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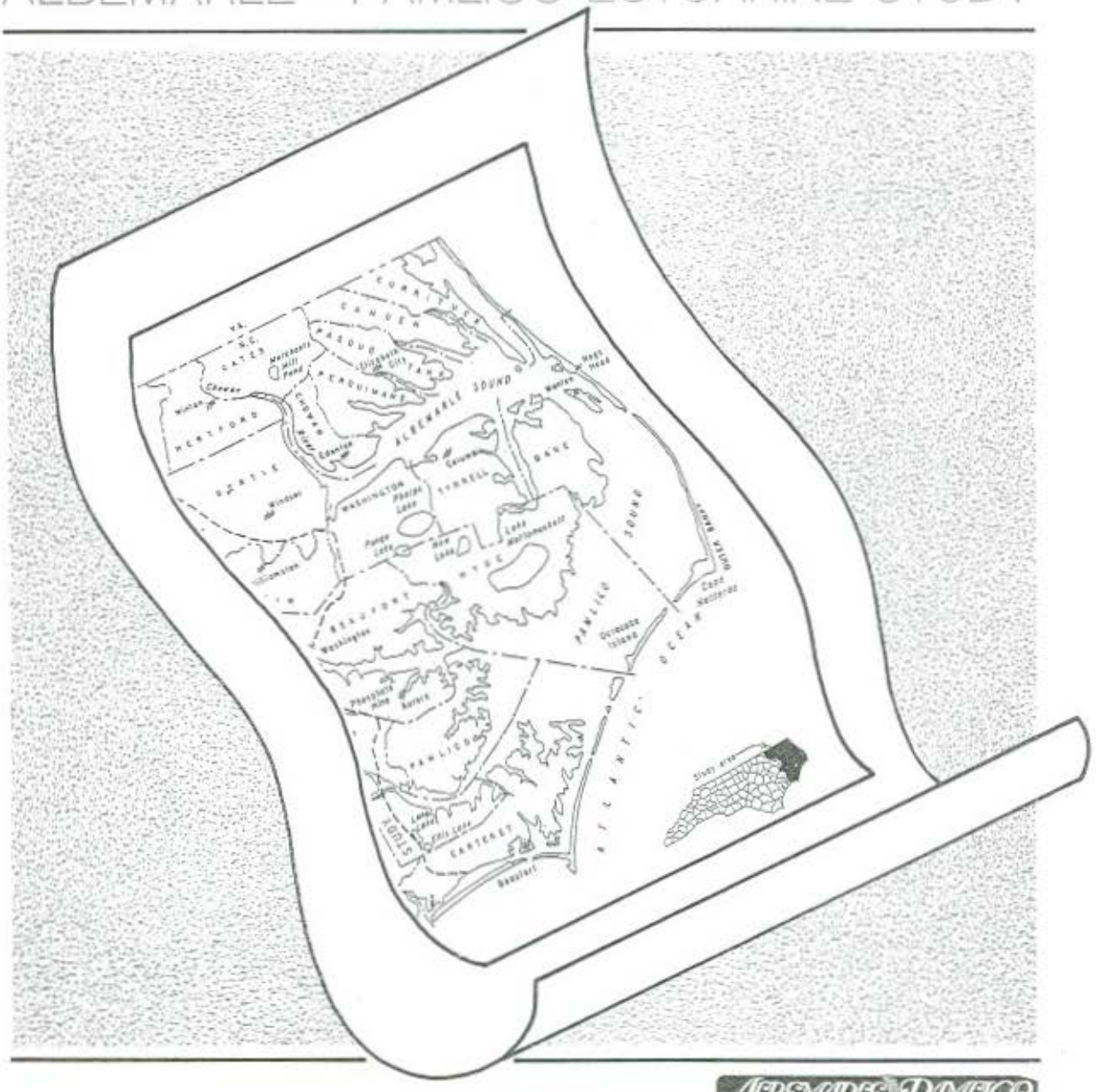
EVALUATION OF STATE ENVIRONMENTAL MANAGEMENT AND RESOURCE PROTECTION PROGRAMS IN THE A/P REGION

ALBEMARLE - PAMLICO ESTUARINE STUDY



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EVALUATION OF STATE ENVIRONMENTAL MANAGEMENT AND RESOURCE PROTECTION PROGRAMS IN THE ALBEMARLE-PAMLICO REGION

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ABSTRACT

A screening-level analysis was used to assess the implementation effectiveness of selected State regulatory programs that address water quality and critical habitat protection in the Albemarle-Pamlico Estuarine Study area. The methodology of implementation analysis (as developed by Paul Sabatier and Daniel Mazmanian) was used to look at 17 individual programs in nine source categories (or "program areas").

The nine program areas addressed in this report are: (1) NPDES point source controls; (2) individual onsite treatment systems; (3) large or community-based treatment systems using subsurface disposal or land application; (4) urban stormwater regulations; (5) implementation of agricultural controls; (6) erosion and sedimentation regulations for construction; (7) marina siting and marine waste disposal; (8) critical aquatic habitat protection; and (9) wetlands protection.

The evaluation criteria used in this project are: (1) tractability of the problem; (2) clarity and specificity of program objectives; (3) soundness of underlying technical theory; (4) adequacy of resources and staff; (5) adequacy of incentives and sanctions; (6) accessibility to supportive constituencies; (7) adequacy of training and technical assistance; and (8) implementing agency's level of commitment to program objectives.

Findings specific for each criterion in each program area are detailed in the report. Also, for each program area, the report summarizes key issues of concern and provides a list of recommendations. Overall results indicate that staff shortages, particularly in positions assigned to compliance and enforcement, may be limiting program effectiveness. Several programs, which do not have formal permitting authority, lack the ability to assess permit fees and thus, suffer more seriously from year-to-year budget battles. With several exceptions, the underlying technical basis of most programs is sound, although continuing efforts are underway to refine program criteria and standards. General recommendations include the expanded use of permit fees and consumption taxes to support programs, the addition of paralegal staff to Regional Offices to carry out routine compliance and enforcement tasks for various programs, and the integration of diverse agencies and programs through a basinwide, and then watershed-by-watershed planning and assessment process that incorporates both point and nonpoint source concerns.

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SUMMARY AND CONCLUSIONS

We believe that this document should serve as a starting point for discussions of specific actions to be included in the Albemarle-Pamlico Comprehensive Management Plan. That is to say, it should remain a "work in progress", not a snapshot of program conditions as they were interpreted by the authors in late 1989. As more or better information becomes available or as regulations change, evaluations, issues of concern and recommendations should be refined. This report is intended to help initiate a process.

General Summary

The activities that cause water quality degradation and habitat loss are extremely diverse, yet most State programs address them through a similar regulatory model. The model includes the development of criteria or standards for individual activities; permit issuance or plan approval; compliance assessment; and enforcement efforts. While each program must meet specific challenges resulting from the nature of the activity being regulated, basic similarities among the programs make it possible to compare and evaluate performance for these different tasks.

Criteria and Standards. Specific (usually numerical) criteria and standards are a governing force in regulatory programs. Standards are hotly debated, often "political" in the broad sense of the word, and subject to challenge and change. In many cases, programs have evolved a broad base of generally accepted standards; then, over time, additions or changes are considered. For each program, there are areas where some constituents view existing standards as either incomplete or inadequate. The following is a brief summary of these "contested" areas for programs reviewed in this document:

- NPDES--Numerical standards for most toxicants are in place although several (lead, arsenic, and chlorinated organics) are undergoing further study to assess the economic and health effects of lowering existing standards. Standards for nutrients in estuaries may be desirable, but first the State needs to develop and refine nutrient reduction target levels for major basins.

- On-site Treatment--A primary issue for small systems and some large subsurface disposal systems is the need to reexamine the adequacy of the minimum 1-foot vertical separation requirement. Other important issues concern the adequacy of density limitations (set by local governments) and the water quality consequences of allowing new systems on "old fill" along finger canals. Siting standards for rapid infiltration systems (rotary distributors) are an area of concern.

- Stormwater--The adequacy of the design storm and the width of vegetative filter strips, especially around SA waters are issues of concern.

- Agriculture--"Standards" in the cost share program generally involve specifications for approved BMPs, which are usually non-controversial. Conspicuous by their absence are specific standards for tracking, inspecting, and permitting most concentrated animal feeding operations in North Carolina.

- Construction--The erosion and sedimentation control program includes a limited number of specific standards that apply to all sites. One that may be questionable is the number of days allowed for restoration of land cover following completion of grading.

- Marinas--Siting criteria are difficult to implement; a revised definition of what constitutes a "marina" may be difficult to enforce.

- Critical Habitat--CAMA's 75-foot shoreline AEC may be inadequate to protect adjacent water quality; DMF's standards regarding trawling in shallow estuaries may not be protective of benthic habitat.

- Wetlands--The effects of small (less than 10-acre) wetland alterations allowed under the Section 404 general permit is uncertain; loss of important wetland functions under the silviculture exemption is the subject of a current lawsuit.

Permit Issuance/Plan Approval. One theme that emerges from this study is that, with only a few exceptions, the primary focus of programs is toward the review and issuance of permits, with less priority given to compliance and enforcement (at least as measured by the adequacy of staff resources devoted to these tasks). Such a strategy is understandable in the context of limited budgets and statutory time limits on permit processing; rarely are there parallel statutory requirements regarding compliance and enforcement. Nevertheless, the net effect of this emphasis may be to undermine the achievement of program goals. Among all the programs, only the NPDES program has worked to automate and expedite the permitting process, assigning much of the routine data collection effort to permittees themselves. The recent basinwide permitting strategy is an example of the program's effort to make the permitting process more efficient.

Compliance Assessment. Often, there are strong cultural, monetary and technical reasons for permittees to violate permits--either intentionally or simply by ignoring problems as they arise. Thus, in many cases, unless permittees feel there is a reasonable chance that noncompliance will be detected and addressed, adequate compliance with permit conditions is unlikely. This is particularly true for nonpoint source problems where routine monitoring is not carried out.

It is probably impossible to overemphasize the importance of having someone actually inspect a site and investigate a problem. In many cases, a solution is precipitated just by having a "warm body" with knowledge and credibility present; without it, usually nothing will happen. Among each of the programs addressed in this study, there was a clear shortage of staff to carry out adequate compliance inspections. In some cases, only large important sources are inspected on a regular basis (NPDES); in others, a small percentage of all sources are inspected (on-site systems, agricultural practices); in others, compliance inspections are not routinely carried out at all except where problems have been previously identified (stormwater, critical habitat).

Enforcement Efforts. With the exception of the agriculture cost share program (which is structured differently because of its voluntary nature), most formal enforcement efforts rely on civil (or "administrative") penalties. (Other sanctions are also available in specific programs, e.g., the denial sewer line extensions to municipal treatment plants.) In many cases, the result is a frequent lack of swift and sure penalties for violations. The process of assessing civil penalties is slow and cumbersome, fraught with appeals, and most importantly requires significant time and resources from an already limited staff. As a result, penalties are generally used only as a last resort to "get their attention" when all other attempts to correct a problem have failed. Each program must find new ways to expedite this process, while preserving individual legal rights.

Two other approaches are available, but are rarely used: criminal penalties and court-ordered injunctions. There are a number of explanations for why criminal sanctions are not used in these programs. First, criminal penalties require a significantly higher standard of proof than civil penalties; that is, the State must prove "intent to violate" or negligence and the standard is "beyond a reasonable doubt" (compared to "the preponderance of evidence" for civil assessments). Second, agency investigators are simply not trained to gather the type and amount of evidence needed to pursue a criminal case; and finally, criminal cases are not tried by the State OGC or Attorney General's Office, but must be tried by local district attorneys, many of whom have little or no experience with environmental law.

Court-ordered injunctions have been used in some enforcement efforts, notably under the Sedimentation Pollution Control Act, and to a lesser extent under CAMA. However, typically, a judge will grant an injunction only if (1) it is possible to show imminent harm or danger to public health and safety and (2) dire consequences (worse than the original violation) will not result from the injunction itself. In most cases it is difficult to meet these criteria. For example, closing down a sewage treatment plant is completely impractical; similarly, an injunction that would close a large industrial or commercial source would put many people out or work. Smaller sources typically do not pose an imminent danger.

Program-Specific Summaries

The following paragraphs are capsule summaries of program scope and primary issues of concern for each program area.

Point Source Discharges: NPDES. The NPDES program is well-established and designed to address a major source of pollutants in the A/P Study area. Of the three primary categories of point sources (municipal, industrial, and small domestic dischargers), direct industrial sources are addressed most completely under this program. Primary issues involve the adequacy of existing knowledge and tools (e.g., models) to address current problems, especially nutrient enrichment and subsequent algal blooms; lack of resources to carry out necessary compliance monitoring and inspections (particularly for smaller dischargers) and for capitalizing the State Revolving Loan Fund; limited enforcement of permits and SOCs/JOCs against municipal treatment plants; and limited availability of technical assistance for municipal and small treatment facilities. In 1990, DEM initiated several important efforts to improve the NPDES compliance and enforcement process. These initiatives include a sophisticated permit and compliance tracking system, a basinwide permitting strategy, streamlined protocols for assessing civil penalties, and automatic fines for dischargers that are late in submitting monthly monitoring reports.

On-site Treatment: Small Systems. Small (usually residential) on-site treatment systems are regulated under State rules that are implemented primarily by local health departments, without monetary support from the State. The regulatory process is a difficult one, especially in rural areas, where septic tank siting rules are often the de facto zoning requirements. Primary issues involve the adequacy of technical criteria, especially the minimum "vertical separation" in areas with porous soils and/or high water tables; limited staff in both the State Division of Environmental Health and in the local health departments; lack of incentives for homeowners to carry out routine maintenance on their systems; and inadequate training and technical assistance for local sanitarians as well as contractors responsible for design and installation of on-site systems.

On-site Treatment: Large Systems. Large on-site treatment systems (generally, community or commercial systems that do not discharge directly to surface water) dispose of wastewater using either subsurface or land application methods. Regulation of these systems is divided between DEM and DEH, with all land application and publicly owned systems under DEM jurisdiction. Large subsurface disposal and rapid infiltrations systems are a relatively new technology, and the long-term effectiveness of these systems is uncertain. Other primary issues involve inconsistencies and overlaps between the DEH on-site sewage program and the DEM nondischarge permit program; the adequacy of siting criteria for large systems; the shortage of staff in all agencies to carry out compliance monitoring and inspections; the lack of a standard reporting and tracking system for self-monitoring data from nondischarge systems; and the need for special training and certification for operators of subsurface and land application systems.

Stormwater Management. Contaminants contained in urban runoff are highly site-specific; principal pollutants of concern near coastal waters are fecal coliform, although toxicants and nutrients are also commonly washed off land surfaces. Urban runoff from new development in the A/P Study area is regulated primarily under the Stormwater Runoff Disposal rules, implemented by DEM. Primary issues involve the relatively low level of resources allocated to this program, with consequent poor follow-up, once required stormwater plans have been approved; uncertainty regarding the effectiveness of required controls and whether maintenance of structural controls is adequate; and the lack of participation by local officials in implementing this program.

Agricultural Cost Share Program. Agriculture is the dominant source of pollutants in the A/P Study area. The two major programs that address agricultural sources are the Agricultural Cost Share Program, which is implemented through local Soil and Water Conservation Districts, and the NPDES program which has authority to designate and permit "concentrated animal feeding operations." The cost-share program is not a permit program, although the State is required to approve all plans where cost-share funds will be used. Significant issues in these two programs are: questions regarding the adequacy with which cost-share funds are targeted to projects that will have greatest water quality benefits; the relatively low importance given to inspections and enforcement in the cost-share program; lack of trained staff in local SWCDs, particularly in the A/P Study area; the absence of any proactive or preventative attention to animal waste facilities; and the apparent lack of cooperation between the Department of Agriculture and DEM to identify and regulate discharges from animal waste facilities.

Sedimentation and Erosion Control. The Sedimentation Pollution Control Act is implemented by the State Division of Land Resources, although several local governments in the A/P Study area are authorized to carry out this program. Like the Agricultural cost-share program, the SPCA is not a permit program, hence the State may not assess permit fees. Primary issues involve the lack funding for adequate inspections of construction sites; an extremely slow and cumbersome enforcement process (the State is frequently in the position of seeking payments long after the degradation has occurred); and inadequate training opportunities for program staff, and the development and construction industry. Also, there is concern that authorized local programs may not be fully committed to implementing this program. Several new provisions in the SPCA (effective in October 1989) have strengthened the Act, however the Sedimentation Control Commission has undertaken a major evaluation of the program to be completed in 1990.

Marinas and Marine Waste Disposal. Marina construction requires a CAMA permit for development in the estuarine AEC, which incorporates all other State and federal permits. In terms of water quality and resource impacts, the most frequent considerations in marina permit reviews are potential loss of productive shellfish beds and potential harm to primary nursery areas. Currently there are no State programs aimed at controlling sewage discharges from boats, although this source is regulated under Section 312 of the Clean

Water Act by the U.S. Coast Guard. Primary issues involve the need for more specific and scientifically sound siting criteria for marinas; the lack of adequate monitoring for compliance with CAMA permit conditions; the Coast Guard's extremely poor record of implementing marine sanitation requirements; and the need for more pump-out facilities and greater incentives and boater education concerning their use.

Critical Habitat Protection. Among the programs that directly address habitat protection (other than wetlands) three were evaluated: CAMA, the N.C. Division of Marine Fisheries regulations protecting primary and secondary nursery areas, and the management program for designated Outstanding Resource Waters. In general, regulatory protection of critical habitat areas is problematic due to the difficulty of establishing cause-effect relationships. For this reason, programs must specifically designate critical areas, then specify performance standards for water-based or surrounding land use activities. Primary issues involve the lack of coordination of effort and tracking among the numerous agencies that address habitat protection; the need for comprehensive habitat inventories and protection plans; and the need for improved compliance inspections and enforcement.

Wetlands Protection. Wetlands management is in a period of transition. Increasing public recognition of wetlands' value, recent federal initiatives and a State Legislative Study Commission are likely to alter the current program. Efforts evaluated in this report include the Section 404 program, State 401 certifications, and the CAMA permit program for AECs. Primary issues include the cumulative impact of many small wetland conversions allowed under Section 404; the lack of trained staff to review Section 401 certifications and Section 404 permits; and the effects on functional wetland values of normal silvicultural operations (currently exempted from 404).

RECOMMENDATIONS

General Recommendations

- In many cases, additional funds are needed to adequately implement water quality and resource management programs in the A/P Study area. In addition to legislative appropriations, the most direct and equitable way to raise needed funds is through permit fees or fines assessed against those who make use of the assimilative capacity of surface and groundwater. Other potential sources of revenue include various consumption taxes such as a special tax on motel rooms, secondary home rentals, or marine gasoline. Agencies could also benefit from more stable funding, perhaps by initiating multiyear budgets.

- Many of the program-specific recommendations will require additional staff to carry out. Where it is not possible to augment staff, we suggest that programs look carefully at existing priorities to assess whether resources could be reallocated.

- Among staff additions, DEHNR should consider providing a paralegal assistant or part-time attorney for each Regional Office. Such a person could carry out searches to determine property owners or responsible parties, arrange for service of notices of violation, and do other enforcement-related work. This would free up technical staff to do the field work for which they are trained and most needed.

- A primary goal of the A/P Study should be to facilitate integration of efforts among the diverse agencies and programs evaluated in this report. A good vehicle for accomplishing this should be the development of basinwide, and then detailed watershed-by-watershed problem assessments that include <u>both point and nonpoint sources</u>. These detailed-level assessments could be used to focus efforts on the most important problems in each area. "Local" watershed-based planning and assessment could also be used as a hook to promote public involvement in this process. The use of a geographic and hydrologic base for coordinating the diverse point and nonpoint source regulatory efforts is essential.

Program-Specific Recommendations

<u>Point Source Discharges: NPDES</u>.

- In many cases, DEM Regional staff are expected to be generalists, carrying out compliance inspections and enforcement investigations

for point and nonpoint sources, large and small facilities, discharge and nondischarge systems, stormwater controls and wetlands, and in many cases, responding to emergencies. Regional staff may need to "specialize" be more efficient and effective in their work. Individuals should be encouraged to concentrate on only one or two areas instead juggling numerous responsibilities.

- DEM should finalize written policies and guidelines for enforcement actions under the NPDES program.

- DEM should expand the concept of a technical assistance team to address the full range of administrative and operational problems encountered by both POTWs and nondischarge systems.

- DEM should investigate ways to work more closely with local municipal and county staff to implement inspection and compliance monitoring (perhaps using the Wake County model), with appropriate controls to maintain enforceability of results gathered by local agencies.

- DEM should develop nutrient reduction targets for the Tar-Pamlico Basin.

- The General Assembly should appropriate adequate funds to capitalize the State Revolving Loan Fund (approximately $60 million annually is needed for the next ten years).

- DEM should develop better methods for targeting State Revolving Loan funds to maximize water quality benefits.

Onsite Treatment: Small Systems.

- DEH and the General Assembly should assist in funding local health department on-site sewage programs.

- DEH should make greater use of its oversight authority for local programs.

- DEH should reexamine the adequacy of the minimum vertical separation requirement, and consider developing special siting criteria for critical areas (e.g., near SA or ORW waters).

- DEH should work with local agencies to develop stronger incentives and educational materials to promote proper operation and maintenance of on-site systems.

- The State should consider creating a fund to address failing or inadequate on-site systems in areas where water quality degradation has occurred and where residents are clearly unable to pay for remedial measures.

Onsite treatment: Large Systems.

- The current split between large onsite systems regulated by DEM and DEH is artificial and should be eliminated. Both programs should be located under the EMC, with DEH having responsibility for all subsurface systems and DEM continuing to permit all land application systems.

- DEM and DEH should work together to develop uniform monitoring and reporting requirements, reporting forms, and a computer tracking system for compliance monitoring data from large subsurface and land application systems.

- DEM and DEH should investigate ways in which local or regional agencies can carry out compliance inspections for large on-site systems (perhaps similar to the model established by the Wake County Health Department).

- The Wastewater Treatment Operators Certification Commission should expedite efforts to develop separate training and certification for operators of land application and subsurface disposal systems.

Stormwater Management.

- DEM should increase staffing levels to allow site inspections and compliance inspections for engineered stormwater systems, or else train and fund local governments to do this task.

- The EMC should consider whether stormwater disposal should be based on a permit system. This would allow the State to collect fees and establish maintenance and bonding requirements.

Agricultural Practices

- The DSWC should institute a short-term program to inspect a significant percentage of all cost-share projects over the next several years.

- One or more "auditors" should be given responsibility to conduct independent inspections of BMP implementation.

- DSWC should work closely with local SWCDs to develop a watershed-based approach for targeting money to critical areas.

- DEM should work with the agricultural agencies to identify all animal feeding operations, and assess their potential for water quality impacts. All facilities exceeding a specified number of animals (or meeting other criteria) should be designated as a concentrated animal feeding operation and inspected at least once annually. Evidence of chronic noncompliance with best management practices should be grounds for issuance of an NPDES permit.

- The General Assembly and both the Agricultural and Environmental agencies need to acknowledge the need for and begin developing the structure for mandatory controls on agricultural sources, regardless of available subsidies.

Sedimentation and Erosion Control.

- Enforcement capabilities should be improved. Options to strongly consider are stop-work orders; fixed fines for specified types of violations; and requirements that a performance bond be posted with an approved plan.

- The DLR should increase the frequency of site inspections, particularly during active construction. All large construction sites in critical watersheds should be inspected after major storms.

- The DLR should improve training for all program participants and constituents. Training should focus more strongly on technical information tied to real-life situations or case studies.

Marinas and Marine Waste Disposal.

- The DCM should consider revising marina siting criteria to include cumulative impacts of numerous smaller docks and piers and adjacent development as well boat operation and maintenance.

- The DCM should designate a person or persons in each Regional Office to be responsible for periodic inspections of marinas for compliance with permit conditions and investigation of potential water quality problems.

- The State should consider taking responsibility for enforcing the MSD regulations, as they are now empowered to do under the amended Section 312(k).

- The State should take an active role in promoting the use of MSDs and consider offering grants or low-interest loans to marinas for installation and operation of pump-out facilities.

Critical Habitat Protection.

- The DMF and the WRC (in public trust waters) should complete habitat inventories for critical areas. In particular, the WRC should designate functional nursery areas and DMF should expand efforts to designate secondary nursery areas and submerged aquatic vegetation beds.

- Agencies should review the adequacy of existing protection plans and develop new protection plans for SAV beds, shellfish resource waters, and anadromous spawning areas.

- DMF should improve enforcement efforts by adding additional staff, increasing fines and penalties, and encouraging members of the public to report problems or possible violations.

- Habitat protection efforts should be coordinated by development of an annual or biennial report that tracks progress toward program objectives in delineation and protection of critical habitat areas (similar to the Section 305(b) Report for water quality efforts).

Wetlands Protection

- The EMC should specifically recognize wetlands as waters of the State, and create a classification for wetlands with an associated set of designated uses and standards.

- The CRC should consider revising local land use planning guidelines to require that plans designate wetlands as conservation areas, or at least include mapping of wetlands and a statement of local policy with respect to wetland protection.

- The National Wetlands Inventory (or a suitable equivalent) should be made available, with appropriate guidance, to all local governments for use as a screening tool in planning activities.

- DEHNR should evaluate whether and where significant losses of wetland function are occurring as a result of Section 404's exemption for "normal" silviculture operations.

- State acquisition of critical wetlands should be increased through the N.C. Natural Heritage Trust. Additional funding for this effort could be obtained through increased taxes or fees on the development industry.

CHAPTER 1

INTRODUCTION

A. OVERVIEW

A principal goal of the Albemarle-Pamlico Estuarine Study is to develop a comprehensive management plan. To be useful, plans should contain both the broad goals and policies that articulate management priorities and specific implementable actions that will provide measurable progress toward the goals. This report addresses the need for specific actions in the management plan.

Plans are implemented by programs, and the dominant programs that affect water quality and aquatic habitat are regulatory in nature. By regulatory we mean programs that (1) have one or more clearly enforceable provisions and (2) attempt to alter or influence individual behavior in clearly defined ways, usually according to specified criteria or standards developed under the program. We have limited our examination to programs initiated or implemented at the State level, although, clearly, local regulatory programs, such as zoning and subdivision regulations, can have a profound impact on water quality and habitat.

Our approach has been to ask relatively simple questions about how each program is implemented, using as a backbone, the theory and structure of implementation analysis as outlined by Sabatier and Mazmanian (1981; 1979). Based on answers to these questions (gained from program staff, constituents, and written reports), we have highlighted what appear to be important issues of concern. We also provide recommendations based on suggestions from program staff, constituents, researchers, and in some cases, similar programs in other States.

It is important to point out that this project is a "screening-level" study. An in-depth evaluation of individual programs was not and could not be a goal for a project of this size, where the budget provided approximately $3,000 for each program area. As a comparison, the N.C. Sedimentation Control Commission has recently provided over $100,000 for an evaluation of the State's Sedimentation and Erosion Control Program alone.

Two types of regulatory programs are addressed in this report: those organized around specific sources such as municipal and industrial point sources, agricultural sources, or septic systems (Chapters 4 through 10) and those oriented primarily toward habitat protection (Chapters 11 and 12).

Habitat protection is divided into two categories: first, the five critical aquatic habitats identified by the North Carolina Division of Marine Fisheries, and secondly, wetlands. For each source and habitat type, we provide (1) a brief statement of the problem, with particular emphasis on ways in which intervention can address the problem; (2) a summary of the major existing regulatory programs that address the problems; (3) an evaluation of the program(s) using criteria derived from implementation theory (these are described in Chapter 3); (4) a list of primary "issues of concern" regarding implementation of the programs; and (5) recommendations for improving implementation. Readers are strongly encouraged to read the entire chapter for each program area.

We believe that this document should serve as a starting point for discussions on specific management actions to be included in the Albemarle-Pamlico Comprehensive Management Plan. That is to say, it should remain a "work in progress", not a snapshot of program conditions as they were interpreted by the authors in late 1989. As more information becomes available or as regulations change, evaluations and issues of concern will need to be refined; also, other important program areas may need to be addressed. Readers should note that several important sources of pollutants or habitat degradation are not included in this evaluation, including forestry, solid and hazardous waste disposal, spills, atmospheric deposition, and federal facilities.

B. REGULATORY PROGRAM ACTIVITIES

Regulatory programs (especially environmental) have basic structural similarities. Among the diverse programs that are described and evaluated in this report, most address, in some respect, the four areas listed below. The relative importance attached to one or another activity, or the level of resources devoted to one area over another characterize individual programs. Generally new or less established programs will spend more effort on the first two areas; as programs mature, compliance and enforcement may take on greater relative importance.

1. DEVELOPMENT OF CRITERIA AND STANDARDS

- Development of siting criteria, performance standards, water quality standards, designation of critical areas, etc.
- Activities include monitoring, statistical analyses, public participation, political decision making

2. PERMIT PROCESSING (OR PLAN APPROVAL)

- Review of background information, engineering analyses; application of analytical techniques (e.g., soils evaluation, water quality modeling, financial analyses, wetlands identification etc.)
- Site surveys
- Permits/plans circulated to other agencies for review and comment
- Collection of fees, negotiation on specific requirements
- public participation

3. COMPLIANCE ASSESSMENT

- Assessment of initial compliance (construction site visits, sampling)
- Long-term compliance (routine monitoring with quality control, either by permittee or agency; regular site inspections)
- Development of a management tracking system for projects with potentially large impacts

4. ENFORCEMENT ACTIVITIES

- Definition of noncompliance (e.g., how many violations can be tolerated before agency takes action)
- Specification of penalties and enforcement actions (monetary and nonmonetary) including loss of certification, restoration requirements, stop-work orders, civil penalties, criminal penalties, etc.
- Negotiation with permittees, provision of technical assistance where needed.

CHAPTER 2

SOURCES AND PROGRAMS

Numerous statutes and regulations implemented by various levels of government affect water quality and aquatic habitat. Indeed, an early A/P project report lists several hundred federal and State statutes that have a "major" impact on aquatic habitat modification, freshwater drainage, toxicants, nutrients, sediment, coliform bacteria and development in the Albemarle-Pamlico region (Finch and Brower 1987). In addition to regulatory laws, there are also nonbinding policies or guidelines, technical assistance programs, financial grants and loans, public education programs, monitoring and research programs, and special policies and procedures for publicly owned land. These and other activities all could be classified as government "programs".

Except the National Pollutant Discharge Elimination System (NPDES) program (aimed at point sources of pollution), a comprehensive list of State programs is found in the Nonpoint Source Management Program (N.C. DEM 1989b). In this report, we have chosen to focus on a smaller number of key State programs that address major sources of pollution or habitat degradation in the Albemarle-Pamlico Study area.

Generally, sources are nothing more than an activity or pattern of behavior that, historically, has caused water quality or habitat degradation problems. These activities are carried out by a "target group"--for example, operators of municipal wastewater treatment plants, developers, boat owners, farmers, etc. In each case, the target group, although it may be backed by large organizations or lobbying efforts, is really a collection of individuals that are responsible for making decisions or taking certain actions. Ultimately, programs address the behavior of individuals: the farmer spreading manure, the construction grading contractor, or the septic tank installer.

All the programs evaluated in this report are essentially regulatory in nature. Regulatory programs incorporate specific legally defined and enforceable restrictions on target group behavior. One possible exception to this limitation is the Agriculture Cost Share Program (Chapter 8) which is a voluntary program. However, once farmers do choose to participate in this program, they <u>are</u> subject to various conditions and restrictions.

Tables 2-1 and 2-2 list the programs evaluated in this report that are associated with specific sources and resource protection objectives, respectively. Table 2-3 lists sources/resources that may be important, but which are <u>not</u> addressed in this report.

TABLE 2-1 SUMMARY OF EVALUATED SOURCES AND PROGRAMS AFFECTING WATER QUALITY IN THE ALBEMARLE-PAMLICO STUDY AREA

Source	Program	Lead Agency
Industrial & Municipal Point Sources	NPDES	DEM
Small On-site Wastewater Treatment Systems	On-site sewage treatment program	DEH
Large On-site Wastewater Treatment Systems	(1) On-site sewage treatment program (2) Non-discharge permit program	(1) DEH (2) DEM
Urban Stormwater	Coastal stormwater Regulations	DEM
Agricultural Practices	(1) Agricultural cost-share program (2) NPDES (concentrated animal operations)	(1) DSWC (2) DEM
Construction Practices	Erosion and sedimentation control program	DLR
Marinas, Marine Waste	(1) CAMA permit program (2) CWA Marine Sanitation Program	(1) DCM (2) U.S. Coast Guard

TABLE 2-2 SUMMARY OF EVALUATED RESOURCE PROTECTION PROGRAMS IN THE ALBEMARLE-PAMLICO STUDY AREA

Resource	Protection Program	Lead Agency
Critical Habitat (excluding wetlands)	(1) CAMA Permit Program	(1) DCM
	(2) Marine Fisheries Regulations	(2) DMF
	(3) ORW Classification	(3) DEM
Wetlands	(1) Section 404 Permit Program	(1) COE
	(2) 401(b) Certification	(2) DEM
	(3) Antidegradation	(3) DEM
	(4) CAMA Permit Program	(4) DCM

CHAPTER 3

EVALUATION METHODOLOGY

The authors are not experts in the wide range of subjects covered in this study. Given that limitation, our approach has been to ask simple questions of program managers; to interview program constituents, i.e., those persons or groups who are either targeted under the program or who are potential beneficiaries of the program; and to compare the North Carolina programs with successful programs in other states (especially the Chesapeake Bay Program, which is similar to the Albemarle-Pamlico and is by far the most advanced management program on the east coast).

We have conducted this study by adapting an accepted and widely applied approach for implementation analysis: the method outlined by Sabatier and Mazmanian (1981) and Sabatier (1986). Generally, the approach hypothesizes that while there are a large number of variables that affect program success, these can be synthesized into a shorter list of conditions that are generally necessary for the effective implementation of program objectives.

We have looked at each program in terms of seven conditions (or criteria) that are strongly associated with effective programs. In addition, we have evaluated an additional variable that sets the context for each program, i.e., the tractability of the problem that is addressed. The seven conditions are listed in Table 3-1 and summarized in the remainder of this chapter.

