Section A - Chapter 4
Water Quality Issues Related to Multiple Watersheds in the Tar-Pamlico River Basin

4.1 Introduction

Parts 4.2 through 4.5 review the status of specific recommendations and strategies made for multiple watersheds in the 1999 Tar-Pamlico River Basinwide Water Quality Plan. Part 4.6 reviews current stormwater programs in the Tar-Pamlico River basin. Parts 4.7 and 4.8 discuss agricultural issues related to water quality. Part 4.9 discusses issues related to shellfish harvesting waters. Parts 4.10 and 4.11 provide overviews of water quality issues related to the extreme meteorological events that have occurred during the assessment period. Part 4.12 discusses issues related to sedimentation and erosion control. Part 4.13 describes monitoring coalition development in the basin. Parts 4.14 through 4.18 describe water quality problems identified in the basin. Part 4.19 discusses management strategies for threatened and endangered species, and Part 4.20 discusses the NC Source Water Assessment Program.

4.2 Tar-Pamlico River Nutrient Sensitive Waters (NSW) Strategy

4.2.1 Introduction

Recurring nutrient-related problems have been documented in the Pamlico River estuary through the latter half of the 20th century. The frequency of reports of diseased fish in the Pamlico estuary increased significantly in the late 1970s and early 1980s. The state documented greatly increasing numbers of fish kills in the estuary from the mid-70s through the early 1990s. In 1988, Governor Martin established the Pamlico Environmental Response Team to investigate the increasing presence of fish and crab diseases, algal blooms, hypoxic conditions, loss of aquatic vegetation, and degradation of the region's water quality. The team operated for two years and made recommendations on controlling urban and agricultural pollution and on further studies. In 1998, Governor Hunt established the Pamlico River Response Team (PRRT) to investigate algal blooms and fish kills along the Pamlico River and its tributaries. PRRT enabled the algal monitoring program to track algal responses to nutrients and weather events in the brackish Pamlico River throughout the year.

Researchers who studied the river system intensively since the 1960s estimated that there was a several-fold increase in nitrogen inputs to the basin during the last century. Most of the increases were attributed to increased crop fertilization and production, particularly since the 1950s. Increases in farm animals and municipal and industrial discharges also contributed to the rise in nitrogen inputs. Recent studies have shown that nitrogen levels instream have decreased somewhat in the last thirty years. However, they are still considered to be sufficiently high to foster harmful algal blooms.

Phosphorus loading to the estuary decreased significantly as a result of two events beginning in the late 1980s. Effective January 1, 1988, the NC General Assembly adopted a statewide

phosphate detergent ban, which resulted in significant drops in stream phosphorus concentrations statewide. Also, in the fall of 1992, PCS Phosphate, located on the Pamlico River estuary in Aurora, began a wastewater recycling program that reduced its phosphorus discharge by about 94 percent.

NSW Strategy, Phase I

In December 1989, responding to the estuary's nutrient problems, the NC Environmental Management Commission (EMC) designated the Tar-Pamlico River basin as Nutrient Sensitive Waters (NSW), requiring a basin-scale nutrient strategy. The first phase of the strategy largely targeted wastewater treatment plants and other point sources. The Phase I Agreement, from 1990 through 1994, included an innovative nutrient 'trading' program between point and nonpoint sources that served as a nationwide benchmark. A coalition of 16 point source dischargers called the Tar-Pamlico Basin Association (Association), comprising approximately 93 percent of permitted point source flows, agreed to a collective annual, incrementally decreasing, combined nitrogen and phosphorus loading cap. If they exceeded their cap, they would pay a per-kilogram offset fee to fund agricultural nutrient best management practices (BMPs) to be targeted within the basin under the state's Agriculture Cost Share Program.

The Phase I Agreement yielded the following progress:

- In each year, 1990 through 1994, the Association steadily decreased nutrient loading beneath the annually decreasing cap, reducing combined nitrogen and phosphorus load by about 20 percent, despite flow increases due to growth of about 7 percent. They did so initially by implementing nutrient removal-optimizing procedures at all facilities, then by installing biological nutrient removal processes at individual facilities as other plant modifications became necessary.
- An estuary model funded by a federal grant to the Association was completed, allowing establishment of an overall reduction goal for the estuary based on exceedances of the chlorophyll *a* standard.
- The Association provided up-front funding of almost $1 million worth of agricultural BMPs, in large part through a federal EPA grant. They banked credit from this funding against future cap exceedances.

NSW Strategy, Phase II

Adopted by the EMC in December 1994, Phase II covered the period 1995-2004. Based on the estuary model, a 30 percent reduction in total nitrogen loads to the estuary from 1991 conditions was set as an interim goal for Phase II, along with no increase in phosphorus loads. Based on these goals, the Association, expanded to 14 members, received separate, steady nitrogen and phosphorus caps for the duration of Phase II. Cap exceedances would continue to follow the offset payment approach established in Phase I; however, the offset rate was adjusted based on basin-specific agricultural BMP cost-effectiveness data.

The Phase II Agreement also placed restrictions on dischargers who chose not to join the Association. All dischargers above 0.5 MGD were required to meet 6 mg/l TN and 1 mg/l TP limits within five years, and any new loading from expanding or new facilities would have to be mitigated using the offset payment scheme established for the Association.

Nonpoint sources were also addressed in Phase II. In December 1995, the EMC adopted a plan that relied on existing programs to achieve the Phase II goals voluntarily through better targeting, coordination, and increased effort. It included action plans for nine different nonpoint source categories. The EMC received annual status reports on implementation.

Nonpoint Source Rules

In July 1998, after two years of implementing the voluntary nonpoint source plan, the EMC determined that progress was inadequate and initiated what became a lengthy rule-making process for nonpoint sources. Staff conducted a set of intensive stakeholder meetings to develop draft rules during winter 1998, followed by a formal public hearing and comment stage over the latter half of 1999. The EMC adopted a series of nonpoint source rules as detailed in Table A-22. For more information on the rules and their implementation, visit the website at http://h2o.enr.state.nc.us/nps/tarpam.htm.

Table A-22 Tar-Pamlico NSW Rules Summary

Rule Subject	Rule Number 15A NCAC 2B	Date Adopted by EMC	Effective Date of Permanent Rule
1. Riparian Buffers:			
❑ Buffer Protection	.0259	Dec. 1999	Aug. 1, 2000*
❑ Buffer Mitigation	.0260	Dec. 1999	Aug. 1, 2000*
❑ Buffer Delegation	.0261	Dec. 1999	Aug. 1, 2000*
2. Nutrient Management	.0257	July 2000	April 1, 2001
3. Stormwater Management	.0258	July 2000	April 1, 2001
4. *Agriculture:*			
❑ *Nutrient Goals*	.0255	Oct. 2000	April 1, 2001
❑ Agriculture Strategy	.0256	Oct. 2000	Sept 1, 2001**

* Temporary buffer rules were effective January 1, 2000.

** Session Law 2001-355 (House Bill 570), signed into law by Governor Easley August 10, 2001, established this effective date and made certain changes to the rule.

4.2.2 TMDLs for Nitrogen and Phosphorus

Current Status

The EPA approved TMDLs for nitrogen and phosphorus in August 1995 based on the results of estuarine response modeling. The TMDLs called for reducing nitrogen loading at Washington, NC by 30 percent from current levels to 1991 levels and holding phosphorus loading to 1991 levels. These values were based on minimizing exceedances of the 40 µg/l chlorophyll *a* standard for estuarine waters. The TMDL established these as interim goals. It recognized that further loading reductions may be needed, but progress toward the stated loading goals would be needed before more exact targets could be established. It also recognized the need for additional monitoring, BMP accounting, and estuary and fate and transport modeling.

One gauge of overall progress of the nutrient strategy is the evaluation of trends in instream nutrient levels where the Tar River meets the estuarine Pamlico River. In 2003, DWQ staff performed a statistical evaluation of the reduction in nutrient concentrations instream at the top of the estuary. Staff used statistical techniques to minimize the effects of flow and seasonal factors on nutrient concentrations. For the 12-year period of 1991-2002, there were statistically significant reductions in both total nitrogen and total phosphorus, with an estimated 18 percent reduction in nitrogen concentration (Figure A-14).

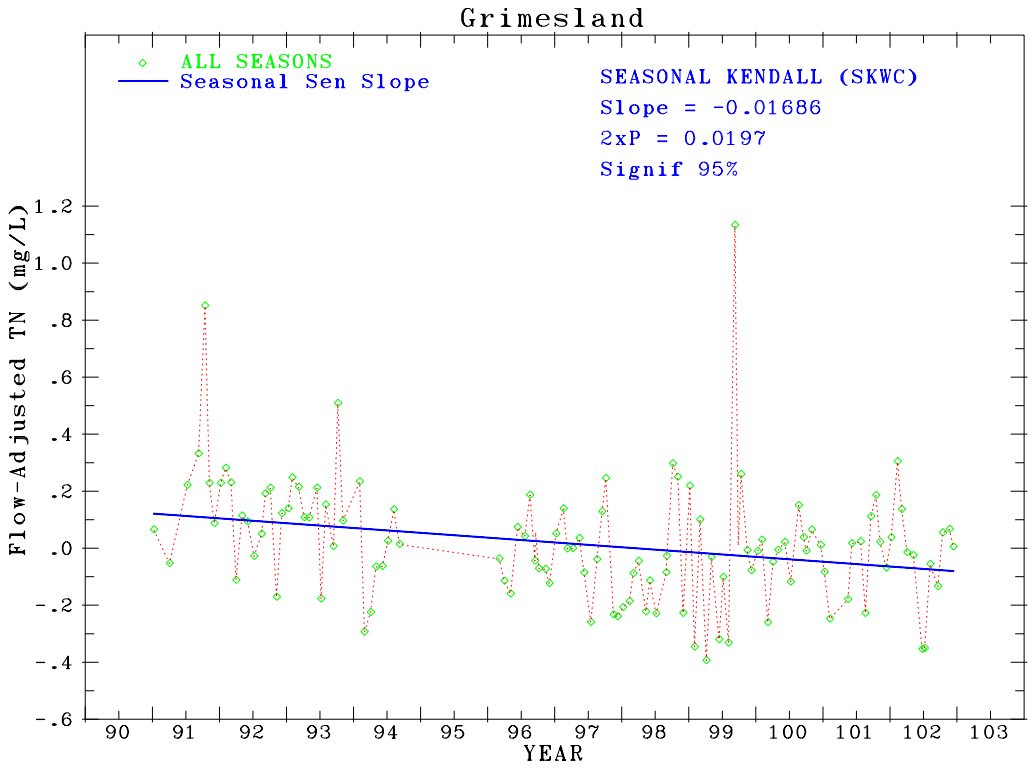

Figure A-14 Flow Adjusted Total Nitrogen at Grimesland, Trend Analysis from 1990 to 2002

2004 Recommendations

DWQ is using an adaptive management approach to implement the Tar-Pamlico estuary nitrogen and phosphorus TMDLs. Recent trend assessment indicates significant reductions in nitrogen and phosphorus loading to the estuary since 1991 (Figure A-14). The adaptive management approach recognizes that different elements of the strategy are occurring under varying schedules. Nonpoint source rules will be substantially implemented by late 2006, but some elements of the urban stormwater rule will phase in as late as 2011, and the need for additional agricultural BMP implementation to meet the phosphorus goal has not been determined. The point source agreement, operating since 1991, will be revisited prior to the initiation of a third phase in January 2005.

