that occurs in summer months but is drained in the winter for weed control. Lake Tabor, like Pages Lake, is man made and also has problems with aquatic plant growth. In July and August of 2006 samples from the lake exceeded the chlorophyll a standard of 40 ug/L. The source of the eutrophication in this lake is most likely from stormwater runoff considering 50 to 75 percent of the shoreline is developed. Lake Waccamaw, the only natural lake tested, was found to be in good condition with the exception of the mercury levels in the fish. However, it was noticed that the adjacent canal has problems with aquatic weed growth.

Water Quality Stressors and Sources

Figure 1-6 shows the stressors that have been identified for rivers and streams whose size is calculated linearly. Similar data is displayed in Figure 1-7 for waterbodies whose size is determined by area, such as lakes, wide coastal rivers and estuaries. Both graphs exclude mercury violations since all water bodies in the basin have been deemed impaired for mercury. Eight out of 14 freshwater ambient monitoring sites exceeded iron standards but these waterbodies were not impaired because iron levels are thought to be naturally high throughout the state.

FIGURE 1-6: FRESHWATER STRESSORS FOR STREAMS AND RIVERS MEASURED IN MILES



Habitat Degradation

Channelization, bottom substrate composition, lack of pool variety, bank instability, lack of riparian buffers, and improper instream water chemistry are all examples of habitat degradation. These factors can lead to a decrease in the overall number and diversity of benthic species indicating a water quality problem. Approximately 31 miles of freshwater streams were reported to be suffering from at least one of the conditions listed above and resulted in a biological impairment. The benthos rating decreased for 16 percent of the benthic macroinvertebrate sites in the basin and three stream segments were impaired for aquatic life. This was the most prevalent cause for new freshwater impairments in the basin. Figure 1-8 illustrates the change in ratings at benthos sampling sites. See Appendix D for a list of biological sampling sites and ratings

Fecal Coliform

Fecal coliform bacteria is a widespread stressor in the basin. Figure 1-9 shows that while some samples throughout the basin contained high levels of fecal coliform bacteria, most exceedances occurred in the Long Bay subbasin where fecal coliform standards are lower because of shellfishing resources. Four of the 15 saltwater ambient sites tested exceeded fecal coliform standards. All waterbodies that are currently impaired for fecal coliform exist in the Long Bay subbasin. All Shellfishing waters (SA waters) in the basin are either permanently or periodically closed to shellfish harvesting. According to surveys conducted by the Division of Environmental Health for the

FIGURE 1-7: STRESSORS FOR WATERBODIES MEASURED IN ACRES (SALTWATER BODIES AND FRESHWATER LAKES)

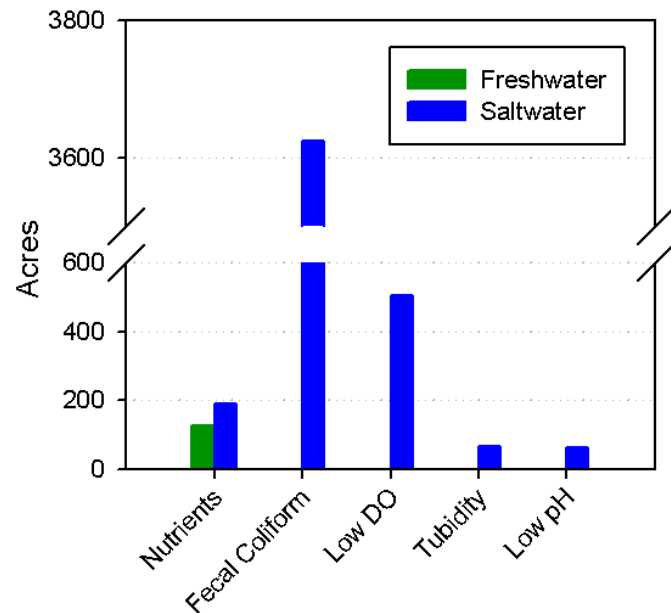
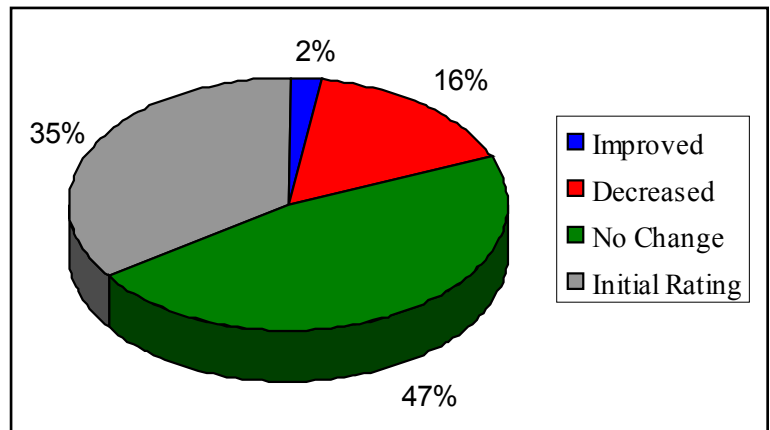


FIGURE 1-8: CHANGE IN BENTHIC SAMPLING SITE RATINGS



three shellfish growing areas in the basin the source of the fecal coliform is suspected to be from stormwater runoff and septic systems. New stormwater rules were implemented on October 1, 2008 by DWQ in the coastal counties and are described in Chapter 5 of the *Supplemental Guide to Basinwide Planning*. This should limit fecal coliform loading from new development, but additional activities will be needed to restore the impaired waters.

Turbidity

Two ambient monitoring sites exceeded the saltwater turbidity standard of 25 NTU in at least 10 percent of the samples. Montgomery Slough was just over the 10 percent while Calabash River was in exceedance over 42 percent of the time. The shallow, tidal nature of Montgomery Slough and the Calabash River may contribute to the elevated turbidity. However, the municipalities of Calabash and Sunset Beach have experienced extremely fast growth and development over the assessment period which could be a contributing factor to existing turbidity problem in the river. The Calabash River watershed also has slightly steeper slopes than the surrounding area making it more susceptible to erosion.

Nutrients

Nitrogen and phosphorous over enrichment can result in algal blooms that deplete oxygen, kill fish, and create taste and odor problems in drinking water. Nutrient levels were analyzed at 15 ambient stations throughout the basin, as well as, at all the lake sampling sites. High levels of nutrients in Lake Tabor, Calabash River, and Montgomery Slough are suspected to be the result of increased stormwater runoff from existing and new developments. None of these waterbodies were impaired for Chlorophyll a due to an insufficient number of samples. The lower portions of the Waccamaw River has high levels of Total Kjeldahl Nitrogen (TKN) which may be from natural sources, such as decaying organic matter in adjacent swamps.

Dissolved Oxygen

Figure 1-10 shows the percentages of samples that exceeded the dissolved oxygen standards. The inland stations do not show any exceedances but this is because these streams are not evaluated for dissolved oxygen. Some of these sites are supplementally designated as Swamp Waters and therefore have a lower standard for dissolved oxygen because it is considered the natural condition of the water. The low dissolved oxygen levels along the coast are caused in some cases by poor flow prohibiting the water from mixing. In others cases it may be the result of interaction with tributaries that possess swamp characteristics.

FIGURE 1-9: PERCENTAGE OF SAMPLES THAT EXCEEDED FECAL COLIFORM STANDARDS FROM 2002-2006

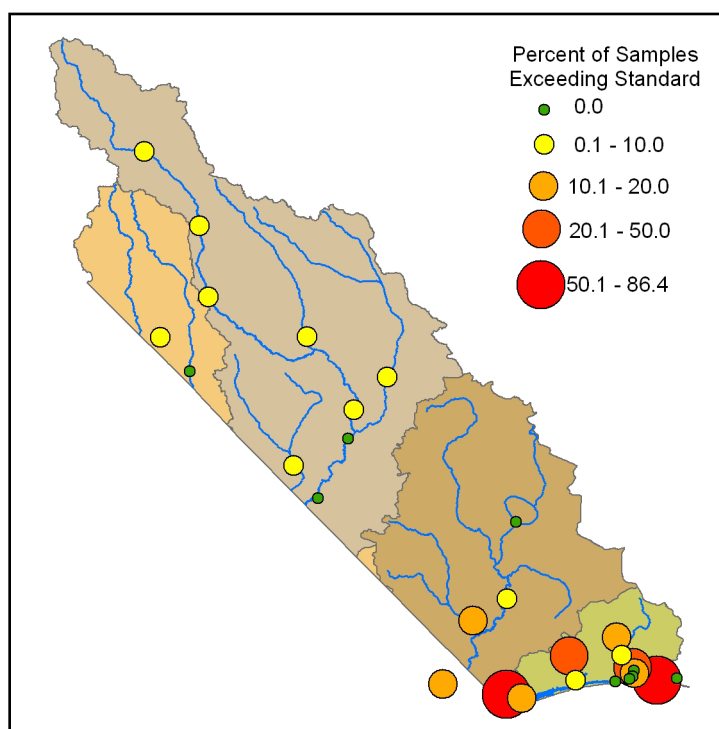
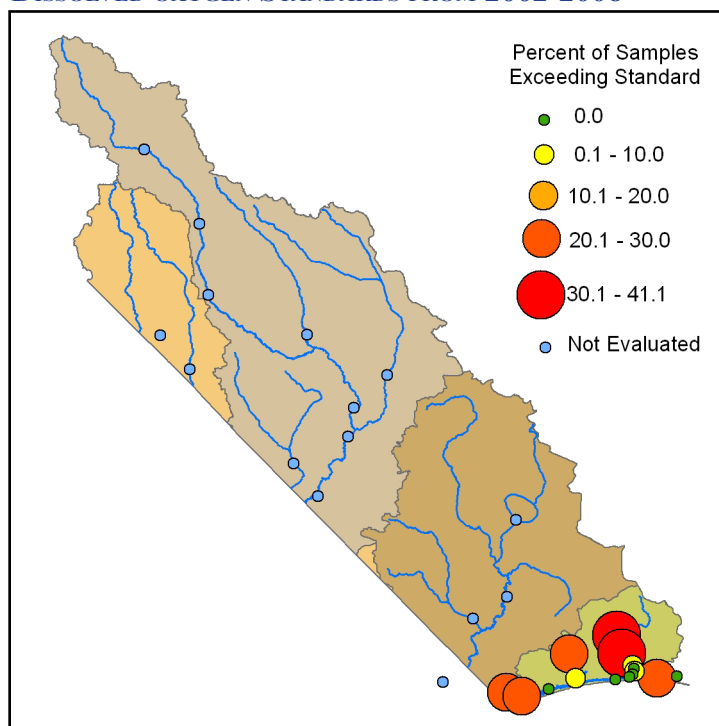


FIGURE 1-10: PERCENTAGE OF SAMPLES THAT EXCEEDED DISSOLVED OXYGEN STANDARDS FROM 2002-2006



Low pH

The standard freshwater range for pH is between 6 su and 9 su, but for waterbodies that are supplementally classified as Swamp Waters the pH can be as low as 4.3 su. The different standard for Swamp Waters is to avoid impairing waterbodies that have naturally low pH and are considered healthy at such levels. Only two river segments were less than the pH standards in at least 10 percent of the samples: a section of Lockwoods Folly River and a section of Shallotte River (Figure 1-11). These waterbodies were Not Rated for pH because of possible swamp water interactions.

Mercury

In 1994, a basinwide fish consumption advisory for mercury was enacted and in 1997 a statewide fish consumption advisory was issued due to mercury levels found throughout the state. Mercury levels in fish have been found at unsafe levels especially in larger fish due to bioaccumulation. The major source of the mercury has been determined to be atmospheric deposition. Only waterbodies where fish tissue samples have been taken were rated as impaired. A TMDL for mercury has been developed for most of the locations in the basin where fish tissue samples were found to have unsafe levels of mercury.

The conditions that exist in a black water system, such as the Lumber River basin, put them at an increased risk for accumulation of methylmercury. This is because high temperature, high organic content, low dissolved oxygen, and low pH provide the ideal conditions for the methylation of mercury.

See Appendix G for more information regarding mercury.

Copper

This is the first time copper has been assessed to determine use support. The Calabash River is the only waterbody in the Lumber basin that is impaired for copper. Possible sources include antifouling coatings on boats, brake dust, wood preservatives, pesticides, and algaecides.

NPDES Wastewater Discharge Permit Summary

The NPDES program is designed to eliminate all discharges to surface waters. Over time small treatment facilities have and continue to be merged with larger more sophisticated facilities. While the large facilities may be allowed to discharge more treated wastewater the standards for the effluent remain strict and in some cases become even more strict. Many discharge facilities are now making the transition from discharge to non-discharge by dispersing effluent on sprayfields. Table 1-2 list the permitted dischargers in the basin by several categories. Note that as of this permitting cycle all dischargers including water treatment plants will be assigned a maximum daily flow.

Aquatic Toxicology Monitoring

North Carolina's NPDES program requires major dischargers to perform whole effluent toxicity (WET) testing as part of its strategy in meeting the Clean Water Act requirements to control the discharge of toxic pollutants. Currently 25 NPDES discharge permits in the Lumber River Basin require WET monitoring. These facilities are rated on a pass/fail basis and in recent years compliance has remained at about 98 percent.

FIGURE 1-11: PERCENTAGE OF SAMPLES BELOW THE pH STANDARDS FROM 2002-2006

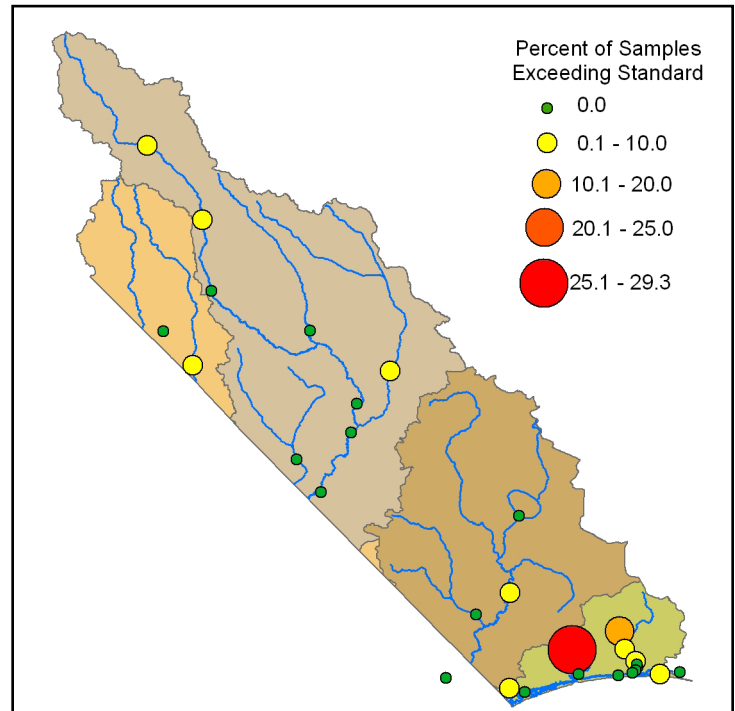


TABLE 1-2: SUMMARY OF NPDES PERMITTED WASTEWATER DISCHARGERS IN THE LUMBER BASIN

FACILITY CATEGORY	03040203	03040204	03040206	03040208	TOTAL
Total Facilities	22	9	11	2	44
Permitted Flow (MGD)	45.47	5.235	6.307	0.01	57.022
GROUPED BY SIZE					
Major	8	1	3	0	12
Permitted Flow (MGD)	42.09	4	5.1	0.0	51.19
Minor	14	8	8	2	32
Permitted Flow (MGD)	3.38	1.235	1.207	0.01	5.832
GROUPED BY TYPE					
100% Domestic	1	1	3	0	5
Permitted Flow (MGD)	0.2	0.018	0.5407	0.0	0.7587
Municipal	10	4	5	0	19
Permitted Flow (MGD)	35.71	4.917	5.74	0.0	46.367
Nonmunicipal	4	2	3	2	11
Permitted Flow (MGD)	9.56	0.3	0.03	0.01	9.9
Water Treatment	7	2	0	0	9
Permitted Flow (MGD)	TBD	TBD	TBD	TBD	TBD

Total Maximum Daily Loads

A Total Maximum Daily Load (TMDL) is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. This includes an allocation of that amount to the pollutant's sources and a margin of safety. A TMDL includes a detailed water quality assessment that can provide the scientific foundation for a restoration implementation plan. However, under the Federal Clean Water Act there is no requirement to develop an implementation plan. Therefore, a TMDL by itself can only identify controls to point sources; however, the allocation estimates are used for development of discharger permit limits. DWQ is supporting local development and implementation of management strategies to address nonpoint sources identified by TMDLs.

There has been one mercury TMDL completed for eleven different waterbodies throughout the Lumber and Waccamaw Watersheds. A statewide TMDL for mercury is being developed and will replace the existing TMDL. Another TMDL is currently under development for fecal coliform in the Lockwoods Folly River Watershed. For more information on TMDL's visit the [*Modeling and TMDL Unit's website*](#).

Supplemental Classifications

Some waterbodies in the basin have been supplementally classified as High Quality Waters (HQW) or Outstanding Resource Waters (ORW) because they either have excellent water quality or they are a significant resource to humans or wildlife. Figure 1-12 provides an overview of the areas affected by these supplemental classifications. A more detailed description of what constitutes an HQW or ORW and the increased protection required for such waterbodies can be found in Chapter 2 of the [*Supplemental Guide to Basinwide Planning*](#). Other supplemental designations in the Lumber River basin include the Swamp Water and Unique Wetland classifications. Swamp Waters have low flows and high organic content that produce naturally low pH and dissolved oxygen levels. Unique Wetlands are wetlands have exceptional state or national significance and are essential for conservation.

High Quality Water (HQW)

There are 171 freshwater miles and 4,668 saltwater acres of HQW classified waters in the basin. About 7.7 percent of all freshwater streams in the basin are classified as HQW. All streams in the watersheds of Jackson

Creek (030402030101), Headwaters Drowning Creek (030402030102), Big Branch-Upper Drowning Creek (030402030104), and Lower Drowning Creek (030402030201) are classified as HQW. Also the first 68.6 miles of the Lumber River are classified HQW. See Appendix B for the classification specific to each individual assessment unit.

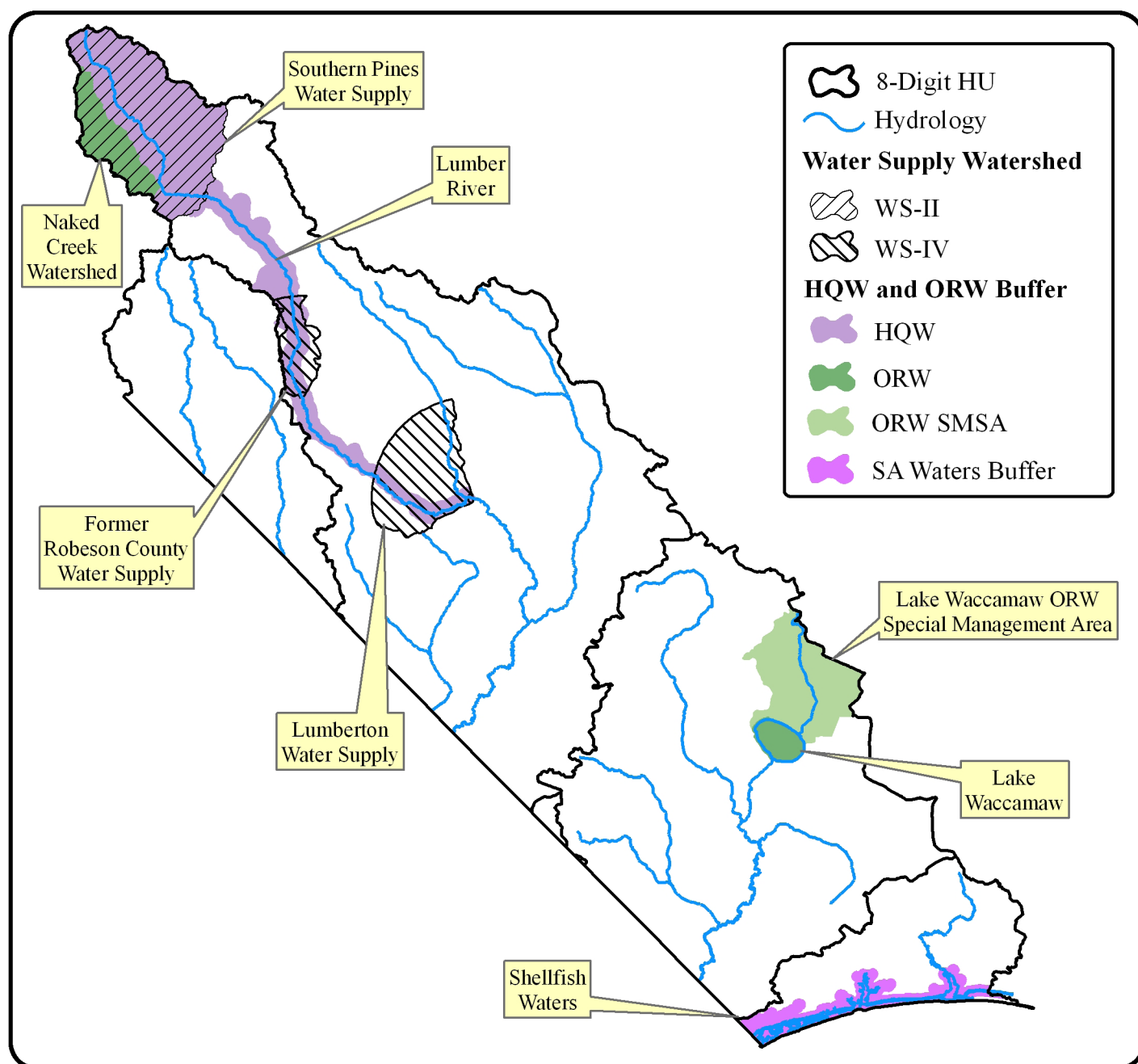
Outstanding Resource Water (ORW)

There are 43 miles and 8840 acres of ORW waters in the basin. All of the streams found within Naked Creek subwatershed (030402030103) and all of Lake Waccamaw (AU# 15-4) are classified as ORW.

ORW Special Management Strategy Area

All waters that drain to Lake Waccamaw are subject to the Lake Waccamaw Special Management Strategy. These waters have the same requirement as ORW waters because they are vital to protecting water quality in the lake [15 NCAC 02B.0225 (c) (10)]. This designation is denoted in Appendix B by a + symbol.

FIGURE 1-12: HIGH QUALITY WATERS AND OUTSTANDING RESOURCES WATERS IN THE LUMBER BASIN



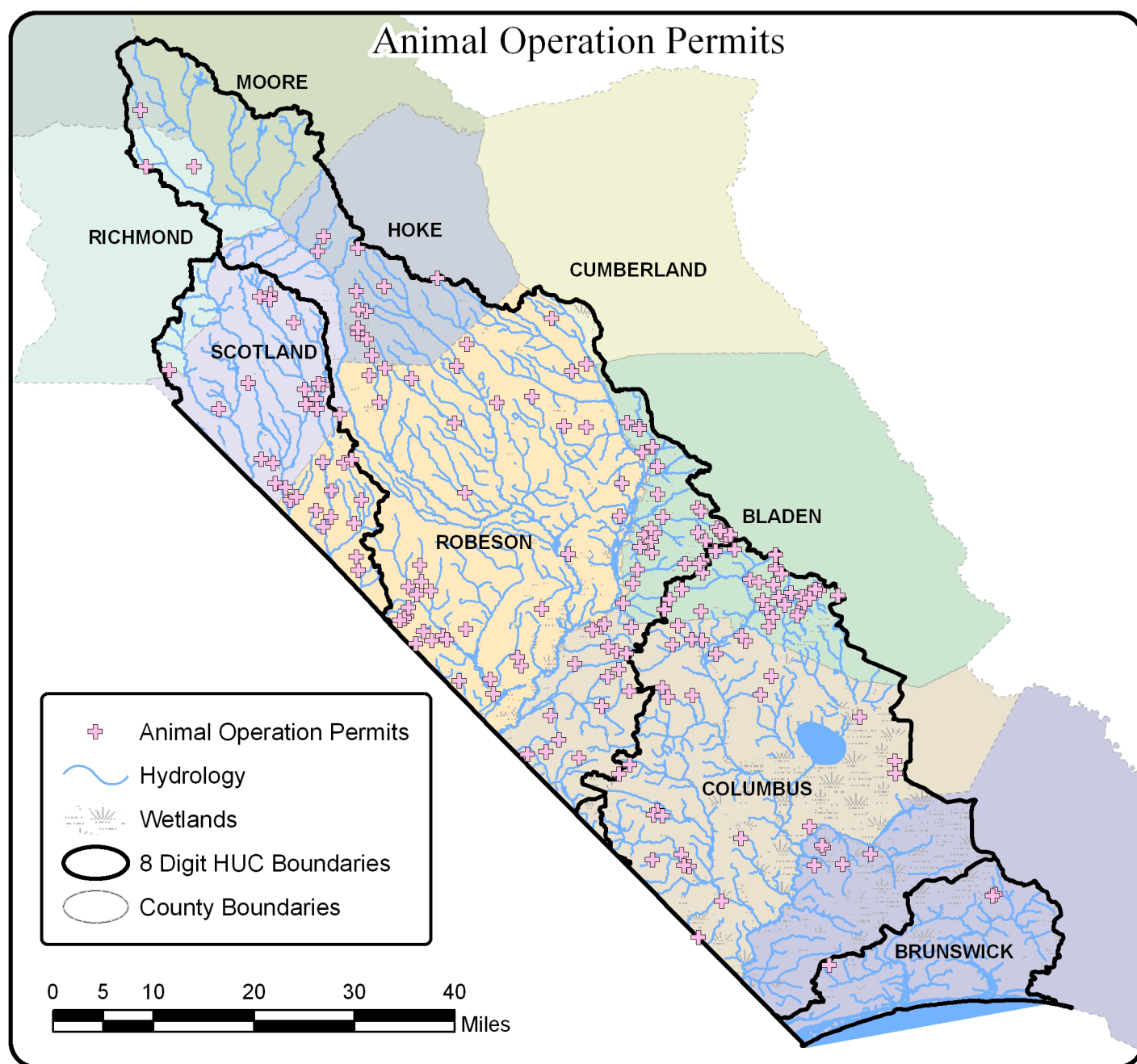
Animal Operations Summary

All animal operations permits in the basin are for swine. There are poultry and cattle operation in the basin but these facilities do not meet the criteria that requires a permit. Over 30 percent of all animal operation permits in the Lumber Basin are in Bladen County despite the fact that most of the county is outside of the basin. Table 1-3 lists the steady state live weight estimates for swine in the Lumber Basin and Figure 1-13 shows the location of permitted swine operations in the basin. There are incentives available through the North Carolina Division of Soil and Water Conservation for farmers that would like to improve their swine operations.

TABLE 1-3: PERMITTED SWINE OPERATIONS IN THE LUMBER BASIN

8 Digit HUC	NUMBER OF FACILITIES	NUMBER OF ANIMALS	STEADY STATE LIVE WEIGHT IN POUNDS
03040203	104	521,847	72,538,383
03040204	30	143,587	31,859,010
03040206	64	296,686	43,629,226
03040208	3	8,072	1,283,420

FIGURE 1-13: ANIMAL OPERATION PERMITS MAP



Recommendations

Reduce Impacts from Point Sources

Upgrade Wastewater Treatment Plants

Regionalization allows for waste from rural areas to come together and be treated at a high quality facility that may not be possible for many small communities otherwise. This may be accomplished through grants such as the CWMTF and loans such as the ones provide by the Construction Grants and Loans Section of DWQ. A recent example of regionalization in the area is the Fairmont Regional Wastewater Treatment Plant (WWTP) which allowed for other older and smaller plants to shut down. Another recent example is the West Brunswick WWTP which began connecting to areas that had previously been on septic systems. Upgrades to WWTPs that are in disrepair or use outdated technology can decrease pollution of surface waters.

Upgrade Animal Operations

The Division of Soil and Water Conservation initiated the Lagoon Conversion Program in 2007. This program provides cost sharing opportunities for swine farmer to upgrade their farms with more technologically advanced systems for managing waste produced by the animals. These innovative waste management systems would reduce discharge or seepage of hog waste to surface waters.

Reduce Impacts from Nonpoint Sources

Limit Impervious Surfaces and Improve Stormwater Management

Areas lacking stormwater regulations are encouraged to develop and implement stormwater management plans. As new construction occurs in the basin, developers are encouraged to design both commercial and residential properties using low impact techniques. The longer these area go without stormwater regulation the problems associated with stormwater runoff become greater and so does the cost of remedying the situation.

Protect and Establish Buffers

Since the last basinwide plan there have been many achievements in conserving lands that protect water quality and provide habitat. There remain many unprotected areas with nationally significant ecosystems and good water quality in need of conservation. The continued purchase of easements and preserves is encouraged especially in the Lumber River and Waccamaw River floodplains. The Boiling Springs Wetlands Complex in Brunswick County is under extreme pressure from development and may be severely impacted if not protected soon. Some common incentive programs for such projects include the Nonpoint Source 319(h) Grant Program, the Clean Water Management Trust Fund (CWMTF), and the North Carolina Agriculture Cost Share Program (NCACSP).

Research Needs

Turbidity and Copper Studies

Calabash River and Montgomery Slough are both impaired for turbidity. Some of the turbidity is believed to be related to the low, shallow, and tidal nature of these streams, although land disturbing activities can not be ruled out entirely. A study is needed to determine the cause of the turbidity impairments and what is required to restore water quality.

Boat maintenance activities, such as scraping, sanding, pressure washing, and painting is a source of copper that may be reaching surface waters. Brake dust can contain varying amount of copper and can reach surface waters through runoff or atmospheric deposition. Some pesticides and algacides contain copper that may be contributing to the copper levels. A copper study is recommended for the Calabash River.

Fish Community Evaluation Criteria

Currently no criteria exist to quantitatively evaluate the health of fish communities in both the sandhills streams or the coastal plain streams of the basin. Developing criteria specific to these ecoregions will allow DWQ to

better evaluate fish community health and how it relates to water quality. Piedmont and mountain methodology applied to this area may lead to improper diagnosis of water quality. Development of such capability is listed as a research priority for the Lumber River Basin in the *North Carolina Wildlife Action Plan* created by the Wildlife Resources Commission.

Non-discharge Methods and Consequences

The goal of the NPDES program is to eliminate discharges of effluent from WWTP to surface waters. The EPA preferred method is to spread the sludge from treated water on sprayfields. The sludge from wastewater treatment plants contain valuable nutrients, but it also contains toxic substances. Studies are needed to determine the environmental problems that may arise as this transition is being made and develop methods to prevent possible runoff contamination of surface waters. GIS mapping of the sprayfields is needed so that better spatial analysis may be conducted.

Restore Impaired Waters

Aquatic Life Impairments

Little Raft Swamp, Mill Branch, and Porter Swamp are all impaired for ecological and biological integrity. Little Raft Swamp was impacted by the Red Springs WWTP, which has since been upgraded and continues to make further improvement to the facility and its operation in order to restore water quality. Both Mill Branch and Porter Swamp are in mostly agricultural watersheds, lack stream buffers, and have modified channels. These streams would benefit from habitat restoration. The Ecosystem Enhancement Program has designated both of these watershed as targeted local watersheds meaning that the program has determined that they exhibit a need for restoration or protection of wetlands, streams, and riparian buffers and will receive priority for EEP planning and project funds. The Division of Soil and Water Conservation are encouraged to direct funds to these watershed through the Agriculture Cost Share Program and the Conservation Reserve Enhancement Program.

A reduction of copper levels is needed in Calabash River to meet water quality standards. Education of individual boat owners about how to safely clean their boats is encouraged.

Shellfish Harvesting Impairments

While new coastal stormwater rules are now in effect to control bacteria loading for new development, additional actions are needed to help restore water quality. DWQ supports prioritizing funding to projects that plan to retrofit existing development with stormwater controls especially in watersheds that drain to shellfishing waters. The Division of Soil and Water Conservation offers grants through the Community Conservation Assistance Program for the instillation of best management practices that restore water quality in urban areas. These types of project could be done in towns like Shallotte and Calabash that need to reduce their impervious surface or put in place other protective measures. The Ecosystem Enhancement Program has identified areas for potential stormwater retrofitting projects in the Lockwoods Folly Watershed.

Fish Consumption Impairments

A decrease in mercury emissions is necessary to reduce mercury levels found in fish tissue samples. The main source of these emissions are from coal fired power plants. Since mercury can be transported over long distances, this is a global problem that requires state, federal, and international cooperation.

TABLE 1-4: IMPAIRED WATERBODIES IN THE LUMBER RIVER BASIN

ASSESSMENT UNIT NUMBER	HYDROLOGIC UNIT CODE	NAME	CLASS	PARAMETER OF INTEREST
14-(13)a	03040203	Lumber River	C;Sw	Mercury
14-(13)b	03040203	Lumber River	C;Sw	Mercury
14-(13)c	03040203	Lumber River	C;Sw	Mercury
14-(13)d	03040203	Lumber River	C;Sw	Mercury
14-(13)e	03040203	Lumber River	C;Sw	Mercury
14-(13)f	03040203	Lumber River	C;Sw	Mercury
14-(4.5)b	03040203	Lumber River	B;Sw;HQW	Mercury
14-(4.5)c	03040203	Lumber River	B;Sw;HQW	Mercury
14-(4.5)d	03040203	Lumber River	B;Sw;HQW	Mercury
14-(7)	03040203	Lumber River	WS-IV;B;Sw;HQW	Mercury
14-10-5b	03040203	Little Raft Swamp	C;Sw	Benthos
14-2-(1)a	03040203	Drowning Creek	WS-II;Sw;HQW	Mercury
14-2-(10.5)	03040203	Drowning Creek	C;Sw;HQW	Mercury
14-2-(6.5)	03040203	Drowning Creek	WS-II;Sw;HQW	Mercury
14-2-11-(5)	03040203	Aberdeen Creek [Pages Lake (Aberdeen Lake)]	B	Mercury
14-22a	03040203	Big Swamp	C;Sw	Mercury
14-22b	03040203	Big Swamp	C;Sw	Mercury
14-27	03040203	Porter Swamp	C;Sw	Benthos; Mercury
14-30a	03040203	Ashpole Swamp	C;Sw	Mercury
14-30b	03040203	Ashpole Swamp	C;Sw	Mercury
14-6	03040203	Mill Branch	C	Benthos
15-(1)a	03040206	Waccamaw River	C;Sw	Mercury
15-(1)b	03040206	Waccamaw River	C;Sw	Mercury
15-(1)c	03040206	Waccamaw River	C;Sw	Mercury
15-(1)d	03040206	Waccamaw River	C;Sw	Mercury
15-(1)e	03040206	Waccamaw River	C;Sw	Mercury
15-(18)	03040206	Waccamaw River	B;Sw	Mercury
15-2	03040206	Lake Waccamaw	B;Sw;ORW	Mercury
15-2-6	03040206	Big Creek	C;Sw;+	Mercury
15-4a	03040206	White Marsh	C;Sw	Mercury
15-4b	03040206	White Marsh	C;Sw	Mercury
15-25-1-(16)a	03040208	Lockwoods Folly River	SA;HQW:@	Shellfish Harvesting
15-25-1-(16)b	03040208	Lockwoods Folly River	SA;HQW:@	Shellfish Harvesting
15-25-1-(16)c	03040208	Lockwoods Folly River	SA;HQW:@	Shellfish Harvesting;
15-25-1-(16)d	03040208	Lockwoods Folly River	SA;HQW:@	Shellfish Harvesting
15-25-1-18-(2)	03040208	Mill Creek	SA;HQW	Shellfish Harvesting
15-25-1-19	03040208	Mullet Creek	SA;HQW:@	Shellfish Harvesting
15-25-1-20	03040208	Lockwoods Creek	SA;HQW:@	Shellfish Harvesting
15-25-1-21	03040208	Spring Creek	SA;HQW:@	Shellfish Harvesting

ASSESSMENT UNIT NUMBER	HYDROLOGIC UNIT CODE	NAME	CLASS	PARAMETER OF INTEREST
15-25-10	03040208	The Big Narrows	SA;HQP	Shellfish Harvesting
15-25-11	03040208	Blane Creek	SA;HQP	Shellfish Harvesting
15-25-11-1	03040208	Fox Creek	SA;HQP	Shellfish Harvesting
15-25-11-2	03040208	Salt Boiler Creek	SA;HQP	Shellfish Harvesting
15-25-11-3	03040208	Bull Creek	SA;HQP	Shellfish Harvesting
15-25-12	03040208	Little River	SA;HQP	Shellfish Harvesting
15-25-12-1	03040208	Dead Backwater	SA;HQP	Shellfish Harvesting
15-25-12-1-1	03040208	East River	SA;HQP	Shellfish Harvesting
15-25-12-2	03040208	Bonaparte Creek	SA;HQP	Shellfish Harvesting
15-25-12-3	03040208	Clayton Creek	SA;HQP	Shellfish Harvesting
15-25-13	03040208	Calabash River	SA;HQP	Shellfish Harvesting, Turbidity; Copper
15-25-13-1	03040208	Hangman Branch	SA;HQP	Shellfish Harvesting
15-25-2-(10)a	03040208	Shallotte River	SA;HQP	Shellfish Harvesting
15-25-2-(10)b	03040208	Shallotte River	SA;HQP	Shellfish Harvesting
15-25-2-(10)c	03040208	Shallotte River	SA;HQP	Shellfish Harvesting
15-25-2-(10)d	03040208	Shallotte River	SA;HQP	Shellfish Harvesting
15-25-2-11-(2)	03040208	The Mill Pond	SA;HQP	Shellfish Harvesting
15-25-2-12-(2)	03040208	Sams Branch	SA;HQP	Shellfish Harvesting
15-25-2-14	03040208	The Swash	SA;HQP	Shellfish Harvesting
15-25-2-15-(3)	03040208	Shallotte Creek	SA;HQP	Shellfish Harvesting
15-25-2-16	03040208	Saucepan Creek	SA;HQP	Shellfish Harvesting
15-25-2-16-1-(2)	03040208	Jinnys Branch	SA;HQP	Shellfish Harvesting
15-25-2-16-4-(2)	03040208	Goose Creek	SA;HQP	Shellfish Harvesting
15-25-3	03040208	Big Gut Slough	SA;HQP	Shellfish Harvesting
15-25-4	03040208	Kilbart Slough	SA;HQP	Shellfish Harvesting
15-25-5	03040208	Gause Landing Creek	SA;HQP	Shellfish Harvesting
15-25-6	03040208	Eastern Channel	SA;HQP	Shellfish Harvesting
15-25-6-1	03040208	Clam Creek	SA;HQP	Shellfish Harvesting
15-25-7	03040208	Sols Creek	SA;HQP	Shellfish Harvesting
15-25-8	03040208	Still Creek	SA;HQP	Shellfish Harvesting
15-25-9	03040208	Jinks Creek	SA;HQP	Shellfish Harvesting
15-25-6-1	03040208	Cooter Creek	SA;HQP	Shellfish Harvesting
15-25d	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25f	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25g	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25i	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25j	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25k	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25l	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25m	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting

ASSESSMENT UNIT NUMBER	HYDROLOGIC UNIT CODE	NAME	CLASS	PARAMETER OF INTEREST
15-25n	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25o	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25p	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25q	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25r	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25s	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25t	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25u	03040208	Intracoastal Waterway	SA;HQP	Shellfish Harvesting
15-25v	03040208	Montgomery Slough	SA;HQP	Shellfish Harvesting, Turbidity; Low DO
99-(1)	03040208	Atlantic Ocean	SB	Mercury

Note: Mercury impairments listed are the result of direct fish tissue samples. However, all waters statewide are impaired for mercury on an evaluated basis.



Chapter 2

Lumber River Subbasin

Part of Hydrologic Unit Code: 03040203

General Description

The Lumber River subbasin (Figure 2-1) encompasses about 1,631 square miles within North Carolina. The Lumber River headwaters are located in the sandhills of Hoke, Montgomery, Moore, Richmond, and Scotland Counties. The Robeson and Columbus County portions of the basin lie within the Inner Coastal Plain. All 115 miles of the Lumber River have been designated as a North Carolina Natural and Scenic River. In addition, 81 miles of the Lumber River are designated as a Federal Wild and Scenic River. These designations allow restrictions to be placed on dam construction and other water resource projects. The Lumber River State Park, created in 1989, currently protects 8,438 acres along the Lumber River, as well as, providing recreational opportunities. The Lumber River discharges to the Little Pee Dee River in South Carolina.

Current Status and Significant Issues

Population and Land Use

Population for this subbasin is estimated to be around 160,368 or 98 people per square mile based on the 2000 census. Lumberton, Pinehurst, and Southern Pines are currently the only municipalities with populations greater than 5,000. The municipalities of Aberdeen, Foxfire Village, Pinebluff, Pinehurst, and Southern Pines are the fastest growing areas and are all located in southern Moore County.

Agriculture dominates much of the land use at just over 30 percent; however, the headwaters have remained heavily forested. Close to a quarter of this subbasin is comprised of wooded wetlands found mainly in the floodplains of the braided river systems. Southern Moore County has a high concentration of golf courses and small lakes.

Ambient Water Quality

Nine Ambient Monitoring System sites were maintained in the Lumber River subbasin during the assessment period. Iron was the only parameter tested that exceeded the water quality standards more than 10 percent of the time at these stations. These waterbodies were not impaired for iron because it was determined that this is the natural condition. During the drought of 2002, conductivity was high at all ambient monitoring sites on the Lumber River, except for the most upstream sampling location. Readings have since returned to normal.

Watershed at a Glance

COUNTIES

Bladen, Columbus, Hoke, Montgomery, Moore, Richmond, Robeson, Scotland

MUNICIPALITIES

Aberdeen, Bladenboro, Boardman, Candor, Cerro Gordo, Chadbourn, Dublin, Fair Bluff, Fairmont, Foxfire Village, Hoffman, Lumber Bridge, Lumberton, Marietta, Maxton, McDonald, Norman, Orrum, Parkton, Pembroke, Pineblugg, Pinehurst, Proctorville, Raeford, Raynham, Red Springs, Rennert, Rowland, Saint Pauls, Southern Pines, Tar Heel, Wagram

PERMITTED FACILITIES

NPDES Discharge

Major: 8

Minor: 14

NPDES Nondischarge: 16

NPDES Stormwater

General: 72

Individual: 5

State: 3

Animal Operations: 104

AQUATIC LIFE SUMMARY

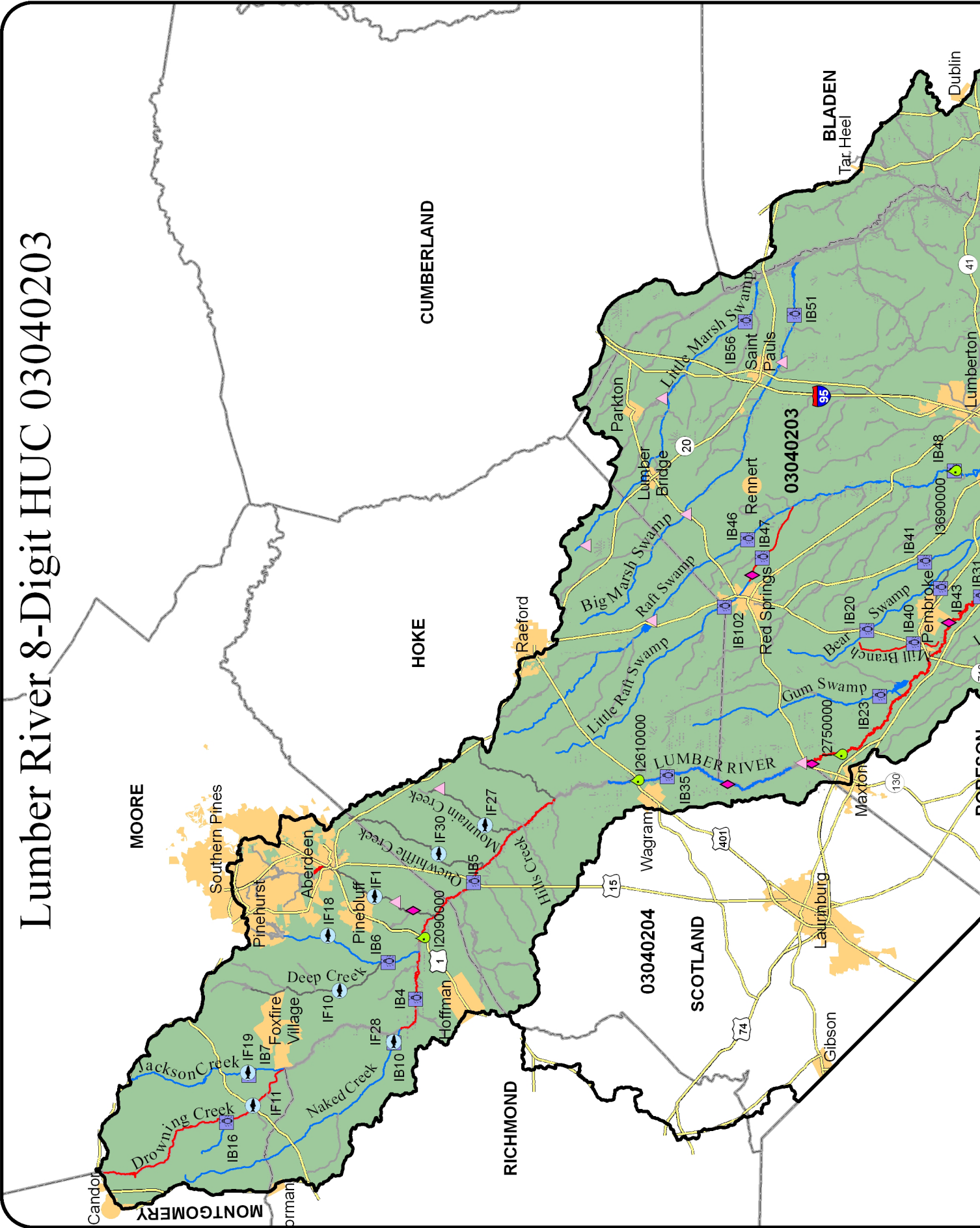
Monitored: 423 Miles
35 Acres

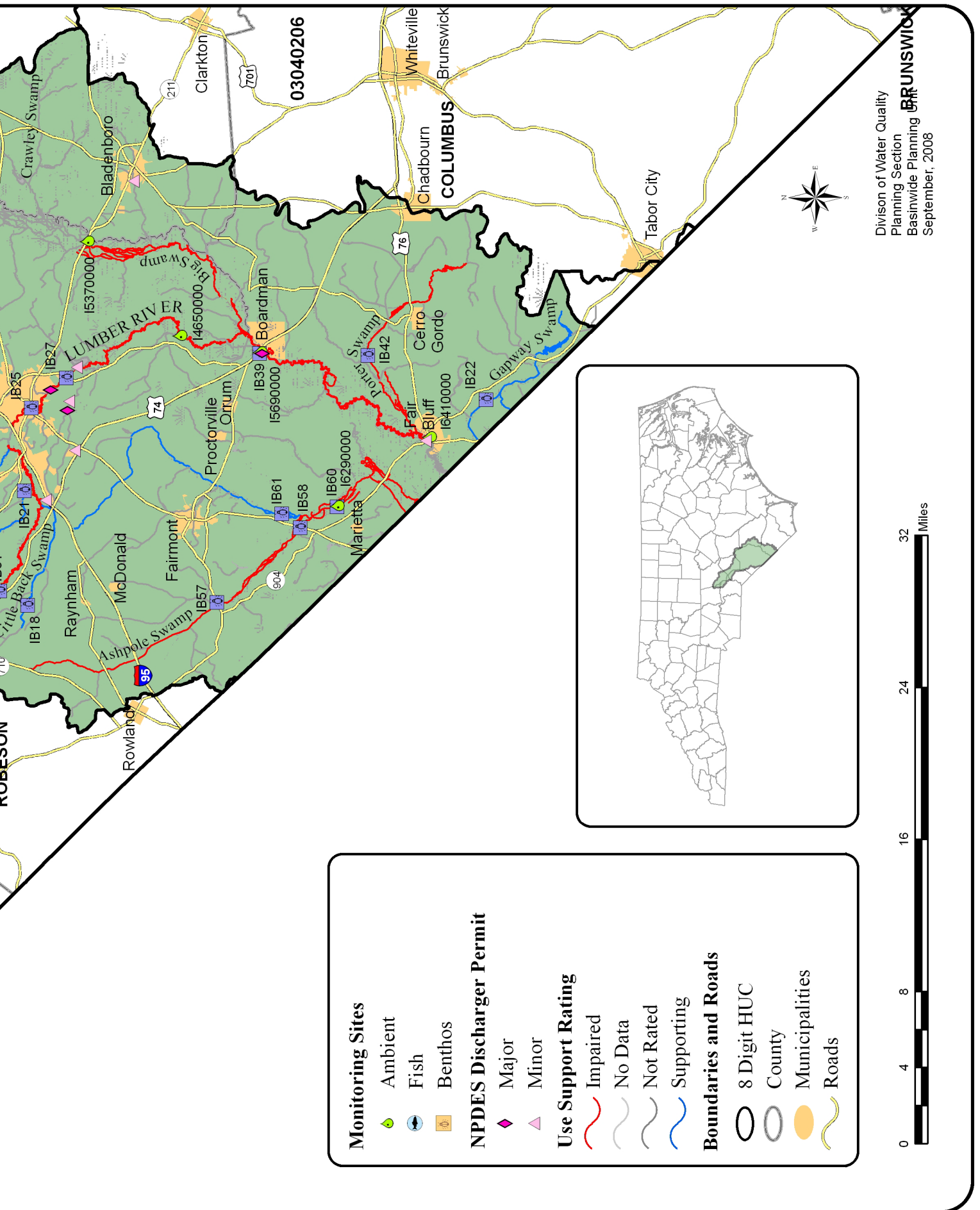
Total Supporting: 340 Miles
0 Acres

Total Impaired: 31 Miles
0 Acres

Total Not Rated: 53 Miles
35 Acres

FIGURE 2-1: LUMBER RIVER SUBBASIN (03040203)

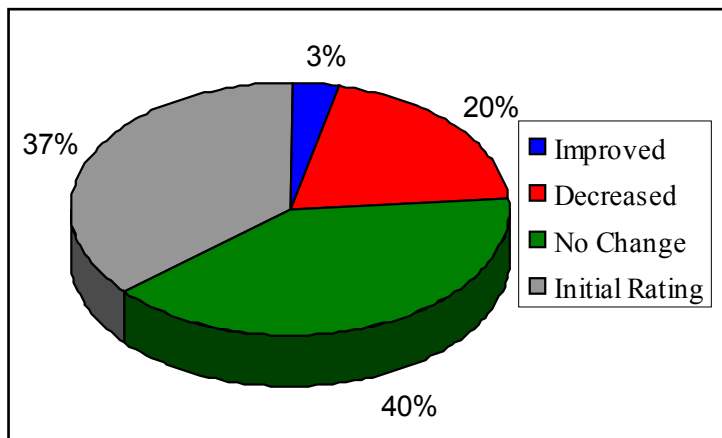




General Biological Health

A total of 33 benthic macroinvertebrate samples from 30 benthic sites were analyzed during the assessment period. There were three stations added to the five-year biological assessment cycle in 2006, plus seven more stations received their first rating as part of special studies. Only one benthic macroinvertebrate sampling site in this subbasin showed an improvement, while six indicated a decline (Figure 2-2). Three locations declined enough to warrant an impaired aquatic life rating. These sampling sites were located on Little Raft Swamp AU# 14-10-5b, Mill Branch AU# 14-6, and Porter Swamp AU# 14-27. Fish communities in the watershed were healthy and only one site reported the presence of a non-native species.