Table 3-1. SEVEN CONDITIONS FOR EFFECTIVE PROGRAM IMPLEMENTATION

1. Clear and Specific Program Objectives
2. Sound Theoretical Basis
3. Adequate Incentives and Sanctions
4. Adequate Resources
5. Access to Supportive Constituency Groups
6. Adequate Training, Technical Assistance and Education
7. Implementation Assigned to Agencies that are Committed to Program Objectives

A. TRACTABILITY

Some problems are easier to deal with than others. Mazmanian and Sabatier have used the word "tractability" to describe the relative ease with which a problem may be "solved" through government programs, and they provide some guidance on how to measure it. A problem that is tractable or solvable is one where the major elements of cause and effect are well understood (or at least generally accepted), where the technology to deal with the problem clearly exists, and only limited changes are necessary in the behavior of a few people. Clearly, many of our complex social problems rank as highly intractable: raising the standard of living for the poor, providing food and shelter for homeless, or assuring high quality educational opportunities. While many environmental issues are less complex, elements of intractability are often present. In some cases, cause-effect relationships are not well understood (e.g., decreases in submerged aquatic vegetation, algal blooms, crab diseases); in other cases, large numbers of people are affected, or significant changes are required in the behavior of some groups.

The job of bringing about change in target group behavior is made even more difficult by the presence of basic conflicts in value judgements; groups may hold different views about the relative importance of environmental preservation versus economic development, or public interest vs. private rights. People resist change not simply because of inertia, inconvenience, or the additional costs that are involved, but because they do not believe that such changes are necessary or correct. This type of conflict often underlies programs that attempt to regulate land use, making these problems notably less "tractable" than those which seek to alter only patterns of behavior (e.g., the discharge of specific pollutants, the frequency of septic tank pump-outs, or the use of particular boat paints).

Where problems are relatively less tractable, each of the conditions necessary for effective implementation (discussed below) take on greater importance. Likewise, where tractability is high, strict adherence to these conditions is less important.

B. CLEAR AND SPECIFIC PROGRAM OBJECTIVES

Much of the work carried out by State and local agencies is made up of routine activities generally accepted as necessary and proper. The validity of these activities are not challenged in court or in public hearings. Usually, however there is a small subset of programs that mandate significant behavioral change or encounter strong resistance from the target population. For such programs, a clear statement of objectives can enhance program implementation.

An initial question asked of every program is simply this: what are the principal objectives of the program, and are these objectives clearly defined in the statute or regulations governing the program. Objectives normally refer to a desired end state, and to the extent this end state is precisely defined, it can serve as an unambiguous guideline for agency staff or the courts; it can serve as a resource for supporters of the objectives; and it is an indispensable aid in evaluating program performance.

Programs may focus on a single primary objective (e.g., the protection of wetlands) or they may embody a balancing act between multiple and competing objectives. In a democracy, nearly all programs must accommodate multiple objectives. However, it is possible to evaluate the extent to which laws and regulations spell out the way in which objectives should be weighed in any given situation. To the extent that objectives and the ranking of multiple objectives are precisely defined, a program is likely to be more successfully implemented.

Sabatier and Mazmanian have proposed the following scale to rate the clarity and consistency of program objectives:

1. Ambiguous: objectives that include ambiguous injunctions to regulate "in the public interest" and mandates to balance potentially conflicting objectives, e.g., water quality and economic development, without establishing priorities among them.

2. Definite "tilt": statues/regulations that involve a relatively clear ranking of potentially conflicting objectives, e.g., maintain water quality standards unless extreme economic hardship would result.

3. Qualitative: statutes/regulations that include a qualitative mandate to, for example, "maintain all existing water quality standards."

4. Quantitative: statutes/regulations that include quantitative objectives or criteria, e.g., "reduce nutrient loading by 50%."

In a similar exercise, Rosenbaum (1981) has rated the "specificity" of State statutes that address wetlands regulation. Four criteria were used to assess specificity:

1. Specificity of basic objectives: Is there an unambiguous mandate to protect natural resources values; or do the objectives require a balancing act (e.g., "balance economic development with environmental protection"); or does the statute fall back on a general mandate to protect the public interest?

2. Precision of geographic boundaries: Land use regulations are crucially dependent on the definition of boundaries. The definition of wetlands ranged from verbal description through vegetative description to photographic mapping.

3. Scope and specificity of exemptions: Does the statute clearly define what activities are exempt from regulation?

4. Specificity of permit approval criteria: Does the statute supply detailed, general, or no mention of permit criteria for areas such as fish and wildlife, water quality, or natural hazards?

C. SOUND THEORETICAL BASIS

Implicit in most of the programs examined for this study is a rationale or causal theory that links the technical content of the regulations as well as other program activities to the desired objectives. This rationale can be expressed as an if-then statement: if X is done, then Y will result. In most programs, the assumption is that by modifying the behavior of certain target groups (e.g., developers, municipal dischargers, farmers, boaters) so they comply with specified "standards", a problem will be solved or at least a bad (or potentially bad) situation will improve. Programs based on a sound theory are those where (1) the principles governing cause and effect are well understood (i.e., it is a relatively tractable problem), and (2) where the technical "standards" or criteria provide reasonable assurance that program objectives can be met.

In effect this condition looks at whether regulations are technically sound. Our intent is not to pass judgement on the technical validity of the regulations (although it may appear that way at times), but to highlight areas of uncertainty or areas where North Carolina's standards may be significantly different than those found in equivalent regulations in other States.

Two points should be noted. First, an adequate understanding of cause-effect relationships may or may not be available (this is considered in evaluating tractability); if there is no generally accepted theory about what is causing a problem (e.g., the loss of submerged aquatic vegetation or reduction in fishing success), then programs must proceed with more caution and are less likely to be successful. Second, if program objectives are not clearly specified, it can be difficult to develop a technically valid regulatory approach.

D. ADEQUATE INCENTIVES AND SANCTIONS

In terms of the regulatory programs addressed in this study, "incentives" are inducements to certain behaviors and they may be either positive or negative. Examples of positive incentives are the provision of subsidies or cost-share payments for certain practices, low interest loans,

reduced fees for consistent compliance or opportunities for education and training. Negative incentives (less frequently employed) are used to discourage behaviors that generate pollutants or degrade habitat. Examples of negative incentives might include development or stormwater fees based on the percentage of impervious cover, surtaxes on agricultural pesticides or fertilizer use, or taxes on land transfers for development purposes.

"Sanctions" are the menu of consequences that can be applied in cases of noncompliance. These include administrative or civil penalties (fines), criminal prosecution, requirements for restoration of any environmental damages or loss of a license or certification.

Because the programs addressed in this report are regulatory in nature, sanctions and the ability to enforce laws and and regulations are an important determinant of program effectiveness. Much has been written about the problem of enforcing environmental laws (see Russell et al. 1986) and we do not attempt to address this area in any detail. Nevertheless, for programs that regulate the discharge of pollutants, we attempt to assess the adequacy of existing sanctions and the process by which they are imposed. There should be clearly understood penalties for noncompliance and the mechanism to administer sanctions should be equitable and swift. In addition, penalties should be appropriate. Large fines for minor violations are not likely to be assessed; by the same token, fines that represent a relatively minor expense for the violator are not likely to be an adequate deterrent. Generally, a more stringent mandate for change (i.e., greater distance between existing behavior and the behavior required by law) requires a more stringent sanction to bring about compliance.

E. ADEQUATE RESOURCES

Money and staff are critical for implementing any program. While the total dollars available is perhaps of greater importance for programs that use cost-share subsidies, in nearly all cases, the most critical measure of resource adequacy is staffing. Adequate staffing levels are particularly important for managing nonpoint source pollution (which make up the bulk of the programs evaluated here) because it is necessary to deal with numerous site-specific problems. Under this criterion, we attempt to rate whether staffing levels are adequate to achieve program objectives. Whenever possible, our approach is to quantify workload or some other measure of program activity over time and compare this with available staff resources. In most cases however, it has not been possible to obtain meaningful numbers for these variables. Instead we have relied on the assessment of program managers and other experts familiar with a programs activities.

F. ACCESS TO SUPPORTIVE CONSTITUENCY GROUPS

Regulatory programs directly affect the interests of two groups: the target group(s) and potential beneficiaries of the program. Presumably, the interests of both groups have been reconciled in the process of developing program objectives contained in statutes and regulations. However, in practice,, program objectives are often vague or technical standards are open to interpretation; thus, in most programs, the relative influence of target groups and program beneficiaries is important.

While target group members (i.e., those whose behavior is being regulated) often have frequent formal and informal contacts with implementing officials, potential beneficiaries may not have this contact, and their influence may be reduced in the day-to-day decision making of program staff. In some cases, this can lead to a situation that has been described as "agency cooption", where the interests of the regulated community are gradually adopted by the regulators.

Sabatier and Mazmanian believe that statutes and programs which allow potential beneficiaries (i.e., supportive groups) to have formal access or "standing" in agency proceedings are more likely to achieve their objectives. They note that, in most regulatory programs,

> ... the target groups do not have problems with legal standing, nor do they generally lack the financial incentives to pursue their case in court if displeased with agency decisions. In contrast, the beneficiaries of most consumer and environmental protection legislation individually do not have a sufficiently direct and salient interest at stake to obtain legal standing and to bear the costs of petitioning adverse agency decisions (1981, p.13).

G. ADEQUATE TRAINING, TECHNICAL ASSISTANCE AND EDUCATION

All programs should incorporate some level of training, technical assistance and education in many cases, for both target groups and for persons who must administer the program. In the case of those who must implement program rules and work directly with target groups, it is important that staff are confident and knowledgeable. In many cases, rules change over time, technology or best management practices change, or there is simply a turnover in personnel. For all these reasons there is a continuing need to carry out training and technical assistance.

For target groups, education, or in some cases, training where technical knowledge is required, is also an essential condition for program implementation. Without education, target groups loose the opportunity to understand the context of requirements, and why they are necessary; their only contact with the program will be through formal permit processing, inspections or enforcement.

H. IMPLEMENTATION ASSIGNED TO AGENCIES THAT ARE COMMITTED TO PROGRAM OBJECTIVES

Even when statutes or regulations satisfy all other conditions, the attainment of objectives that include significantly modifying behavior in target groups is unlikely unless officials in the implementing agencies are strongly committed to those objectives. New programs in particular require administrators "who are not merely neutral, but also sufficiently persistent to develop new regulations and standard operating procedures and to enforce them in the face of resistance from target groups and from public officials" (Sabatier and Mazmanian 1981, p. 13). Such commitment is most likely when a new agency is created specifically to administer a program.

In practice, the choice of implementing agencies or officials is constrained. Usually programs are assigned to existing agencies (or commissions) who may be ambivalent about the objectives. Even if supportive, agency personnel are often immersed in numerous existing programs and any new or "strengthened" program tends to get lost in the shuffle, unless the statute accords it high priority by providing significant new funding.

While it is difficult to imagine an objective measure of whether agencies (and ultimately agency directors or leaders) are adequately committed to program goals, we have attempted to look at the traditional orientation or constituency of the implementing agencies and the historical record of how decisions were made.

CHAPTER 4

POINT SOURCE DISCHARGES: NPDES

A. PROBLEM DEFINITION

Point sources of pollution--i.e., discharges that enter surface waters at a single, identifiable place, usually a pipe or ditch--are a significant cause of water quality degradation in 8.5% of the impaired rivers and 31.2% of the impaired estuarine areas statewide (N.C. DEM 1988a, 15&29). Note that this does not mean that 31.2% of estuarine areas are impaired, but that of the acres that are impaired (about 7% of the total), point sources are responsible for 31.2% of the problems. Within the A/P Study area alone, the percentages for rivers are approximately the same as statewide (7%), but for estuaries they are somewhat higher with point sources responsible for 27%, 36%, and 40% of the impairment in the Pamlico, Neuse, and Chowan basins, respectively (N.C. DEM 1988a, 30).

As of 1987, about 600 point source dischargers held permits to release approximately 368 million gallons of effluent daily in the A/P basins (N.C. DNRCD 1987, p.III-3). Actual discharges were about 65% of the permitted level or about 230 million gallons per day (MGD). These figures do not include dischargers in the upstream (Virginia) portion of the Chowan basin (e.g., Union Camp pulp mill where daily waste flows may exceed 150 MGD) or discharges upstream of Roanoke Rapids Dam or upstream of the Falls of the Neuse Reservoir in the Neuse basin.

Table 4-1 shows a breakdown of point source discharges, by type, in the A/P Study area during 1987.

TABLE 4-1. POINT SOURCES IN THE A/P BASIN

Facility Type	No.	percent of total permitted dis.
Major POTWs	33	43*
Minor POTWs	60	
Major industrials	18	54
Minor industrials	180	2
Small domestic sources	300	1

* includes both major and minor POTWs

4: Point Source Controls: NPDES

A. 1. Municipal Treatment Plants

During the last two decades, EPA and North Carolina have spent nearly a billion dollars statewide to control conventional pollutants from municipal sewage treatment plants or "publicly-owned treatment works" (POTWs) through grants and loans. Conventional pollutants are oxygen-depleting substances, suspended solids, fecal coliforms, pH, and oil and grease. These efforts have been largely successful, and most POTWs are now meeting at least the technology-based goals of secondary treatment; however, significant isolated problems still remain as far as meeting the performance standards for secondary treatment (85% removal of BOD and suspended solids). The continuing problems of low dissolved oxygen in downstream slow-moving coastal waters, as well as phosphorus and nitrogen enrichment and subsequent eutrophication has been the impetus for most tightening of permit limits and requirements for tertiary treatment. This is particularly true in NSW basins; with the exception of runoff from animal waste management areas, nutrients from POTWs are significantly more bioavailable than those from nonpoint sources.

Municipal treatment plants are also a significant potential source of toxicants, particularly in cases where facilities receive industrial wastewater. The toxic constituents contributed by these "indirect discharges" (termed "significant industrial users" or SIUs) may interfere with the operation of the plant and/or be passed through the plant to contaminate the water, air, or sludge. Industrial pretreatment programs are designed to reduce these problems by removing wastes before they enter the sewers. However, recent studies by the EPA and the U.S. General Accounting Office have concluded that, on a national level, the pretreatment program is plagued by poor compliance and institutional problems that limit its effectiveness (e.g., U.S. GAO 1989; U.S. Congress 1988).

The principal remaining challenges regarding POTWs are to: (1) control nutrient and BOD levels in effluent to a greater degree (particularly in downstream facilities); (2) control toxicants in effluent to a greater degree; (3) deal with increasing volumes (and perhaps toxicity) of sludge; (4) ensure that plants enforce pretreatment standards; and (5) ensure that plants maintain adequate control over treatment processes in the face of continuing growth.

A. 2. Industrial Sources

Industrial sources include those that discharge directly to public waters and those which pump their waste to sewage treatment plants (i.e., indirect dischargers). Important direct industrial discharges in the A/P basin include pulp and paper mills (Champion International, two Weyerhaeuser plants and Union Camp, in Virginia), a phosphate mining operation (Texasgulf); textile industries (National Spinning, Burlington Industries, United Piece Dye Works, West Point Pepperal); a large military base with industrial-type effluent (Cherry Point); and several large seafood processing operations. Among the important indirect discharges are meat processing operations, pharmaceutical companies, textile mills and numerous small manufacturing operations.

Generally, industrial sources have been more successful than POTWs in consistently meeting permit limits (pers. comm. Susan Rollins, EPA). While there are various reasons for this, it is clear that industries generally have easier access to sufficient funds for wastewater treatment and also have more direct control of their waste stream. For industrial sources, regulatory challenges include (1) increased monitoring, particularly for toxicants and expanded coverage to include instream as well as effluent samples; (2) greater efforts to reduce the overall use or discharge of toxic materials (either by process changes or inplant recycling); and (3) better back-up systems and emergency response to deal with spills, power failures, major storm events, etc.

A. 3. Small Domestic Sources

Small domestic sources represent about half of all discharges, but account for only a small percentage of the total waste flow. For the most part, these systems serve small communities, schools, prisons, nursing homes, etc. that are not tied to a municipal sewage treatment plant; many are small privately owned and operated treatment plants. Typical treatment methods include septic tank/sand filters, recirculating sand filters, lagoons and package plants. In the coastal area, package plants typically employ secondary biological treatment and tertiary treatment consisting of solids removal and chlorination. In terms of regulatory activity, these small domestic discharges account for the bulk of new permits being issued in the State, especially in the rural or resort areas common in the A/P Study area.

As small treatment systems (especially package plants) have become more prevalent, many problems have been noted. Nelson and Burby (1988) in their survey of 106 sewerage jurisdictions in the southeastern coastal United States, found that only a quarter of those surveyed (26) even allow privately-owned package sewage treatment plants. Of these 26, a majority cited problems with these systems, the most common of which were improper or inadequate operation (65%), inadequate maintenance (62%), poorly-trained personnel (42%), and uncertain financing for adequate future operation and maintenance (35%). Typical sources of problems are (1) most plants do not have full-time operators to monitor and correct problems; (2) small plants often cannot adjust to rapid surges in wastewater flow during peak hours or on weekends; and (3) small amounts of household toxicants can severely damage a small plant, crippling biological treatment capacity for days or weeks.

The principal challenge regarding these small systems will be to ensure adequate ongoing operation and maintenance by increasing the level of compliance inspections and technical assistance.

B. EXISTING PROGRAMS

The direct discharge of municipal and industrial waste is regulated under a well-established program set up by the Federal Water Pollution Control Act Amendments in 1972. Although authority originally vested in the EPA was delegated to North Carolina's Environmental Management Commission in 1975, EPA maintains an oversight role and retains ultimate authority to enforce all federal requirements. The principal State regulations governing this program (15 NCAC 2H.0100) implement NCGS 143-215.1; these regulations follow federal requirements, the most important of which is the requirement that all direct dischargers to navigable waters must obtain a National Pollutant Discharge Elimination System (NPDES) permit. Other related programs include the pretreatment program, which oversees municipal regulation of industrial users, and the construction grants/revolving loan program, which assists with financing for construction and repairs in municipal treatment plants.

B. 1. The NPDES and Related Programs

The NPDES program is a large and complex collection of activities that is implemented by the EMC and DEM. At least 100 staff members in the central and regional offices are directly involved with permitting, monitoring, compliance and enforcement for approximately 3600 permittees in the State. More than other regulatory programs, the NPDES and pretreatment efforts are closely monitored by EPA and are subject to EPA performance requirements.

The Permit System. An NPDES permit is required for any discharge of wastewater into surface waters of the State. The permits establish specific limitations on the concentration and/or total amount of contaminants that may be discharged, and in some cases, on the overall toxicity of the effluent. Permit limits are established in one of two ways: (1) through minimum "technology-based" limits established by EPA regulations for different categories of wastewater (e.g., "Best Available Technology" or Best Practicable Technology" for different industrial categories or municipal treatment plants); or (2) through "water quality-based" limits that are established by calculating or modeling instream concentrations relative to water quality standards. Where discharge limits would differ under the two approaches, the most restrictive must be applied (i.e., water quality-based limits take precedence over technology-based requirements.)

A public notice is required for proposed NPDES permits; public comments are accepted on the draft permit limits and a public hearing may be held if there is sufficient interest. All final decisions on permit conditions are made by the DEM Director. Permits are issued for a maximum of five years duration to allow regular review and upgrade of limits, although permits may be "reopened" under specified conditions.

Monitoring Requirements. All major industrial and municipal dischargers and most minor dischargers are required to regularly monitor their effluent (for flow and selected pollutants) and send the reports to the State. These Discharge Monitoring Reports, along with periodic inspections by DEM staff, are the primary source of information for making compliance determinations. Over the last several years, the State has also begun requiring major permittees to carry out effluent toxicity testing and conduct an annual pollutant analysis for organic toxicants.

Inspections and Enforcement. All NPDES permittees are categorized as either "Major" or "Minor", according to criteria that roughly correspond to the size of the discharge and the presence of complex pollutants. EPA requires that, annually, the State inspect all major dischargers; at least 20% of all nonmunicipal minor dischargers; and all municipal pretreatment programs. Inspections vary from basic compliance evaluation inspections (CEIs) to sampling inspections (CSIs) to full operations and maintenance inspections (O&Ms). The basic thrust of the inspections program is to meet the EPA mandated minimum requirements. Where additional inspections are carried out, DEM targets problem plants or priority areas (e.g., NSWs).

When a treatment facility is determined to be out of compliance, DEM begins a series of actions, starting with letters (Notices of Violation) and then fines. In major cases, DEM and the EMC will seek a special order by consent (SOC) or a judicial order (JOC) that specifies exactly what the permittee is expected to do to come into compliance, scheduled dates or milestones, and penalties if milestones are not met. Where civil penalties (fines) are assessed, DEM recommends an amount, usually well below the maximum allowable. Dischargers may appeal fines to the EMC, where they may be reduced, dropped, or upheld as originally assessed.

Construction Grants Program. DEM administers both the federal Construction Grants Program and a separate State Revolving Loan Fund. Both are designed to provide money to design and construct municipal sewage treatment facilities, with the federal program having more complex application procedures and a larger maximum dollar amount per project ($7.5 million vs. $1.5 million). Eligible facilities for the federal program are listed, while the State fund is open to any applicant that meets certain minimum criteria. Fund allocations under the State program are made according to certain priorities; however, since its inception in 1987, the State fund has been severely underfunded; to date, approximately $15 million dollars have been allocated to 29 communities during 1988 and 1989.

C. PROGRAM EVALUATION

C. 1. Tractability of the the Problem

The NPDES program could be considered moderately tractable. Municipal

and industrial dischargers are a well-defined target population whose contribution to water quality degradation, at least in riverine systems, may be readily assessed. For example, dischargers commonly are asked to sample above and below an outfall to identify impacts (although instream sampling for toxicants is usually not required). The target group is small relative to the total population, and the technology for reducing pollutant discharges from municipal and most industrial wastes is well developed. Nevertheless, other factors are present that complicate the problem of regulating point sources of pollution.

Probably most critical is the problem of measuring cause and effect, which arises in two contexts: setting numerical water quality standards (or "criteria") and predicting pollutant fate and transport in estuarine systems. All NPDES permits are written to assure that ambient water quality standards are met; however, setting accurate and defensible standards that protect human health and aquatic life is a difficult task, especially for toxic parameters. The link between cause and effect is difficult to establish at extremely low concentrations and where numerous competing variables may be present. Numerical standards are important because they are critical for determining water quality-based effluent limits.

The second area of difficulty is linking point source discharges to specific pollutant effects in estuarine waters. Estuarine modeling is extremely complex and significantly more data are required to ensure accuracy (compared to riverine models). Current State capabilities in estuarine modeling are limited to one or two pollutant parameters (BOD and ammonia).

C. 2. Clear and Specific Program Objectives

The principal objective of the NPDES program is clear: to assure that ambient water quality standards are maintained and designated uses are supported. The objective is specific to the extent that the standards are expressed as numeric limits. These numeric standards, which provide the regulatory backbone for the NPDES program, are exclusively the State's responsibility; that is, there are no federal water quality standards which serve as a benchmark (EPA has published water quality "criteria" for toxicants; these may be used as guidelines). Recently, interest has focused on the need for establishing more comprehensive standards for toxicants. During the last triennial review of standards (completed in 1989), the State adopted or revised standards for about 20 contaminants.

Whether the new criteria are adequate for all toxicants of concern in North Carolina remains to be seen: an additional year of study was scheduled for lead, arsenic and chlorinated by-products to evaluate potential economic and health effects of lowering the standards for these pollutants (N.C. DEM 1989h). Also, concerns were expressed that, during the 1989 review, the State did not look at all sources of information regarding compounds being discharged in the State (i.e., the toxic chemical release forms filed by industries, as required by Title III of the federal Superfund Amendments and Reauthorization Act of 1986).

Numerical standards or target objectives are equally important for pollutants other than toxicants. The development of nutrient management strategies in particular, has been hampered by the extreme difficulty of coming up with valid and defensible nutrient standards. While there is general consensus that excessive nutrient loading (either past or present) is responsible for algal blooms, the dynamics of how nutrient inputs relate to water quality effects are extremely complex, and depend on the various forms of available nutrients, flow, salinity, turbidity, and temperature to name a few key variables. Recent work by Paerl (1989) has found nitrogen to be limiting in the summer and fall months, while co-limitation by nitrogen and phosphorus was observed during winter-spring periods.

In the absence of feasible ambient standards for nutrients, the State has adopted a numerical standard for chlorophyll a, which serves as a good indicator of nutrient effects. Based in part on high levels of chlorophyll a, North Carolina has designated the three largest basins in the A/P Study area as nutrient sensitive (Chowan, Neuse, and Tar-Pamlico). As a result, nutrient control strategies have been developed, which include technology-based effluent limits on total phosphorus in all three basins and on total nitrogen in the Chowan and the Tar-Pamlico. These are good initial steps in light of the tremendous uncertainties that exist in this area.

The ultimate goal of nutrient strategies should be the development and then the refinement of specific nutrient reduction targets for each basin, with reductions apportioned among all important point and nonpoint sources. While initial reduction targets have been developed for the Chowan and Neuse basins, no target-level reduction has yet been calculated for the Tar-Pamlico (pers. comm. John Dorney, DEM). This should be an important priority.

C. 3. Sound Theoretical Basis

Developing permits that have a sound theoretical basis and are fully protective of water quality is, quite simply, the crux of the problem for water quality-based permits. (Technology-based permit limits are relatively straightforward to administer.) Water quality-based permit limits are set by making assumptions about what level of pollutant already exists in the receiving water and how the waste will behave once it is discharged. Generally, this is accomplished using wasteload allocation models. The following are some key areas of uncertainty with respect to the technical basis for wasteload allocations.

- DEM's current approach for allocating wastes among dischargers is to assign 100% of the assimilative capacity of the receiving water for each permit. Thus, each time a water quality standard changes or a new discharger locates in the basin, all permit limits must be readjusted (or else a new discharger's effluent must meet the water quality standard). The basic problem is that this approach leaves the State little or no flexibility to accommodate future growth.

- Generally, permit limits for toxicants are set by assuming that the upstream or background concentration is zero. This assumption may well be incorrect, particularly in urban areas or where clusters of dischargers exist. (Where upstream ambient data are available, they are used.)

- The time and expertise required to develop models for estuarine and tidal for waters pollutants other than BOD has prevented DEM from undertaking this task. As a result, it is very difficult to predict receiving water levels of nutrients, organics or other nonconventional pollutants in estuaries.

None of these issues will be easy to solve although the new basinwide permitting strategy to be implemented by DEM by 1995 will make it possible to tackle these problems more directly.

C. 4. Adequate Resources for Implementing Agencies

About 50% of the staff in DEM's Water Quality Section (total staff in 1989 is about 185) are directly engaged in either permitting or compliance and enforcement under the NPDES or Pretreatment Programs. Until quite recently, a large portion of the funds required to implement the Water Quality Program were provided by Federal grants. Section 205(j) money was used for staff positions and Section 201 money funded construction of POTWs. In both areas, federal funds have been reduced considerably and they will continue to decrease over the next several years; 205(j) funds are expected to be phased out by 1991-92 and 201 money will end in 1995. Needless to say, actual federal appropriations for these programs may vary considerably depending on fiscal constraints.

NPDES. Two primary activities under the NPDES program are issuing permits (developing permit limits, site renewal inspections) and monitoring/inspecting to ensure compliance with permit requirements. Over much of the last five years, DEM has not had the resources to adequately carry out these activities, although the situation may be improving. One indicator of inadequate resources for permitting has been the backlog of expired NPDES permits (facilities operating for more than one year after their permit has expired). Although expired permits are fully enforceable, they may not reflect current requirements necessary to protect receiving waters. The backlog of expired permits during the last three years is shown below.

NUMBER OF FACILITIES OPERATING
WITH EXPIRED NPDES PERMITS:

7/1987: 193 permits
7/1988: 80 permits
6/1989: 70 permits

In hearings before the General Assembly in 1987, George Everett (then Deputy Director of DEM) noted that the NPDES program needed an additional $1.1 million for issuing permits and conducting inspections (Tursi and Finger 1988, 68). Subsequently, the Legislature passed House Bill 94 to address the shortfall. This bill allowed DEM to increase State permit fees from a maximum of $1500 to a maximum of $7500 for a five-year permit. The increase was designed to raise about $1.7 million over 5 years and allow the State to hire an additional 45 people. So far, however, only minor increases in staff have been possible because of large unexpected decreases in federal funding; money from the increased permit fees has been used to retain existing staff. While it is fortunate that the fees allowed DEM to maintain a well-trained and dedicated staff in the face of federal cuts, the intended purpose of expanding the program was not achieved by House Bill 94.

Nevertheless, permit backlogs are being reduced and recent initiatives in the water quality program should result in substantial benefits in terms of increasing the efficiency of operations. Two important initiatives are the central data management system for tracking permit and compliance information and the basinwide permitting strategy that is now being set up and will be fully operational in 1995. Both efforts are likely to assist the agency in making better use of existing resources.

All compliance inspections and enforcement actions are initiated in DEM's Regional Offices. In the two Regions that cover the A/P Study area (Raleigh and Washington), the number of staff assigned to compliance has either stayed the same (Raleigh) or declined (Washington) over the last three years. In Washington, an initial drop from 3 1/2 to 1 1/2 FTEs assigned to compliance inspections occurred when the Pamlico Emergency Response Team (PERT) was set up. Subsequently, 1 person was pulled off full-time PERT duty and another laboratory person has been "borrowed" part-time to close the gap. The current situation is that if there are no major emergencies or personnel shifts, the region should be able to meet its minimum inspection requirements for EPA (pers. comm. Barry Adams, DEM).

Construction Grants. Authorized federal funds for grants under Section 201 of the Clean Water Act will be gradually reduced over the next ten years. During this transition period, States are to set up their own revolving load fund to finance the multitude of expansions, repairs, and new plants that will be needed to maintain adequate wastewater treatment. For this purpose, the N.C. General Assembly created, in 1988, a State revolving loan fund (SRLF) to finance treatment plant construction. To date, however, virtually no funds have been available for this fund, as most of the dollars appropriated are used to meet the 20% State match required under the federal construction grant program. Table 4-2 indicates the value of proposed projects and funded projects during the first two years of the SRLF. Of the nearly $15 million that has been committed, most went to smaller communities (29 projects have been funded). The State has estimated that approximately $40 to $60 million is needed annually for the next ten years to adequately capitalize this fund (pers. comm. Coy Batten, DEM).

TABLE 4-2. ACTIVITIES UNDER THE STATE REVOLVING LOAN FUND: 1988 AND 1989

Semiannual Funding cycle	Value of approved applications ($)	Funds available and allocated ($)
1/1/88 - 7/30/88	57,000,000	3,571,000
8/1/88 - 12/31/88	82,000,000	8,061,000
1/1/89 - 7/30/89	62,000,000	861,984
8/1/89 - 12/31/89	61,000,000	873,792

C. 5. Adequate Incentives and Sanctions

Compliance assessment and the enforcement of permits and associated administrative orders have been weak, whether due to a lack of resources or management priorities, is not clear. Recent efforts have improved, if measured by the number and dollar amounts of fines that have been assessed (Legislative Research Commission 1989a). However, to date, there has not been a comprehensive "audit" of enforcement activities, with the possible exception of the recent review of permits and monitoring reports for dischargers in the Pamlico-Tar River Basin (N.C. EDF 1989b).

Lack of enforcement has been true especially for municipal treatment plants (pers. comm. Susan Rollins, EPA Region 4). In general, the State has not taken aggressive enforcement action against municipalities, especially when grant funds are needed to construct additional facilities. North Carolina is not unique in this respect. An audit of the State and Regional NPDES efforts in the Chesapeake Bay Program area found that inadequate enforcement of permits was the single biggest deficiency in the programs (U.S. EPA 1989a). The EPA report termed the efforts "forceless enforcement" and noted that "even when pollution was serious or longstanding, the states were very patient...and assessed only insignificant penalties after several years or did not assess any penalties" (p. 12). Clearly, closing down a municipal wastewater facility is not an option, and often the imposition of fines only intensifies a local budget problem. One viable option left open to the State to bring pressure on POTWs is to prohibit additional sewer extensions and hookups until problems are resolved. North Carolina law requires that sewer extensions be denied for any facility not in compliance, if the additional flow would result in water quality degradation, unless the facility is operating under a special order or a judicial order by consent; if operating under an SOC or JOC, extensions may be approved by the DEM director. Recent reports regarding the Rocky Mount facility call into question the criteria or the consistency used to grant extensions to POTWs in these circumstances.

EPA Region IV's 1988 end-of-year review of DEM's water program noted several enforcement problems including (1) six State Consent Orders with municipalities that had been revised to change compliance schedules with no collection of stipulated penalties or concessions by the municipality and (2) that about 20% of all facilities operating under consent orders had exceeded a scheduled compliance milestone by more than 60 days.

Recently, EPA has begun initiating enforcement actions because of the State's failure to act. North Carolina submits (to EPA) Quarterly Noncompliance Reports (QNCRs), and when the same facility appears twice in two consecutive QNCRs, the State is required to take some kind of enforcement action; if they do not, EPA is obligated (under the Clean Water Act) to take appropriate action. Following the most recent QNCR (last quarter in 1989), EPA Region 4 initiated four enforcement actions. Such federal actions superseding a State program are not taken lightly and usually indicate a "last resort".

Another issue raised during EPA's oversight reviews of the North Carolina program has been inconsistency in compliance and enforcement efforts among the different DEM Regional Offices. To mitigate this problem and to clarify and streamline enforcement efforts, EPA has required all States to develop and implement an Enforcement Management System (EMS). The EMS is simply a complete set of written enforcement policies for ensuring consistent and adequate enforcement procedures. DEM has developed a draft version of this document, however, except for certain parts (e.g., the Enforcement Management Strategy for Pretreatment Programs), a final document has not been implemented.

During the last year, the Agency has worked hard to implement a computer-based tracking system that will automate the process of routine compliance assessment to a considerable extent, as well as allow the DEM Central Office to better assess Regional needs and performance. This is a strong positive step that should allow Water Quality staff in the Regional Offices to spend more time on inspections and technical assistance. The new system will automatically fine dischargers that (1) fail to send in monthly monitoring reports or (2) fail to apply on time for permit renewals. In addition, DEM has set a target of issuing violations for any discharger that accrues five or more permit violations during a six-month period.