As discussed in the Phase II Agreement and the 1999 basinwide plan, the original estuary modeling runs suggested that more than a 30 percent total nitrogen reduction may be needed to stem eutrophication effects in the estuary, but that progress toward the loading goals would be needed first to enable better assessment. Monitoring will continue and modeling will be improved and updated in the coming years. Nutrient monitoring will continue at various points

in the river to determine compliance with the reduction goals, and estuarine monitoring will be used to continue evaluating success in meeting the chlorophyll *a* response criterion. As nonpoint source rules are implemented, a second estuary modeling effort is planned to evaluate the need to revise and refine the nitrogen and phosphorus reduction goals. DWQ expects to conduct additional watershed and fate and transport modeling to support the establishment of a Phase III point source agreement.

It is important to recognize the long-term time constraints associated with restoring nutrient over-enriched waters. Nutrient loading to the estuary may be the most direct measure of progress, but changes in nutrient management on the land may take years to fully express themselves instream. Once instream, nutrient inputs may take time to appear in measured loading at the estuary due to year-to-year variations in precipitation and flow. Changes in the causal variable nutrient loading serve as one indicator of progress, but ultimately, we must look beyond that to the estuary's response over time. Estuarine response involves so many other variables that short-term assessments of progress are fraught with great uncertainty, and we must continue monitoring over longer time periods for better informed decision-making.

4.2.3 Protection and Maintenance of Existing Riparian Buffers

Current Status

The purpose of the riparian buffer rule is to maintain the nutrient removal functions of natural riparian areas along stream corridors. The riparian area that is to be maintained extends 50 feet from intermittent and perennial streams, lakes, ponds and estuarine waters. This 50-foot area would consist of the first 30 feet of virtually undisturbed natural vegetation, typically wooded, and the outer 20 feet of grass, vegetation or trees that could be managed to some extent. This rule does not apply to portions of the 50-foot zone where uses existed prior to the rule and remain ongoing. It does apply when type of use within the buffer changes. DWQ received some funding to help staff the Raleigh and Washington Regional Offices to enforce the buffer rule.

2004 Recommendations

Because the buffer rule protects existing buffers but does not require existing uses within the 50 feet to be returned to a vegetated buffer, the rule will largely serve to hold the line against increases in loading that would result from loss of buffers and from more nutrient-intensive adjacent land uses. The rule will result in small net gains in protection where land use in the buffer changes, prompting new buffer establishment. DWQ will continue to enforce this rule. It is also recommended that local governments in high growth areas adopt more stringent buffer rules extending to ephemeral stream protection. Local governments and individuals should also identify areas where buffers can be reestablished.

4.2.4 Wastewater Discharge Requirements

Current Status

As described in the introduction to this section, Phase II of a collective nutrient loading compliance agreement was established with the Tar-Pamlico Basin Association through 2004. Requirements

were also imposed on non-association facilities in the Phase II Agreement and through a follow-up rule, 15A NCAC 2B .0229 and .0237, that was effective April 1997.

The Association's annual combined nutrient caps and loads, as well as flows, from 1991 through 2002 are shown in Figure A-15. To date in Phase II, as in Phase I, the Association has not exceeded its nitrogen or phosphorus cap. Association loads of both nutrients have decreased steadily through Phase II, even while flows increased steadily. Nitrogen loads decreased to the range of mid-60s percent of the nitrogen cap by 2002, while phosphorus loads showed a similar trend, reaching the mid-40s percent of that cap through 2002. The Association accomplished this through its continued commitment to having individual facilities incorporate biological nutrient removal at cost-effective opportunities. Step increases in the caps at the outset of Phase II and in 2001 are visible in the figure. These increases resulted from the initial Phase II cap-setting process using an instream chlorophyll *a* response target and the addition of Robersonville, respectively.

As of June 2003, the Association numbered 15 members, and the addition of a 16th, Scotland Neck, was anticipated in the near future. This membership would comprise 93 percent of all individually permitted point source flows in the basin.

For non-association facilities, NPDES permit renewals issued by DWQ following approval of the 1999 basinwide plan were subject to the non-association requirements embodied in the Phase II Agreement and the offset rule. No facilities met the criteria for receiving new 6 mg/l TN and 1 mg/l TP limits. The several potentially subject facilities either joined the Association during Phase II or connected flows to an association member. Further, there were no new facilities or expansions that would generate new loads requiring mitigation through offset payments.

2004 Recommendations

The Phase II Agreement will be revisited with the Association and environmental groups prior to the initiation of a third phase in January 2005. DWQ expects to revisit the nutrient caps, including the use of fate and transport and watershed modeling to refine load delivery estimates. The offset payment rate should also be revisited, considering changes in agricultural BMP emphasis, better cost-effectiveness information, BMP longevity, and establishment of a separate rate for phosphorus cap exceedances.

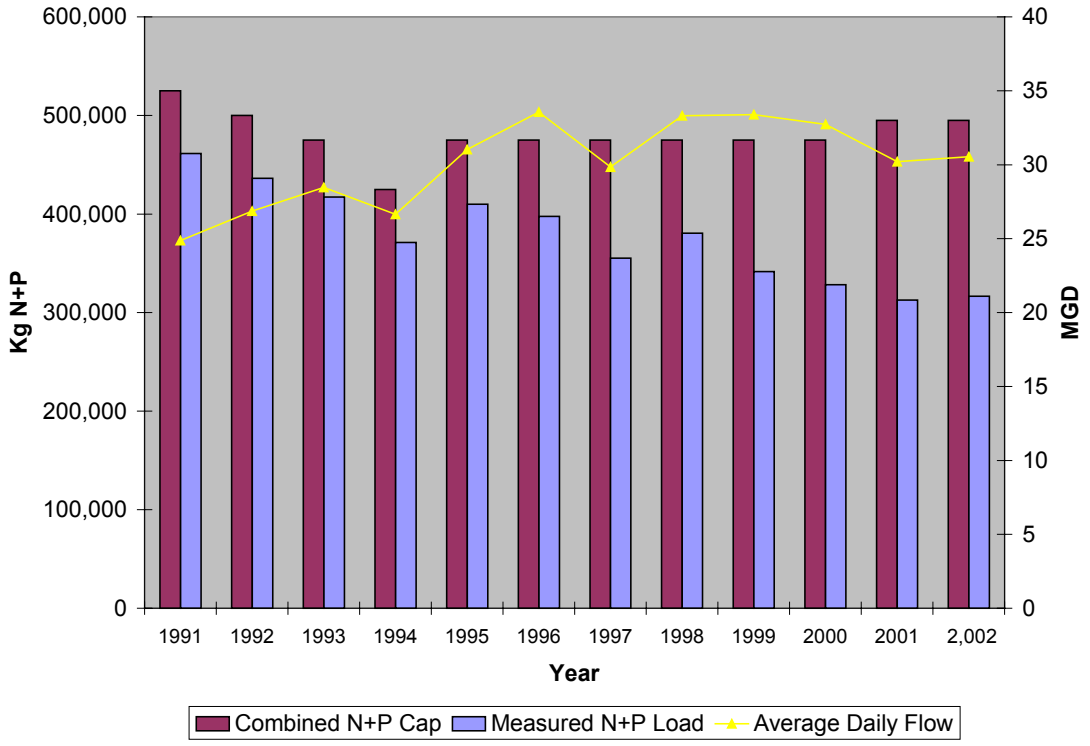

Figure A-15 Tar-Pamlico Basin Association Combined Nutrient Loads and Caps

4.2.5 Local Government Stormwater Requirements

Current Status

The objectives of the stormwater rule are to meet the Phase II nitrogen and phosphorus goals on new development lands, to control runoff volumes from new development to protect receiving streams from degradation, and to minimize nutrient loading from existing developed areas. The rule requires six municipalities and five counties in the Tar-Pamlico River basin, capturing the bulk of new development in the basin, to develop and implement stormwater programs. The municipalities are: Greenville, Henderson, Oxford, Rocky Mount, Tarboro and Washington. The counties are: Beaufort, Edgecombe, Franklin, Nash and Pitt. These local governments were identified based on their potential nutrient contributions to the Pamlico estuary. The EMC may add other local governments in the future through rule making based on criteria specified in the rule.

Local programs are to include the following:

- A permitting program requiring new development to reduce nitrogen runoff by 30 percent compared to predevelopment levels, and to keep phosphorus inputs down to predevelopment levels. Also, new development must avoid eroding receiving waters; peak discharge rates cannot exceed predevelopment rates for the 1-year, 24-hour storm.
- Ensure that new development complies with the riparian buffer protection rule.
- Identification and removal of illicit discharges in a phased 10-year cycle.

- A program to educate citizens on minimizing runoff pollution and to educate and train developers on rule requirements.
- Efforts toward treating runoff from existing developed areas; at minimum, identify and prioritize retrofit opportunities in developed areas.