FIGURE 2-2: CHANGE IN BENTHIC SITE RATINGS



Local Water Quality

There are 12 whole and two partial watersheds (10-digit HUCs) in the North Carolina portion of the Lumber River subbasin made up of 58 subwatersheds (12-digit HUCs). In order to determine the source of a pollutant in a watershed it is useful to break down a large drainage area into smaller areas. This approach also helps identify where monitoring and restoration is being conducted and where it is in need. Table 2-1 list the number of benthic and ambient monitoring sites that were sampled for the 2002-2006 assessment period by watersheds. Figure 2-3 shows the location of these watersheds and is labeled with the last two digits of the 10 digit HUC.

TABLE 2-1: NUMBER OF BENTHIC AND AMBIENT SITE IN THE LUMBER RIVER SUBBASIN BY 10-DIGIT WATERSHED

10 - DIGIT HUC	NAME	SQUARE MILES	BENTHIC SITES	AMBIENT SITES
0304020301	Upper Drowning Creek	129.8	4	0
0304020302	Lower Drowning Creek	193.9	2	1
0304020303	Gum Swamp - Lumber River	94.0	2	2
0304020304	Bear Swamp - Lumber River	84.5	7	0
0304020305	Raft Swamp	168.7	4	1
0304020306	Gallberry Swamp	152.2	2	0
0304020307	Upper Big Swamp	116.1	0	0
0304020308	Middle Big Swamp	85.5	0	1
0304020309	Lower Big Swamp	90.3	0	0
0304020310	Saddletree Swamp	115.1	3	2
0304020311	Porter Swamp	133.9	1	1
0304020312	Ashpole Swamp Headwaters	202.2	4	1
0304020313	Ashpole Swamp	*18.5	0	0
0304020314	Lumber River Outlet	*46.0	1	0

*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

Upper Drowning Creek (0304020301)

All streams in this watershed are classified as Water Supply II and are supplementally classified as either a HQW or an ORW. Parts of Candor, Foxfire Village, and Hoffman are in this watershed (Figure 2-4). There are no permitted wastewater discharges but there are three permitted animal operations. It has four subwatersheds (12-Digit HUCs) .

Jackson Creek (030402030101)

Samples from benthic macroinvertebrate sampling site IB7, located on Jackson Creek AU # 14-2-5, produced many pollution intolerant taxa. One taxa collected here was not found at any other station in the Lumber Basin. The rating given to this location was Good and it was determined that the water quality condition here has remained steady.

Fish community sampling site IF19, at the same location as IB7, yielded typical results for fish communities in the sand hills ecoregion. Seventeen total species were found here which marks a slight improvement from 2001. The Dusky Shiner was the most common fish and two species of Special Concern the Sandhills Chub and Pinewoods Darter were present.

Lake Auman, created in 1979, is a 772 acre private man-made spring-fed lake with an earthen dam. The dam underwent repairs in 1996 and 2009 because its stability rating had dropped. DWQ does not monitor private lakes but volunteer monitors from Lake Auman have participated in the *Great North American Secchi Dip-in*. This event, which is sponsored by the North American Lake Management Society and the Environmental Protection Agency, seeks to increase public interest in volunteer monitoring while gaining insight into lake water transparency across North America. Lake Auman has consistently been one of the clearest lakes tested.

Drowning Creek Headwaters (030402030102)

Fish community sampling site IF11, located at NC Highway 73 on Drowning Creek AU # 14-2-(1)a, resulted in the documentation of 20 total species. This stream segment had the greatest variety of any fish community sampled during the 2006 assessment. It also produced the only exotic species reported which was a Redlip Shiner. The Dusky Shiner was the most abundant species and two species of Special Concern, the Sandhills Chub and the Pinewoods Darter were both collected.

Naked Creek (030402030103)

Every waterbody in this entire subwatershed is supplementally classified as ORW including Naked Creek AU # 14-2-6 and Rocky Ford Branch AU # 14-2-6-1. In 2006, the Sand Hills Area Land Trust received a grant from the Clean Water Management Trust Fund (CWMTF) to purchase a 50.8 acre easement on Naked Creek. It was designated by the *Ecosystem Enhancement Program* (EEP) as a *targeted local watershed* (TLW) in 2008 due to the high level of assets and the existence of active local conservation groups.

Benthic macroinvertebrate sampling site IB10, located at State Road 1003 on Naked Creek AU # 14-2-6, continued a streak of 14 consecutive Excellent ratings dating back to 1983. The total number of taxa collected here was greater in 2006 than 2001 and six taxa were only collected here and nowhere else in the Lumber Basin. However, it was noted that one side of the creek lacked a riparian buffer.

Fish community sampling site IF28, in the same location as benthic macroinvertebrate station IB10, varied little from the other fish community sites within the Upper Drowning Creek Watershed. The number of different species collected here has increased since sampling first began 1996.

FIGURE 2-3: 10 DIGIT HUCs IN THE LUMBER SUBBASIN

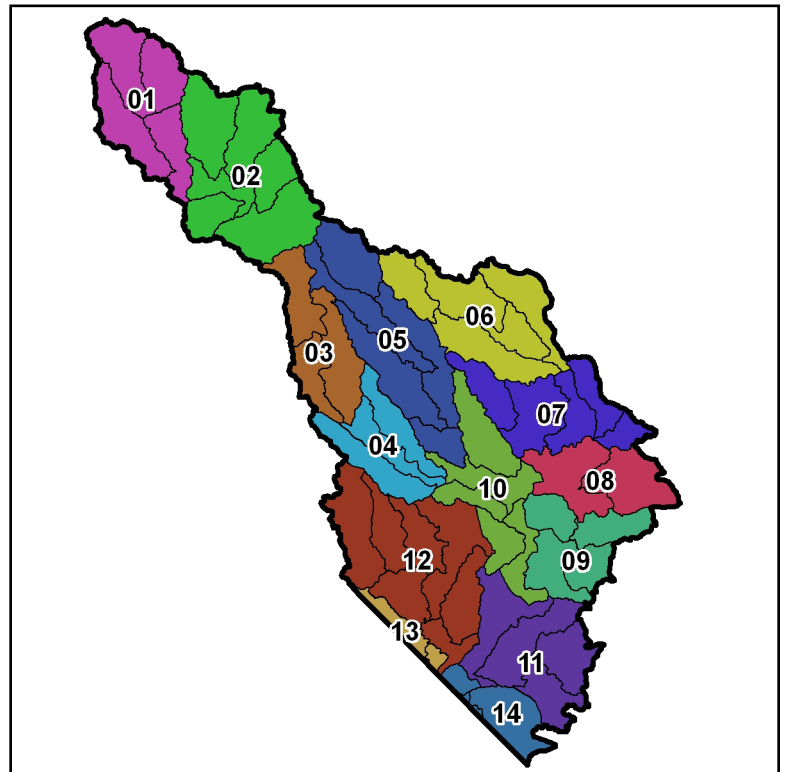
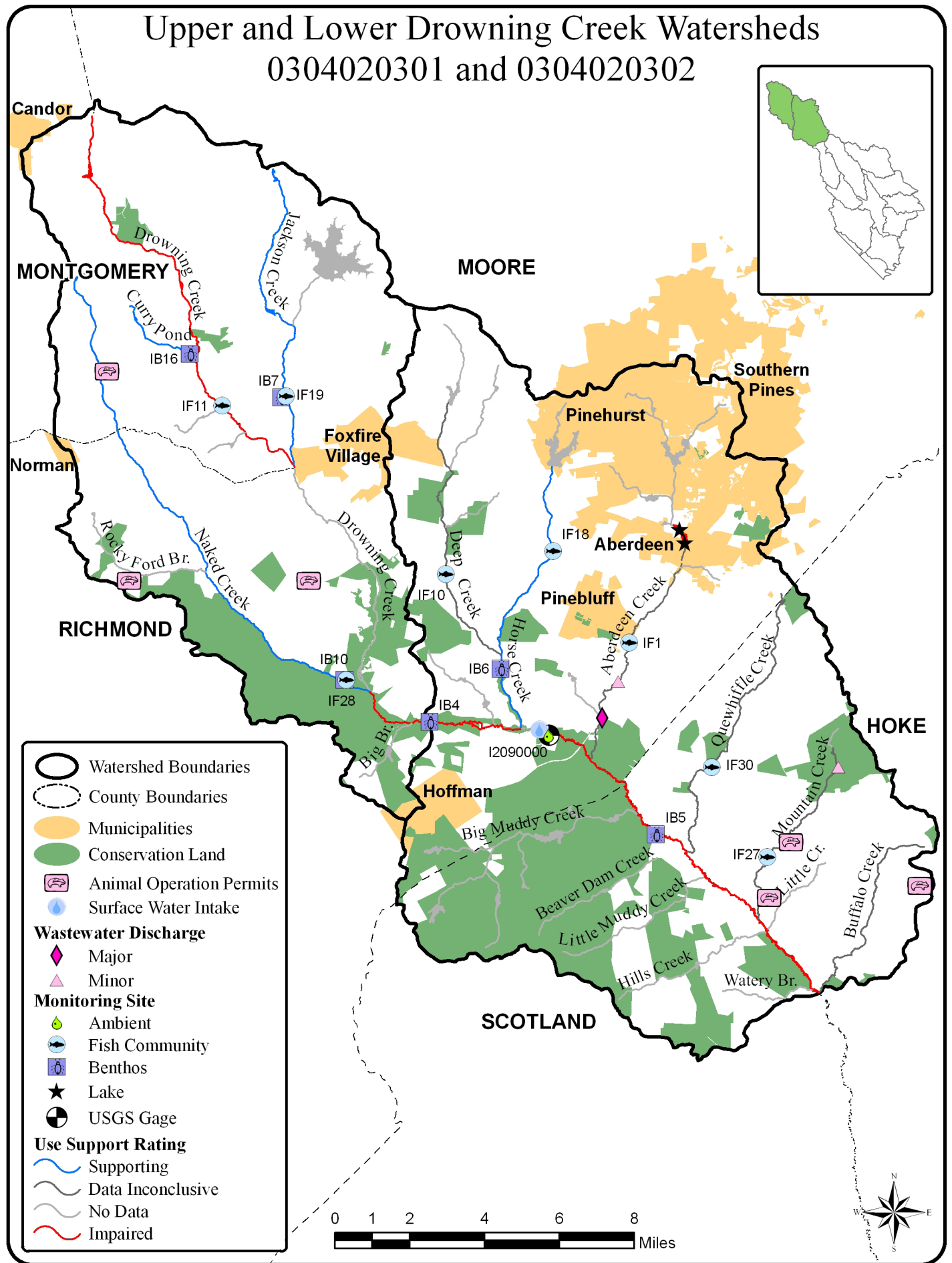


FIGURE 2-4: UPPER AND LOWER DROWNING CREEK WATERSHEDS (0304020301 AND 0304020302)



Big Branch-Upper Drowning Creek (030402030104)

Benthic macroinvertebrate sampling site IB4, located at State Road 1004 on Drowning Creek AU# 14-2-(6.5), is at the outlet for the Big Branch Watershed. This site received an Excellent bioclassification rating for every assessment since 1985. Many pollution intolerant species continue to inhabit this location and there are three species found here that were not found anywhere else in the Lumber Basin.

Lower Drowning Creek (0304020302)

Municipalities in Lower Drowning Creek watershed include part of Pinehurst, Southern Pines, Foxfire Village, Hoffman plus all of Aberdeen and Pinebluff (Figure 2-4). Also located here is the almost 8,000 acre Camp Mackall Military Reservation. There are one major and two minor NPDES discharge permits in the watershed with a total permitted flow of 6.7 MGD. This watershed has six subwatersheds.

Horse Creek (030402030201)

Fish community sampling site IF18, located at State Road 1112 on Horse Creek AU # 14-2-10b, approximately 2.7 miles downstream from Pinehurst Lake AU # 14-2-10a, was established as a new monitoring location during the 2006 field season. While this site was Not Rated it was reflective of the number and diversity of fish species typically found in a healthy sandhills stream. It received one of the highest habitat scores in the Lumber Basin with a 96 out of 100.

Further downstream at State Road 1102 on the same assessment unit (stream segment) of Horse Creek, benthic macroinvertebrate station IB6 was sampled in 2006. Many species previously noted at this site were absent; however, a high number of intolerant taxa contributed to an Excellent bioclassification rating. The pH at the time of sampling was 5.0 su, below the standard of 6.0 su, which may explain why some previously recorded taxa were absent from the samples. This was the only benthic macroinvertebrate sampling site to have its rating increase from 2001. The site rated Good in 2001 as the result of difficulties in sampling due to high flow conditions. Previous samples taken in 1991 and 1996 were also rated Excellent.

Fish community sampling site IF10, located at State Road 1113 on Deep Creek AU # 14-10-1-(2), was given a bioclassification of Not Rated. This site showed an improvement in the diversity of species and had a high habitat score of 96 out of 100. Like many fish community sites in the sandhills the most dominant species was the Dusky Shiner and both the Sandhill Chub and Pinewoods Darter, species of Special Concern, were present. The pH at the time of sampling was 4.8 su below the standard of 6.0 su.

Aberdeen Creek (030402030202)

This subwatershed is the most urbanized subwatershed in both Upper and Lower Drowning Creek Watersheds. It contains large portions of Aberdeen, Southern Pines, Pinehurst, and Pinebluff. Pages Lake AU # 14-2-11-(5) is a man-made lake built in the 1930's and is approximately 35 acres. This lake, which is located in Aberdeen, was sampled as part of the 2006 Lakes and Reservoir Assessment. The lake suffers from an overabundance of aquatic plants but is drained in the winter to control these aquatic weeds. It was treated for Hydrilla and Parrotfeather in 2009 as part of the Division of Water Resources Aquatic Weed Control Program.

Fish community sampling site IF1 is located at State Road 1105 on Aberdeen Creek AU # 14-2-1-(6) within Pinebluff. A lower number of total fish were collected at this site compared to other fish communities sampled in the sandhills but the sample was still fairly diverse with species. This was the only site sampled during the assessment period that did not contain the Sandhills Chub or the Pinewoods Darter; however they were not present in 2001 either.

Big Muddy Lake-Big Muddy Creek (030402030203)

There has not been any water quality data gathered from this subwatershed by DWQ. The Town of Hoffman and Camp MacKall Military Reservation are located here. Camp Mackall makes up about 37 percent of the

subwatershed and the Sandhills Game Land makes up another 47 percent of the subwatershed. The Sandhills Gameland is managed by the North Carolina Wildlife Resources Commission.

Middle Drowning Creek (030402030204)

Ambient monitoring station I2090000, located at US Highway 1 on Drowning Creek AU # 14-2-(10.5), exceeded the iron standard in 25 percent of the samples. Drowning Creek was not impaired for exceeding this standard because elevated levels of iron are normal for this area. There are no permitted dischargers upstream of this sampling point, which is near the water supply intake for the town of Southern Pines.

Quewhiffle Creek (030402030205)

Fish community sampling site IF30, located at State Road 1225 on Quewhiffle Creek AU # 14-2-14, had the fewest total number of specimens and the least amount of diversity. However, it was tied for the highest habitat score in the entire Lumber Basin with a score of 97 out of 100. It was also the only site where the Pinewoods Darter, a species of Special Concern, was the dominant species. This sample varied little from the sample taken at this site in 2001, so water quality does not seem to be in decline.

Lower Drowning Creek (030402030206)

Fish community sampling site IF27, located at State Road 1215 on Mountain Creek AU # 14-2-16-(2), decreased in diversity with the Dusky Shiner making up 91 percent of the fish community. However, the pollution intolerant Pinewoods Darter and Sandhills Chub were also present suggesting that overall the fish community is healthy. The habitat score given to this location was a 97 out of 100.

Gum Swamp-Lumber River (0304020303)

About one-third of this watershed is classified as a Water Supply IV watershed. There are two major and one minor NPDES discharge permits in the watershed with a total permitted flow of 4.31 MGD (Figure 2-5). There are 8 permitted animal operation located here and all but one are in the Gum Swamp subwatershed (030402030302). This watershed has three subwatersheds.

Town of Wagram-Lumber River (030402030301)

This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203020010) based on lack of stream buffers and the presence of endangered species. About 28 square miles of the watershed are classified as a Water Supply IV watershed because the former raw water intake for Robeson County is located in this subwatershed on the Lumber River AU # 14-(4). This water supply intake is currently not in use because several groundwater wells were installed to replace it but all classifications will remain in place to protect it for future use.

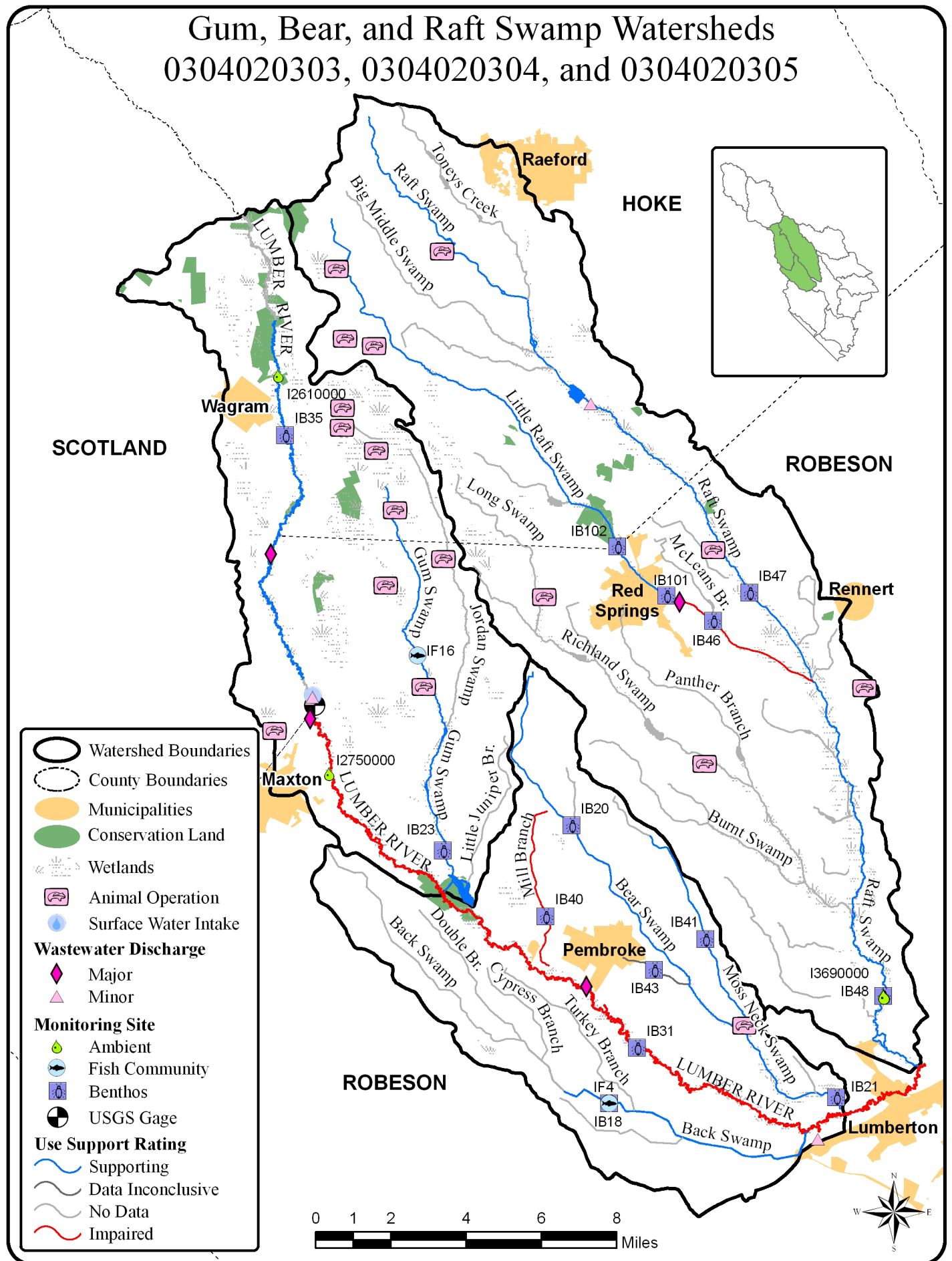
Benthic macroinvertebrate sampling site IB35, located at State Road 1404 on the Lumber River AU # 14-(3), was sampled during the 2006 field season. A high number of intolerant taxa, as well as, a high overall number of specimens were collected. This site received an excellent bioclassification rating continuing a perfect record of excellent ratings since collection began here in 1985. The habitat score given for this location was a 90 out of 100.

Gum Swamp (030402030302)

This subwatershed is designated as a Targeted Local Watershed (03040203040010) by the Ecosystem Enhancement Program in 2003. It was chosen because of its 125 miles of streams only 30 percent had adequate buffers.

Benthic macroinvertebrate sampling site IB23, located at State Road 1312 on Gum Swamp AU # 14-5, was given a Natural bioclassification rating due to the presence of a high number of intolerant taxa in both 2001 and 2006. The bottom substrate and pool variety here was rated lower than many of the streams in the sandhills resulting in a lower habitat score of 76 out of 100.

FIGURE 2-5: GUM, BEAR, AND RAFT SWAMP WATERSHEDS (0304020303, 0304020304, AND 0304020305)



Town of Maxton-Lumber River (030402030303)

This subwatershed contains northeastern Maxton and is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203020010). Although, the Robeson County water intake is currently not in use, much of this subwatershed is classified as a Water Supply IV watershed. Conductivity at ambient monitoring site I2750000, on the Lumber River AU# 12-(4.5), ranged from 36 to 1371 umhos/cm with a median of 121 umhos/cm. However, conductivity was only high during the drought of 2002 and returned to normal after the drought ended.

Bear Swamp-Lumber River (0304020304)

This watershed has three subwatersheds. This entire watershed is now designated as a Targeted Local Watershed by the Ecosystem Enhancement Program with the addition of Mill Branch and Bear Swamp-Lumber River as TLWs in 2008. In February of 2006, EEP published a local watershed management plan for Mill Branch and Bear Swamp-Lumber River watersheds. This local watershed management plan identifies the type, cause, and location of problems, as well as, prioritizes specifically what needs to be done and where. This plan can be found at: http://www.nceep.net/services/lwps/Bear_Swamp/Lumber_River_Watershed_Management_Plan.pdf.

There is one permitted discharger with a maximum daily flow of 1.33 MGD that belongs to the Town of Pembroke WWTP (Figure 2-5). The Pembroke WWTP received a CWMTF grant in 2007 for upgrades to the facility. The town of Pembroke also received a second CWMTF grant in 2007 to connect Union Chapel Elementary School to the treatment plant thus eliminating a troubled septic system.

Back Swamp (030402030401)

Benthic macroinvertebrate sampling site IB18, located at State Road 1003 on Back Swamp AU# 14-8-(2.5), has been evaluated four times; twice in 2001 and twice in 2006. This site was Not Rated for both of the samples taken in 2001. The first sample taken in 2006 was done in February using swamp criteria and the second was done in July using flowing stream criteria. It rated Natural in February but only received a Good-Fair rating in July when streams classified as swamp waters are usually not evaluated. The total number of specimens collected here has decreased but the amount of intolerant taxa has remained stable. While there is a stormwater drain near the site it is not thought to be the cause of the population decline. The main reason for the decline in this area is believed to be from channel modification, poor bottom substrate, and the lack of pool variety. These characteristics led to a habitat score of 64 out of 100.

Fish Community Sampling site IF4, located at the same location as IB18, has shown an increase in the total number of fish collected between 1991 and 2001. The number of pollution intolerant fish species has remained fairly stable throughout the same time period. This site was not sampled for fish during the assessment period.

Bear Swamp-Lumber River (030402030402)

Moss Neck Swamp AU# 14-9-3-(2), at State Road 1570, Bear Swamp AU# 14-9-(0.5) at NC 710, and Watering Hole Swamp AU# 14-9-2 were assessed in 2004 as part of the EEP study. Moss Neck and Bear Swamp both received a Good-Fair rating but Watering Hole Swamp was Not Rated because the drainage area is too small. EEP's local watershed plan evaluated this subwatershed and characterized most of the subwatershed as a critical area having low functioning hydrology. The main causes leading to this loss of function are lack of riparian buffers, channelization, ditching of wetlands, and conversion of agricultural land to residential/commercial uses.

Benthic macroinvertebrate sampling site IB21, located at State Road 1339 on Bear Swamp AU# 14-9-(1.5), was given a Moderate bioclassification rating despite receiving the lowest habitat score in the entire basin during the assessment period, 52 out of 100.

Mill Branch-Lumber River (030402030403)

This subwatershed is part of Ecosystem Enhancement Program's Targeted Local Watershed (03040203030010). Benthic macroinvertebrate sampling site IB40, located at NC 710 on Mill Branch AU# 14-6, was evaluated by the Biological Assessment Unit in March of 2004 as part of the development of an EEP watershed management plan and was rated Fair. The EEP watershed management plan reported elevated levels of Nitrate-Nitrite in Mill Branch attributed to agricultural runoff. This assessment unit is currently impaired for aquatic life and appears of the draft 303(d) list.

Benthic macroinvertebrate sampling site IB31, located on the Lumber River along AU # 14-(7), was sampled during the 2006 field season. A high number of intolerant taxa, as well as, a high overall number of specimens were collected. This site received its tenth Excellent bioclassification rating since 1983. The habitat score given for this location was a 88 out of 100.

Raft Swamp (0304020305)

The Town of Red Springs and the western part of Raeford are the only municipalities in this watershed (Figure 2-5). The Red Springs WWTP and the Antioch Water Treatment Plant (WTP) are the only permitted wastewater dischargers in the watershed with a combined maximum daily flow of 2.5 MGD. There are 8 permitted animal operations in the watershed. There are five subwatershed in this watershed.

Upper Raft Swamp (030402030501)

Upper Raft Swamp subwatershed is part of EEP's Targeted Local Watershed (03040203060020) and also contains western Raeford. In early 2006, an animal operation was fined \$11,529.36 for discharging swine waste to an Unnamed Tributary of Big Middle Swamp AU # 14-10-1.5.

Little Raft Swamp (030402030502)

The Red Springs WWTP, which discharges to Little Raft Swamp AU# 14-10-5b, has had numerous standards violations for a multitude of parameters including chlorine, copper, cyanide, fecal coliform bacteria, mercury, nitrogen, and total suspended solids. These violations have contributed greatly to a dramatic decline in water quality which is very apparent in the benthos data collected during the assessment period. The Town of Red Springs has been working to correct these issues by making upgrades to the treatment plant and collection system. In 2008, mercury traps were installed at the town dentist office and the lateral line leading to the building was replaced. An equalization basin was added to the treatment plant in February 2009. The town is continuing to make further upgrades and replacements at the treatment plant to improve its operation.

Benthic macroinvertebrate sampling site IB102 located, at State Road 1323 on Little Raft Swamp AU# 14-10-5a, just over two miles upstream of the Red Spring WWTP, was sampled in 2006. This sample yielded more specimens and 16 intolerant species, far more than the downstream station IB46. In addition to the intolerant species, there were 5 species found here and nowhere else in the Lumber Basin. This site was rated Natural.

Benthic macroinvertebrate sampling site IB46, located at State Road 1505 on Little Raft Swamp AU# 14-10-5b, is approximately one mile downstream from the Red Springs WWTP outfall. A 2001 study of benthic sampling site IB46 and IB101, located less than one-half of a mile upstream from the discharger, found no difference between the two sites. Samples from site IB46 changed dramatically between 2001 and 2006 with a decrease in the number of specimens collected. The overall diversity of species decreased especially among the pollution sensitive species, which decreased from nine in 2001 to three for the latest assessment. The decline in biological health of Little Raft Swamp AU# 14-10-5b resulted in a Severe bioclassification and it was placed on the draft 2008 303(d) list.

Little Raft Swamp subwatershed is part of the EEP's Targeted Local Watershed (03040203060020).

Richland Swamp (030402030503)

There has not been any data collected by DWQ in the Richland Swamp watershed since two benthic macroinvertebrate stations were assessed in 1991. The data collected proved to be inconclusive and they were assigned a rating of Not Rated.

Middle Raft Swamp (030402030504)

Middle Raft Swamp subwatershed is part of the EEP's Targeted Local Watershed (03040203060020). This subwatershed has four waterbodies that are supplementally classified as Unique Wetlands because they possess exceptional state or national ecological significance. They are Antioch Bay, Hamby's Bay, and two Bays known as Oak Savanna. All of these areas are properties owned by The Nature Conservancy.

Benthic macroinvertebrate sampling site IB47, located at State Road 1505 on Raft Swamp AU# 14-10-(1), was rated Natural in 2006. There was little change in the habitat or benthic organisms at this location between assessments.

Lower Raft Swamp (030402030505)

Lower Raft Swamp subwatershed is the EPP's Targeted Local Watershed (03040203060030). All waterbodies within this subwatershed are classified as WS-IV and therefore require stream buffers to protect the City of Lumberton's water supply.

Benthic macroinvertebrate sampling site IB48, located at State Road 1527 on Raft Swamp AU# 14-10-(5.5), was evaluated for the first time during the 2006 assessment. This station was added because all upstream drainage in the entire Raft Swamp watershed flows through this point so it can be used to assess cumulative effects. This station received a habitat score of 79 out of 100, only 1 point lower than the upstream station IB47. IB48 was rated Moderate because it had a lower number and fewer types of organisms. Red Springs WWTP on Little Raft Swamp, which is about 15 miles upstream from this site, may still be impacting water quality in Raft Swamp. However, other causes such as impacts from nearby animal operations can not be ruled out completely.

Gallberry Swamp (0304020306)

This watershed contains the municipalities of Lumber Bridge, Parkton, Saint Pauls, and part of Rennett (Figure 2-6). There are 3 minor NPDES wastewater dischargers with a total permitted flow of 0.7 MGD and 7 animal operation permits. This watershed has five subwatersheds. All assessed streams are supporting their uses.

Upper Little Marsh Swamp (030402030601)

The Parkton WWTP discharges to Dunns Marsh AU # 14-22-1-3-2 just before it reaches Little Marsh Swamp AU# 14-22-1-3. Dunns Marsh is currently not monitored but Little Marsh Swamp is rated Supporting.

Lower Little Marsh Swamp (030402030602)

Benthic macroinvertebrate sampling site IB56, at State Road 1907 on Little Marsh Swamp AU# 14-22-1-3, had results in 2006 similar to samples taken in 2001 with only a slight reduction in the types of intolerant species. The overall number of specimens collected did not change at all, so this site's bioclassification of Natural remains.

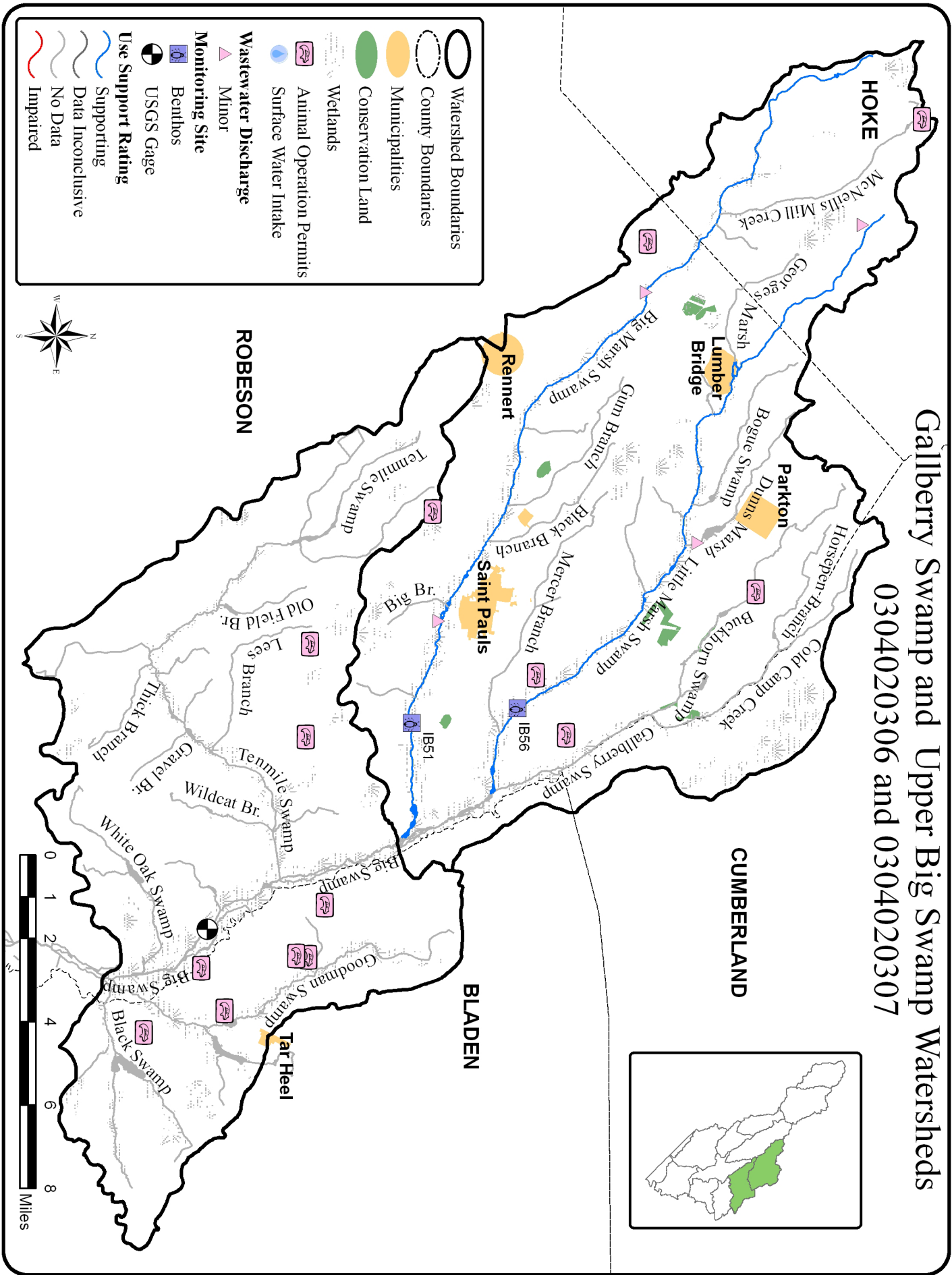
Upper Big Marsh Swamp (030402030603)

Goose Pond Bay, which is owned by The Nature Conservancy, is located in this subwatershed and is supplementally classified as a Unique Wetland.

Lower Big Marsh Swamp (030402030604)

Dunahoe Bay and Pretty Pond Bay, which are owned by The Nature Conservancy, are both located in this subwatershed and are supplementally classified as a Unique Wetland. These are both clay-based carolina bays that rely solely on rainfall as a source for water. Dunahoe Bay serves as a nesting location for Cattle Egrets and Anhingas.

FIGURE 2-6: GALLBERRY AND UPPER BIG SWAMP WATERSHEDS (0304020306 AND 0304020307)



Benthic macroinvertebrate sampling site IB51, located at State Road 1924 on Big Marsh Swamp AU # 14-22-2, was sampled and evaluated as Natural. This site had many intolerant taxa and an increase in the overall number of specimens collected.

Big Branch AU # 14-22-2-4 has been selected as a random ambient monitoring site for the 2009-2010 cycle. The 1.8 mile stream, which drains to Big Marsh Swamp, will be tested for a wide range of parameters during this two year period. Big Branch empties to Big Marsh Swamp about a half a mile upstream of sampling site IB51.

Gallberry Swamp (030402030605)

Most of this subwatershed is part of the EEP Targeted Local Watershed (03040203110010). This subwatershed has the potential to grow rapidly because its proximity to Fayetteville. The Fayetteville area is expected to experience rapid growth over the next few years due to an expansion of activities associated with Fort Bragg Military Base. I-295 is a road that is planned for construction and will run in between Fayetteville and Fort Bragg. The I-295 outer loop is planned to meet I-95 proper in this subwatershed.

Upper Big Swamp (0304020307)

The Town of Tarheel is partially located in this watershed (Figure 2-6). There are no permitted wastewater discharges in the watershed and it is made up of five subwatersheds. The world's largest swine processing facility is located in this watershed which makes southeastern North Carolina a desirable location for swine farms.

No samples were collected in *Upper Tenmile Swamp subwatershed (030402030701)*.

Lower Tenmile Swamp (030402030702)

In July 2007, DWQ responded to a complaint about an illicit discharge from a confined animal feeding operation. Upon inspection, DWQ found evidence of a past discharge that had adverse impacts to surface waters. The animal operation permit holder was fined \$3,948.49 for a non-permitted discharge of swine waste to Lees Branch AU# 14-22-3-9 and failure to report such a discharge.

No no samples were collected in *Goodman Swamp subwatershed (030402030703)*, *Bryan Millpond-Black Swamp subwatershed (030402030704)*, or *Lewis Mill Branch-Big Swamp subwatershed (030402030805)*.

Middle Big Swamp (0304020308)

Middle Big Swamp watershed, with 20 animal operation permits, has the highest concentration of animal operation permits of all 10-digit watersheds in the entire Lumber Basin, at one for about every 4.25 square miles. (Figure 2-7). This watershed is made up of only two subwatersheds.

No samples were collected in *Crawley Swamp subwatershed(030402030801)*.

Jackson Swamp-Big Swamp (030402030802)

Samples taken at ambient monitoring site I5370000, on Big Swamp at NC Highway 211, do not show any signs of being impacted by the many swine operations in the watershed.

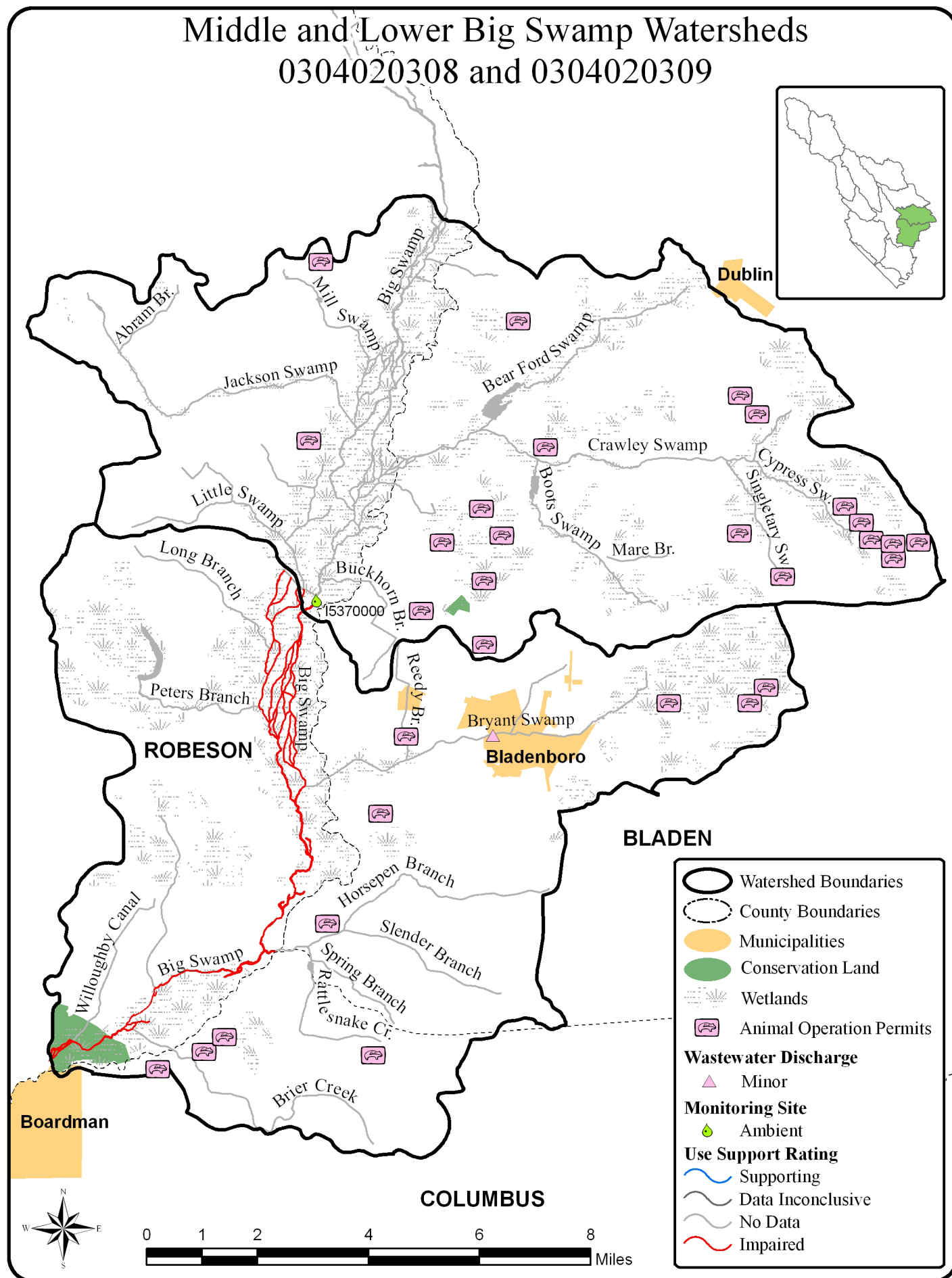
Lower Big Swamp (0304020309)

The town of Bladenboro is located in this watershed and operates the only permitted discharger the Bladenboro WWTP (Figure 2-7). This watershed has four subwatersheds.

Bryant Swamp (030402030901)

In 2006, the Town of Bladenboro received a grant from the CWMTF to conduct an inflow and infiltration study of their sewer collection system. The results of this study determined that lines and manholes need to be replaced and at an estimated cost of over 1.2 million dollars.

FIGURE 2-7: MIDDLE AND LOWER BIG SWAMP WATERSHEDS (0304020308 AND 0304020309)



No samples were collected in *Peters Branch-Big Swamp subwatershed (030402030902)* or *Horsepen Branch subwatershed (030402030903)*.

Brier Creek-Big Swamp (030402031004)

In 2008 and 2009, the planning and construction phases of the Ecosystem Enhancement Program's Columbus Swamp Project were completed. This project restored 33.5 acres of wetland and enhanced another 2.5 acres of wetland along Brier Creek AU # 14-22-17. This project is now in the monitoring phase and will be monitored for five years to ensure that the restoration was successful.

Saddletree Swamp-Lumber River (0304020310)

This watershed contains almost all of the City of Lumberton and 5 NPDES discharge permits (Figure 2-8). There are 2 major and 3 minor NPDES discharge permits with a total maximum daily flow of 22.56 MGD. This watershed has six subwatersheds.

Saddletree Swamp (030402031001)

Part of this subwatershed is the Ecosystem Enhancement Program's Targeted Local Watershed (03040203080020). This part of the subwatershed which is mainly east of Interstate 95 contains much of northern Lumberton. It was selected as a TLW because this part of the watershed was determined to have approximately 11 percent impervious cover and 63 percent of the streams lacked buffers.

Jacob Swamp (030402031002)

Benthic macroinvertebrate sampling site IB25, located at NC 41 on AU # 14-(13)a of the Lumber River within the municipality of Lumberton, was assessed in 2006. This was the third time that this site has been assessed since 1996 and it has received an Excellent rating every time. Due to the presence of pollution sensitive species and the overall number of species, this site was awarded an Excellent rating despite a low habitat score of 66 out of 100. Although this site has a low habitat score, macroinvertebrates are thriving where the habitat is suitable for colonization due to excellent upstream water quality.

Benthic macroinvertebrate sampling site IB27, located on the Lumber River AU# 14-(13)d, is downstream from benthic macroinvertebrate station IB25. It is at this point that the river becomes slower and deeper. This station differed from the downtown Lumberton station (IB25) in that it had a higher percentage of species tolerant to pollution and a higher habitat score of 77 out of 100. Comparing this assessment period to previous assessments, water quality appears to be holding steady here with a Good-Fair rating but is at risk for impairment.