A final issue concerns the adequacy of fines or penalties collected once they have been assessed. Generally, DEM assesses fines that are a small fraction of the maximum amount allowed by law. In spite of this, many assessments are appealed to the EMC, where they may be either reduced, dropped altogether, or let stand as assessed. Recently, because of the large number of appeals that require a significant amount of time, the EMC is considering the possibility of changing the State's remissions policy to allow the EMC to increase the fines. EMC chairman Charles Baker has noted that where the appeal is without merit, there ought to be a risk to the permittee in pursuing an appeal. Such an action seems justified, based on the generally low level of dollars that are actually collected.

C. 6. Access to Supportive Constituency Groups

All NPDES permits are announced in public notices and open to public comment. DEM also maintains a mailing list to notify people of draft permits. Particularly for major permits (e.g., Texasgulf, Weyerhaeuser), comments and contributions from citizen groups are often important in developing the final permit. A recent addition to the State statutes (effective in 1990) requires that DEM also send out for public notice permit modifications contained in SOCs and JOCs.

C. 7. Adequate Training, Technical Assistance and Education

Under the NPDES program, training is usually aimed at treatment plant operators (and pretreatment managers). Training for operators is managed by the Wastewater Treatment Operators Certification Commission (WTOCC). North Carolina requires that all operators be certified at a grade level that is equivalent to the plant that they are operating (Grades 1-4). Training is conducted by full-time staff, in the DEM central and Regional Offices. North Carolina's Pretreatment program is particularly strong in the training materials that are provided to local municipalities. In fact, EPA has considered using materials developed by the State as a model for others to follow.

Unlike operators, DEM inspectors are not required to have special training, other than a background in chemistry and science. Very few State compliance inspectors are certified operators (although several possess a Grade 1 certificate which can be obtained without working in a treatment plant). While it is not clear how much of a handicap this presents, the advantages of having a certified operator performing monitoring and compliance inspections can be enormous (pers. comm. Cindy Finan, Wake County Health Department).

Technical assistance for treatment plants generally has been handled on an informal basis by each DEM Regional Office. Several States have found that a more formal approach is needed and Kentucky, for example, has formed a technical assistance team that travels to individual plants and carries out diagnostic analyses and makes engineering, operational, or administrative suggestions. At EPA's request, DEM has undertaken such a program in 1990. The program is called Municipal Compliance Initiatives and while no money has been budgeted for it this year, the hope is that future success and high visibility will ensure its continuation. For now the program is being carried out within the State construction grants budget. Already a technical assistance team has been formed (consisting of experts in areas such as inflow and infiltration, plant engineering, and financial concerns) and they have worked closely with three plants on problems related to sludge disposal and industrial users. So far the experience and the results have been very positive (pers. comm. Coy Batten, DEM).

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

The NPDES program (and related efforts) is a mixture of activities carried out by different agencies, with DEM responsible for all aspects of standards development, permitting, inspections, and enforcement. Dischargers themselves have primary responsibility for compliance monitoring, and municipal treatment plants are delegated to operate the pretreatment program.

Clearly, DEM is the appropriate agency to implement the NPDES program, which has important Statewide implications for both water quality and economic development. One area where it may be appropriate for DEM to relinquish some responsibility, however, is compliance inspections and technical assistance for small domestic (and other minor) dischargers. Several surveys and many experts have noted that these plants are prone to failure, yet due to time and budget constraints, DEM inspects them very infrequently, often only once every 18 to 24 months. Several urban counties in North Carolina (Wake and Mecklenburg) have taken over some responsibility for inspecting these smaller systems and, equally important, are working with operators to improve system performance. The local programs can perform more frequent inspections (quarterly in Wake County) and maintain a constant presence to ensure that problems are corrected.

There has always been some skepticism (at least among the environmental groups) about the self-monitoring program, but the reality is that for DEM to carry out routine compliance monitoring for each discharger would be prohibitive in time and cost. The issue is not who should do it (permittees should), but how well they do it and whether there are sufficient disincentives to prevent "cheating." It is worth noting that all chemical and toxicity tests must be processed by a State-certified laboratory whose certification can be revoked (although many major dischargers have inhouse certified labs). Tests that do not require laboratories (e.g., pH, temperature, flow) are taken by the permittee, and it is not clear that quality control on these measurements is adequate.

Finally, among many weaknesses in the National Pretreatment Program, one of the major ones been the absence of strong municipal enforcement of the pretreatment standards. Among the reasons for the lack of enforcement are (1) limited resources and expertise and (2) political difficulties in imposing sanctions against local industries, which employ local citizens and pay a large share of the taxes that support treatment plant operations (U.S. GAO 1989). DEM may well have a better record of ensuring that local plants maintain compliance among industrial users; but in the long run, local treatment plants may not be the best place to locate this program.

D. ISSUES OF CONCERN

- DEM Regional Offices (at least in the A/P Study area) lack adequate staff to carry out compliance inspections. Inspections are infrequent and generally announced in advance. Often, only the bare minimum necessary to meet EPA requirements can be completed. For example, full Operation and Maintenance inspections, which approximate a complete "audit" of POTW operations, are now performed only rarely due to staff limitations (in the past, O&M inspections were more frequent). Also minor facilities are inspected very rarely, generally once every 18 to 24 months.

- Small discharges using package treatment plants are a particular concern because of frequent operational problems and failures. Many of these small plants are being administered, managed and operated by a single individual who may have other responsibilities as well. A principal need in many of these cases may be greater technical assistance.

- The scope of work in this project did not allow review of individual permits, self-monitoring reports, or records of compliance and enforcement actions. We relied on other studies that focused exclusively on this area, and the results of these studies suggest that enforcement efforts may be weak and inconsistent, particularly regarding municipal treatment plants, and smaller package plants. Written enforcement policies have not been adopted, and there appears to be few efforts to escalate enforcement actions for continuing or repeated violations. Civil penalties that are assessed, often are reduced by the EMC.

- For the most part, nutrient loading from point sources is being addressed by effluent limits for total phosphorus and total nitrogen on discharges in the designated NSWs of the A/P Study area. However, more work is required to develop target reductions in the Tar-Pamlico Basin, as well as further refine initial reduction targets in the Chowan and Neuse. These targets provide a tool for rationally assigning reductions among point and nonpoint sources in each basin.

- Currently, there are very limited tools for doing wasteload allocations in estuaries. Existing models deal only with dissolved oxygen and are usually developed to accommodate a single major discharger. Once DEM adopts the basinwide permitting strategy, a basinwide model that includes estuarine and tidal areas will be essential. A private consultant, working with DEM, is designated to develop such a model for the Pamlico to implement the proposed nutrient trading plan. The need for models in other estuarine areas should be investigated.

- Although individual permits were not examined under this project, the EDF's recent report (1989b) on POTWs in the Tar-Pamlico Basin notes a number of permit deficiencies. Problems mentioned include (1) permits that lack monitoring requirements for oil and grease, metals and other toxicants known or suspected to be present and (2) permits that are not consistent with minimum federal secondary treatment requirements.

- There is a need for a more sensitive indicator of "major" discharges that accounts not just for volume of flow or the presence of toxics, but also for the importance and sensitivity of certain highly valued, high quality, or sensitive receiving waters. The "major" discharger designation establishes a facility as having priority for both permitting and enforcement; such attention should be given to so-called "minor" permits if the discharge is to a particularly sensitive or important water resource.

- Federal resources available for funding municipal sewage treatment investments are declining, and the ability of the State or local governments to take over this responsibility is uncertain. At the current rate of funding the State Revolving Loan Fund will never accumulate the resources needed to capitalize the fund.

E. RECOMMENDATIONS

E. 1. Increase Compliance Oversight Efforts

- The number of staff with full-time responsibility for compliance inspections must be increased. Unlike some other areas of the NPDES program where efficiency can be increased through improved data management, models and permitting strategies, inspections depend on available human beings with sufficient time and expertise.

- DEM should perform more unannounced inspections and full O&M inspections.

- DEM should forthrightly address the problem of infrequent compliance inspections for minor and small domestic dischargers. Either the Agency should make a commitment to pay closer attention to these dischargers, particularly package plants, or pursue arrangements with local agencies to take over some of this burden.

- Currently, many DEM staff that carry out compliance inspections also have other duties (e.g., emergency response, nondischarge permits). While this may have worked in the past, when there were

fewer dischargers or tanker truck collisions or fish kills, it seems to result in many inefficiencies now. DEM staff in the Regional Offices will need to become more specialized to complete inspection workloads without interruptions and distractions.

- DEM should seek out more certified operators (Grade 3 or 4) to perform compliance inspections.

E. 2. Improve Enforcement Actions

- DEM should complete its development of the Enforcement Management System. This document would provide clear guidance to Regional Offices and permittees as to (1) what criteria and information will be used to define noncompliance and (2) what steps will be taken to enforce permit requirements.

- DEM should make full use of effluent toxicity data for compliance assessment and enforcement actions.

- DEM should develop a clear and uniform method for addressing sewer line extensions during moratoria imposed for noncompliance.

- The legislature should support an EMC proposal that would allow the Commission to increase civil penalties where dischargers undertake frivolous appeals in the hopes of gaining a remission.

E. 3. Strengthen Permits in Sensitive/Impaired Waters

- DEM should require state-of-the-art (e.g., BAT, tertiary treatment) technology for all point sources where discharges would enter waters subject to significant cumulative upstream loading. In many cases this would solve the immediate problem of allocating 100% of the assimilative capacity for receiving waters; it would also reduce the uncertainty surrounding the instream effects of pollutants. Tertiary treatment is not economically unreasonable and should be required where necessary to protect water quality, even if it is not possible to establish strict cause-effect relationships. (Note, under the new Antidegradation Policy, local governments may request "appropriate management strategies...for waters with unused pollutant loading capacity to accommodate future economic growth"*(15 NCAC 2B.0201)*).

- During the 1990 triennial review, DEM should consider whether it is possible to develop numerical standards for nitrogen and phosphorus for different waterbody types. In addition, the next triennial review should consider additional toxicants using data submitted by all dischargers under Title III of SARA. In the interim, DEM should investigate the expanded use of site-specific criteria or monitoring for toxicants suspected to be present but not included in existing standards.

- DEM should require more instream monitoring for toxicants, both upstream and downstream from outfalls to establish background levels for more accurate wasteload allocations.

E. 4. Expand Technical Assistance

- DEM should continue, and formalize, the technical assistance team organized under the construction grants program to work with POTWs. Such a team would be separate from the compliance inspection team, and cover all areas of operations, maintenance, and administration.

- Problems resulting from sewage collection systems (e.g., pump failures, inflow and infiltration) are major concerns for many POTWs and a cause of operation difficulties. DEM should develop a formal training program aimed at operation and maintenance of these systems.

- Technical assistance should include the investigation of alternative treatment technologies appropriate for smaller coastal communities, especially the use of artificial wetlands for improved final wastewater treatment.

E. 5. Report on Status of NPDES Permits in the A/P Basin

- DEM should supply the A/P Management Conference with a regular report (perhaps biennially) on NPDES permits, compliance status, and enforcement actions within the A/P Basin. Information should be presented in a format that facilitates comparative review and analysis, and include comments and recommendations where appropriate. The A/P Technical Committee should work closely with DEM to ensure that useful information is included in this report; some examples of key items that might be included for all major (and some minor) discharges would be:

  1. Summary of monitoring efforts, including discharger and DEM data for instream water quality, effluent water quality and toxicity, and biomonitoring.

  2. Violations or concerns suggested by monitoring results.

  3. Inspections conducted; results.

  4. Incidence of spills, overflows.

  5. Status of enforcement efforts.

  6. Civil penalties assessed, and the amount collected.

  7. List of SOCs and JOCs with compliance schedules.

CHAPTER 5

ON-SITE WASTEWATER TREATMENT: SMALL SYSTEMS

A. PROBLEM DEFINITION

This Chapter addresses small on-site wastewater treatment systems used to treat domestic waste from one or several residences or small commercial operations. Generally, the design capacity for small systems is 480 gallons per day (GPD) or less, although some systems may treat up to several thousand GPD. North Carolina is second only to Florida in the number of on-site treatment systems used, and these systems are particularly common in the rural northeastern portion of the State (see Table 5-1).

Small on-site systems usually are classified as one of three types:

1. Conventional systems--gravity flow systems with standard placement of nitrification trenches

2. Modified conventional systems--gravity flow with shallow or ultra shallow placement of nitrification trenches, or mounded fields

3. Alternative systems--systems with pressurized distribution systems, especially low pressure pipe (LPP) systems.

In the coastal A/P region, most systems installed over the last 5 to 10 years have been modified conventional systems, that is relying on gravity flow. A survey by Hoover and Amoozegar (1988) reported that the majority of systems permitted in the coastal region between 1982 and 1987 were shallow trench systems, followed by conventional trench systems, ultra-shallow trench systems, and areal fill systems.

Under proper conditions, septic systems can provide excellent wastewater treatment, comparable to that of a secondary municipal treatment plant. Coastal and estuarine areas however, are often particularly unsuited for on-site wastewater treatment: porous soils and high water tables reduce treatment effectiveness, and nearby coastal waters are threatened by contaminated surface runoff and groundwater recharges. Under unfavorable conditions, on-site systems can introduce pathogens (bacteria and viruses), nutrients, oxygen-demanding wastes, and toxic organics into ground and surface waters. The contaminants most often traced to septic systems are fecal bacteria and nutrients. Unquestionably, the most significant limitation for on-site treatment in the A/P region, particularly in counties

that border the water and where growth is greatest, is soil wetness. Carlile (1985, p.304) has noted that "Studies in high water table areas of North Carolina...show that the separation distance between the trench bottom and the seasonal high water table is the most significant factor affecting septic system performance."

TABLE 5-1. SUMMARY DATA ON HOUSEHOLD SEWERAGE DISPOSAL FOR KEY COUNTIES IN THE A/P STUDY AREA.

County	Public Sewer (%)	Septic Tank (%)	Other (%)
Beaufort	29.9	62.9	7.2
Bertie	24.5	57.1	18.5
Camden	2.3	83.1	14.6
Chowan	42.6	49.4	8.0
Craven	46.8	49.3	3.9
Currituck	10.0	83.6	6.3
Dare	13.4	83.2	3.3
Edgecombe	57.7	33.1	9.2
Gates	3.6	72.9	23.6
Greene	18.1	66.2	15.8
Halifax	50.8	35.4	13.9
Hertford	40.6	45.8	13.7
Hyde	5.9	77.8	16.3
Johnston	34.1	59.0	6.9
Jones	17.2	70.5	12.3
Lenoir	52.8	41.5	5.7
Martin	36.9	52.7	10.4
Nash	51.6	39.0	9.5
Northampton	26.6	53.7	19.6
Pamlico	2.1	85.7	12.2
Pasquotank	53.0	43.5	3.5
Perquimmons	27.3	62.8	9.8
Pitt	61.4	33.1	5.5
Tyrrell	23.7	58.8	17.5
Washington	33.3	57.9	8.8
Wayne	45.5	50.5	4.1
Wilson	62.7	30.5	6.8

Source: 1980 Census of Housing, Vol. 1, U.S. Dept of Commerce, June 1983.

Contamination from septic systems has been linked to shellfish area closures, and it is a potential cause of other health hazards (e.g., via contact recreation) as well as increased eutrophication. It is difficult to

assess the full extent to which this source has degraded water quality without extensive surveillance because the number of systems is extremely large, systems are dispersed over a wide area, and impacts are likely to be highly localized. However, DEM has estimated that on-site system failures are a source of water quality degradation for 3,143 acres or 2.4% of impaired estuarine waters in the A/P study area (N.C. DEM 1988a). Statewide, DEM listed septic systems as the cause of 13% of the closed shellfish waters, making septic systems the second leading cause of shellfish closures in SA waters (following agricultural sources).

Septic systems may be said to "fail" if they do not adequately treat wastewater prior to its ultimate discharge to surface or groundwater. In terms of water quality impacts, failure can occur in three ways: (1) untreated wastes may rise to the ground surface where they may drain directly to surface waters ("surface ponding"), (2) untreated or poorly treated waste may drain directly to surface waters, or (3) inadequately treated sewage may migrate to the groundwater and indirectly enter surface waters. Obviously, subsurface migration is less apparent and more difficult to detect.

One or more of the following conditions cause the majority of septic system failures, and these are the conditions that State and local programs must address if water quality problems are to be avoided:

1. Poor siting--Failure to adequately consider lot size, soil type, depth to groundwater, etc. For example, many soils in the A/P region are poorly suited for conventional systems.

2. Inadequate or inappropriate system design--Experimental or untested designs, undersized systems, or systems requiring frequent maintenance.

3. Improper installation--Installation that does not meet all State and local standards.

4. Poor operation and maintenance--Operation beyond design capacity; failure to obtain periodic pump-outs and checks; or the introduction of concentrated grease, solvents, or toxic compounds.

5. Old age--As systems age, the treatment capacity of soils diminishes and there is a need to replenish soil treatment capacity or move the disposal field. A number of studies have found that failure is more likely for older systems.

An important related problem in the study area concerns the "other" column in Table 5-1: the non-sewered, non-septic residences that are relatively common in northeastern North Carolina. Often sanitation at these sites is adequate, relying on privies or straight-piping of waste directly to ditches or streams. Nearly all are located in very low income communities, and many are situated on poor soils where there are limited alternatives for handling wastewater. Generally, the water quality

consequences of these situations have not been documented although the public health needs are being studied (pers. comm. Kim Connolly, N.C. Rural Communities Assistance Project).

Some of these sites are surface discharges of domestic sewage from homes or small public buildings. Prior to the establishment of DEM and the State's NPDES permit program in 1975, county health departments issued all sanitation permits based upon percolation test results. If a site was unsuitable for a septic system, many counties approved surface discharges of sand filtered wastes into small streams and ditches as an alternative. Although these surface discharges are now illegal (i.e., they operate without the required NPDES permit), there has been no systematic program to identify and notify owners of the need to obtain a valid permit and upgrade treatment. DEM staff believe that these unpermitted discharges (estimated to be in the thousands, Statewide) contribute substantially to water quality problems, especially in communities developed before 1975 on poorly drained soils, where such systems are common. It is not clear how prevalent this problem is in the A/P basins.

B. EXISTING PROGRAMS

Privately owned septic tanks (that do not contain industrial wastewater) are regulated by the DEHNR's Division of Environmental Health (DEH) through local health departments whose sanitarians serve as authorized "agents" of the State. This is in contrast to most other State environmental management programs, which are implemented directly by State personnel (The Agricultural Cost Share Program is also implemented to a large extent by local officials, through Soil and Water Conservation Districts). The DEH program is governed by the Rules for Sanitary Sewage Collection, Treatment, and Disposal (10 NCAC 10A .1900), which establishes a permit procedure, siting criteria, and minimum standards for system design. Each county health department implements the State regulations, however, counties may adopt more stringent rules if desired (modifications must be approved by the State). Recently (August 1989), the sanitary sewage rules were revised following over 3 years of review and study by a committee of health and environmental professionals. Following formal adoption, the revisions became effective on January 1, 1990.

B. 1. The DEH On-Site Sewage Program

The Permit System. Siting and installation of on-site sewage systems are regulated under a two-tiered permit program that is administered by county sanitarians--with oversight and assistance from State DEH staff. The first permit is an **improvement permit**, which is required before construction may proceed. This permit must be issued prior to all other construction permits, allows only temporary access to electrical power, and does not

guarantee that the system may be used after construction is completed. Landowners denied an improvement permit, may request an informal review by the local health department or DEH staff. Also applicants (or a designated consultant) may submit data to indicate that an alternate system will adequately treat their sewage. If denied again, the applicant is entitled to a contested hearing as provided by Chapter 150B of the General Statutes. Finally, if the permit is denied at the administrative hearing, applicants may appeal the decision in superior court.

The second tier of this permit program is administered after construction is completed: the applicant must obtain a **certificate of completion** (for systems 480 GPD or less) or an **operation permit** (for systems greater than 480 GPD or which include a "pump or other appurtenance") before the building can be occupied. The local health department is responsible for inspecting the septic system installation for consistency with the improvement permit conditions before issuing the operation permit or certificate of completion.

Site Evaluation. Prior to receiving the initial permit, a site-suitability investigation must be performed by a local environmental health specialist, including an assessment of soil characteristics, water table depth, proximity to coastal waters, and design capacity. The regulations specifically prohibit siting septic tanks within 100 feet of class SA waters and within 50 feet of other coastal waters.

In general, the regulations establish minimum siting and performance standards to classify sites as either suitable, provisionally suitable, or unsuitable, then provide options for upgrading sites classified as "unsuitable" to a "provisionally suitable" classification. In the coastal region, most undeveloped sites are provisionally suitable or unsuitable because the minimum vertical separation requirement (3 feet between the seasonal high water table or heavy clay subsoil and the soil surface) cannot be met.

For conventional or modified conventional systems, the basic siting rule (regarding vertical separation) is contained in Section .1955(m): "trenches shall be installed with at least one foot of naturally occurring soil between the trench bottom and...any soil horizon unsuitable as to structure, clay mineralogy or wetness." Under the new rules, an alternative system must be used if the distance between the bottom of the trench and a wetness condition is less than 18 inches and if more than 6 inches of this distance consists of sand.

For alternative systems and fill-based systems, the basic rule (again, only for vertical separation) is contained in Section .1957(b)(1)(A) and .1957(b)(1)(B): the minimum distance between the trench bottom and unsuitable soil structure is 24 inches or 18 inches if a LPP system is used; the minimum distance between the trench bottom and a soil wetness condition is 18 inches or 12 inches if a LPP system is used.

Finally, for sites located on "old fill" (material in place prior to July 1, 1977), Section .1957(b)(2) requires use of an LPP and at least 24 inches between the trench bottom and any soil limiting conditions; old fill must be of suitably sandy texture or new fill may be used to meet this requirement.

Maintenance Requirements. Once in operation, septic tank owners are responsible for preventing system failures. For conventional or modified conventional systems, there are no inspection or maintenance requirements, although the rules state that owners "should" check their systems at least once every three years to determine if sludge removal (i.e., cleaning) is necessary. For alternative systems, the revised rules have instituted a requirement (for new systems permitted after July 1990) that a specific "management entity" (public agency, certified operator, or certified installer) must be contracted to perform regular inspections and reporting.

The DEH rules also state that the owner must repair a system that "creates or has created a public health hazard or nuisance by surfacing of effluent or discharge directly into ground water or surface waters" within 30 days of notification by the State or local health department.

Inspections and Enforcement. Regular inspections are not required for the majority of small systems which require only a certificate of completion. However, alternative systems (or any system requiring an operation permit) are to be inspected at least once annually. When a violation is discovered, property owners are notified and given 30 days to correct the problem. If the owner fails to cooperate, the local health department may suspend or revoke a permit, or the owner may be charged with a misdemeanor and/or assessed an administrative penalty of up to $50 a day. If a system has been improperly sited or is not repairable, the rules require revocation of the permit (essentially, condemning of the property). However, such proceedings are extremely rare in North Carolina; instead, the local health department and DEH will persist in attempting to develop alternative strategies to correct the problem.

Registration/Certification Requirements. Sanitarians must have a college degree, complete a special course approved by the Board of Sanitary Examiners, or have at least two years experience in the field of environmental health sanitation, to qualify for registration. Generally, contractors who are employed to construct, install, or clean septic tanks must register with the county health director, but do not have to be certified; however, as of July 1990, installers of alternative septic systems must be certified by the Wastewater Treatment Operators Certification Commission. (Currently, there is some question of whether the WTOCC will retain this responsibility.)

Exemptions. The sanitary sewage rules exempt properly functioning systems installed prior to July 1, 1982 from existing siting requirements as long as sewage flow and other characteristics remain unchanged. Additional exemptions are allowed for the following: (1) individual systems on lots created prior to January 1, 1983 are not required to have a 100% repair/reserve area for system back-up and (2) individual systems on lots created prior to July 1, 1977 are not required to meet minimum horizontal setback requirements.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

Small on-site treatment systems exhibit the classic characteristics that make nonpoint source pollution difficult to control: many sources dispersed over a wide area, each having relatively small and localized effects. The problems associated with septic tank failures are usually episodic (in this case associated with high rainfall and/or high water table conditions), and may be the result of other (related) sources, especially stormwater runoff, making monitoring to establish clear cause-effect relationships difficult.

The task of managing on-site systems is made even more difficult however because it is often the pivotal point for any decision to develop (and thus increase the value of) property. In many rural areas septic tank siting rules are the de facto zoning requirements. Thus, the potential impact of changes in on-site sewage regulations are large and important to many people. They are important to landowners, real estate interests, developers, builders and banks for financial reasons; and they are important to environmental groups not only for direct water quality effects, but because relaxing (or failing to enforce) the rules will have spin-off effects associated with higher density and increased use of the resource.

C. 2. Clear and Specific Program Objectives

The goals of the DEH/County sanitarian program strongly emphasize the protection of public health. They are designed to ensure the treatment and disposal of sewage "in a manner to protect the health, environment, and well-being of the general public" (10 NCAC 10A, .1934). Generally, the rules define as public health hazards, systems which cause surfacing of effluent or direct discharge of untreated wastes into ground or surface water. The rules include detailed design and site specifications to prevent system failures, but do not directly address compliance with surface or groundwater quality standards.

C. 3. Sound Theoretical Basis

The primary technical standards underlying the on-site sewage program are reflected in siting criteria used by State and local health officials. Of these criteria, the most critical for protection of public health and water quality are soils type, density limitations and the interplay between vertical separation (the distance between the bottom of the distribution trench and the mean or seasonal high water table) and the horizontal setback or drainage gradient. These three are discussed below.

As far as soils, North Carolina significantly advanced the accuracy of this criterion when the State implemented the use of a comprehensive soil evaluation and classification system (instead of percolation tests) as a basic decision tool. This current system appears to work well.

Density criteria for septic systems are not specified in the State regulations, and are, for the most part, left up to individual local governments. In many cases, State officials believe that local zoning or allowable densities are well beyond recommended levels. Augsburger (1989, p. 23) cites a 1982 DEM study reporting that

> a minimum density of one subsurface absorption field per 2.8 ha of watershed was determined to provide adequate treatment..., and a density of one system per 4 ha was recommended for development adjacent to shellfishing waters. These figures are dwarfed by the regulatory [local zoning] density allowing up to 3 residential units per 0.4 ha and actual drainfield densities in excess of 13 systems per ha.

Finally, North Carolina's basic vertical separation requirement (a 12-inch minimum for most systems) is not well supported in either the scientific/public health literature or by comparison with other States. (Although immediately adjacent States Virginia and South Carolina appear to have even less stringent separation requirements.) This criterion, cited as "the most significant factor affecting septic system performance and local groundwater quality" by Carlile (1985) and others, has been the subject of extensive research. In a comprehensive literature review, Florida's Department of Health and Rehabilitative Services (1984) found that nearly all research and government publications (including the U.S. Department of Housing and Urban Development and the EPA) recommended between 24 and 48 inches separation, with greater separation recommended for highly permeable soils (i.e., sand or sandy loam), such as those commonly found in coastal areas.

N.C. DEM's recent evaluation of water quality problems in the Lockwoods Folly area (N.C. DEM 1989f, 39-43) also suggests that the evidence supports a greater minimum separation than now exists. Other States are also actively examining this issue. The State of Florida has undertaken a multiyear effort to reevaluate whether their current vertical separation requirement of 24 inches is adequate (Florida DHRS 1984; 1989). Washington State, which revised its on-site treatment regulations in 1988, surveyed septic system siting criteria in 16 coastal States and found that North Carolina was one of only three States that required 12 inches or less vertical separation; the other 13 States required separations of 2 to 6 feet. As a result of their investigations, Washington is revising their siting criteria to require a vertical separation of 3 feet for conventional systems and 2 feet for approved alternative systems (pers. comm. Robert Woolrich, Washington DSHS).

Because the horizontal movement of effluent through soils also is important, setback requirements--that is, the distance between the drainfield and property lines, wells, or SA waters--are crucial in siting. DHS rules provide strong guidance on setback requirements, although whether they are adequate in any individual case depends on site-specific factors.

C. 4. Adequate Resources for Implementing Agencies

Current funding for the State On-Site Sewage Branch is inadequate to carry out basic technical assistance, quality assurance, and program review aimed at local health departments and sanitarians that implement this program. Three Raleigh staff, ten District sanitarians (who spend less than one-half time on this program), and three Regional Soil Specialists are assigned to over 500 local agents. Currently, DEH is limited to responding to specific problems or complaints, and conducting basic training for local officials. The need for additional State staff has been raised by both DEH and the Legislative Research Commission (1989b).

Resource and staff limitations in local health departments also reduce the effectiveness of this program. As noted in the NPS Management Program, strict permitting procedures regulate site selection, system design, and installation; however "when a system malfunctions...there are severe staff limitations" that prevent the identification and correction of problems (N.C. 1989b, 64). It is important to note that local sanitarians have competing responsibilities, including quarterly inspections of all food handling operations, which are given higher priority than septic system inspections. More importantly, first priority is always given to site evaluations for new systems.

C. 5. Adequate Incentives and Sanctions

The DEH regulations provide significant incentives for the proper siting and installation of on-site systems, but few incentives to encourage proper maintenance of existing systems. For example, the septic system improvement permit is a prerequisite for all other construction permits, and without it, development cannot proceed. However, routine maintenance is suggested, rather than required for nearly all residential on-site systems that are installed in the coastal region.

One of the simplest and most effective maintenance activities for septic systems is regular septage pumping. Yet this action is not required and is rarely performed by owners. A 1982 survey by the N.C. Division of Health Services found the average age of septic systems when first pumped was 8 to 9 years (Grayson et al. 1982). The recommended frequency for most systems is every 3 to 5 years, or more often if a garbage disposal is used. Perhaps the flaw is the assumption that individual homeowners know what type of system treats their wastewater, how it should operate, and how to maintain it. Experience has shown that many failures are caused by homeowners' basic lack of knowledge about their system (e.g., assuming that puddles in the backyard are normal or unintentionally damaging low pressure pipe fixtures with lawn mowers).

As far as sanctions, DEH has found that most homeowners respond promptly to a Notice of Violation. Once people are made aware of the problem, they generally act in a reasonable time to carry out repairs. The threat of a daily fine of $50 is probably adequate for this situation, given that acute water quality effects are usually not involved.

C. 6. Access to Supportive Constituency Groups

Direct input by outside parties into this permitting process is limited for several reasons. First, the program's intent is to base decisions, to the extent possible, on consistent technical grounds, rather than public comment; the assumption is that public input on decisions in this area is best accomplished through the process of local planning and zoning. Access is also provided during the development of DEH program regulations. On practical grounds, it would be virtually impossible to accommodate public review of all individual septic system permits.

C. 7. Adequate Training, Technical Assistance, and Education

Current efforts to supply training and technical assistance to local sanitarians, as well as contractors responsible for design and installation of on-site systems, is clearly inadequate. State staff members and an environmental consultant who works with numerous county health departments in siting on-site systems noted that a basic need is for greater training in soil science. Notably, all of the recommendations in the State's four-year action plan to control NPS pollution from on-site treatment systems address training and technical assistance (N.C. DEM 1989b):

1. Expand staff to provide education and training regarding on-site wastewater disposal systems.

2. Evaluate mechanisms to prepare a comprehensive reference manual for county sanitarians regarding on-site wastewater disposal.

3. Evaluate the need for regional on-site wastewater management centers to conduct research, demonstration, and training.

4. Continue the formal training program for sanitarians and emphasize water quality components.

5. Write a quarterly newsletter to sanitarians.

6. Seek sufficient funding to accomplish the above tasks.

An aspect of the training problem is the fact that local sanitarians are not viewed as professionals and paid accordingly. A common problem has been that once local sanitarians are fully trained, they move on to other jobs that carry more respect and better pay. Needless to say, additional training will have little effect if trainees don't stay on the job. This problem has been recognized by a recent Legislative Research Commission (1989b) who found that the salary for sanitarians was too low (for the breadth and depth of knowledge required) and the turnover rate significantly high, affecting the ability of local health departments to recruit and keep qualified individuals.

In addition to technical training for sanitarians, educational materials for the public and homeowners is necessary to achieve proper operation and maintenance of on-site treatment systems. Numerous suggestions have been made in this area including brochures, discussion of septic tank operation in high school curriculums, TV spots, etc.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

The primary responsibility for implementing the septic tank program lies with the local sanitarians who perform site evaluations and surveillance. On-site systems would be difficult to regulate entirely at the State level, and the program benefits tremendously from the local sanitarians' proximity, training, and knowledge of site conditions. On the other hand, the high turnover rate of county sanitarians undermines the development of a skilled staff, and they have less political independence to enforce siting and maintenance regulations. For example, a former sanitarian encountered threats of job dismissal from developers and a member of a county health board, who complained that the sanitarian was interpreting the regulations too strictly. Such incidents may be infrequent, but there is little doubt that they do occur. Political pressure may result in a subtle erosion of sanitarians' confidence in their permit decisions--a problem shared by many regulatory agencies where the staff maintain frequent contact with the regulated community. County sanitarians are particularly susceptible to this pressure regarding septic tank permits because there is considerable judgement in how the regulations are applied (e.g., in determining soil suitability or the adequacy of a replacement area). While this allows local health staff to address individual site or regional conditions, it also results in uneven interpretations of the law.

At the State level, the regulation of on-site wastewater treatment systems is assigned to an agency strongly committed to the objective of protecting public health; in addition, it is likely that the recent integration of this unit into the DEHNR will enhance the Division's sensitivity to water quality issues. The DEH staff perceive their role as consumer advocates, protecting potential homeowners from investing their resources in residences which cannot treat wastes. The approach, stated by one DEH employee, is to err on the conservative side, rather than permit a septic system to be installed on an unsuitable site.

D. ISSUES OF CONCERN

D. 1. DEH Program

- Given the continuing growth of on-site systems in the coastal region, with much of the development occurring on sandy soils and/or in close proximity to water, and with densities that are

higher than "recommended" levels, the provision of adequate vertical separation is critical in providing a margin of safety for receiving waters. The current requirements in this area seem to have little support among the scientific community in terms of their ability to prevent system failures.

- Generally, there is a lack of data on the long-term effectiveness of systems, and the reasons for failure. In particular, more effort is needed to assess failure rates for (1) older systems which are concentrated near estuarine waters and (2) on-site systems that have been installed over a drainage system intended to lower groundwater levels.