DWQ worked with the affected local governments and other stakeholders during 2002 to develop a model local program, which was approved by the EMC in February 2003. Local governments were required to submit their programs for EMC approval by February 2004 and begin implementing them by August 2004.

2004 Recommendations

The rule is expected to achieve the Phase II nitrogen and phosphorus loading goals for lands that are converted from other uses to new development within the subject jurisdictions, aside from vested projects, once local programs are underway in August 2004. It is hoped that some loading reductions will be achieved from existing developed areas within these jurisdictions through education of homeowners and businesses and by removal of illicit discharges. Additional loading reductions from existing developed areas could be obtained by implementing retrofitting projects, which are encouraged by the rule. It is recommended that local governments in the basin identify and pursue funding sources to implement such retrofits. DWQ will assist local governments in developing and implementing their programs. Local governments must submit annual reports to DWQ so that implementation progress can be tracked and evaluated.

4.2.6 Agricultural Nutrient Reduction Strategy

Current Status

The agriculture rule calls on farmers in the basin to implement best management practices (BMPs) that achieve the Phase II nutrient goals as follows: 1) a 30 percent reduction in nitrogen loading from 1991 baseline levels within five to eight years of the rule's effective date; and 2) control of phosphorus levels at or below 1991 levels within four years of the approval of a phosphorus accounting method called for in the rule.

Rule implementation relies on cooperation between a Basin Oversight Committee and, in each of 16 counties, a Local Advisory Committee. The Basin Oversight Committee, or BOC, is to develop a tracking and accounting methodology that Local Advisory Committees, or LACs, will use to gauge progress toward the nitrogen and phosphorus goals from implementation of BMPs. The BOC reviews and approves local nitrogen strategies and summarizes them for EMC approval. The BOC determines steps needed to satisfy the phosphorus goal and calls on LACs to implement them. The BOC also establishes minimum requirements for annual progress reporting by LACs. The BOC is a ten-member board with representation from DWQ, DSWC, NC Department of Agriculture, NRCS, NC Cooperative Extension Service, and environmental, farming and scientific communities.

Each LAC was to conduct a registration process for the farmers in its county within one year of the rule's effective date and develop a strategy within two years of the rule's effective date for achieving the nutrient goals. Each LAC is made up of representatives of local agricultural agencies and five to ten area farmers. Each local strategy was to establish baseline nitrogen

loading conditions in 1991, reductions achieved to date through implementation of best management practices (BMPs), and project the additional acreage that farmers in the county will need to treat with various BMPs to achieve the nutrient goals. LACs are also responsible for reporting their progress annually to the BOC.

Farmers who are involved in the commercial production of crops or horticultural products, or whose livestock or poultry holdings exceed rule-specified numbers are subject to the rule and were required to register with their LAC during the first year the rule was in effect, by September 1, 2002. Registration was intended to help farmers get details on rule options and on technical and cost share assistance, as well as providing LACs a listing of the farmers they have to work with.

Not all farmers are required to implement specific practices in the first five years, but each LAC as a whole is to achieve its nitrogen goal within that five years through farmer BMP implementation. Farmers have the option of implementing standard BMPs or getting approval from their LAC for site-specific BMPs. Farmers who implement standard or sufficient site-specific BMPs approved by their LAC within five years will not be subject to any additional requirements under the rule. If a LAC does not meet its nitrogen goal within five years, then the EMC may call for additional BMP implementation to meet the goal within eight years, relying on farmers who do not implement standard or other LAC-approved BMPs within the first five years.

As mentioned above, the agriculture rule underwent a legislative negotiation process following its adoption to resolve concerns raised by the pasture community. The process yielded certain changes to the rule, as established in a bill, Session Law 2001-355. The changes call for the following:

- Raise threshold numbers of rule applicability for all livestock species except cattle.
- Expand the definition of agriculture to include a one-time allowance for tree harvesting within riparian buffers under specific circumstances.
- Require the SWCC to approve BMPs for pasture operations, to establish a point system that defines options for pasture operations, and to include pasture and other interests in the process.
- Ensure full farmer representation on Local Advisory Committees by raising the minimum number of farmers from two to five, by having commodity groups in each county nominate farmers, and by having the Commissioner of Agriculture appoint the farmer members.

While no new resources were allocated to facilitate rule implementation, LACs conducted farmer registration to the best of their ability. It is believed that most farmers were eventually registered. The EMC approved the use of the agricultural accounting tool developed for the Neuse agriculture rule, the Nitrogen Loss Estimation Worksheet, or NLEW, for overall accounting in October 2002. In February 2003, the EMC approved a spreadsheet accounting process for the point system to be used by pasture operations. The Soil and Water Conservation Commission began approving pasture BMPs and standard BMPs in July 2002.

During September 2003, the BOC reviewed and approved 14 local strategies for achieving the rule's basinwide nitrogen goal of a 30 percent reduction in loading from baseline 1991 levels.

The EMC approved these strategies on October 9, 2003. From 1992 through 2001, ten of 14 counties estimated that they exceeded their individual 30 percent reduction goals, with nitrogen loss reduction estimates ranging from 39 percent to 56 percent. Altogether, basin counties achieved an estimated aggregate 34 percent reduction in nitrogen loss. Approximately 16 percent, or almost half, of the reduction resulted from fertilization rate decreases across most crops. BMP implementation accounted for an estimated 6 percent, or about one-fifth, of the reduction. The remainder of the reduction came from a decrease in cropland acreage (5%) and a cropping shift from corn and other crops into cotton, which lowered fertilization rates greatly on the affected acres. The crop shift, which accounted for almost one-quarter of the aggregate 34 percent reduction, is susceptible to economic pressures over time. Four counties remain significantly below 30 percent, ranging from 12 percent to 24 percent. These counties' Local Advisory Committees (LACs) have proposed BMP implementation strategies for achieving 30 percent reductions.

In reviewing reduction estimates made by the LACs, the BOC noted that the basinwide 34 percent reduction, representing the period of 1992 through 2001, was achieved almost entirely prior to the effective date of the agriculture rule, September 2001. While the role of the rule-making effort in facilitating progress would be difficult to quantify, the administrative and accounting structure established by the rule has provided perhaps the most thorough quantification of progress achievable. Other benefits include better understanding of the magnitudes of different factors contributing to reductions and consequently how to shift management focus, a better ability to geographically target areas where implementation should be augmented, increased efforts to address long-term maintenance of progress, and ongoing tracking of progress by county and basinwide.

One indicator of efforts made by the agricultural community to improve water quality is the expenditures by government cost share and incentive programs on nutrient reducing farm practices. One such program is the NC Agriculture Cost Share Program, administered by DSWC. Between 1992 and 2003, the ACSP spent an estimated $12.5 million on nutrient reducing BMPs on cropland, pastureland and animal operations, affecting approximately 224,000 acres. Another DSWC-administered program, the federal Conservation Reserve Enhancement Program, has obligated approximately $33.1 million in the Tar-Pamlico River basin since its inception in 1998 to establish about 11,350 acres of riparian buffers in 30-year and permanent conservation easements. The Clean Water Act's Section 319 grant program funds improvements in agricultural and other nonpoint source activities. Between 1995-2003, approximately $2,670,000 in Section 319 expenditures were directed toward NPS projects in the Tar-Pamlico River basin. This funding supported a variety of activities, including BMP demonstration and implementation, technical assistance and education, GIS mapping, development and dissemination of accounting tools, and monitoring. Of the total, approximately $935,000 was directed toward agricultural BMPs.

Unlike the adjacent Neuse River basin nutrient strategy, no new resources were allocated to facilitate implementation of the Tar-Pamlico rules. The BOC recognized the difficulties created for agriculture rule implementation by the lack of new resources at both local and basin levels. The Section 319 grant funding described above was sought to help fill gaps, but resource limitations continue to present challenges in efforts to fully meet rule mandates.

2004 Recommendations

LACs have until September 2006 to achieve 30 percent nitrogen reductions before the EMC would be requested to determine the need for additional actions by the agriculture community. The BOC is pleased with the progress demonstrated by the agricultural community and believes that the current rule framework will continue to serve its intended purpose. The BOC has recognized the primary importance of continuing to improve monitoring, accounting and reporting, as well as targeting of increased implementation efforts. Specific priorities for implementation of the agriculture rule following October 2003 EMC approval of the local strategies are as follows:

- The four LACs with less than 30 percent nitrogen reductions to date will implement their strategies to achieve the goal by September 2006.
- The BOC will work with conditionally approved LACs to refine estimates of implementation to date and increase BMP implementation that will reduce the role of crop shifts in maintaining their reductions.
- All LACs will work to increase BMP implementation to ensure lasting reductions, improve nutrient management practices, ensure BMP maintenance, and track BMP contract expirations and changes in cropping.
- LACs will report their progress annually through the BOC to the EMC.
- They will be assisted by newly established Technician positions, which are being combined with Neuse River Basin Technician positions for a total of 9½ positions covering all or portions of 24 counties.
- Development and implementation will continue on pasture BMPs and the pasture accounting system.
- The BOC will coordinate a technical committee to develop recommendations on the need for additional actions to meet the phosphorus goal.

4.2.7 Nutrient Management

Current Status

The nutrient management rule requires people who apply fertilizer in the basin, except residential landowners who apply fertilizer to their own property, to either take state-sponsored nutrient management training or have a nutrient management plan in place for the lands to which they apply fertilizer. Applicators are required to comply with one of these two options within five years of the rule's effective date, or April 1, 2006. For residential fertilizer users, the Division of Water Quality will develop and implement an education program within three years of the rule's effective date. The rule applies to fertilizer applicators, people who own or manage fertilized lands, and consultants who provide nutrient management advice.

Cooperative Extension Service staff of North Carolina State University provided "train the trainer" sessions for local extension staff in fall 2003. Local extension then began offering training sessions for applicators to various crops periodically at dates of their choosing, with advance publicity. Those who choose to have a plan for the lands to which they apply will need to ensure that the plan is approved by a technical specialist designated by the Soil and Water Conservation Commission.