No samples were collected in *Jacob Swamp-Lumber River subwatershed (030402031003)* or *Tenmile Branch-Mill Swamp subwatershed (030402031004)*.

River Swamp-Lumber River (030402031105)

Conductivity at ambient monitoring site I4650000, on the Lumber River, ranged from 57 to 1157 umhos/cm with a median of 142 umhos/cm. However, the high values occurred during the drought of 2002 and returned to normal when the drought ended. Conductivity at Ambient monitoring site I5690000, ranged from 65 to 1214 umhos/cm with a median of 126 umhos/cm but also returned to normal after the drought.

Porter Swamp (0304020311)

The municipalities that are completely or partially in this watershed include Chadbourn, Cerro Gordo, Boardman, Orrum, and Fair Bluff (Figure 2-9). It also contains the NCDOT mitigation site known as Bush Island and much of the Lumber River State Park. The recently constructed Fairmont Regional WWTP discharges to the Lumber River in this watershed with a permitted maximum daily flow of 1.75 MGD. There are 8 permitted animal operations located here.

FIGURE 2-8: SADDLETREE SWAMP-LUMBER RIVER WATERSHED (0304020310)

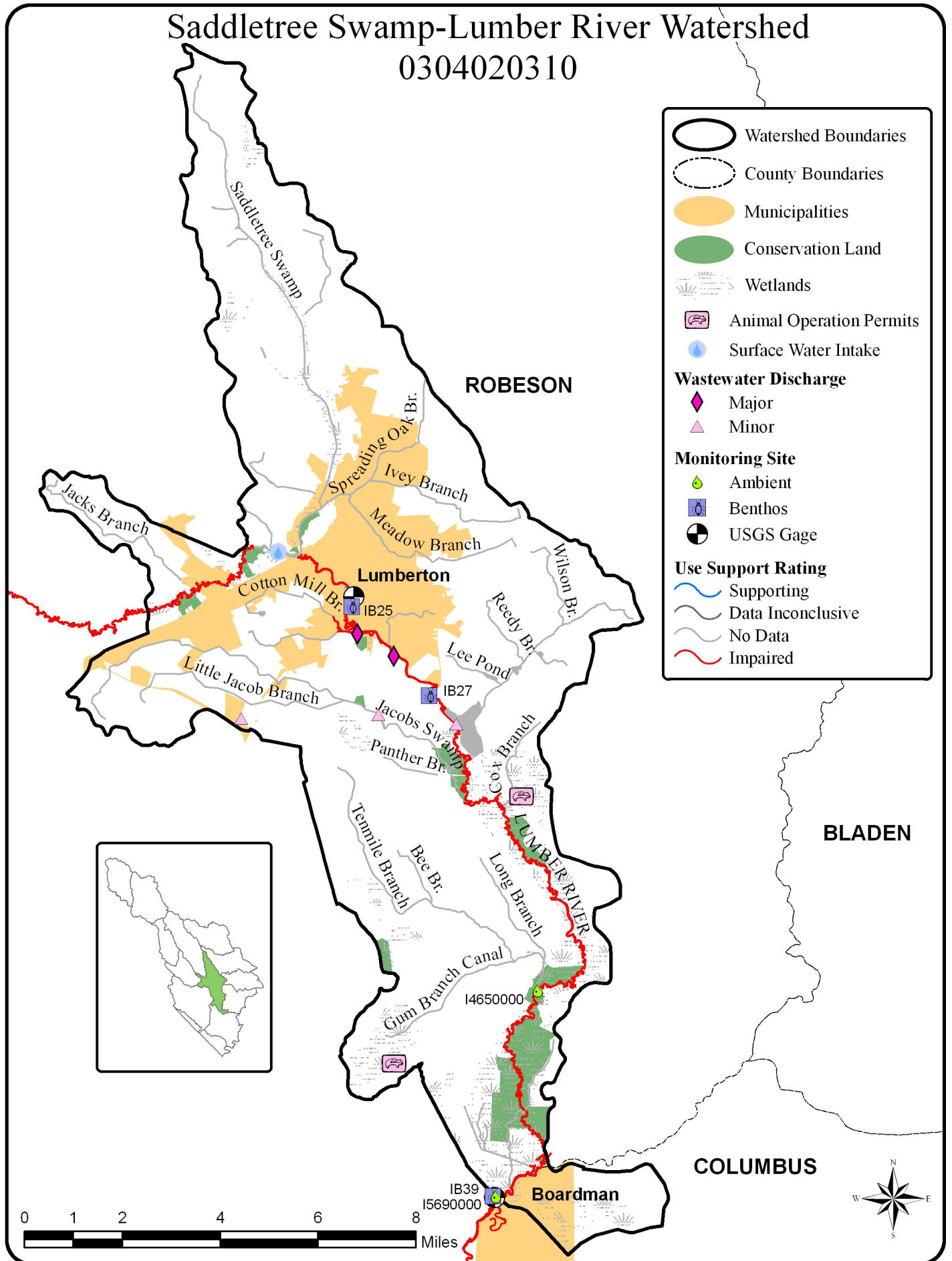
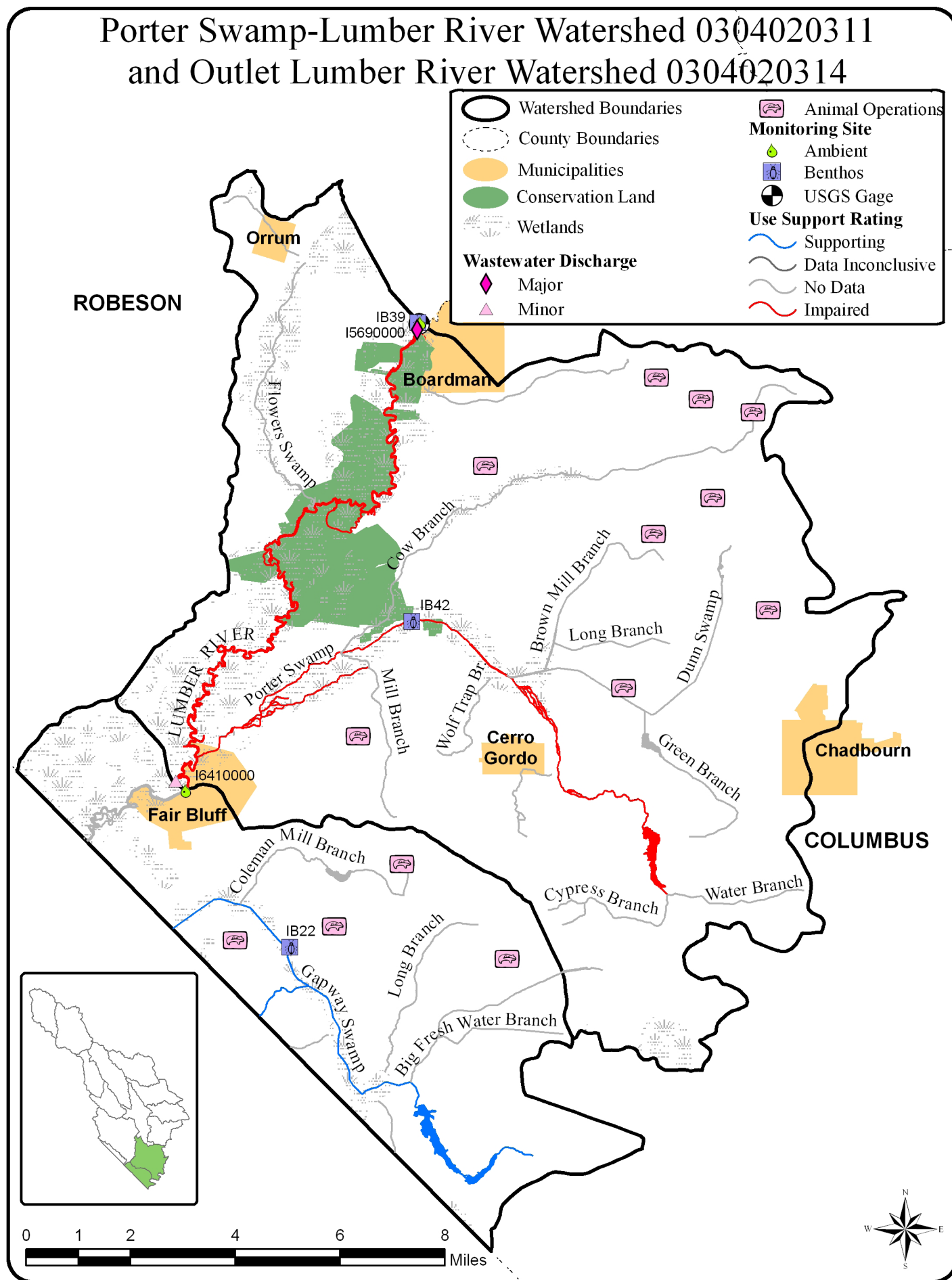


FIGURE 2-9: PORTER SWAMP-LUMBER RIVER AND OUTLET LUMBER RIVER WATERSHEDS (0304020311 AND 0304020314)



Dunn Swamp (030402031101)

This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203191010). It was chosen because it is part of the larger Porter Swamp watershed and Porter Swamp watershed downstream has a biological impairment downstream of Dunn Swamp.

Upper Porter Swamp (030402031102)

This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203191010). It was chosen because of a biological impairment in the subwatershed. Porter Swamp AU# 14-27 was placed on the draft 2008 303(d) list for ecological and biological integrity as a result of the benthic macroinvertebrate sample taken at site IB42 located at State Road 1503. It was noted that at the time of sampling there was a higher than normal rate of flow that made sampling difficult. Additional sampling will assist with verifying this rating. Porter Swamp has been impaired for mercury since 1998 but was not on the 303(d) list because there is an approved *TMDL for mercury*.

Lower Porter Swamp (030402031103)

This subwatershed makes up the majority of the Ecosystem Enhancement Program's Targeted Local Watershed (03040204190010).

Benthic macroinvertebrate sampling site IB42, located at State Road 1503 on Porter Swamp AU# 14-27, has declined in the overall number of specimens and intolerant taxa. In 1996 and 2001, it was reported that there were six different types of intolerant taxa at the Porter Swamp site but there was only one present in 2006. Some of the declines may be due to high flow conditions during sampling. Regardless, the site received a bioclassification rating of Severe, thus making it impaired for aquatic life. Porter Swamp AU# 14-27 was placed on the draft 2008 303(d) list. This area is mostly rural and there are no discharge permits. High flows or nonpoint source pollution may be the cause of this decline.

Flowers Swamp-Lumber River (030402031104)

The part of this subwatershed to the west of the Lumber River is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040203190010).

Benthic macroinvertebrate sampling site IB39, located at Highway 74 on the Lumber River AU # 14-(13)f, is reflective of water quality flowing into the watershed. There was an absence of stoneflies and a reduction of mayflies in the 2006 samples, but this was attributed to high flow at the time of sampling. Although the bioclassification rating dropped from an Excellent rating in 2001 to a Good rating in 2006, it was determined that water quality at this location is stable since it was given a Good rating for 3 samples prior to 2001.

Ambient monitoring site IB6410000 did not exceed any water quality parameters in more than 10 percent of the samples taken and had lower conductivity than the upstream ambient station I5690000.

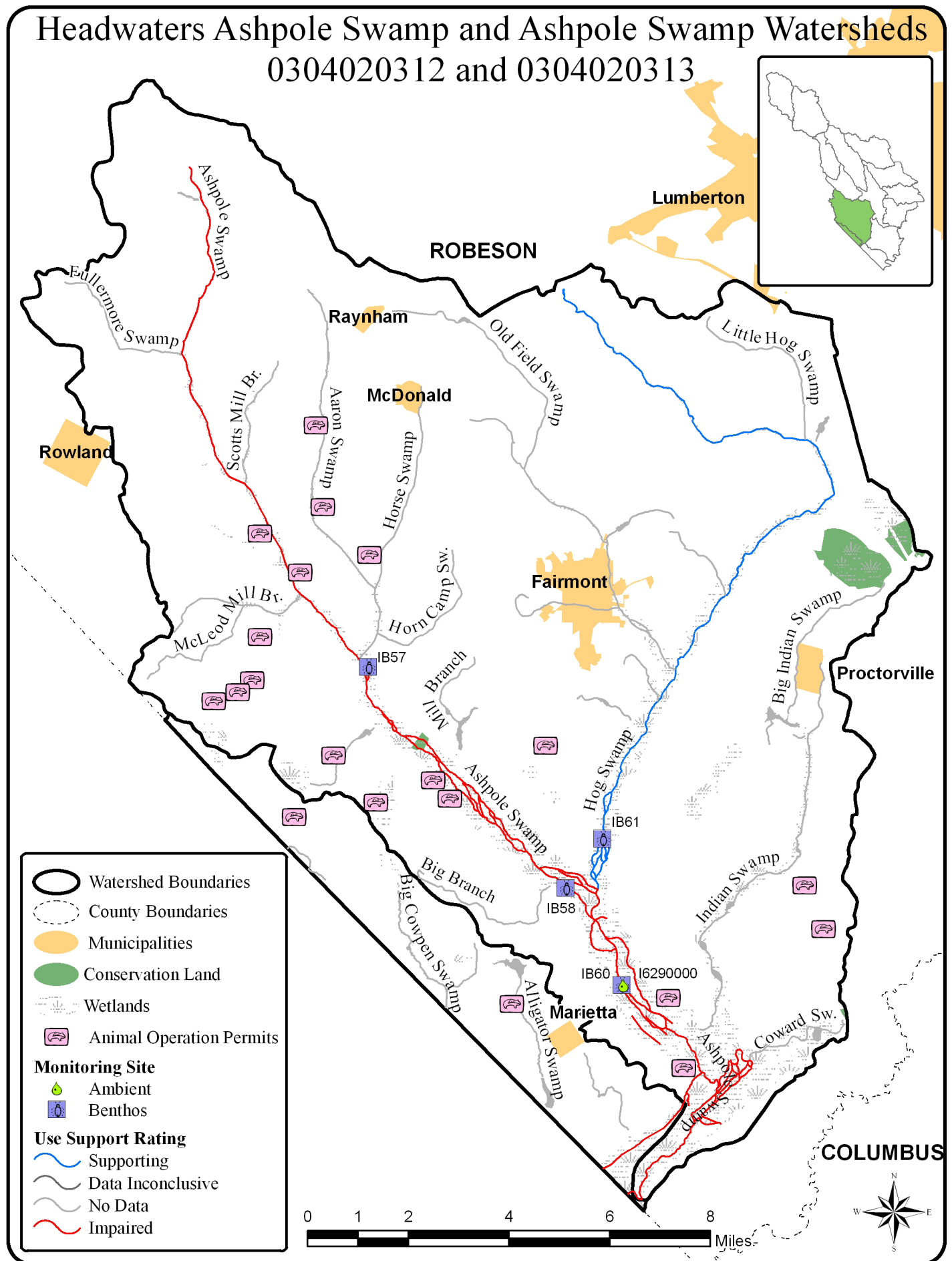
Ashpole Swamp Headwaters (0304020312)

Municipalities in this watershed include Proctorville, McDonald, Raynham, and Fairmount (Figure 2-10). There are no NPDES discharge permits here but there are 18 permitted animal operations. Ashpole Swamp AU # 14-30 a & b are considered by the Natural Heritage Program to possess significant aquatic habitats. Colonial wading bird colonies and Rotund Mysterysnails have been reported to inhabit Ashpole Swamp.

Horse Swamp (030402031201)

No samples were collected in this subwatershed. Benthic macroinvertebrate sampling site IB57 is located just after Horse Swamp empties into Ashpole Swamp AU # 14-30a and is the best available indicator of water quality in this subwatershed.

FIGURE 2-10: HEADWATERS ASHPOLE SWAMP AND ASHPOLE SWAMP WATERSHEDS (0304020312 AND 0304020313)



Ashpole Swamp Headwaters (030402031202)

Benthic macroinvertebrate sampling site IB57, located at NC Highway 130 on Ashpole Swamp AU# 14-30a, was sampled for the first time in 2006. It was rated Moderate although it has good habitat characteristics and contained a good diversity of taxa including pollution sensitive taxa.

Town of Fairmont-Old Field Swamp (030402031203)

This subwatershed completely contains the municipality of Fairmont. Stormwater runoff from Fairmont eventually ends up in Old Field Swamp AU# 14-30-7-4 which empties in Hog Swamp AU# 14-30-7-1. DWQ has not collected any water quality data from this subwatershed so impacts can only be assessed by data collected in Hog Swamp.

Hog Swamp (030402031204)

Samples taken from benthic macroinvertebrate sampling site IB61, located at State Road 2262 on Hog Swamp AU# 14-30-7-1, indicate that water quality has decreased in Hog Swamp. The site rated Natural in 1996 and 2001 but fell to Moderate in 2006 because there was a decrease in pollution sensitive organisms. Despite the decrease in intolerant taxa, it is Moderate because the overall number of specimens collected increased from previous samples. The type of taxa found and not found suggest that low dissolved oxygen levels and organic enrichment may be the cause of the change in species composition at the site.

No samples were collected in *Mill Branch-Ashpole Swamp subwatershed (030402031205)*.

Benthic macroinvertebrate sampling site IB58, located at NC Highway 41 on Ashpole Swamp AU# 14-30a just prior to the confluence with Hog Swamp AU# 14-30-7, was sampled twice in 2006. This site was rated Natural in 1996 and 2001 but showed a slight decrease in both intolerant taxa and overall population of organisms which resulted in a Moderate rating in 2006. This decline may be the result of high flow rates at the time of sampling. This segment of Ashpole Swamp appears to be healthy and has a broad floodplain with adequate buffers.

Indian Swamp (030402031206)

In 2006, NC DOT restored wetland hydrology to Juniper Bay, a 728.5 acre former carolina bay located in headwaters of this watershed just north of Proctorville. EEP is currently managing the monitoring of this reconstructed wetland that drains to Big Indian Swamp AU # 14-30-8-1.

Coward Swamp-Ashpole Swamp (030402031207)

Ashpole Swamp AU # 14-30b, at ambient monitoring site I6290000, exceeded the iron standard in 64.7 percent of the samples. This is natural and does not pose a threat to water quality.

Ashpole Swamp (0304020313)

This Watershed is mainly in South Carolina but a small portion, which contains the municipality of Marietta, is in North Carolina (Figure 2-10). It has no permitted discharges and only two animal operation permits. Ashpole Swamp AU# 14-30b is the only assessed waterbody in the watershed and is supporting for aquatic life and recreation but is impaired for fish consumption due to mercury levels in fish tissue. There are two subwatersheds in this watershed. They are *Cowpen Swamp-Bear Swamp (030402031302)* and *Ashpole Swamp (030402031403)*.

Lumber River Outlet (0304020314)

This watershed contains southern Fair Bluff and the town's WWTP which has a permitted daily maximum flow of 0.23 MGD (Figure 2-9). There are also 4 animal operation permits. This watershed has part of 3 subwatersheds.

TABLE 2-2: CWMTF GRANTS FUNDED FOR FISCAL YEARS 1997 - 2007 IN THE LUMBER SUBBASIN*

PROJECT ID	APPLICANT	PURPOSE	AMOUNT FUNDED	TOTAL COST
1997A-108	NC Div. of Parks and Recreation	Buffer Acquisition	\$400,000	\$900,000
1997A-118	Town of Fairmount	Wastewater	\$1,000,000	\$6,965,700
1997B-002	NC Div. of Parks and Recreation	Buffer Acquisition	\$550,000	\$1,750,000
1997B-611	Town of Wagram	Wastewater	\$400,000	\$2,647,850
1998A-203	Sand Hills Area Land Trust	Buffer Acquisition	\$96,000	\$3,097,000
1998A-602	Town of Pembroke	Wastewater	\$380,000	\$1,200,000
1998B-511	City of Lumberton	Wastewater	\$1,000,000	\$4,000,000
1999B-015	Sand Hills Area Land Trust	Buffer Acquisition	\$31,250	\$35,000
1999B-509	City of Lumberton	Wastewater	\$692,000	\$2,112,617
1999B-510	Town of Parkton	Wastewater	\$670,000	\$705,700
1999B-515	Town of Saint Pauls	Wastewater	\$95,000	\$95,000
2001A-027	Sand Hills Area Land Trust	Buffer Acquisition	\$389,000	\$402,000
2001A-506	Town of Red Springs	Wastewater	\$351,000	\$924,000
2001A-509	Town of Saint Pauls	Wastewater	\$296,000	\$369,700
2001B-013	City of Lumberton	Buffer Acquisition	\$69,000	\$369,941
2001B-047	Sand Hills Area Land Trust	Buffer Acquisition	\$40,000	\$157,500
2001B-501	Town of Bladenboro	Wastewater	\$1,863,000	\$2,327,976
2002A-027	Sand Hills Area Land Trust	Buffer Acquisition	\$44,000	\$102,000
2003D-009	Lumber River Conservancy	Minigrant Donated	\$9,200	\$36,200
2003D-011	Lumber River Conservancy	Minigrant Donated	\$15,350	\$229,850
2004A-005	Town of Fair Bluff	Buffer Acquisition	\$91,000	\$222,060
2004A-009	City of Lumberton	Buffer Acquisition	\$100,000	\$192,212
2004A-502	Town of Fair Bluff	Wastewater	\$2,063,000	\$1,328,100
2004D-019	Lumber River Conservancy	Minigrant Donated	\$5,000	\$5,000
2004M-004	Lumber River Conservancy	Minigrant Standard	\$25,000	\$31,250
2005A-018	NC Div. of Parks and Recreation	Buffer Acquisition	\$2,000,000	\$4,698,600
2005A-807	Robeson County	Planning	\$238,000	\$303,000
2005D-018	Lumber River Conservancy	Minigrant Donated	\$4,000	\$3,800
2005B-019	Lumber River Conservancy	Buffer Acquisition	\$188,000	\$188,000
2005B-020	Lumber River Conservancy	Buffer Acquisition	\$73,000	\$153,000
2005B-021	Lumber River Conservancy	Buffer Acquisition	\$400,000	\$406,800
2005B-706	Robeson County	Stormwater	\$1,195,000	\$2,399,450
2006A524	Town of Red Springs	Wastewater	\$1,850,000	\$4,571,000
2006A-604	City of Lumberton	Wastewater	\$246,000	\$410,800
2006B-030	Sand Hills Area Land Trust	Buffer Acquisition	\$153,000	\$208,437
2006S-009	Town of Aberdeen	Minigrant Stormwater	\$50,000	\$68,000
2006B-802	Town of Bladenboro	Planning	\$40,000	\$44,500
2007-530	Town of Pembroke	Wastewater	\$79,000	\$1,275,400
2007-615	Town of Pembroke	Wastewater	\$20,000	\$464,600
2007-801	Town of Aberdeen	Planning	\$40,000	\$55,000
TOTAL	--	--	\$17,210,840	\$46,857,043

*Does not include statewide or regional grants.

Headwaters Gapway Swamp (030402031401)

Benthic macroinvertebrate sampling site IB22, located at State Road 1356 on Gapway Swamp AU# 14-31, was assessed for the third time in 2006. Over the past ten years intolerant taxa have been steadily declining; however, their numbers have not yet decreased enough to warrant a change in the bioclassification of Moderate. At this time, there is not enough information to determine the cause of this steady decline. If this site worsens during the next assessment period, it will most likely result in the impairment of Gapway Swamp. Gapway Swamp has been highly channelized and lacks buffers at some locations.

No samples were collected in *Hook Branch subwatershed (030402031403)* or *Lumber River subwatershed (030402040804)*.

Incentive Programs

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. A list of CWMTF Grants that have been funded through 2007 is provided in Table 2-2 on the preceding page.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

TABLE 2-3: BMP INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BMP IMPLEMENTED	AMOUNT	UNITS	COST
Conservation Tillage (3 years)	6269	Acres	\$383,456
Long Term No-Till	394	Acres	\$49,186
Cropland Conversion - Grass	883	Acres	\$194,661
Cropland Conversion - Trees	475	Acres	\$58,790
Stripcropping	9	Acres	\$1,227
Grassed Waterway	0.2	Acres	\$282
Field Border	121	Acres	\$25,840
Filter Strip	3	Units	\$982
Water Control Structure	5	Units	\$14,535
Grade Stabilization	1	Units	\$12,367
Livestock Exclusion	3250	Feet	\$2,194
Dry Stack	2	Units	\$40,602
Incinerater	20	Units	\$112,354
Closure - Waste Impoundments	1	Units	\$958
Waste Application Equipment	7	Units	\$44,955
TOTAL	--	--	\$942,389

Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 2-3 shows the number of projects implemented in the Lumber River subbasin and the dollar amount invested. Table 2-4 shows the water quality benefits realized from that investment.

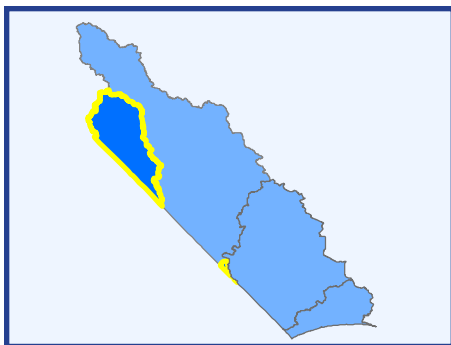
TABLE 2-4: BENEFITS RESULTING FROM BMPs INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BENEFITS	AMOUNT	UNITS
Acres Affected	11,736	Acres
Soil Saved	33,462	Tons
Nitrogen Saved	307,462	Pounds
Phosphorous Saved	26,019	Pounds
Waste - Nitrogen Managed	1,017,568	Pounds
Waste - Phosphorus Managed	1,082,371	Pounds

Recommendations

Mill Branch AU # 14-6 and Porter Swamp AU # 14-27 are both impaired for biological and ecological integrity due to habitat degradation resulting partly from nonpoint source pollution. Water quality in these streams may be improved by buffer acquisition and/or stream/wetland restoration. Such projects may be funded through grants such as the CWMTF or the DWQ Nonpoint Source 319(h) Program. Also both of these streams are in an EEP targeted local watershed and, therefore, could be restored through mitigation projects.

Stormwater regulation is essential to preventing pollution from reaching waterbodies. It is more expensive to retrofit developed areas with stormwater controls than to install them during the initial development. It is recommended that local governments consider developing and implementing stormwater management regulations as soon as possible.



Chapter 3 Little Pee Dee Subbasin

Part of Hydrologic Unit Code: 03040204

General Description

The headwaters of this subbasin are within the sandhills ecoregion, characterized by sandy streams with year-round flow. Over 23 square miles of this 393 square mile subbasin are managed by the North Carolina Wildlife Resource Commission as part of the Sandhills Game Land. This subbasin is split into two areas by the border between North and South Carolina. Most of the subbasin is to the west of the Lumber River but a small portion lies along the western portion of Tabor City. Gum Swamp Creek and Shoe Heel Creek merge to form the Little Pee Dee River in South Carolina.

Current Status and Significant Issues

All monitored waters in this subbasin are meeting all water quality standards (Figure 3-1).

Population and Land Use

Population for this subbasin is estimated at 43,476 or 111 people per square mile based on the 2000 census. Laurinburg is the only municipality in this subbasin with a population greater than 5,000. This area is predicted to experience very slow growth between now and 2020.

About 30 percent of the subbasin is agricultural land and approximately a quarter is covered by forest. It is estimated that around 20 percent of the subbasin is composed of wetlands.

Ambient Water Quality

There are two ambient monitoring sites located in the subbasin. One monitoring site is on Leith Creek downstream from Laurinburg and the other is on Shoe Heel Creek downstream from Maxton. Both stations are less than 4 miles from the South Carolina border. Neither site exceeded any of the measured water quality parameters in more than 10 percent of the samples, except the Leith Creek station for iron. Leith Creek was not impaired for iron because it was determined to be natural.

General Biological Health

During the last assessment period, six sites were sampled for benthic macroinvertebrates and five sites were sampled for fish community health. Two of the six benthic locations were sampled twice. Currently all streams in this subbasin are rated Supporting for Aquatic Life. None of the fish communities sampled were rated because presently there are no criteria developed to evaluate them. Although not rated, all streams sampled for fish community health had pollution intolerant species.

Watershed at a Glance

COUNTIES

Columbus, Richmond, Robeson, Scotland

MUNICIPALITIES

East Laurinburg, Gibson, Laurinburg, Maxton, Rowland, Tabor City, Wagram

PERMITTED FACILITIES

NPDES Discharge

Major:	1
Minor:	8

NPDES Nondischarge:	3
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NPDES Stormwater

General:	26
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Animal Operations:	29
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AQUATIC LIFE SUMMARY

Monitored:	120 Miles
	0 Acres

Total Supporting:	112 Miles
	0 Acres

Total Impaired:	0 Miles
	0 Acres

Total Not Rated:	8 Miles
	0 Acres

FIGURE 3-1: LITTLE PEE DEE SUBBASIN (03040204)

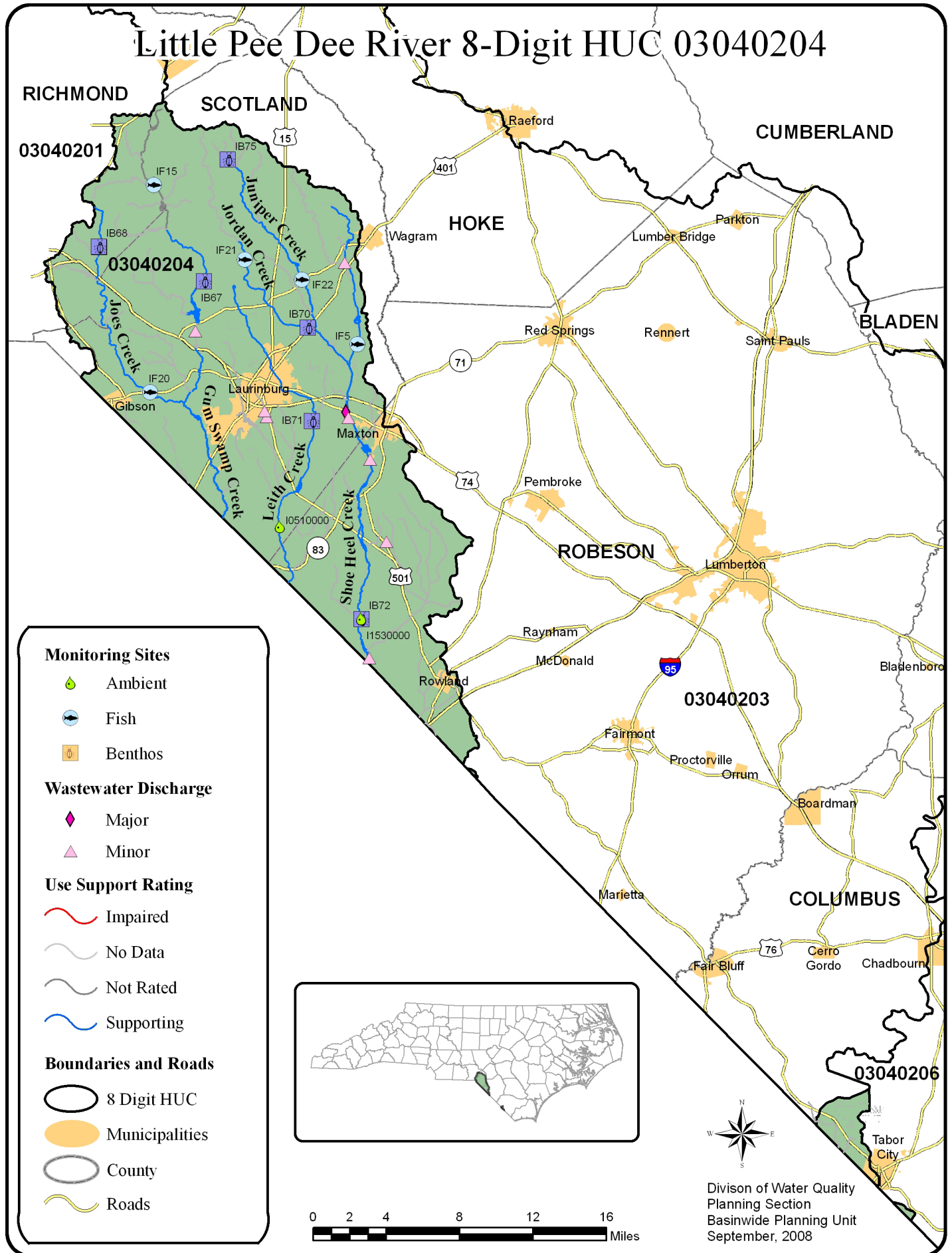


TABLE 3-1: NUMBER OF BENTHIC AND AMBIENT SITE IN THE LITTLE PEE DEE SUBBASIN BY 10-DIGIT WATERSHED

10-DIGIT HUC	NAME	SQUARE MILES	BENTHIC SITES	AMBIENT SITES
0304020401	Upper Little Pee Dee River	*138.1	2	0
0304020402	Leith Creek	*75.5	1	1
0304020403	Shoe Heel Creek	*156.1	3	1
0304020405	Middle Little Pee Dee River	*17.9	0	0
0304020406	Lake Swamp	*8.3	0	0

*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

Local Water Quality

Table 3-1 list the number of benthic and ambient monitoring sites that were sampled for the 2002-2006 assessment period by watershed (10-digit HUC). There are 5 watersheds and 17 subwatersheds (12-digit HUCs) within the Little Pee Dee subbasin. Figure 3-2 shows the location of these watersheds labeled with the last two digits of the 10-digit HUC.

Upper Little Pee Dee River (0304020401)

This watershed includes the municipality of Gibson and the southeastern part of Laurinburg (Figure 3-3). Over 10,000 acres of this watershed have been placed into conservation as part of the Sandhills Gameland. There is one NPDES permitted wastewater discharger with a maximum daily flow of 0.3 MGD.

Gum Swamp Creek Headwaters (030402040101)

Fish community sampling site IF15, located at State Road 1344 on Gum Swamp Creek AU# 14-32-(1), was sampled in 2006. All species present in 2001 were also found in 2006 plus three new species not noted in 2001. The most common species was the Pinewoods Darter, a species of Special Concern. This site was not rated but provides an excellent habitat for fish and currently has a diverse population.

Richmond Mill Lake-Upper Gum Swamp Creek (030402040102)

Benthic macroinvertebrate sampling site IB67, located at State Road 1323 on Gum Swamp Creek AU# 14-32-(7), was given a bioclassification of Good-Fair. This is lower than the Good rating received in 2001 and the same as it was assigned in 1996 and 1991. The lower rating is a reflection of a reduction in the variety of intolerant taxa. Since this area is rural and there are no permitted dischargers upstream nonpoint sources are likely the cause of the reduction.

Joes Creek (030402040103)

Fish community sampling site IF20, located at NC Highway 79 on Joes Creek AU# 14-32-14, was given a habitat score of 96 out of 100. There was a 43 percent increase in the number of fish at this site and a slight increase in variety, however the Dusky Shiner accounted for 65 percent of the fish.

Middle Gum Swamp Creek (030402040104)

In 2007, Scotland County was awarded grants from the CWMTF and from the NC Rural Center to connect Springfield Village to the City of Laurinburg-Leith Creek WWTP, thus eliminating the Springs Industries WWTP.

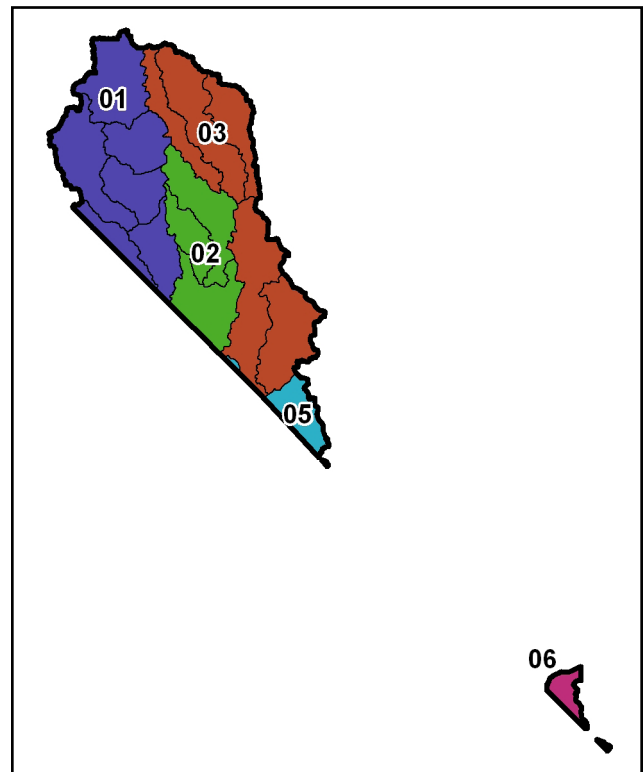
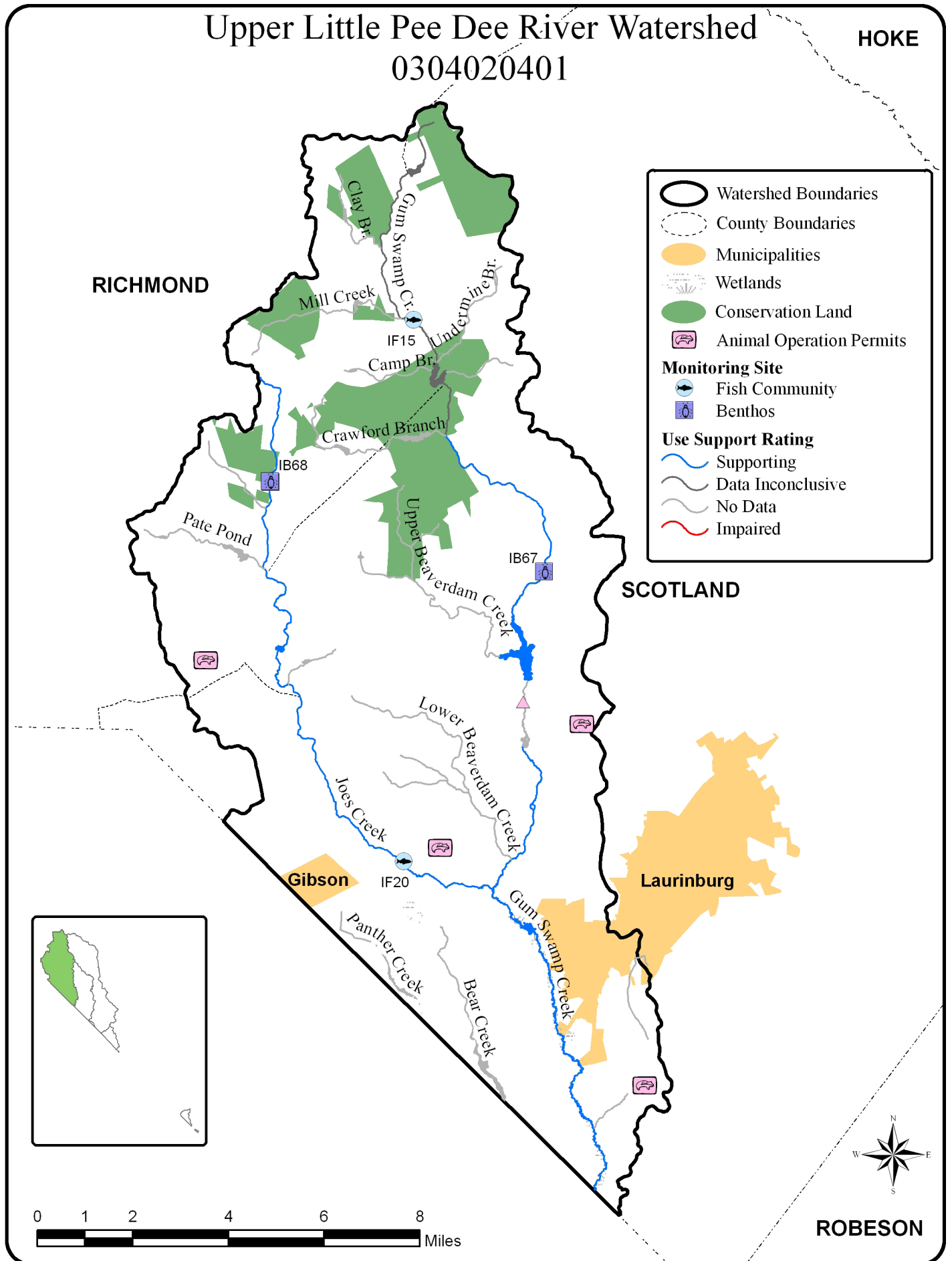
FIGURE 3-2: WATERSHEDS (10-DIGIT HUCs) IN THE LITTLE PEE DEE SUBBASIN

FIGURE 3-3: UPPER LITTLE PEE DEE RIVER WATERSHED (0304020401)



This project has eliminated the discharge of 10,500 gallons per day of treated wastewater to Gum Swamp Creek AU # 14-32-(12). This wastewater will now be sent to the Leith Creek WWTP. Despite its name the Leith Creek WWTP actually discharges to Shoe Heel Creek AU# 14-34.

No samples were collected in *Lower Gum Swamp Creek subwatershed (030402040105)*.

Beaverdam Creek-Gum Swamp Creek (030402040106)

This subwatershed is the Ecosystem Enhancement Program's Targeted Local Watershed (03040204010060). It only has 12 miles of streams but has a high concentration of Carolina bays in need of restoration.

Leith Creek (0304020402)

Leith Creek watershed contains all of East Laurinburg and most of Laurinburg, as well as, 2 permitted NPDES wastewater dischargers (Figure 3-4). The 2 dischargers have a combined maximum daily flow of 0.03 MGD. There are three subwatersheds in this watershed.

Leith Creek Headwaters (030402040201)

Benthic macroinvertebrate sampling site IB71, located at State Road 1609 on Leith Creek AU# 14-33a, was sampled in 2006 for the first time since 1991. This site was sampled as part of a special study and received a rating of Moderate.

No samples were collected in *Bridges Creek subwatershed (030402040202)*.

Leith Creek subwatershed (030402040203)

Ambient monitoring site I0510000, located at State Road 1615 on Leith Creek AU # 14-33b, did not exceed any water quality standards in greater than 10 percent of the samples, except for Iron. This waterbody was rated supporting because the iron levels were deemed to be at natural levels.

Shoe Heel Creek (0304020403)

This watershed contains part of two municipalities, Maxton and Wagram (Figure 3-4). There are 6 permitted NPDES wastewater dischargers with a maximum daily flow of 4.935 MGD. It has five subwatersheds.

Jordan Creek (030402040301)

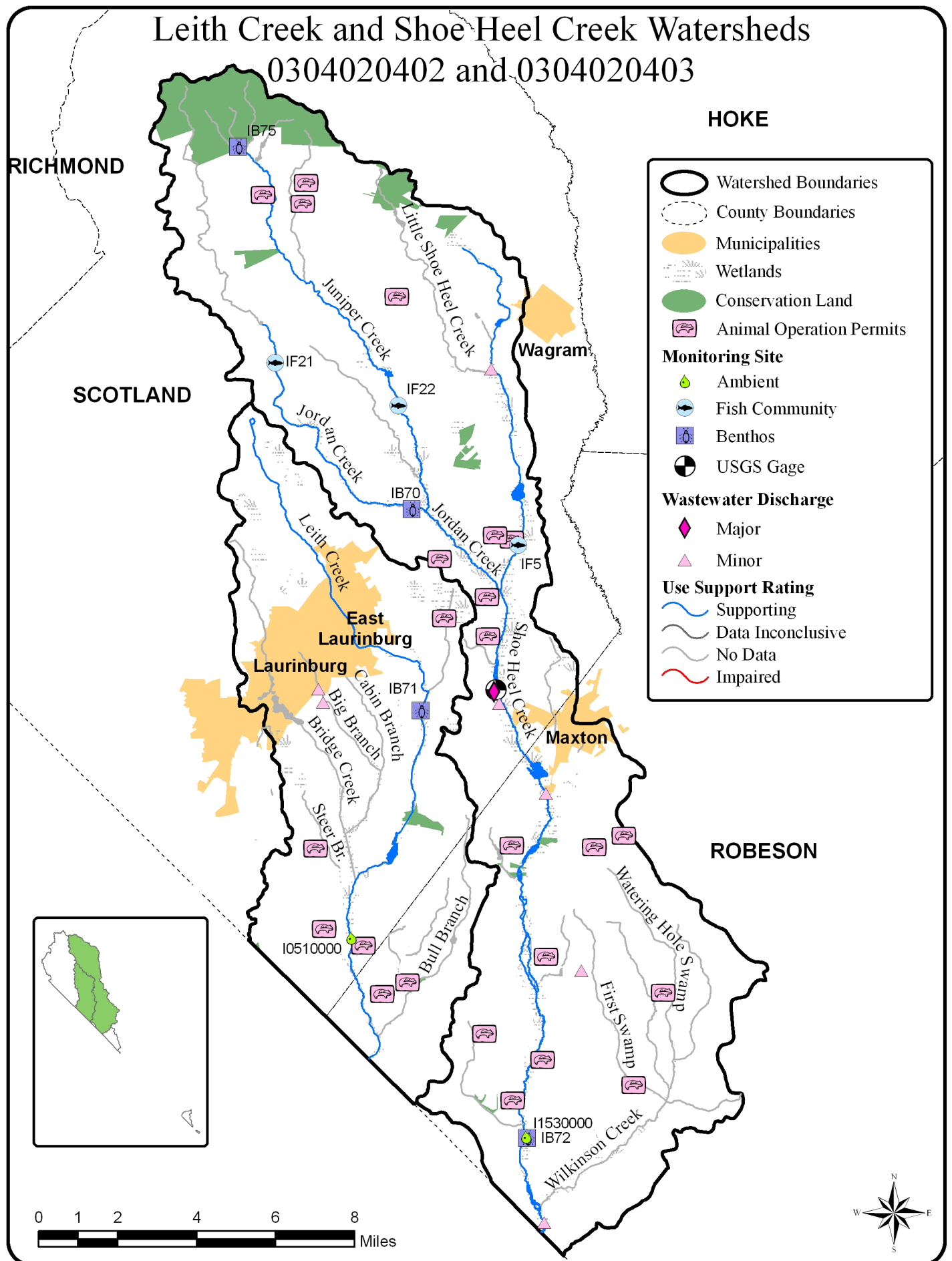
Fish community sampling site IF21, located at State Road 1324 on Jordan Creek AU# 14-34-4-(2), provides excellent habitat for aquatic life. The diversity of species increased in 2006 from the 2001 assessment by five species. The intolerant Pinewoods Darter was present in both years.

Benthic macroinvertebrate sampling site IB70, located at US Highway 401 on Jordan Creek AU# 14-34-4-(2), has slightly less suitable habitat than the fish community sampling site on Jordan Creek but is still adequate. This location has been sampled three times in the last twelve years and has rated Good-Fair every time. Water quality on Jordan Creek has remained stable since monitoring began.

Juniper Creek (030402040302)

Fish community sampling site IF22, located at NC Highway 144 on Juniper Creek AU# 14-34-4-3, is extremely healthy with a habitat score of 97 out of 100. There was a net gain of 5 species from 2001 to 2006, including the intolerant Pinewoods Darter, and the total number of fish increased by 84 percent. It was also noted during sampling that the riparian buffers were of high quality on both side of the stream.

FIGURE 3-4: LEITH AND SHOE HEEL CREEK WATERSHEDS (0304020402 AND 0304020403)



Shoe Heel Creek Headwaters (030402040303)

Fish community sampling site IF5, located at State Road 1433 on Shoe Heel Creek AU# 14-34, received a habitat score of 97 out of 100. It gained ten new species since the 2001 assessment of which five were pollution intolerant species. This represents an enormous improvement in the fish population during a period of only five years.

Wilkinson Creek (030402040304)

This subwatershed is the Ecosystem Enhancement Program's Targeted Local Watershed (03040204048010). This subwatershed was selected as a TLW by EEP because 59 percent of the land use is agriculture and 55 percent of the streams lack buffers.