- Due to its limited staff, DEH is unable to provide adequate oversight and review of local programs--an essential function, especially given the relatively high attrition rate among local health department employees.

- While new alternative systems, permitted after July 1990, will receive certain inspection and maintenance checks, the DEH regulations do not provide a similar requirement (or any incentives) to maintain conventional or modified conventional systems, or alternative systems permitted before July 1990. These older, early systems may actually be in greater need of inspections and maintenance.

- The permit system assumes that proper installation can be determined through visual inspection before the operation permit is granted. However, for many alternative systems, installation cannot be assessed until after the system has been operated for several days or weeks (i.e., after the permit has been issued). This points up again the need for follow-up inspections, which, in most cases, local health departments do not have the staff to carry out.

- Recent changes in DEM's groundwater standards appear to have the effect of making many (perhaps most) on-site systems a cause of violations. DEM has not clearly addressed how the new groundwater standards should be applied to on-site sewage disposal systems.

D. 2. Local Programs

- Most local health departments are quite simply not funded to a level that allows them to fully implement the State program. Sanitarians are expected to make numerous critical decisions which affect the development of land yet are poorly paid and thus suffer a high rate of attrition; also staff limitations dictate that nearly all efforts must go toward the rigorous siting process for new systems, with the result that systematic inspections of existing, even problem systems, are not carried out. The ultimate

result is that numerous failing systems are not discovered until they cause an acute problem or someone complains.

- There may be inconsistent interpretation of the DEH rules by county health departments. Sanitarians often receive complaints from developers who claim that officials in neighboring counties are more lenient (e.g., enforcing the requirement that adequate area for a replacement system be provided).

- Sanitarians may not be adequately trained to fully implement the intent of the on-site sewage regulations. The DEH Eastern Regional supervisor noted that there had been about 50% turnover among local sanitarians in the last five years--which makes it difficult to achieve the consistency necessary to run a complex permitting program.

E. RECOMMENDATIONS

A few of the recommendations listed below have been addressed by the Legislative Research Commission (1989b), but none have been acted upon at this time.

E. 1. Increase Funding for DEH and Local Programs

- DEH needs additional funding that will allow the agency to adequately assist local health departments, perform program reviews, develop and maintain tracking systems for compliance data (for larger and alternative systems), develop necessary training and educational materials, and review and oversee relevant research.

- The State should assist with funding for local health department on-site sewage programs. Currently, local agencies receive virtually no State dollars for this purpose, even though they are enforcing State rules. Other programs that rely on local officials to implement State rules often provide funds: for example, the Agricultural Cost Share Program pays up to 50% of the salary for technical positions in local Soil and Water Conservation Districts; and DCM funds local governments to issue and inspect minor CAMA permits. DEH should be authorized to fund sanitarian positions.

E. 2. Improve Inspection Activities

- With additional staff, local health departments should be strongly encouraged to undertake more frequent compliance inspections of existing systems, with priority given to systems in critical areas and non-conventional or alternative systems.

- DEH should organize and assist in coordinating systematic monitoring or surveys of systems in critical areas, if local health departments are unable to carry this out.

- DEH should make greater use of its authority to review local programs and, if necessary, work more closely with local health departments to ensure consistency and proper interpretation of State regulations.

E. 3. Reevaluate Siting Criteria

- Reexamine the adequacy of the minimum one-foot vertical separation requirement, particularly for rapidly permeable soils with shallow water tables or high gradients for groundwater flow.

- Consider developing special siting criteria that would apply in critical areas (e.g., directly adjacent to shellfish waters).

- Carry out extensive monitoring to assess the effectiveness of new systems built on "old fill" as allowed under the revised rules.

E. 4. Establish Maintenance Incentives or Requirements

- Require that homebuyers be notified of the type, placement, and age of the system treating the residence's wastewater whenever property sales occur. Notify new owners of maintenance requirements or responsibilities at that time also.

- Develop strong incentives (or disincentives) that will ensure adequate maintenance of conventional on-site systems as well as alternative systems installed prior to July 1990.

- Work with septage tank pumping companies to encourage them to report any instances of failed or failing systems; these people, probably more than anyone else, "monitor" the performance of on-site systems.

- Provide septage pumping for low-income households or services to correct failing systems, targeting residences in problem areas.

E. 5. Expand Training and Licensing

- Increase the starting salary and availability of training for county sanitarians to enhance tenure and qualifications. Make the training sessions mandatory and provide counties with additional funding for travel expenses needed to attend the training (see also E.1.).

- Follow up on the proposal to create regional on-site wastewater management centers (suggested in N.C. DEM 1989b). Such a center in the coastal region could provide additional training for sanitarians, serve as a repository of information or clearinghouse for obtaining additional expertise. A newsletter would provide additional support and encourage the transfer of information that will help bring about program consistency.

- DEH should develop a training manual or guide to serve as a reference for local health departments and a workbook for training programs.

E. 6. Develop Educational Materials

- Collaborate with the North Carolina State University Agricultural Extension Service to provide educational materials to homeowners and operators of on-site sewage systems. Homeowners could be reminded to perform routine maintenance tasks in regular bulletin mailings, public service announcements, or as part of their annual tax bill.

- Develop and distribute homeowner educational materials, television public service announcements, etc. that focus on preventive maintenance including: water conservation, discouraging installation of garbage disposals, and proper disposal of household chemicals.

E. 7. Special Projects

- DEH, along with DEM, local health departments, and social service agencies should undertake a coordinated effort to solve wastewater treatment problems in low income communities without adequate sanitation facilities. Solutions will require a concerted effort to develop systems that will work and creative financing that will fund their installation.

- The State should devote additional resources to development and testing of innovative and alternative on-site systems.

CHAPTER 6

ON-SITE WASTEWATER TREATMENT: LARGE SYSTEMS

A. PROBLEM DEFINITION

The large on-site treatment facilities addressed in this chapter are nondischarge systems--i.e., they do not discharge directly to surface waters. These systems primarily serve multiple dwellings or units (e.g., small communities, condominiums, motels, nursing homes, residential subdivisions, mobile home parks), and commercial uses (e.g., restaurants) and usually have a design capacity of 3,000 to 100,000 GPD, although some may be larger. Generally, raw waste is pretreated, either in septic tanks, lagoons, or package plants, and final effluent disposal is through either subsurface disposal or land application; the particular type of system used depends on conditions such as soils and the availability of land. Environmental impacts of these facilities are generally assumed to affect groundwater most directly, although both direct and indirect contamination of surface waters has been observed.

Within the A/P study area, there are rarely more than 25 large on-site systems in any county (many counties have ten or less), except for Dare and Carteret Counties, which may have close to 100 systems each. The following types of large on-site treatment facilities are most common:

SUBSURFACE DISPOSAL:

- Conventional Septic System--A large conventional system with pumped distribution to nitrification lines may be used where soils and depth to water table are adequate and land is plentiful.

- Low Pressure Distribution--These systems are fully pressurized to ensure more even dosage to nitrification lines. Essentially, they are larger versions of the low pressure pipe systems employed for small systems where soils or site conditions prevent use of conventional septic systems.

- Tertiary Treatment Followed by Low Pressure Distribution--Low pressure systems may carry out initial treatment of waste (e.g., in package plants) to allow higher dosage in the disposal field.

6: On-Site Treatment: Large Systems

LAND APPLICATION:

- Spray irrigation-- Partially treated waste (primary treatment or a lagoon plus chlorination) is distributed by fixed spray nozzles over large grassy areas at low dosages.

- Rapid infiltration systems--Treated waste (usually tertiary treatment in package plants) is distributed through rotary spray units at a relatively high rate of application over naturally sandy soils. These "rotary distributors" are often employed where available land is limited (e.g., on Roanoke Island and the outer banks).

In most cases, the facilities described above, if properly sited, installed, operated and maintained, can provide effective waste treatment. When any of these conditions are not met however, large systems can be a significant source of local pollution. In general, large on-site systems generate the same contaminants as smaller systems (pathogens, nutrients, oxygen-demanding wastes, and organic toxicants, discussed in the preceding chapter); but when they fail, they can produce potentially greater impacts on water quality because of their greater size.

Aside from size and the subsequent greater consequences of failure, two characteristics that distinguish large on-site systems from small systems are the nature of ownership and the critical need for ongoing oversight and maintenance. While small systems are usually privately owned and "owner-operated", large systems are frequently owned in common by a group of home-owners and operated by a licensed operator or a public utility. The result, in some cases, is that accountability for system operation or correction of problems is "diffused" between the permit holder and the management entity operating the system (although ultimate responsibility always lies with the permit holder).

Secondly, because large systems are more complex, maintenance requirements are crucial to ensure effective treatment. Pumps must be maintained, spray nozzles checked, low pressure systems must be flushed periodically and the pressure head readjusted, septage should be pumped frequently, and broken pipes and leaking pump tanks must be repaired, and surface areas should be maintained using best management practices. Systems employing chemical or biological treatment require more sophisticated and regular attention. It is this need for vigilance in operation and maintenance that has been associated with problems and failures in large on-site systems.

Like small on-site systems, failures in large nondischarge facilities can result in either contaminating groundwater supplies or by surface runoff and subsequent direct discharge to surface waters. Also, as for small systems, the majority of failures may be attributed to one or more of the following (see Chapter 5): (1) poor siting, (2) inadequate system design, (3) improper installation, (4) poor operation and maintenance, and (5) old age.

Currently, monitoring data do not exist to systematically evaluate treatment effectiveness among large on-site systems in the State. However, several recent studies in North Carolina indicate that both subsurface disposal systems and certain types of land application systems may require closer attention. A recent study of large subsurface disposal systems (N.C. DEM 1989g) sampled groundwater at five sites chosen to represent facilities of different size, age, type, and soil conditions. While some contamination was detected at all sites, the report concludes that "contamination is higher at (a) the older sites, (b) sites where the water table is closer to the land surface, and (c) sites where the sand content of the soil is highest" (p.9). In another ongoing project funded by the N.C. Water Resources Research Institute, monitoring data from land application systems are being examined. Evidence examined to date shows that levels of selected constituents (especially nitrate-nitrogen and total organic carbon) frequently are elevated in the shallow groundwater beneath rapid infiltration systems such as the rotary distributors (pers. comm. Dr. Robert Rubin, NCSU).

B. EXISTING PROGRAMS

Historically, the regulation of large on-site wastewater treatment systems has been divided between two agencies: the State's environmental agency (DEM) and the public health agency (DEH). DEH (formerly DHS) was, prior to the 1989 reorganization, located within the Department of Human Resources. Both agencies are now located in the same department (DEHNR), but separate permitting and enforcement operations have been maintained. The distinction between systems regulated by the two agencies is shown in Table 6-1. Many of the large subsurface systems, installed before 1982 were originally under DEM's jurisdiction, but in that year were transferred to the DEH program. While all systems larger than 3,000 GPD were at one time permitted by DEM, size is no longer a criterion for division of responsibilities.

B. 1. DEH On-site Sewage Program

The DEH program for large on-site systems is substantially the same as that described for small systems in Chapter 5; the program is governed by regulations described in 10 NCAC 10A, .1934-.1968, and it is primarily implemented by county health department sanitarians who serve as agents of DEH. There are several important differences between the large and small system programs however, and these, as well as recent revisions in the DEH rules (effective in 1990) are noted below.

TABLE 6-1. AGENCY RESPONSIBLITY FOR LARGE ON-SITE TREATMENT SYSTEMS

Ultimate Disposal	DEM	DEH
Surface water discharges	All	None
Land Application	All	None
Subsurface	Public utilities County or municipally owned Sanitary districts Industrial wastewater systems	Private Systems - residential - condo assoc. - businesses State & Federal - state bldgs

The Permit System. All plans and specifications for systems with a design capacity greater than 3,000 GPD must be reviewed and approved by State DEH staff before the local health department may issue an improvement permit. Then, once construction is complete, and certification by a professional engineer is received, these large systems are issued an operation permit (instead of a certificate of completion); this permit carries with it the implication that (1) conditions may be attached to the permit and (2) ongoing attention such as maintenance or inspections may be required. In practice, few small systems but an increasing number of large systems include special conditions. Although not required, State officials often accompany local sanitarians during final inspections of large systems, particularly where engineered systems are involved.

Site Evaluation. Site evaluation is similar to that described for small systems except that the minimum vertical separation between trench bottom and soil wetness for large systems is 24 inches instead of 12 inches. Also, State soil scientists more frequently carry out site visits for large system permits.

Maintenance and Monitoring. Prior to the recent revisions, DEH regulations did not require specific arrangements for operation and maintenance (although these were included as special conditions on some permits). Under the new rules requirements have been added for large on-site systems and some smaller alternative systems. The new rules will take effect in July 1990, and state that Improvement Permits for new systems may not be issued "unless a management entity...is specifically authorized, funded and operational...in the county or service district in which the proposed system is to be located" (10 NCAC 10A.1961(b)). The same regulation states that an Operation Permit may not be issued until a contract between the system owner and the management entity has been executed.

"Management entities" must be either a public institution (e.g., a city, sanitary district, public utility or county health department) or a certified operator for some small systems. In addition, the new rules set up requirements that the management entity carry out system inspections (once per month, except for systems with mechanical, biological, or chemical pretreatment, which must be inspected more frequently) and report results to the local health department.

Inspections and Enforcement. Local sanitarians are to inspect all systems with capacities greater than 3,000 GPD once annually. In practice, these annual inspections are not carried out in many counties unless there is a problem or complaint (pers. comm. Steve Berkowitz, DEH). In some cases, State or Regional DEH personnel may do inspections. Administrative penalties for inaction to correct a failing system (after notification) are $300 per day for large systems. The State may also suspend or revoke a permit with consequent eviction of residents or business closure if necessary.

B. 2. DEM On-Site Treatment (Nondischarge) Program

Unlike DEH, which addresses only subsurface wastewater treatment, the DEM nondischarge permit program regulates both subsurface disposal and land application systems, if these systems are treating industrial waste or operated by a public utility. The program is guided by 15 NCAC 2H .0200 (Waste not Discharged to Surface Waters); and 15 NCAC 2H .0300 (Septic Tank Systems). In the immediate coastal area, the program is also guided by 15 NCAC .0400 (Coastal Waste Treatment Disposal). The following description represents only a brief outline of these complex regulations, highlighting the differences in DEM and DEH procedures.

The Permit System. Permit applications for construction or repair of nondischarge treatment systems are processed largely by DEM's Raleigh staff with some support from Regions where needed. The rules provide review criteria such as acceptable soil types, design specifications, and requirements such as access to back-up systems during system malfunctions. In the coastal area, special consideration is given to density and proximity to Class SA and other waters. Unlike the DEH program which relies on local sanitarians or Regional Soil Specialists to evaluate site suitability, DEM relies more heavily on information provided by the applicant. Thus, along with detailed project plans, the applicant must submit a complete soils evaluation and hydrogeological analysis. Following plan approval, a right-to-construct permit is issued by the DEM staff. Unlike the DEH program, a final construction inspection and additional operation permit is not required. (DEM does require that a professional engineer certify that the disposal system was installed in accordance with the approved plans and specifications.) Land application permits are usually issued for a period of five years and must be renewed; many subsurface systems do not have renewal requirement, although some are now being modified to require renewals.

6: On-Site Treatment: Large Systems

All permit applicants are charged a standard permit application and renewal fee based on system size. A portion of the fee is used to fund the recently enacted Wastewater Treatment Emergency Maintenance, Operation and Repair Fund. In addition, DEM charges annual fees for administration and compliance monitoring. For example, standard fees for a domestic system with a capacity of 1,001 to 10,000 GPD are: $200 for permit application; $100 for renewal; and $225 annual administrative fee.

Maintenance and Monitoring. DEM has, for some time, required that large on-site systems be operated and maintained by a wastewater treatment operator certified under by the State's Wastewater Treatment Operators Certification Commission. In all cases, the grade of the operator must be matched to the grade of the facility. However, training and certification that is specifically designed for land application or subsurface disposal system operators has not been developed to date.

Requirements to sample effluent and groundwater as well as monitor system performance (e.g., head pressure) are frequently included in land application system permits; commonly facilities must submit data three times per year. Water quality monitoring is a less frequent requirement for subsurface disposal systems, although it is becoming more common.

Inspections and Enforcement. Once DEM's nondischarge permits are issued, inspections and enforcement are the responsibility of the DEM Regional staff. Generally, Regional staff attempt to inspect all land application systems once a year; if a complaint is received or a violation noted, the site may be inspected more frequently. In DEM Region 5, inspections are targeted first to municipals and then to systems that are directly along the coastline. Most subsurface disposal systems are not inspected on a regular basis unless there is a problem or complaint. If a problem is identified during an inspection, the owner of the failing system is notified and given a deadline for corrective action. A follow-up visit is performed to ensure that the problem has been addressed; if the problem persists, the DEM staff cite the facility owner for a violation in a noncompliance notice. This effectively raises the annual administrative fee charged to the owner to operate their facility. The owner then has 30 days to correct the problem. If the problem persists, information is sent to the DEM Director, who sets a daily fine (imposed until the problem is corrected) up to a maximum of $10,000 per day. Generally, the Director sets the fine between two and three thousand dollars per day. The Director may also modify or revoke a permit if permit conditions are consistently violated.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

Compared to managing thousands of dispersed small systems, the job of assuring adequate treatment by large on-site systems is relatively tractable. However, there appears to be numerous questions about how well the

technology performs. North Carolina permits more large subsurface disposal systems than any other State, and the research on effectiveness of these systems is only now getting underway. Specifically, there is a need for more research on how to determine the carrying capacity of sites for large on-site systems. Particularly in the eastern part of the State, the complexity of soils and hydrogeology make such determinations quite difficult. Rapid infiltration systems also are relatively new and their long-term effectiveness is unknown. The target group for this program is extremely diverse; it includes individual homeowners who discharge to community systems, some commercial establishments, private contractors, and public utilities.

C. 2. Clear and Specific Program Objectives

DEH. As noted in Chapter 5, the DEH program has emphasized public health protection (over aquatic life support), since onsite systems do not discharge, at least directly, to surface waters. Thus, concern with nutrients has been less important than attention to coliform bacteria and viruses as consequences of failure.

DEM. DEM program objectives clearly address water quality, especially in the coastal area where regulations state that "all wastewater generated in the State of North Carolina shall be treated to such an extent as to insure the compliance with water quality standards promulgated by the commission (EMC)" (15 NCAC 2H .0400).

C. 3. Sound Theoretical Basis

For subsurface disposal systems, the discussion in C.3, Chapter 5 regarding the adequacy of the 12-inch minimum vertical separation applies here. Indeed, a major recommendation in the recent DEM study of large subsurface disposal systems (N.C. DEM 1989g) is to reevaluate the adequacy of the minimum design requirement for vertical separation. A related technical weakness is the methodology for evaluating the treatment capacity of sites for large systems. Currently, permits for subsurface systems are based almost exclusively on hydraulic loading considerations (i.e., the amount of effluent that can be discharged without excessive rise in the water table around the disposal field); in contrast, issues of chemical loading and chemical treatment receive relatively little attention. Several researchers suggested that chemical loading should be explicitly considered in the process of system design and siting (pers. comm. Dr. Robert Rubin, NCSU; and pers comm. Dr. Aziz Amoozegar, NCSU).

Technical standards for permitting land application systems are more stringent than those for subsurface disposal and most systems using the spray irrigation technique appear to be performing well, although there are some problems with surface water runoff during saturated soil conditions (pers. comm. Dr. Robert Rubin, NCSU). Considerably more doubt has been cast on the effectiveness of design standards for rapid infiltration systems (rotary distributors), which have gained widespread use only within the last

five to ten years. The extremely high loading rates used by these systems, combined with sandy soils and elevated water tables due to the "mounding effect" under these systems has suggested to researchers that little or no attenuation will take place in the soil, and contaminants are more likely to migrate off site. Recent monitoring data confirm these problems (see e.g., groundwater monitoring data from DEM nondischarge permit 10905).

C. 4. Adequate Resources for Implementing Agencies

DEH. DEH staff in Raleigh are responsible for reviewing plans for all systems over 3,000 GPD capacity (approximately 100 per year statewide), as well as other systems that involve any mechanical pretreatment; providing technical assistance and advice to local sanitarians; carrying out training and educational programs; and evaluating research involving various effluent transport mechanisms, alternative systems and siting criteria. Currently, most of this work is carried out by two engineers and the program director in Raleigh (when this report was prepared, one of the two engineering staff positions had been vacant for several months). Raleigh staff provide assistance and support for 3 Regional Soil Specialists, 10 District Sanitarians, and nearly 600 local sanitarians (who have many responsibilities beyond this program).

At its current level, the DEH program is significantly understaffed; additional people are needed to carry out permit reviews, provide technical assistance and training as well as manage this program. For example, due to staff limitations, a basic data system for tracking information concerning large on-site systems was only developed in 1988. Other areas that suffer from lack of personnel are oversight of local programs, and "research" into persistent technical difficulties. While DEH requests for additional personnel have been turned down in the past, the Division plans to request increases again during the next fiscal year (pers. comm. Steve Steinbeck, DEH).

As noted in Chapter 5, local health departments are notoriously underfunded and short of qualified staff. In theory, local sanitarians are to inspect all large (over 3,000 GPD) and engineered systems once annually; in practice this is often not accomplished, and many systems are only inspected when there is a problem or complaint (pers. comm. Steve Berkowitz, DEH).

DEM. Current DEM staff in Raleigh (which coordinates the permit application and review process) is stretched thin, but is adequate. However, assuming passage of legislation requiring public notice for nondischarge permits (see C.6 below), additional staff will probably be required. Staff resources for the DEM program are more profoundly limited with respect to inspections and enforcement activities, both of which are predominantly the responsibility of the DEM Regional Offices.

To a large extent DEM's inspections are driven by EPA grant requirements. These requirements apply only to surface water (NPDES) discharges, however; for nondischarge systems there is no formal mandate (either from

EPA or the State) to carry out inspections. DEM does try to inspect nondischarge systems, particularly municipal land application systems, once every 12 to 18 months. This frequency is "definitely inadequate" according to one State official, however staff limitations and priority given to surface water discharges makes it impossible to do more. Several professionals familiar with program have also noted that the low priority given by DEM to construction/installation inspections is short-sighted. Many problems that are discovered later could have been identified during a thorough installation inspection (e.g., leaking tanks, poor connections, wrong size pipes, poor grading and drainage around the site).

The lack of compliance oversight is becoming even more critical in the A/P Study area. Due to increasingly stringent discharge limits, many more nondischarge systems are now being permitted, particularly in NSWs (Chowan, Pamlico-Tar basins). To do an adequate job, at least one more full-time staff position is needed in DEM Region 5 (pers. comm., Barry Adams, DEM).

C. 5. Adequate Incentives and Sanctions

DEH. There are no formal incentives to maintain compliance under the DEH program. One of the primary "outside" incentives has come from banks, which are now taking a more active role in determining whether systems are working properly when property is bought or sold. The authority to invoke sanctions under the DEH program resides primarily at the local level. State staff report that in many cases, it is difficult to get adequate enforcement of the regulations by local officials primarily because the staff simply do not have the time to support such efforts. Another primary weakness in the DEH program has been the lack of program requirements for monitoring and system maintenance, although recent rule changes have addressed the need for an ongoing management entity. Potential enforcement actions under DEH are either administrative fines (up to $300 per day), court-ordered injunctions, or condemnation and eviction. In practice, injunctions are used most frequently, when an enforcement action is taken; administrative penalties require a great deal of staff time and eviction is simply too drastic to be practical in most cases.

DEM. The DEM program provides a financial incentive to comply with the monitoring and maintenance conditions specified in their permit. If full compliance is maintained during the previous calendar year, the annual administrative fee is reduced by 25%. (Note, the maximum fee for the largest facility is $800, which would result in an annual savings of only $200.) In contrast, sanctions for noncompliance can be set at $10,000 per day. DEM staff report that most operators are willing to make corrections promptly following notification rather than risk being fined.

C. 6. Access to Supportive Constituency Groups

Under DEH, there is no provision for public notice or public comment when new systems are under review; however, adjacent property owners may appeal a permit decision.

6: On-Site Treatment: Large Systems

Currently, DEM is not required to notify the public of applications for nondischarge permits. However, proposed legislation (House Bill 35) would require public notification of all permit applications for spray irrigation systems, sludge disposal sites, and large subsurface systems treating more than 30,000 GPD.

C. 7. Adequate Training, Technical Assistance and Education

All the issues discussed in C.7, Chapter 5 apply here as well. Greater training and technical guidance is needed for local sanitarians as well as contractors who design and install on-site systems. The recommendations cited from the State NPS Management Plan apply here, and there is a continuing need to educate users of nondischarge systems concerning the disposal of complex organics and toxic materials in the wastewater system.

Training for wastewater treatment operators is the responsibility of DEM, while certification procedures are developed by the N.C Wastewater Treatment Operators Certification Commission (WTOCC). To date, there is very little formal training and no certification specifically designed for operators of land application and large subsurface systems. This is a significant failing (WTOCC has been aware of the problem for some time) due to the special problems of these systems. While some efforts are underway to correct this problem, they should be expedited.

Dr. Robert Rubin, of the N.C. State Department of Biological and Agricultural Engineering, serves as a technical advisor to the WTOCC, and recently, as part of his work for the Commission, he completed a survey of wastewater treatment operators in the State. Issues that emerged from the survey were (pers. comm. Robert Rubin, NCSU):

- Salary levels are not high enough to attract and keep qualified personnel (once trained, operators frequently leave for other jobs).

- Operators need more education and training. Generally, operators felt that DEM staff are qualified to provide technical assistance, but that they do not have the time to provide the level of assistance needed.

Much of the needed "training" could be provided informally during site inspection visits; however, the current schedule of inspections (once/year) is too infrequent to be of much use.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

DEH. Clearly, the discussion in Chapter 5 applies here: local sanitarians are paid a relatively low wage, have a high turnover rate, and may suffer to some degree from political pressure. In small counties, they

must be experts in both food service and food handling as well as soil science and site evaluation for septic systems. Also, because primary importance is given to public health considerations, there may be less commitment to overall water quality concerns. However, for large systems, while local health departments remain the primary responsible agency, the State DEH staff play a larger role in both plan review and in providing technical assistance.

DEM. The DEM on-site wastewater treatment program is directed by the Permitting and Engineering Unit, which appears to be strongly committed to preventing failure of on-site systems and contamination of ground and surface waters. During the past four years, the unit has demonstrated its commitment to the program objectives by upgrading the guidelines for design approval. The unit staff now require design features that enable large on-site systems to be more easily monitored and portions to be shut down for repair without disabling the entire system.

D. ISSUES OF CONCERN

D. 1. General Issues

- Inconsistencies and overlaps between the DEH on-site sewage program and the DEM nondischarge permit program are apparent and in some cases encourage developers to go "permit shopping" to find the most favorable treatment. For example, monitoring requirements, fees, frequency of inspections, and adequacy of emergency funds to deal with failures all may differ for the same system permitted under one division versus the other. The distinction between systems operated as public utilities and those operated privately is artificial from the standpoint of water quality protection; i.e., it is not relevant to most of the questions that involve siting, system design and requirements for adequate operation, maintenance, and repair. The original justification for splitting the program between DHS and DEM was to take advantage of "rural set aside" money under the Federal 201 program. As it turned out, this money never did become available in North Carolina; and, in any case, it is no longer even a possibility.

- Compliance monitoring data from land application and subsurface disposal systems are not reported or tracked in a standard format. Unlike the tracking system developed for monitoring data submitted by surface water dischargers, groundwater data are not standardized, are rarely tracked, and largely remain in paper files in the groundwater section of the DEM Regional Office. Reports are submitted in various formats, and often as simply raw data, making it difficult to track compliance with reporting requirements as well as chronic water quality problems.

6: On-Site Treatment: Large Systems

- Emphasis in both the DEH and the DEM programs is placed on siting new systems, apparently at the expense of monitoring/inspecting the performance of existing systems. This lack of emphasis on existing systems may result in operator carelessness and seriously prolong the discovery and correction of failing systems. It is interesting that whenever surveys of system performance are done, many failures are discovered. (This is not to imply that all system failures have serious water quality consequences.)

- Operators of land application systems and large subsurface disposal systems often do not have special training that is relevant for these systems. The Wastewater Treatment Operators Certification Commission has not developed special certification requirements for nondischarge systems, which in many cases are fundamentally different than typical municipal wastewater systems.

- There is evidence that recent revisions to the groundwater standards have caused many sites with on-site disposal systems (possibly a majority of all homes with septic systems) to be in violation. The question of whether groundwater standards should be strictly applied to subsurface disposal systems has not been resolved.

- Research indicates that the minimum one foot vertical separation requirement, which applies to many (though not all) subsurface disposal systems is not adequate for protection of ground and surface water quality.

- A more scientifically valid approach for determining the carrying capacity of sites for large subsurface or land application systems is needed.

D. 2. DEH Program

- A severe shortage of staff at the State level makes it difficult to adequately carry out necessary technical support and oversight for local programs.

- DEH has very little authority (carrots or sticks) to use with local governments who are lax in inspecting systems or enforcing State on-site sewage rules.

- Local sanitarians who are on the front lines in implementing this program are underpaid, overworked, and undertrained.

- DEH, though now located within the DEHNR still does not coordinate with the Groundwater Section on permit reviews for large subsurface disposal systems (unlike DEM which circulates all nondischarge permits to Groundwater).

- DEH does not have a sinking fund or bonding requirement to fund unexpected repairs or defaults among large systems (i.e., no equivalent to DEM's "Wastewater Treatment Works Emergency Maintenance, Operation and Repair Fund"). Consequently, extended time may elapse between identification of a problem and the making of necessary repairs.

D. 3. DEM Program

- DEM may rely too heavily on site evaluations and certifications prepared by consultants selected by the developer. A particular weakness exists in the area of soils evaluation. The regulations require a soil evaluation of the disposal site by a soil scientist "or an individual with a demonstrated knowledge in soils science" (15 NCAC 2H, .0203). This is vague and allows uncertified individuals to provide critical siting information. As DEM has little or no inhouse soil science expertise or staff to perform independent checks of site evaluations, this allowance should be corrected.

- An important weakness in the DEM program is the lack of formal communication with local health departments. Local officials often have valuable site-specific knowledge that should be used. Under the current system, a turf battle seems to exist, with all permits carrying either a DEM or health department label. Instead, both should be part of the same "team", protecting water quality and public health.

- DEM regulations covering subsurface disposal systems (.0300) have not been revised for over ten years and may not adequately address problems associated with newer systems (e.g., low pressure systems) as well as many other problems.

- While most large land application systems require groundwater monitoring, there is evidence that surface water runoff, especially during high rainfall/saturated soil conditions, also contributes to contamination (pers. comm. Robert Rubin, NCSU). DEM should consider requiring some surface water monitoring or at least visual inspections during these conditions.

E. RECOMMENDATIONS

E. 1. Consolidate/Coordinate DEM, DEH and Local Health Department Programs

- The two Divisions that currently handle large on-site treatment systems should be integrated into one program. Under the current

arrangements, DEM does not take advantage of the extensive soil science and local experience that could be obtained through the DEH program; likewise, DEH has not coordinated with the Groundwater Section or had the benefit of oversight from the WTOCC, as does DEM. The best option would be to divide responsibilities so that all subsurface systems are permitted by DEH and all land application systems are permitted by DEM, with review and comment by DEH. Even with such an arrangement however, both programs should rely more heavily on local health departments and certified wastewater treatment operators for inspections and enforcement assuming that adequate local programs can be developed (see E.2., below).

- DEM and DEH should work with the Groundwater Section to develop uniform monitoring and reporting requirements, reporting forms, and a tracking system (perhaps modeled after the State's NPDES tracking system) for compliance monitoring data from large on-site (non-discharge) systems.

- DEH and DEM should work together (along with the WTOCC) to develop training programs and materials for sanitarians, wastewater treatment plant operators and installers, as well as educational materials and announcements for the public.

E. 2. Improve Compliance Inspections

- DEM, DEH and local health departments should strive to increase the frequency of compliance inspections and site visits to provide technical assistance. One model for accomplishing this is provided by the the Wake County Department of Health's Water Quality Program (a similar program exists in Mecklenburg County). The Wake program, funded half by permit fees and half by local tax dollars is delegated to inspect all minor NPDES facilities as well as DEM nondischarge systems. The Water Quality Program staff includes certified wastewater treatment operators who work closely with both DEM and sanitarians on siting, inspection and enforcement issues. For smaller counties, a regional program, encompassing two or three counties, may be a more feasible approach.

- Timing and extent of visits/inspections are critical. Systems in areas with high water tables should be inspected after heavy rains or during periods of heavy use (if seasonal) when failure is most likely. For systems in well-drained soils, observable failures will be extremely unlikely, so groundwater sampling should be carried out.

E. 3. Reevaluate Siting Criteria

- Reexamine the adequacy of the minimum one-foot vertical separation requirement, based on recent survey and scientific data.

- Reevaluate the adequacy of siting criteria for rapid infiltration systems based on a comprehensive survey of existing systems' performance--using available and newly collected groundwater monitoring data.

- Support research to develop a technically sound method for establishing the carrying capacity of sites for large on-site systems.

E. 4. Implement Special Certification for Operators of Land Application and Large Subsurface Disposal Systems

- The unique operational problems of land application and pretreatment/subsurface systems should be recognized in a curriculum and certification test designed for these systems. (Note: the WTOCC has been aware of this need for some time, and has been developing such a curriculum.)

CHAPTER 7

STORMWATER MANAGEMENT

A. PROBLEM DEFINITION

This chapter describes programs that address stormwater runoff from developed areas (i.e., urban runoff). It is the only chapter that deals directly with development as a source of pollution or use impairment.

Numerous reports indicate that urban runoff can be a significant source of water quality degradation (see McCullough 1985; U.S. EPA 1983). Constituents contained in urban stormwater can include sediment, coliform bacteria, oil and grease, nutrients (nitrogen and phosphorus), heavy metals, and other toxic contaminants such as pesticides. Generally, the sources of these materials include wet and dry deposition of pollutants from the atmosphere; street refuse, including litter, street dirt, vegetation, and organic matter; vehicle emissions including exhaust, tire wear, lubrication fluids; and urban erosion. Such materials, deposited on roofs, roads, parking lots, and other impervious surfaces wash off during rainstorms and may eventually reach rivers and estuarine waters, if they are not intercepted beforehand.