2004 Recommendations

DWQ will continue to work with extension to offer periodic training from county extension offices. DWQ has developed educational materials and will conduct outreach efforts to homeowners on nutrient management in the coming years. DWQ will also work with local governments toward this end. For those who choose training, registration forms are available at county Cooperative Extension Service offices, or people can register at the sessions.

4.3 Use Restoration Waters (URW) Approach

Current Status

DWQ has developed a conceptual strategy to manage watersheds with nonpoint source impairments as determined through the use support designations. In July 1998, the state Environmental Management Commission approved the Use Restoration Waters (URW) Program concept, which will target all NPS Impaired waters in the state using a two-part approach. As envisioned, this concept will apply to all watersheds that are Impaired. The program will catalyze voluntary efforts of stakeholder groups in Impaired watersheds to restore those waters by providing various incentives and other support. Simultaneously, the program will develop a set of mandatory requirements for NPS pollution categories for locations where local groups choose not to take responsibility for restoring their waters. This URW concept offers local governments an opportunity to implement site-specific projects at the local level as an incentive ("the carrot"). If the EMC is not satisfied with the progress made towards use restoration by local committees, impairment based rules will become mandatory in those watersheds ("the stick"). These mandatory requirements may not be tailored to specific watersheds, but may apply more generically across the state or region.

2004 Recommendations

With more than 400 Impaired waters on stream segments in the state, it is not realistic for DWQ to attempt to develop watershed specific restoration strategies for nonpoint source pollution. By involving the stakeholders in these watersheds, DWQ can catalyze large-scale restoration of Impaired waters. One of the major implementation challenges of this new program will be educating public officials and stakeholders at the local level as to the nature and solutions to their impairments. To address this challenge, the state plans to develop a GIS-based program to help present information at a scale that is useful to local land management officials. Other incentives that the state might provide include seed grants and technical assistance, as well as retaining the authority to mandate regulations on stakeholders who are not willing to participate.

In cases where incentives and support do not result in effective watershed restoration strategies, mandatory management requirements would be implemented in the watershed. This is not the state's preferred alternative, as it would add to state monitoring and enforcement workload. However, in areas where it is necessary, DWQ plans to implement such requirements. In the management area, DWQ would be assisted by regulatory staff from the Division of Coastal Management, Division of Environmental Health, Division of Land Resources, and Division of Marine Fisheries to insure compliance.

4.4 Implementation of EEP Watershed Restoration and Local Watershed Plans

Current Status
For the Tar-Pamlico River basin, the North Carolina Ecosystem Enhancement Program (page 168) has integrated information normally found separately in EEP Watershed Restoration Plans into this basinwide water quality plan. A separate version of the watershed restoration plan for the Tar-Pamlico River basin will be available online at the EEP website by the spring of 2004. These plans identify Targeted Local Watersheds within which EEP will focus restoration efforts.

2004 Recommendations
DWQ will continue to integrate EEP restoration planning efforts into the basinwide process. An overview of the program is presented on page 168. Table C-3 on page 171 lists all the Targeted Local Watersheds selected by the EEP, arranged by DWQ subbasins. This section also includes a description of the EEP Local Watershed Planning initiative. The EEP will continue to use a comprehensive, integrated watershed approach in the identification of high priority local watersheds in North Carolina's river basins. Also, the EEP hopes to expand their Local Watershed Planning efforts into more areas of the state, as additional compensatory mitigation resources become available.

4.5 Biological Criteria for Assessment of Aquatic Life

4.5.1 Introduction

DWQ strives to properly evaluate the health of aquatic biological communities throughout the state. Swamp stream systems, small streams and estuarine waters have presented unique challenges for benthic macroinvertebrate evaluation, while nonwadeable waters and trout streams have done the same for fish community evaluations. This section discusses some of these challenges. Refer to Appendix II for further information.

4.5.2 Assessing Benthic Macroinvertebrates in Swamp Streams

Current Status
Extensive evaluation, conducted by DWQ, of swamp streams across eastern North Carolina suggested that different criteria must be used to assess the condition of water quality in these systems. Swamp streams are characterized by seasonally interrupted flows, lower dissolved oxygen and often lower pH. They also may have very complex braided channels and dark-colored water. Since 1995, benthic macroinvertebrates swamp sampling methods have been used at over 100 sites in the coastal plain of North Carolina, including more than 20 reference sites. Investigations indicate that there are at least five unique swamp ecoregions in the NC coastal plain, and each of these may require different biocriteria. The lowest "natural" diversity has been found in low-gradient streams (especially in the outer coastal plain) and in areas with poorly drained soils.

2004 Recommendations

DWQ has developed biological criteria to assign bioclassifications to these streams (as is currently done for other streams and rivers across the state). Refer to Appendix II for more information on swamp criteria and assigning bioclassifications. The Tar-Pamlico River basin is the first basin where the swamp criteria were used to assign bioclassifications to the benthic communities. Use support ratings for swamp streams presented in this plan were determined based on the swamp bioclassifications. DWQ will continue to refine the criteria used to assign bioclassifications in swamp streams.

4.5.3 Assessing Benthic Macroinvertebrate Communities in Small Streams

Current Status

The benthic macroinvertebrate community of small streams is naturally less diverse than the streams used to develop the current criteria for flowing freshwater streams. The benthic macroinvertebrate database is being evaluated, and a study to systematically look at small reference streams in different ecoregions is being developed with the goal of finding a way to evaluate water quality conditions in such small streams.

2004 Recommendations

DWQ will use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. DWQ will continue to develop criteria to assess water quality in small streams. Refer to Appendix II for more information on assigning bioclassifications.

4.5.4 Assessing Fish Communities

Current Status

Fish communities in most wadeable streams can be sampled by a crew of 2-4 persons using backpack electrofishers and following the DWQ Standard Operating Procedures. The data are evaluated using the North Carolina Index of Biotic Integrity (NCIBI) (NCDENR-DWQ, 2001). The NCIBI uses a cumulative assessment of 12 parameters or metrics. Each metric is designed to contribute unique information to the overall assessment. The scores for all metrics are then summed to obtain the overall NCIBI score.

2004 Recommendations

In order to obtain data from nonwadeable coastal plain streams (that are difficult to evaluate using benthic macroinvertebrates), a fish community boat sampling method is being developed with the goal of expanding the geographic area that can be evaluated using fisheries data. This project may take many years to complete. DWQ will continue to use this monitoring information to identify potential impacts to these waters even though a use support rating is not assigned. Refer to Appendix II for more information on assigning bioclassifications.

4.6 DWQ Stormwater Programs

4.6.1 Introduction

There are many different stormwater programs administered by DWQ. One or more of these programs affects many communities in the Tar-Pamlico River basin. The goal of the DWQ stormwater discharge permitting regulations and programs is to prevent pollution from entering the waters of the state via stormwater runoff. These programs try to accomplish this goal by controlling the source(s) of pollutants. These programs include NPDES Phase I and II, coastal county stormwater requirements, HQW/ORW stormwater requirements, Tar-Pamlico River basin NSW stormwater requirements, and requirements associated with the Water Supply Watershed Program. Local governments that are or may be affected by these programs are presented in Table A-23.

4.6.2 NPDES Phase I

Current Status
Phase I of the EPA stormwater program started with Amendments to the Clean Water Act (CWA) in 1990. Phase I required NPDES permit coverage to address stormwater runoff from medium and large stormwater sewer systems serving populations of 100,000 or more people. Phase I also had requirements for ten categories of industrial sources to be covered under stormwater permits. Industrial activities which require permitting are defined in categories ranging from sawmills and landfills to manufacturing plants and hazardous waste treatment, storage or disposal facilities. Construction sites disturbing greater than five acres are also required to obtain an NPDES stormwater permit under Phase I of the EPA stormwater program.

There are no NPDES Phase I stormwater permits issued to communities in the basin. There are currently 11 individual stormwater permits issued to facilities in the Tar-Pamlico River basin and 164 facilities that have general permit coverage. These facilities are mapped in each subbasin chapter in Section B and listed in Appendix I.

2004 Recommendations
DWQ recommends continued implementation of the current stormwater programs as well as implementation of the Phase II requirements. Development and implementation of local stormwater programs that go beyond the minimum requirements will be needed to restore aquatic life to Impaired urban streams.

4.6.3 NPDES Phase II

Current Status
The Phase II stormwater program is an extension of the Phase I program that will include permit coverage for smaller municipalities and cover construction activities down to one acre. The local governments permitted under Phase II will be required to develop and implement a comprehensive stormwater management program that includes six minimum measures.

1) Public education and outreach on stormwater impacts.
2) Public involvement/participation.
3) Illicit discharge detection and elimination.
4) Construction site stormwater runoff control.
5) Post-construction stormwater management for new development and redevelopment.
6) Pollution prevention/good housekeeping for municipal operations.

Construction sites greater than one acre will also be required to obtain an NPDES stormwater permit under Phase II of the EPA stormwater program in addition to erosion and sedimentation control approvals.

Three municipalities and three counties (see Table A-23) in the basin are automatically required (based on 1990 US Census Designated Urban Areas) to obtain a NPDES stormwater permit under the Phase II rules. Greenville, Rocky Mount and Winterville have turned in applications to be covered by the Phase II program. The three counties have certified that they do not have a storm sewer system.

Results of the 2000 US Census expanded coverage of automatically designated areas, adding two municipalities and one county. Applications for these communities were due in May 2004. Nashville has submitted an application to be covered by the program; Dortches and Franklin County have yet to submit applications. DWQ is currently developing criteria that will be used to determine whether other municipalities should be required to obtain a NPDES permits and how the program will be implemented. DWQ is also working to finalize state rules to implement the Phase II stormwater rules as required by the EPA.

2004 Recommendations

DWQ recommends that the local governments that will be permitted under Phase II proceed with permit applications and develop programs that can go beyond the six minimum measures. Implementation of Phase II, as well as the other stormwater programs, should help to reduce future impacts to streams in the basin. Local governments, to the extent possible, should identify sites for preservation or restoration. DWQ and other NCDENR agencies will continue to provide information on funding sources and technical assistance to support local government stormwater programs.