Maxton Pond-Shoe Heel Creek (030402040305)

In 2006, there was an incident in this watershed where an employee of the Maxton-Laurinburg Airport WWTP was dumping sludge into wetlands that drain to Shoe Heel Creek AU # 14-34. It is believed that the dumping occurred over a period of months forcing the responsible employee to resign under criminal charges of violating the Clean Water Act. The facility has been fined \$95,000 for the illegal dumping.

In 2007, the Town of Maxton was awarded a grant from the CWMTF to reduce inflow and infiltration to the town's wastewater collection system. This project will prevent unnecessary treatment of stormwater and reduce leaking of wastewater from the system to local streams and groundwater.

Benthic macroinvertebrate sampling site IB72, located at State Road 1101 on Shoe Heel Creek AU# 14-34, has been sampled seven times since 1985. In that time it has fluctuated between an Excellent and Good rating although the last sample was rated Good. Overall species richness and intolerant species richness remains high but the number of intolerant species has declined slightly which accounts for the Good rating. Elevated conductivity at the site was attributed to the Maxton WWTP an upstream NPDES discharger.

Ambient monitoring site I0510000

Middle Little Pee Dee River (0304020405)

The town of Rowland is located in the Middle Little Pee Dee watershed, as well as, two permitted animal operations. There are no permitted wastewater dischargers in this watershed. It has two subwatersheds.

Carolina Branch-Little Pee Dee River (030402040501)

Less than 1 square mile of this subwatershed is located within North Carolina and there are no assessment units in this watershed.

Hayes Swamp (030402040503)

This subwatershed is the Ecosystem Enhancement Program's Targeted Local Watershed (03040204010060). EEP administered a mitigation project on two UT of Conrary Swamp AU # 14-35-2 and five acres of wetlands that is currently in the monitoring stage. The project which is know as the Brown Marsh project, restored 5,004 feet of linear streams, 5 acres of nonriverine wetlands, as well as, reforested approximately 20 acres of floodplain, stream bank, upland slopes and nonriverine wetlands.

Lake Swamp-Little Pee Dee River (0304020406)

This watershed only has one 12-Digit HUC that is in North Carolina, Mitchell Swamp subwatershed (030402040601). All waters draining from this watershed empty into the Little Pee Dee River after its confluence with the Lumber River. The watershed is mostly agricultural fields but the southwestern part of Tabor City can be found here.

Incentive Programs

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. A list of CWMTF Grants that have been funded through 2007 is provided in Table 3-2.

TABLE 3-2: CWMTF GRANTS FUNDED THROUGH 2007 IN THE LITTLE PEE DEE SUBBASIN*

PROJECT ID	APPLICANT	PURPOSE	AMOUNT FUNDED	TOTAL COST
1997B-506	Town of Gibson	Wastewater	\$286,500	\$903,000
2000B-012	NC WRC	Buffer Acquisition	\$46,000	\$170,000
2003A-510	Town of Maxton	Wastewater	\$154,000	\$154,000
2005B-806	Town of Maxton	Planning	\$40,000	\$45,000
2007-817	Scotland County	Planning	\$42,000	\$45,000
2007-525	Town of Maxton	Wastewater	\$2,524,000	\$3,019,370
2007-538	Scotland County	Wastewater	\$28,000	\$1,050,000
TOTAL	--	--	\$3,120,500	\$5,386,370

*Does not include statewide or regional grants.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

TABLE 3-3: BMP INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BMP IMPLEMENTED	AMOUNT	UNITS	COST
Conservation Tillage (3 years)	3099	Acres	\$182,408
Cover Crop	400	Acres	\$10,000
Cropland Conversion - Grass	164	Acres	\$40,637
Cropland Conversion - Trees	33	Acres	\$4,515
Nutrient Scavenger Crop	1,170	Acres	\$26,773
Conservation Tillage	193	Acres	\$10,917
Grassed Waterway	2	Acres	\$2,969
Water Control Structure	1	Units	\$14,137
Trough or Tank	2	Units	\$3,798
Livestock Exclusion	739	Feet	\$4,397
Incinerater	5	Units	\$27,893
Waste Application Equipment	4	Units	\$25,909
TOTAL	--	--	\$354,353

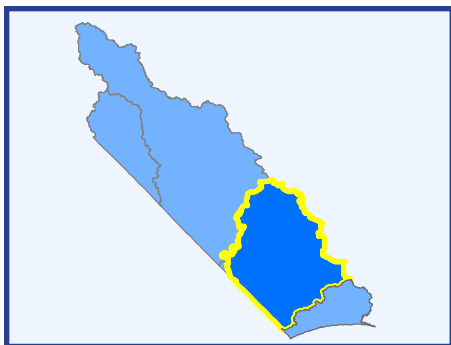
Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 3-3 shows the number of projects implemented and in the Little Pee Dee Subbasin and the dollar amount invested. Table 3-4 shows the water quality benefits realized from that investment.

TABLE 3-4: BENEFITS RESULTING FROM BMPs INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BENEFITS	AMOUNT	UNITS
Acres Affected	7,343	Acres
Soil Saved	31,015	Tons
Nitrogen Saved	631,513	Pounds
Phosphorous Saved	16,500	Pounds
Waste - Nitrogen Managed	87,885	Pounds
Waste - Phosphorus Managed	40,853	Pounds

Recommendations

Stormwater regulation is essential to preventing pollution from reaching waterbodies. It is more expensive to retrofit developed areas with stormwater controls than to install them during the initial development. It is recommended that local governments consider developing and implementing stormwater management regulations as soon as possible.



Chapter 4

Waccamaw Subbasin

Part of Hydrologic Unit Code: 03040206

General Description

This subbasin contains some of the most unique environments in the state. Lake Waccamaw, the largest Carolina bay lake and the second largest natural lake in the state, can be found here (Figure 4-1). The lake contains three species of endemic fish and four species of endemic mollusk as well as many other rare species. The eastern and southern shore of the lake have been protected by the Lake Waccamaw State Park since 1976. Lake Waccamaw has been designated as an ORW and all waters draining to it are part of the ORW management strategy area [15 NCAC 02B.0225 (c) (10)]. A portion of the Green Swamp, a large natural pine wetlands preserve with many carnivorous plants, is partially located in this subbasin.

Current Status and Significant Issues

All of the waters in the subbasin are supplementally classified as Swamp Waters. Swamp waters have lower pH and dissolved oxygen standards than other waterbodies. In addition to the chemical/physical differences, swamp waters are also evaluated for biological communities using modified criteria. For more information on swamp water standards visit the Classification and Standards Unit website at <http://h2o.enr.state.nc.us/csu/index.html>.

The portion of the subbasin east of the Waccamaw River and south of Juniper Swamp will now be subject to new coastal stormwater rules because it is in Brunswick County. Brunswick County is one of twenty coastal counties affected by Session Law 2008-211 that became effective on October 1, 2008. For more information about Session Law 2008-211 see Chapter 5 of the *Supplemental Guide to Basinwide Planning*.

Population and Land Use

Population for this subbasin is estimated at 59,901 or 57 people per square mile based on the 2000 census. Whiteville is the only municipality in this subbasin with a population greater than 5,000. It is the least densely populated subbasin in the Lumber River basin and is not expected to increase in population as fast as neighboring Long Bay Subbasin. The southeastern corner of the subbasin is expected to be the fastest growing area as coastal development extends further inland.

This is the least developed subbasin in the Lumber River basin. It has the highest percentage of wetlands at over 31 percent and the highest amount of forest land at over 27 percent. When taking into account the amount of wooded wetlands the percent of the subbasin covered by forest increases to just over 58 percent (Figure 4-2).

Watershed at a Glance

COUNTIES

Bladen, Brunswick, Columbus

MUNICIPALITIES

Bolton, Brunswick, Calabash, Carolina Shores, Chadbourn, Clarkton, Lake Waccamaw, Shallotte, Tabor City, Whiteville

PERMITTED FACILITIES

NPDES Wastewater Discharge

Major: 3

Minor: 8

NPDES Nondischarge: 3

NPDES Stormwater

General: 18

State: 21

Animal Operations: 64

AQUATIC LIFE SUMMARY

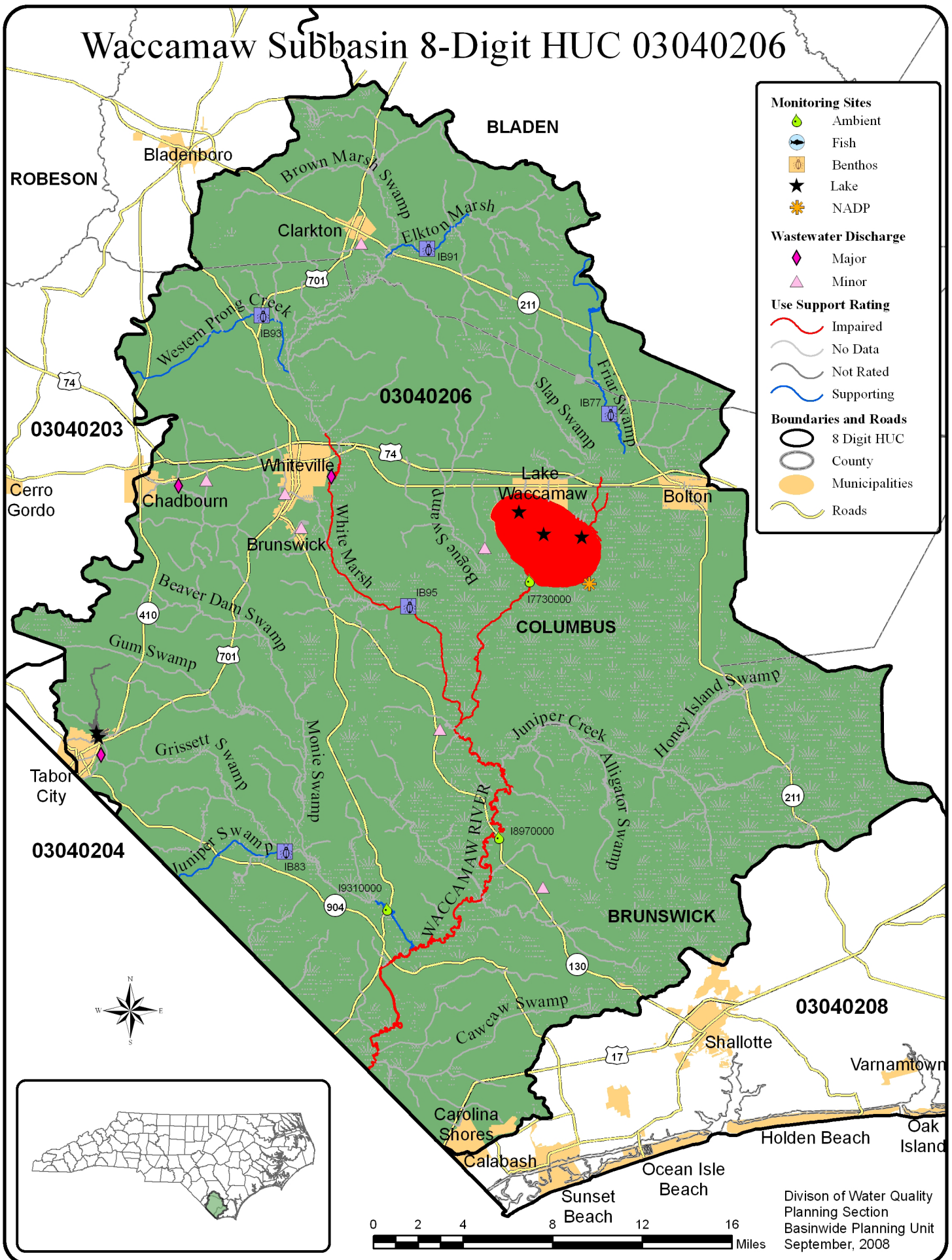
Monitored: 95 Miles
8966 Acres

Total Supporting: 92 Miles
8840 Acres

Total Impaired: 0 Miles
0 Acres

Total Not Rated: 3 Miles
126 Acres

FIGURE 4-1: WACCAMAW SUBBASIN (03040206)



Ambient Water Quality

DWQ monitored ambient water quality in the subbasin at four different locations but one of those sites was in South Carolina. The South Carolina site was dropped from sampling in September of 2003. The only standard to be exceeded in more than 10 percent of the samples was iron. Both the Waccamaw River site and the Seven Creeks site exceeded the standard for iron in 50 percent or more of the samples. However, these waterbodies were not impaired for iron because it is believed to be natural. Total Kjeldahl Nitrogen was found to be elevated at three of the four ambient sites with the only exception being the site located just below the spillway of the Lake Waccamaw dam.

General Biological Health

Five benthic macroinvertebrate sites were sampled from 2002 through 2006, two of which were part of a special study. Of the 4 permanent sites none of them changed in their bioclassification from the 2001 field season. All sites were rated Moderate except one that was rated as Natural. Three sites on the Waccamaw River, normally sampled, were not sampled due to high flow conditions but are expected to be visited during the 2011 field season.

Local Water Quality

Table 4-1 list the number of benthic and ambient monitoring sites that were sampled for the 2002-2006 assessment period by watershed (10-digit HUC). Figure 4-3 shows the seven watersheds (10-digit HUCs) and the thirty-five subwatersheds (12-digit HUCs) within the Waccamaw River subbasin. They are labeled with the last 2 digits of the 10-digit HUC.

TABLE 4-1: NUMBER OF BENTHIC AND AMBIENT SITE IN THE WACCAMAW SUBBASIN BY 10-DIGIT WATERSHED

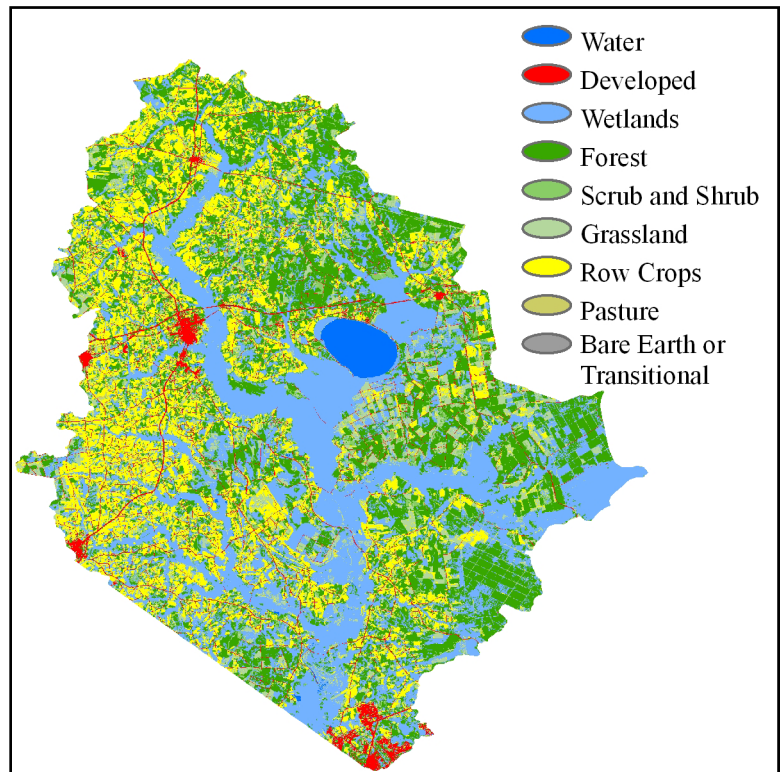
10-DIGIT HUC	NAME	SQUARE MILES	BENTHIC SITES	AMBIENT SITES
0304020601	Red Hill Swamp	172.0	2	0
0304020602	White Marsh	134.0	1	0
0304020603	Waccamaw River Headwaters	120.4	1	1
0304020604	Juniper Creek-Waccamaw River	167.5	0	0
0304020605	Seven Creeks	*167.6	1	1
0304020606	Gore Branch	113.4	0	1
0304020607	Buck Creek	*95.7	0	1

*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

Red Hill Swamp (0304020601)

Red Hill Swamp watershed, with 38 Animal Operation Permits, has the second highest concentration of animal operation permits of all 10-digit watersheds in the Lumber Basin. It has 1 animal operation permit for about every 4.5 square miles. This watershed is very rural with only one municipality, the Town of Clarkton (Figure 4-4). The Town of Clarkton's WWTP is the only permitted NPDES discharger in the watershed with a maximum daily flow of 0.24 MGD. There are five subwatersheds in the Red Hill Swamp watershed.

FIGURE 4-2: WACCAMAW SUBBASIN LAND USE BASED ON THE 2001 NATIONAL LAND COVER DATASET



A special study was conducted in this watershed by the Environmental Science Section of DWQ on two assessment units, Elkton Marsh (AU # 15-4-1-1-2) and Western Prong Creek (AU # 15-4-2), to gain knowledge about an area that previously lacked data to make an assessment.

No samples were collected in *Whites Creek subwatershed* (030402060101), or *Brown Marsh Swamp subwatershed* (030402060102).

Elkton Swamp (030402060103)

The Elkton Swamp subwatershed has a higher density of animal operation permits than any other subwatershed in the Lumber River basin with 16 Animal Operation Permits or approximately 1 for every 2.6 square miles.

Benthic macroinvertebrate sampling site IB91, located at State Road 1710 on Elkton Marsh AU #15-4-1-1-2, has consistently been rated Moderate. Intolerant taxa have remained steady but low at this location; however, the number of overall species increased considerable for this assessment. Some of the new species indicate that low dissolved oxygen levels are becoming more frequent even though dissolved oxygen was normal at the time of sampling.

Western Prong Red Hill Swamp (030402060104)

Benthic macroinvertebrate sampling site IB93, located at US Highway 701 on Western Prong Creek AU# 15-4-2, was sampled as part of a special study in 2006 to gain some knowledge about an area that lacked any biological or chemical data. The types of species at this site often inhabit water that has low dissolved oxygen level and low flow rates that exist in such ephemeral streams as Western Prong Creek. Three taxon of rare macroinvertebrates that had not previously been collected in the Lumber Basin were found here. *Telebasis byersi* collected at this site was only the seventh such collection by DWQ in the state. Also for only the second time being collected in the state was *Planorbella scalare*. While only two intolerant taxa were collected, the site was rated Moderate because of high overall diversity of species.

An animal operation permit owner was in violation in 2007 for a discharge of 180,000 gallons to Browders Branch AU # 15-4-2-3. Browders Branch flows into Western Prong Creek just before sampling site IB93. The owner was assessed a penalty of \$16,448.45 for this violation.

No samples were collected in *Slades Swamp-Red Hill Swamp subwatershed* (030402060105).

White Marsh (0304020602)

This watershed contains part of the Town of Chadbourn plus all of Whiteville and Brunswick (Figure 4-5). It has been estimated that this is the most populated watershed in the Waccamaw subbasin. There are 5 permitted NPDES wastewater dischargers with a total maximum daily flow of 4.03 MGD. It has four subwatersheds.

A large portion of this watershed is made up of forested wetlands known as White Marsh Swamp and Bouge Swamp. These wooded swamps have mainly two types of trees, Tupelo (Black Gum) and Cypress. These bottomland hardwood swamps have not been as hydrologically altered as have the pine stands because they are

FIGURE 4-3: 10 DIGIT HUCs IN THE WACCAMAW SUBBASIN

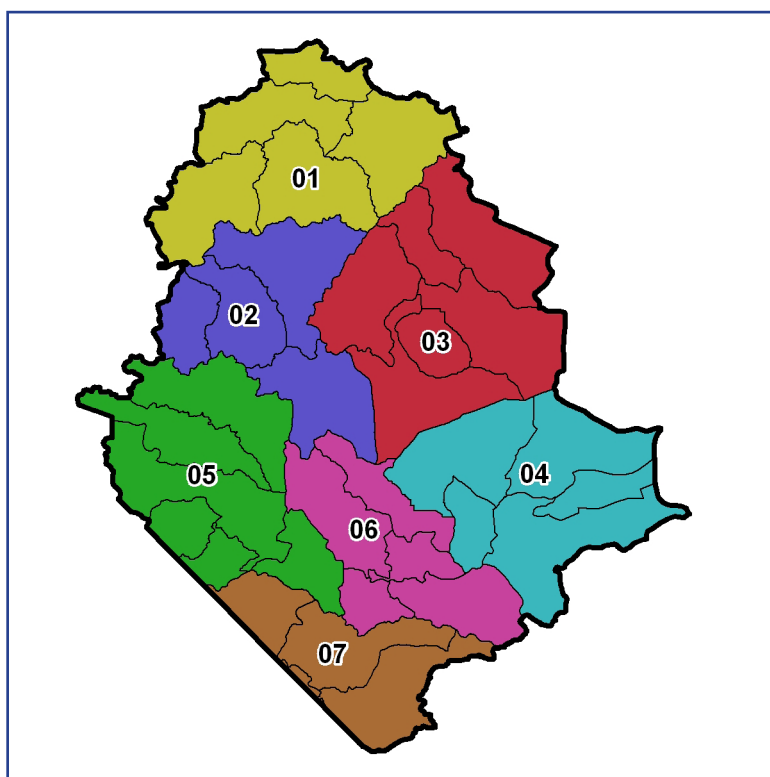
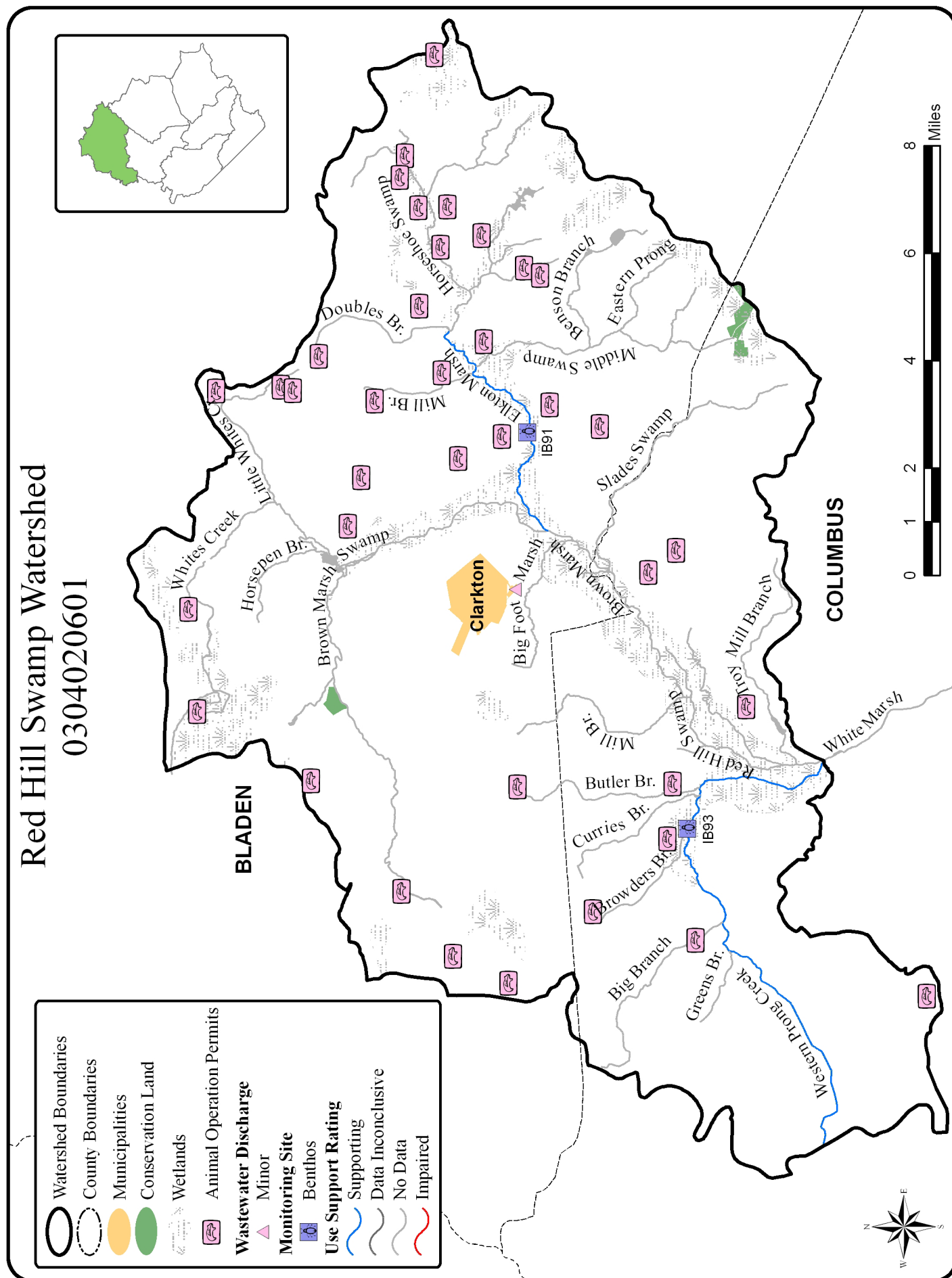


FIGURE 4-4: RED HILL SWAMP WATERSHED (0304020601)



harvested during periods of drought. During the recent droughts of 2007 and 2008 many areas throughout White Marsh Swamp and Bouge Swamp were clear-cut. It is unsure what impacts this will have on water quality in these areas. The Division of Forestry has been delegated the responsibility of monitoring forestry activities; however, no water samples are taken and land owners are not required to make notification of before logging begins. Some studies have found that nitrogen and phosphorous increase for a period of one to two years after clear-cutting (Ensign and Mallin, 2001).

No samples were collected in *Upper Soules Swamp subwatershed (030402060201)*.

Lower Soules Swamp (030402060202)

The Town of Chadbourn was awarded \$606,246 by the Construction Grants and Loan Section of DWQ from the State Revolving Fund to repair and replace 4,100 feet of wastewater collection lines near Soules Swamp (AU# 15-4-8). These funds were made available through the American Recovery and Reinvestment Act of 2009.

Town of Whiteville-White Marsh (030402060203)

In 2004, the White Marsh WWTP that services the Town of Whiteville and some of the surrounding area was awarded a grant by the CWMTF to upgrade the plant. The plant has experienced several problems over the past few year but upgrade to the facility were completed in 2009. The plant is still allowed to discharge small amounts of mercury to a waterbody that is already impaired for mercury but the limits are strict. The municipalities of Bolton and Lake Waccamaw are currently in the process of being connected to the White Marsh WWTP.

Cypress Creek-White Marsh (030402060204)

Benthic macroinvertebrate sampling site IB95, located at State Road 1001 on White Marsh AU# 15-4b, was given a bioclassification of Moderate. The 2006 biological sampling produced an increase of seven new intolerant species as well as an increase in the overall number of species. A likely cause for this improvement is due to improvements at the Whiteville WWTP.

Waccamaw River Headwaters (0304020603)

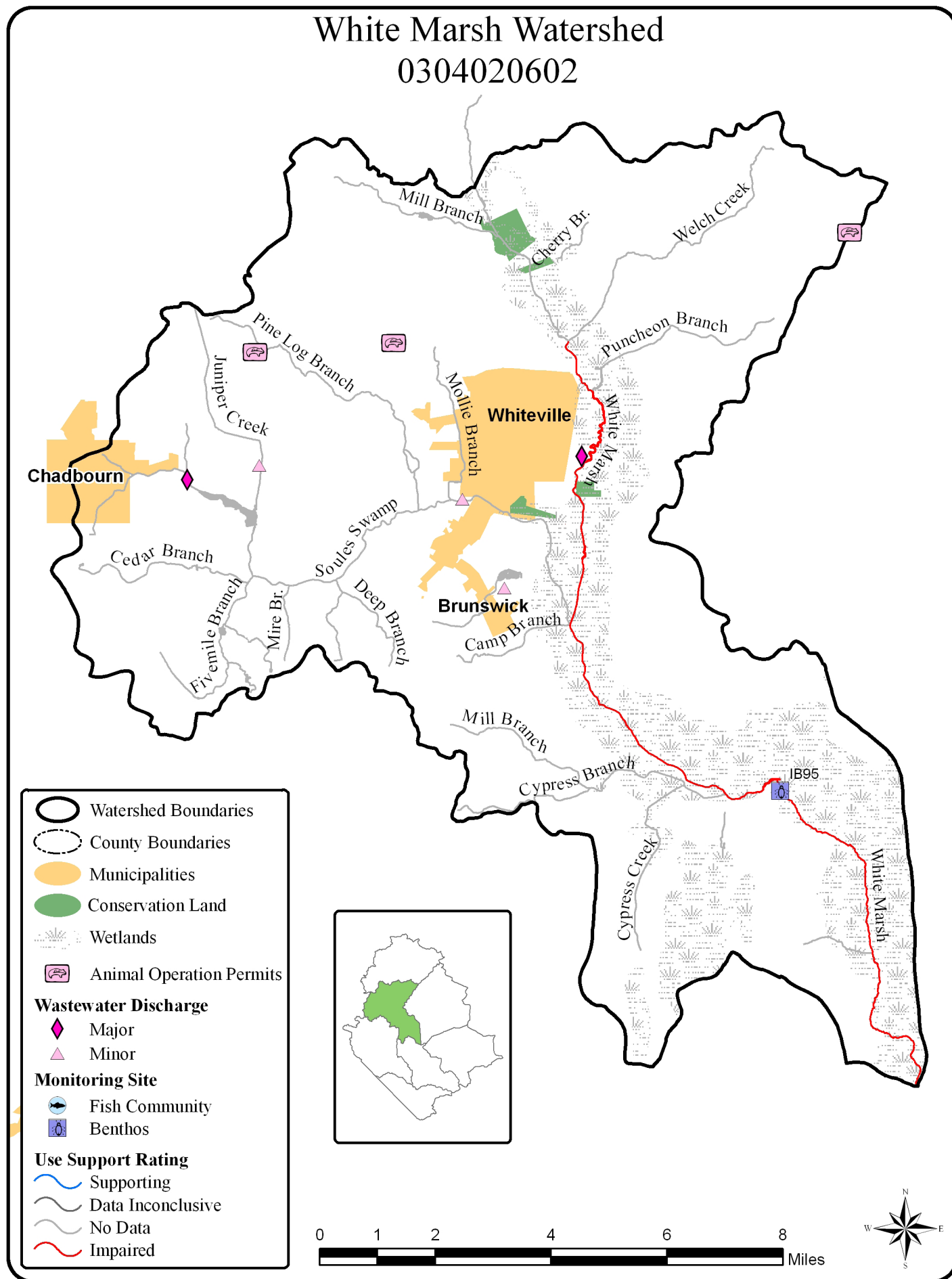
All of the subwatersheds within the Waccamaw River Headwaters watershed are either partially or completely within the Lake Waccamaw ORW Special Management Strategy Area. The Lake Waccamaw State Park and parts of the Columbus County Gameland are located in the Waccamaw River Headwater watershed. This watershed contains three endemic species of fish and two other significantly rare species of fish. In addition, there are four endemic species of mollusk that inhabit the watershed and many other rare species. It has six subwatersheds with two municipalites, Lake Waccamaw and Bolton (Figure 4-7).

Sassapan Branch-Boggy Swamp (030402060301)

This entire watershed is part of the Lake Waccamaw ORW Special Management Strategy Area. The Lake Waccamaw ORW Special Management Strategy states that all waters that drain to Lake Waccamaw be treated as though they are classified as ORW in order the protect the lake. These waterbodies were not classified as ORW because they have not been rated Excellent for bioclassification, which is required by the state of North Carolina to be reclassified as HQW or ORW.

Benthic macroinvertebrate sampling site IB77, located at State Road 1740 on Friar Swamp AU# 15-2-6-3, has been sampled six times in the past thirteen years. It was sampled four times between 1996 and 1999 to serve as a reference site in the creation of the Swamp Waters sampling criteria for Swamp Region S. All six samples taken from Friar Swamp dating back to 1996 were rated Natural suggesting that water quality is very stable here. Downstream from this point water flows into the Columbus County Gameland which is under the management of the North Carolina Wildlife Resources Commission.

FIGURE 4-5: WHITE MARSH WATERSHED (0304020310)



Slap Swamp (030402060302)

This entire subwatershed is part of the Lake Waccamaw ORW Special Management Strategy Area. Slap Swamp AU # 15-2-6-4 is partially buffered by the Columbus County Gameland.

Green Swamp-Big Creek (030402060303)

This subwatershed contains both the Town of Bolton and Town of Lake Waccamaw. It is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040206020040). Almost 8 square miles of this subwatershed are preserved by the Columbus County Gameland. This entire subwatershed is in the Lake Waccamaw ORW Management Strategy Area.

Big Creek AU # 15-2-6 is impaired for excessive level of mercury discovered in fish tissue samples, but is not on the 303(d) list because a TMDL for mercury has been completed.

Lake Waccamaw (030402060304)

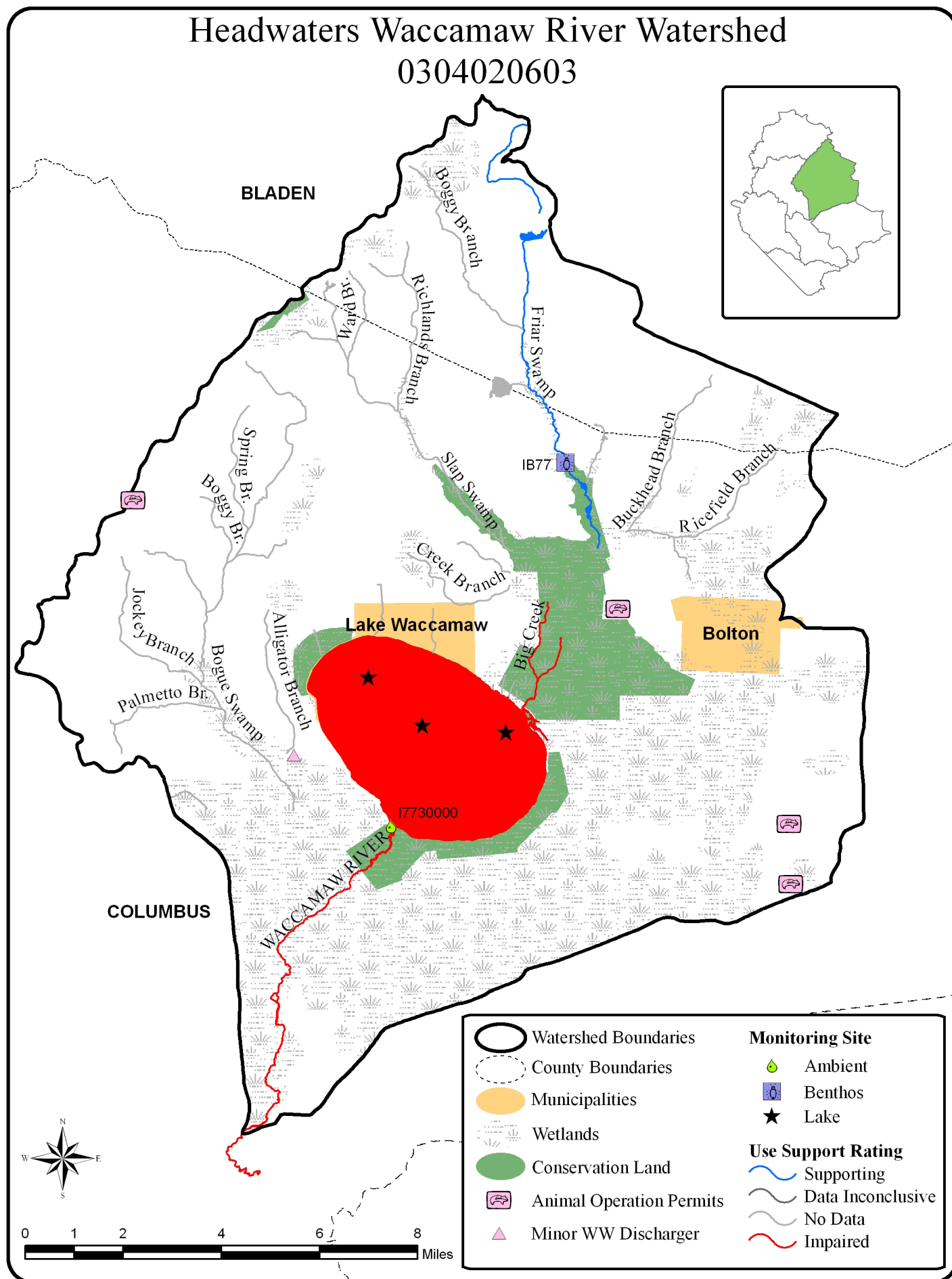
This subwatershed is covered mainly by Lake Waccamaw and the only part outside of the lake is in the Lake Waccamaw State Park on the southeastern shore of the lake. The entire subwatershed is part of the EEP Targeted Local Watershed (030402060040) and is considered by the North Carolina Natural Heritage Program to be of national significance.

Lake Waccamaw AU# 15-2 is supplementally classified as an ORW due to high water quality, high recreational value, and because it provides habitat for many rare and endemic species. The shoreline along the Lake Waccamaw State Park is supplementally classified as a Unique Wetland. There are three species of fish, the Waccamaw Silverside, Waccamaw Darter, and Waccamaw Killfish which are endemic to Lake Waccamaw. The Waccamaw Silverside is currently on the Federal Threatened Species list. Two species of significantly rare fish, the Carolina Pygmy Sunfish and Broadtail Madtom, also inhabit the lake. At least twenty-six species of mollusk live in the lake including four endemic species, the Waccamaw Spike, Waccamaw Fatmucket, Waccamaw Amnicola, and Waccamaw Siltsnail. Most Carolina bays have very low pH levels brought on by tannic acid

FIGURE 4-6: PHOTOGRAPH OF LAKE WACCAMAW



FIGURE 4-7: HEADWATERS WACCAMAW RIVER WATERSHED (0304020603)



leaching from organic matter and slow flows, however, Lake Waccamaw has a neutral pH because it receives groundwater from the Pee Dee Aquifer and shallow groundwater filtered through a limestone bluff (Riggs, et al, 2000).

The lake was placed on the 303(d) list in 2006 due to fish tissue samples that showed excessive levels of mercury. Mercury levels are a significant problem throughout the entire Lumber River Basin and is not reflective of a point source. There is an EPA National Atmospheric Deposition Program (NADP) monitoring site located at the Lake Waccamaw State Park that records mercury deposition levels next to the lake. Since the closure of a chlor-alkali plant near Regielwood in October 2000, there has been a decrease in atmospheric deposition at the NADP site. For more information on Mercury see Appendix G.

Bogue Swamp (030402060305)

Almost this entire subwatershed is one big forested swamp that is harvested by the timber industry. The western half of the subwatershed was hydrologically altered beginning in the 1930's in order to plant pine stands.

Boggy Swamp-Waccamaw River (030402060306)

Cove Swamp is a 440 acre crescent shaped wetland on the northeast side of Lake Waccamaw, which was once part of the lake before an artificial canal and ridge were constructed in 1946. This swamp includes an Unnamed Tributary near Artesia AU# 15-2-1 and is still connected at some locations to the lake. In 2007, a grant of \$350,000 was awarded by the CWMTF to the NC Division of Parks and Recreation to help fund the purchase of this swamp. The Parks and Recreation Trust Fund supplied \$300,000 and the remaining \$50,000 needed to purchase Cove Swamp was raised by the Nature Conservancy through private donations. The swamp will be added to the Lake Waccamaw State Park.

The Cove Swamp Canal has been experiencing chronic problems with aquatic weeds. This canal was treated for Alligatorweed, Duckweed, and Parrotfeather in 2009 as part of the Division of Water Resources Aquatic Weed Control Program.

Boggy Swamp-Waccamaw River subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040206020040).

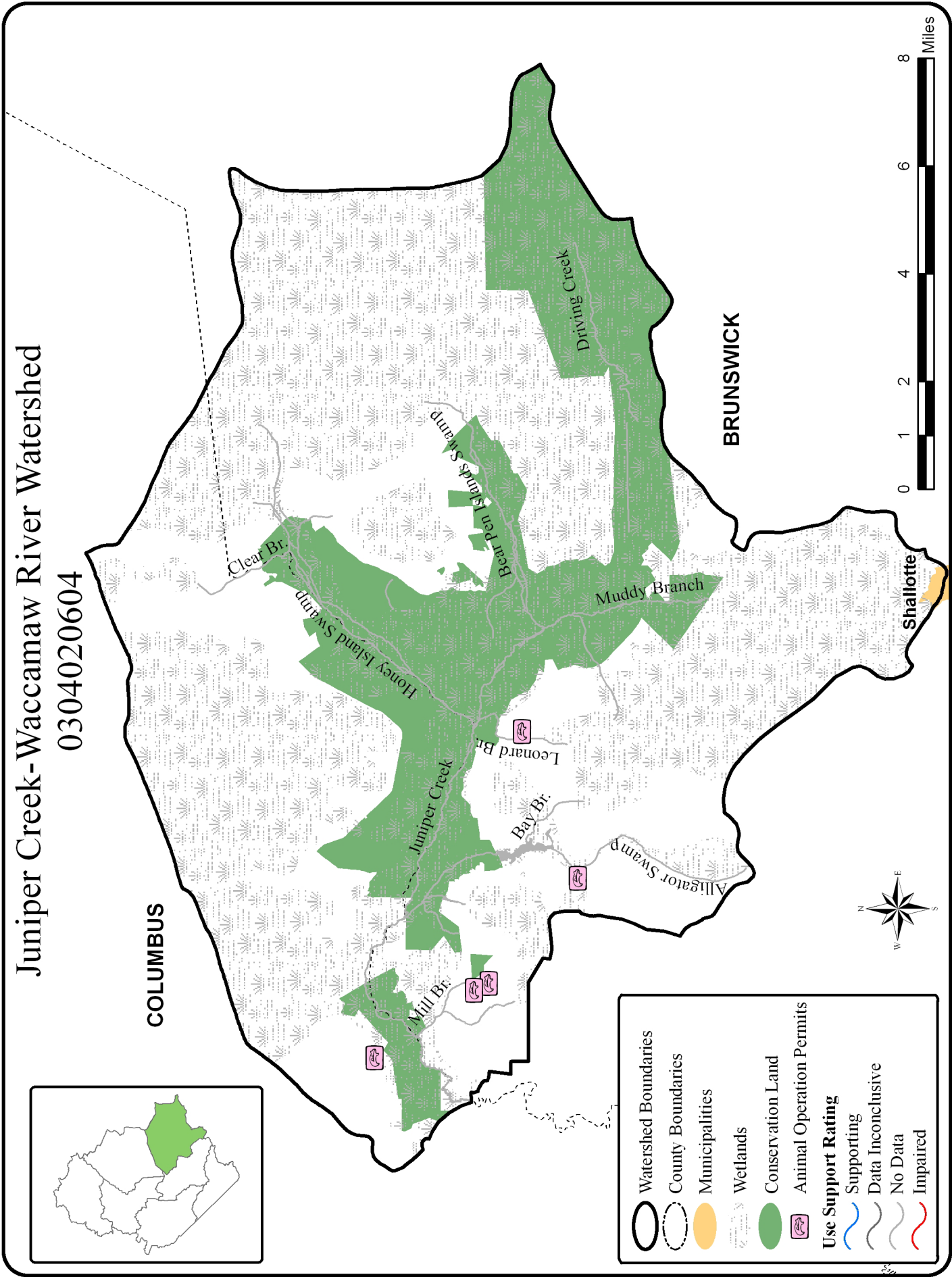
Juniper Creek-Waccamaw River (0304020604)

This entire watershed was selected as a Targeted Local Watershed (03040206030010) by Ecosystem Enhancement Program in 2003. It was chosen because of its extensive area of rare plant and animal habitats. This watershed is over 37 percent wetlands, over 38 percent forested, and almost 13 percent grasslands according the 2001 National Land Cover Dataset. Less than 10 percent of the watershed is dedicated to agricultural use and there is very little developed area. This watershed is important to the timber industry, as well as, wildlife.

Recently, the Nature Conservancy purchased lands along Driving Creek, Muddy Branch, Little Muddy Branch, Bear Pen Island Swamp, Honey Island Swamp, Leonard Branch, Alligator Swamp, and Juniper Creek. This purchase, which was transferred to the NC Wildlife Resource Commission, added over 29 square miles of conservation land to this watershed. The Nature Conservancy now manages over 10 square miles of the watershed and the NC Wildlife Resource Commission manages another 31.37 square miles. Over 25 percent of this watershed is in conservation and with the exception of about 2 miles of Juniper Creek there is a continuous preserve from the Green Swamp to the Waccamaw River (Figure 4-8). The remainder of this watershed is mainly used by the forestry industry.

No samples were collected in *Bear Pen Island Swamp subwatershed (030402060401)*, *Honey Island Swamp subwatershed (030402060402)*, *Upper Juniper Creek subwatershed (030402060403)*, or *Alligator Swamp subwatershed (030402060404)*.

FIGURE 4-8: JUNIPER CREEK-WACCAMAW RIVER WATERSHED (0304020604)



Lower Juniper Creek (030402060405)

Myrtle Head Savanna, which is owned by The Nature Conservancy, is supplementally classified as a Unique Wetland. This longleaf pine savanna supports the largest and one of the few remaining populations of Cooley's Meadowrue, a federally listed endangered plant species. This Unique Wetland also supports many other rare plant species.

Seven Creeks (0304020605)

There are 10 permitted animal operations throughout the six subwatersheds of Seven Creeks watershed. This watershed encompasses most of Tabor City including its WWTP which has a maximum daily flow of 1.1 MGD (Figure 4-9). The Tabor City WWTP has had numerous violations in the past few years for mercury, chlorine, BOD, and dissolved oxygen. During a recent inspection, problems with the operation of this plant were noted and DWQ is currently working with the WWTP operators to correct these problems. This is the only permitted wastewater discharger in the watershed.

No data was collected in *Gum Swamp subwatershed (030402060501)*.

Monie Swamp Headwaters (030402060502)

In 2005 and 2007, the planning and construction phases of the Ecosystem Enhancement Program's Mill Branch Project were completed. The project restored 3,500 feet of and preserved 1,750 feet of an Unnamed Tributary of Mill Branch AU # 15-17-1-12-1-6-1. In addition, 37.3 acres of wetlands were preserved along the drainage.

No data was collected in *Toms Fork subwatershed (030402060501)*.

Juniper Swamp (030402060504)

Benthic macroinvertebrate sampling site IB83, located at State Road 1141 on Juniper Creek AU# 15-17-1-11 near the confluence with Grissett Swamp AU# 15-17-1-(5), changed only slightly since first sampled in 2001. This is a highly braided stream with very low flows in the summer months. The low flows and corollary low DO results in a high proportion of organisms that can tolerate low dissolved oxygen levels.

Monie Swamp-Grissett Swamp (030402060505)

Lake Tabor AU# 15-17-(1)b, a man-made lake, was built in 1952. Its dam was breached in 1996 during Hurricane Fran and was rebuilt in 2000. Lake Tabor is a small shallow lake covering approximately 126 acres. Most of the lake is unbuffered with 50 to 75 percent of the shoreline developed as residential housing. The lake was last sampled in 2006 as part of the Lake and Reservoir Assessment and was found to be experiencing eutrophication throughout the lake. Chlorophyll a samples taken in July and August of 2006 exceeded the state water quality standard of 40 ug/l. The lake has been plagued by aquatic weeds which are currently being controlled using multiple methods including chemical herbicides, mechanical harvesting, and stocking the lake with Grass Carp.

In April of 2003, the Environmental Science Section of DWQ reported a fish kill of 400 fish including bluegill, warmouth, flier, and chubsuckers in Lake Tabor. Low dissolved oxygen levels were detected below the lake surface possibly brought on by decomposing vegetation. Again in April of 2005, a fish kill of 300 fish including sunfish, crappie, catfish, and bass was reported. Subsequent water quality sampling detected Chlorpyrifos (Dursban), an organophosphorus pesticide banned for most residential use in 2000, in the lake. This chemical is known to be toxic to fish, aquatic invertebrates, small mammals, birds, and bees. The label states that, "Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas." Dursban is now approved only for specific agricultural uses, but still poses a threat to aquatic organisms and human health.