During the late 1970s, the National Urban Runoff Program (NURP) found median concentrations of some pollutants in runoff to be many times allowable instream standards (EPA 1983). Although the impacts of urban runoff on receiving water quality are extremely site-specific, the NURP studies suggested that coliform bacteria are probably of primary concern in areas surrounding estuarine waters due to direct impacts on shellfish harvesting and beach closures. With minor exceptions (e.g., golf courses), the most significant variable affecting urban runoff is the extent of impervious surface area relative to surrounding pervious land.

North Carolina's Nonpoint Source Management Plan (DEM 1989b) estimates that about 1,600 miles of assessed streams are impacted by urban runoff, as are about 5,400 acres, or 3.7 %, of estuarine waters. While urban runoff impacts are much less widespread than, for example, agricultural impacts, they can have severe local effects on coastal waters. Furthermore, some of the the State's coastal areas are rapidly being developed, and runoff from new development is more easily controlled than runoff from other nonpoint sources.

NC Nonpoint Source Mgmt. Program
(FINAL DRAFT) WQ Section. RALEIGH.

Controlling stormwater impacts involves reducing the volume and/or rate of flow due to rainfall events, and minimizing or removing the pollutants in this runoff. In general, these goals can be achieved in two ways: (1) the low-density approach, in which limits are placed on the amount of impervious surface (i.e., parking lots, roads, rooftops); or (2) by requiring engineered systems to collect and treat the runoff. North Carolina agencies spent much energy in the 1980s developing strategies and programs to limit the water quality impacts of coastal development. This effort resulted in regulations and programs that favor the low-density approach but allow use of engineering systems. Coastal stormwater control regulations and programs are described below.

B. EXISTING PROGRAMS

Current stormwater management efforts in North Carolina focus on controlling runoff from new development in the coastal area. The program is implemented by the Division of Environmental Management (DEM), with primary responsibility given to staff in the regional field offices. The program is guided by two regulations enacted by the Environmental Management Commission (EMC): the coastal stormwater runoff rules (15 NCAC 2H.1003) and the Outstanding Resource Waters rules (15 NCAC 2B.0216). These rules, discussed in more detail in the following section, seek to limit development densities rather than encouraging the use of treatment technology. The most stringent requirements apply to projects draining to SA waters or Outstanding Resource Waters (ORW).

The current stormwater rules replaced rules passed by the EMC in 1986 and designed to expire in 1987. The previous rules featured more stringent runoff containment requirements (including a 4.5-inch, 24 hour design storm) and different low-density options, however, they only applied to projects within 575 feet of SA waters. In modifying the rules, the EMC opted for less stringent design requirements and greatly expanded coverage; the current rules extent protection to virtually all waters in the 20-county area covered by the N.C. Coastal Area Management Act.

General Requirements. The current stormwater regulations went into effect January 1, 1988 and apply to new development greater than one acre in size (within the 20-county area). New development draining directly to SA waters (or to unnamed tributaries to SA waters) must include one of the following: a design density of 25 percent or less built-upon area, or treatment systems to control runoff from a 1.5 inch, 24-hour design storm. Only infiltration systems are allowed for projects draining to SA waters, and runoff in excess of the design volume must be routed overland through vegetative filters at least 50 feet wide.

New development greater than one acre in size and draining to non-SA waters must include one of the following: a design density of 30 percent or less built-upon area (one-third acre lots in the case of single-family dwellings); or treatment systems to control runoff from a 1-inch, 24-hour design storm. Wet detention ponds may be used for treatment of runoff, provided they are designed to provide 85 percent removal of suspended solids and storage of 1 inch of runoff above the permanent pool. When engineered systems are used, excess runoff must be routed through vegetative filters at least 30 feet wide.

Rules that apply to the ORW classification (discussed more fully in Chapter 11) took effect October 1, 1989 and January 1, 1990. The rules, in combination with management plans to be implemented for each ORW, have the following consequences for stormwater management: projects within 575 feet of ORWs which require a Sediment and Erosion Control Plan or a CAMA major development permit must comply with the low density option of the coastal Stormwater Runoff Disposal rules; that is, they must meet the 25 percent built-upon limit or one-third-acre minimum lot size. For example, the owner of a 50 foot by 100 foot lot in a new subdivision could construct up to 1250 sq ft of built-upon area which might include 150 sq ft of driveway and a two story house with an 1100 square foot footprint (N.C. DEM 1989d). For projects outside the 575 foot AEC, the less restrictive coastal stormwater runoff rules apply.

Program Implementation. Any development project affecting more than one acre in the CAMA counties must submit an erosion and sedimentation control plan. With the exception of two local erosion control programs on the Outer Banks, these permits are reviewed by the Land Quality Section in the Division of Land Resources. Land Quality personnel in the Washington and Wilmington Regional Offices then notify their counterparts in the Water Quality Section of the project, and the Regional stormwater specialist reviews the project plans to determine if the stormwater rules apply. (Recently, some design firms have begun submitting plans directly to Water Quality staff). DEM has interpreted the rules to exclude any project with a built-upon area less than one acre, rather than a total project area of less than one acre, so not all projects needing a sedimentation control plan also need a stormwater review. This interpretation is based on the definition of "development" in the rules.

The DEM stormwater specialist reviews the package for completeness and deals directly with the design consultant as needed. Approximately 5 projects per month are reviewed in the Washington Regional Office, and about 20 per month in the Wilmington Office. Roughly half of the projects reviewed are low-density projects. If a project complies with either the low-density or high-density options of the rules, approval is given to proceed. Most of DEM's effort since the rules became effective has focused on getting the review/approval process underway. In nearly all cases, DEM relies on the consulting engineer's certification that a project has been built as specified in the approved plans.

Maintenance Requirements. Stormwater controls that rely on engineered systems must include an operation and maintenance plan naming responsible parties and describing maintenance procedures to be followed. A sample operation and maintenance agreement for a wet detention pond has been developed for the Regional Offices as part of a system design example (Hawes undated). This sample agreement provides for the following:

- The owner is responsible for maintaining and operating the pond, and for checking the pond after all rainfall events to ensure that the orifice is free of debris, that the vegetative filter is stable, and that the pond side slope is stable.
- When the depth of sediment in the pond reaches 0.5 feet deep, the owner must have the sediment removed.
- The owner must mow the side slopes and vegetative filter when the vegetation reaches 8 inches, and must repair any erosion damage.

Guidance for maintenance of infiltration basins recommends inspection after every major storm during the first few months following construction; thereafter, annual inspections are suggested (Schueler 1987). Maintenance operations include mowing, debris removal, erosion control, and infrequent sediment removal.

Inspections and Enforcement. The Washington Regional Office, with one stormwater specialist, does not do any compliance inspections to determine if the approved design plans and maintenance agreements are being followed. The Wilmington Regional Office is starting to conduct compliance inspections as time permits; approximately 6 to 8 projects per month are visited, at various stages of construction and operation. To date, Wilmington's inspections are mainly confirming the need for additional compliance checks. Monitoring wells are being required in the high-density, engineered systems to facilitate compliance inspections in the future. These wells will enable testing of infiltration rates and the movement of pollutants into groundwater.

Exemptions. The coastal stormwater rules apply to new development of land for residential, industrial, commercial, or institutional uses only. Agriculture and forestry are specifically exempted.

C. PROGRAM EVALUATION

C.1. Tractability of the Problem

Protecting water quality from stormwater impacts involves land use controls, and therefore is considered moderately intractable because of the behavioral and belief-system changes required of the target population

(landowners and developers). Several commenters, during public hearings on the proposed stormwater regulations, expressed concern that development has been singled out for regulation while other activities, such as agriculture, have not. The lack of data on how well different stormwater management options actually protect water quality adds to the intractability of the problem. On the positive side, nearly all coastal residents understand the recreational and economic value of good water quality and are generally receptive to the idea of some controls on urban runoff if they can be shown to protect the resource. The development community seems to have accepted the coastal stormwater rules and is relieved to finally know what requirements they are expected to meet.

C. 2. Clear and Specific Program Objectives

The EMC's stormwater regulations clearly state the goal of "minimizing any water quality impacts of development activities to ensure that existing and designated uses are maintained and protected...." (15 NCAC 2H .1001) Maintaining and protecting designated uses is a major goal of all programs under the Clean Water Act. The EMC rules further state (15 NCAC 2H .1003): "the intent of the commission is to achieve the water quality protection which low density development near productive coastal waters would provide. To that end, the director...will cause development to comply with the antidegradation requirements specified in 15 NCAC 2B .0201 by protecting high quality waters and highly productive aquatic resources from the adverse impact of uncontrolled high density development or the potential failure of stormwater control measures." The stormwater rules are not clouded by consideration of economic or other factors which might conflict with water quality protection.

The stormwater management program in North Carolina received a boost from the General Assembly in June 1989 when a law was passed directing the EMC to develop stormwater runoff rules and programs Statewide. The law amends G.S. 143-213 and 143-214.7, and specifies that the EMC should phase in standards and best management practices for waters in the following order of priority: classified shellfish waters; water supply watersheds; outstanding resource waters; high quality waters; other waters needing protection. The State's ability to prevent cumulative impacts from piecemeal development in cases requiring CAMA permits was strengthened by another law passed in the same session. This act, which amends G.S. 113A-120(a) and G.S. 143-215.1(b), requires denial of permits for projects that have practicable alternatives or which would contribute cumulatively to water quality problems.

C. 3. Sound Theoretical Basis

The fact that urban runoff contributes (in some cases significantly) to water pollution is well documented. However, the effectiveness of the low-density and engineered options in preventing water quality impacts is not documented. The selection of density limits and design storms contained in

the North Carolina regulations seems to have evolved in an effort to find limitations that: (1) offered a reasonable chance of protecting designated uses; (2) would be acceptable politically; and (3) could be applied uniformly throughout the CAMA counties.

Regarding item (1) above, the EMC justified the rules on the basis of providing protection in all coastal areas draining to estuarine systems, a degree of protection more consistent with nonpoint source control programs than with programs limited to areas bordering sensitive waters. DEM also noted that control of the 1.5-inch storm plus a vegetative filter for overflow would capture all the runoff and the pollution generated from 90 percent of all storms, and that some pollutants reach receiving waters even in undeveloped areas (N.C. DEM 1989d). Opponents of the proposed rules argued strongly that larger design storms were needed to protect sensitive waters. By their estimates, the 1.5 inch design storm would be exceeded an average of 8 times per year (N.C. Coastal Federation 1987). Opponents further argued that the 1987 rules were based on a "first flush" theory which holds that most pollutants can be captured in the first one-half inch of urban runoff, although some pollutants have been shown not to exhibit this effect (N.C. Coastal Federation 1987). Other technical issues have been raised about the adequacy of the 30- to 50-foot wide vegetative filters required with engineered systems. A recent modeling study (Phillips 1989) suggests that a width of about 260 feet may be required for effective pollutant removal at the North Carolina coast, but the study lacks field data to verify the modeling results.

Regarding item (2) above, a much larger design storm (perhaps the 4.5 inch storm of the 1986 rules) could have been retained for projects bordering SA waters, with the lesser design storms for other waters, as recommended by at least one civic group (Holton 1987). The decision apparently was made to opt for more uniform restrictions on development projects, which resulted in somewhat reduced protection of SA waters, in exchange for enhanced protection of all other coastal waters from stormwater impacts. The technical and political decisions that went into the current stormwater rules may have been sound and in the best interest of coastal water quality, but the effectiveness of the rules has yet to be tested in the field. The State is now in a good position to bolster the basis for the regulations by monitoring the water quality impacts of selected low-density and engineered projects.

C. 4. Adequate Resources for Implementing Agencies

DEM's stormwater management program is understaffed. In the Washington Regional Office, less than one full-time-equivalent (FTE) staff member is available to the program. This engineer is able to keep up with plan reviews for engineered systems and for low-density projects, but not onsite inspections of projects during or immediately after construction. Nor are compliance inspections done to be certain that engineered systems are performing adequately. The Wilmington Regional Office is similarly understaffed, with one full-time engineer and one technician who devotes 60

to 70% of his time to stormwater reviews and inspections. Staffing devoted to the coastal stormwater program at the central office of DEM in Raleigh is roughly one-fourth FTE (the level of staffing in Raleigh was much higher during development and startup of the regulations).

Thus, the total DEM staffing for the coastal stormwater program is less than 3 FTEs, which implies a budget of less than $100,000.

C. 5. Adequate Incentives and Sanctions

Theoretically, a maximum fine of $10,000 per day could be levied against a developer who builds without an approved plan and causes violations of State water quality standards. In reality, developers who attempt to build without approved plans receive formal notices of noncompliance from DEM, and subsequently come into compliance before fines are levied. Because of this practice and the fact that the coastal stormwater program is still young, there is no history of violations or fines. Most individuals seem to be complying with the new requirements with the following exceptions.

Developers of small tracts have an incentive to develop their projects piecemeal or to find creative ways to avoid the one-acre cutoff. For example, a tract of land was recently developed in Wilmington for four banks. This parcel was developed by a single developer, cleared by a single contractor, and graded as a single unit. However, the developer escaped requirements for both sediment and erosion control and stormwater controls on the basis of having four separate building permits. In another instance, two adjacent parcels, one owned by a father and another by his son, were developed as one tract but escaped the stormwater rules under the one acre exemption. DEM attorneys are currently evaluating their ability to bring cases against individuals who purposefully try to circumvent the rules.

In the absence of compliance inspections and the threat of penalties, there are few incentives for responsible parties to comply with maintenance agreements after construction is completed. In fact, there is a positive incentive to avoid costs by postponing maintenance; for example, costs for cleaning out small, wet-detention ponds typically ranged from $5 to $10 per cubic yard of sediment in 1986, with costs doubling if the material had to be hauled offsite (Schueler 1987).

C. 6. Access to Supportive Constituency Groups

Formal involvement of the public in the coastal stormwater program has been largely limited to the rulemaking process. Because permits are not issued, there are no public notices or public hearings concerning projects under review. Some of the most significant projects are monitored by environmental groups, who comment on project plans and agency approvals through letters and other forms of contact with DEM and elected officials. In some cases, the public may notify DEM of violations of stormwater regulations.

Projects requiring CAMA permits are subject to the CAMA public review process. Developers and environmental groups have equal opportunity to appeal CRC permit decisions, and hearings may be requested up to 20 days following permit approval.

C. 6. Adequate Training, Technical Assistance and Education

DEM has developed and put on workshops for design engineers on the stormwater regulations and appropriate system design. Within DEM, stormwater technical staff have received little training. They could benefit from training on successful stormwater control technologies and maintenance practices. Because so few people are currently working in the North Carolina program, the most cost effective way to provide training might be to send these employees to workshops in other States, or to have them visit States or municipalities with well-developed stormwater programs.

C. 7. Implementation Assigned to Agencies that are Committed to Program Objectives

It is clear that the DEM staff are highly motivated and dedicated to successful implementation of the stormwater rules. DEM staff pioneered development of the rules and shepherded them through various revisions, compromises and expansions of coverage. While commitment is high, there appears to be some frustration at not being able to follow up on projects with a viable inspection program.

D. ISSUES OF CONCERN

- The Regional Offices are understaffed in the coastal stormwater management program. Existing staff are unable to perform the onsite compliance inspections needed to ensure both adequate construction of engineered systems and ongoing maintenance practices.

- The one-acre exemption, and DEM's interpretation of it to mean one acre of built-upon surface, allows developers of small tracts to avoid incorporating stormwater management into their projects, and may promote piecemeal development.

- Since the coastal stormwater rules are relatively new, the degree of water quality protection offered by low-density and engineered options has not been established.

- The State does not collect fees to defray the costs of the program. As the number of existing and planned projects grows, staff efforts will be further diluted if additional funds are not available.

- EMC regulations (15 NCAC 2B.0201) appear to suggest that new development draining to High Quality coastal waters are subject to less stringent requirements for stormwater control than is development in similar freshwater High Quality Waters. Section .0201(d)(2)(C) excludes waters located in the 20 coastal counties "since they already have requirements for nonpoint source controls"; yet the requirements for coastal counties are less strict than the stated requirements for development draining to High Quality Waters (25% maximum built upon area versus 12% built upon area).

- Local involvement in coastal stormwater management is low, which could ultimately weaken the program. Greater involvement from local agencies could relieve DEM of some of the burden of the program. On the other hand, many local agencies would have a difficult time implementing even minimum State stormwater control requirements due to pressures from local development interests.

E. RECOMMENDATIONS

E. 1. Increase Staffing Levels

- It seems clear that the current level of staff support is not adequate to fully implement the coastal stormwater management rules, especially regarding operation and maintenance of the systems. Additional staff are needed in the Regional Offices to review plans, carry out inspections during and after construction, work with local agencies, and investigate site-specific problems. The personnel shortage is likely to become more critical as the number of projects increases. At present, at lease one additional technical person is needed in each of the two Regional Offices serving the A/P area.

E. 2. Improve Compliance Monitoring and Enforcement

- DEM should institute inspections both during construction and after project completion to determine if systems are being maintained properly. Where distance restricts surviellance of a project, DEM staff should be able to work with a local official (e.g., a building inspector or soil conservation district officer) to monitor progress and consistency with the approved plan.

- DEM should develop written guidelines for enforcement of the stormwater regulations, including the use of civil penalties and restoration requirements.

E. 3. Ensure the Adequacy of Structural Controls

- DEM should assess the effectiveness of structural controls (detention ponds) constructed under the high density option. Surface and groundwater monitoring studies as representative sites should be carried out.

- DEM should undertake a systematic study of the extent to which structural controls are being adequately maintained by private contractors or homeowner associations.

- If maintenance is found to be unsatisfactory, the agency should consider implementing a publicly funded local or regional maintenance program to ensure a continuing responsibility and commitment of the necessary financial resources.

E. 4. Implement a Fee System

- Fees are used in other water pollution control programs to offset the cost of the programs. For example, at least four States recoup a portion of erosion control program expenses by assessing a processing fee for plan review. Neither the erosion and sediment control program or the stormwater management program are permit programs in North Carolina, but a fee system seems warranted nonetheless.

E. 5. Improve Training and Education

- DEM staff could benefit from further training in stormwater management systems. This might be accomplished by attending workshops or meeting with experts in States that have more established programs and procedures, such as in Maryland and Florida.

- Increased outreach is needed to local governments through education about the need for stormwater controls, and the problems associated with poor maintenance or site design. With increased involvement, more local agencies may eventually be able to assume responsibility for stormwater management or enforce land use regulations that supplement the State stormwater rules.

CHAPTER 8

AGRICULTURAL PRACTICES

A. PROBLEM DEFINITION

The 1989 North Carolina Nonpoint Source Assessment Report (N.C. DEM 1989a) lists agricultural practices as the dominant source of pollutants, among all types of nonpoint sources, for surface waters in the State. The Report notes that, Statewide, agricultural practices are a significant source of water quality problems in approximately 67% of degraded rivers and streams and 61% of degraded estuarine waters. Among the basins that make up the A/P Study area, except for the Neuse Basin, agricultural impacts are even more pronounced (see Table 8-1 below).

Agriculture is by far the largest industry in the 28-county A/P region; this northern and central coastal area of the State accounts for over 40% of North Carolina's gross farm receipts, contains 45% of the State's cropland, 50% of the hogs, and 25% of the chickens (N.C. DNRCD 1987). The agricultural economy is also expanding in the region; soils are good, land is relatively inexpensive, and the location is within an overnight drive of much of the East coast's population. From a water quality standpoint, the two types of agricultural practices of greatest concern in the A/P region are row crops (e.g., corn, tobacco, soybeans, cotton) and confined animal feeding operations (primarily hogs, but to some extent poultry and possibly aquaculture).

Row cropping is a principal source of sediment as well as nutrients and pesticides in the A/P Study area. In nearly all cases, pollutants are delivered to watercourses through stormwater runoff, although the extent of pollution varies considerably depending on numerous site-specific factors including slope, soil type, variety of crop, and proximity to water.

Animal feeding operations generally house large numbers of animals in a small space, and water quality problems arise in the course of managing the enormous amounts of raw waste (manure) which is a byproduct of these operations. In fact, studies have shown that there is a statistically significant relationship between the amount of manure generated in a watershed and the mean concentration of nutrients in nearby streams (Humenik and Foreman 1984). Generally, the wastes are stored on-site in lagoons. For most operations, impacts result from either (1) overflows of waste from poorly designed or maintained storage lagoons, (2) discharges from such lagoons that enter waterways, or (3) excessive application of manure to land. Such practices have resulted in both fish kills and shellfish closures in the A/P

region (N.C. DEM 1985b). In the Tar-Pamlico basin alone, there are approximately 875 swine, chicken, dairy, and turkey operations. "Many of these operations are using out-dated waste management facilities or have expanded beyond the original systems' capacities" (Cummings 1989).

TABLE 8-1. IMPACT OF AGRICULTURAL PRACTICES IN A/P STUDY AREA

A/P Basin	1 Total size (mi/ac)	2 Size impaired* (mi/ac)	3 Portion impaired by NPS (% of #2)	4 Portion impaired by Agric. (% of #2)
CHOWAN BASIN				
Riverine (miles)	759.5	456	92	70
Estuarine(acres)	35600	35600	60	60
NEUSE BASIN				
Riverine	3287.5	883	92	54
Estuarine	328700	14438	64	51
PASQUOTANK BASIN				
Riverine	436.5	273	95	81
Estuarine	868800	9487	100	68
TAR-PAMLICO BASIN				
Riverine	2308.1	714	97	67
Estuarine	634400	68814	73	71
ROANOKE BASIN				
Riverine	2303.1	1190	90	79
Estuarine	0.0			

* Impaired size does not include areas where use support was not evaluated.
Source: 1988 305(b) Report (N.C. DEM 1988a)

Swine production accounts for the largest proportion of animal feeding operations in the A/P region, and these often have the most serious water quality impacts. Compared to dairy or cattle farms, there is less land available for storage and application of manure; and unlike poultry waste, which is dry, swine waste is a liquid. The number of hog producers in the A/P region is not known with certainty, but numbers supplied by the N.C. Department of Agriculture suggest that there are at least 2,000 producers in DEM Region 5, which includes the eastern 2/3 of the A/P Study area (pers. comm. Dick Denton, DEM Region 5).

Aquaculture facilities, which resemble animal feeding operations in some respects, are becoming increasingly popular in northeastern North Carolina (DEM Region 5 estimates that there are at least 20 operations in their area and potentially many more). These facilities are raising stripped bass, catfish, crawfish, and other species in confined areas, and to date, the State has not carried out a comprehensive assessment of water quality impacts from these operations.

The most important pollutants resulting from agricultural practices are described below:

- Sediments are considered to be the most widespread agricultural pollutant and the major cause of surface water degradation in the State (N.C. DEM 1988a). The primary sources of sediment pollution are tillage on highly erodible soils, or simply poor row-crop practices.

- Nutrients are contributed primarily by crop residues, animal waste, and commercial fertilizer. Fertilizer or manure applications that do not properly consider the source, amount, timing and method of application are most likely to result nutrients delivery to surface waters. Generally, nutrients are divided into phosphate-phosphorus (PO_4-P) and nitrate-nitrogen (NO_3-N).

- Pesticide delivery to surface waters most often results from a failure to properly consider site characteristics, timing and the method of application. Pesticides can be transported in stormwater runoff, carried offsite during application by high winds, or introduced by accidents and spills. Improper disposal of pesticide containers is also a potential source of contamination.

- Pathogens originating from animal wastes may contaminate surface waters via runoff from feedlots, failing manure storage facilities or banks where animals are allowed direct access to water courses.

B. EXISTING PROGRAMS

The dominant State program addressing agricultural impacts on water quality is the North Carolina Agricultural Cost-Share Program (ACSP) for Nonpoint Source Pollution Control. Like agricultural NPS programs in other states, the North Carolina program initially relied heavily on the structure and approach developed under federal agricultural assistance programs (begun in the 1930s) to combat erosion and enhance farm productivity. Central to these programs were a set of approved erosion control practices, a network of federal technical experts (the Soil Conservation Service) and designated units of local government, the Soil and Water Conservation Districts. However, during the five years in which the ACSP has operated, there is ample

evidence that the program has expanded beyond the erosion control/farm assistance orientation of the federal programs and established its reputation as a State water quality program for agriculture.

While animal feeding operations are addressed under the ACSP, many operations could fall under the jurisdiction of the State's NPDES permit program; that is, these operations may be designated and permitted under existing federal and State regulations if certain criteria are satisfied. Even though very few NPDES permits have been issued, this is an important tool for addressing what is a significant source of pollutants in the A/P study area.

Two other State programs that address agricultural practices are the N.C. Pesticide Law of 1971 and the Pesticide Disposal Program. The Pesticide Law is administered by the N.C. Pesticide Board and the Pesticide Section of the Department of Agriculture. This program regulates the use, application, sale, disposal, and registration of pesticides. The Raleigh Office staff of the Pesticide Section includes 20 employees (including a full-time lawyer); there are 10 inspectors and the annual budget for pesticide control and analytical work is $1.4 million (N.C. DEM 1989b, p.16). The Pesticide Disposal Program, administered by the Food and Drug Division of the N.C. Department of Agriculture, is intended to provide affordable and environmentally acceptable disposal for unwanted pesticides. This "voluntary" program is staffed by the ten inspectors who enforce the N.C. Pesticide Law and by one full-time pesticide disposal specialist who coordinates the program (N.C. DEM 1989b, p. 17).

In addition to the cost-share and pesticide programs, State funds are used to support numerous educational and technical assistance activities; many of these programs are more directly related to the control of soil erosion and enhancement of farm productivity.

The remainder of this chapter concentrates on North Carolina's agricultural cost-share program and the NPDES/facility designation program for animal feeding operations.

B. 1. The Agriculture Cost-share Program

The ACSP was initiated in 1984 to assist landowners in 16 counties whose land was within the watersheds of State-designated "Nutrient Sensitive Waters" (NSW). The program has been expanded three times since 1984, first to include all land within counties that border NSWs plus 17 coastal counties; in 1988 to include 24 additional counties in the piedmont and mountains; and finally in September 1989 to include all 100 counties in the State. Of the 36 counties that include land within the A/P drainage basin, many were included initially, and a total of 31 were covered following the 1988 expansion; so most counties have had some experience with the cost-share program.

It is important to note that the ASCP is completely voluntary; farmers are not required to participate in any way. Those that do participate however, may be reimbursed for 75% of the predetermined average cost of installing approved agricultural best management practices (BMPs), excluding operation and maintenance costs. These average costs are set by the State Soil and Water Conservation Commission and reviewed annually for accuracy and representativeness. In addition to the 75:25 cost-share on approved BMPs, the program offers 100% incentive payments for several other practices (including conservation tillage and proper land application of animal waste) which can be obtained for a maximum length of three years. The limit on total cost-share payments is $15,000 per-year per-farmer. During FY 1989, approximately 6.5 million dollars were distributed to 2,550 farms in 56 counties.

In addition to payments to individual landowners, a separate cost-share account is used to fund technical positions at local Soil and Water Conservation Districts (a 50:50 match is required). During FY 1988, approximately $800,000 was distributed for such positions, which, under the rules of the program, must be used to promote ACSP activities in the District.

The principal federal, State and local agencies involved in administering the North Carolina ACSP are as follows:

- NC Soil and Water Conservation Commission--The Commission is the primary decision-making body for overall policies, cost-share funds, and approval of specific BMPs and has final authority for allocation of funds to each of the local districts. Allocations are based on many parameters including water quality problems, availability of technical assistance, and intensity of agricultural uses. The Commission is advised by two "subcommittees": the Technical Review Committee (which provides a fact finding role in reviewing agricultural plans and proposed BMPs) and the Agricultural Task Force (which advises the Commission on policy matters).

- NC Division of Soil and Water Conservation--Within the DSWC, the Agricultural Nonpoint Source Pollution Control Section serves as staff to the Commission and administers the ACSP. The Division works with local SWCDs to develop program requests, reviews all Strategy Plans submitted by the local SWCDs.

- Soil and Water Conservation District Boards--Local SWCDs play the central role in implementing the North Carolina ACSP. The district offices are responsible for submitting to DSWC an annual "Strategy Plan" that identifies priority areas where controls are needed; working directly with farmers to promote the cost-share program; signing contractual agreements with landowners; providing technical assistance to design and implement BMPs; coordinating reimbursement to farmers; and enforcing ACSP contracts. Districts typically have from two to nine employees that work for the district, county, local municipalities, or the SCS. District staff are distinct from the district board, with the board composed of five unpaid members (called supervisors). Three board members are elected and the Commission appoints the remaining two members.

- U.S. Soil Conservation Service--The SCS provides design specifications for BMPs (only practices that meet SCS specifications are eligible for cost-share) and technical support to the local SWCDs.

Implementation of the ASCP requires close coordination between State ACSP staff (in the DSWC), and the supervisors and staff of the local SWCDs. In addition, the DSWC coordinates with DEM and the Department of Agriculture. The situation appears to work well as their are clear lines of responsibility within the program, and close communication between the local districts and the Regional staff as well as the Raleigh Office. District staff are responsible for developing contracts based on district priorities; in most cases, the districts are flexible as far as meeting farmer preferences and, if necessary, rewriting contracts to accommodate weather problems or a changes in crops. However, before any contract can be signed and money committed, the State ACSP staff must review each contract for consistency with water quality objectives; the State can refuse approval or return for corrections any contract that does not meet the standards.

B. 2. DEM designation of Animal Feeding Operations

Regulations developed under the CWA (40 CRF 122.23) state that "concentrated animal feeding operations" are point sources subject to the NPDES permit program. Operations that fall under this regulatory framework must first be "animal feeding operations" which are defined as locations where: (1) animals are confined for a total of 45 days or more in a 12-month period, and (2) vegetation is not sustained in the normal growing season over any portion of the facility. To be designated as a <u>concentrated</u> operation subject to the NPDES program, a direct discharge of pollutants to surface waters must occur and the facility must meet the following criteria:

1. More than 1,000 animal units are confined, or

2. More than 300 animal units are confined and either one of the following conditions are met:

   a. Pollutants are discharged into surface waters through a ditch or other man-made conveyance, or

   b. Pollutants are discharged directly into surface waters which originate outside of and pass through the facility.

3. No animal feeding operation is subject to NPDES requirements if discharges only occur in the event of a 25-year, 24-hour storm.

In addition, the Director of DEM may designate (and subsequently permit) <u>any</u> animal feeding operation as "concentrated," on a case-by-case basis, if the State determines that it is a significant source of pollution. This is important because most animal operations in North Carolina contain fewer than 300 animal units (An animal unit is a unit of equivalency; for example 200 dairy cattle, 750 swine or 9,000 laying hens all equal 300 animal units).

To date, North Carolina has chosen not to invoke the State's NPDES authority to require permits for animal feeding operations that meet the designation criteria. Instead, the DEM Regional Offices inspect animal operations only in response to citizen complaints or detected water quality problems (e.g., a fish kill downstream). If a problem is detected, which means, in most cases any direct discharge to a surface water, the farm operator given a notice of designation and has 60 days to cease the discharge. The farmer must certify that the discharge has been stopped within this period; in some cases, followup inspections are conducted, but typically they are not. If the farmer has not stopped the discharge, he may be assessed a civil penalty of several thousand dollars ("a few" penalties have been assessed in Region 5). Since August 1986, the DEM Region 5 Office in Washington has designated 40 (of the approximately 2,000) animal feeding operations; nearly all are hog farms. The advantage of the designation is that it allows future inspections and would expedite the future issuance of a permit if discharges are not corrected or if they reoccur at a later date.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

Along with other quandries like poverty, drug abuse, or education, agricultural nonpoint source pollution seems to possess many elements of intractability. It is difficult to establish strict cause-effect relationships between individual farm practices and water quality problems; the size of the target population is extremely large (and influential!); and the extent of behavioral change required is sometimes large and not in the farmers' short-term financial interest. Not least of the factors affecting this source is the strong independence of farmers concerning farm practices.

In addition, Thompson (1989, p.50) has noted that certain macro-economic forces discourage risk taking and hence the adoption of environmental protection measures among farmers. Prices for agricultural commodities can be very unstable; farmers must confront the risks of unpredictable weather, pests and crop or animal disease; and finally, economies of scale are difficult to achieve because a constant quantity of land is necessary to produce a given output. All these factors combine to discourage large-scale investment, lead to relatively short-term planning horizons, and to cost-cutting behavior that can result in water quality degradation.

Probably for these and other historical reasons, States have not implemented regulatory environmental programs (e.g., using the water quality-based model developed by EPA under the Clean Water Act) that mandate certain behaviors, technology or fees for agricultural sources. In contrast to nearly all other programs that address major sources of pollution or habitat degradation, programs addressing agricultural impacts are either voluntary or primarily reactive in nature.

C. 2. Specificity of Program Objectives

The North Carolina ACSP operates under a clear statutory goal which is "... to reduce the delivery of agricultural nonpoint source pollution into the water courses of the State" (15 NCAC 6E). This is in contrast to most other programs aimed at agricultural NPSs, where the focus is on reducing soil erosion. Beyond this general statement however, the more specific objectives of meeting water quality standards or targeting program resources to address critical areas and critical pollutants are not included. In the absence of such criteria, it is difficult to assess whether pollutants have (1) been reduced by an adequate amount, (2) whether the reductions have been achieved for the most important pollutants, or (3) whether reductions have been achieved in the most efficient way.

The objectives of the NPDES program (for concentrated animal feeding operations) are clearly drawn and specific; this program has the additional advantage that permitted discharge levels may be tied to State water quality standards.

C. 3. Sound Theoretical Basis

The two assumptions that underlie all agricultural cost-share programs are: (1) that economic subsidies (in this case, 75 percent of the cost of installation) will motivate landowners to adopt approved BMPs that they would not have otherwise adopted and (2) that the implementation of approved BMPs will reduce agricultural NPS loading and thereby improve water quality.

The first assumption has been generally proved true by the high participation rates in the ACSP. In nearly all cases, the number of applications for cost-share assistance exceeds the available funds. In addition, the fact that some farmers, who were turned down for cost-share money, have implemented BMPs on there own, points out that the ACSP also serves as an educational and demonstration program. One minor note is that in some cases, farmers who would have adopted BMPs even in the absence of subsidies, have delayed implementation in the hope of receiving cost-share funds. As reported in a recent evaluation of the North Carolina program (for EPA), "This is more likely to happen with low cost BMPs than high-cost ones, and in the eastern part of the State, where the irrigation benefits of water control structures are high" (Industrial Economics 1989, p.D-7).