4.6.4 Tar-Pamlico River Basin NSW Stormwater Requirements

Because of the water quality problems in the Tar-Pamlico estuary related to nutrient overloading, six municipalities and five counties in the Tar-Pamlico River basin (Table A-23) are required to develop stormwater programs to reduce nutrient delivery to surface waters. The program must include review of stormwater management plans for new development, public education, removal of illegal discharges, and identification of stormwater retrofits. For more information on this program, refer to the Tar-Pamlico River basin NSW strategy (page 61).

4.6.5 State Stormwater Program

Current Status

The State Stormwater Management Program was established in the late 1980s under the authority of the North Carolina Environmental Management Commission (EMC) and North Carolina General Statute 143-214.7. This program, codified in 15A NCAC 2H .1000, affects development activities that require either an Erosion and Sediment Control Plan (for disturbances of one or more acres) or a CAMA major permit within one of the 20 coastal counties and/or development draining to Outstanding Resource Waters (ORW) or High Quality Waters (HQW).

The State Stormwater Management Program requires developments to protect these sensitive waters by maintaining a low density of impervious surfaces, maintaining vegetative buffers, and transporting runoff through vegetative conveyances. Low density development thresholds vary from 12-30 percent built-upon area (impervious surface) depending on the classification of the receiving stream. If low density design criteria cannot be met, then high density development requires the installation of structural best management practices (BMPs) to collect and treat stormwater runoff from the project. High density BMPs must control the runoff from the 1 or 1.5-inch storm event (depending on the receiving stream classification) and remove 85 percent of the total suspended solids.

Table A-23 shows the one municipality and three coastal counties in the Tar-Pamlico River basin where permits may be required under the state stormwater management program under CAMA or ORW stormwater rules. All development requiring an Erosion and Sediment Control Plan (for disturbances of one or more acres) must obtain a stormwater permit.

2004 Recommendations

DWQ will continue implementing the state stormwater program with the other NCDENR agencies and local governments. Local governments should develop local land use plans that minimize impervious surfaces in sensitive areas. Communities should integrate state stormwater program requirements, to the extent possible, with other stormwater programs in order to be more efficient and gain the most water quality benefits for protection of public health and aquatic life.

Table A-23 Communities in the Tar-Pamlico River with Stormwater Requirements

Local Government	NPDES		Tar-Pamlico NSW Stormwater Rules	Coastal Stormwater Rules	State Stormwater Program	Water Supply Watershed Stormwater Requirements
	Phase I	Phase II*				
Municipalities						
Greenville		**X**	**X**			**X**
Henderson			**X**			
Rocky Mount		**X**	**X**			**X**
Tarboro			**X**			**X**
Winterville		**X**				**X**
Oxford			**X**			
Dortches		**2000**				
Washington			**X**	**X**		
Louisburg					**X**	**X**
Franklinton						**X**
Leggett						**X**
Nashville		**2000**				**X**
Speed						**X**
Falkland						**X**
Pantego				**X**		
Belhaven				**X**		
Chocowinity				**X**		
Bath				**X**		
Aurora				**X**		
Washington Park				**X**		
Counties						
Edgecombe		**X**	**X**			**X**
Nash		**X**	**X**			**X**
Pitt		**X**	**X**			**X**
Franklin		**2000**	**X**			**X**
Hyde				**X**	**X**	
Beaufort			**X**	**X**	**X**	
Vance						**X**
Granville						**X**
Halifax						**X**
Washington				**X**		
Terrell				**X**		
Pamlico				**X**	**X**	
Martin						**X**
Wilson						**X**
Person						**X**

* More local governments may be designated, once designation criteria are developed, in addition to those that may be automatically designated based on 2000 Census.

4.6.6 Water Supply Watershed Stormwater Rules

Current Status
The purpose of the Water Supply Watershed Protection Program is to provide a proactive drinking water supply protection program for communities. Local governments administer the program based on state minimum requirements. There are restrictions on wastewater discharges, development, landfills and residual application sites to control the impacts of point and nonpoint sources of pollution. The program attempts to minimize the impacts of stormwater runoff by utilizing low density development or stormwater treatment in high density areas.

All communities in the Tar-Pamlico River basin in water supply watersheds have EMC approved water supply watershed protection ordinances.

2004 Recommendations
DWQ recommends continued implementation of local water supply protection ordinances to ensure safe and economical treatment of drinking water. Communities should also integrate water supply protection ordinances with other stormwater programs, to the extent possible, in order to be more efficient and gain the most water quality benefits for both drinking water and aquatic life.

4.7 Agriculture and Water Quality in the Tar-Pamlico River Basin

Current Status
Agriculture in the form of row crops and livestock make up a significant economic resource in the Tar-Pamlico River basin. Approximately 767,434 (22%) acres were in cultivated cropland and 101,137 acres were in pasture/managed herbaceous land covers (CGIA, 1996; page 18). The NRI (page 19) reported a 153,000-acre (16%) decrease in cultivated cropland from 1982 to 1997. There are also 120 registered animal operations (mostly swine) in the basin (page 23). Between 1994 and 1998, there was an increase in swine and poultry production and a decrease in dairy production (page 23).

Impacts to streams from row crop agriculture can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination and sedimentation. In the coastal plain, many agricultural areas are ditched, increasing the delivery of contaminants to larger water bodies. Animal waste lagoons can also cause water quality problems if breeched, and over application of waste onto spray fields can contaminate surface waters as well.

There are currently over 106 stream miles that are Impaired in areas where agriculture is the predominant land use. DWQ biologists have noted sedimentation, nutrient loading, channelization and pesticides as potential stressors to the biological communities in these streams. Agriculture is also a contributor of nutrients that can stimulate algal blooms that can cause chlorophyll *a* levels to exceed the water quality standard in downstream estuarine waters in the basin. Over 6,000 estuarine acres are Impaired because of exceedances of the chlorophyll *a* criterion. Bacterial runoff from agricultural land may also contribute to closures of shellfish harvesting waters as well. Water quality problems that are specific to a stream are discussed in the subbasin chapters in Section B.

There are several water quality programs implemented by state and federal agencies that affect agriculture in the Tar-Pamlico River basin. The NSW strategy sets forth rules for agriculture to reduce nutrients by implementation of BMPs (page 61) and also to develop nutrient management plans (page 61). There are also rules that address animal operations of a certain size and recent legislation that extended a moratorium on new swine operations (page 23).

The Clean Water Act Section 319 has provided funding for technical assistance to the DSWC (page 166) and the NCCES to help in implementation of the NSW requirements. The Agricultural Cost Share Program (page 166) spent almost six million dollars in the basin between 1997 and 2002 affecting over 116,000 acres of agricultural land. Funds have been requested through the Agricultural Sediment Initiative to address localized agricultural impacts (page 166). Farmers and ranchers in the Tar-Pamlico River basin are also eligible to enroll in the EQIP program (page 165) to help address soil, water and natural resource concerns.

Impacts to streams from agricultural activities can include excessive nutrient loading, pesticide and herbicide contamination, bacterial contamination and sedimentation. In the coastal plain, many agricultural areas are ditched, thereby, increasing the delivery of the contaminants to surface waters.

2004 Recommendations

DWQ will identify streams where agricultural land use may be impacting water quality and aquatic habitat. This information will be related to local DSWC and NRCS staff to investigate the agricultural impacts in these watersheds and to recommend BMPs to reduce impacts. DWQ recommends that funding and technical support for agricultural BMPs be continued and increased. Refer to Appendix VI for agricultural nonpoint source agency contact information.

4.8 Confined Animal Operations

Current Status

Confined animal operations in North Carolina result in increased production efficiency, improved production economics, and a better industry support system. However, high animal concentration and accompanying high nutrient import into eastern NC counties also impose a serious environmental threat to water quality.

Some portion of nitrogen in swine waste is emitted to the air as ammonia from hog houses, lagoons and spray fields. The contribution of atmospheric deposition to nutrient budgets in natural systems has not been fully appreciated until recently. In a June 2000 report, *Deposition of Air Pollutants to the Great Waters – 3rd Report to Congress 2000 (1)*, the USEPA presented estimates for selected waterbodies of the portion of the total nitrogen (N) load that was due to atmospheric inputs. With the range varying between 5 and 38 percent, that for the Albemarle-Pamlico Sounds was one of the highest at 38 percent. There is much uncertainty in calculating emissions from animal waste lagoons.

2004 Recommendations

DWQ recommends that the agricultural community associated with confined animal operations work to research and implement best management practices to address the atmospheric

deposition. See also page 61 for more information on the Tar-Pamlico River basin NSW strategy.

4.9 Shellfish Harvesting in Class SA Waters

Current Status
In the 1998 Tar-Pamlico River basin use support assessment, approved shellfish harvesting waters were fully supporting (FS) and prohibited waters were partially supporting (PS). In the 1998 assessment, there were 552,489 acres rated FS and 4,825 acres rated PS. Class SA acres were reported by the nine Division of Environmental Health Shellfish Sanitation and Recreational Water Quality Section (page 51) growing areas (e.g., G1: Goose Creek, 300 acres).

DWQ and DEH are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closure based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools were not available for use support assessment in Class SA waters during this planning cycle. DWQ believed it important to identify frequency of closures in these waters, so an interim methodology was used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that define areas and closure frequency.

2004 Recommendations
DWQ will continue to develop the tools necessary to make use support decisions in Class SA waters using a frequency of closures methodology. Refer to Appendix III for more information. Class SA waters are closed to shellfish harvesting because of bacterial contamination or the presence of stormwater outfalls.

4.10 Water Quality Problems Resulting from Hurricanes

Current Status
The Natural Resources Conservation Services (NRCS) Emergency Watershed Protection (EWP) Program is responsible for emergency de-snagging (removal of piles of woody debris from stream and river channels) activities. The EWP Program is intended to respond to watersheds impacted by natural disasters such as hurricanes, floods and fire. The purpose of the program is to restore watershed functions to predisaster conditions. Areas selected for debris removal are based on the amount and location of debris and the increased risk of flooding to improved property (including cropland) or public safety (primarily roads and bridges). Location maps and a description of all proposed work are sent to appropriate federal and state agencies for review and comment prior to contracting the work. The program's intent is to consider environmental concerns.