Grissett Swamp-Seven Creeks (030402060506)

Total Kjeldahl Nitrogen levels in samples taken from ambient monitoring site I9310000, located on Seven Creeks AU # 15-17, ranged from 0.46 to 2.8 mg/L with a median of 0.94 mg/L. However, ammonia levels are normal so most of this is organic nitrogen which is not readily bioavailable.

FIGURE 4-9: SEVEN CREEKS WATERSHED (0304020605)

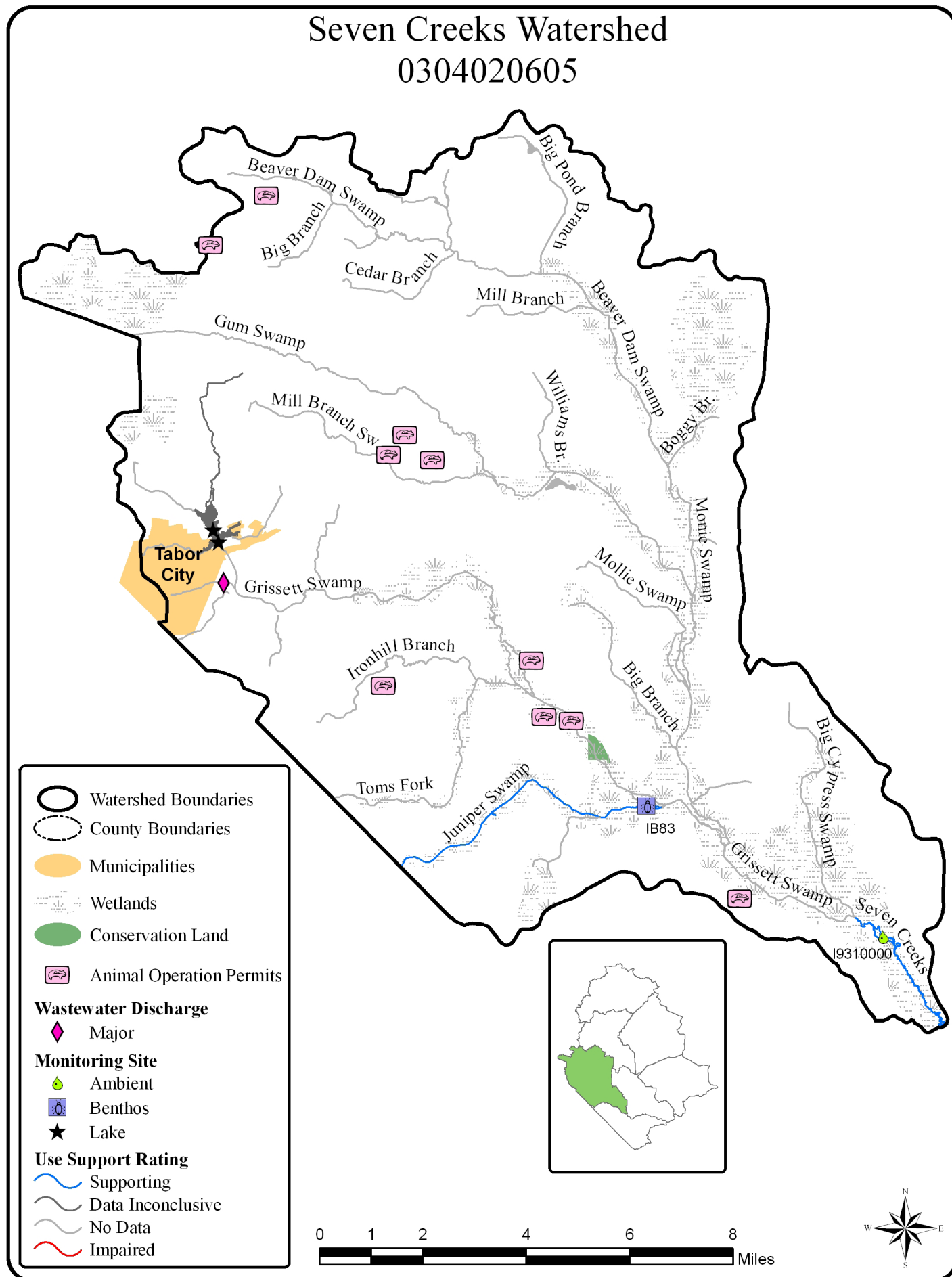
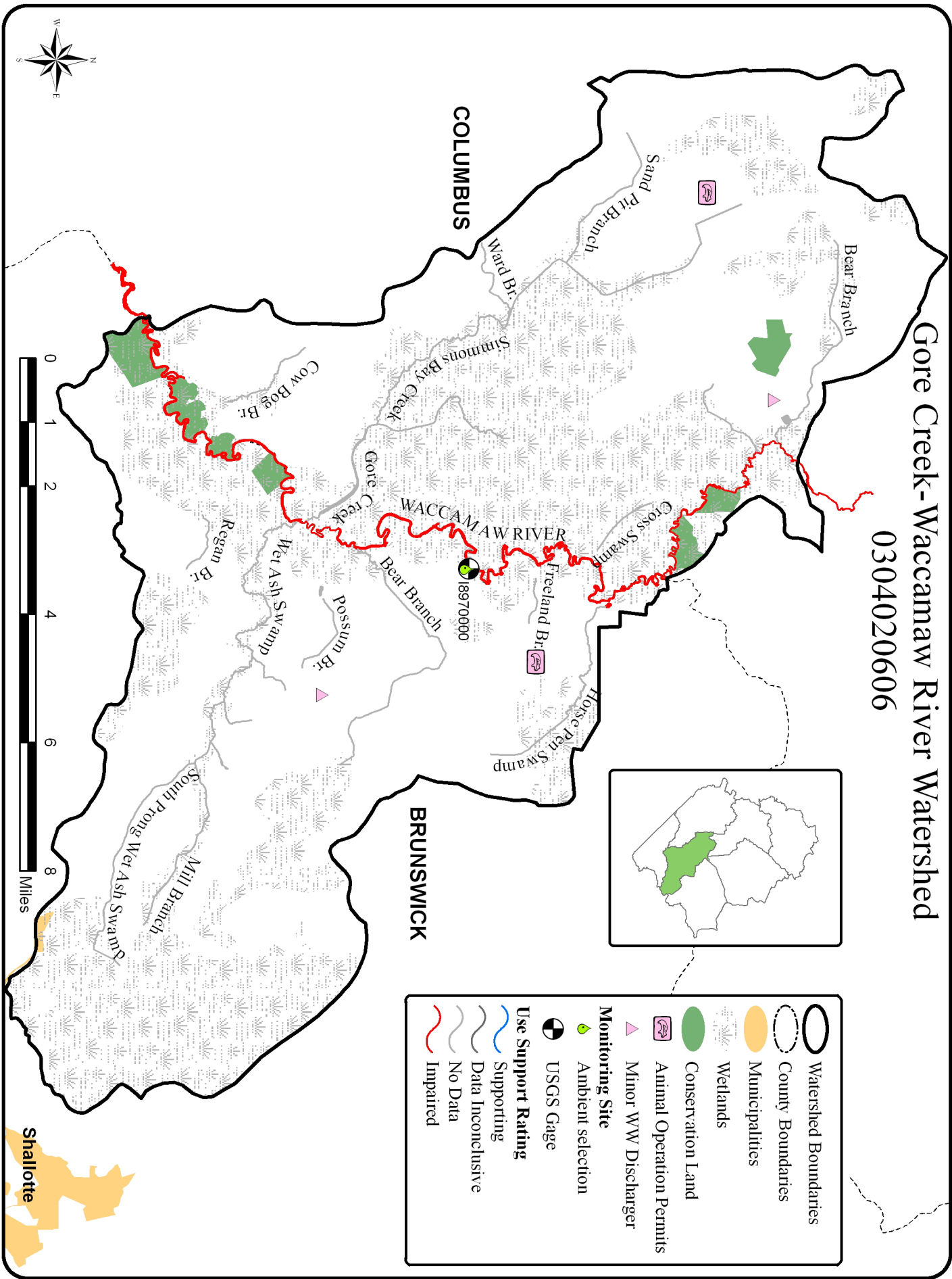


FIGURE 4-10: GORE CREEK-WACCAMAW RIVER WATERSHED (0304020606)



Gore Creek (0304020606)

This rural watershed has 2 minor NPDES wastewater dischargers that have a combined permitted maximum daily flow of 0.0107 MGD (Figure 4-10). There are also 2 animal operation permits in the watershed. There are four separate Columbus County Gameland tracts that provide buffers along portions of the Waccamaw River.

Horse Pen Swamp-Waccamaw River (030402060601)

The portion of this subwatershed to west of the Waccamaw River is the EEP's TLW (03040206010070) the portion to the east of the river is in EEP TLW(03040206030010).

Old Dock Savanna, which is owned by The Nature Conservancy, is supplementally classified as a Unique Wetland. Old Dock Savanna is underlain with limestone. Typical pine savannas have a low pH and are very acidic, whereas limestone-influenced savannas like Old Dock have a higher pH. Called marl savannas, these rich plant areas have an infusion of nutrients not available in more acidic habitats. The savanna at Old Dock is dominated by pond pine, with an open shrub layer of titi, black gum, myrtle-leaf holly, and bayberry. Scattered among the shrubs are dense patches of herbs, including a diverse assemblage of carnivorous plants, grasses, sedges, and wildflowers.

Gore Lake-Gore Creek (030402060602)

This subwatershed is part of EEP's Targeted Local Watershed (03040206060010).

Wet Ash Swamp (030402060603)

Wet Ash Swamp AU # 15-14 has been selected as a random ambient monitoring site for the 2009-2010 cycle. There is one NPDES wastewater discharger in this watershed with a permitted maximum daily flow of 5,700 gallons/day.

Bear Branch-Waccamaw River (030402060604)

Total Kjeldahl Nitrogen (TKN) levels in samples taken from ambient monitoring site I8970000, from the Waccamaw River AU # 15-(1)d, ranged from 0.51 to 2.1 mg/L with a median of 1 mg/L. This is much higher than the TKN found upstream at ambient monitoring site I7730000, which ranged from 0.2 to 0.78 mg/L. However, the median 1 mg/L is less than the 1.25 mg/L median reported for downstream ambient monitoring site I9350000. Since ammonia levels at this site are normal it suggest that most of the nitrogen is organic and therefore not readily bioavailable.

Regan Branch-Waccamaw River (030402060605)

The portion of this subwatershed to the west of the river is part TLW(03040206060010) and the portion to the east of the river is part of TLW(03040206050010). On September 9, 2008 the NC Coastal Land Trust purchased 296 acres in Columbus County along four miles of the Waccamaw River AU # 15-(1)e.

Buck Creek (0304020607)

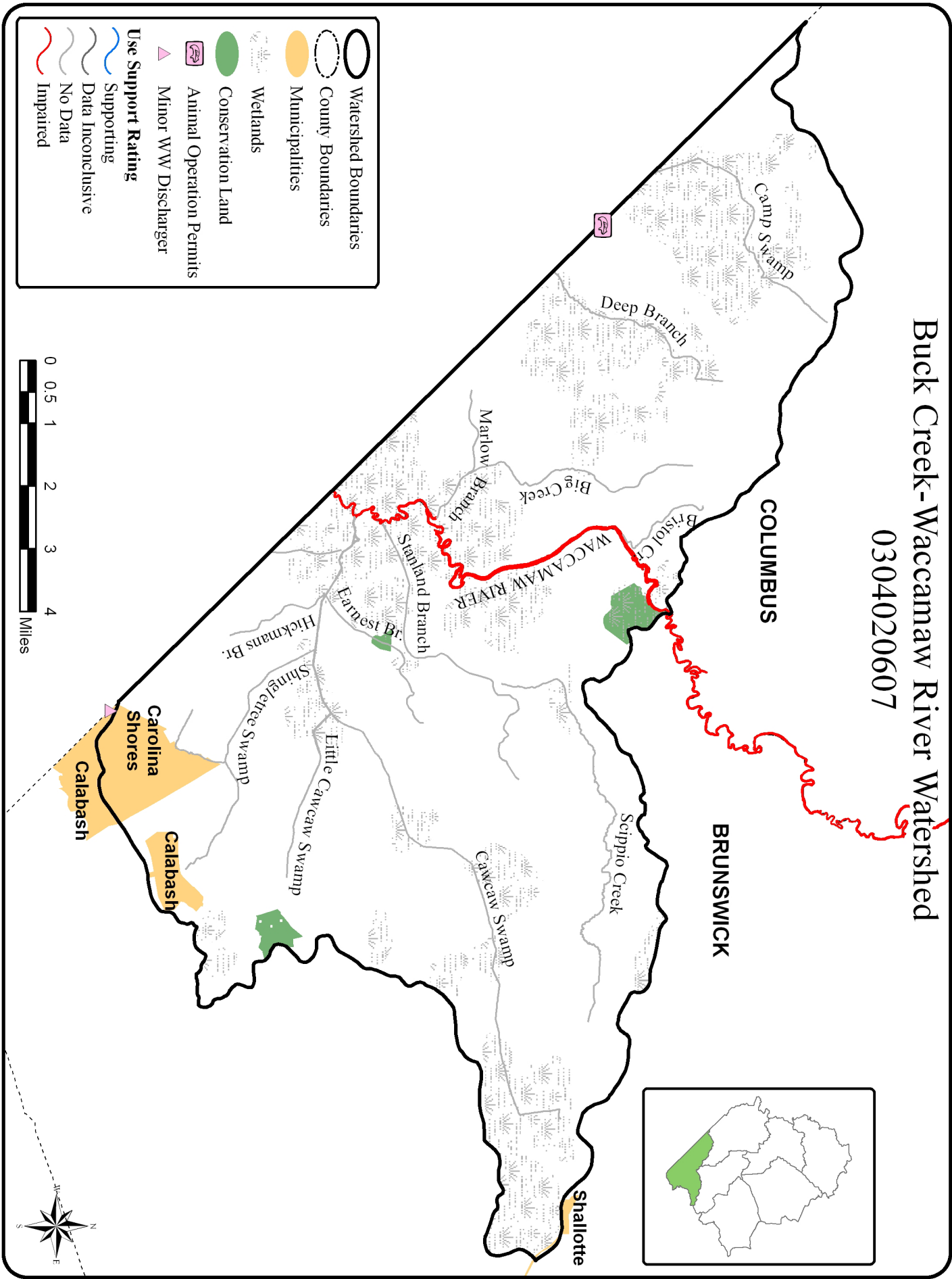
Buck Creek watershed contains part of the municipalities of Carolina Shores and Calabash (Figure 4-11). There is one permitted NPDES wastewater discharger with a maximum daily flow of 0.53 MGD and one animal operation permit.

Cawcaw Swamp (030402060701)

Persimmons Swamp AU # 15-23-2-1 is the receiving stream for the Carolina Shores WWTP. Eventually this discharger should be merged with another facility within the southwestern Brunswick County wastewater district.

The North American Land Trust manages an 82 acre conservation easement near the headwaters of Little Cawcaw Swamp AU # 15-23-1. This easement protects natural communities such as Longleaf Pine-Wiregrass, Pine Flatwoods, and significant wetland areas supporting good populations of yellow and purple pitcher plants.

FIGURE 4-11: BUCK CREEK-WACCAMAW RIVER WATERSHED (0304020607)



Big Creek-Waccamaw River (030402060702)

Part of the portion of this subwatershed to the east of the river is part of the EEP's TLW (03040206050010) and the entire western portion is in TLW (03040206090010).

Buck Creek subwatershed (030402060703)

Most of this subwatershed is in South Carolina; just under 2 square miles are in North Carolina. DWQ collected ambient water samples from this subwatershed in South Carolina until September 2003 when it was discontinued.

Bellamy Branch-Waccamaw River (030402060704)

The portion of this subwatershed to the west of the Waccamaw River is part of Targeted Local Watershed (03040206090010).

Incentive Programs

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. A list of CWMTF Grants that have been funded through 2007 is provided in Table 4-2.

TABLE 4-2: CWMTF GRANTS FUNDED FROM 1997 THROUGH 2007 IN THE WACCAMAW WATERSHED*

PROJECT ID	APPLICANT	PURPOSE	AMOUNT FUNDED	TOTAL COST
1997A-117	Town of Tabor City	Wastewater	\$570,000	\$600,000
1998A-508	Town of Chadbourn	Wastewater	\$1,312,000	\$1,640,750
2000B-007	The Nature Conservancy	Buffer Acquisition	\$84,000	\$1,549,450
2000B-705	Town of Lake Waccamaw	Stormwater	\$4,500,000	\$4,836,000
2001B-022	The Nature Conservancy	Buffer Acquisition	\$290,000	\$365,250
2001B-040	NC WRC	Buffer Acquisition	\$900,000	\$1,312,950
2003A-503	Town of Clarkton	Wastewater	\$185,000	\$210,000
2004A-506	Town of Lake Waccamaw	Wastewater	\$145,000	\$605,800
2004A-513	City of Whiteville	Wastewater	\$2,625,000	\$6,300,000
2006A-018	The Nature Conservancy	Buffer Acquisition	\$8,324,584	\$20,758,495
2006A-601	Town of Bolton	Wastewater	\$2,065,600	\$5,339,000
2006A-532	Town of Tabor City	Wastewater	\$420,000	\$1,050,000
2006S-004	Town of Tabor City	Minigrant - Stormwater	\$50,000	\$55,000
2007-025	NC Coastal Land Trust	Buffer Acquisition	\$486,000	\$729,304
2007-039	NC Div. of Parks and Recreation	Buffer Acquisition	\$350,000	\$700,000
TOTAL	--	--	\$22,257,184	\$39,751,999

*Does not include statewide or regional grants.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

TABLE 4-3: BMP INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BMP IMPLEMENTED	AMOUNT	UNITS	COST
Long Term No-Till	470	Acres	\$58,009
Sod-Based Rotation	50	Acres	\$4,770
Cropland Conversion - Grass	612	Acres	\$130,752
Cropland Conversion - Trees	349	Acres	\$30,456
Field Border	28	Acres	\$26,660
Trough or Tank	6	Units	\$8,090
Livestock Exclusion	27,420	Feet	\$15,032
Stream Crossing	32	Units	\$2,457
Incinerater	6	Units	\$23,422
TOTAL	--	--	\$299,648

Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 4-3 shows the number of projects implemented and in the Waccamaw Subbasin and the dollar amount invested. Table 4-4 shows the water quality benefits realized from that investment.

TABLE 4-4: BENEFITS RESULTING FROM BMPs INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BENEFITS	AMOUNT	UNITS
Acres Affected	2,146	Acres
Soil Saved	5,356	Tons
Nitrogen Saved	88,405	Pounds
Phosphorous Saved	30,624	Pounds
Waste - Nitrogen Managed	158,948	Pounds
Waste - Phosphorus Mananged	138,450	Pounds

Recommendations

Stormwater regulation is essential to preventing pollution from reaching waterbodies. It is more expensive to retrofit developed areas with stormwater controls than to install them during the initial development. It is recommended that local governments consider developing and implementing stormwater management regulations as soon as possible.

Since the last basinwide plan there have been many achievements in conserving lands that protect water quality and provide habitat. There remain many unprotected areas with nationally significant ecosystems and good water quality in need of conservation. The continued purchase of easements and preserves is encouraged especially in the White Marsh and Waccamaw River floodplains.

There is a need for increased water quality monitoring in this subbasin. There are many areas for which there is no recent, reliable data to make an assessment. This may be achieved in part through the implementation of citizen water quality monitoring programs such as the Muddy Water Watch Program and the Waccamaw River Volunteer Monitoring Program.

Further studies on evaluating water quality of streams classified as Swamp Waters are needed to better assess this subbasin. Since 100 percent of the waters in the subbasin are classified as Swamp Waters, more information on their characteristics will allow for better evaluation of the subbasin's health.



Chapter 5

Long Bay Subbasin

Part of Hydrologic Unit Code: 03040208

General Description

Long Bay subbasin is located entirely within the Brunswick County borders (Figure 5-1). It lies mainly in the poorly drained flatwoods ecoregion of the coastal plain but also has barrier islands, coastal marshes, and swampy peat lands. Most of the barrier islands that line the coast have been completely developed with one exception. Bird Island was purchased by the state of North Carolina and added to the National Estuary Research Reserve. This area serves as one of North Carolina's biggest vacation destinations.

Current Status and Significant Issues

There are only two remaining NPDES discharge permits in this subbasin both of which are oyster processing facilities on the Shallotte River. All the facilities that treat wastewater in the subbasin have non-discharge permits and utilize infiltration ponds and spray fields. The treated water is usually sprayed on one of the many golf courses in the area.

The Lockwoods Folly Water Quality Management Plan (15A NCAC 02B.0227) places tighter water quality standards on the Lockwoods Folly River South of Genoes Point and Mullet Creek. Assessment units subject to these rules are denoted in Appendix B Use Support Tables by an @ symbol.

The Division of Coastal Management is currently reviewing CAMA Land Use Plan drafts for Brunswick County, Calabash, Holden Beach, Ocean Isle Beach and Shallotte as required by 15A NCAC 07B. There is a certified plan for Varnamtown. These plans should stress strong support for low impact development, stormwater controls and conservation easements in order to protect and restore water quality.

New coastal stormwater rules known as Session Law 2008-211 went into effect on October 1, 2008 place stricter stormwater standards on Brunswick County and 19 other coastal counties. Upon implementation, these rules should reduce fecal coliform bacteria from future developments. Further reduction for existing development is needed to ensure the survival of the shellfishing and tourism industries in Brunswick County.

This area contains limestone formations called karst that are susceptible to sinkhole development which creates engineering hazards. Rainwater mixes with carbon dioxide in the air to make carbonic acid that slowly dissolves the limestone creating either a depression or an underground cave. This is hazardous to both domestic and commercial development and can lead to costly damages. These hazards increase if stormwater is allowed to flow through such formations increasing the weathering effects.

Watershed at a Glance

COUNTIES

Brunswick

MUNICIPALITIES

Boiling Spring Lakes, Bolivia, Calabash, Carolina Shores, Holden Beach, Saint James, Shallotte, Sunset Beach Varnamtown

PERMITTED FACILITIES

NPDES Wastewater Discharge

Major:	0
Minor:	2

NPDES Nondischarge:	8
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NPDES Stormwater

General:	22
State:	157

Animal Operations:	3
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AQUATIC LIFE SUMMARY

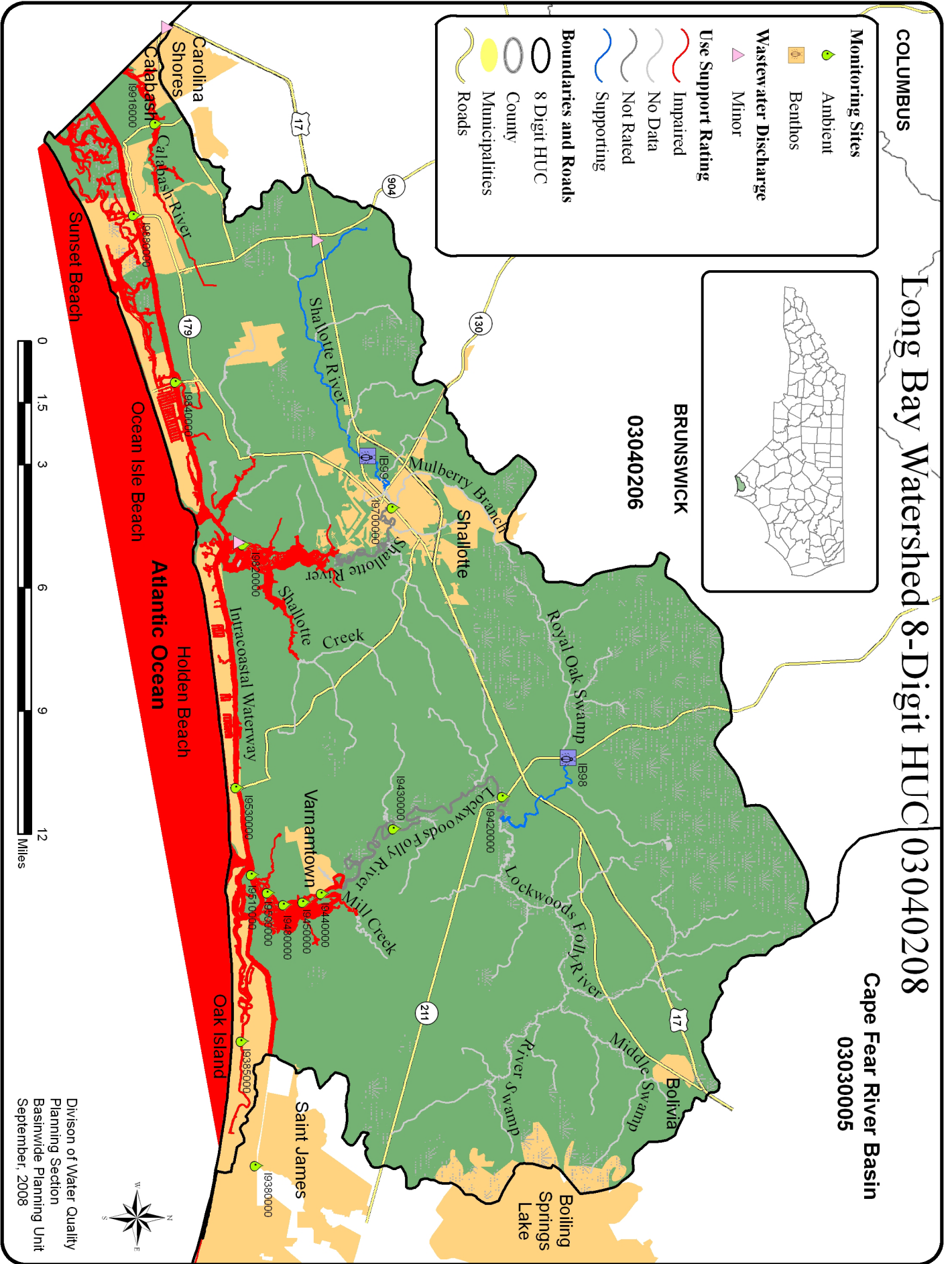
Monitored:	26 Miles
	1,640 Acres

Total Supporting:	13 Miles
	1,305 Acres

Total Impaired:	13 Miles
	411 Acres

Total Not Rated:	0 Miles
	0 Acres

FIGURE 5-1: LONG BAY/COASTAL CAROLINA SUBBASIN (03040208)



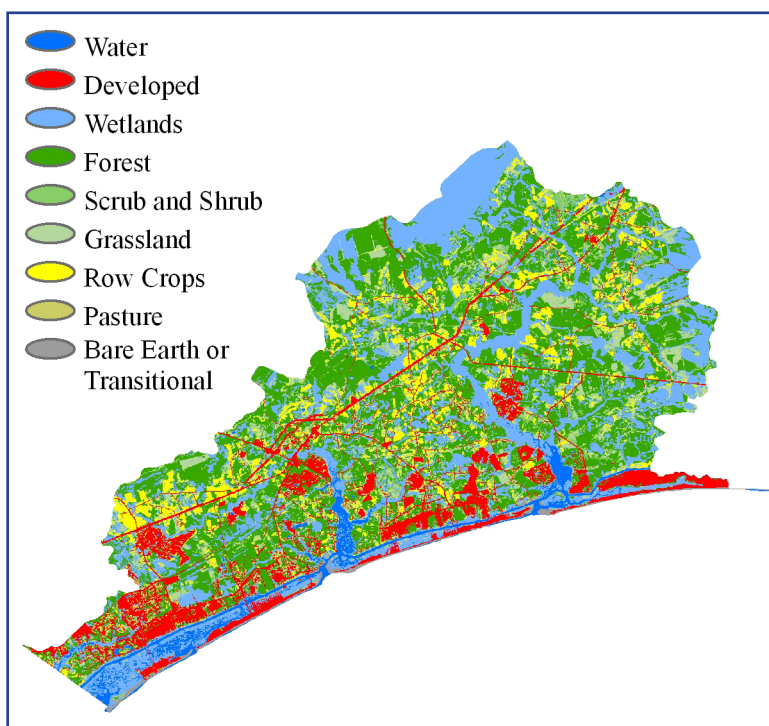
Salt water intrusion can create problems for people who obtain their water from groundwater aquifers. If groundwater aquifers become contaminated with saline water, then it places greater strain on surface water supplies.

Population and Land Use

Population for this subbasin is estimated at 34,632 or 137 people per square mile based on the 2000 census. However, Brunswick county has been one of the fastest growing counties in the nation in recent years. In addition to the growing permanent population, the US census does not account for seasonal population changes related to vacation homes and tourism. Even without adjusting for seasonal population this is still the most densely population subbasin in the Lumber River basin.

The amount of developed land in this subbasin based on 2001 data is over 12 percent. It is the most impervious subbasin in the Lumber River basin. This area has experienced very rapid growth since 2001 and much more development has been planned so the amount of land currently developed is probably greater than 12 percent. Forest remains the dominant land cover at over 34 percent, while wetlands are second at over 26 percent of the land cover (Figure 5-2).

FIGURE 5-2: LONG BAY SUBBASIN LAND USE BASED ON THE 2001 NATIONAL LAND COVER DATASET



Ambient Water Quality

There are no freshwater ambient monitoring sites in the subbasin; however 15 saltwater sites were sampled. Six of these ambient sites were dropped in July of 2002. All active ambient monitoring site in the Long Bay subbasin exceeded at least one water quality standard. The most common exceedance was dissolved oxygen with six sites below the standard. Fecal coliform counts exceeded the screening criteria at five locations including the Calabash River which exceeded the shellfish standard of 43 colonies/100 mL over 86 percent of the time. Other parameters exceeded consist of low pH, turbidity, and copper. With only two discharge permits and little agriculture, the most likely cause of ambient standards exceedances is stormwater runoff.

General Biological Health

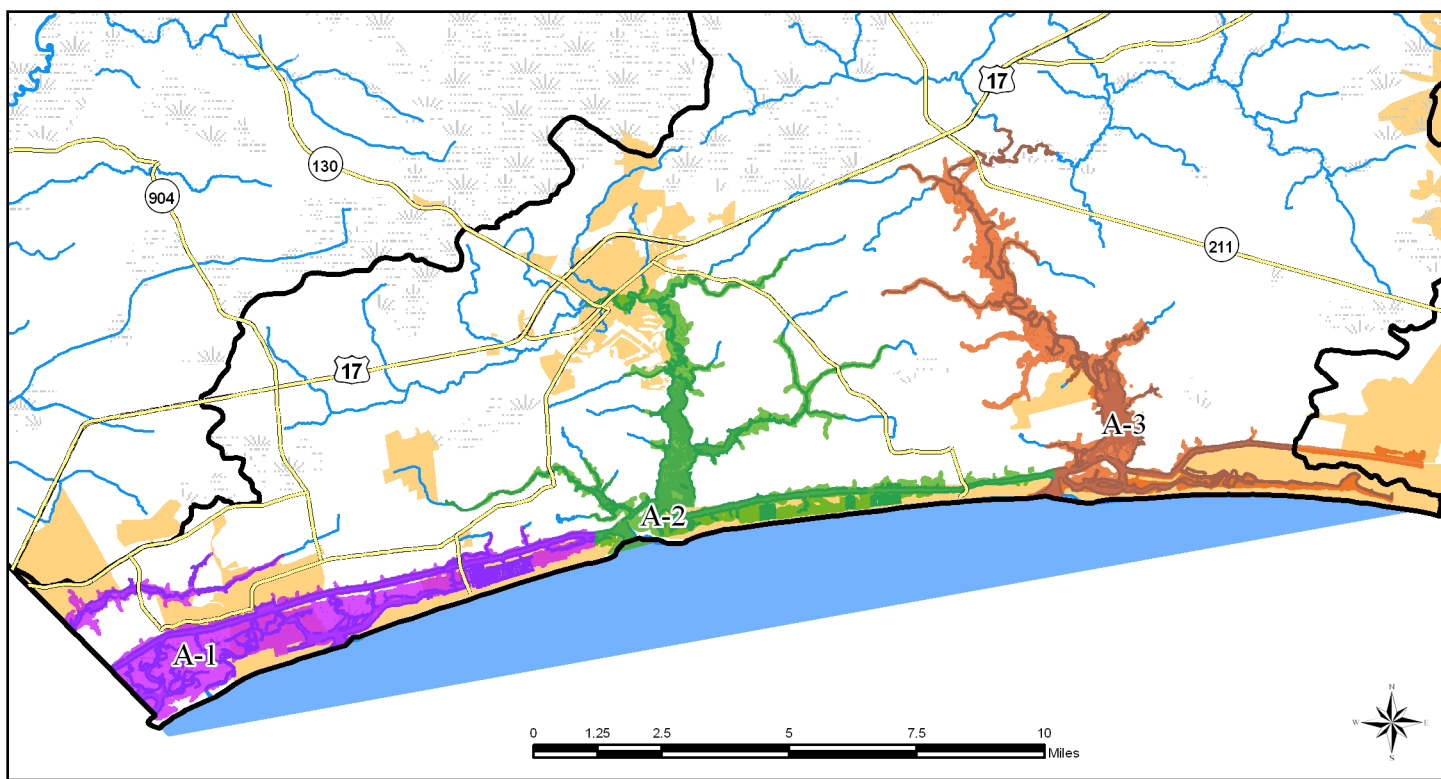
There is a lack of freshwater biological data from the watershed to determine the overall biological health in the subbasin. Only two stations were sampled for benthic macroinvertebrates during the assessment period. One station received a Natural bioclassification rating while the other was rated Good-Fair. The benthic sites for the Shallotte River and Lockwoods Folly River near US Highway 17 have been removed from regular sampling because of saltwater intrusion. Another benthic site in the headwater of Lockwoods Folly was not sampled in 2001 or 2006 due to insufficient flow. Many of the smaller tributaries have no flow in the summer thus benthic macroinvertebrate sampling is often done in the winter.

Division of Environmental Health Recreational Water Quality Program

The N.C. Recreational Water Quality Program began testing coastal waters in 1997. This program tests 40 swimming sites in the Long Bay watershed for enterococcus bacteria and issues swimming advisories in order to protect human health. Most recreational monitoring sites are tested on a weekly basis during the swimming

season, which runs from April 1 to October 31. DEH divides these site into 3 tiers with tier 1 having the most strict standards because they are used most frequently by swimmers. There were 7 swimming advisories proclamations in the basin between 2002 and 2008. Two of these advisories were basinwide and were associated with hurricanes. All waterbodies assessed for recreation are considered Supporting.

FIGURE 5-3: SHELLFISH GROWING AREAS IN THE LUMBER BASIN



Division of Environmental Health Sanitary Shellfish Program

The North Carolina State Division of Environmental Health (DEH) is responsible for classifying coastal waters as to their suitability for shellfish harvesting, monitoring and issuing advisories for shellfish closures. DEH assess the level of enterococcus or fecal coliform bacteria in the water column. These bacteria are found in the intestines of warm-blooded animals. While they do not cause illness themselves, scientific studies indicate that enterococci and fecal coliform bacteria may indicate the presence of other disease-causing organisms. As the area has grown and stormwater runoff has increased the status of growing areas are trending toward conditionally approved closed or prohibited. There are three shellfish growing areas located entirely or partially within the Long Bay watershed (Figure 5-3). All waters classified as SA in the watershed are considered impaired for shellfish harvesting due to high bacteria levels from stormwater runoff.

Growing Area A-1

Area A-1 extends from the state border to channel marker #84 west of Shallotte Inlet. Traditionally this area has been heavily harvested for clams and oysters, but recent declines in water quality have led to further shellfish area closures (Table 5-1). Some of these closures are permanent while other are rainfall dependent. A report released by the DEH in February 2006 attributes the water quality declines to stormwater runoff based on a comprehensive shoreline survey conducted in 2003. The Conditional Area Management Plan for this area states that Conditionally Approved Open (CAO) areas be immediately closed following a rainfall event of 1 inch or greater in a 24 hour period. The area remains closed until there are adequate water samples that show acceptable bacteria levels. Conditionally Approved Closed (CAC) area may only be opened to shellfish harvesting during very dry period and after water quality testing has been completed. These areas are monitored frequently while open and are immediately closed after a 0.5 inch rainfall event in a 24 hour period.

Growing Area A-2

Area A-2 consists of the Shallotte River and its tributaries, Saucepan Creek and its tributaries, and the Intercoastal Waterway from Channel Marker #82 to Flashing Beacon #47. The January 2006 Report of Sanitary Survey of growing area A-2 concluded that water quality in the area is continuing to decline resulting in further closures of shellfish harvesting waters. Similar to growing area A-1 the main source of pollution in the area is stormwater runoff from new and existing development. The CAO section of the Shallotte River is immediately closed following a rainfall event of 1.5 inches in a 24 hour period. The same is true for the CAO sections of the Intercoastal Waterway after a rainfall event of 2.5 inches in a 24 hour period.

Growing Area A-3

Growing area A-3 is composed of Lockwoods Folly River, its tributaries, Montgomery Slough, and the Intracoastal Waterway between flashing beacon #51 and flashing beacon #16. The latest Report of Sanitary Survey for this growing area continues to show numerous closures related mainly to stormwater runoff. However, it also reports a net gain of 8 acres being reclassified from Prohibited to Conditionally Approved Open.

Rapid development is still occurring in the Lockwoods Folly Watershed which potentially will lead to further shellfish closures if Low Impact Development (LID) practices are not implemented. Many Conditionally Approved Open areas are closed following rainfall events of greater than 0.5 inch in a 24 hour period or 0.75 inch in a 48 hour period. Other areas have higher thresholds and will be closed after 1.0 inch or in some cases 2.0 inches of rainfall in a 24 hour period.

TABLE 5-1: SHELLFISH GROWING AREA CLASSIFICATION BY ASSESSMENT UNIT

ASSESSMENT UNIT NUMBER	NAME	GROWING AREA CLASSIFICATION	SUBWATERSHED	GROWING AREA
15-25-3	Big Gut Slough	CAO	030402080303	A-1
15-25-4	Killbart Slough	Prohibited	030402080204	A-1
15-25-5	Gause Landing Creek	Prohibited	030402080204	A-1
15-25-6	Eastern Channel	CAO; CAC	030402080303	A-1
15-25-6-1	Clam Creek	CAC	030402080303	A-1
15-25-7	Sols Creek	CAC	030402080303	A-1
15-25-8	Still Creek	CAC; CAO	030402080303	A-1
15-25-9	Jinks Creek	CAC	030402080303	A-1
15-25-9-1	Cooter Creek	CAC	030402080303	A-1
15-25-10	The Big Narrows	CAC	030402080303	A-1
15-25-11	Blane Creek	CAC	030402080303	A-1
15-25-11-1	Fox Creek	CAC	030402080303	A-1
15-25-11-2	Salt Boiler Creek	CAC	030402080303 030402080309	A-1
15-25-11-3	Bull Creek	CAC	030402080303	A-1
15-25-12	Little River	CAC	030402080303	A-1
15-25-12-1	Dead Backwater	CAC	030402080303	A-1
15-25-12-1-1	East River	CAC	030402080303	A-1
15-25-12-2	Bonaparte Creek	CAC	030402080303	A-1
15-25-12-3	Clayton Creek	CAC	030402080303	A-1
15-25-13	Calabash River	Prohibited	030402080302	A-1
15-25-13-1	Hangman Branch	Prohibited	030402080302	A-1
15-25d	Intracoastal Waterway	Prohibited; CAC	030402080303	A-1

ASSESSMENT UNIT NUMBER	NAME	GROWING AREA CLASSIFICATION	SUBWATERSHED	GROWING AREA
15-25f	Intracoastal Waterway	Prohibited	030402080303	A-1
15-25g	Intracoastal Waterway	CAC	030402080303	A-1
15-25i	Intracoastal Waterway	Prohibited	030402080303 030402080204	A-1
15-25j	Intracoastal Waterway	Prohibited	030402080204	A-1
15-25k	Intracoastal Waterway	CAO	030402080204	A-1
15-25l	Intracoastal Waterway	CAO	030402080204	A-1;A-2
15-25-2-(10)a	Shallotte River	Prohibited	030402080204	A-2
15-25-2-(10)b	Shallotte River	Prohibited	030402080204	A-2
15-25-2-(10)c	Shallotte River	Prohibited	030402080204	A-2
15-25-2-(10)d	Shallotte River	CAO	030402080204	A-2
15-25-2-11-(2)	The Mill Pond	Prohibited	030402080204	A-2
15-25-2-12-(2)	Goose Creek	Prohibited	030402080204	A-2
15-25-2-14	The Swash	CAO	030402080204	A-2
15-25-2-15-(3)	Shallotte Creek	CAO	030402080203	A-2
15-25-2-15.5	Gibbs Creek	CAO	030402080204	A-2
15-25-2-16	Saucepan Creek	Prohibited	030402080204	A-2
15-25-2-16-1-(2)	Jinnys Branch	Prohibited	030402080204	A-2
15-25-2-16-4-(2)	Goose Creek	Prohibited	030402080204	A-2
15-25m	Intracoastal Waterway	CAO	030402080204	A-2
15-25n	Intracoastal Waterway	CAO	030402080204	A-2
15-25n	Intracoastal Waterway	CAO	030402080204	A-2
15-25o	Intracoastal Waterway	CAO; Prohibited	030402080204	A-2
15-25p	Intracoastal Waterway	CAO	030402080204	A-2
15-25q	Intracoastal Waterway	Prohibited	030402080204	A-2
15-25r	Intracoastal Waterway	CAO; Prohibited	030402080204	A-2
15-25s	Intracoastal Waterway	CAO	030402080204	A-2
15-25t	Intracoastal Waterway	CAO	030402080204 030402080107	A-2;A-3
15-25-1-(16)a	Lockwoods Folly River	Prohibited	030402080106	A-3
15-25-1-(16)b	Lockwoods Folly River	Prohibited	030402080106	A-3
15-25-1-(16)c	Lockwoods Folly River	Prohibited	030402080106	A-3
15-25-1-(16)d	Lockwoods Folly River	CAO	030402080106	A-3
15-25-1-18-(2)	Mill Creek	Prohibited	030402080105	A-3
15-25-1-19	Mullet Creek	Prohibited	030402080106	A-3
15-25-1-20	Lockwoods Creek	Prohibited	030402080106	A-3
15-25-1-21	Spring Creek	CAO	030402080106	A-3
15-25u	Intracoastal Waterway	Prohibited	030402080107	A-3
15-25v	Montgomery Slough	Prohibited	030402080107	A-3

Contact the **Department of Environmental Health** to get the latest classifications and closures. Shellfishing closures are enforced by the **Division of Marine Fisheries**.

TABLE 5-2: NUMBER OF BENTHIC AND AMBIENT SITE IN THE LONG BAY SUBBASIN BY 10-DIGIT WATERSHED

10-DIGIT HUC	NAME	SQUARE MILES	BENTHIC SITES	AMBIENT SITES
0304020801	Lockwoods Folly	146.5	1	10
0304020802	Shallotte River	84.7	1	3
0304020803	Little River	*21.2	0	2

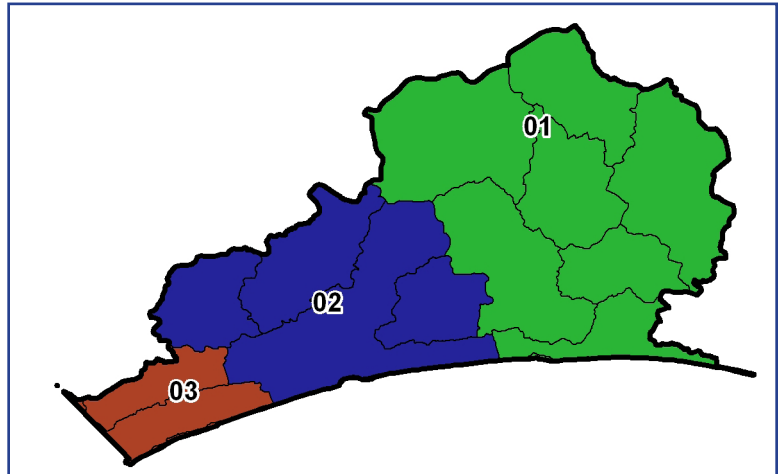
*Denotes HUC is only partially in North Carolina and the area was only calculated for that portion.

Local Water Quality

Table 5-2 list the number of benthic and ambient monitoring sites that were sampled for the 2002-2006 assessment period by watershed (10-Digit HUC). There are three watersheds and fifteen subwatersheds in the subbasin. Figure 5-4 shows the location of these watersheds which are labeled with the last 2 digits of the 10 digit HUC.

Lockwoods Folly River (0304020801)

In 2007, the DWQ Watershed Assessment Team completed a water quality study in the Lockwoods Folly River watershed as part of an agreement with the Ecosystem Enhancement Program. This report is a summary of the data collected by DWQ in this watershed prior to September 2005. Also in 2007, a local watershed plan for the Lockwoods Folly watershed was created by the North Carolina Coastal Federation, NC Ecosystem Enhancement Program, NC Department of Transportation, the NC Shellfish Sanitation Program, and Stantec. This project received funds from the Nonpoint Source 319 Grant Program. The Lockwoods Folly Local Watershed Plan can be found at: <http://www.nceep.net/services/lwps/Lockwood/Lockwoods%20Folly%20DA-TM%20Report%20Final.pdf>.

FIGURE 5-4: 10-DIGIT HUCs IN THE LONG BAY WATERSHED

A new regional WWTP, called the West Brunswick WWTP, was constructed in the watershed and is expected to service the needs of the entire watershed. The regionalization of this plant was funded in part by a grant from the CWMTF. In late 2008, this facility's non-discharge permit limit was increased from approximately 3 MGD to approximately 6 MGD. The effluent from this plant is sprayed over 854.47 acres of fields and golf courses. A countywide study is needed to plan for increased spraying of treated wastewater in the area. The Brunswick County CAMA Land Use Plan projects that seasonal wastewater flows in Lockwoods Folly watershed will exceed 6 MGD by 2015.

Middle Swamp (030402080101)

Middle Swamp subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020010). It also contains part of the Boiling Spring Lakes Plant Conservation Preserve. Samples taken from Bolivia Branch AU # 15-25-1-6-4-1 for development of the Lockwoods Folly Local Watershed Plan were found to have high concentrations of nutrients. It is thought that the cause is a former discharger that ceased operation in October of 2006.

Lockwoods Folly River Headwaters (030402080102)

This subwatershed contains part of the Green Swamp Preserve. It is also part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020010). In 2008, as part of the EEP Plum Creek Project, 80 acres of nonriverine wetlands were restored and 6 acres adjacent to Boggy Branch AU # 15-25-1-2-1 were enhanced. Mitigation included the plugging of ditches and the planting of natural vegetation. This site will be monitored for 5 years to determine if the restoration efforts were successful.

Lockwoods Folly River Watershed
0304020801



Royal Oak Swamp (030402080103)

Royal Oak Swamp subwatershed has been designated by the Ecosystem Enhancement Program as Targeted Local Watershed (03040207020020). This watershed contains part of the Green Swamp Preserve and much of the headwaters of Lockwoods Folly River.

Benthic macroinvertebrate sampling site IB99 is located at NC Highway 211, on Royal Oak Swamp AU # 15-25-1-12a. It was sampled for benthic macroinvertebrates in late winter since flow is usually highest in the watershed during the winter. It has received a natural rating in all 5 samples taken since 1996 and was used to help develop the swamp waters criteria. It was noted that pool variety and bottom substrate were poor due to increased silt deposition. This site serves as a reference site for freshwater benthic communities for the rest of the subbasin.

Royal Oak Swamp was last sampled for fish community health in 2001 when it showed a diverse and healthy community including the pollution intolerant Ironcolor Shiner, which was the most abundant specimen. As the headwaters of Lockwoods Folly River it is important to protect Royal Oak Swamp in order to prevent further degradation downstream in the impaired Lockwoods Folly River.