A potentially more serious question concerns the second assumption and the time-frame over which pollutant reductions are achieved. While cost-share programs have been shown to reduce NPS loading over the life expectancy of the BMP, it is not clear what reductions will be maintained after this period, or after the cost-share program has ended. Under the ASCP, farmers are generally required to maintain a cost-shared practice for 10 years. Where a BMP is not in a landowners economic self-interest (e.g., where maintenance costs exceed on-site benefits), the practice may be abandoned after initial contract expires, and long-term reductions in NPS loading may not be achieved.

C. 4. Adequate Resources for Implementing Agencies

ACSP. Apart from the monetary resources required for cost-share reimbursement, within the ACSP, staff resources are required for program administration, technical assistance, and project monitoring. Program administration involves the review of district strategy plans and cost-share contracts. Before any contract can be signed and money committed, the State ACSP staff must review it for consistency with water quality objectives. Technical assistance, includes assistance to local districts and this is provided largely by Regional Field Representatives. Finally, project monitoring is not being carried out at this time due to a shortage of staff. Current staff are stretched to the limit reviewing local contracts; little or no time is available to focus on monitoring to maintain quality control or to focus on problem areas or plan new initiatives.

Over the three fiscal years, 1989, 1990 and 1991, program plans show a shortage of approximately one position to simply carry out the mechanics of running the program (i.e., not counting the need for new staff to serve as "project monitors"). With the expansion of the cost-share program to include the entire State, more time will be spent with counties that are new to the program.

Animal feeding operations. In the DEM Region 5 Office, which is one of the most active in tracking animal feeding operations, one person spends 20% of their time on this activity. Responsibilities include investigating sites following complaints, carrying out the paper work associated with the designation process, and doing followup inspections. Over the last year, the Office has been able to respond to only about half of all complaints due to a lack of staff time. In many cases, only facilities that generate more than one or two calls are investigated. Also, due to a lack of time, followup inspections are not carried out unless additional complaints are received.

C. 5. Adequate Incentives and Sanctions

ACSP. Over the five years that the N.C. ACSP has been operating, applications for cost-share agreements have nearly always exceeded available funds; clearly, current incentives are at least adequate to ensure participation of many farms, although it does not follow that these are farms where pollution control needs are greatest.

The second part of this condition involves the adequacy of sanctions, or in this case, inspections to ensure compliance with program agreements. Currently, compliance inspections are conducted only by local districts (both SWCD personnel and the SCS). Each district is to inspect five percent of all participating farms annually, and all animal waste management systems are to be inspected annually for five years following implementation. State program staff feel this level is not adequate. In addition to the relatively low priority put on inspections, the inspections that are carried out may not look at the larger questions regarding the intent of the program. For

example, in many cases, inspections only assess the technical or engineering aspects of the BMP--whether the width and slope of a grassed strip are correct, whether the concrete used in a lagoon will last 40 years, etc.; what is less likely to be checked are the adequacy of the buffer strip or the location of the lagoon relative to water quality.

Animal feeding operations. An important incentive to clean up waste management practices, once a facility has been designated, is the availability of cost-share funds to implement a full waste management plan. In fact, it was noted that in some districts, cost-share funds for animal operations are prioritized based on who is "feeling the heat" from DEM. To date, the sanction of a possible fine and potential NPDES permit have been enough to correct acute problems. However, the long-term effectiveness of the designation process is not known as followup inspections are not conducted (unless the operation does receive cost-share funds; it would be interesting to check what percentage of DEM designated facilities have received cost-share money).

C. 6. Access to Supportive Constituency Groups

Generally there is little or no formal opportunity for public comment in the development of a district's Strategy Plan, which is prepared by each district board and submitted to the SWCC for approval. (This Plan is probably the most important determinant of the distribution of cost-share monies as it outlines the problems and priorities for funding.) Of course district meetings are open to the public, but in most cases, they are not widely publicized, nor is the Strategy Plan itself.

C. 7. Adequate Training, Technical Assistance and Education

Training (or education) are needed for (1) the local SWCD technicians that oversee and administer the cost-share program (2) the local SWCD Board members who are charged with preparing a Strategy Plan for distributing cost-share funds and with carrying out annual spot checks of 5% of cost-share projects, and (3) the farmers themselves.

A two-week training session, run by the U.S. Soil Conservation Service, is provided for all local technicians employed under the cost-share program. This training is probably adequate for the technicians as they are not expected to design projects, but only review engineering plans or project specifications; also, the technicians usually can work with the local SCS District Conservationist where questions or problems arise.

Board members are not provided with formal training, although there are annual meetings of the Association of Conservation District that do offer some workshops. It is assumed that most Board members are farmers and are familiar with the principles and practices of agricultural BMPs for water quality. This may be true in many cases, although not always.

Finally, for the farmers, in some sense, it can be said that a primary objective of the entire cost-share program is education. As more farmers are exposed to these practices and practices implemented by neighbors, attitudes are changing, and this may be one of the most successful aspects of the program; indeed, it is the best kind of education where one learns by doing or from one's peers. Of course, in addition to the cost-share program, other agencies provide farmers with technical assistance and training, including the Agricultural Extension Service and the SCS, although traditionally this assistance has not been aimed at water quality protection efforts.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

ASCP. At the State level, it is clear that program staff in the DSWC are both committed and skillful in administering this large program. Clearly, however, the greatest burden for implementation falls on the local SWCDs. Districts must set priorities, work with farmers to encourage participation (in some cases), develop contracts, and carry out inspections. While initially, the districts' commitment to program goals may have been weak, as the program has matured and additional technical staff have been hired (under the 50:50 funding program), many districts have risen to the challenge of making water quality a primary objective.

There are some local districts however that have not yet developed the full expertise and commitment to run the ACSP, and unfortunately, many districts in the A/P region fall into this category (pers. comm. Jim Cummings, DSWC). These districts often simply lack the necessary knowledge and/or staff to adequately address program responsibilities. In many cases, technical assistance in these regions is limited to staff whose primary responsibility involves farmer assistance with federally funded erosion control projects.

In terms of inspections and enforcement, local SWCD staff are, in some ways, in the same predicament as the local sanitarian; both must work with constituents on a day-to-day basis to encourage sound practices, and also carry out inspections and enforcement, where necessary. It is difficult to adopt this dual role and still maintain a good working relationship with constituents. (The agricultural Cooperative Extension Service is aware of this fact, and, for this reason, does not provide information to NPS regulatory agencies).

Animal feeding operations. The DEM Regional Offices are committed to addressing this problem, but they are limited by a shortage of staff and lack of jurisdiction. It is DEM policy that no facilities will be inspected unless there is a complaint or reason to suspect that problems exist.

D. ISSUES OF CONCERN

D. 1. Agriculture Cost-Share Program

- In some local districts, funds may not be targeted to critical areas where the water quality benefits of BMPs will be greatest. There may be tendency to emphasize BMPs where on-farm benefits are greatest instead of those with off-site benefits. As the demand for cost-share money nearly always exceeds the supply, targeting is an important consideration. Reports of assistance on a "first-come, first-served" basis (e.g., Rogers and Rosenthal 1988) may be exaggerated, but nevertheless serve to point out the problem.

- The ACSP, which focuses on water quality, is a major reorientation from previous and existing federal programs (also implemented by SWCDs) that emphasize erosion control. Some districts have not yet adjusted to this change and tend to focus on erosion control instead of sediment delivery in selecting BMPs.

- Relatively low importance is given to inspections and enforcement in the ACSP. This is true at both the local district level and at the State level. As the program matures, State and local staff will need to place more emphasis on these activities.

- Many local districts in the A/P study area are not equipped to provide sufficient technical assistance for design and installation of BMPs. Many districts have only a part-time staff, or no staff member who's primary orientation is water quality protection.

- There is a lack of data on water quality improvements resulting from implementation of BMPs. This is a common concern of all cost-share programs. While it is generally agreed that monitoring data (e.g., before and after studies) would be useful, the cost of such studies is seen as an insurmountable barrier.

- Political interest in funding the ACSP is currently strong. However, should fiscal conditions change, funding for the ACSP may receive lower priority. Unlike other programs that are tied to Federal requirements (e.g., NPDES program, wetlands protection, coastal management), this program is more vulnerable to annual legislative funding priorities.

- There are no policies or plans for renewing cost-share contracts. Agricultural activities will continue to be a source of pollution after current contracts expire, and currently there is no State policy that addresses this issue. One factor that may mitigate the need for additional cost-share funds is the federal requirement

(under the Food Security Act of 1985) that all farms receiving federal benefits must have a conservation plan approved by 1990 and fully implemented by 1995.

D. 2. Animal Feeding Operations

- Concentrated animal feeding operations in general and hog manure lagoons in particular are a major potential source of pollutants in the A/P Study area. Nearly all facilities that are investigated following complaints are found to be discharging to surface waters. Unfortunately, DEM's relationship with the Department of Agriculture in attempts to track and monitor these facilities has been mostly adversarial.

- Enforcement (or even the discovery) of problems caused by animal feedlots or manure application is almost exclusively reactive in nature: through citizen complaints or discovery during the course of investigating a water quality problem. The DEM program should have some means for identifying illegal discharges before they cause an acute problem.

- Aquaculture, defined in EPA regulations as "concentrated aquatic animal production facilities" (40 CFR 122.24), are <u>not</u> exempt from NPDES permits and may be designated as point sources, similar to concentrated animal feeding operations. However, like animal feedlots, these facilities are considered under the umbrella of the agricultural exemption, and DEM does not inspect--or may not even be aware of--these facilities. The potential water quality effects of these operations should be assessed.

E. RECOMMENDATIONS

E. 1. Increase Staff Assigned to the ACSP

- DSWC needs additional staff to (1) carry out program development, and administrative activities, e.g., to coordinate with DEM and the Department of Agriculture; (2) review SWCD contracts and provide technical assistance to local districts; and (3) carry out inspections and program reviews.

- DSWC ACSP staff should work with the A/P study to determine which local SWCDs (1) contain land areas or agricultural practices having significant impacts on water quality and (2) are most in need of technical or administrative assistance to improve program implementation. Additional assistance and program review should be targeted first to those districts that meet both criteria.

8: Agricultural Practices

- DSWC staff should work closely with the five counties/SWCDs in the A/P basin that only became eligible for ACSP money in 1989. These counties, in the upstream portion of the Tar-Pamlico and Roanoke Basins, are Vance, Warren, Halifax, Edgecombe, and Martin Counties. They should be encouraged to target problem areas that have significant downstream impacts in the Albemarle and Pamlico estuaries.

E. 2. Improve Inspection Activities

- Institute a short-term program to inspect a large percentage of all cost-share agreements over the next several years. Inspections should compare implementation with SCS specifications (where applicable) and pay particular attention to the overall water quality effects of the practice as implemented.

- Examine the feasibility of creating one or more "State auditors" who would be responsible for conducting independent inspections of BMP implementation and reviewing the quality of implementation and enforcement by local districts.

E. 3. Develop and Promote a Watershed-based Approach for Agricultural/Urban NPS Management

- SWCDs are based on political (i.e., county, or multicounty) boundaries. DSWC should develop policies and guidance for local districts to take a "watershed-by-watershed" approach--as DEM is obligated to do under the Clean Water Act's NPS program. SWCDs should be encouraged to integrate agricultural NPS management with other programs (e.g., coastal stormwater, septic tanks) in critical watersheds.

- Guidance should include an approach for targeting watersheds within each district, based on water quality impacts, soils, slope, etc.

- Prepare targeting criteria that allows flexibility for local districts but which can be used to measure performance of all districts in this area.

E. 4. Take a More Active Role in Assessing and Managing Concentrated Animal Feeding Operations

- DEM should work with the Agricultural Extension Service, ACSP, and other agencies to identify animal feeding operations and aquaculture facilities and track relevant water quality-related information such as location, size, type of facility, nearest surface water, potential groundwater impacts, date of most recent inspection etc. This was a principle recommendation in DEM's 1985 assessment of the water quality effects of concentrated feedlots (N.C. DEM 1985, 1).

- DEM should hire an additional staff member for the Washington Regional Office who works exclusively, or primarily with agricultural sources of pollution. The current effort of 0.2 FTE on animal operations is clearly not adequate.

- DEM should should work the Department of Agriculture or the Extension Service to establish a regular schedule for inspection and/or monitoring of designated or permitted feeding operations.

- DEM, with DSWC, should assess the current and potential water quality impacts of aquaculture operations in the A/P region and what types of BMPs are most appropriate for these sources.

CHAPTER 9

CONSTRUCTION PRACTICES: SEDIMENTATION AND EROSION CONTROL

A. PROBLEM DEFINITION

When natural land cover is disturbed during the construction of residential and commercial structures or highways and bridges, the rate at which soil erodes can increase dramatically. Studies have shown that disturbed land may erode at rates up to 1,000 times greater than under pre-construction conditions (Simmons 1988). The subsequent increase in sedimentation (sediment delivered to streams, rivers, lakes and estuaries) results in water quality degradation. In terms of volume and effects, sediment is the largest single cause of water quality degradation in North Carolina, accounting for about 60% of all impaired waters (N.C. DEM 1989a).

Statewide, of the 60% of waters impaired by sedimentation from nonpoint sources, approximately 12% is due to general construction practices. This varies considerably by region, however: from 15% to 17% in the piedmont and mountains to less than 1% in the coastal plain (N.C. DEM 1989a). The problems of erosion and sedimentation are much less critical in the coastal plain due to the relatively low population density, flat topography and the presence of large-grain, sandy soils. By far, the largest source of sediment is agriculture, with forestry and to a lesser extent mining also contributing.

Although erosion within the coastal plain may be relatively minor, sedimentation generated upstream within the Piedmont may have significant effects in the lower portions of the A/P basins. In particular, the Upper Tar and the Upper Neuse Basins (both in the A/P drainage area) have been singled out as "the two most severely eroded basins in North Carolina" (N.C. DEM 1987, p.12). Upper basin sedimentation is made up largely of small colloidal materials that (1) remain suspended in the water column for great distances, often all the way to the estuary, and (2) are extremely "active" in terms of their ability to adsorb nutrients (particularly phosphorus), metals, and to some extent, toxic organic chemicals.

The water quality impacts caused by the transport and deposition of sediments is well documented, and some impacts can be long-lasting. In addition to introducing nutrients and toxic materials, sedimentation damages fish populations by destroying spawning beds, eggs and larval fish. Benthic organisms that serve as a food source for fish may be smothered and the increased turbidity hinders light penetration,resulting in reduced photosyn-

thesis by primary producers and eliminating some species from certain areas. Downstream, sediment also fills navigation channels, increasing the need for maintenance dredging.

It is important to note that there is not a one-to-one relationship between erosion (the movement of soil off-site) and increased sedimentation in waterways. Results of a recent study that sampled sediment data at 152 sites across North Carolina between 1970 and 1979 suggested that "only a small percentage of eroded material becomes suspended sediment in large streams. Compared to mean annual values of suspended sediment discharge, less than 5 percent of materials eroded in the rural agricultural basins of the Coastal Plain, and about 16 percent in the rural-agricultural basins of the Piedmont and Blue Ridge provinces become streamborne" (Simmons 1988, 102). The majority of eroded material is stored on upland slopes, flood plains, and in stream channels.

Erosion control may be said to "fail" if sediment is not retained on-site and away from flowing water. One or more of the following conditions cause the majority of erosion/sedimentation problems from construction sites, and these are the conditions that State and local programs must address:

1. Failure to consider erosion--Disregard of erosion potential during site selection, site planning and/or construction (e.g., building on steep slopes or flood plains or perpendicular to natural contours); failure to prepare and submit and erosion control plan.

2. Inadequate design of erosion control systems--Failure to adequately consider topography, potential soils loading, etc. in designing an erosion control system.

3. Poor operation and maintenance--Failure to inspect and maintain erosion control systems may cause more damage than is initially prevented.

B. EXISTING PROGRAMS

In 1973, the North Carolina General Assembly enacted the first regulatory program to specifically address nonpoint source pollution: The Sedimentation Pollution Control Act (SPCA). This law was re-enacted in 1981 and has been amended a number of times, most recently during both the 1988 and 1989 sessions of the General Assembly. The 1988 Bill, which became effective on January 1, 1989 made three important changes: (1) the North Carolina Building code was amended making receipt of a building permit contingent on an approved erosion control plan (where a plan is required); (2) out-of-state individuals that engage in land disturbing activities must

designate an agent in North Carolina; and (3) DEHNR was authorized to assess a maximum $1000 fine (one time only) for activities carried out without an approved plan. In addition, the 1988 amendments directed DEHNR to report to the General Assembly by October 1990 on the advisability of additional ammendments to strengthen State authorities under this law.

Two bills ratified in 1989 made the following major changes: (1) the exemption of forestry from the original 1973 Act was qualified so that any forestry operation that does not employ BMPs approved by the N.C. Division of Forest Resources will fall under the SPCA; (2) in deciding whether to approve or disapprove an erosion control plan, staff may consider (in addition to technical adequacy) the past performance of applicants; and (3) the maximum penalty for noncompliance was raised from $100 to $500 for each day of noncompliance. Most of these provisions became effective in October 1989, so it is too early to evaluate their effectiveness.

B. 1. Description of the Erosion and Sedimentation Control Program

The SPCA of 1973 created the Sedimentation Control Commission, which is charged with developing and administering North Carolina's erosion and sedimentation control program. The program is implemented by the DEHNR's Division of Land Resources (DLR), Land Quality Section which acts as staff to the Commission. Most plan reviews and inspections are carried out by DEHNR Regional staff, with oversight and enforcement actions largely handled by staff in Raleigh. The SPCA also authorizes local governments (counties or municipalities) who adopt an ordinance to implement their own program; however local programs must be approved by the Commission and must meet or exceed the minimum State standards. Local programs can be put on probation or have their authority revoked if they do not adequately administer the program. Statewide, approximately 40 local programs are in effect. In the A/P study area, five local agencies implement this program in the lower basin (DEHNR Washington Region): Pitt County, and the cities of Farmville, Greenville, Nags Head, and Kitty Hawk. In the upper basin (Raleigh Regional Office), seven local agencies are delegated: Wake, Durham, and Orange Counties and the cities of Raleigh, Cary, Henderson, and Rocky Mount.

General Requirements. For construction or other nonexempted land disturbing activity that will affect one or more contiguous acres, an erosion and sedimentation control plan must be submitted at least 30 days before work begins. This plan must be approved by the regulatory authority (either State or local) before any other permit can be issued for construction, demolition, reconstruction or related activities.

The SPCA is performance oriented with the requirement that measures must be designed to control sediment pollution from the peak runoff of a 10-year frequency storm (i.e., rainfall of an intensity expected to be equalled or exceeded, on the average, once in 10 years). The Sedimentation Control Commission has developed a manual that describes Best Management Practices (BMPs) for erosion control which can be used to meet the following specific requirements of the Act:

- A sufficient buffer zone must be established along any natural watercourse to contain all visible sediment to the first 25% of the buffer strip nearest the disturbed area.

- The angle of cut-and-fill slopes must be sufficient for stabilization and graded slopes must be vegetated or otherwise stabilized within 30 working days of completing any phase of grading.

- Off-site sedimentation must be prevented, and a ground cover sufficient to prevent accelerated erosion must be provided within 30 working days or 120 calender days, whichever is shorter.

Maintenance Requirements. During construction, the person financially responsible for site development is responsible for maintenance of erosion control practices. The landowner may also be held responsible. After construction is complete, responsibility passes to the landowner or the person managing the land.

Inspections and Enforcement. The SPCA authorizes the State or a delegated local agency to inspect all land-disturbing activities and to prosecute persons who either violate approved plans or who have undertaken construction projects without an approved plan. For highway and bridge construction, the SPCA is administered jointly with the State Department of Transportation (DOT), although DLR inspectors oversee and inspect DOT and contractor work. Target inspection frequency is once per month unless a notice of violation has been issued or an enforcement action is pending, in which case, sites are to be inspected every two weeks (although present staffing levels are insufficient to reach these target frequencies).

Enforcement sanctions available under the SPCA are civil penalties (fines); criminal penalties; and injunctive relief. Civil penalties up to a maximum of $1000 may be assessed (one time) for operating without an approved plan; penalties up to a maximum of $500 per day may be assessed for violations of an approved erosion control plan. Criminal penalties for willful violation may be imposed to a maximum of 90 days in jail and a $5000 fine. Also, court-ordered injunctions to stop-work may be obtained by the State for violators who continually fail to comply.

In addition, any person claiming damages due to violations of the SPCA may bring a civil action against the violator. (Where damages of $5000 or less are assessed, violators also must pay litigation costs.)

Exemptions. The SPCA exempts all land disturbing activities related to the production of agricultural products and all mining activities that are covered under the Mining Act of 1971. Land disturbing activity conducted for the production of forest products is exempt as long as "Forest Practice Guidelines Related to Water Quality" (forestry BMPs) are employed on the tract.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

The problem of controlling erosion and sedimentation generated by construction or forestry activities is moderately tractable. The effects of erosion both on land and in nearby watercourses are readily identifiable, and it is easy to assess whether or not specific BMPs have been implemented during a site inspection. The factors that cause erosion and sedimentation are well known as are the practices required to prevent the problem. Also, the costs of erosion control are usually small relative to the overall cost of a project. On the other hand, the target group is large, often influential, and diverse; it includes plan designers (e.g., landscape architects and engineers), grading contractors, developers and land owners.

C. 2. Clear and Specific Program Objectives

One of the SPCA's major strengths is the clarity and simplicity of its legislative intent. The Act and the program rules constitute an unambiguous mandate to prevent erosion and sedimentation from all non-exempted land disturbing activities. In several areas this mandate is expressed in quantitative terms that are, for the most part, readily measurable. However, since the Act is primarily performance-oriented (i.e., the end results, not any particular means for achieving it are required), there is significant room for judgement among field personnel or project engineers about whether any particular practice will operate effectively.

C. 3. Sound Theoretical Basis

The critical assumptions that serve as the foundation for the erosion and sediment control program are (1) design for the 10-year storm will provide adequate protection for downstream water resources; (2) available BMPs for erosion control can retain sediment on-site; and (3) allowance of 30 working days (or 120 calender days) for exposed areas to remain uncovered will provide adequate protection.

Of these, there is no evidence that the first two assumptions are not fully capable of protecting water quality. In particular, there seems to be universal agreement that available BMPs have a proven record and will work if installed and maintained correctly. On the third condition, there may be some controversy as other States allow less than 30 days. For example, Maryland recently reduced the time allowed for soil stabilization to 14 days overall and 7 days for stabilization around the perimeter of the site. The 30-day limit is particularly difficult to enforce because the rules allow contractors 30 working days from the "completion of any phase of grading",

and unless an inspector is present when grading is completed, it is impossible to know when to "start the clock." Since restoration of land cover is generally felt to be the single best method for reducing erosion potential, it is important that this requirement be sound and adequate to meet program objectives.

C. 4. Adequate Resources for Implementing Agencies

Major activities of the DLR, Land Quality Section staff under the sedimentation control program include erosion and sediment control plan reviews; site inspections; enforcement actions (notices of violation, referrals for enforcement); technical training and educational efforts; review of local ordinances and local programs; and the provision of technical assistance to local programs. Total staff for the program (November 1989) is approximately 27.5 FTEs plus approximately two FTE in DEHNR's Office of General Counsel (OGC) and one to two FTE attorneys in the Attorney General's office. Of the 27.5 FTEs, four are located in Raleigh with the remainder located in DEHNR Regional Offices. Regional staff must divide their time among two other programs in addition to sedimentation control (dam safety and mining), although these efforts are not included in the total of 27.5.

The general consensus among persons knowledgeable about this program is that the Land Quality Section is "terribly" understaffed. The N.C. Nonpoint Source Management Plan (N.C. DEM 1989b, p.58) specifies the need for an estimated 300% to 400% increase in staff. There has been no additional funding since 1987 for this program; as illustrated in Table 9-1, in spite of a dramatic increase in the number of plan reviews, the number of site inspections and local program reviews have actually gone down over the last year. In many cases, regional sedimentation specialists are responsible for hundreds of projects in 8 to 10 counties and simply cannot provide adequate oversight, let alone plan review, enforcement actions, and training. As an example, the Washington Regional Office has two inspectors that cover 21 counties. In October 1989, these two technicians were responsible for sedimentation and erosion inspections at approximately 500 active construction sites and 30 to 40 DOT projects; their job also includes semiannual inspections at 200 mines, and safety inspections for about 85 dams.

In some cases, local programs have even greater funding problems, and the staff frequently are liable to be assigned to other jobs as well (building inspections, engineering plan reviews etc.). The NPS Management Plan recommends the State adopt a cost-share program to fund additional local program staff that are needed to supplement State personnel.

TABLE 9-1. SPCA FUNDING AND PROGRAM ACTIVITIES, FY86-FY89

	FY 86	FY 87	FY 88	FY 89
Total State Funding (x$1000)	906	1,225	1,159	1,159
No. Sedimentation Site Inspections	8,582	10,038	13,202	11,376
No. Erosion & Sediment Control Plans Reviewed[a]	1,319	1,484	1,975	3,011
No. Local Sediment Control Ordinances Reviewed	53	27	31	17

a Includes reviews for both initial and revised plans.

C. 5. Adequate Incentives and Sanctions

Currently there are no incentives (i.e., positive benefits for maintaining compliance) under the SPCA. In fact, there is a positive incentive to save money by not complying. For sanctions, civil penalties (fines) are the most commonly used enforcement tool. Fines are assessed for noncompliance or for operation without an approved plan, with the average fines ranging from $2,500 to $10,000. Of all those who are assessed a civil penalty, about one-tenth pay the assessed fine; the remainder either negotiate a reduced settlement (usually about 70% of the original fine) or appeal the fine in an administrative hearing.

While the current enforcement process is much improved over the situation several years ago when OGC had only one FTE assigned to the program and cases were backlogged sometimes for several years, still the process for assessing and collecting civil penalties is extremely slow and does not provide a timely deterrent. The process often takes three to four months from the time a violation is discovered until a fine is collected; where assessments are appealed, cases can take a year or more. In some of these cases, sites remain out of compliance with off-site damage occurring. In other cases, the project has been completed but fines either have not been paid or are being appealed. A previous review of the SPCA enforcement program noted that in some cases, field staff do not even refer cases of violations to OGC because they cannot expect any action in time to prevent damages before the project is completed (Carolina Resource Consultants 1987).

The result is that the State is frequently in a position of seeking payments after the fact for water quality degradation from erosion and sedimentation rather than preventing such damage from occurring as was intended by the law. The problem lies not in lack of staff or staff dedication, but in the legal constraints imposed by the law itself. By its nature, the process of assessing civil penalties is cumbersome and is not well suited to serving as a deterrent. Developers faced with large interest payments and tight schedules may simply find it cost-effective to pay a relatively small fee sometime in the future and continue with their work. The increased maximum fine (up to $500/day) effective in October 1989, may mitigate this situation somewhat by increasing the potential liability of noncompliance, but the lengthy assessment process will continue to reduce the deterrent intent of the increased penalty.

C. 6. Access to Supportive Constituency Groups

Formal involvement of the public and environmental groups in the sedimentation and erosion control program is relatively limited. Parties who are directly damaged by violations of the SPCA may prosecute responsible parties under the law. The other important method of participation is that members of the public notify headquarters and Regional staff of erosion control problems.

C. 7. Adequate Training, Technical Assistance and Education

In 1988, program staff and other agencies completed a comprehensive and detailed technical manual for the design and operation of sedimentation and erosion control measures (Sedimentation Control Commission et al. 1988). Also, the staff of the Land Quality Section generally has conducted annual workshops and conferences to train engineers, contractors and local officials involved in erosion and sediment control planning. Some educational efforts also are carried out in schools.

In spite of these efforts, there is apparent agreement that present training efforts are not sufficient. The North Carolina Nonpoint Source Management Program notes that "there is an extensive need for education and technical training for Land Quality Section and local program staff, the development industry, construction industry and design professions" and suggests that a full-time training officer is needed (N.C. DEM 1989b, 58). Another program review found that there is often no strong incentive for people who would benefit from training to participate in the annual training sessions. "This is especially true for smaller engineering and construction firms and local contractors who are reluctant to send people out of town to be trained or who see no urgent need to do so when the penalty for noncompliance with the SPCA is uncertain or insignificant" (Carolina Resource Consultants 1987, 4). Finally, recently completed evaluations of erosion and sedimentation control programs in Pennsylvania and Virginia placed great emphasis on the need for expanded technical training among program personnel (Virginia DCHR 1988).

Related to the question of training is the need for some level of certification for contractors and/or inspection officials. Maryland has a certification program for contractors and is considering the development of a certification program for inspectors. At least four other State erosion and sedimentation control programs have mandatory training in their statutes (Virginia DCHR 1988). By requiring grading contractors to be certified (or to have a certified individual on the site), they cannot claim ignorance--and thus "buy more time"--when an inspector notes a clear violation or poorly maintained practice.

Whether certification is adopted or not, North Carolina should evaluate whether the type of training currently conducted is conducive to mastering technical material. Current workshops follow the model of a conference, rather than hands on, participatory problem solving.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

It is clear that the State staff in the Land Quality Section are highly motivated, competent, and concerned about implementing the SPCA to protect water quality. The 1987 Carolina Resources Consultants report noted that within the program there is high morale and excellent communication, although many staff members "expressed frustration at their inability to do a better job, which they attributed primarily to legal and administrative restrictions under which the program operates."

Where programs are implemented by local authorities, it is not always true that the agencies are fully committed to water quality objectives. In some cases, the lack of trained staff and/or conflicts with other local officials may hamper enforcement activities. For example, of the 12 local programs currently operating in the A/P region, four have been on probation within the last five years and authority for another local program, in Havelock, was revoked. In all cases, DLR staff report that the principal problems involved failures to take appropriate enforcement actions against sites where there was continuing violations and off-site damages.

D. ISSUES OF CONCERN

- State staff, both in Raleigh and the Regional Offices, are spread extremely thin, and cannot carry out inspections with adequate frequency, nor give adequate oversight to approved local programs. One State staff member noted that under better conditions, more local program authorizations might be revoked; however, the State does not have adequate staff to take on the additional responsibilities that would come with dissolution of the local programs.

9: Sedimentation and Erosion Control

- Because erosion control plans are not State "permits", like NPDES or CAMA permits, the State cannot collect permit fees. (However, nearly all delegated local programs require that developers pay fees to cover plan review and site inspections.) As a result, there is no continuing source of funding to help defray program costs. As the number of construction projects continues to increase, and with the addition of forestry practices to the already heavy workload in the Land Quality Section, staff efforts may become further diluted.

- The process for assessing civil penalties is, necessarily, extremely slow and cumbersome. Compliance attained many months after a notice of violation does little to protect downstream property ownerts or attain the objectives of the Act. Serious sedimentation problems can remain unchecked while lengthy enforcement procedures are carried out.

- The fines (civil penalties) themselves may not be of sufficient magnitude to deter violations, although the recent increase in allowable penalties may address this issue. In particular, the level of penalties assessed (usually following appeal) are not significant compared to developers other costs and the advantages that come from saved time.

- While some local programs are undoubtedly more effective than the State program (i.e., they have stricter standards, carry out more inspections and enforcement, and achieve higher levels of citizen awareness), other local programs frequently fail to meet the minimum State requirements. This occurs primarily when the programs are understaffed and/or not adequately trained, or when program staff are reluctant to carry out enforcement because of conflicts with or political pressures from other local officials.

- Other than for areas with steep slopes, currently, there are no special requirements or guidelines for erosion and sediment control in environmentally sensitive areas (e.g., flood plains, AECs or near ORWs). Recently, additional requirements for construction in areas surrounding High Quality Waters were approved and will become effective in May 1990.

E. RECOMMENDATIONS

Many of the recommendations below would require amendments to the SPCA in order to be implemented. However, most of these changes have already been discussed within DLR or proposed, and in many cases they have been adopted by other States or by local programs within North Carolina. The Land Quality Section in DLR is currently reviewing the feasibility of many of these recommendations.

E. 1. Increase Staff to Implement the SPCA

- It seems clear that the current level of staff support is not adequate to effectively implement the SPCA. Additional staff are needed in the Regional Offices to review plans, carry out inspections, work with local programs and investigate site-specific problems. More staff would also be needed to upgrade current opportunities for training.

- DEHNR should investigate the possibility of providing a paralegal assistant or a part-time or shared attorney for the staff in each Regional Office. This person would carry out searches to determine property owners or responsible parties, arrange for service of notices of violation, and do other enforcement-related work for SPCA and other laws. This would free engineers and other technical staff to do the field work for which they are trained and needed (Carolina Resource Consultants 1987).

E. 2. Implement Permit Processing Fees

- At least four States, as well as local programs in North Carolina, recoup a portion of erosion control program expenses by assessing a processing fee for plan review. In Virginia's recent review of their fee system (Virginia DCHR 1988), it was recommended that the existing upper limit on fees be removed to allow programs to cover all administrative and enforcement costs if desired. Other similar permitting programs (e.g., NPDES, Building Permits, Subdivision Permits) assess reasonable permit fees.

E. 3. Improve Enforcement Capabilities

Enforcement is often the most frustrating part of the SPCA for many DLR and local program personnel, and the DLR is examining various options to improve enforcement capabilities. Several strong possibilities that should be considered are listed below.

- Consider authorizing sedimentation control inspectors or Regional Engineers to issue stop-work orders for activities that involve either operating without a plan or for continuing violations of plans that are causing off-site damage. Stop work orders should apply to the whole project, not just land disturbing activities, to ensure that problems will be corrected even after earth moving has been completed. Stop-work orders provide an immediate deterrent effect because they affect what is often the developers' most important commodity, time. This authority would be analogous to that which is already held by building inspectors or the Corps of Engineers (who may issue cease and desist orders when dredge and fill permits are violated). Some local programs in North Carolina (e.g., Orange County) use stop-work orders and rarely assess civil

penalties. Stop work orders are also authorized under the Virginia and Maryland Erosion and Sediment Control Programs. It is important to note that the effective use of stop-work orders depends on adequate frequency of inspections; violations must first be discovered (preferably before significant erosion has occurred) before they can be stopped.