The activity of debris removal is of great interest to DWQ as the excessive removal of debris can impact the aquatic habitat and aquatic life within a stream reach. The decision to remove debris is made considering topography, proximity of improved property subject to damage, location of culverts, bridges and other restrictions, comparison of costs and benefits, and potential environmental impacts. NRCS, along with other state and federal agencies, is in the process of

developing guidelines for debris removal that will improve the decision-making process with regard to eligibility and damage thresholds, as well as improving the standards and specifications for removing woody debris in a manner that leaves enough to provide suitable habitat. Debris removal under EWP is not intended to remove all debris from stream channels, only that which causes or may cause an increased risk of flooding or streambank erosion.

Woody debris is the predominant habitat for benthic macroinvertebrates in larger, slower-moving coastal stream and wetland systems. Therefore, removal of these snags removes the habitat available for aquatic life. If care is not taken in properly removing woody debris, the streambanks and streambed can be altered as well as causing moderate to severe habitat degradation.

2004 Recommendations

DWQ is aware of the need to remove obstructions to water flow, including snags, near bridges or other structures in emergency situations because of safety concerns, to reduce economic loss in the event of natural disasters, and to reduce the risk of flooding. NRCS has recently adopted an Interagency Coordination and Implementation Plan for the EWP Program that allows for a direct and ongoing role for several agencies to play in the implementation process. The method in which snags are removed, the amount of debris that is removed, and the sites selected should all be chosen following a thorough review by the various agencies responsible for the implementation of the EWP Program. Local governments that receive additional funding for this type of activity should also implement the same management strategies as outlined in the EWP implementation plan to reduce impacts to water quality, aquatic habitat and aquatic life.

4.11 Water Quality Issues Related to Drought

Water quality problems associated with rainfall events usually involve degradation of aquatic habitats because the high flows may carry increased loadings of substances like 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 grow more due to longer periods of sunlight, and streamflows 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 streamflows 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 streamflows decrease, there is less habitat available for aquatic insects and fish, particularly around lake shorelines. There is also less water available for irrigation and for water supplies. The dry conditions and increased removal of water for these uses further increase 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 insects 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 of 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 difficulty in water treatment resulting in taste and odor problems in finished drinking water.

4.12 Sedimentation Pollution Control

Current Status

One of the most commonly noted types of habitat degradation in the Tar-Pamlico River basin was a result of sediment entering streams from adjacent land uses. The Sedimentation Pollution Control Act (SPCA) is administered by the NC Division of Land Resources. The Division of Land Resources (DLR) has the primary responsibility for assuring that erosion is minimized and sedimentation is reduced.

As a result of new stormwater rules enacted by EPA in 1999, construction or land development activities that disturb one acre or more are required to obtain a NPDES stormwater permit. An erosion and sediment control plan must also be developed for these sites under the SPCA. Site disturbances of less than one acre are required to use BMPs, but a plan is not required.

Major Causes of Sedimentation in the Tar-Pamlico River Basin

- Land clearing activities (construction and preparing land for planting crops)
- Streambank erosion
- Channelization

Forestry activities in North Carolina are subject to regulation under the SPCA. However, a forestry operation in the Tar-Pamlico River basin may be exempt from the permitting requirements if compliance with performance standards outlined in *Forest Practice Guidelines Related to Water Quality* (15NCAC 1I .201-.209) and General Statutes regarding stream obstruction (77-13 and 77-14) are maintained. Forestry activities in the Tar-Pamlico River basin must also adhere to the riparian buffer protection rules (page 61). Extensive information regarding these performance standards and rules as they apply to forestry operations can be found on the NC Division of Forest Resources' website at http://www.dfr.state.nc.us/managing/water_qual.htm.

For agricultural activities which are not subject to the SPCA, sediment controls are carried out on a voluntary basis through programs administered by several different agencies. As part of the Tar-Pamlico River NSW strategy (page 61), agriculture operations are required to address

nutrients using BMPs. Many of these BMPs will also reduce sediment delivery into adjacent waters.

In February 1999, the NC Sedimentation Control Commission adopted significant changes for strengthening the Erosion and Sedimentation Control Program. The following rule changes were filed as temporary rules, subject to approval by the Rules Review Commission and the NC General Assembly:

- Allows state and local erosion and sediment control programs to require a preconstruction conference when one is deemed necessary.
- Reduces the number of days allowed for establishment of ground cover from 30 working days to 15 working days and from 120 calendar days to 90 calendar days. (Stabilization must now be complete in 15 working days or 90 calendar days, whichever period is shorter.)
- Provides that no person may initiate a land-disturbing activity until notifying the agency that issued the plan approval of the date the activity will begin.
- Allows assessment penalties for significant violations upon initial issuance of a Notice of Violation (NOV).

Additionally, during its 1999 session, the NC General Assembly passed House Bill 1098 to strengthen the Sediment Pollution Control Act of 1973 (SPCA). The bill made the following changes to the Act:

- Increases the maximum civil penalty for violating the SPCA from $500 to $5000 per day.
- Provides that a person may be assessed a civil penalty from the date a violation is detected if the deadline stated in the Notice of Violation is not met.
- Provides that approval of an erosion control plan is conditioned on compliance with federal and state water quality laws, regulations and rules.
- Provides that any erosion control plan that involves using ditches for the purpose of de-watering or lowering the water table must be forwarded to the Director of DWQ.
- Amends the General Statutes governing licensing of general contractors to provide that the State Licensing Board for General Contractors shall test applicants' knowledge of requirements of the SPCA and rules adopted pursuant to the Act.
- Removes a cap on the percentage of administrative costs that may be recovered through plan review fees.

For information on North Carolina's Erosion and Sedimentation Control Program or to report erosion and sedimentation problems, visit the new website at http://www.dlr.enr.state.nc.us/ or you may call the NC Division of Land Resources, Land Quality Section at (919) 733-4574.

2004 Recommendations

DWQ will continue to work cooperatively with DLR and other agencies that administer sediment control and instream mining programs in order to maximize the effectiveness of the programs and to take appropriate enforcement action when necessary to protect or restore water quality. However, more voluntary implementation of BMPs is needed for activities that are not subject to these rules in order to substantially reduce the amount of widespread sedimentation present in the Tar-Pamlico River basin. Public education is needed basinwide to educate landowners about

the value of riparian vegetation along small tributaries and the impacts of sedimentation to aquatic life.

Funding is available for cost sharing with local governments that set up new erosion and sedimentation control programs or conduct their own training workshops. The Sediment Control Commission will provide 40 percent of the cost of starting a new local erosion and sedimentation control program for up to 18 months. Two municipalities or a municipality and county can develop a program together and split the match. It is recommended that local governments draft and implement local erosion and sedimentation control programs.

Funding is also available through numerous federal and state programs for farmers to restore and/or protect riparian buffer zones along fields or pastures, develop alternative watering sources for livestock, and fence animals out of streams (refer to Section C, Part 1.4.3). EPA's *Catalog of Federal Funding Sources for Watershed Protection* (Document 841-B-99-003) outlines some of these and other programs aimed at protecting water quality. A copy may be obtained by calling the National Center for Environmental Publications and Information at (800) 490-9198 or visit the website at http://www.epa.gov/OWOW/watershed/wacademy/fund.html. Local contacts for various state and local agencies are listed in Appendix VI.

4.13 Developing a Monitoring Coalition in the Tar-Pamlico River Basin

DWQ has combined NPDES instream monitoring requirements with watershed based monitoring to evaluate the instream impact of member dischargers and produce quality ambient data. The discharge monitoring coalition program was developed to better utilize the resources spent by NPDES permit holders and provide an effective way of assessing water quality. Each coalition's data is collected and analyzed by a state certified laboratory and all data are readily available in an electronic format. The monitoring program is designed to fit the specific river basin and discharger group. The monitoring locations are coordinated with the state's existing ambient and biological monitoring network. In exchange for participation in a discharge monitoring coalition, members are exempted from instream monitoring requirements in NPDES permits. Effluent monitoring requirements are not altered in any way by this program. DWQ is working with the Tar-Pamlico Basin Association (page 178) to develop a monitoring coalition that will start collecting ambient water quality data in 2005.

4.14 Algal Blooms

Algae are aquatic, microscopic plants, which respond to nutrients, temperature and light, and are an important food source for fish and other aquatic animals. Algae also contain pigments, including chlorophyll, which enable them to photosynthesize and produce oxygen. During summer, algae respond to warm temperatures, high light and nutrients washed into waterways after rain events. When temperatures and nutrient concentrations are elevated, algae reproduce to high concentrations ("bloom"). When this occurs at a particular site, chlorophyll *a*, dissolved oxygen (DO) and pH increase. When a site experiences dissolved oxygen concentrations >9.0 mg/l, DO percent saturation >110%, pH >8.0, or chlorophyll *a* concentrations exceed the state standard of 40 µg/l, the site is likely experiencing an algal bloom. When these algae die off or respire at night, dissolved oxygen can become very low. Many times low dissolved oxygen caused by algal die off can cause fish kills. Algal blooms have been a problem in lakes,

reservoirs and estuaries that are overloaded with nutrients. In 2001, over 500,000 fish died in 23 reported kill events. In the early 1990s, some estuarine fish kills within the Pamlico River were attributed to the toxic dinoflagellate, *Pfiesteria*, but no *Pfiesteria* related fish kills have been reported in the Tar-Pamlico River basin since 1997. Not all fish kill events are associated with algal blooms.

2004 Recommendations
Continued implementation of the Tar-Pamlico River basin NSW strategy (page 61) will help to reduce the potential for fish kills in the Tar-Pamlico River estuary.

4.15 Low Dissolved Oxygen

Maintaining an adequate amount of dissolved oxygen (DO) is critical to the survival of aquatic life and to the general health of surface waters. A number of factors influence DO concentrations including water temperature, depth and turbulence. Additionally, in the Tar-Pamlico River basin, a large floodplain drainage system and flow management from upstream impoundments also influence DO. The DO water quality standard for Class C waters is "not less than a daily average of 5.0 mg/l with a minimum instantaneous value of not less than 4.0 mg/l". Swamp waters (Class C Sw) "may have lower values if caused by natural conditions" (NCDENR-DWQ, August 1, 2000).