The Northwestern portion of this watershed is part of The Nature Conservancy's Green Swamp Preserve. There are two waterbodies in the preserve, The Green Swamp Small Depressional Pond and Big Island Savanna, that are supplementally classified as Unique Wetlands.

Scotts Branch-Lockwoods Folly River (030402080104)

Scotts Branch-Lockwoods Folly River subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020010).

Mill Creek (030402080105)

Mill Creek subwatershed is part of EEP's Targeted Local Watershed (03040207020030)

Pamlico Creek-Lockwoods Folly River (030402080106)

The Pamlico Creek-Lockwoods Folly River Watershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020030).

There are five assessment units belonging to Lockwoods Folly River in this subwatershed. Four of the five are impaired and the remaining segment is Not Rated. Lockwoods Folly River AU # 15-25-1-(16) a,b,c, and d are all impaired due to shellfishing restrictions and segments b and c are on the 303(d) list for fecal coliform bacteria exceedances. Lockwoods Folly River AU # 15-25-1-(11) is currently Not Rated for low pH, low dissolved oxygen, and chlorophyll a. This segment was not impaired for chlorophyll a because there was an insufficient number of samples taken to make an accurate determination. It was not impaired for pH and dissolved oxygen because of possible interactions with adjacent swamp waters and tidal influences.

Where Sandy Branch AU # 15-25-1-14 meets Lockwoods Folly River AU # 15-25-1-(11) the North Carolina Coastal Land Trust placed a 259 acre tract of land into a permanent conservation easement. There are plans to install about a mile of trails, some parking, and restrooms for visitors seeking to enjoy Lockwoods Folly River and the adjacent floodplain.

Town of Long Beach-Montgomery Slough 030402080107

A portion of this subwatershed is part of EEP's TLW(03040207020040) and another portion is in EEP's TLW (03040207020050).

Montgomery Slough (AU # 15-25v), has been impaired for fecal coliform bacteria exceedances since 2006 and in 2008 it also became impaired for turbidity and low dissolved oxygen levels. It is currently on the 303(d) list for all of these parameters. Also of concern is that two out of six samples taken from ambient monitoring site

I9385000 exceeded the chlorophyll a standard. Montgomery Slough was not impaired for chlorophyll a because 10 samples are required.

Intracoastal Waterway segment AU# 15-25t was added to the 303(d) list for 2008 because water sample collected by the Division of Environmental Health had fecal coliform levels that exceeded the standard for shellfish harvesting.

The Town of Oak Island is in the process of connecting its residents to its sewer system thus eliminating several septic systems. Once collected this waste will be sent to the Brunswick County Regional Sewer System for treatment.

Town of Long Beach-Long Beach (030402080108)

The Atlantic Ocean (AU # 99-(1)) is impaired for fish consumption because of high mercury levels found in fish tissue samples.

Shallotte River Watershed (0304020802)

Most of the municipal limits of Shallotte, Ocean Isle Beach, and Holden Beach are within the Shallotte River Watershed (Figure 5-6). The only two NPDES wastewater discharge permits are minor and belong to oyster companies with a maximum daily discharge of 20,000 gallons/day.

Upper Shallotte River (030402080201)

Upper Shallotte River subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020060).

Middle Shallotte River (030402080202)

Ambient monitoring site I9700000, on the Shallotte River AU # 15-25-2-(7.5), had the highest fecal coliform geometric mean with 444 colnies/100mL. The Middle Shallotte River was not impaired for recreation because it is classified as SC. Middle Shallotte River subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020060).

Benthic macroinvertebrate station IB99, located on the Shallotte River AU# 12-25-2-(1), was sampled as part of a special study in 2003. The study was conducted to determine if a Fair bioclassification rating received in 2001 was accurate or due to drought. The study resulted in a Good-Fair bioclassification rating but has now been dropped from regular sampling because of high salinity from saltwater intrusion.

Shallotte Creek (030402080203)

Shallotte Creek AU # 15-25-2-15-(3) is currently impaired due to frequent shellfish harvesting closures. This subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020060).

Lower Shallotte River (030402080204)

A portion of this subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020060) and another portion is part of TLW(03040207020090). A 224 acre conservation easement was donated to the North Carolina Agricultural Foundation, Inc. in December 2008. It is currently being maintain by the foundation as a nature preserve dedicated to research and education. This easement provides a buffer on one side of a small portion of Sharron Creek AU# 15-25-2-9-(1).

Shallotte River AU # 15-25-2-(7.5) is Not Rated due to pH and low dissolved oxygen levels, at ambient monitoring site I9420000, that were below standards in 41.1 and 12.7 percent of the time respectively. The river was not impaired for either parameter because swamp waters contributions and tidal influences are not fully understood. chlorophyll a sample exceeded the standard in 14.3 percent of the samples but this segment of the Shallotte River was not impaired because only seven samples were taken and 10 is required to make a determination.

DRAFT



Shallotte River AU #s 15-25-2-(10) a,b,c, and d are all impaired for loss of shellfishing use. All of these segments are on the 303(d) list for fecal coliform bacteria levels that exceeded the standard for shellfishing waters, except AU # 15-25-2-(10)b.

Lyoyd's Oyster Company has a NPDES wastewater discharge permit to discharge treated wastewater to the Shallotte River AU# 15-25-2-(10)a. DWQ inspectors have noted that this facility needs to remove solids from their settling basin more frequently to maintain permit compliance.

Saucepan Creek AU# 15-25-2-16 is impaired for fecal coliform bacteria levels that exceeded the fecal coliform standard for shellfishing waters and is currently on the 303(d) list.

Intracoastal Waterway AU#s 15-25 i,p,t, and u are impaired for fecal coliform bacteria exceedances and are on the 303(d) list.

Holden Beach-Long Bay (030402080205)

The Atlantic Ocean AU# 99-(1) is impaired for fish consumption because of high mercury levels found in fish tissue samples.

Little River Watershed (0304020803)

All assessed waterbodies in this watershed are impaired by the state of North Carolina, furthermore, eight assessment units are on the 303(d) list of impaired waters. The Towns of Calabash, Sunset Beach, and the western part of Ocean Isle Beach are found here (Figure 5-7). The Town of Calabash currently has a CAMA Land Use Plan that was completed in 2006 and is currently under review by the Division of Coastal Management.

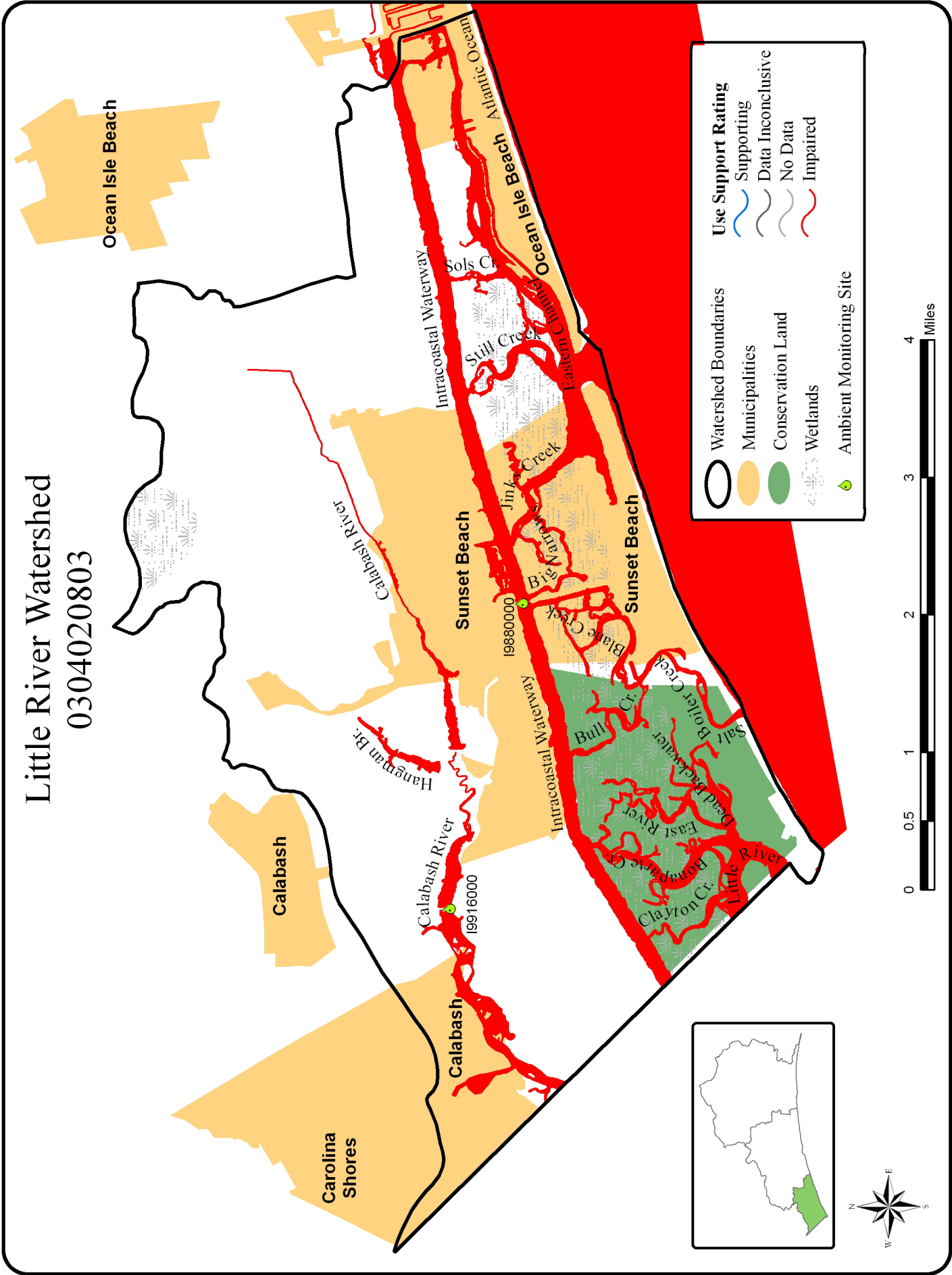
A study was conducted in Southwest Brunswick County between October 1996 and October 2002 found that in the Little River watershed septic tanks are contributing to the bacteria load (Cahoon, 2006). Researches discovered evidence of lateral transport in areas that have a high density of septic tanks and sandy soil not suited for septic tanks. Brunswick County is currently installing sewer lines in these areas which include all areas of Sunset Beach that currently do not have sewer service. Residents with septic tanks are encouraged to connect to this system. Once completed the waste will be sent to the Sea Trails WWTP. Since much of Brunswick County's sewer systems are interconnected they will also have the option of sending the waste to either Shallotte WWTP or the West Brunswick Regional WWTF. These plants currently have enough additional capacity to accept the additional flow. This project is scheduled to be completed in June of 2011. Installation of the sewer line is not expected to increase impervious surface because the area being provided sewer is nearly built-out.

Calabash Creek (030402080302)

This subwatershed is part the Ecosystem Enhancement Programs Targeted Local Watershed (03040207020110). At just under 10 square miles, this subwatershed is the entire drainage area for the Calabash River. The Calabash River is particularly problematic because its drainage area, which includes the Town of Calabash, has steeper slopes than the rest of the watershed making it more susceptible to stormwater runoff. It is also shallow and tidal which results in regular mixing throughout the water column.

The Calabash River (AU # 15-25-13) was added to the 303(d) list for turbidity and copper. It remains on the list for fecal coliform and shellfish harvesting closures. Samples from ambient monitoring site I9880000, on the Calabash River, exceeded the standard for copper, fecal coliform, turbidity, and low dissolved oxygen. The turbidity and low dissolved oxygen exceedances may be due to tidal fluctuations. The site exceeded the standard for copper in forty-five percent of the samples. Potential sources of copper include runoff from boat cleaning, wood pressure-treated with chromium copper arsenate (CCA), brake dust from brake pads containing copper, as well as, algacides and pesticides that contain copper.

FIGURE 5-7: LITTLE RIVER WATERSHED (0304020803)



Lower Little River-Atlantic Intracoastal Waterway (030402080303)

This subwatershed contains Bird Island which became part of the North Carolina Coastal Reserve in 2002. This undeveloped barrier island has approximately 136 upland acres and over 1,060 acres of marsh, intertidal flats, and subtidal area. Biotic communities found here consist of upper beach, dune grass, maritime dry grassland, maritime wet grassland, maritime shrub thicket, maritime shrub swamp, brackish marsh, salt shrub, salt flat, and salt marsh. The island serves as a nesting location for the Loggerhead Sea Turtle.

The Carolina Shores WWTP had two spills in 2004 caused by hurricanes. It is unknown what impact these incidents had on water quality in the Little River watershed.

Four segments of the Intracoastal Waterway are impaired in this subwatershed due to fecal coliform bacteria exceedances, including AU #s 15-25 d, f, g, and i, all of which are on the 303(d) list. Bonaparte Creek AU # 15-25-12-2 is also impaired for fecal coliform bacteria levels and is on the 303(d) list.

The mainland side of this subwatershed is part of the Ecosystem Enhancement Program's Targeted Local Watershed (03040207020110).

Tubbs Inlet-Long Bay (030402080309)

Madd Inlet, which is the mouth of Salt Boiler Creek AU # 15-25-11-2, is now shoaled over and prevents flushing of the estuarine waters. Tubbs Inlet, which separates Sunset Beach from Ocean Isle Beach, is partially shoaled over. Neither of these inlets are maintained by the United States Army Corp of Engineers because they are not considered major transportation paths.

Atlantic Ocean (030402080312)

The Atlantic Ocean (AU # 99-(1)) is impaired for fish consumption because of high mercury levels found in fish tissue samples.

Incentive Programs

Clean Water Management Trust Fund

Created in 1996, the Clean Water Management Trust Fund (CWMTF) makes grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems. These projects include land acquisitions, capital improvements to wastewater and stormwater infrastructure, and stream restorations. Brunswick County was awarded a CWMTF grant in 2004 for the construction of new lines to connect the communities of Holden Beach and Winding River Plantation to the West Brunswick WWTP. A list of CWMTF Grants that have been funded through 2007 is provided in Table 5-3.

TABLE 5-3: CWMTF GRANTS FUNDED FROM 1997 - 2007 IN THE LONG BAY SUBBASIN*

PROJECT ID	APPLICANT	PURPOSE	AMOUNT FUNDED	TOTAL COST
1998A-001	Town of Long Beach	Buffer Acquisition	\$456,000	\$956,590
2001A-019	NC Div. of Coastal Management	Buffer Acquisition	\$2,750,000	\$4,500,000
2002A-020	NC Coastal Land Trust	Buffer Acquisition	\$652,000	\$1,185,500
2004B-503	Brunswick County	Wastewater	\$1,357,000	\$12,294,000
TOTAL	--	--	\$5,215,000	\$18,936,090

*Does not include statewide or regional grants.

North Carolina Agriculture Cost Share Program

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

TABLE 5-4: BMP INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BMP IMPLEMENTED	AMOUNT	UNITS	COST
Long Term No-Till	147	Acres	\$18,426
Cropland Conversion - Grass	99	Acres	\$22,208
Grassed Waterway	1	Acres	\$2,556
Waste Application Equipment	1	Units	\$24,888
TOTAL	--	--	\$68,078

TABLE 5-5: BENEFITS RESULTING FROM BMPs INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BENEFITS	AMOUNT	UNITS
Acres Affected	316	Acres
Soil Saved	509	Tons
Nitrogen Saved	2,472	Pounds
Phosphorous Saved	779	Pounds

Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 5-4 shows the number of projects implemented and in the Long Bay subbasin and the dollar amount invested. Table 5-5 shows the water quality benefits realized from that investment.

Section 319-Grant Program

There have been two 319-grant funded project located within the Long Bay subbasin during the assessment period. Funded in fiscal year 2002, the North Carolina State University College of Design completed a study of *Water Quality Impacts of Alternative Build-out Scenarios for Brunswick County, NC*. A second project was started by the North Carolina Coastal Federation to develop the Lockwoods Folly Water Quality Restoration TMDL. The Quality Assurance Project Plan (QAPP) for this project can be found on the *319 Grant Program website*. These two projects received a total of \$392,637 in funding from the 319-Grant Program.

NC Green Business Fund Grant

Clean Marine Solutions, a Wilmington North Carolina based company, was awarded a NC Green Business Fund grant of \$84,602 by the *North Carolina Board of Science and Technology* for their innovative boat pressure washing system. This non-discharge wastewater treatment system is design to remove metals, such as copper, from the wastewater and reduce the amount of water needed for boat cleaning at marinas and boat yards.

RECOMMENDATIONS

Reduce Bacteria Loading

The Ecosystem Enhancement Program has developed a local watershed plan for the Lockwoods Folly River Watershed that specifically addresses the issue of bacteria loading. It identifies possible locations for stormwater retrofits and suggestions on future development. Local governments are encouraged to use this document as a guide for planning and developing local ordinances.

Increased and Improved Local Planning

Develop and implement local watershed plans for Shallotte River and for Calabash River similar to the local watershed plan for the Lockwoods Folly River. Improve CAMA Land Use Plans to place more emphasis on protecting water quality and strengthen implementation.

Low Impact Development (LID)

Brunswick County has the opportunity to become one of the leaders in the nation in design and implementation of low impact development. The Brunswick County Build-out Scenario study that was funded by the nonpoint source 319(h) grant program suggest alternative residential development practices that reduces impervious surfaces yet allows for an equivalent number of residences.

Reduce Copper in the Calabash River

Calabash River appears to have a problem with excessive amounts of copper. There are a variety of activities that could be contributing to increased copper concentrations. Activities involving boat maintenance are a possible source of copper to the river. Boat maintenance such as scraping, sandblasting, and painting should be done in a manner that prevents these materials from reaching surface waters [15A NCAC 7H.0208 (b)(5)(N)]. Runoff from pressure washing that reaches surface waters either directly or indirectly through stormwater drains is considered wastewater and requires permit [NCGS 143-215.1 (a)(6)]. Increased education, inspection, and enforcement of permits and water quality standards for these activities is needed to ensure that these activities are not contributing to copper levels in the river. Consumers are encouraged to use wood products and brake pads that contain no or low amounts of copper. The use of herbicides containing copper may be contributing to elevated copper concentrations. Better practices such as proper fertilization and buffers should be utilized to reduce the need for such herbicides in stormwater and amenity ponds.

Education

Increased education of local residents about boat cleaning practices and runoff should be continuous. Brunswick County is experiencing increased immigration so stormwater education should be a continuous process. Revitalization of the Clean Marinas Program with more emphasis on educating the public and marina owners about the program and why it is important is recommended.

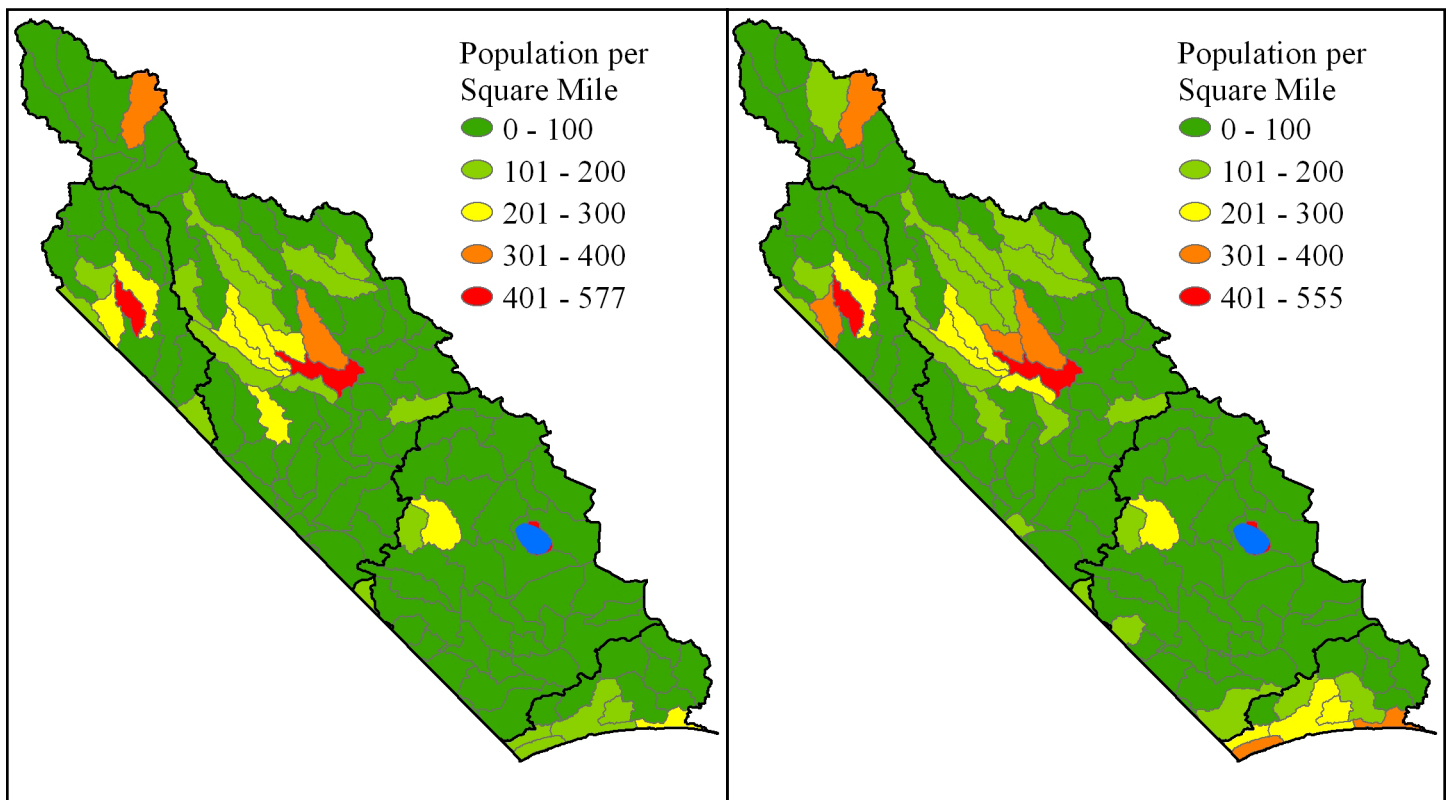
Chapter 6

Population and Land Cover

Population in the Lumber Basin

The population of the entire basin for the year 2000 was estimated at about 300,000 or about 90 people for every square mile. Population trends are not consistent throughout the basin. Two areas in the basin have been experiencing very rapid growth, that is expected to continue. While other areas are undergoing very little growth. The fastest growth is taking place in Brunswick, Hoke, and Moore counties with the development of retirement communities and golf courses (Table 6-1). The most populous areas occur around Southern Pines, Laurinburg, Lumberton, Whiteville, and along the Atlantic Coast in Brunswick County (Table 6-2). In addition to the permanent population living along the Atlantic coast in Brunswick County, the population escalates greatly in the summer with seasonal residents. Figure 6-1 shows population density by subwatershed based on the 1990 and 2000 census. As population throughout the basin grows, it increases pressure on the natural environment.

FIGURE 6-1: POPULATION DENSITY BY SUBWATERSHED FOR 1990 (LEFT) AND 2000 (RIGHT)



Land Cover in the Lumber Basin

Agriculture, Forest, and Wetlands account for three quarters of the land cover in the Lumber basin with each one making up about one quarter of the total area. In the Lumber and Little Pee Dee subbasins, agricultural use is slightly higher, but in the Waccamaw and Long Bay subbasins, forest and wetlands make up a larger percent of land use. Table 6-3 contains estimates for land cover percentages by type. Land cover patterns in the Lumber Basin mirror those of population. As an area becomes more populated the amount of impervious surface increases. Impervious surface estimates, by subwatershed for 2001, can be found in Appendix F Population and Impervious Surface.

TABLE 6-1: COUNTY POPULATION ESTIMATES AND PROJECTIONS

COUNTY	% OF COUNTY IN BASIN	2000 POPULATION	2007 ESTIMATED POPULATION	PERCENT CHANGE 2000 -2007	2020 PROJECTED POPULATION	PERCENT CHANGE 2000 - 2020
Bladen	31.19	32,278	32,500	0.7	32,629	1.1
Brunswick	56.17	73,143	99,440	36.0	147,370	101.5
Columbus	89.58	54,749	54,460	-0.5	58,968	7.7
Cumberland	1.98	302,963	313,616	3.5	345,007	13.9
Hoke	43.26	33,646	42,932	27.6	58,368	73.5
Montgomery	5.37	26,822	27,588	2.8	29,105	8.5
Moore	21.36	74,769	83,932	12.3	103,877	38.9
Richmond	19.00	46,564	46,662	0.2	47,460	1.9
Robeson	99.53	123,339	129,425	5.0	145,575	18.0
Scotland	99.87	35,998	36,830	2.3	41,420	15.1
Total	N/A	804,271	867,385	7.8	1,009,779	25.6

Source: Office of State Budget and Management, 2009.

Note: The numbers reported reflect county populations; however, these counties may not entirely be within the basin.

The intent is to demonstrate growth for counties located wholly or partially within the basin.

TABLE 6-2: MUNICIPAL POPULATION PROJECTIONS AND ESTIMATES

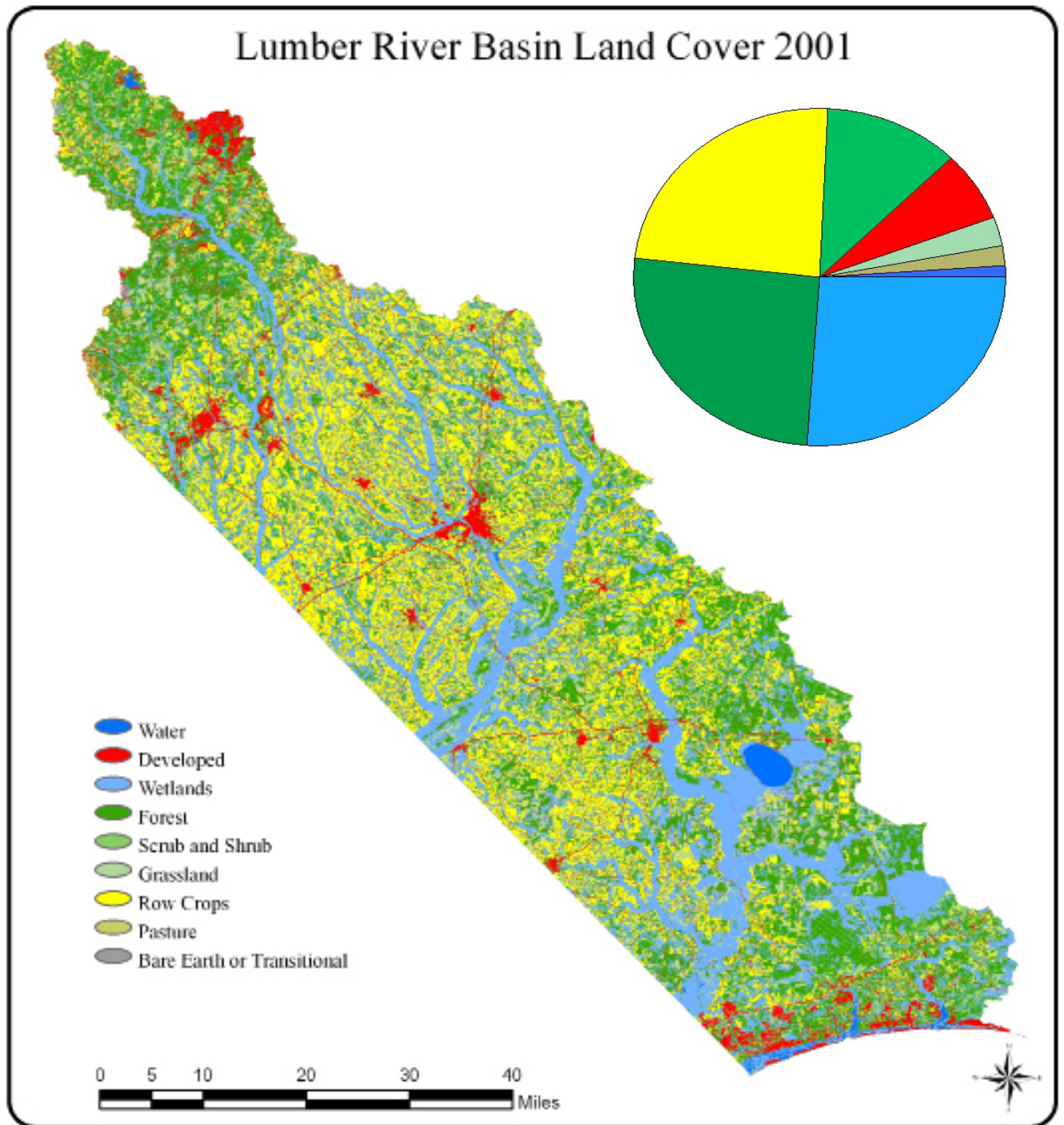
MUNICIPALITIES	COUNTY	2000 POPULATION	2007 ESTIMATED POPULATION	PERCENT CHANGE 2000-2007
Aberdeen	Moore	3,400	4,579	34.68
Bladenboro	Bladen	1,718	1,653	-3.78
Boardman	Coulmbus	202	195	-0.53
Boiling Springs Lakes*	Brunswick	2,972	4,115	38.46
Bolivia	Brunswick	148	171	15.54
Bolton*	Columbus	494	482	-2.43
Brunswick	Columbus	360	1,044	190.00
Calabash	Brunswick	711	1,435	101.83
Candor*	Montgomery	825	845	2.42
Carolina Shores	Brunswick	1,482	2,873	93.86
Cerro Gordo	Columbus	244	242	-0.82
Chadbourn	Columbus	2,129	2,113	-0.75
Clarkton	Bladen	705	765	8.51
Dublin*	Bladen	250	250	0.00
East Laurinburg	Scotland	295	289	-2.03
Fair Bluff	Columbus	1,181	1,214	2.79
Fairmont	Robeson	2,604	2,744	5.38
Foxfire Village	Moore	474	547	15.40
Gibson	Scotland	584	579	-0.86
Hoffman	Richmond	624	677	8.49
Holden Beach	Brunswick	787	931	18.30
Lake Waccamaw	Columbus	1,411	1,312	-7.02
Laurinburg	Scotland	15,874	15,875	0.13
Lumber Bridge	Robeson	118	120	1.69

MUNICIPALITIES	COUNTY	2000 POPULATION	2007 ESTIMATED POPULATION	PERCENT CHANGE 2000-2007
Lumberton	Robeson	20,795	22,929	10.26
Marietta	Robeson	164	159	-3.05
Maxton	Robeson/Scotland	2,551	2,539	-0.47
McDonald	Robeson	119	127	6.72
Norman*	Richmond	72	73	1.39
Oak Island*	Brunswick	6,571	8,261	25.72
Ocean Isle Beach	Brunswick	426	508	19.25
Orrum	Robeson	79	77	-2.53
Parkton	Robeson	429	545	27.04
Pembroke	Robeson	2,681	2,732	1.90
Pinebluff	Moore	1,109	1,360	22.63
Pinehurst*	Moore	9,729	11,632	19.56
Proctorville	Robeson	133	129	-3.01
Raeford*	Hoke	3,386	3,837	13.32
Raynham	Robeson	72	88	22.22
Red Springs	Robeson	3,493	3,509	0.46
Rennet	Robeson	283	348	22.97
Rowland	Robeson	1,146	1,167	1.83
Saint James*	Brunswick	804	2,445	204.10
Saint Pauls	Robeson	2,247	2,351	4.64
Shallotte	Brunswick	1,381	1,908	38.16
Southern Pines*	Moore	10,918	12,210	11.83
Sunset Beach	Brunswick	1,824	3,090	69.41
Tabor City	Columbus	2,509	2,544	1.39
Tar Heel*	Bladen	70	95	35.71
Varnamtown	Brunswick	481	583	21.21
Wagram	Scotland	801	775	-3.25
Whiteville	Columbus	5,148	5,091	-1.11
Source: Office of State Budget and Management, 2008.				
*Denotes that the municipality is only partially located in the basin.				

Explanation of the Land Cover Data and Categories

The national land cover database (2001) is a geographic information systems raster file that was developed by the Multi-Resolution Land Characterization Consortium, which is made up of several federal government agencies. These agencies include the US Geological Survey, the Environmental Protection Agency, National Oceanic and Atmospheric Administration, US Forest Service, Bureau of Land Management, National Aeronautics and Space Administration, National Park Service, and Natural Resources Conservation Service. It was developed using multiple datasets including, three sets of infrared landsat imagery that were collected during the spring, summer, and fall seasons. This data was then improved upon using ancillary data files such as a 30 meter digital elevation model, population density, buffered roads, and city lights. The percent impervious cover and the percent tree canopy were created to show the intensity at which land was either developed or forested. For more information on this land cover data visit: Multi-Resolution Land Characteristics Consortium <http://www.mrlc.gov/>.

FIGURE 6-2: 2001 LAND COVER



Open Water - All areas of open water, generally with less than 25 percent cover of vegetation or soil.

Developed, Open Space - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Developed, Low Intensity -Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

Developed, Medium Intensity - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

TABLE 6-3: 2001 LAND COVER PERCENT BY TYPE

TYPE	ENTIRE BASIN	03040203	03040204	03040206	03040208
Developed, Open Space	4.8	5.2	5.4	3.5	6.7
Developed, Low Intensity	1.5	1.4	1.9	0.8	4.9
Developed, Medium Intensity	0.3	0.4	0.5	0.1	0.7
Developed, High Intensity	0.1	0.1	0.1	0.0	0.1
Developed	6.7	7.1	7.9	4.5	12.3
Forest, Deciduous	3.2	4.5	4.8	1.3	0.6
Forest, Evergreen	20.3	16.7	19.3	23.6	32.7
Forest, Mixed	2.2	2.3	1.8	2.4	1.5
Forest	25.7	23.5	26.0	27.3	34.8
Pasture/Hay	1.9	2.8	3.3	0.4	0.9
Cultivated Crops	23.9	27.6	27.6	20.3	8.9
Agriculture	25.9	30.7	30.9	20.7	9.8
Wetlands, Wooded	25.3	23.9	20.2	30.8	21.1
Wetlands, Emergent Herbaceous	0.8	0.4	0.2	0.7	5.2
Wetlands	26.1	24.3	20.4	31.5	26.2
Scrub/Shrub	2.8	2.4	2.4	3.6	4.4
Grasslands/Herbaceous	11.8	12.2	12.1	11.4	11.6
Bare Earth, Rock, Sand, Clay	0.1	0.0	0.3	0.0	0.9

Developed, High Intensity - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.

Barren Land (Rock/Sand/Clay) - Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15 percent of total cover.

Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20 percent of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

Shrub/Scrub - Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

Grassland/Herbaceous - Areas dominated by graminoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

Cultivated Crops - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

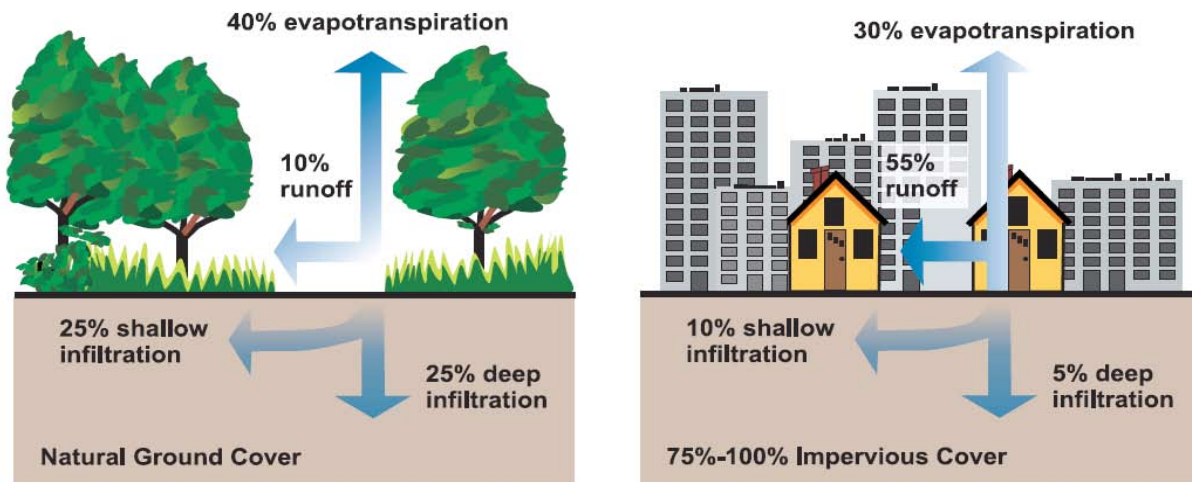
Woody Wetlands - Areas where forest or shrub land vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Emergent Herbaceous Wetlands - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Population, Land Cover, and Stormwater

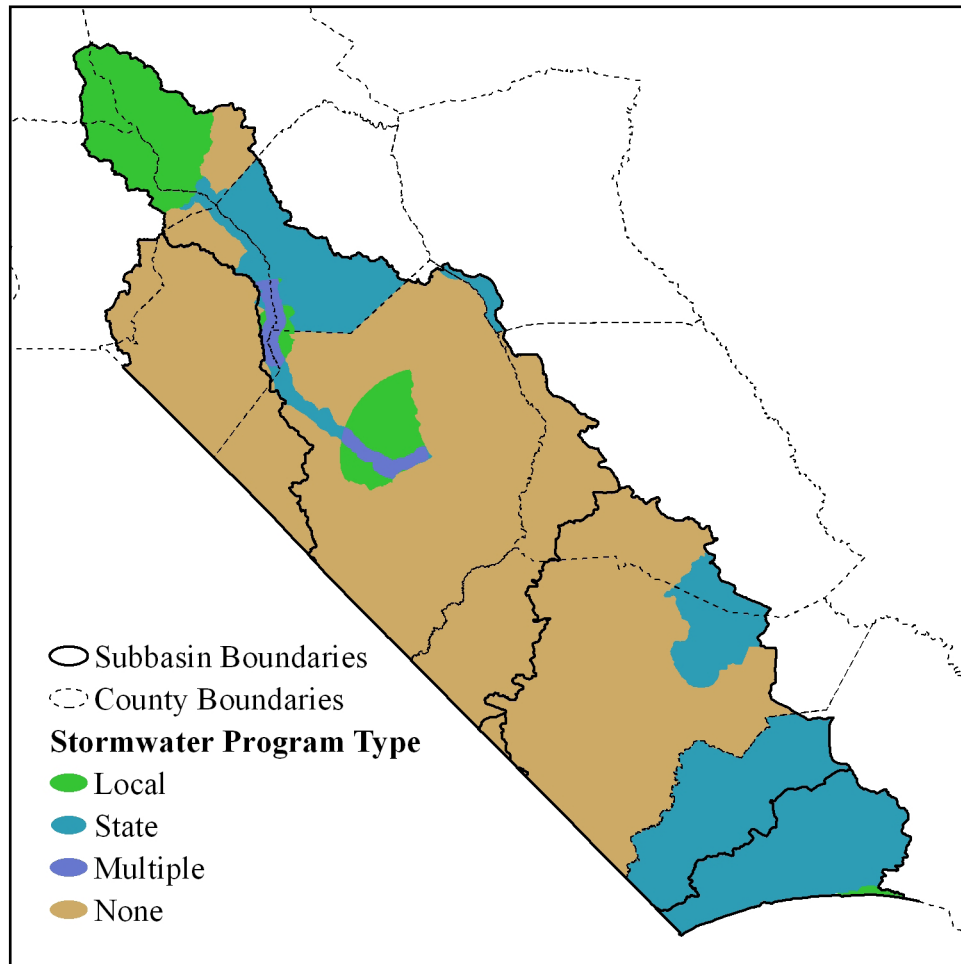
As population increases, so does the amount of land covered by impervious surfaces such as parking lots, roads, and roof tops. As impervious surface increases, the amount of precipitation that enters surface waters as runoff increases and the amount of precipitation infiltrating into the ground decreases (Figure 6-3). Increased stormwater runoff contributes to flooding during rainfall events and decreases the amount of groundwater available during droughts. Runoff harms aquatic life by physically and chemically altering the habitat. Increased flow creates greater erosion of stream channels and banks, as well as, the pollution load to water. In order to allow growth to occur but to maintain water quality a comprehensive stormwater program is necessary. Many areas throughout the basin have such programs in place but some areas are still lacking adequate protection from stormwater (Figure 6-4). For more information on stormwater and how to manage it refer to Chapter 5 of the Supplemental Guide to Basinwide Planning or visit DWQ's Stormwater Branch at <http://h2o.enr.state.nc.us/ws/>.

FIGURE 6-3: IMPERVIOUS SURFACE AND RUNOFF (EPA, 2003)



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface runoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

FIGURE 6-4: AREAS REQUIRING A STORMWATER PERMIT AND THE TYPE OF PERMIT REQUIRED IN THE LUMBER BASIN



Chapter 7

Forestry and Water Quality

Forestry and Water Quality Impacts Overview

Forests are an ideal land use for water quality protection because they stabilize soil and filter stormwater runoff from adjoining, non-forested areas. In order to sustain a forest's ability to protect water quality, some degree of management is often required. Timber harvesting is part of the forest renewal cycle and is usually the most intensive forest management activity that requires special attention to assure water quality is protected. Inappropriate management practices can impact water quality by destabilizing streambanks, reducing riparian vegetation and removing tree canopies. Any one of these impacts can alter the interface of the aquatic and terrestrial ecosystem, influence downstream flooding and change watershed functions. Sedimentation is the most common water pollution agent that may result from forestry activities. Potential sources of sedimentation include stream crossings, forest roads, skid trails and log decks. As a result, the majority of regulations and erosion control recommendations pertaining to forestry focus on these four main areas.

FORESTLAND OWNERSHIP*

Approximately 75% of the forestland in the basin is privately-owned by individuals. An estimated 20% of the forestland is owned by forest-industry, forest-investment companies or conservation groups, with the remaining 5% in public ownership, including Lumber River State Park and Lake Waccamaw State Park. It should be noted that since the most recent ownership data was compiled by the USDA-Forest Service, a significant shift in ownership occurred with the sale of large parcels of forestland within the basin by International Paper Company, largely in the Green Swamp. Some parcels of land were acquired by various forestland investment companies, while other parcels were acquired by conservation groups for the purposes of land conservation and possible eventual transfer into public ownership.

* The ownership estimates come from the most recent data published by the USDA-Forest Service ("Forest Statistics for North Carolina, 2002." Brown, Mark J. Southern Research Station Resource Bulletin SRS-88. January 2004).

Forest Practices Guidelines Related to Water Quality

Forestry operations in North Carolina are subject to regulation under the Sedimentation Pollution Control Act of 1973 (GS Ch.113A Art.4 referred to as "SPCA"). However, forestry operations may be exempted from the permit and plan requirements of the SPCA, if the operations meet the compliance standards outlined in the Forest Practices Guidelines Related to Water Quality (15A NCAC II .0100 - .0209, referred to as "FPGs") and General Statutes regarding stream and ditch obstructions (GS 77-13 and GS 77-14).

The North Carolina Division of Forest Resources (DFR) is delegated the authority to monitor and evaluate forestry operations for compliance with these aforementioned laws and/or rules. In addition, the DFR works to resolve identified FPG compliance questions brought to its attention through citizen complaints. Violations of the FPG performance standards that cannot be resolved by the DFR are referred to the appropriate State agency for enforcement action.

During the period January 1, 2003 through December 31, 2006, the DFR conducted 1,003 FPG inspections of forestry-related activities in the basin; 97% of the sites inspected were in compliance.

Other Water Quality Regulations

In addition to the State regulations noted above, DFR monitors the implementation of the following Federal rules relating to water quality and forestry operations:

- The Section 404 silviculture exemption under the Clean Water Act
- The federally mandated 15 best management practices (BMPs) related to road construction in wetlands
- The federally mandated BMPs for mechanical site preparation activities for the establishment of pine plantations in wetlands of the southeastern U.S.

Water Quality Foresters

The majority of the Lumber River basin falls within the coverage area of a DFR Water Quality Forester, with the exception of Hoke and Robeson counties. Statewide, there is a Water Quality Forester position in 10 of DFR's 13 Districts. Water Quality Foresters conduct FPG inspections, survey BMP implementation, develop pre-harvest plans, and provide training opportunities for landowners, loggers and the public regarding water quality issues related to forestry. These foresters also assist County Rangers on follow-up site inspections and provide enhanced technical assistance to local DFR staff.

Forestry Best Management Practices

Implementing forestry Best Management Practices (BMPs) is strongly encouraged to efficiently and effectively protect the water resources of North Carolina. In 2006, the first ever revision to the North Carolina forestry BMP manual was completed. This comprehensive update to the forestry BMP manual is the result of nearly four years of effort by the DFR and a DENR-appointed Technical Advisory Committee consisting of multiple sector stakeholders, supported by two technical peer-reviews. The forestry BMP manual describes measures that may be implemented to help comply with the forestry regulations while protecting water quality. A significant addition to this revised manual is a description of wetland-related regulations and specific BMPs to consider when operating in wetlands. Copies of the new forestry BMP manual can be obtained at a County Ranger or District Forester office. The new BMP manual is also available at <http://dfr.nc.gov/> within the 'Water Quality' portion.

In the basin during this period, the DFR assisted or observed greater than 1,000 forestry activities in which BMPs were either implemented or recommended, encompassing a total area of over 46,000 acres. Additional BMP, water quality, and nonpoint source program accomplishments are highlighted in the DFR's annual "Year In Review" 4-page color brochure available at <http://dfr.nc.gov/>.

From March 2000 through March 2003, the DFR conducted a statewide BMP Implementation Survey on 565 active forest harvest operations to evaluate the usage of forestry BMPs. This survey evaluated 35 sites in the basin, with a resulting BMP implementation rate of 86%. The problems most often cited in this survey across the state relate to stream crossings, skid trails and site rehabilitation. This and subsequent surveys will serve as a basis for focused efforts in the forestry community to address water quality concerns through better and more effective BMP implementation and training. A copy of this survey report is available from the DFR Central Office or <http://dfr.nc.gov/>.

Protecting Stream Crossings with Bridgemats

The DFR provides bridgemats on loan to loggers for establishing temporary stream crossings during harvest activities in an effort to educate loggers about the benefits of installing crossings in this manner. Temporary bridges can be a very effective solution for stream crossings, since the equipment and logs stay completely clear of the water channel. Since late-2003 all District Offices in the basin have had steel bridgemats available for loan-out. While exact figures specific to the Lumber River basin are not recorded, the three District Offices that cover the basin participated in 38 loan-events between 2003 and 2006, which protected 45 stream crossings and accessed over 1,600 acres of timber. More information about bridgemats is available at <http://dfr.nc.gov/>.

Forest Management

Over 21,000 acres of land were established or regenerated with forest trees across the basin from January 1, 2003 through December 31, 2006. During this same time period the DFR provided over 1,700 individual forest plans for landowners that encompassed almost 71,500 acres in the basin.

Bottomland Hardwood/Cypress Swamps

Across the Lumber River basin, (and elsewhere in North Carolina) there are prime examples of high-quality and highly productive bottomland hardwood/cypress swamps. These swamps have provided a sustainable source of wood fiber for well over 200 years, and served as the foundation for the creation of the forest products industry in eastern North Carolina. Since the settlement of North Carolina in colonial times, our forests have been harvested multiple times, including these hard-to-access swamps. Practically-speaking, it is inconceivable that any “old growth” or “virgin” timber remain in this region. A diversity of forest tree species are adapted to grow in these bottomland swamps, some regenerating by seed and others primarily by sprouting from severed stumps. Nearly all swamp-adapted tree species require full sunlight to adequately regenerate, thus necessitating a removal of the shading overstory. Due to the cyclic nature of the hydrology in a specific swamp, fluctuations in the water table, and the obvious difficulty of site access, the planting of trees to regenerate a swamp after a timber harvest is not commonly observed as a suitable or viable silviculture practice. Management of a bottomland/cypress swamp forest is relatively passive when compared with pine or upland hardwood forest areas. Once the new stand of trees has successfully regenerated, there is usually little need to conduct intermediate stand treatments that might otherwise be suitable on pine or upland hardwood forests. Implementing a silviculturally-sound swamp timber harvest in a manner that minimizes soil and water impacts has shown to be the practical and viable prescription for forest management in bottomland/cypress swamps.