- Consider developing set fines for specified types of violations. Such fines could be issued by an inspector for each day of noncompliance. These would be similar to traffic tickets issued by patrolmen; violators would be given a certain period to pay or else to contest the fine. Such a system would also have a more immediate deterrent effect, as the fines could be assessed in much less time that is required for civil penalties.

- Consider requiring financially responsible parties to post a performance bond or surety to assure compliance with approved plans. Return of the surety should be based on the achievement of adequate stabilization, not project or land disturbance completion; and surety monies should be available to repair off-site damages, with the Department able to bill the party for costs that exceed the amount of the surety (Virginia DCHR 1988). The North Carolina Mining Act already requires a surety bond from applicants prior to receiving a mining permit, and several local sediment control programs in North Carolina (e.g., Durham County) require bonds under their program.

E. 4. Improve Inspection Procedures

- Generally the frequency of inspections should be increased. The State should adopt as a goal that site inspections be carried out at least every two weeks during the period of active construction on any site (pers. comm. Ray Burby, UNC). Inspections are the primary deterrent against violations, and as contractors come to understand that the probability of discovering violations is high, voluntary compliance will improve.

- It should be State policy that the frequency and number of site inspections should be based on factors such as: the amount of activity at a site; whether the site is located in a water quality critical area; results of previous inspections; and the experience of responsible parties.

- All large construction sites or sites in critical watersheds should be inspected after major storms to check effectiveness of erosion and sediment controls.

E. 5. Improve Training and Education

- The DEHNR should adopt the recommendation of the NPS Management Plan and hire several full-time training staff to develop training programs for builders, contractors, local program officials, and State inspectors.

- Educational efforts should focus more strongly on formal technical training, possibly with post-program testing to ensure an acceptable level of achievement. The training should include greater individual participation by using case studies (tied to the local area where the training is given) for small group discussion. Successful participants should be given a certificate recognizing their level of achievement.

- Another educational effort should be to develop instructional materials, based on real situations, for use in college or continuing educational courses that address sediment and erosion control practices.

- In addition to the large and detailed technical design manual recently completed by the Sedimentation and Control Commission, a smaller manual that is readable and usable at the field level (20-30 pages, waterproof cover) could be produced. This would include pictures of basic practices, warnings, a checklist for site preparation, a list of resources for assistance and additional information, etc. Such a field guide has been prepared in Washington State with assistance from the Association for General Contractors (with funds from the Puget Sound Water Quality Authority). It is now distributed, along with the safety manual, to all contractors, who may request additional copies for foremen and job site supervisors.

E. 6. Investigate Requiring Certification for Inspectors and Contractors

- Once adequate training is available, DEHNR should require that all local program officers complete the training to retain full authority.

- Once training has been available for several years, DEHNR should require that all erosion control plans submitted for approval must be prepared, or reviewed and certified, by someone who has completed the training (unless the person is, for example, a registered engineer or landscape architect).

- Certification should be valid for a specified period of time (e.g., two to three years). A requirement that certification be renewed will ensure that contractors and inspectors are familiar with particular problems or changes in the law, new or alternative control methods, etc.

CHAPTER 10

MARINAS AND MARINE WASTE DISPOSAL

A. PROBLEM DEFINITION

In a June 1986 memorandum discussing State policies regarding marinas, David Owens, then Director of the N.C. Division of Coastal Management (DCM), noted that the siting of new boat slips required considerable attention by Division staff and that "as boating use continues to grow, the demand for in-water docking space will also grow, raising questions regarding conflicts with other uses, marine habitat alteration, water quality impacts, and public trust area allocation." Indeed, marina development in the A/P region, represented by the number of marina slips, has grown steadily, with an increase during the past decade of 29% (Tschetter 1989). In real numbers, 6,051 marina slips were constructed in the twelve coastal counties included in the A/P region between 1978 and 1988 (pers. comm. George Matthis, DCM), and this figure does not include individual docks and piers associated with homes or condominium projects.

As an overall source of water quality impacts, marinas and boat discharges are relatively minor. In 1988, DEM estimated that 1,089 acres of estuarine waters in the A/P region were impaired by marinas (NC DEM 1989), an area that represents only about 1% of the impaired estuarine waters. However, marina activities can have a substantial impact on local water quality, particularly in small rivers or embayments. The greatest risk occurs in waters where recreational boats are heavily concentrated and where dilution is limited and poor flushing conditions exist.

Unfortunately, protected waters that are desirable for marinas, mooring areas, and anchorages are also often the most susceptible to damage from pollution because of their poor flushing characteristics (Flushing refers to the degree of mixing between water within the marina or basin and adjacent waters). Basin marinas are also desirable from the standpoint of limiting obstructions within public waterways; however, from a water quality standpoint, open water marinas, with greater flushing, would be desirable.

Water quality impacts associated with marinas and boat use include marina construction, maintenance dredging to maintain necessary water depth, day-to-day marina operations, and boat discharges (especially sewage). However, much of the controversy concerning the water quality impacts of marinas has focused on fecal coliform inputs associated with boat discharges and the effect of increased coliform levels on the shellfish industry.

10: Marinas and Marine Waste Disposal

Since 1986, the Shellfish Sanitation Branch has recommended shellfish harvesting prohibitions in the vicinity of all marinas in SA waters. The closure policy was adopted following a 1985 survey which noted that 75% of all marinas located in North Carolina's SA waters were closed to shellfish harvesting because of elevated fecal coliform concentrations (N.C. DEM 1985a).

Studies conducted throughout the Southeast have documented elevated fecal coliform levels at marinas (N.C. DEM 1985a), but well-designed quantitative studies in North Carolina are limited. One of the best studies (Fisher et al. 1987) was a 1985 monitoring survey of two Bogue Sound marinas, one basin type and one open water marina. Results indicated clearly that higher coliform counts were associated with high boat occupancy and usage. In both the basin and open water marina, shellfish standards were violated near the docks; in the basin marina, the coliform standard for primary contact recreation was also violated. At stations sampled 1000 feet away from the docks, only the basin marina continued to violate shellfishing standards.

Conflicting results were obtained by a DEM water quality survey in thirteen coastal marinas (including eight marinas in the A/P region) during the summer of 1988. This screening level survey did not identify consistent violations, and there was no evidence that marina activities were responsible for the infrequent violations observed. DEM staff suspect that boat operators are flushing their sewage systems outside of the marinas, so the coliform counts inside the marinas are not elevated. Overall, dissolved oxygen concentrations were slightly lower inside the marinas, which DEM attributed to sediment resuspension following dredging, rather than day-to-day marina operations (pers. comm. Mary Jaynes, DEM).

The specific problems and sources of contaminants associated with marinas and recreational boat use are summarized below:

1. Marina construction--Dredging may damage critical habitats and shellfish resources by uprooting organisms and submerged vegetation and resuspending toxic contaminants, organic materials, and sediment. Dissolved oxygen levels also may drop as the resuspended organic materials decompose.

2. Marina operation--Boat maintenance activities, such as paint scraping and fueling, can introduce heavy metals and hydrocarbons into marina waters. Other sources include leaking gasoline storage tanks, anti-fouling preservatives on pilings, and accelerated run-off from paved surfaces. Additional maintenance dredging may cause the resuspension of organic materials and contaminants as well as disturb benthic communities.

3. Boat use--Raw sewage introduces fecal coliform and associated pathogens which contribute to bacterial contamination of shellfish as well as hazards for water recreation. Sewage also contains nutrients and BOD wastes, and treated wastes may contain toxics

such as formaldehyde and chlorine. Other contaminants from boat use include hydrocarbons from boat motor exhaust, cleaning solvents, and general litter.

4. Sewage treatment--Where wastes are transferred from boats at pump-out facilities, they must be treated on-site (at the marina) or transferred to a municipal treatment plant. The ability of on-site treatment systems at marinas to handle the potential volume of waste is a concern. Recent evidence indicates that chemicals used in boat holding tanks will not disrupt treatment under normal operation, where wastes are diluted at least 50% (Novak et al. 1989).

B. EXISTING PROGRAMS

The construction and, to some extent, the operation of marinas is regulated under the CAMA permit program for Areas of Environmental Concern (AECs). Permit standards adopted by the Coastal Resources Commission (CRC) specify criteria for the siting and construction of marinas, docks, and piers in estuaries, wetlands, and public trust waters. DCM implements this program in conjunction with the State dredge and fill permit program.

In addition to the CAMA permit, marina projects requiring basin and/or channel excavation must receive a 401 certification from DEM (a statement that State water quality standards will not be violated) and a Section 404 dredge and fill permit from the U.S. Army Corps of Engineers (COE). However, federal participation in marina siting has been minimized by creating a general 404 permit that is automatically issued to projects that have received a CAMA permit and the 401 water quality certification. In effect, all permit review and approval responsibilities have been delegated to the State agencies.

Currently, there are no State programs aimed at controlling sewage discharges from boats. This source is regulated under Section 312 of the federal Clean Water Act in a program implemented by the U.S. Coast Guard. Both the CAMA permit program and the Section 312 marine sanitation program are described below.

B. 1. Coastal Area Management Act (CAMA)

CAMA Permit Review. Marina development proposed in estuarine areas (designated AEC's), must be approved for a major CAMA permit by DCM before construction can proceed. The permit review process involves two primary considerations: (1) consistency with specific marina design requirements described in CAMA; and (2) an analysis of whether predicted water quality impacts will violate State antidegradation provisions.

10: Marinas and Marine Waste Disposal

DCM relies heavily upon the expertise of other agencies to determine whether a marina will have detrimental impacts on coastal resources. In its review process, DCM circulates marina proposals to multiple State and federal agencies and considers all comments before making a final decision. The most influential comments usually are submitted by the Division of Marine Fisheries (DMF), DEM, and the Division of Health Services' Shellfish Sanitation Branch. However, all review agencies can request additional conditions in the permit. The agencies interact as follows:

- DMF determines if harvestable shellfish resources exist at the proposed marina site. DMF also examines potential impacts on primary nursery areas and submerged macrophytes.

- The Shellfish Sanitation Branch determines if the proposed marina would result in a shellfish harvesting closure. Closures are recommended automatically if a marina is to be constructed in Class SA waters and a shellfishing resource exists. Other situations must be assessed on a case-by-case basis; for example, proposed expansions of existing marinas in closed SA waters may or may not result in additional closures. Shellfish closures are designated by DMF based upon Shellfish Sanitation's recommendation.

- DEM determines if the proposed marina will result in violation of numerical water quality standards, use support, or antidegradation provisions. DEM examines information submitted by DMF and DHS and may also sample existing water quality and employ modeling to predict water quality changes. If standard violations are predicted, DEM will not issue the 401 certification required as a prerequisite for the Section 404 dredge and fill permit.

- DEM also reviews marina plans for compliance with coastal stormwater regulations.

In terms of water quality and resource impacts, the most frequent considerations in marina permit reviews are potential loss of productive shellfish beds and potential harm to primary nursery areas (PNA's). For example, marina construction in SA waters is often blocked because a shellfish use would be degraded by the Shellfish Sanitation Branch's automatic closure rule. To a lesser extent, damage to submerged vegetation or coastal wetlands is also considered. CAMA specifically prohibits new dredging through PNA's and siting marinas in or near productive shellfish waters that have been harvested since 1975 (after which antidegradation rules apply). Maintenance dredging is permitted on a case-by-case basis.

An approved CAMA permit usually specifies marina dimensions and construction requirements, such as dredging depth and provisions for pump-out facilities. Operation requirements, such as establishment of non-discharge policies, may be stated in the permit. Water quality conditions are seldom specified in the permit, although water quality monitoring requirements recommended by DEM were included in a recent permit.

Several marina design requirements in CAMA are especially relevant to protecting water quality. Specifically, the location of boat maintenance areas must ensure that all scraping, sandblasting, and painting will occur over dry land with adequate containment devices to prevent entry of waste materials into adjacent waters. Also, notices must be posted informing boaters that the discharge of sewage is prohibited, and explaining the local availability of pump-out facilities.

Exempted activities. Prior to June 1989, docking facilities accommodating less than 10 boats were not defined as marinas and thus were exempt from the automatic closure policy. As of June 1, 1989, this exemption was expanded to include docking areas accommodating up to 30 boats as long as the boats are 21 feet in length or less and without installed heads. Such facilities are issued dock/pier permits, which must also be circulated to the review agencies, but are subject to fewer requirements. General permits can be issued to individual homeowners who wish to construct a dock for personal use, without review by other agencies.

B. 2. CWA Marine Sanitation Program

Section 312 of the CWA prohibits the discharge of untreated wastes from marine toilets in all waters within three miles offshore. The regulations do not require boats to be equipped with an installed toilet or marine head; for example, portable toilets are not considered installed and are not subject to these regulations. However, boaters that do have marine heads must comply with the law by installing a Coast Guard approved marine sanitation device (MSD). Federal regulations list three types of approved MSDs: Type I and Type II MSDs are treatment devices, and Type III MSDs are holding tanks which must be pumped out at docking facilities. Boats under 65 feet in length must install either a Type I, II, or III MSD; boats over 65 feet long must install either a Type II or Type III MSD. However, neither the CWA or federal regulations require marinas to install the pump-out facilities necessary to unload holding tanks.

Rogers and Abbas (1982) reported that the majority of recreational boats registered in North Carolina are less than 16 feet in length and 98 percent are less than 26 feet. While vessels used in coastal waters are probably larger than the average for the State, still, many boats are unlikely to have installed heads, and thus are exempt from the discharge restrictions (owners can legally dispose wastes overboard with a bucket). On larger boats, the most common MSD is the Type III holding tank. The availability of pump-out facilities has been rather poor in North Carolina (9 in the state in 1981); however, the development of low-cost portable equipment has spurred an increase in facilities to at least 21 in 1988.

Despite the improvements, use of the pump-outs remains rather low and it appears that many boaters are flushing their systems into open waters beyond the marina boundaries. A recent survey of boaters in the Maryland waters of Chesapeake Bay found that "of the 500 boaters interviewed, 320 of whom owned boats with holding tanks or self-contained toilets, less than 20% had ever used a pumpout service." Even boaters with holding tanks who were

interviewed at marinas with pumpout services reported using the services about 50% of the time and discharging overboard for the remainder (Gibson and Arnold 1988, 853).

Originally, Section 312(k) empowered only the U.S. Coast Guard to enforce the marine sanitation regulations (with minimum fines of $2000 for each violation). However, in 1987, the Act was amended to allow enforcement by the States. No States in the Southeast have obtained enforcement powers, and at least one reason is that the ultimate fate of money collected is unclear. One interpretation of current wording in the Act is that even if States take over enforcement responsibilities, all fines would revert to the U.S. treasury. However, new federal legislation has been proposed to clarify the situation (pers. comm. Jonathan Amson, EPA (OMEP), Marine Operations Div.).

EPA regulations also allow states to petition EPA to prohibit all discharges, whether treated or not, from marine toilets (40 CFR 140.4). Petitions for No Discharge Zones must meet a number of specific requirements, the most important of which is the provision of adequate and reasonably priced pump-out facilities in the designated area. To date, EPA has approved very few such "No Discharge Zones" (most are in small bays in California). The Virginia State Water Control Board has petitioned EPA for a No Discharge Zone and the Chesapeake Bay Commission has adopted a resolution that border States "...actively pursue the elimination of sewage discharge from boats and the eventual designation of the Bay and its tributaries as a No Discharge Zone" (Chesapeake Bay Commission 1989, p.14).

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

First, it should be noted that the problems associated with marina development include issues other than water quality. Perhaps of equal importance in siting are questions about whether marina structures will interfere with public uses of the waterway. These are land use questions (balancing public interests against private rights to use the shoreline), and the problem might be considered rather intractable for this reason alone.

If one accepts that the construction of a marina will have some impact on water quality, then the appropriate questions are: what level of impact is acceptable, what impact is likely to occur, and how can impacts be minimized. The significant problem lies with the second question, i.e., understanding cause and effect relationships. Current knowledge makes it extremely difficult to predict, in advance, if a particular marina will impair water quality beyond acceptable levels (Fisher et al. (1987) list the numerous factors that need to be taken into account).

The technology for minimizing marina impacts is well developed (marina design, good housekeeping practices, MSDs, and pump-out facilities). However the size of the target group is large and includes developers (during the initial permit phase), marina operators, and recreational boat owners.

C. 2. Specificity of Program Objectives

The overall goal of CAMA is to establish a coordinated and balanced program for managing coastal resources. Like any program that addresses land use, regulatory actions require numerous balancing judgements; thus, the objectives are full of words that sound helpful, but in fact are subject to a great deal of uncertainty or interpretation: "compatible development", "continued productivity", etc. In fact, the management objectives for estuarine AEC's (where most marina development occurs) are somewhat contradictory: to "establish a management system capable of conserving and utilizing estuarine waters so as to maximize their benefits to man and the estuarine system." Clearly, activities that benefit people are often detrimental to the health of the estuarine system.

Siting criteria do specifically prohibit marina construction in certain "critical land and water areas" which include primary nursery areas and harvestable shellfish waters. The regulations attempt to protect other critical areas, such as wetlands, but are significantly weakened by an exception: the rules state that, marinas shall "not disturb valuable shallow water, submerged aquatic vegetation, and wetland habitats, except for dredging necessary to access high-ground sites." In such cases, personal judgements (of both the DCM staff and the CRC members), can play a major role in determining whether or not a marina permit is issued.

For boat discharges, the objectives of Section 312(b)(1) are extremely clear: federal standards "... shall be designed to prevent the discharge of untreated or inadequately treated sewage into or upon the navigable waters from new vessels and existing vessels, except vessels not equipped with installed toilet facilities." Note however that the objectives are also extremely narrow (water quality is not mentioned); contain a major exemption (boats without installed heads); and are very limited in scope (the ultimate fate of boat sewage is not addressed). The remainder of the evaluation looks beyond the limited objectives of this program and compares performance with a broader objective of mitigating water quality impacts from boat discharges.

C. 3. Sound Theoretical Basis

As noted under above, marina siting questions suffer from the absence of a good method for predicting the water quality and resource impacts of salt water marinas. This point was emphasized in a recent federal evaluation of North Carolina's coastal program (NOAA 1989). NOAA's recommendation was that the State should develop "more precise and predictable marina siting regulations based on appropriate scientific documentation."

A related issue is whether DCM's recent change in the definition of marinas will allow some developments to "slip through the cracks." Facilities not defined as marinas (which now includes docking facilities for up to 30 boats) are exempt from the automatic shellfish closure policy. The concern is that without automatic closure, the permit is expedited and may not receive careful scrutiny, while the future use of the facility by headless boats less than 21 feet in length will be extremely difficult to enforce.

For the limited objectives of the current marine sanitation program, the program theory is basically sound; however, it is difficult to enforce the use of MSDs, only their installation where required. For the larger question of protecting water quality, the "theoretical basis" does not yet exist. For example, there is no provision for ensuring adequate pump-out facilities for boats with holding tanks. DEM has recently made pump-outs a requirement in some marina permits, but the vast majority of marinas do not have facilities (N.C. DOT 1988). In addition, the vast majority of boaters who do not have installed heads are not required to treat their sewage in any way, and the water quality effects of this exemption are not known.

C. 4. Adequate Resources for Implementing Agencies

The number of all CAMA permit applications processed by DCM has risen from 852 in 1980 to 1870 in 1988. Marina permits have increased substantially over this period as well (Table 10-1). However, staffing levels have not kept pace with the increase in workloads, and enforcement activities have suffered as a result (pers. comm. Preston Pate, DCM). Recently, a federal review of North Carolina's coastal management program cited DCM staff reductions and reassignments as a source of permit backlogs; the reviewers recommended that the State "seriously consider the creation of additional staff positions for the four regional offices and Raleigh office" (NOAA 1989, p.12).

As for the Coast Guard's marine sanitation program, this agency is clearly overwhelmed by the number of boats subject to the MSD requirements and cannot even begin to monitor for compliance.

TABLE 10-1 CAMA MARINA PERMITTING ACTIVITIES, 1980-1988

	1980	1981	1982	1983	1984	1985	1986	1987	1988
No. permits processed[a]	10	13	12	21	36	23	26	17	22
No. permits issued	9	13	12	20	36	21	24	13	19

a This table does not include permit applications that were withdrawn, or applications for pier permits, and therefore underestimates the DCM marina work load.

C. 5. Adequate Incentives and Sanctions

CAMA empowers DCM to seek criminal penalties, civil penalties ranging from $100 to $2500 daily, and injunctive relief for the restoration of wetlands and estuarine waters damaged by permit violations. In the past, criminal cases were seldom pursued, and most marina violations were assessed a minimum civil fine of $100 (pers. comm., Preston Pate, DCM). The majority of violations, however, involve unpermitted construction rather than noncompliance with permit conditions; in most of these cases, penalties are not imposed simply because it would require time and effort that the limited staff cannot afford to spend.

The ability of DCM to collect compensation for wetlands restoration is threatened by a court case originating in Carteret County. The State Court of Appeals upheld a lower court decision that CAMA permit violators had the right to a jury trial in cases where injunctive relief for AEC restoration was sought by DCM. The State Supreme Court has agreed to make a final ruling on the case. If the lower court ruling is upheld, DCM's power to enforce AEC restoration will be greatly reduced because DCM does not have the large staff needed to prepare pretrial documentation.

The problem of sewage discharges from boats is one where there is neither a viable set of incentives or sanctions. Conventional wisdom is that the discharge of raw sewage is a common occurrence, and even the Coast Guard estimates that only about 20% of the affected vessels comply with marine sanitation regulations (Chesapeake Bay Commission 1989).

Under Section 312, the Coast Guard may impose fines of $2000 for violations of MSD requirements. In this case, the penalty is thought to be inappropriately high, and is one reason why the regulations are not enforced. In theory, there is no reason why the law could not be enforced; requirements for life jackets, fire extinguishers, etc. are taken seriously by boaters due to spot checks. However, at this point, the Coast Guard simply does not have the commitment, the resources or the necessary enforcement tools to implement this law.

In the absence of feasible sanctions, the program should provide incentives to comply, however, these also are lacking. The most direct incentives would be a coordinated boater education program and greater availability of pump-out facilities as well as dump stations for portable toilet equipment. In Gibson and Arnold's survey (1988) when boaters were asked what could be done to encourage greater use of pumpouts, the most frequent response was "to provide more facilities throughout the area."

C. 6. Access to Supportive Constituency Groups

Application for a major CAMA permit, required for marina development or major modification to an existing marina, must be announced in the legal section of a major newspaper in the county where construction is proposed. Adjacent riparian property owners must also be notified of proposed marina

construction and modifications. The public can request a copy of the field report prepared by the DCM field staff and submit written comments which are read and considered by the permit officer. However, a public hearing is not mandatory and can only be requested by the DCM staff. Recent amendments to CAMA now require public notice when a significant modification is proposed to a major permit application or to a previously issued major permit. Members of the public who have expressed interest in a specific permit case also are notified of proposed amendments to the permit application.

C. 7. Adequate Training, Technical Assistance and Education

State and Regional CAMA staff provide training and technical assistance to Marina operators to some extent. However, a primary need is for greater training and education of boat owners about the potential water quality effects of boat use (e.g., cleaning, gas spills, and waste disposal). The distribution of the DOT's North Carolina Coastal Boating Guide in 1988 was a good effort for publicizing the location of pump-out facilities. Much more could be done to provide educational materials and questionnaires to owners--e.g., when they pay for their annual boating licenses.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

The DCM, which was created specifically to implement CAMA, is strongly committed to the program goals. The staff commitment to preserving water quality is sometimes questioned when a marina permit is approved, but the Agency cannot deny a permit unless a CAMA rule is clearly violated or other review agencies submit documentation supporting their objections. The staff's commitment was apparent during interviews, when they expressed frustration over the lack of enforcement and their own inability to deny permits in cases where other agencies withdrew objections to a marina project.

In contrast to the general support for CAMA both within and outside DEHNR, the Coast Guard's marine sanitation program is practically moribund. The fact is that this program is administered by a federal agency whose primary mission relates to border patrols and rescue services--not water quality. However, State legislatures around the Chesapeake Bay have been actively engaged in developing new programs to supplement the Coast Guard's authority. For example, the Virginia General Assembly adopted regulations in 1975 requiring marinas to develop a plan for onshore sanitary facilities and pump-out stations. In 1987 these regulations were strengthened to (1) provide minimum design criteria for pump-outs; (2) require all establishments with pump-out facilities to operate them; and (3) require marina operators to provide a dump station for portable toilets. In 1987, the Maryland General Assembly endorsed the use of State Waterway Improvement Funds for building and maintaining pump-outs; and in 1989, the State enacted a bill to prohibit the construction of new marinas unless adequate pump-out facilities are located within 2 miles.

D. ISSUES OF CONCERN

- The full extent of water quality impacts due to marinas are unknown. Most monitoring has focused on assessing fecal coliform contamination; while DEM's most recent marina study examined DO levels, well designed studies to account for nutrients, BOD, hydrocarbons, and metal contaminants are needed.

- The marina development regulations apply only within the twenty coastal counties under CAMA jurisdiction. Marina development on freshwater streams in much of the A/P basin is not regulated.

- The cumulative effects of numerous small facilities (docks or piers that have 10 or fewer slips) may not be adequately considered under the existing program. During permit reviews, DMF regularly comments on the negative cumulative impact of the small docking facilities, but without supporting comments from other agencies, DCM does not have sufficient evidence to legally deny a dock-pier permit.

- DCM does not have adequate staff to routinely inspect marinas for compliance with permit conditions, or identify poor practices that may result in water pollution.

- The majority of recreational boats registered in North Carolina do not have installed toilets and are exempt from the marine sanitation regulations. Of even greater concern (since it is more likely that waste is being discharged) is the large number of boats that do have installed heads, but which do not comply with the MSD regulations. The Coast Guard estimates that at least 4 of every 5 boats with an installed toilet uses a "through hole" for direct discharge of waste.

- The Coast Guard does not actively enforce federal regulations requiring MSDs, and the State has not chosen to take over this responsibility.

- Adequate pump-out facilities may not be available. In the A/P region, there are 73 marinas with 3,630 slips and only 12 pump-out facilities (N.C. DOT 1988). And as the Chesapeake Bay Commission (1989) noted, "adequate" goes beyond the simple presence of the equipment at a marina. Depth of water at the pump-out station must be adequate to accommodate users, pump-outs should be connected to a workable treatment facility, hours of use should be convenient to boaters, and the cost of pump-outs should not be unreasonable.

- Many boaters do not believe that boats are a significant source of water pollution.

E. RECOMMENDATIONS

E. 1. Improve Marina Siting/Permitting Procedures

- Develop scientifically sound criteria for siting and design of marinas that go well beyond shellfish harvesting and consider water quality concerns in siting, operation, and maintenance activities. As with other health and safety regulations, siting should evaluate a "worst case scenario" (e.g., highest reasonable occupancy and usage on a busy holiday weekend).

- Require all marinas (in addition to new marinas) to install containment devices to collect debris from boat maintenance activities, and prevent entry of paint into adjacent waters.

- Permit conditions should specify that fuel pumps be equipped with overflow nozzles and require proper maintenance of pumps, hoses, and other fueling equipment to reduce the discharge of hydrocarbons.

E. 2. Monitor Boating areas

- Design a monitoring program to better determine the extent of contamination by boats. In particular, identify and assess areas where large numbers of recreational boats congregate in poorly flushed bays or harbors. (This information will be useful not only for the program but for boater education.)

- Consider requiring large marinas to conduct routine water quality monitoring.

E. 3. Improve Inspection/Enforcement Activities

- Designate one person in each DCM regional office to be responsible for periodic inspections of marinas for compliance with permit conditions.

- Strongly consider taking responsibility for enforcing the MSD regulations, as they are now empowered to do under the amended Section 312(k).

- Consider initiating a program of "selective enforcement" of the MSD regulations to raise boater awareness and compliance. The Chesapeake Bay Commission recommends random inspections on a weekly or biweekly basis.

E. 4. Study Boater/Marina Operator Behavior

- Initiate a study (perhaps a survey) to examine behavioral issues, locational factors, and institutional constraints associated with the use of pump-out facilities or pollutant-generating activities at marinas. The study should include an evaluation of currently available pump-out facilities around the Albemarle-Pamlico sounds, their condition and capacity, as well as present and anticipated levels of use.

E. 5. Develop Boater Education/Incentive Programs

- Based on the results of the study, develop a comprehensive boater education program. The Coast Guard and the State should institute a full-fledged effort to increase boaters awareness of the costs and environmental consequences of boat discharges. Written materials, signs, or cooperative programs with boater or marina organizations could be used.

- Provide information on how to select, install and operate a MSD; encourage the use of pump-out facilities and dump stations; discourage anchoring of boats in areas where shellfish beds are located; and include information about safe use of antifouling paints, cleaning solvents, and petroleum products.

- Consider offering grants or low-interest loans to marinas for installation and operation and maintenance of pump-out facilities (Maryland operates such a program).

- Ensure the wide distribution of charts or brochures publicizing the location and placement of pumpout facilities.

E. 6. Do Not Propose No Discharge Areas at this time

- Priority should be given to enforcement of existing MSD regulations. The designation of No Discharge Areas serves to penalize boaters who have installed Type I or Type II MSDs and requires high levels of enforcement to be effective, possibly making it necessary to reduce enforcement efforts in other areas.

CHAPTER 11

CRITICAL HABITAT PROTECTION

A. PROBLEM DEFINITION

Ultimately, water quality management programs are designed to protect various "beneficial uses." Among the most important uses of estuarine waters is their role in supporting the vast array of living resources that depend on the aquatic environment for survival and reproduction. Over 90% of the annual fishery landings in North Carolina are comprised of species dependent on estuarine or wetland habitat during their life cycle. Figure 11-1, for example, shows the major nursery and spawning areas for economically important species of fish (shellfish areas are not included). Many of the most important human uses of the Albemarle-Pamlico sounds also depend on living resources. It is not surprising that the most tangible warning signs of environmental distress have been alterations in the health and abundance of the sounds' living resources: e.g., fish kills and fish diseases, shellfish area closures, and declines in fish and shellfish landings.

This chapter, and the following chapter on wetlands protection, examine programs that are directly concerned with the protection of aquatic fish and wildlife habitat and indirectly with the living resources that depend on these habitats. In this chapter, we concentrate on the five critical estuarine habitats recognized by North Carolina's Division of Marine Fisheries (DMF). These are: primary nursery areas (PNAs), secondary nursery areas (SNAs), anadromous spawning grounds, shellfish management areas, and submerged aquatic vegetation beds (SAV).

1. PNAs are waters where initial post-larval development of fish, shrimp, and crabs occur. About 4% of coastal waters in the State are currently designated as PNAs; they are usually located in the upper portions of creeks and bays and in shallow waters fringed by wetlands.

2. As the post-larval fish grow, they migrate downstream to secondary nursery areas (SNAs) in more open estuarine waters. SNAs are populated by a mixture of juvenile and sub-adult fish.

3. Anadromous species, such as river herring, migrate from marine waters into the estuarine tributaries to spawn. These species spawn in numerous tributaries, particularly along Albemarle Sound (N.C. DEM 1989c).

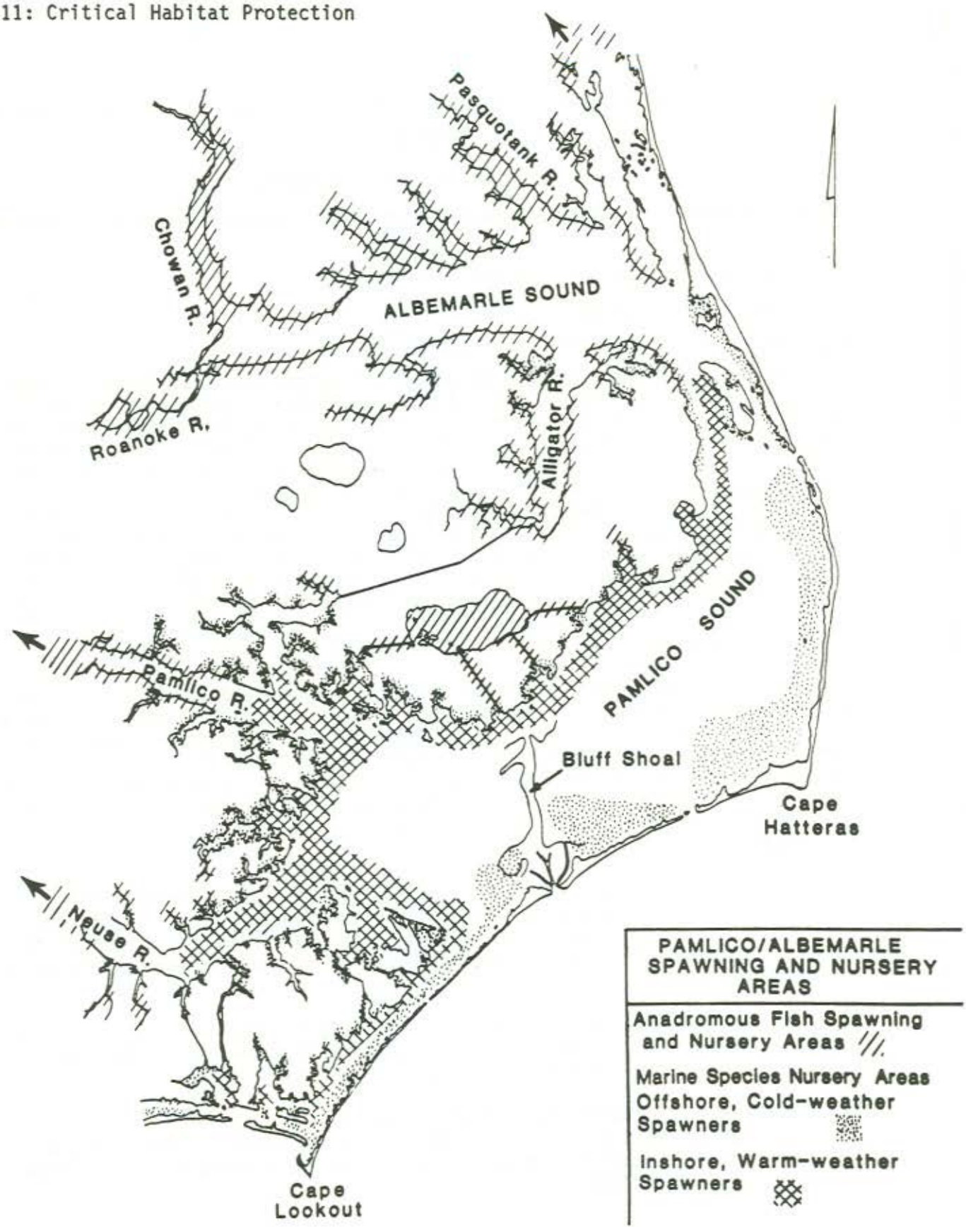

Figure 11-1. Major Nekton Nursery Areas for Commercially Important Species in the A/P Study Area (Epperly and Ross 1986)

4. Shellfish management areas include oyster beds, clam waters and scallop habitat. Each species prefers a different salinity regime, although the habitat ranges do overlap.