Oxygen-consuming wastes such as decomposing organic matter and some chemicals can reduce DO levels in surface water through biological activity and chemical reactions. NPDES permits for wastewater discharges set limits on certain parameters in order to control the effects that oxygen depletion can have in receiving waters.

For more information about oxygen-consuming wastes and what DWQ does to limit water quality impacts from these wastes, refer to *A Citizen's Guide to Water Quality Management in North Carolina*. This document is available online at http://h2o.enr.state.nc.us/basinwide/ or by calling (919) 733-5083.

4.16 Habitat Degradation

Instream habitat degradation is identified in the use support summary (Appendix III) where there is a notable reduction in habitat diversity or a negative change in habitat. This term includes sedimentation, bank erosion, channelization, lack of riparian vegetation, loss of pools or riffles, loss of woody habitat, and streambed scour. Good instream habitat is necessary for aquatic life to survive and reproduce. Streams that typically show signs of habitat degradation are in watersheds that have a large amount of land-disturbing activities (construction, mining, timber harvest and agricultural activities) or a large percentage of impervious surfaces. A watershed in which most of the riparian vegetation has been removed from streams or channelization has occurred also exhibits instream habitat degradation. Streams that receive a discharge quantity that is much greater than the natural flow in the stream often have degraded habitat as well.

Sedimentation is the process by which eroded soil is deposited into waters. Sediment that accumulates on the bottom of streams and rivers smothers fish habitat vital to reproduction and

impacts aquatic insects that fish feed upon. Sediment filling rivers and streams decreases their storage volume and increases the frequency of floods (NCDENR-DLR, 1998). Suspended sediment can decrease primary productivity (photosynthesis) by shading sunlight from aquatic plants, affecting the overall productivity of a stream system. Suspended sediment also has several effects on various fish species including avoidance and redistribution, reduced feeding efficiency, and therefore, reduced growth by some species, respiratory impairment, reduced tolerance to diseases and toxicants, and increased physiological stress (Roell, June 1999). Suspended sediment also increases the cost of treating municipal drinking water.

Some Best Management Practices

Agriculture

- No till or conservation tillage practices
- Strip cropping and contour farming
- Leaving natural buffer areas around small streams and rivers

Construction

- Using phased grading/seeding plans
- Limiting time of exposure
- Planting temporary ground cover
- Using sediment basins and traps

Forestry

- Controlling runoff from logging roads
- Replanting vegetation on disturbed areas
- Leaving natural buffer areas around small streams and rivers

Bank erosion can add large amounts of sediment to a stream. High flows after rain events can remove soil from the streambank and deposits further downstream. During very high flow events entire streambanks can be eroded into streams. There are many places along the Tar River where large portions of the riverbank fell as a result of high flows during and following Hurricane Floyd. When these banks began to fail, tons of sediment were washed into the river along with trees and other debris. Streambank erosion from smaller rain events is also common along many urban stream corridors.

Channelization refers to the physical alteration of naturally occurring stream and riverbeds. Increased flooding, bank erosion and channel instability often occur in downstream areas after channelization has occurred (McGarvey, 1996). Direct or immediate biological effects of channelization include injury and mortality of benthic macroinvertebrates, fish, shellfish/mussels and other wildlife populations, as well as habitat loss. Indirect biological effects include changes in benthic macroinvertebrate, fish and wildlife community structures, favoring species that are more tolerant of or better adapted to the altered habitat (McGarvey, 1996). Channelization also increases the efficiency that bacteria reach shellfish harvesting waters.

Lack of riparian areas can cause reductions in bank stability, nutrient and sediment removal efficiency and increases stream temperatures because of reduced shading. Aquatic habitat can be adversely affected because of the resultant higher temperatures and increased sediment.

Loss of pools and riffles results in loss of the two major aquatic habitat types in streams. High sediment loads can fill pools and bury riffles. For aquatic life to be supported, pools and riffles need to be present and stable in streams for long periods of time.

Loss of woody habitat from streams causes reductions in important aquatic habitat and processing of organic matter. Woody material from surrounding riparian areas provides aquatic habitat for many benthic macroinvertebrate species. Woody material forms debris dams that can

be stable for many years in streams. These debris dams hold organic material in the stream longer and increase processing efficiency.

Streambed scour directly removes benthic macroinvertebrates from woody material and large rocks.

2004 Recommendations
Determining the cause and quantifying amounts of habitat degradation is very difficult in most cases. To assess instream habitat degradation in most streams would require extensive technical and monetary resources and perhaps even more resources to restore the stream. DWQ is working to develop a reliable habitat assessment methodology.

Although DWQ and other agencies are starting to address this issue, local efforts are needed to prevent further instream habitat degradation and to restore streams that have been Impaired by activities that cause habitat degradation. As point sources become less of a source of water quality impairment, nonpoint sources that pollute water and cause habitat degradation will need to be addressed to further improve water quality in North Carolina's streams and rivers.

Erosion and sedimentation can be controlled during most land-disturbing activities by using appropriate BMPs. In fact, planning to minimize the (1) amount and (2) time the land is exposed can prevent substantial amounts of erosion. Land clearing activities that contribute to sedimentation in the Tar-Pamlico River basin include: construction of homes and subdivisions as well as commercial and public buildings; plowing soil to plant crops; site preparation and harvest on timberlands; and road projects.

Restoration or recovery of channelized streams may occur through natural processes or artificially induced ones. In general, streams that have not been excessively stressed by the channelization process can be expected to return to their original forms. However, streams that have been extensively altered may establish a new, artificial equilibrium (especially when the channelized streambed has been hardened). In such cases, the stream may enter a vicious cycle of erosion. Once the benefits of a channelization project become outweighed by the costs, both in money and environmental integrity, channel restoration efforts are likely to be taken (McGarvey, 1996).

4.17 Fecal Coliform

Fecal coliform bacteria live in the digestive tract of warm-blooded animals (humans as well as other mammals) and are excreted in their waste. Fecal coliform bacteria do not actually pose a danger to people or animals. However, where fecal coliform are present, disease-causing bacteria may also be present, and water that is polluted by human or animal waste can harbor other pathogens that may threaten human health.

The presence of disease-causing bacteria tends to affect humans more than aquatic creatures. High levels of fecal coliform bacteria can indicate high levels of sewage or animal wastes, which could make water unsafe for human contact (swimming) or the harvesting and consumption of shellfish. Fecal coliform bacteria and other potential pathogens associated with waste from warm-blooded animals are not harmful to fish and aquatic insects. However, high levels of fecal

coliform bacteria may indicate contamination that increases the risk of contact with harmful pathogens in surface waters. In the Tar-Pamlico River basin, data from DWQ's ambient monitoring stations in subbasin 03-03-01 showed somewhat high levels of fecal coliform bacteria. Many areas in the coastal region of the basin (subbasins 03-03-07 and 03-03-08) are Impaired because of shellfish harvesting area closures. There are also many waters that have high levels of fecal coliform bacteria associated mostly with stormwater runoff in urban areas. DWQ is currently developing TMDLs (see Appendix IV) for waters that are on the 303(d) list of Impaired waters.

Pathogens associated with fecal coliform bacteria can cause diarrhea, dysentery, cholera and typhoid fever in humans. Some pathogens can also cause infection in open wounds.

Under favorable conditions, fecal coliform bacteria can survive in bottom sediments for an extended period (Howell et al., 1996; Sherer et al., 1992; Schillinger and Gannon, 1985). Therefore, concentrations of bacteria measured in the water column can reflect both recent inputs as well as the resuspension of older inputs.

Reducing fecal coliform bacteria in wastewater requires a disinfection process, which typically involves the use of chlorine and other disinfectants. Although these materials may kill the fecal coliform bacteria and other pathogenic disease-causing bacteria, they also kill bacteria essential to the proper balance of the aquatic environment, and thereby, endanger the survival of species dependent on those bacteria.

Water quality standards for fecal coliform bacteria are intended to ensure safe use of waters for recreation and shellfish harvesting (refer to Administrative Code Section 15A NCAC 2B .0200). The North Carolina fecal coliform standard for freshwater is 200 colonies/100ml based on the geometric mean of at least five consecutive samples taken during a 30-day period and not to exceed 400 colonies/100ml in more than 20 percent of the samples during the same period. The 200 colonies/100ml standard is intended to ensure that waters are safe for water contact through recreation.

The standard for Class SA waters (waters used for shellfishing) is a median or geometric mean fecal coliform Most Probable Number (MPN) not greater than 14 MPN/100ml. In addition, not more than 10 percent of the samples can be in excess of 43 MPN/100ml. Many areas closed to shellfish harvesting have median levels below 14 MPN/100ml, but fail to meet the second criteria due to periodic contamination that occurs after moderate to heavy rainfall events.

The North Carolina Division of Environmental Health (DEH) has subdivided all of the state's coastal waters into shellfish growing areas in which a sanitary survey is conducted every three years. Beginning in the summer of 1997, DEH began assessing fecal coliform levels in coastal recreation waters. These assessments provide a gauge of water quality along the North Carolina coast over the short and long-term.

If a certain area along the coast is found to have potential water quality problems related to stormwater pipes or high levels of indicator bacteria, health officials will post signs recommending that people not swim there or harvest shellfish from the area. The location will

be listed on the DEH website at (http://www.deh.enr.state.nc.us/shellfish/), and local media and county health departments will be notified.

Sources of Fecal Coliform in Surface Waters

- Urban stormwater
- Wild animals and domestic pets
- Improperly designed or managed animal waste facilities
- Livestock with direct access to streams
- Improperly treated discharges of domestic wastewater, including leaking or failing septic systems and straight pipes

The state does not encourage swimming in surface waters since a number of factors, which are beyond the control of any state regulatory agency, contribute to elevated levels of disease-causing bacteria. To assure that waters are safe for swimming indicates a need to test waters for pathogenic bacteria. Although fecal coliform standards have been used to indicate the microbiological quality of surface waters for swimming and shellfish harvesting for more than 50 years, the value of this indicator is often questioned. Evidence collected during the past several decades suggests that the coliform group may not adequately indicate the presence of pathogenic viruses or parasites in water.