Stream & Watershed Restoration

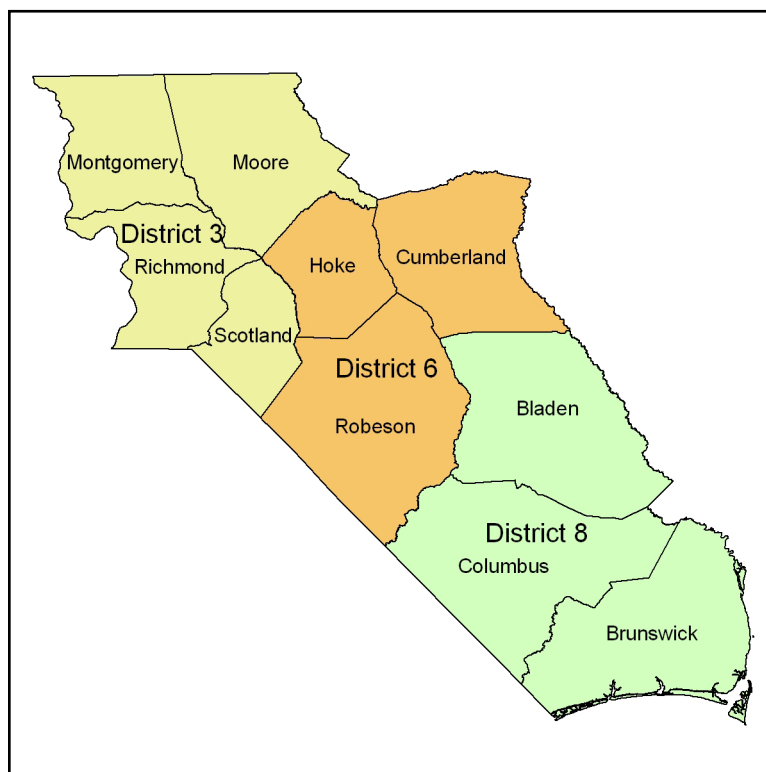
The N.C. Clean Water Management Trust Fund and the U.S. EPA Nonpoint Source Section 319 Grant jointly provide overall funding, with technical oversight provided by the NCSU Department of Biological & Agricultural Engineering. Progress of the work can be followed from the DFR Web site in the ‘Water Quality’ portion: www.dfr.state.nc.us.

Locating and Contacting Your District

The Lumber River basin contains portions of three North Carolina Division of Forest Resource districts including districts three, six, and eight (Figure 7-1). Districts 3 and 6 are in region two while district eight is in region one. Forestry contacts for the Lumber River Basin are provided in Table 7-1.

TABLE 7-1: FORESTRY CONTACTS

OFFICE LOCATION	CONTACT PERSON	PHONE	ADDRESS
District 3 - Rockingham	Water Quality Forester	(910) 997-9220	1163 North US Hwy 1, Rockingham, NC 28379-8513
District 6 - Fayetteville	Water Quality Forester	(910) 437-2620	221 Airport Road, Fayetteville, NC 28301-9202
District 8 - Whiteville	Water Quality Forester	(910) 642-5093	1413 Chadbourn Hwy., Whiteville, NC 28472-2053
Region 1	Asst. Regional Forester	(252) 520-2402	2958 Rouse Road Extension, Kinston, NC 28504-7320
Region 2	Asst. Regional Forester	(919) 542-1515	3490 Big Woods Road Chapel Hill, NC 27517-7652
Raleigh Central Office (Statewide)	Nonpoint Source Unit Forest Hydrologist	(919) 857-4856	1616 Mail Service Center, Raleigh, NC 27699-1616
Griffiths Forestry Center (Statewide)	Water Quality and Wetlands Forester	(919) 553-6178 Ext. 230	2411 Old Hwy 70 West, Clayton, NC 27520

**FIGURE 7-1: NC DIVISION OF FOREST RESOURCES DISTRICTS
IN THE LUMBER BASIN**

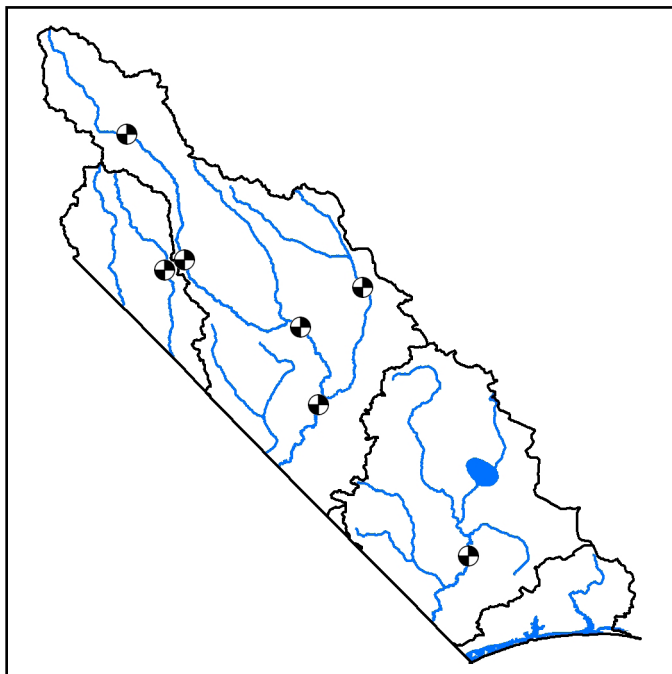
Chapter 8

Managing Water Quality & Quantity

Understanding Stream Flow

Stream flow is monitored by U.S. Geological Survey gaging stations (Figure 8-1) and the 7-day 10-year low flow (7Q10) statistic is calculated to determine minimum flow requirements appropriate for water use activities. Examples of these activities include point source discharger effluent assimilation, water withdrawals, protection of aquatic life, navigation, wetland maintenance, recreation, hydropower and TMDL development. Flows less than the 7Q10 may be the result of drought, but also can be caused by water withdrawals or impoundments. When stream flow falls below the 7Q10, water quality violations may occur. Flow requirements are often thought of as minimum flows or releases, but they can also include maximum flow limits for peaking hydropower dams, seasonal releases for fish spawning, or weekend releases for recreation. Flow, often abbreviated as “Q”, is measured in terms of volume of water per unit of time, usually cubic feet per second (cfs). For more information about instream flow see DWR website: http://www.ncwater.org/About_DWR/Water_Projects_Section/Instream_Flow/welcome.html.

FIGURE 8-1: USGS GAGING STATIONS IN THE LUMBER BASIN



Managing Flow from Impoundments

Many of the larger waterbodies in the relatively flat Coastal Plain often meander and are lined with swamps consisting of bottomland forest. Coastal Plain soils are deep sands that have a high groundwater storage capacity. This abundance of groundwater and lack of good sites for dams means there are few reservoirs in the basin. Eighty-one miles of the Lumber River are classified as Natural and Scenic, limiting dam construction on the river which contributes to the low number of reservoirs.

TABLE 8-1: MINIMUM RELEASES FROM IMPOUNDMENTS IN THE LUMBER BASIN

NAME OF DAM	WATERBODY	DRAINAGE AREA	MINIMUM RELEASE
Holly Course Dam	Sandy Run Creek	0.9 mi ²	0.4 cfs
Lake Auman Dam	UT of Jackson Creek	4.2 mi ²	2.0 cfs
Lake Pinehurst Dam	Horse Creek	4.3 mi ²	2.5 cfs
Watson Lake Dam #2	Aberdeen Creek	8.75 mi ²	0.3 cfs
Pinehurst National Golf Course # 1	Aberdeen Creek UT	1.7 mi ²	0.2 cfs
Pinehurst National Golf Course # 2	Aberdeen Creek UT	1.7 mi ²	0.3 cfs
Pages Lake	Aberdeen Creek	14.1 mi ²	4.3 cfs
Town of Southern Pines Offstream Storage Dam (Proposed)	Horse Creek UT	0.3 mi ²	0.3 cfs

Note: Although every attempt has been made to include all flow requirements in the basin, omission from the list does not negate those with flow requirements from fulfilling their obligations.

Conditions may be placed on dam operations specifying mandatory minimum releases in order to maintain adequate quantity and quality of water downstream of the impoundment. One of the purposes of the Dam Safety Law is to ensure maintenance of minimum streamflows below dams. The *Division of Water Resources* (DWR), in conjunction with the *Wildlife Resources Commission* (WRC), recommends conditions related to release of flows to satisfy minimum instream flow requirements. The *Division of Land Resources* (DLR) issues the permits and is responsible for enforcement. Calculated minimum streamflows for impoundments in the Lumber River Basin are listed in Table 8-1. If the inflow is less than the minimum release the minimum release becomes that inflow rate.

Water Withdrawals

North Carolina General Statute G.S. 143-215.22H, originally passed in 1991, requires surface water and ground water withdrawers who meet conditions established by the General Assembly to register their water withdrawals and surface water transfers with the State and update those registrations at least every five years. Agricultural water users that withdraw one million gallons of water a day or more and non-agricultural water users that withdraw one hundred thousand gallons of water a day are required to register. Administrative rules that became effective in March 2007 (15A NCAC 02E.0600) stipulate that registrants must also report their water usage annually to the Department of Environment and Natural Resources. In its 2008 session, the General Assembly established civil penalties for failure to comply with these requirements.

TABLE 8-2: CURRENT SURFACE WATER WITHDRAWALS BY LOCAL WATER SUPPLY SYSTEMS

COUNTY	WATER SYSTEM	SOURCE	WITHDRAWAL	HUC
Moore/Richmond	Town of Southern Pines	Drowning Creek	14 MGD max. 3.06 MGD avg.	03040203
Robeson	City of Lumberton	Lumber River	4 MGD avg.	03040203
Brunswick	Dea Trail Corp.	Onsite Pond	0.081 MGD avg.	03040208
Brunswick	Ocean Ridge Plantation Golf	Onsite Pond	0.246 MGD avg.	03040208
Brunswick	Brick Landing Plantation CC	Onsite Pond	0.081 MGD avg.	03040208
Brunswick	Brunswick Plantation Golf Resort	Onsite Pond	0.115 MGD avg.	03040208
Brunswick	Lockwoods Folly Country Club	Onsite Pond	0.11 MGD avg.	03040208
Brunswick	Meadowlands Golf Club	Onsite Pond	0.15 MGD avg.	03040208
Brunswick	Farmstead Golf Links	Onsite Pond	0.096 MGD avg.	03040208
Brunswick	Oak Island Golf Club	Onsite Pond	0.027 MGD avg.	03040208
Brunswick	Sandpiper Bay Golf Club	Onsite Pond/ Wastewater Effluent	0.112 MGD avg.	03040208
Hoke	Carolina Turf Farm	Onsite Pond	0.029 MGD avg.	03040203
Moore	Pinehurst, Inc.	Onsite Pond	0.667 MGD avg.	03040203
Moore	The Country Club of NC	Watson Lake	0.267 MGD avg.	03040203
Moore	The Pit Golf Links	Onsite Pond	0.096 MGD avg.	03040203
Moore	The Bluff Golf Links	Onsite Pond	0.085 MGD avg.	03040203
Moore	Pinewild CC of Pinehurst	Onsite Pond	0.112 MGD avg.	03040203
Moore	Beacon Ridge Golf and CC	Lake Auman	0.725 MGD avg.	03040203
Moore	National Golf Club	Onsite Pond	0.115 MGD avg.	03040203
Richmond	Unimin Corporation	Onsite Pond	1.352 MGD avg.	03040204
Robeson	Progress Energy Carolinas, Inc.	Lumber River	6.017 MGD avg.	03040203
Scotland	Scotch Meadows CC Inc.	Gum Swamp Creek	0.036 MGD avg.	03040204
Scotland	Deercroft Golf, LLC	Lake Sinclair	0.055 MGD avg.	03040204

Units of local government that supply or plan to supply water to the public are required to prepare a Local Water Supply Plan (LWSP). Like the withdrawal registrations, a LWSP must be updated at least every five years and systems required to prepare a LWSP must also report water usage annually to the Division of Water Resources. Preparing a LWSP and keeping it updated meets a local government's obligation to register their water withdrawals under General Statute 143-215.22H. Local Water Supply Plans and associated materials can be found at www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/.

In the Lumber River Basin there are twenty-three registered users that withdraw surface water. Two of these are units of local government that have prepared a Local Water Supply Plan, the towns of Southern Pines and Lumberton. In addition to the 20 golf-related facilities that use surface water from the basin, Progress Energy operates the 173-megawatt Weatherspoon Steam Electric Plant near Lumberton which uses water from the Lumber River. The most recent withdrawal and use information available for these facilities are summarized in Table 8-2.

Interbasin Transfers

In 1993, the North Carolina Legislature adopted the Regulation of Surface Water Transfers Act (G.S. §143-215.22I). The intent of the law is to regulate large surface water transfers between river basins. It does this by requiring a certificate from the Environmental Management Commission. The act has been modified several times since it was first adopted, most recently in 2007 when G.S. §143-215.22I was repealed and replaced with G.S. §143-215.22L. In general, transfer certificates are required for new transfers of 2 million gallons per day (MGD) or more and for increases in an existing transfer by 25 percent or more (if the total including the increase is over 2 MGD). Certificates are not required for facilities that existed or were under construction prior to July 1, 1993, up to the full capacity of that facility to transfer water, regardless of the transfer amount. More information on current interbasin transfers, the controlling regulations, and the approval process can be found on the Division of Water Resources website at www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/.

The Brunswick County Water system is the only system in the Lumber River Basin that needs an interbasin transfer certificate. Currently they are pursuing permission to increase their allowable transfer. The Brunswick County water system treats water from the Cape Fear River and distributes potable water to communities throughout the county. The coastal communities in the county, most of which are located in the Shallotte River watershed, depend on the county water system to meet their customer's needs. Filings and notices associated with Brunswick County's request for an increase in the transfer can be found on the Division of Water Resources website. Table 8-3 summarizes the systems that depend on this transfer and the volume of water involved.

TABLE 8-3: ESTIMATED INTERBASIN TRANSFER IN THE LUMBER BASIN

SUPPLYING SYSTEM	RECEIVING SYSTEM	SOURCE	DESTINATION	EST. TRANSFER (MGD)
Brunswick County	All Municipalities	Cape Fear River	Shallotte River	8.37
Brunswick County	Brunswick County	Cape Fear River	Waccamaw River	0.65

In determining whether a certificate should be issued, the state must determine that the overall benefits of a transfer outweigh the potential impacts. Factors used to determine whether a certificate should be issued include:

- the necessity, reasonableness and beneficial effects of the transfer;
- the detrimental effects on the source and receiving basins, including effects on water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, hydroelectric power generation, navigation and recreation;
- the cumulative effect of existing transfers or water uses in the source basin;
- reasonable alternatives to the proposed transfer; and
- any other facts and circumstances necessary to evaluate the transfer request.

FIGURE 8-2: DISCHARGE MEASURED BY USGS GAGING STATION 02134500 LUMBER RIVER AT BOARDMAN 1998-2008

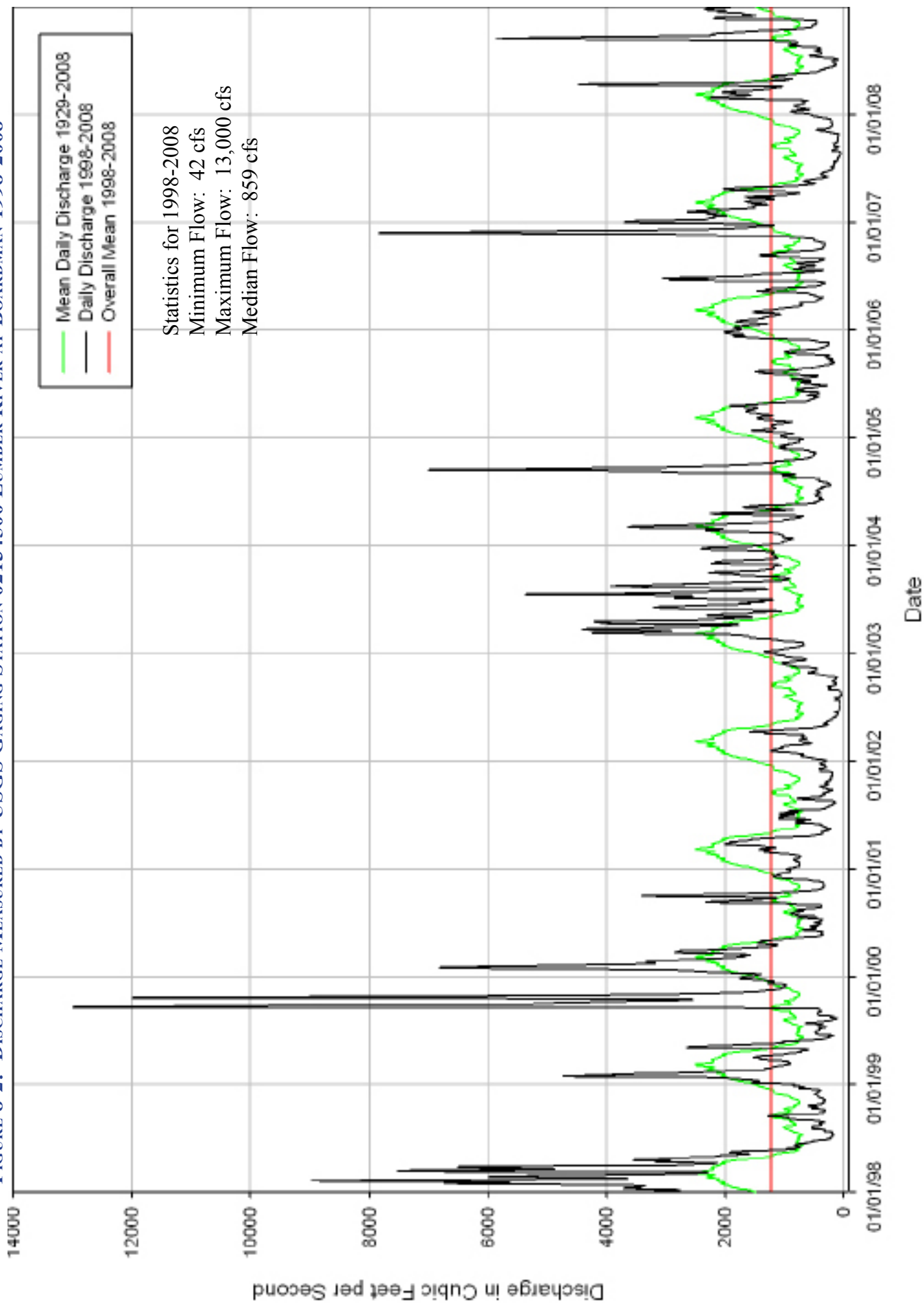
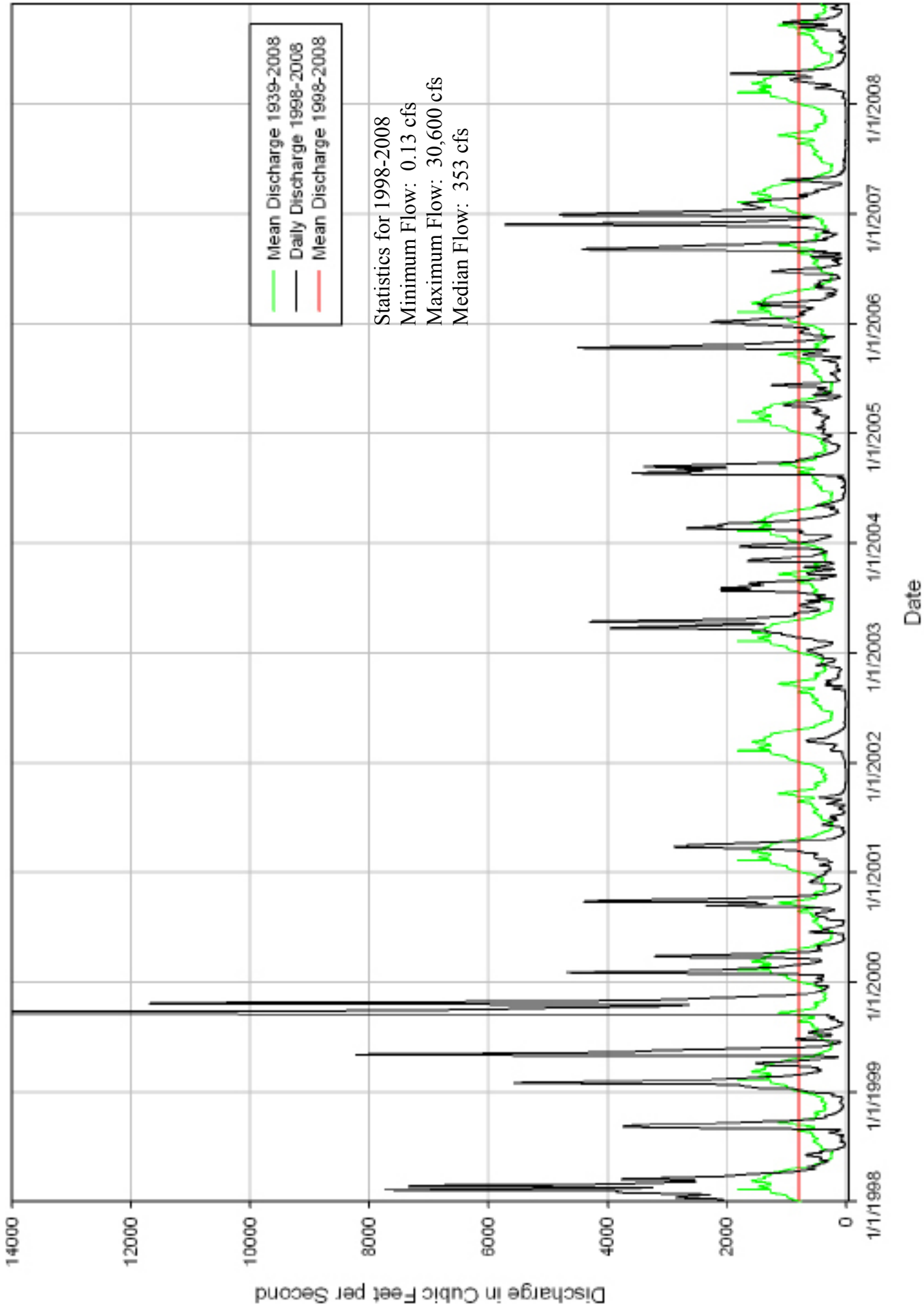


FIGURE 8-3: DISCHARGE MEASURED BY USGS GAGING STATION 02109500 WACCAMAW RIVER AT FREELAND 1998-2008



A provision of the interbasin transfer law requires that an environmental assessment or environmental impact statement be prepared in accordance with the State Environmental Policy Act as supporting documentation for a transfer petition. For more information on water withdrawals, visit <http://www.ncwater.org> or call DWR at (919) 733-4064.

Observed Flow

Figures 8-2 and 8-3 depicts the flow pattern for the Lumber and Waccamaw Rivers from between 1998 and 2008. Also shown is the daily flow averages for the past 80 and 70 years, respectively. Notice that flow is usually at its highest levels in the late winter and early spring. The lowest flows can be seen in the summer and fall with the occasional spike in discharge due to tropical systems that frequent the area in late summer and early fall.

Water Quality Issues Related to Drought

The recent drought in North Carolina has highlighted natural resource management and the importance of the relationship between water quantity and quality. Droughts and floods are natural processes and their impacts are often amplified by land use activities. Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because high flows may carry increased loadings of substances (e.g., metals, oils, herbicides, pesticides, sand, clay, organic material, bacteria and nutrients). These substances can be toxic to aquatic life (fish and insects) or may result in oxygen depletion or sedimentation. During drought conditions, these pollutants become more concentrated in streams due to reduced flow. Summer months are generally the most critical months for water quality. Dissolved oxygen is naturally lower due to higher temperatures, algae growth increases due to longer periods of sunlight, and stream flows are reduced. In a long-term drought, these problems can be greatly exacerbated and the potential for water quality problems to become catastrophic is increased. This section discusses water quality problems that can be expected during low flow conditions.

The frequency of acute impacts due to nonpoint source pollution (runoff) is actually minimized during drought conditions. However, when rain events do occur, pollutants that have been collecting on the land surface are quickly delivered to streams. When stream flows are well below normal, this polluted runoff becomes a larger percentage of the water flowing in the stream. Point sources may also have water quality impacts during drought conditions even though permit limits are being met. Facilities that discharge wastewater have permit limits that are based on the historic low flow conditions. During droughts these wastewater discharges make up a larger percentage of the water flowing in streams than normal and might contribute to lowered dissolved oxygen concentrations and increased levels of other pollutants.

As stream flows decrease, less habitat is available for aquatic insects and fish, particularly around lake shorelines. Less water is also available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increases strain on the resource. With less habitat, naturally lower dissolved oxygen levels and higher water temperatures, the potential for large kills of fish and aquatic organisms is very high. These conditions may stress the fish to the point where they become more susceptible to disease and where stresses that normally would not harm them result in mortality.

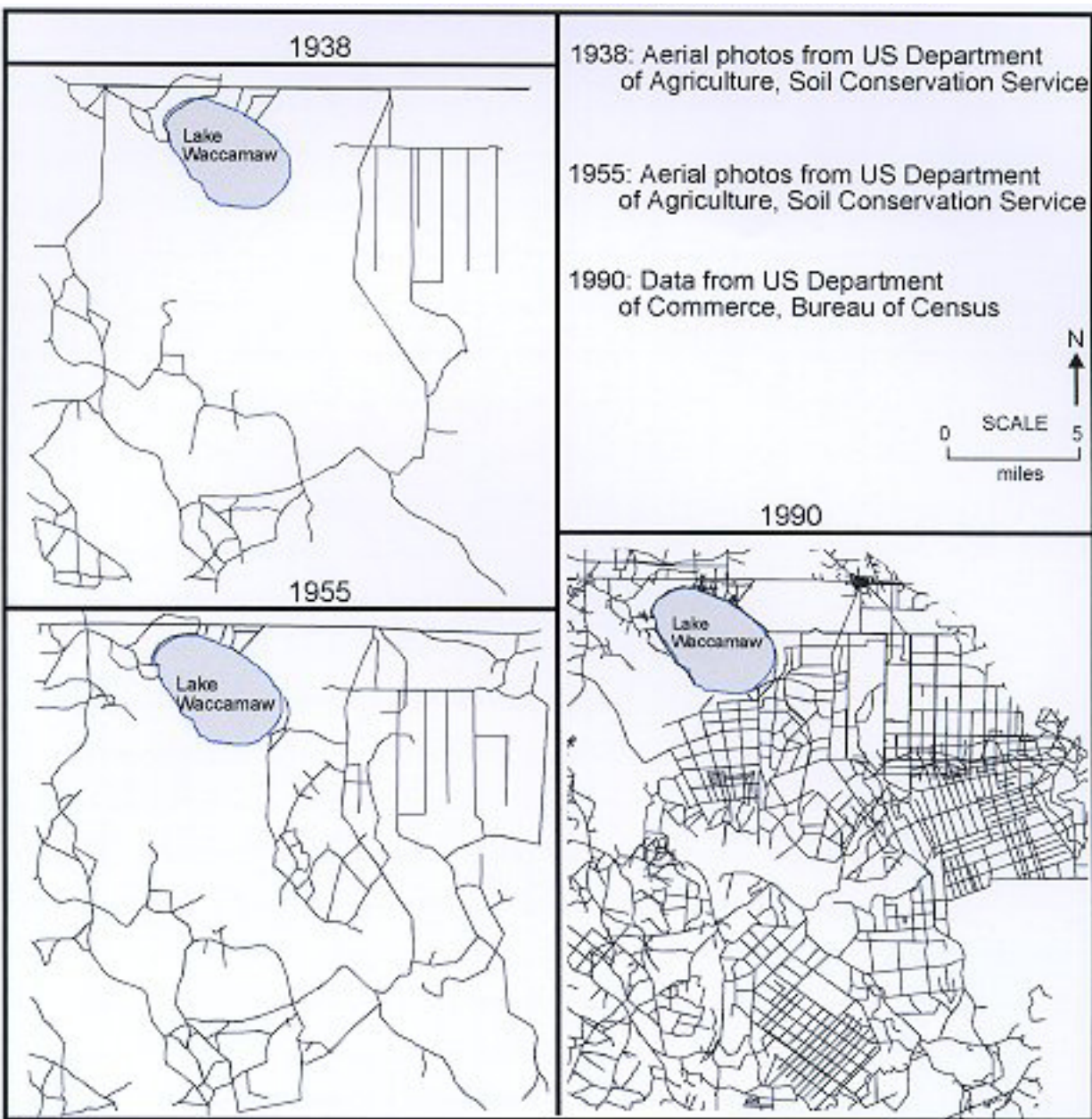
These are also areas where longer retention times due to decreased flows allow algae to take full advantage of the nutrients present resulting in algal blooms. During the daylight hours, algae greatly increase the amount dissolved oxygen in the water, but at night algal respiration and die off can cause dissolved oxygen levels to drop low enough to cause fish kills. Besides increasing the frequency of fish kills, algae blooms can also cause problems for recreation and difficulty in water treatment resulting in taste and odor problems in finished drinking water.

Effects of Artificial Drainage

Artificially draining wetlands, as is the case in much of the Waccamaw and Long Bay Subbasins, can have impacts on water quality. It increases both the severity of flooding and drought. Wetlands reduce the risk and

severity of flooding by retaining water and allowing it to slowly seep into the ground and recharge the aquifers. The surficial and Pee Dee aquifers feed into the Waccamaw River, supplying it with a more consistent baseflow. Without discharge from the aquifers to the river the water will be dominated by swamp water and could result in decreased pH. Recharge of the aquifers is important to the Long Bay Subbasin because it prevents saline water from intruding into the aquifer and up the coastal rivers. Figure 8-4 shows the extent of artificial drainage of the wetlands along the Columbus and Brunswick County border.

FIGURE 8-4: ARTIFICIAL DRAINAGE IN THE WACCAMAW AND LONG BAY SUBBASINS THROUGH TIME
FROM RIGGS, ET AL.



Chapter 9

Source Water Assessment Program

Introduction

The Federal Safe Drinking Water Act (SDWA) Amendments of 1996 emphasize pollution prevention as an important strategy for the protection of ground and surface water resources. This new focus promotes the prevention of drinking water contamination as a cost-effective means to provide reliable, long-term and safe drinking water sources for public water supply (PWS) systems. In order to determine the susceptibility of public water supply sources to contamination, the amendments also required that all states establish a Source Water Assessment Program (SWAP). Specifically, Section 1453 of the SDWA Amendments require that states develop and implement a SWAP to:

- Delineate source water assessment areas;
- Inventory potential contaminants in these areas; and
- Determine the susceptibility of each public water supply to contamination.

In North Carolina, the agency responsible for the SWAP is the Public Water Supply (PWS) Section of the DENR Division of Environmental Health (DEH). The PWS Section received approval from the EPA for their SWAP Plan in November 1999. The SWAP Plan, entitled North Carolina's Source Water Assessment Program Plan, fully describes the methods and procedures used to delineate and assess the susceptibility of more than 9,000 wells and approximately 207 surface water intakes. To review the SWAP Plan, visit the PWS website at <http://swap.deh.enr.state.nc.us/swap/>.

Delineation of Source Water Assessment Areas

The SWAP Plan builds upon existing protection programs for ground and surface water resources. These include the state's Wellhead Protection Program and the Water Supply Watershed Protection Program.

Wellhead Protection (WHP) Program

North Carolinians withdraw more than 88 million gallons of groundwater per day from more than 9,000 water supply wells across the state. In 1986, Congress passed Amendments to the SDWA requiring states to develop wellhead protection programs that reduce the threat to the quality of groundwater used for drinking water by identifying and managing recharge areas to specific wells or wellfields.

Defining a wellhead protection area (WHPA) is one of the most critical components of wellhead protection. A WHPA is defined as "the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The SWAP uses the methods described in the state's approved WHP Program to delineate source water assessment areas for all public water supply wells. More information related to North Carolina's WHP Program can be found at <http://swap.deh.enr.state.nc.us/swap/>.

Water Supply Watershed Protection (WSWP) Program

DWQ is responsible for managing the standards and classifications of all water supply watersheds. In 1992, the WSWP Rules were adopted by the EMC and require all local governments that have land use jurisdiction within water supply watersheds adopt and implement water supply watershed protection ordinances, maps and management plans. SWAP uses the established water supply watershed boundaries and methods established by the WSWP program as a basis to delineate source water assessment areas for all public water surface water intakes. Additional information regarding the WSWP Program can be found at <http://h2o.enr.state.nc.us/wswp/>.

Susceptibility Determination – North Carolina’s Overall Approach

The SWAP Plan contains a detailed description of the methods used to assess the susceptibility of each PWS intake in North Carolina. The following is a brief summary of the susceptibility determination approach.

Overall Susceptibility Rating

The overall susceptibility determination rates the potential for a drinking water source to become contaminated. The overall susceptibility rating for each PWS intake is based on two key components: a contaminant rating and an inherent vulnerability rating. For a PWS to be determined “susceptible”, a potential contaminant source must be present and the existing conditions of the PWS intake location must be such that a water supply could become contaminated. The determination of susceptibility for each PWS intake is based on combining the results of the inherent vulnerability rating and the contaminant rating for each intake. Once combined, a PWS is given a susceptibility rating of higher, moderate or lower (H, M or L).

Inherent Vulnerability Rating

Inherent vulnerability refers to the physical characteristics and existing conditions of the watershed or aquifer. The inherent vulnerability rating of groundwater intakes is determined based on an evaluation of aquifer characteristics, unsaturated zone characteristics and well integrity and construction characteristics. The inherent vulnerability rating of surface water intakes is determined based on an evaluation of the watershed classification (WSWP Rules), intake location, raw water quality data (i.e., turbidity and total coliform) and watershed characteristics (i.e., average annual precipitation, land slope, land use, land cover, groundwater contribution).

Contaminant Rating

The contaminant rating is based on an evaluation of the density of potential contaminant sources (PCSs), their relative risk potential to cause contamination, and their proximity to the water supply intake within the delineated assessment area.

Inventory of Potential Contaminant Sources (PCSs)

In order to inventory PCSs, the SWAP conducted a review of relevant, available sources of existing data at federal, state and local levels. The SWAP selected sixteen statewide databases that were attainable and contained usable geographic information related to PCSs.

Source Water Protection

The PWS Section believes that the information from the source water assessments will become the basis for future initiatives and priorities for public drinking water source water protection (SWP) activities. The PWS Section encourages all PWS system owners to implement efforts to manage identified sources of contamination and to reduce or eliminate the potential threat to drinking water supplies through locally implemented programs

To encourage and support local SWP, the state offers PWS system owners assistance with local SWP as well as materials such as:

- Fact sheets outlining sources of funding and other resources for local SWP efforts.
- Success stories describing local SWP efforts in North Carolina.
- Guidance about how to incorporate SWAP and SWP information in Consumer Confidence Reports (CCRs).

Information related to SWP can be found at <http://swap.deh.enr.state.nc.us/swap>.

Public Water Supply Susceptibility Determinations in the Lumber Basin

In April 2004, the PWS Section completed source water assessments for all drinking water sources and generated reports for the PWS systems using these sources. The assessments are updated regularly; the most recent updates were published in May 2007. The results of the assessments can be viewed in two different ways, either through the interactive ArcIMS mapping tool or compiled in a written report for each PWS system. To access the ArcIMS mapping tool, simply click on the “NC SWAP Info” icon on the web page: <http://swap.deh.enr.state.nc.us/swap/>. To view a report, select the PWS System of interest by clicking on the “SWAP Reports” icon.

In the Lumber River Basin, 381 public water supply sources were identified. Two are surface water sources, seven are groundwater under the influence of surface water and 372 are groundwater sources. Of the 372 groundwater sources, 40 of them have a Higher, 273 have a Moderate and 59 have a Lower susceptibility rating. Of the seven groundwater sources under the influence of surface water, all of them have a Higher susceptibility rating. Table 9-1 identifies the surface water sources and their overall susceptibility ratings. It is important to note that a susceptibility rating of Higher does not imply poor water quality. Susceptibility is an indication of a water supply’s potential to become contaminated by the identified PCSs within the assessment area.

TABLE 9-1 SWAP RESULTS FOR SURFACE WATER SOURCES IN THE LUMBER RIVER BASIN

PWS ID NUMBER	INHERENT VULNERABILITY RATING	CONTAMINANT RATING	OVERALL SUSCEPTIBILITY RATING	NAME OF SURFACE WATER SOURCE	PWS NAME
0378010	H	M	H	Lumber River	City of Lumberton
0363010	M	M	M	Drowning Creek	Town of Southern Pines

Chapter 10

Natural Heritage Program

Overview

The Natural Heritage Program is a part of the Office of Natural Resource Planning and Conservation. The program inventories, catalogues, and supports conservation of the rarest and the most outstanding elements of the natural diversity of our state. These elements of natural diversity include those plants and animals which are so rare or the natural communities which are so significant that they merit special consideration as land-use decisions are made.

The Natural Heritage Program follows methodology developed by The Nature Conservancy and shared by the Natural Heritage Network and NatureServe. By consolidating information about hundreds of rare species and natural communities, the program is able to ensure that the public is able to get the information that is needed, to weigh the ecological significance of various sites, and to evaluate the likelihood and nature of ecological impacts. This information supports informed evaluations of the trade-offs associated with biological diversity and development projects before plans have been finalized. Finally, this information facilitates the establishment of priorities for the protection of North Carolina's most significant natural areas.

Natural Heritage Areas in the Lumber Basin

There are several natural heritage areas in the Lumber Basin that are vital not only because they provide habitat for unique plant and animal species but also because they protect water quality. Some of the areas identified by the Natural Heritage Program are currently being protected by private non-profit organizations, state agencies, or the federal government. Figure 10-1 depicts the areas identified by the Natural Heritage Program as significant natural resources to be protected.

Many rare and endemic species have been cataloged by the Natural Heritage Program in the basin. There are currently six species on the US Fish and Wildlife list of Endangered species. Another four are considered Threatened and 45 more are Species of Concern. The state of North Carolina list 24 Endangered species, 29 Threatened species, 136 Significantly Rare species, and 30 species of concern in the Lumber Basin. A list of these species is provide in Tables 10-1 for animals and 10-2 for plants. While not all of these species are aquatic dwelling all of them rely on clean sources of water. There are 45 species of animals in the basin that are considered either aquatic or wetland dwelling and considered by the Natural Heritage Program to be Rare or Endangered.

Nationally Significant Natural Heritage Areas

There are 24 areas in the basin that are considered by the NC NHP to be of national significance. Two of these areas are currently under extreme pressure. The Upper Waccamaw River Swamp has been affected by and is under continued pressure by the logging industry due to the clear-cutting of cypress and tupelo trees in the swamp. The Boiling Springs Wetland Complex is being threatened by development that would eliminate much of this area as a suitable habitat for species that are on the verge of being lost. It would also impact the hydrologic regime creating further stormwater runoff to already Impaired shellfish waters.

For more information on the Natural Heritage Program visit <http://www.ncnhp.org>.

FIGURE 10-1: CONSERVATION AREAS IN THE LUMBER RIVER BASIN

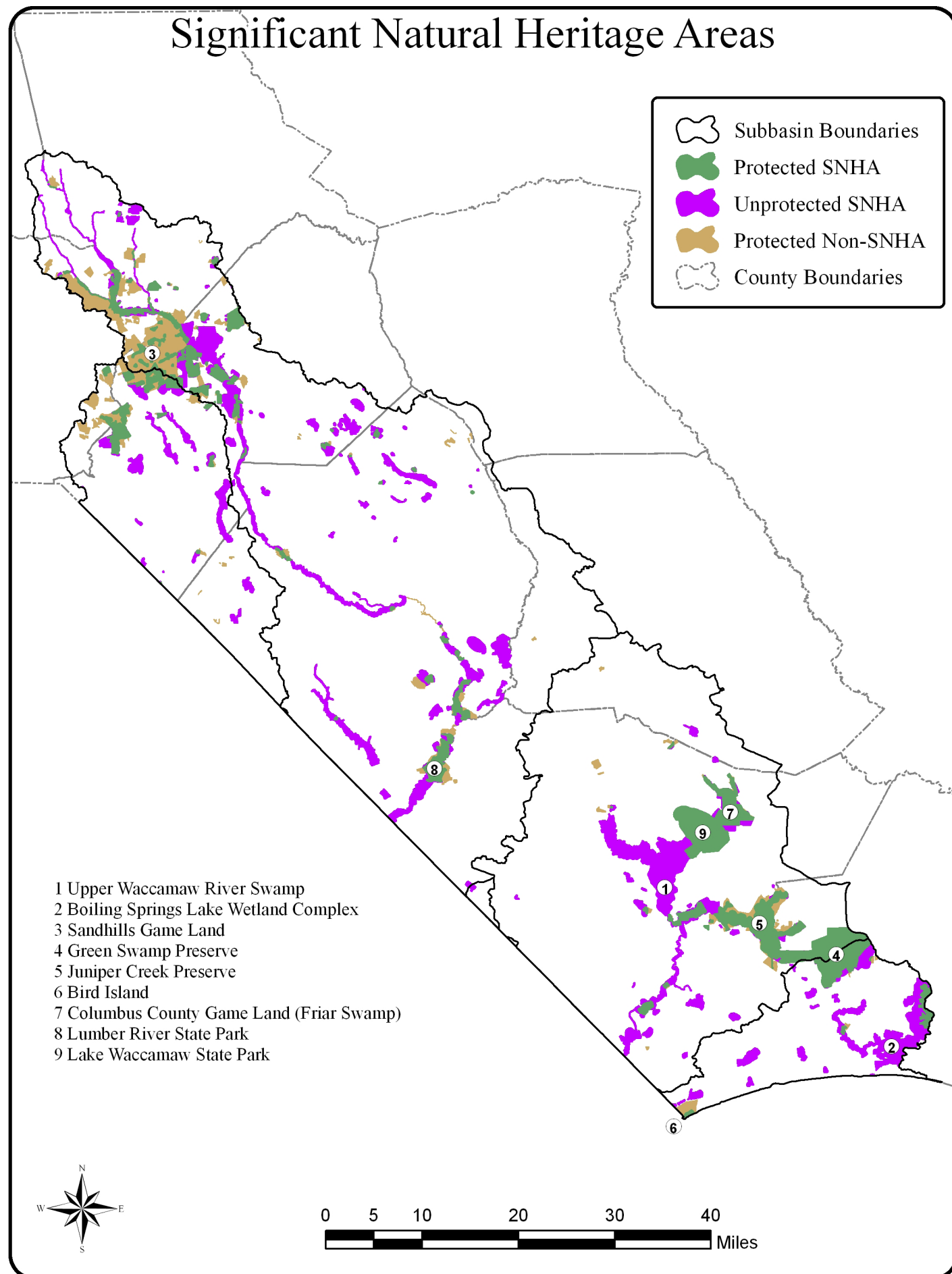


TABLE 10-1: RARE AND ENDANGERED ANIMAL SPECIES IN THE LUMBER BASIN

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
<i>Acronicta sinenscripta</i>	Dagger Moth (sp)	Significantly Rare	None
<i>Agrotis carolina</i>	Dart Moth (sp)	Significantly Rare	Species of Concern
<i>Aimophila aestivalis</i>	Bachman's Sparrow	Species of Concern	Species of Concern
<i>Alligator mississippiensis</i> *	American Alligator	Threatened	Threatened (S/A)
<i>Amblyscirtes alternata</i>	Dusky Roadside-Skipper	Significantly Rare	None
<i>Amblyscirtes reversa</i> *	Reversed Roadside-Skipper	Significantly Rare	None
<i>Ambystoma mabeei</i> *	Mabee's Salamander	Significantly Rare	None
<i>Ambystoma tigrinum</i> *	Eastern Tiger Salamander	Threatened	None
<i>Ammodramus henslowii susurrans</i>	Eastern Henslow's Sparrow	Species of Concern	Species of Concern
<i>Amnicola species 1</i> *	Waccamaw Snail	Species of Concern	None
<i>Anacamptodes cypressaria</i>	Inchworm Moth (sp)	Significantly Rare	None
<i>Apantesis Species 1</i>	Tiger Moth (sp)	Significantly Rare	None
<i>Attaneuria ruralis</i> *	Stonefly (sp)	Significantly Rare	None
<i>Calephelis virginienensis</i> *	Little Metalmark	Significantly Rare	None
<i>Callophrys hesseli</i> *	Hessel's Hairstreak	Significantly Rare	None
<i>Callophrys irus</i>	Frosted Elfin	significantly Rare	None
<i>Carinella waccamawensis</i> *	Waccamaw Ambersnail	Threatened	None
<i>Ceraclea cancellata</i> *	Caddisfly (sp)	Significantly Rare	None
<i>Charadrius melodus</i>	Piping Plover	Threatened	Threatened
<i>Charadrius wilsonia</i>	Wilson's Plover	Species of Concern	None
<i>Chelonia mydas</i> *	Green Seaturtle	Threatened	Threatened
<i>Chondestes grammacus</i>	Lark Sparrow	Significantly Rare	None
<i>Choroterpes basalis</i> *	Mayfly (sp)	Significantly Rare	None
<i>Cincinnatia species 1</i> *	Waccamaw Siltsnail	Species of Concern	None
<i>Columbina passerina</i>	Common Ground Dove	Significantly Rare	None
<i>Condylura cristata population 1</i>	Star-nosed Mole - Coastal Plain Population	Species of Concern	None
<i>Corynorhinus rafinespuii macrotis</i>	Rafinesque's Big-eared Bat - Coastal Plain Subspecies	Species of Concern	Species of Concern
<i>Crotalus adamanteus</i>	Eastern Diamondback Rattlesnake	Endangered	None
<i>Croalus horridus</i>	Tiber Rattlesnake	Species of Concern	None
<i>Cyprinella Species 1</i> *	Thinlip Chub	Species of Concern	None
<i>Deirochelys reticulata</i> *	Chicken Turtle	Significantly Rare	None
<i>Dendroica virens waynei</i>	Black-throated Green Warbler - Coastal Plains Population	Significantly Rare	None
<i>Egretta caerulea</i>	Little Blue Heron	Species of Concern	None
<i>Egretta thula</i>	Snowy Egret	Species of Concern	None
<i>Elassoma boehlkei</i> *	Carolina Pygmy Sunfish	Threatened	Species of Concern
<i>Elliptio folliculata</i> *	Pod Lance	Species of Concern	None
<i>Elliptio marsupiobesa</i> *	Cape Fear Spike	Species of Concern	None
<i>Elliptio Waccamawensis</i> *	Waccamaw Spike	Endangered	Species of Concern
<i>Etheostoma mariae</i> *	Pinewoods Darter	Species of Concern	Species of Concern
<i>Etheostoma perlongum</i> *	Waccamaw Darter	Threatened	Species of Concern
<i>Eubaphe meridiana</i>	The Little Beggar	Significantly Rare	None
<i>Euphyes bimacula</i> *	Two-spotted Skipper	Significantly Rare	None
<i>Eurycea quadridigitata</i> *	Dwarf Salamander	Species of Concern	None