The detection and identification of specific pathogenic bacteria, viruses and parasites such as *Giardia*, *Cryptosporidium* and *Shigella* are expensive, and results are generally difficult to reproduce quantitatively. Also, to ensure the water is safe for swimming would require a whole suite of tests for many organisms, as the presence/absence of one organism would not document the presence/absence of another. This type of testing program is not possible due to resource constraints.

4.18 Fish Consumption Advice

The presence and accumulation of mercury in North Carolina's aquatic environment are similar to contamination observed throughout the country. Mercury has a complex life in the environment, moving from the atmosphere to soil, to surface water and into biological organisms. Mercury circulates in the environment as a result of natural and human (anthropogenic) activities. A dominant pathway of mercury in the environment is through the atmosphere. Mercury that has been emitted from industrial and municipal stacks into the ambient air can circulate across the globe. At any point, mercury may then be deposited onto land and water. Once in the water, mercury can accumulate in fish tissue and humans. Mercury is also commonly found in wastewater.

The NC Department of Health and Human Services issues fish consumption advisories and advice for those fish species which have median and/or average methyl mercury levels at 0.4 mg/kg or greater. These fish include shark, swordfish, king mackerel, tilefish, as well as largemouth bass, bowfin (or blackfish) and chain pickerel (or jack) in North Carolina waters south and east of Interstate 85. See *Fish Consumption Advice* below. Refer to Appendix III for more information regarding use support ratings and assessment methodology.

DWQ has sampled fish tissue from three locations on the Tar River mainstem. Refer to subbasin Chapters 3 and 5 for more information on these waters.

Fish Consumption Advice

Fish is an excellent source of protein and other nutrients. However, several varieties of freshwater fish may contain high levels of mercury, which may pose a risk to human health. These guidelines will help you make healthy food choices. A "meal" is defined as six ounces of cooked fish for adults and children 15 years or older and two ounces of cooked fish for younger children.

FDA and EPA Advisory

On March 19th, 2003, the Food and Drug Administration and EPA issued a joint consumer advisory about mercury in fish and shellfish. The advice is for women who might become pregnant, women who are pregnant, nursing mothers, and young children. Aside from being issued jointly by two federal agencies, this advisory is important because it emphasizes the positive benefits of eating fish and gives examples of commonly eaten fish that are low in mercury. In the past, FDA issued an advisory on consumption of commercially caught fish, while EPA issued advice on recreationally caught fish.

By following these three recommendations for selecting and eating fish or shellfish, women and young children will receive the benefits of eating fish and shellfish and be confident that they have reduced their exposure to the harmful effects of mercury:

- **Do not eat** shark, swordfish, king mackerel or tilefish because they contain high levels of mercury.
- Eat up to 12 ounces (2 average meals) a week of a variety of fish and shellfish that are lower in mercury.
- Five of the most commonly eaten fish that are low in mercury are shrimp, canned light tuna, salmon, pollock and catfish.
- Another commonly eaten fish, albacore ("white") tuna has more mercury than canned light tuna. So, when choosing your two meals of fish and shellfish, you may eat up to 6 ounces (one average meal) of albacore tuna per week.
- Check local advisories about the safety of fish caught by family and friends in your local lakes, rivers and coastal areas. If no advice is available, eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but do not consume any other fish during that week.

For more detailed information, visit EPA's internet site at http://www.epa.gov/waterscience/fish/ or visit http://www.cfsan.fda.gov/seafood1.html or call the FDA's food information line toll-free at 1-888-SAFEFOOD.

NCDHHS Advice

The NC Department of Health and Human Services updated the following advice on April 16th, 2002.

Women of Childbearing Age (15-44 years), Pregnant Women, Nursing Women and Children under 15:

- ◊ **Do not eat** shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are often high in mercury.
- ◊ Eat up to two meals per week of other fish.

Other Women, Men, and Children 15 years and older:

- ◊ **Eat no more than one meal* per week** of shark, swordfish, tilefish or king mackerel; or blackfish (bowfin), largemouth bass or jack fish (chain pickerel) caught in North Carolina waters south and east of Interstate 85. These fish are often high in mercury.
- ◊ Eat up to four meals per week of other fish.

* A meal is 6 ounces of cooked fish for adults and 2 ounces of cooked fish for children under 15.

For more information and detailed listing of site-specific advisories, visit the NC Department of Health and Human Services website at http://www.schs.state.nc.us/epi/fish/current.html or call (919) 733-3816.

2004 Recommendations

Improved Ambient Sampling Techniques

DWQ aims to stay abreast of new technology and sampling techniques to ensure that water quality data are accurate, precise and of highest value. In 2000, DWQ started training water quality sampling staff on the new EPA Method 1631 technique. Current monitoring using a higher detection limit (EPA Method 245.1) has consistently yielded non-detected values, and DWQ aims to use the 1631 Method to allow detection levels three orders of magnitude lower than EPA Method 245.1.

NC Eastern Regional Mercury Study

In an effort to better manage state waters that may have methyl mercury issues, DWQ initiated a study using grant funding from EPA Region IV. The study aims to provide information that may be used in water quality standard and TMDL development. The study goals include:

- Determining levels of ambient mercury in the surface water system.
- Estimating site-specific total mercury: methyl mercury translators to evaluate water quality criteria.
- Develop site-specific water to fish bioaccumulation factors.
- Determine levels of mercury in treatment plant effluent.

DWQ will make these results available to the public when complete. For more information, contact the DWQ Planning Branch Modeling/TMDL Supervisor at (919) 733-5083.

DWQ Mercury Workgroup

DWQ is committed to characterizing methyl mercury exposure levels and determining if NPDES sources need to be controlled. DWQ formed an internal Mercury Workgroup to improve communication from all programs that directly affect mercury issues (i.e., Pretreatment,

Environmental Sciences, Basinwide Planning, etc.). The workgroup meets as needed to share information and determine next steps in addressing mercury issues associated with the aquatic environment.

DWQ will continue to host an internal workgroup to stay abreast of current mercury issues. The public has voiced concerns that DWQ should be working on the ecological components and consequences of mercury bioavailability to biota in these areas and the biogeochemical cycling and production of methyl mercury from associated wetlands along these streams.

DWQ will continue to monitor concentrations of various contaminants in fish tissue across the state and will work to identify and reduce wastewater contributions of mercury to surface waters. The Division of Air Quality (DAQ) evaluates mercury levels in rainwater on a regular basis through the EPA Mercury Deposition Network. Pollution prevention efforts are being investigated on a state and federal level to reduce mercury emissions.

NPDES Mercury Requirement, Implementation of EPA Method 1631

NPDES permittees have worked with the state to reduce potential risks from this pollutant, including tasks associated with collecting and reporting more accurate data. The most commonly used laboratory analysis for total mercury (EPA Method 245.1) has a method detection level of 0.2 µg/l, while the current water quality standard is an order of magnitude lower at 0.012 µg/l. Thus, true compliance with the water quality standard could not be judged. A more recently approved laboratory method (EPA Method 1631) has a detection level below the water quality standard (0.0005 µg/l), which would allow the Division to assess potential water quality impacts from dischargers more accurately.

A total of 155 facilities statewide will be required to use EPA Method 1631 (or subsequent low level mercury methods approved by EPA in 40 CFR 136) when analyzing for total mercury beginning September 1, 2003. These facilities are subject to this new requirement because of either criteria: 1) the facility has a current total mercury limit in its NPDES permit that is <0.20 µg/l; or 2) the facility has limited instream dilution (i.e., the instream waste concentration (IWC) is >6 percent). This requirement complies with 15 A NCAC 2B.0505(e)(4), which requires that "test procedures must produce detection and reporting levels below the permit discharge requirements".

The State of North Carolina alone cannot eliminate the atmospheric deposition of mercury over surface waters. Actions for reducing atmospheric mercury will also be needed at the national and international levels. The Mercury Report to Congress (EPA, 1997) lists initiatives under the Clean Air Act that may reduce atmospheric mercury emissions from industrial sources. The most significant initiative is emission limits for municipal waste combustors and medical waste incinerators.

4.19 Management Strategies for Federally Threatened and Endangered Species

The Tar River spinymussel (https://ecos.fws.gov/species_profile/SpeciesProfile?spcode=F015) and the Dwarf wedgemussel are federally-listed endangered species in certain waters within the Tar-Pamlico River basin and are subject to a new rule (Administrative Code: 15A NCAC 02B

.0110) requiring the development of site-specific management strategies by DWQ. The intent of these strategies is to provide for maintenance and recovery of the water quality conditions required to sustain these species.

Considerable information on these species, as well as the waters in which they are found, is needed for the development of appropriate management strategies as required by the rule. DWQ currently has neither the resources nor the expertise to gather this information alone. Therefore, the US Fish and Wildlife Service, the NC Wildlife Resources Commission, the NC Natural Heritage Program, and other interested parties are collaborating on a process that will ensure successful development and implementation of appropriate management strategies to protect these species. DWQ held an initial meeting in July 2002 between the agencies to discuss the rule and its applications to the Tar-Pamlico River basin. A work group has been formed and plan development is proceeding.

4.20 North Carolina Source Water Assessment Program

The 1996 Safe Drinking Water Amendments required that all states establish Source Water Assessment Programs (SWAP) and submit a plan to the Environmental Protection Agency (EPA) by February 6, 1999. The EPA provided guidance to the states describing the required content of a Source Water Assessment Program Plan, requirements for public participation, and linkages to other federal programs. The State of North Carolina convened a Technical and Citizens Advisory Committee comprised of a variety of stakeholders that met three times during the fall of 1998 and provided valuable input and review during the development of the North Carolina Source Water Assessment Program Plan. Source water assessments will allow the state to systematically address issues of potential contamination of public water supplies using existing data from established environmental programs.

As described in the SWAP Plan, North Carolina has been proactive in the prevention of contamination of the state's drinking water supplies through the establishment and implementation of the state's Wellhead Protection Program and Water Supply Watershed Protection Program. The SWAP allows North Carolina to build upon these existing programs, to assess the susceptibility of drinking water supplies to contamination, and to provide a sound basis for planning future source water protection strategies. For more information on SWAP and other Public Water Supply programs, visit the website at http://www.deh.enr.state.nc.us/pws/.