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
<i>Exyra semicrocea</i>	Pitcher Plant Moth (sp)	Significantly Rare	None
<i>Fundulus waccamensis</i> *	Waccamaw Killfish	Species of Concern	Species of Concern
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Threatened	None
<i>Hesperia attalus slossonae</i>	Dotted Skipper	Significantly Rare	None
<i>Hesperia meskei</i>	Meske's Skipper	Significantly Rare	None
<i>Heterodon simus</i>	Southern Hognose Snake	Species of Concern	Species of Concern
<i>Hyla andersonii</i> *	Pine Barrens Treefrog	Significantly Rare	None
<i>Hypagyrtis brendae</i>	Benda's Hypagyrtis	Significantly Rare	None
<i>Lampsilis cariosa</i> *	Yellow Lampmussel	Endangered	Species of Concern
<i>Lampsilis fullerkati</i> *	Waccamaw Fatmucket	Threatened	Species of Concern
<i>Lampsilis radiata</i> *	Eastern Lampmussel	Threatened	None
<i>Leptodea ochracea</i> *	Tidewater Mucket	Threatened	None
<i>Masticophis flagellum</i>	Coachwhip	Significantly Rare	None
<i>Menidia extensa</i> *	Waccamaw Silverside	Threatened	Threatened
<i>Metarranthis lateritiaria</i>	Inchworm Moth (sp)	Significantly Rare	None
<i>Micrurus fulvius</i>	Eastern Coral Snake	Endangered	None
<i>Mycteria americana</i>	Wood Stork	Endangered	Endangered
<i>Myotis austroriparius</i>	Southeastern Myotis	Species of Concern	Species of Concern
<i>Nematocampa baggetaria</i>	Baggett's Nematocampa	Significantly Rare	None
<i>Noturus species 2</i> *	Broadtail Madtom	Species of Concern	Species of Concern
<i>Ophisaurus mimicus</i>	Mimic Glass Lizard	Species of Concern	Species of Concern
<i>Orgyia detrita</i>	Tussock Moth (sp)	Significantly Rare	None
<i>Papaipema appassionata</i>	Pitcher Plant Borer Moth	Significantly Rare	None
<i>Papilio cressphontes</i>	Giant Swallowtail	Significantly Rare	None
<i>passerina ciris ciris</i>	Eastern Painted Bunting	Species of Concern	Species of Concern
<i>Picoides borealis</i>	Red-cockaded Woodpecker	Endangered	Endangered
<i>Pituophis melanoleucus melanoleucus</i>	Northern Pine Snake	Species of Concern	Species of Concern
<i>Porphyrio martinica</i>	Purple Gallinule	Significantly Rare	None
<i>Procambarus braswelli</i> *	Waccamaw Crayfish	Species of Concern	None
<i>Pseudacris ornata</i> *	Ornate Chorus Frog	Significantly Rare	None
<i>Rana capito</i> *	Carolina Gopher Frog	Threatened	Species of Concern
<i>Rana heckscheri</i> *	River Frog	Species of Concern	None
<i>Regina rigida</i> *	Glossy Crayfish Snake	Significantly Rare	None
<i>Rynchops niger</i>	Black Skimmer	Species of Concern	None
<i>Satyrium edwardsii</i>	Edward's Hairstreak	Significantly Rare	None
<i>Satyrium favonius ontario</i>	Northern Oak Hairstreak	Significantly Rare	None
<i>Sciurus niger</i>	Eastern Fox Squirrel	Significantly Rare	None
<i>Seminatrix pygaea</i> *	Black Swamp Snake	Significantly Rare	None
<i>Semotilus lumbee</i> *	Sandhills Chub	Species of Concern	Species of Concern
<i>Sistrurus miliarius</i>	Pygmy Rattlesnake	Species of Concern	None
<i>Spartiniphaga caterae</i>	Carter's Noctuid Moth	Significantly Rare	Species of Concern
<i>Sternula antillarum</i>	Least Tern	Species of Concern	None
<i>Toxolasma pullus</i> *	Savannah Lilliput	Endangered	Species of Concern
<i>Trienodes marginatus</i> *	Trienode Caddisfly (sp)	Significantly Rare	None
<i>Trichechus manatus</i> *	West Indian Manatee	Endangerd	Endangered
<i>Triodopsis soelneri</i> *	Cape Fear Threetooth	Threatened	Species of Concern
<i>Viviparus intertextus</i> *	Rotund Mystrysnail	Significantly Rare	None

*Denotes Aquatic or Wetland Dwelling Species

TABLE 10-2: RARE AQUATIC AND WETLAND PLANTS IN THE LUMBER BASIN

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
<i>Agalinis virgata</i>	Branched Gerardia	Significantly Rare	None
<i>Allium</i> sp. 1	Savanna Onion	Significantly Rare	Species of Concern
<i>Amorpha georgiana</i> v. <i>confusa</i>	Savanna Indigo-bush	Threatened	Species of Concern
<i>Amphicarpum muehlenbergianum</i>	Florida Goober Grass	Endangered	None
<i>Andropogon mohrii</i>	Bog Bluestem	Significantly Rare	None
<i>Aristida simpliciflora</i>	Chapman's Three-awn	Significantly Rare	None
<i>Arnoglossum ovatum</i>	Savanna Indian-plantain	Significantly Rare	None
<i>Asclepias pedicellata</i>	Savanna Milkweed	Significantly Rare	None
<i>Bacopa caroliniana</i> *	Blue Water-Hyssop	Significantly Rare	None
<i>Campylopus carolinae</i>	Savanna Campylopus	Significantly Rare	Species of Concern
<i>Carex canescens</i> ssp. <i>disjuncta</i>	Silvery Sedge	Significantly Rare	None
<i>Carex crus-corvi</i>	Crowfoot Sedge	Significantly Rare	None
<i>Carex exillis</i>	Coastal Sedge	Threatened	None
<i>Carex</i> sp. 4	Canebreak Sedge	Significantly Rare	None
<i>Carex verrucosa</i>	Warty Sedge	Significantly Rare	None
<i>Cheilolejeunea rigidula</i>	A Liverwort	Significantly Rare	None
<i>Cirsium lecontei</i>	Leconte's Thistle	Significantly Rare	None
<i>Cladium mariscoides</i>	Twig-rush	Significantly Rare	None
<i>Coreopsis helianthoides</i>	Beadle's Coreopsis	Significantly Rare	None
<i>Crocanthermum carolinianum</i>	Carolina Sunrose	Significantly Rare	None
<i>Cyperus lecontei</i>	Leconte's Flatsedge	Significantly Rare	None
<i>Danthonia epilis</i>	Bog Oatgrass	Significantly Rare	None
<i>Dichanthelium</i> sp. 9	A Witch Grass	Significantly Rare	None
<i>Dionaea muscipula</i>	Venus Flytrap	Significantly Rare	Species of Concern
<i>Ditrysinia fruticosa</i>	Sebastian-bush	Threatened	None
<i>Drosera filiformis</i>	Threadleaf Sundew	Significantly Rare	None
<i>Echinodorus tenellus</i>	Dwarf Burhead	Significantly Rare	None
<i>Eleocharis atropurpurea</i>	Purple Spikerush	Significantly Rare	None
<i>Eleocharis robbinsii</i>	Robbin's Spikerush	Significantly Rare	None
<i>Epidendrum magnoliae</i>	Green Fly Orchid	Significantly Rare	None
<i>Eriocaulon aquaticum</i>	Seven-angled Pipewort	Significantly Rare	None
<i>Eupatorium leptophyllum</i>	Limesink Dog-fennel	Significantly Rare	None
<i>Eupatorium resinosum</i>	Pine Barren Boneset	Species of Concern	None
<i>Fimbristylis perpusilla</i>	Harper's Fimbry	Endangered	Species of Concern
<i>Gelsemium rankinii</i>	Swamp Jessamine	Significantly Rare	None
<i>Gratiola aurea</i>	Golden Hedge-hyssop	Significantly Rare	None
<i>Gratiola ramosa</i>	Branched Hedge-hyssop	Significantly Rare	None
<i>Helenium pinnatifidum</i>	Dissected Sneezeweed	Significantly Rare	None
<i>Helenium vernale</i>	Spring Sneezeweed	Endangered	None
<i>Helianthus floridanus</i>	Florida Sunflower	Endangered	None
<i>Hibiscus aculeatus</i>	Comfortroot	Significantly Rare	None
<i>Hymenocallis pygmaea</i>	Waccamaw River Spiderlily	Significantly Rare	None
<i>Hypericum fasciculatum</i>	Peelbark Saint John's-Wort	Significantly Rare	None
<i>Ilex amelanchier</i>	Sarvis Holly	Significantly Rare	None
<i>Iva microcephala</i>	Small-headed Marsh Elder	Significantly Rare	None
<i>Lachnocaulon minus</i>	Brown Bogbutton	Significantly Rare	None

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
<i>Lechaea torreyi</i>	Torrey's Pinweed	Significantly Rare	None
<i>Lejeunea bermudiana</i>	A Liverwort	Significantly Rare	None
<i>Lilaeopsis carolinensis</i> *	Carolina Grasswort	Threatened	None
<i>Lilium pyrophilum</i>	Sandhills Lily	Species of Concern	Species of Concern
<i>Lindera subcoriacea</i>	Bog Spicebush	Threatened	Species of Concern
<i>Linum floridanum</i> v. <i>chrysocarpum</i>	Yellow-fruited Flax	Significantly Rare	None
<i>Lipocarpa micrantha</i>	Small-flowered Hemicarpha	Endangered	None
<i>Litsea aestivalis</i>	Pondspice	Significantly Rare	Species of Concern
<i>Lobelia boykinii</i>	Boykin's Lobelia	Threatened	Species of Concern
<i>Lophiola aurea</i>	Golden-crest	Endangered	None
<i>Lopholejeunea muelleriana</i>	A Liverwort	Significantly Rare	None
<i>Ludwigia linifolia</i>	Flaxleag Seedbox	Significantly Rare	None
<i>Ludwigia ravenii</i>	Raven's Seedbox	Significantly Rare	Species of Concern
<i>Ludwigia sphaerocarpa</i>	Globe-fruit Seedbox	Significantly Rare	None
<i>Ludwigia suffruticosa</i>	Shrubby Seedbox	Significantly Rare	None
<i>Luziola fluitans</i> *	Southern Water Grass	Significantly Rare	None
<i>Lysimachia asperulifolia</i>	Rough-leaf Loosestrife	Endangered	Endangered
<i>Macbridea caroliniana</i>	Carolina Bogmint	Threatened	Species of Concern
<i>Muhlenbergia torreyana</i>	Pinebarren Smokegrass	Endangered	None
<i>Oldenlandia boscii</i>	Bosc's Bullet	Significantly Rare	None
<i>Oxypolis canbyi</i>	Canby's Dropwort	Endangered	Endangered
<i>Parnassia caroliniana</i>	Carolina Grass-of-parnassus	Endangered	Species of Concern
<i>Paspalum dissectum</i>	Mudbank Crowngrass	Significantly Rare	None
<i>Peltandra sagittifolia</i>	Spoonflower	Significantly Rare	None
<i>Persicaria hirsuta</i>	Hairy Smartweed	Significantly Rare	None
<i>Pityopsis graminifolia</i> v.	A Silkgrass	Significantly Rare	None
<i>Plagiochila dubia</i>	A Liverwort	Significantly Rare	None
<i>Plantago sparsiflora</i>	Pineland Plantain	Endangered	Species of Concern
<i>Platanthera integra</i>	Yellow Fringeless Orchid	Threatened	None
<i>Platanthera nivea</i>	Snowy Orchid	Threatened	None
<i>Polyfala hookeri</i>	Hooker's Milkwort	Significantly Rare	None
<i>Potamogeton confervoides</i> *	Conferva Pondweed	Significantly Rare	None
<i>Rhexia aristosa</i>	Awed Meadow-beauty	Threatened	Species of Concern
<i>Rhynchospora alba</i>	Northern White Beaksedge	Significantly Rare	None
<i>Rhynchospora brevifolia</i>	Short-bristled Beaksedge	Significantly Rare	None
<i>Rhynchospora decurrens</i>	Swamp Forest Beaksedge	Significantly Rare	Species of Concern
<i>Rhynchospora divergens</i>	White-seeded Beaksedge	Significantly Rare	None
<i>Rhynchospora macrocarpa</i>	Southern White Beaksedge	Endangered	None
<i>Rhynchospora odorata</i>	Fragrant Beaksedge	Endangered	None
<i>Rhynchospora pinetorum</i>	Small's Beaksedge	Significantly Rare	None
<i>Rhynchospora pleiantha</i>	Coastal Beaksedge	Threatened	Species of Concern
<i>Rhynchospora thornei</i>	Thorne's Beaksedge	Endangered	Species of Concern
<i>Rhynchospora tracyi</i>	Tracy's Beaksedge	Significantly Rare	None
<i>Sabatia kennedyana</i>	Plymouth Centian	Species of Concern	None
<i>Sagittaria isoetiformis</i>	Quillwort Arrowhead	Significantly Rare	None
<i>Sagittaria stagnerum</i> *	Water Arrowhead	Significantly Rare	None
<i>Sagittaria weatherbiana</i>	Grassleaf Arrowhead	Significantly Rare	Species of Concern
<i>Sarracenia minor</i>	Hooded Pitcher Plant	Threatened	None

SCIENTIFIC NAME	COMMON NAME	STATE STATUS	FEDERAL STATUS
<i>Schoenoplectus etuberculatus*</i>	Canby's Bulrush	Significantly Rare	None
<i>Schoenoplectus subterminalis*</i>	Swaying Bulrush	Significantly Rare	None
<i>Schwalbea americana</i>	Chaffseed	Endangered	Endangered
<i>Scleria baldwinii</i>	Baldwin's Nutrush	Significantly Rare	None
<i>Scleria reticularis</i>	Netted Nutrush	Significantly Rare	None
<i>Scleria verticillata</i>	Savanna Nutrush	Significantly Rare	None
<i>Solidago leavenworthii</i>	Leavenworth's Goldenrod	Significantly Rare	None
<i>Solidago verna</i>	Spring-flowering Goldenrod	Threatened	Species of Concern
<i>Sphagnum fallax</i>	Pretty Peatmoss	Significantly Rare	None
<i>Sphagnum torreyanum*</i>	Giant Peatmoss	Significantly Rare	None
<i>Spiranthes eatonii</i>	Eaton's Ladies'-tresses	Significantly Rare	None
<i>Spiranthes laciniata</i>	Lace-lip Ladies'-tresses	Significantly Rare	None
<i>Spiranthes longilabris</i>	Giant Spiral Orchid	Threatened	Species of Concern
<i>Sporobolus teretifolius</i>	Wireleaf Dropseed	Threatened	Species of Concern
<i>Sporobolus virginicus</i>	Saltmarsh Dropseed	Significantly Rare	None
<i>Stylisma aquatica</i>	Water Dawnflower	Significantly Rare	None
<i>Thalictrum cooleyi</i>	Cooley's Meadowrue	Endangered	Endangered
<i>Thalictrum macrostylum</i>	Small-leaved Meadowrue	Significantly Rare	Species of Concern
<i>Torreyochloa pallida*</i>	Pale Mannagrass	Significantly Rare	None
<i>Tridens ambiguus</i>	Pineland Triodia	Endangered	None
<i>Utricularia cornuta*</i>	Horned Bladderwort	Significantly Rare	None
<i>Vaccinium macrocarpon</i>	Cranberry	Significantly Rare	None
<i>Vaccinium virgatum</i>	Small-flower Blueberry	Significantly Rare	None
<i>Xyris chapmanii</i>	Chapman's Yellow-eyed-grass	Significantly Rare	None
<i>Xyris difformis</i> v. <i>floridana</i>	Florida Yellow-eyed-grass	Significantly Rare	None
<i>Xyris scabrifolia</i>	Harper's Yellow-eyed-grass	Significantly Rare	Species of Concern
<i>Xyris Stricta</i>	Pineland Yellow-eyed-grass	Significantly Rare	None

*Denotes Aquatic

Chapter 11

Ecosystem Enhancement Program

Overview

The North Carolina Ecosystem Enhancement Program (EEP) is responsible for providing ecologically effective compensatory mitigation in advance of permitted impacts associated with road projects and other development activities. The fundamental mission of the program is to restore, enhance and protect key watershed functions in the 17 river basins across the state. This is accomplished through the implementation of wetland, stream and riparian buffer projects within selected local watersheds. The vital watershed functions that EEP seeks to restore and protect include water quality, floodwater conveyance and storage, fisheries and wildlife habitat.

The EEP is not a grant program, but can implement its restoration projects cooperatively with other state or federal programs such as the Section 319 Program. Combining EEP-funded restoration or preservation projects with 319 or other local watershed initiatives (e.g., those funded through the Clean Water Management Trust Fund or local/regional Land Trusts) increases the potential to improve the water quality, hydrologic and habitat functions within selected watersheds.

Watershed Planning by the Ecosystem Enhancement Program

The selection of optimal sites for EEP mitigation projects is founded on a basinwide and local watershed planning approach that results, respectively, in the development of River Basin Restoration Priorities and Local Watershed Plans.

River Basin Restoration Planning

In developing River Basin Restoration Priorities (RBRP) (formerly called Watershed Restoration Plans), the EEP identifies local watersheds with the greatest need and opportunity for restoration, enhancement or preservation projects. These high-priority watersheds are called “Targeted Local Watersheds” (TLWs). Targeted Local Watersheds are identified, in part, using information compiled by DWQ’s programmatic activities (e.g., Basinwide Assessment Reports). Local factors considered in the selection of TLWs include: water quality impairment, habitat degradation, the presence of critical habitat or significant natural heritage areas, the presence of water supply watersheds or other high-quality waters, the status of riparian buffers, estimates of impervious cover, existing or planned transportation projects, and the opportunity for local partnerships. Recommendations from local resource agency professionals and the presence of existing or planned watershed projects are given significant weight in the selection of TLWs. Targeted local watersheds represent those areas within a river basin where EEP resources can be focused for maximum benefit to local watershed functions. TLWs are therefore given priority by EEP for the implementation of new stream and wetland restoration/enhancement or preservation projects. The location of the EEP targeted local watersheds in the basin are shown in Figure 11-1.

The 2008 Lumber River Basin Restoration Priorities can be found on the EEP website at http://www.nceep.net/services/lwps/pull_down/by_basin/lumber_RB.html. This is the second River Basin Restoration Priorities plan that has been completed by EEP for the Lumber River basin.

Local Watershed Planning

In addition to river basin restoration planning, EEP also develops Local Watershed Plans (LWPs), usually within targeted local watersheds identified in the RBRPs. Through the local watershed planning process, EEP conducts watershed characterization and field assessment tasks to identify critical stressors in local watersheds. The EEP planners and their consultants coordinate with local resource professionals and local governments to identify

optimal watershed projects and management strategies to address the major functional stressors identified. The LWPs prioritize restoration/enhancement projects, preservation sites, and best management practices (BMP) projects that will provide water quality improvement, habitat protection and other environmental benefits to the local watershed.

NCEEP planners make decisions regarding the possible need for new LWP initiatives within a given basin annually. These decisions are based primarily on the quantity and type of compensatory mitigation projects the Program is required to implement, as well as the opportunity for local partnerships within selected 14-digit hydrologic units within the basin.

EEP completed a Local Watershed Plan for Bear Swamp in 2006. For more information on the Bear Swamp LWP, see the online factsheet at http://www.nceep.net/services/lwps/Bear_Swamp/Bear_Swamp.pdf. Another LWP was completed for Lockwoods Folly River in 2007. For more information on the Lockwoods Folly River LWP, see the factsheet at http://www.nceep.net/services/lwps/Lockwood/Lockwood_Folly.pdf or contact EEP Planner Michele Dostin at (919) 715-6817 or via email at michele.dostin@ncdenr.gov.

For further information on EEP LWPs please visit the EEP factsheets located online at <http://www.nceep.net/services/lwps/localplans.htm>.

NCEEP Projects in the Lumber Basin

As of August 2009, a total of 16 EEP mitigation projects have been implemented within the Lumber Basin. Implemented projects include stream and wetland restoration/enhancement and preservation projects that are in one of three stages: design; construction; or monitoring (construction complete). The 16 EEP projects in this river basin include three projects in the design phase and seven in monitoring. The six remaining projects have completed their monitoring requirements. Of these 16 projects, none have been acquired through EEP's full delivery mitigation program. Table 11-1 lists all EEP restorations projects in the Lumber basin.

TABLE 11-1: EEP MITIGATION PROJECTS IN THE LUMBER RIVER BASIN

PROJECT NUMBER	PROJECT NAME	COUNTY	8-DIGIT HUC
60	Bush Island	Columbus	03040203
128	Ephemeral Pool	Scotland	03040203
201	Juniper Bay	Robeson	03040203
225	Little McQueen	Robeson	03040203
233	Long Swamp	Hoke	03040203
251	Mill Branch	Columbus	03040206
92120	Deep - Horse Creek Mckean	Moore	03040203
92121	Drowning Creek IP Forest Investments	Moore	03040203
92163	Drowning Creek	Moore	03040203
92164	Beaver Dam - Drowning Creek II (Rankin Tract)	Moore	03040203
92165	Wimberly Tract - Nat's Creek	Moore	03040203
92209	Bird Island	Brunswick	03040208
92351	Meadow Branch (Fivemile Branch)	Robeson	03040203
92517	Brown Marsh Swamp	Robeson	03040203
92549	Plum Creek	Brunswick	03040208
92760	Columbus Swamp	Robeson Columbus	03040203

For more information on EEP mitigation projects in the Lumber River Basin, contact Jeff Schaffer (Eastern Operations Supervisor) at (919) 715-1952.

For additional information about EEP's Project Implementation efforts, go to:
http://www.nceep.net/services/implementation/project_implementation.htm.

For additional information about EEP in general, including its various program activities and products, visit
<http://www.nceep.net/>.

FIGURE 11-1: EEP TARGETED LOCAL WATERSHEDS

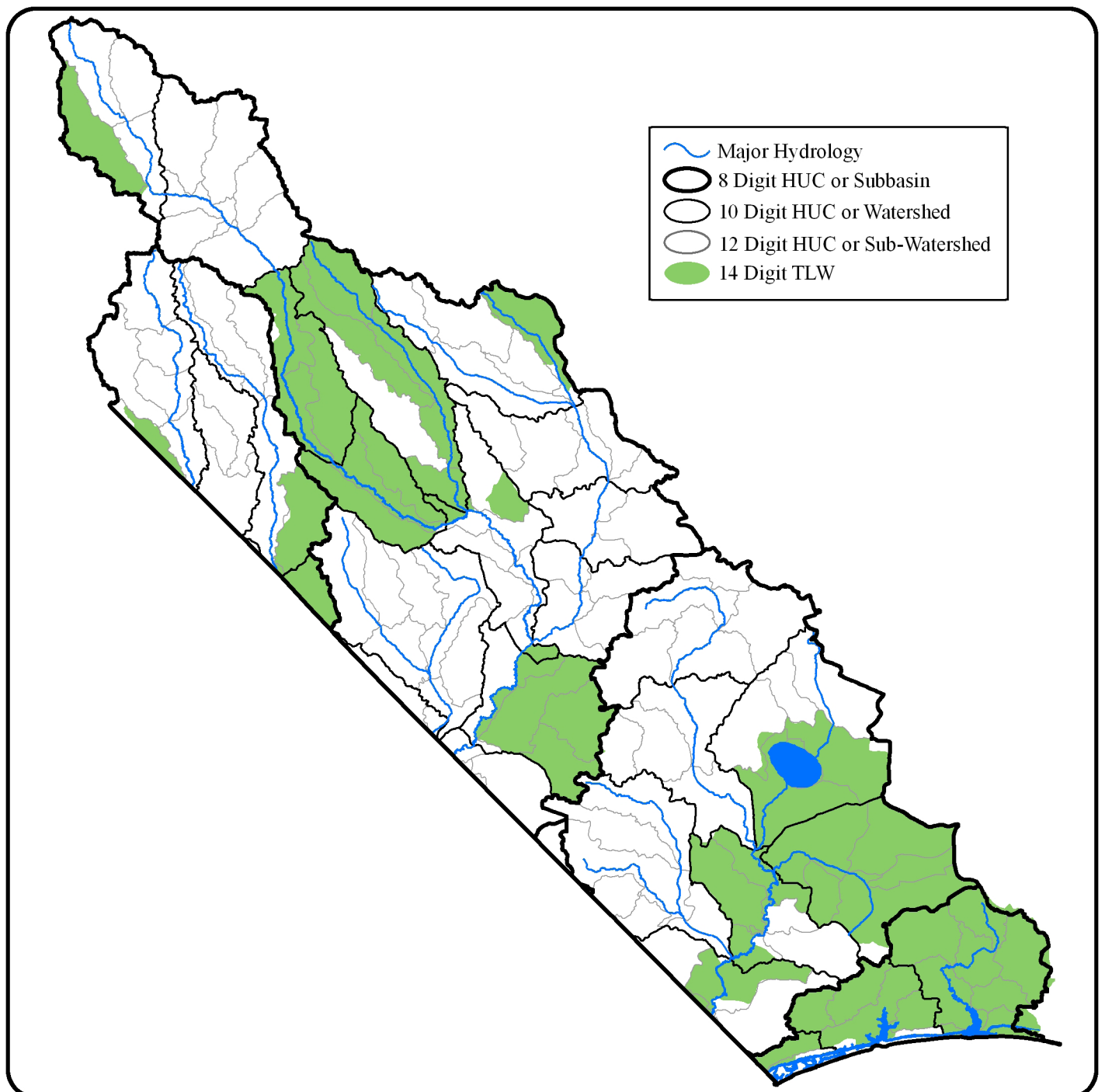


TABLE 11-2: TARGETED LOCAL WATERSHEDS AND 12 DIGIT HUCs

12 DIGIT HUC SUBWATERSHED	SUBWATERSHED NAME	TARGETED LOCAL WATERSHED NUMBER
030402030103	Naked Creek	03040203010040
030402030301	Town of Wagram - Lumber River	03040203020010
030402030302	Gum Swamp	03040203040010
030402030303	Town of Maxton - Lumber River	03040203020010
030402030401	Back Swamp	03040203030020
030402030402	Bear Swamp	03040203050010
030402030403	Mill Branch - Lumber River	03040203030010
030402030501	Upper Raft Swamp	03040203060020
030402030502	Little Raft Swamp	03040203060020
030402030504	Middle Raft Swamp	03040203060020
030402030505	Lower Raft Swamp	03040203060030
030402030605	Gallberry Swamp	03040203110010
030402031001*	Saddletree Swamp	03040203080020
030402031005	River Swamp - Lumber River	03040203190010
030402031003*	Jacob Swamp - Lumber River	03040203050010 03040203060030
030402031101	Dunn Swamp	03040203191010
030402031102	Upper Porter Swamp	03040203191010
030402031103	Lower Porter Swamp	03040203190010 03040203191010
030402031104*	Flowers Swamp - Lumber River	03040203190010
030402040106*	Beaverdam Creek - Gum Swamp Creek	03040204010060
030402040503	Middle Little Pee Dee River	03040204037010
030402040304	Wilkinson Creek	03040204048010
030402060303	Green Swamp - Big Creek	03040206020040
030402060305*	Bogue Swamp	03040206020040
030402060306	Boggy Swamp - Waccamaw River	03040206020040
030402060401	Bear Pen Island Swamp	03040206030010
030402060402	Honey Island Swamp	03040206030010
030402060403*	Upper Juniper Creek	03040206030010
030402060404	Alligator Swamp	03040206030010
030402060405	Lower Juniper Creek	03040206030010
030402060601	Horse Pen Swamp - Waccamaw River	03040206030010 03040206010070
030402060602	Gore Lake - Gore Creek	03040206060010
030402060605	Regan Branch - Waccamaw River	03040206060010 03040206050010
030402060702	Buck Creek - Waccamaw River	03040206050010 03040206090010
030402060704	Bellamy Branch - Waccamaw River	03040206090010
030402080101	Middle Swamp	03040207020010

12 DIGIT HUC SUBWATERSHED	SUBWATERSHED NAME	TARGETED LOCAL WATERSHED NUMBER
030402080102	Headwaters Lockwoods Folly River	03040207020010
030402080103	Royal Oak Swamp	03040207020020
030402080104	Scotts-Branch - Lockwoods Folly River	03040207020010
030402080105	Mill Creek	03040207020030
030402080106	Pamlico Creek - Lockwoods Folly River	03040207020030
030402080107	Town of Long Beach - Montgomery Slough	03040207020040
030402080201	Upper Shallotte River	03040207020060
030402080202	Middle Shallotte River	03040207020060
030402080203	Shallotte Creek	03040207020060
030402080204*	Lower Shallotte River	03040207020060 03040207020090
030402080302	Calabash Creek	03040207020110
030402080303*	Lower Little River - Atlantic Intracoastal Waterway	03040207020110

* Denotes that only part of this subwatershed intersects with an EEP targeted local watershed

Chapter 12

Voluntary Incentive Programs

USDA Natural Resources Conservation Service Programs

Conservation Reserve Program (CRP)

The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, conservation planning and practice implementation. For more information about CRP visit <http://www.nrcs.usda.gov/programs/crp/>.

Environmental Quality Incentives Program (EQIP)

This program addresses locally identified problems with natural resources. High priority is given to assistance where agricultural improvements will help meet water quality objectives. EQIP offers contracts that provide incentive payments and cost sharing for conservation practices, such as manure management systems, pest management, erosion control, and other practices to improve and maintain the health of natural resources. For more information about EQIP visit <http://www.nrcs.usda.gov/programs/eqip/>.

Emergency Watershed Protection Program (EWP)

Section 382 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127, amended the Emergency Watershed Program (EWP) to provide for the purchase of floodplain easements as an emergency measure. Since 1996, NRCS has purchased floodplain easements on lands that qualify for EWP assistance. Floodplain easements restore, protect, maintain, and enhance the functions of the floodplain; conserve natural values including fish and wildlife habitat, water quality, flood water retention, ground water recharge, and open space; reduce long-term federal disaster assistance; and safeguard lives and property from floods, drought, and the products of erosion. For more information about EWP visit <http://www.nrcs.usda.gov/programs/ewp/>.

Wetland Reserve Program (WRP)

Participating landowners can establish conservation easements of either permanent or 30-year duration or can enter restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land and 100 percent of the restoration costs for restoring the wetland. The 30-year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum 10-year duration and provide for 75 percent of the cost of restoring the involved wetlands. Easements set limits on how the lands may be used in the future. Restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the agreement. In all instances, landowners continue to control access to their land. For more information about WRP visit <http://www.nrcs.usda.gov/programs/wrp/>.

Conservation Security Program (CSP)

CSP is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and

private working lands. Working lands include cropland, grassland and improved pasture, as well as, forested land that is an incidental part of an agriculture operation. In 2008, two 8-digit HUC in the state participated in this program one of which is the Little Pee Dee River watershed.

NC Division of Soil and Water Conservation Programs

North Carolina Agriculture Cost Share Program (NC ACSP)

Nonpoint source pollution is a significant source of stressors that lead to stream degradation. The approach taken in North Carolina for addressing agriculture's contribution to the nonpoint source water pollution problem is to primarily encourage voluntary participation by the agricultural community. This approach is supported by financial incentives, technical and educational assistance, research, and regulatory programs.

TABLE 12-1: ACSP PROJECT EXPENDITURES IN THE LUMBER BASIN BETWEEN 2002 AND 2006

8-DIGIT HUC	EROSION REDUCTION/NUTRIENT LOSS REDUCTION IN FIELDS		STREAM PROTECTION FROM ANIMALS		PROPER ANIMAL WASTE MANAGEMENT	
	TOTAL IMPLEMENTED	COST	TOTAL IMPLEMENTED	COST	TOTAL IMPLEMENTED	COST
03040203	8843 acres	\$714,908	6320 feet	\$4,266	27 units	\$176,627
	6 units	\$26,902	--	--	--	--
03040204	5664 acres	\$279,728	--	--	8 units	\$53,214
	490 feet	\$958	--	--	--	--
	1 unit	\$14,137	--	--	--	--
03040206	1570 acres	\$245,640	35540 feet	\$32,347	6 units	\$23,422
	2 units	\$2,979	40 units	\$10,547	--	--
03040208	273 acres	\$46,674	--	--	1 unit	\$24,888
TOTAL	--	\$1,316,831	--	\$47,160	42 units	\$278,151

Financial incentives are provided through North Carolina's Agriculture Cost Share Program. The Division of Soil and Water Conservation (DSWC) within the DENR administers this program. It has been applauded by the U.S. Environmental Protection Agency and has received wide support from the general public as well as the state's agricultural community. Table 12-1 shows the number of projects implemented and in the Lumber Basin and the dollar amount invested. Table 12-2 shows the water quality benefits realized from that investment. For more information about the NC ACSP visit <http://www.enr.state.nc.us/DSWC/pages/agcostshareprogram.html>.

TABLE 12-2: BENEFITS RESULTING FROM BMPs INSTALLED THROUGH NCACSP BETWEEN 2002 AND 2006

BENEFITS	AMOUNT	UNITS
Acres Affected	21,541	Acres
Soil Saved	70,342	Tons
Nitrogen Saved	1,029,852	Pounds
Phosphorous Saved	73,922	Pounds
Waste - Nitrogen Managed	1,264,401	Pounds
Waste - Phosphorus Managed	1,261,674	Pounds

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program, a joint effort between the USDA and the NC DSWC, was originally established in 1999 and was expanded in 2008 to include the Lumber River Basin. This program encourages agricultural land owners to convert sensitive and marginal pastureland to conservation easements. These lands are rented from the owner at a rate based on the soil rental rate as calculated by the Farm Service Agency (FSA).

A CREP conservation easement is a written agreement between a landowner and the state of North Carolina in which there is an acquired interest in the land to install conservation practices that protect natural resources. The conservation easement exists for 10-, 15-, 30 years or permanently, depending on the landowner's choice. With CREP, the landowner voluntarily limits future use of the land for activities such as crop farming and development, yet retains private ownership. As water quality becomes a bigger environmental issue, this program improves and protects water quality while restoring and enhancing riparian habitat corridors next to streams, drainage ditches, estuaries, wetlands and other watercourses. Listed below are the approved BMPs allowed by the CREP program.

- grassed filter strips
- forested riparian buffers
- hardwood tree establishment
- wetlands restoration

For more information about CREP visit <http://www.enr.state.nc.us/DSWC/pages/crep.html>.

Community Conservation Assistance Program (CCAP)

The Community Conservation Assistance Program (CCAP) is designed to improve water quality through the installation of various best management practices (BMPs) on urban, suburban and rural lands, not directly involved in agricultural production. CCAP provides educational, technical and financial assistance to landowners through the local soil and water conservation districts. This program is open to homeowners, businesses, schools, parks, churches, and community groups. The landowner may be reimbursed up to 75 percent of the pre-established average cost of the BMP. For more information about CCAP visit http://www.enr.state.nc.us/DSWC/pages/ccap_program.html. Listed below are the approved BMPs allowed by the CCAP program.

- | | |
|---------------------------------|---------------------------------------|
| • Impervious Surface Conversion | • Grassed Swales |
| • Bioretention Areas | • Stormwater Wetlands |
| • Backyard Wetlands | • Riparian Buffers |
| • Stream Restoration | • Pet Waste Receptacles |
| • Permeable Pavement | • Critical Area Planting |
| • Backyard Rain Gardens | • Abandoned Well Closure |
| • Diversion | • Streambank and Shoreline Protection |
| • Cisterns | |

NC Division of Coastal Management Programs

Coastal and Estuarine Land Conservation Program (CELCP)

The Coastal and Estuarine Land Conservation Program (CELCP) is a Federal funding program that helps states protect coastal and estuarine lands that are important for their ecological, conservation, recreational, historical or aesthetic values. The program provides state and local governments with matching funds to purchase significant coastal lands or easements from willing sellers. Lands or easements acquired with CELCP funds are protected in perpetuity so that they may be enjoyed by future generations. For more information about CELCP visit <http://dcm2.enr.state.nc.us/celcp.htm>

Clean Marina Program

Clean Marina is a nationwide program developed by the National Marine Environmental Education Foundation, a nonprofit organization that works to clean up waterways for better recreational boating. The foundation encourages states to adapt Clean Marina principles to fit their own needs. The Clean Marina program is designed to show that marina operators can help safeguard the environment by using management and operations techniques that go

above and beyond regulatory requirements. If a marina meets criteria developed by N.C. Marine Trades Services and the Division of Coastal Management (DCM), it will be designated as a Clean Marina. Such marinas will be eligible to fly the Clean Marina flag and use the logo in their advertising. The flags will signal to boaters that a marina cares about the cleanliness of area waterways. Marinas that do not meet the standards will be able to learn about improvements needed for Clean Marina designation. Marina owners can reapply after making the necessary changes. For more information about the Clean Marina Program visit <http://dcm2.enr.state.nc.us/Marinas/clean.htm>.

Marina Pumpout Program

The program, established as a result of the federal Clean Vessel Act of 1992, provides financial assistance to marinas and other boat-docking facilities for the installation and renovation of pumpout and dump stations in North Carolina. Using funding from the US Fish & Wildlife Service, DCM has made grants of up to \$15,000 available on a yearly basis to private and commercial marinas, gas/service docks, fish houses/seafood dealers and other boat docking facilities in the 20 coastal counties. A 25 percent match is required of the marinas. A 25 percent match also is required of local governments installing pumpouts at public docks. Since its establishment in 1995, the program has awarded more than \$200,000 in grants for 47 pumpout projects, bringing the total number of pumpout facilities available on the coast to 89. For more information about the Marine Pumpout Program visit <http://dcm2.enr.state.nc.us/Marinas/pumpout.htm>.

NC DWQ Construction Grants and Loans Section

The Construction Grants & Loans Section is a non-regulatory section in the Division of Water Quality that administers several funding programs for publicly owned wastewater treatment facilities. Additionally, the section issues all Authorizations to Construct for the division and administers the Tax Certification process.

TABLE 12-3: PROJECTS FUNDED BY THE CONSTRUCTION GRANTS AND LOAN SECTION OF DWQ 2002-2008

APPLICANT	GRANT OFFERED	PROJECT	8-DIGIT HUC	DATE OFFERED
GRANT PROJECTS (CLEAN WATER BOND OR SRG)				
Bladenboro	\$1,729,000	WWTP Rehabilitation and Land Application System	03040203	7/23/2003
Tabor City	\$3,000,000	New Collection Lines	03040206	4/23/2007
FEDERAL LOAN PROJECTS (SRF)				
Oak Island	\$9,000,000	Pump Station and ICWW Force Main	03040208	1/22/2008
Oak Island	\$8,500,000	Force Main to West Brunswick WWTP	03040208	
Brunswick County	\$20,000,000	West Brunswick WWTP and Conveyance System	03040208	5/17/2004
Brunswick County	\$10,000,000	West Brunswick WWTP and Conveyance System	03040208	8/30/2004

The section administers three major funding programs that assist local governments: the federally funded Clean Water SRF Program (State Revolving Fund), the NC Clean Water Revolving Loan and Grant Program, and a federal special appropriations program known as the State and Tribal Assistance Grants (STAG) program. These programs can provide both low interest loan and grant funds for wastewater treatment projects. Table 12-3 lists all grants and loans offered in the Lumber Basin between 2002 and 2008. Additional information about the Construction Grants and Loan Section can be found at www.nccgl.net.

NC DWQ Nonpoint Source Program (319)

The U.S. Environmental Protection Agency provides funds to state and tribal agencies, which are then allocated via a competitive grant process to organizations to address current or potential NPS concerns. Funds may be used to demonstrate innovative best management practices (BMPs), support education and outreach programs, establish Total Maximum Daily Load (TMDL) for a watershed, or to restore impaired streams or other water resources.

TABLE 12-4: 319 GRANTS FUNDED IN THE LUMBER BASIN FROM 1999-2008

CONTRACT NUMBER	FISCAL YEAR	PROJECT	DESCRIPTION	8-DIGIT HUC	AGENCY	FUNDING
EW200024	1999	Sandhills Longleaf Pine Ecosystem Waste Management Project	Waste Management	03040203 03040204	Environmental Impact (RC&D), Inc.	\$61,667
EW02050	2001	Lake Waccamaw Nonpoint Source Management and Assessment Project	Stormwater Education	03040206	Town of Lake Waccamaw	\$166,000
EW04032	2002	Water Quality Impacts of Alternative Build-out Scenarios for Brunswick Co.	Planning	03040208 03040206	NCSU College of Design	\$183,385
EW08013	2004 2007	Lockwoods Folly Water Quality Restoration TMDL	TMDL Development	03040208	NC Coastal Federation	\$209,252

Grants are divided into two categories: Base and Incremental. Base Projects are research-oriented, demonstrative, or educational and are targeted at identifying and preventing potential NPS impacted areas in the state, where waters may be at risk of becoming impaired. Incremental projects seek to restore streams or other portions of watersheds that are already impaired. State and local governments, interstate and intrastate agencies, public and private nonprofit organizations, and educational institutions are eligible to apply for Section 319 grants. Table 12-4 lists all 319 grants awarded in the Lumber Basin between 2000 and 2008. For more information about the 319 Grant Program Visit http://h2o.enr.state.nc.us/nps/Section_319_Grant_Program.htm.

NC DWQ WATER QUALITY MANAGEMENT PLANNING GRANT 205(j)

The 205(j) Grant Program is a federally funded program administered in North Carolina by the state Department of Environment and Natural Resources Division of Water Quality. Limited competitive funding is available to regional Councils of Government (COGs) for water quality management planning efforts. Table 12-5 lists all 205(J) funds awarded since 2001. For more information about 205(j) grants visit <http://h2o.enr.state.nc.us/pb/205jPlanningGrantHomePage.htm>.

TABLE 12-5: 205(J) FUNDING AWARDED IN THE LUMBER BASIN FOR FISCAL YEARS 2001-2008

YEAR	RECIPIENT	DISCRIPTION	AMOUNT
2005	LRCOG	Assist Regional and Local Governments with Stormwater Planning	*\$9,900
2004	LRCOG	Development of a Commercial/Industrial Conservation and Reuse Strategy	\$8,250
2003	LRCOG	Development of a Plan to Restore Waters Impaired by Mercury	\$10,000
2001	LRCOG	Development of a Clean Water Action Plan	\$17,000

*Returned

Chapter 13

Local Initiatives

Winyah Rivers Foundation

The mission of the Winyah Rivers Foundation is to protect, preserve, monitor, and revitalize the health of the lands and waters of the greater Winyah Bay watershed, focusing on local activism through the Waccamaw Riverkeeper® program. The Waccamaw Riverkeeper® is licensed by the Waterkeeper Alliance, Inc. and housed within Coastal Carolina University's Center for Marine and Wetland Studies.

Currently the Waccamaw Riverkeeper® is engaged with stakeholders in North Carolina to implement two new programs. The first would expand an existing Volunteer Water Quality Monitoring program upstream into North Carolina to include sampling locations along the Waccamaw River and in Lake Waccamaw. Proposed analyticals include conductivity, pH, dissolved oxygen, temperature, turbidity, nutrients (ammonia, nitrate, nitrate) and bacteria (fecal coliform). Volunteer water monitors will be trained and then conduct semimonthly monitoring at identified locations in the river and lake. Data will be collated with South Carolina data in a publicly accessible database available through Coastal Carolina University's website. The second new program is to establish a Muddy Water Watch program to the Waccamaw River watershed in North Carolina. Volunteers will be trained to identify and report occurrences of erosion and sedimentation that are in violation of State law and that pose a threat to water quality. The Riverkeeper® is also working with stakeholder to establish a paddle trail on the river to promote recreation and awareness of water quality issues. More information can be obtained from <http://www.winyahrivers.org> and contacting the Waccamaw Riverkeeper®, Christine Ellis, at wrk@coastal.edu.

Waccamaw Watershed Academy

In 2004, Coastal Carolina University established the Waccamaw Watershed Academy (WWA) under the aegis of the Center for Marine and Wetland Studies (CMWS) to meet local needs for expertise in the areas of watershed and wetland science and management. The mission of the academy is to deliver educational, research, and public outreach services to the university and the local region. For more information about the Waccamaw Watershed Academy visit <http://www.coastal.edu/wwa/>.

Sand Hills Area Land Trust

The Sandhills Area Land Trust (SALT) is a community-based, 501(c)(3) non-profit organization that serves Moore, Richmond, Scotland, Hoke, Cumberland, and Harnett counties in southeastern North Carolina. SALT works with private landowners to negotiate voluntary conservation agreements (Conservation Easements) on private property. In 2008, the organization was awarded a grant of \$661,000 to purchase a 209 acre conservation easement along Drowning Creek south of Pinebluff. In 2006, they received a grant from the CWMTF for \$153,000 to purchase a 50.8 acre easement along Naked Creek. For more information on the Sand Hills Area Land Trust and their conservation work in the basin visit <http://www.sandhillslandtrust.org/>.

NC Coastal Land Trust

The North Carolina Coastal Land Trust is a non-profit organization formed in 1992 to help protect locally and regionally valuable natural areas and waters. Since its inception, the Coastal Land Trust has protected over 40,000 acres of barrier island beaches, riparian corridors, and other special natural areas. On September 9, 2008 the NC Coastal Land Trust purchased a landowner agreement for 296 acres in Columbus County along four miles of the Waccamaw River. This purchase was funded by the CWMTF and the Attorney General's Environmental Enhancement Grant Program. It will help to protect water quality and wildlife. For more information about the NC Coastal Land Trust visit <http://www.coastallandtrust.org/index.jsp>.

The Nature Conservancy

The Nature Conservancy works around the world to protect ecologically important lands and waters for nature and people. They administer several preserves throughout the Lumber Basin including over 18,000 acres along Juniper Creek and its tributaries recently purchased from International Paper, Inc., with help from a CWMTF Grant. This purchase doubled the amount of land protected by the Nature Conservancy in the basin to over 36,000 acres. These newly acquired lands help connect the Green Swamp Preserve to the Waccamaw River. For more information about the Nature Conservancy visit <http://www.nature.org/>.

Friends of the Lake Waccamaw State Park

The Friends of Lake Waccamaw State Park (FLWSP) members and volunteers have been committed to the protection of water quality and the national significance for biological diversity on the park lands and in Lake Waccamaw as well as the Waccamaw River watershed since 1986. Initiatives include funding for projects to improve and support clean water in and around Lake Waccamaw and the Waccamaw River.

Regional Councils of Government

Regional councils are multi-county planning and development agencies serving different areas of the state. Membership in these councils is voluntary. In North Carolina, 17 councils serve regions that share similar economic, physical and social characteristics. Their function is to aid, assist and improve the capabilities of local governments in administration, planning, fiscal management and development.

Lumber River Council of Governments

The Lumber River Council of Governments services Bladen, Hoke, Richmond, Robeson, and Scotland counties and the 31 municipalities within them. For more information about the Lumber River COG visit <http://www.lrcog.dst.nc.us/>.

Cape Fear Council of Governments

The Cape Fear Council of Governments services Brunswick, Columbus, New Hanover, and Pender counties. For more information about the Cape Fear COG visit <http://www.capefearcog.org/>.

Cape Fear Resource Conservation and Development (RC&D)

The mission of the Cape Fear RC&D is to work cooperatively with individuals and groups to improve social, economic and environmental conditions, thereby enhancing the quality of life in Bladen, Brunswick, Columbus, New Hanover, and Pender counties. In 2007 the Cape Fear RC&D conducted a debris removal project with a \$182,091 grant from the Division of Water Resources. For more information about the Cape Fear RC&D visit <http://www.capefearrcd.org>.

Cape Fear Arch Conservation Collaboration

Created in 2006, the Cape Fear Arch Conservation Collaboration is a nonprofit partnership of organizations and individuals interested in protecting this region while balancing the needs of man and nature. Its mission is to develop and implement a community conservation vision to build awareness, protection and stewardship of the region's important natural resources. For more information about the Cape Fear Arch Conservation Collaboration visit <http://www.capefeararch.org>.

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