5. Seagrasses are the predominant type of SAV. Many studies have documented the importance of SAV beds, and all emphasize that these beds are "essential to the abundance, if not even the existence, of many of North Carolina's coastal fisheries. This is especially true for the bay scallop fishery" (N.C. DEM 1989c, 28). PNA survey data also suggest that SAV beds function as nursery areas for multiple fish species (pers. comm. Elizabeth Noble, DMF).

The availability of critical habitat areas is only one among numerous variables that affect the abundance and health of living resources. Other key variables include weather, population cycles, reproductive potential, disease, predation and the availability of food. Clearly, many human activities may directly or indirectly affect these variables, although the mechanism of action is not always clear. Indeed, the vast array of threats to critical habitat makes this area a difficult one to address. However, there appears to be three major categories of human intervention that cause disruption of habitat: (1) the introduction of pollutants into the water column or sediments, (2) alteration of population dynamics through commercial and recreational fishing, and (3) direct physical damage to habitats through fishing, boating or construction activities.

The following list summarizes the most important causes of habitat loss and degradation in coastal areas.

- Freshwater drainage and alterations in wetland hydrology can increase runoff rates, destabilizing salinity concentrations. This reduces the suitability of nursery habitat for many commercial fish and shellfish species (Pate and Jones 1981) and may serve as a contributing factor making fish more susceptible to disease (Noga et al. 1989). While the most significant ditching and drainage occurred prior to 1980, as part of agricultural and forestry projects, continuing incremental ditching is being carried out to accommodate near shore and coastal barrier island development.

- Nutrients (phosphorus and nitrogen) from both point and nonpoint sources accelerate eutrophication, resulting in algal blooms. The consequent decomposition of organic matter can significantly deplete oxygen levels in the water. Lowered oxygen levels harm aquatic life directly and may stress fish, reducing immunity to disease and directing energy reserves away from growth and reducing reproductive success.

- Oxygen demanding substances (which lower instream dissolved oxygen levels) are generated by numerous point sources as well as urban and agricultural runoff and overboard disposal of fish by-catch.

- Large increases in turbidity, primarily caused by erosion and sedimentation upstream, can have detrimental effects on many organisms and habitats. Particularly affected are SAV and benthic invertebrates. Sediment reduces light penetration needed for SAV and probably contributed to dramatic shifts in oyster productivity in the Pamlico (N.C. DEM 1987).

- Toxicants, introduced by both point and nonpoint sources, may accumulate in sediments, where they can enter the food chain and cause fish disease or endanger human health. Some important sources of toxicants are large point sources, waste disposal sites, urban runoff, agricultural pesticides, marine paints, and boating fuels.

- Fecal coliform contamination from improperly functioning waste treatment facilities, septic tanks, animal feedlot facilities, runoff, and marine waste disposal have all been tied to closure of shellfish waters at various times (pers. comm. George Gilbert, Shellfish Sanitation Branch). In North Carolina, while the overall rates of closure have dropped somewhat, closures in saline waters (prime oyster and saltwater clam areas) increased by 16% between 1980 and 1986 (Finger 1988).

- Physical alterations of habitat by fishing equipment contribute to declining fish and shellfish harvests (pers. comm. Dr. Charles Peterson, UNC). For example, mechanical harvesting of clams and oysters or trawling by large commercial boats can uproot SAV beds, which degrades functional nursery habitat (N.C. DCM 1989). Trawls, dredges, and clam kicking also stir bottom sediments which accumulate on oyster rocks making them unsuitable for oyster spat colonization. Even boat wakes may have detrimental effects on SAV (Ferguson 1988).

- Other physical alterations in stream beds may have significant effects. For example, the DOT has begun replacing bridges with culverts on small road crossings, with the result that access to spawning or nursery areas may be removed. Researchers believe this is partially responsible for the historical declines in anadromous fish landings in many coastal areas (Rader 1988).

B. EXISTING PROGRAMS

Three North Carolina programs include estuarine habitat protection as an important goal: the N.C. Coastal Area Management Act (CAMA) permit program for Areas of Environmental Concern; the Division of Marine Fisheries (DMF) program regulating fishing practices in some critical habitat areas; and the management programs for coastal Outstanding Resource Waters (ORW).

B. 1. Coastal Area Management Act (CAMA)

The Division of Coastal Management (DCM) under the direction of the North Carolina Coastal Resources Commission (CRC) implements the CAMA permit program for development within Areas of Environmental Concern (AECs). Currently, AECs include (1) estuarine waters, coastal wetlands and adjacent shoreline area within 75 feet of the mean high water line; (2) ocean hazard areas; (3) public water supplies; and (4) natural and cultural resource areas. Authority to designate both PNAs and ORWs as AECs was provided in the 1989 amendments to CAMA. The following discussion focuses on permitting for estuarine waters and adjacent shoreline (i.e., areas in and around critical habitats such as those shown in Figure 11-1).

The Permit System. CAMA defines estuarine waters as the Atlantic Ocean within North Carolina boundaries and "all the waters of the bays, sounds, rivers and tributaries thereto seaward of the dividing line between coastal fishing waters and inland fishing waters." Within this area and up to 75 feet from the mean high water mark, DCM reviews proposed development projects for compliance with CAMA standards and consistency with local land use plans. Three types of development permits are issued under CAMA: major, minor, and general permits. Each type of permit is subject to varying degrees of review and public notice requirements.

Generally, major permits are required for large projects such as marina construction, or projects that require additional State or federal permits (e.g., Section 404 permits or Sediment and Erosion Control Plan approval). The DCM staff in Raleigh circulate all major permit applications to multiple State and federal agencies for review and comment. Often, the comments of DEM, DMF, and the Shellfish Sanitation Branch are most relevant to the permit decision. These agencies provide input on water quality standards violations, disturbance of PNAs and SAV beds, and shellfish closures, respectively.

Minor permits are required for all activities which do not require a major permit or meet the requirements for a general permit. Minor permits are issued by local government staff and are subject to the same general development standards as major permits, but can be approved by DCM without review from other agencies. General permits are issued by DCM field staff without public review for activities thought to pose little or no environmental threat (e.g., construction of private docks and piers or small boat ramps, installation of estuarine bulkheads, or wooden groins).

All projects requiring a CAMA permit must comply with development regulations and guidelines designed to protect water quality and estuarine habitat. Several guidelines address PNAs directly, prohibiting any new dredging and limiting maintenance dredging to periods of minimal juvenile fish abundance. (In addition, local land use plans required under CAMA have been used to protect nursery areas by limiting development around these areas.)

11: Critical Habitat Protection

Public Involvement. Notice of major and minor CAMA permit applications or significant modifications to proposed or issued major permits must be published in the legal section of a local newspaper. Adjacent property owners must also be notified of proposed projects. Following a permit decision, both the applicant and individuals who may be affected by the project may file for a contested case hearing. The CRC will automatically grant a hearing for appeals requested by permit applicants; third party appeals will be granted only if the appeal appears likely to be successful. If the CRC denies the hearing request, the decision may be appealed to the State Superior Court.

Variances and Exemptions. CAMA specifically excludes agricultural, silvicultural, and public road maintenance activities from the definition of development, which effectively exempts such activities from CAMA jurisdiction unless a project requires excavation and/or filling which affects estuarine waters. The CRC also exempts single family residences from minor CAMA permit requirements if the structure is located more than 40 feet from the mean high water mark.

Inspections and Enforcement. DCM staff are responsible for CAMA major permits and general permits. The regional DCM staff examine all development sites where a major permit will be required, prior to permit approval. Inspections during construction are carried out for most projects, and follow-up compliance inspections (after project completion) are usually carried out only for complex projects with multiple permit requirements. Minor permit holders are inspected with somewhat more frequency by local government staff (e.g., building inspectors), as CAMA provides funds to the counties for this purpose. Violations for unpermitted development are detected primarily through aerial surveillance performed every two months, and to some extent through routine inspections.

Unauthorized development accounts for the majority of detected violations (approximately 90%). During fiscal year 1987-88, DCM processed 108 violations in estuarine AEC's. Overall, the most common CAMA violations are for unpermitted filling of wetlands, bulkhead construction, and pier construction. The most common violation occurring in estuarine shoreline AEC's is unauthorized clearing and grading.

Penalties for Noncompliance. The civil penalties for failure to obtain a CAMA permit or violating CAMA permit conditions may be assessed against the contractor, the land owner, and the developer managing the site. The regulations empower the CRC and DCM to fine violators for irreversible damage, restoration costs, and investigation costs. Fines range from $100 to $2500 per day, depending upon the size and type of AEC damaged, with each day following a Notice of Violation considered a separate violation. Willful disregard of the CAMA rules is a misdemeanor crime which can result in a daily fine of $1000 and 60 days in jail.

B. 2. DMF Nursery Area Program

The DMF, under the direction of the Marine Fisheries Commission (MFC), delineates several types of critical estuarine habitats and regulates fishing activities within these areas. Generally speaking, only PNAs and SNAs are significantly addressed.

It should be noted that the DMF does not have jurisdiction over all waters that function as PNAs. In 1977, State waters were divided between the MFC and the Wildlife Resources Commission (WRC). An agreement established boundaries for inland fishing waters (not open to commercial fishing and under WRC jurisdiction), coastal fishing waters (under MFC jurisdiction), and joint waters. For the most part, dividing lines were set in estuarine tributaries, creating administrative divisions through areas that function as PNAs.

Program Description. PNAs and SNAs are formally delineated and protected in the regulations adopted by the Marine Fisheries Commission (15 NCAC 3B, .1400). The regulations prohibit the use of trawl nets, long haul seines, swipe nets, dredging, or mechanical methods in designated PNAs. The rules also prohibit the use of trawl nets year round in permanent secondary nursery areas (SNAs), and during the summer in special SNAs.

Other regulations that protect designated habitat areas are contained in the general coastal fishing regulations. For example, crab spawning sanctuaries have been delineated for special protection during the spring and summer when the areas are utilized for reproductive activity. At the DMF Director's discretion, the use of trawl nets and taking of crabs with commercial fishing equipment can be prohibited in the crab spawning sanctuaries between April 1 and August 31. Trawl nets are also prohibited in posted oyster beds. SAV beds are protected through a prohibition of clam kicking and mechanical dredge harvesting in these areas.

Monitoring. Since 1970, DMF has carried out a nursery area estuarine monitoring program. Over 400 stations have been sampled monthly within the A/P study area for both biological information (size, abundance, diversity) and physical-chemical data (salinity, bottom composition, etc.).

Inspections and Enforcement. Coastal waters are patrolled by 47 DMF officers. The majority of surveillance activity occurs in boats (about 75%), but two sea planes are also employed to perform aerial surveillance during the peak fishing season. DMF also rents a plane that is specially equipped for night surveillance. The penalties for using unlawful fishing equipment in PNAs include a misdemeanor fine between $50 and $500, possible imprisonment for up to 30 days, and temporary license revocation. Following a fourth conviction, license revocation is permanent. DMF will also confiscate the catch of a suspected violator, sell the catch, and hold the proceeds pending a court decision on the defendant's guilt. The value of the catch usually exceeds the fine.

B. 3. Outstanding Resource Waters Classification

In 1986, the EMC created the supplemental classification of Outstanding Resource Waters to serve as part of the foundation for the State's antidegradation policy. This new classification was designed to protect areas with exceptional water quality and habitat value that may be vulnerable to degradation down to existing standards. In September 1989, the EMC approved the first set of coastal ORWs. The ORW program is not a regulatory program so much as a classification process; once ORW waters are classified, supplemental regulations under other existing programs may be implemented.

Designation Process. To be designated as an ORW, waters must exhibit three conditions: (1) water quality is excellent and not significantly impacted by pollution; (2) an outstanding ecological or recreational resource value is present; and (3) assigned narrative and numerical standards may not protect the waters' special features. It is noteworthy, perhaps, that five of the seven designated coastal areas were recommended because they possessed "outstanding fish habitat and fisheries" (N.C. DEM 1989d).

The designation of ORWs is a three-step process: nomination of waters by petitioning the EMC; acceptance of the nomination by the EMC; and final approval of the designation. DEM assists the EMC by screening petitions, conducting intensive studies, and preparing management plans for nominated waters. The public can comment on ORW nominations and management plans at public hearings held before the final designation decision is made by the EMC.

ORW Management Plans. Once waters are designated as ORWs, a site-specific management plan is prepared following guidelines established by DEM. The plan contains a set of recommended modifications regarding potential permit activities, e.g., NPDES, nondischarge permits, CAMA, and stormwater controls. Generally, the guidelines recommend different regulatory packages depending upon the type of exceptional resource value present (see Table 11-1).

The management plans will be implemented and enforced primarily by DEM and DCM, the agencies that administer the relevant programs. The ORW regulations do not specify additional penalties, and agencies will rely upon the standard enforcement procedures to encourage compliance.

Table 11-1 Guidelines for ORW Management Plans

Basic Regulatory Mechanism	Standard Procedures for Coastal Waters	TYPE OF OUTSTANDING RESOURCE VALUE PRESENT		
		Recreational Value or Park Designation	Exceptional Fisheries	Special Designation, or Ecological or Scientific Value
		MODIFICATIONS OF STANDARD REGULATORY PROCEDURES		
New NPDES Discharge Permits	New discharges are permitted if standards will not be violated. Domestic and industrial discharges not permitted in SA areas	Domestic and industrial discharges will not be permitted into SA and SB waters.	Only discharges of cooling waters and other non-processed waters will be permitted.	No new discharges will be permitted.
New Non-Discharge Permits	Septic tank siting is based on soil suitability tests. Systems must be set back 100 feet from SA waters.	Standard permitting for septic tanks and other non-discharge systems will continue.	Loading rates will be reduced and shoreline buffer widths extended.	Loading rates will be reduced and shoreline buffer widths extended.
Stormwater Regulations	SA waters: New development within 75 ft. of shore must have stormwater controls if built-upon area exceeds 25%. Vegetative buffer must be 50 feet wide. SB waters: Stormwater controls are required if built-upon area exceeds 30% and the vegetative buffer must be 30 feet.	The low density option will be implemented within 575 feet of mean high water (i.e., density limits cannot be raised by installing stormwater control devices). However, high density with control structures will be permitted if adequate performance can be assured.	Low density option will be required in an area adjacent to the shoreline. The width of the low density area will be determined case by case. High density with control structures will be permitted if adequate performance can be assured.	Low density option will be required in an area adjacent to the shoreline. The width of the low density area will be determined case by case. High density with control structures will be permitted if adequate performance can be assured.
Marina Construction (CAMA regs)	Construction is permitted if shellfish resources will not be degraded and standards will not be violated. Dredging is not permitted through grass beds except to access upland basins.	Standard CAMA regulations will be implemented.	Marinas will only be permitted in upland basins.	Marinas will not be permitted.
Dredge and Fill Activities	Dredge and fill activity is not allowed in areas where shellfish or SAV resources occur, except for maintenance dredging.	Standard regulations will be implemented.	Standard regulations will be implemented.	Dredging will not be permitted except to access facilities related to special designation.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

The protection and management of critical habitats is difficult because of the complex nature of estuarine systems, the wide range of activities that can cause degradation, and the resulting uncertainties regarding cause and effect. Estuarine systems are notoriously complex, and by their nature, living resources integrate the entire spectrum of physical, chemical, and ecological influences, both natural and anthropogenic. While this characteristic makes habitat quality an excellent indicator of environmental health, it also complicates the investigation of causal relationships.

The target group addressed by CAMA and the DMF program include all persons developing or altering land within the 75-foot estuarine AEC (or 575-foot border surrounding ORWs) as well as commercial and recreational fishermen. The target groups are large, diverse, and often influential.

C. 2. Clear and Specific Program Objectives

CAMA is clearly an attempt to balance the competing objectives or values often embodied as preservation (or conservation) versus development. There is no clear statement of priority, although it might be argued that the statutes bias is toward accommodating development, while "minimizing damage to the natural environment." The prospect of trading off one goal for another in uncertain situations is not addressed, and many critical decisions concerning policy and implementation are left to the appointed members of the CRC. In truth, CAMA itself is not oriented toward protection of water quality and critical habitat, so much as it is toward planning and regulation of land use in coastal areas. The program's relationship to water quality standards and habitat protection are not direct, but are accomplished through the interagency review process, a tenuous connection at best.

The objectives of the DMF nursery area regulations are clearly stated: to "establish and protect those fragile estuarine areas which support juvenile populations of economically important seafood species," (15 NCAC 3B .0102, p. 71). The regulations further specify that, "Nursery areas need to be maintained, as much as possible, in their natural state." The mechanisms specified to protect the nursery areas are prohibition of bottom-disturbing gears and severe restrictions of excavation and fill activities. However, due to jurisdictional limitations, the actual regulations restrict fishing practices only. DMF must rely upon DCM to address excavation and fill activities through the dredge and fill and CAMA permit programs.

The ORW program objectives are stated as a clear but qualitative mandate: "Water quality conditions shall clearly maintain and protect the outstanding resource values of waters classified as ORW," (15 NCAC 2B .0216). The objective is not diminished by competing and conflicting objectives, such as balancing potential economic benefits. The strength of this stance was demonstrated as the EMC debated ORW designations in September 1989; two commissioners stated that the EMC's mandate was to protect significant aquatic resources over other considerations, including economic effects. It should be noted that while objectives are clearly stated, the regulations offer only weak guidance for determining the presence of exceptional waters, leaving the process open to subjective judgement and case-by-case determination.

C. 3. Sound Theoretical Basis

Generally critical habitats are not lost or degraded in response to a single activity or event. The process occurs slowly, possibly in response to several different causes. For this reason, it is difficult to establish a clear cause-effect connection between human activities and habitat quality, or even between activities and the symptoms of habitat degradation. Given this situation, it is extremely difficult to develop a scientifically sound technical approach, and there is always the temptation to carry out additional research.

However, even in the absence of definitive theory, an effective program should include (1) a clear identification of critical habitats in need of protection (or a process for doing this) and (2) standards, perhaps based on best professional judgement, for activities that will and will not be allowed in or near designated areas. Among the three program areas evaluated here, each has areas of strength where identification and standards are adequate and other areas where this may not be true.

Within the CAMA program, there has been criticism that some significant habitat areas are not included among the designated AECs (e.g., PNAs and non-tidal wetlands). Standards for the estuarine shoreline AEC are also of questionable adequacy. Specifically, the 75-foot shoreline AEC zone was designed more to address shoreline erosion than to protect adjacent water quality. A recent review of the N.C. Coastal Management Program by the authorizing federal agency (National Oceanic and Atmospheric Administration (NOAA)) recommended that the CRC and DCM consider "expanding the Estuarine Shoreline AEC to an area that would meet water quality protection requirements and revising the regulations to combine land management activities with water quality issues" (U.S. NOAA 1989). Another study (Phillips 1989) also suggests that the existing AEC dimensions are inadequate--in this case to detain stormwater from directly entering adjacent estuarine waters--and recommended that the AEC be extended to 260 feet.

Within DMF, the identification and designation of critical habitat has been mixed. PNAs and, to a lesser extent, SNAs are well established; however DMF nursery area criteria "do not recognize additional critical

habitats and their associated species, such as SAV, anadromous fish spawning and nursery areas, and inland nursery areas...which may be functioning as nursery areas" (Noble and Noble 1989, 239). Many areas were not designated because the MFC has concentrated on areas supporting selected commercial species in estuarine habitats.

Currently, DMF is mapping shellfish resources as a component of the Governor's Coastal Initiative. The initial phase of the mapping process is complete, and ongoing stratified random sampling will ground truth the habitat ratings. The inventory will be useful for directing development away from highly productive shellfish resources and also will provide a baseline inventory for future assessments (pers. comm. Donald Freeman, DMF).

Whether DMF fishing regulations are adequate to protect water quality and existing habitat is a continuing and controversial question. Declines in fish landings are resulting in greater pressure by some fishermen to "open up" areas that are currently restricted as well as greater resistance to any additional restrictions. Rader (1988) and others have suggested that bottom trawling may have severe effects on benthic ecology and productivity, and DEM in their report on coastal ORWs suggested that the DMF "should evaluate the potential for certain harvesting practices to destroy habitat and thereby compromise valuable ORW fisheries" (N.C. DEM 1989c, 9). Finally, a committee of Pamlico fishermen recently recommended a ban on trawling in Pamlico Sound and the Pamlico and Neuse Rivers to maintain fishing resources (Smith et al. 1988).

Of the three programs, the ORW process best accomplishes the two tasks of identifying habitats and specifying management goals and standards. While the programs included in any individual ORW management plan may vary in completeness, most major activities that are under DEM and DCM jurisdiction are covered. Some activities that are not included in the management plan are agriculture, silviculture, construction, and individual septic systems.

C. 4. Adequate Resources for Implementing Agencies

The 1989 NOAA review of North Carolina's coastal program cited DCM staff reductions, reassignments, and vacancies for weakening the State's ability to process the expanding permit load and offer technical support to the CRC (NOAA 1989). These two areas can be singled out as in need of either additional resources or restructuring.

The coastal management program is a complex effort that includes numerous activities other than its regulatory functions. However, the Agency's permit loads have approximately doubled since 1979, and the program currently devotes close to 40% of its total budget to permit review and enforcement. Over the last several years, the DCM has annually issued between 225 and 250 major permits and approximately 1000 general permits; local governments have issued another 600 to 800 minor permits annually. A great deal of effort is spent working with developers in issuing these permits (particularly major permits), but much less time appears to be

devoted to inspections and project monitoring. Preston Pate, DCM's assistant director, estimates that one additional person in each of the four DCM Regional offices would be needed to adequately inspect all permitted developments. An alternative would be to restructure the permit process so that staff could reduce the amount of time spent working with developers on new projects, and increase efforts in inspections and enforcement. A necessary first step toward this goal, clarifying development rules and making them more "user-friendly", has been under discussion for some time.

Additional resources are also needed for technical studies to support new initiatives under the 1989 amendments to CAMA. For example, the 1989 amendments added important expansions to the areas that may be designated as AECs; additions include "contiguous areas necessary to protect wetlands"; ORWs, as designated by DEM; and PNAs as designated by DMF. All these will require significant new efforts by staff to implement.

DMF employs 47 officers to enforce all fishing regulations throughout the 2,044,375 acres of tidal estuaries and sounds in North Carolina--making the ratio of enforcement officers to surveillance area 1 per 43,500 acres. Generally, the enforcement staff has been unable to keep pace with the increase in fishing activity. Five officers have been added to the DMF staff during the last 25 years, while the number of fishing permits has increased by approximately ten fold (pers. comm. DMF public relations officer). While the DMF issues an average of 1100 citations per year for violations of all fishing regulations, including nursery area rules, it is impossible to estimate how many violations are undetected. The resources for enforcement appear to be inadequate.

C. 5. Adequate Incentives and Sanctions

Although the potential for substantial fines exists, the State seldom imposes CAMA penalties exceeding $500 (pers. comm., Preston Pate, DCM). Instead, the State uses the threat of large fines to encourage violators to perform restoration of disturbed AECs in exchange for a reduced fine. Violators refusing to perform restoration have been fined up to $35,000. It is not clear whether the emphasis on restoration provides adequate incentive to deter future violations. DCM staff noted examples of several veteran developers, well-versed on CAMA rules and requirements, who have been found in violation (including one member of the CRC).

There is a possibility that DMF fines for violating fishing regulations also may be too low to deter willful disregard of the law. Since the value of the catch usually exceeds the fine, it may be economically advantageous for fisherman to risk a low fine in order to haul in a profitable catch.

Penalties for violating adopted ORW management plan requirements are not specified in the regulations. Sanctions vary, depending upon the management strategies adopted. The management plans approved so far modify existing program requirements, such as the NPDES program, and rely upon the sanctions of the existing programs to enhance compliance. While the

approved management plans may not provide adequate protection to ORWs, the designation does obligate the State to protect the exceptional water resources. If future degradation proves that current management plans are inadequate, the State will have to revise the plans.

C. 6. Access to Supportive Constituency Groups

CAMA is noteworthy in the extent to which public access is provided throughout the permit process. The recent amendment requiring public notice for significant modifications to permit applications or modifications to a previously issued permit, extends this fact.

The ORW program provides several opportunities for supportive constituents to express their concerns to the regulatory agency. The ORW rules require that public hearings be held to discuss proposed ORW designations and management plans, and the management plan guidance requires public hearings to be held prior to permitting new NPDES discharges. The hearing process did influence DEM's recommendations to the EMC during the designation of coastal ORW's. Public comments made at the hearings enabled DEM to document recreational values at Topsail and Middle Sound.

C. 7. Adequate Training, Technical Assistance and Education

DCM and the CRC have made extensive efforts to educate developers about the CAMA requirements through publications, newsletters, and workshops. For example, the full spectrum of CAMA regulations and guidelines are contained in an clearly written and well-illustrated publication produced by DCM (N.C. DCM 1988). Nevertheless, staffing limitations have hampered attempts to initiate a new educational program requested by the CRC (NOAA 1989).

Similar educational efforts are needed by DMF and DEM for nursery and ORW waters. The ORW Intensive Study (N.C. DEM 1989c, 8) notes that "perhaps the single most important recommendation" is the need for a comprehensive education effort to inform residents, organizations, businesses, and industries of the importance of the designated areas and the actions needed to protect them. Likewise, all property owners whose land drains to a designated nursery area should receive a brochure or other materials explaining the boundaries, significance of the area and regulations.

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

Clearly, the staff in DCM, DEM and DMF are committed to habitat protection. Ultimately, however, designations of critical habitats and protection standards are developed by the appointed commissions (CRC, EMC and MFC). There have been questions regarding the commitment of these commissions in the past, to the extent that in 1989, the General Assembly modified membership qualifications for both the EMC and the CRC. The

General Assembly specified more clearly that certain CRC members "shall be persons who do not derive any significant portion of their income from land development...and do not otherwise serve as agents for development-related business activities" (NCGS 113A-104). At the same time, CAMA was further amended to direct that CRC members shall serve "solely for the best interests of the public and public trust" and shall provide adequate disclosure of potential conflicts of interest. EMC membership was modified during 1989 to provide greater representation of environmental science expertise.

D. ISSUES OF CONCERN

D. 1. Interagency Coordination

- Numerous agencies are involved in different aspects of habitat protection (monitoring, permitting, inspections, enforcement); in protecting different types of critical habitats (PNAs, SNAs, SAV, shellfish areas, wetlands); or in regulating different sources of habitat degradation (point sources, land development, fishing practices). The diversity of monitoring alone is instructive. DEH monitors shellfish areas; DMF monitors PNAs and SNAs; DEM monitors ORW and other waters; and DCM conducts special studies. Additional efforts are carried out under the Coastal Reserve Program and the Natural Heritage Trust Program.

- There is little effort to coordinate or integrate data collection and data analysis among the participating agencies.

- There is little effort to coordinate, among agencies, educational efforts aimed at informing the public and local government officials about the significance of critical habitats and the regulations that currently protect these areas.

D. 2. Habitat Inventory and Tracking

- Comprehensive habitat inventories (on maps) are needed. Inventories are proceeding for most of the critical habitat areas, however, outputs in the form of usable maps are not yet available.

- The WRC has not completed designation of functional nursery areas in coastal waters under their jurisdiction. This effort has become more important as these areas are now recognized (under the State's new antidegradation policy) as High Quality Waters and subject to additional protection (15 NCAC 02B.0101 (e)).

11: Critical Habitat Protection

- Most State protection programs focus on nursery areas and fisheries habitat for economically important species such as shrimp, flounder, blue crab, spot and menhaden. Additional protection is needed for SAV and and other aquatic habitats that may not have direct commercial uses.

D. 3. Protection Standards

- The 75-foot shoreline AEC along estuarine waters may be inadequate to protect estuarine habitats from water quality degradation.

- Non-tidal wetlands are not designated as a critical area under any existing habitat protection program.

- The restriction of estuarine waters to those waters seaward of the WRC/MFC jurisdictional line may weaken program coverage as this line is somewhat arbitrary.

- Stormwater controls required around High Quality Waters (including PNAs and functional nursery areas) located in one of the 20 coastal counties under CAMA are <u>less</u> stringent than controls that are required elsewhere. Regulation 02B.0201(d) exempts CAMA counties from the runoff controls for High Quality Waters as these counties "already have requirements for nonpoint source controls."

D. 4. Enforcement of Regulations and Permits

- There is no written policy or CRC guidance regarding an acceptable level or frequency of project inspections. (e.g., to cite two other programs, among NPDES permits, all major permittees and 20% of minor permittees must be inspected at least once annually; among agricultural cost-share projects, at least 5% of all projects and <u>all</u> animal waste management facilities must be inspected annually).

- Staff support for inspections and enforcement of CAMA permits is inadequate. Where the risk of detection is very low, the result is weakened incentives for permittees to comply when permit conditions are onerous. Prior to the Agency's reorganization, several years ago, some staff were assigned exclusively to inspection and enforcement tasks; currently however, this role is combined with permit development and review.

- Although we did not closely examine the frequency and amounts of penalties assessed for different violations of CAMA permits, it appears that very few penalties are more than token assessments ($500). Unless the full restoration costs are extremely high, again, the result if weakened incentives for compliance.

- Additional staff and higher penalties may be needed to deter violations of DMF regulations.

E. RECOMMENDATIONS

The protection of critical aquatic habitats will require the involvement of numerous agencies managing various activities that take place in, on, near and around important estuarine and public trust waters. Clearly protection should include maintenance of water quality, through control of both point and nonpoint sources and the maintenance of physical habitat through regulation of dredging and fish and shellfish harvest practices.

E. 1. Enhance Interagency Coordination

- Criteria for predicting the severity of cumulative impacts should be developed by an interagency workgroup. Currently, DMF recommends permit denial for most CAMA applicants, based upon predictions of unacceptable cumulative impacts. In most instances, DCM cannot deny the applicant because supporting evidence is lacking. Defining criteria is a necessary step towards addressing the 1989 Legislative mandate to address cumulative impacts in the CAMA permit review process.

- Nonregulatory habitat protection programs such as the Natural Heritage Program and the Coastal Reserve System should coordinate more closely with the regulatory programs. For example, in some cases, development rights or open space easements may be more readily obtained once an area has been designated as an ORW or PNA.

- The A/P program should consider taking a lead role in coordinating habitat protection efforts. This could take to form of (1) ensuring that policy decisions by all relevant agencies consider A/P goals and objectives, and (2) development of annual or biennial reports tracking progress toward program objectives in delineation and protection of critical habitat areas. Just as DEM publishes the biennial Section 305(b) Report (tracking surface and groundwater quality), a separate report tracking progress and new initiatives for critical habitat areas should be developed.

E. 2. Complete Habitat Inventories and Develop Protection Plans

- Inventories of critical habitats should be completed using uniform inventory protocols. Many agencies and groups collect habitat information and a uniform protocol would ensure that all data using this protocol could be compared.

- A great deal of habitat data for PNAs already exists in the DMF database. This information should be examined for trends to determine if protection measures are adequate. Noble and Noble

(1989) have proposed to use these data to examine the effect of human activities on nursery area productivity. They propose to address questions such as: the effect of marinas on PNAs; the relationship of increased perturbations and species abundance and diversity; and PNA utilization by juvenile finfish and crustaceans after adjacent land has been disturbed.

- Utilize results of PNA cluster analysis to designate additional PNAs. The recent analysis, conducted by DMF with A/P funding, found that numerous areas populated by juvenile fish are not currently designated as PNAs (pers. comm. Elizabeth Noble, DMF). The unprotected areas include high salinity waters behind the barrier islands, and SAV beds.

- Implement a protection program for inland nursery areas (PNAs) under WRC jurisdiction. Although commercial fishing activities are banned in the inland PNAs, these areas are susceptible to degradation from development activities since they fall outside of CAMA jurisdiction.

- Develop protection plans for SAV beds, shellfish resource waters, and anadromous spawning areas. At this time, these critical habitats are not designated for special regulatory protection, as are PNAs and (to a lesser extent) SNAs. Limited protection is provided by individual fishing gear restrictions scattered throughout the DMF rules and by ORW designations which include significant acreage of critical habitats. However, comprehensive protection is lacking and might be improved by creating specific regulations prohibiting certain activities in these critical areas.

E. 3. Investigate Expansion of CAMA Jurisdiction

- The CAMA AECs should be expanded to include non-tidal wetlands and a larger shoreline buffer area.

E. 4. Improve Enforcement of Existing Regulatory Programs

- Additional funding for staff and surveillance equipment is needed by both DCM and DMF. The NOAA review of N.C.'s coastal program specifically recommended that additional DCM staff positions be created (NOAA 1989).

- Increase fines and penalties, as well as the frequency with which fines are assessed for violators.

- Encourage members of the public to report violations by publicizing clear descriptions of the restrictions that apply to critical habitats and the Agency phone numbers that can be called to report violations.

CHAPTER 12

WETLANDS PROTECTION

A. PROBLEM DEFINITION

Wetlands of the Albemarle-Pamlico (A/P) region perform valuable functions that maintain water quality and aquatic life. These functions include providing spawning and nursery habitat for commercially important fish and shellfish species; dampening freshwater flows to saline nursery areas; and reducing pollutant inputs to receiving waterbodies. Examples of wetlands serving as nursery habitat are those bordering Rose Bay and other saline tributaries to Pamlico Sound. The U.S. 264 Low Pocosin (Dare County) and the Upper Alligator River Pocosin (Hyde County) are large wetlands which moderate freshwater flowrates during runoff events. Examples of wetlands providing pollutant removal are forested areas below certain pump stations in Dare and Tyrrell Counties; these wetlands effectively reduce nutrient and sediment loads from thousands of acres of agricultural land (Chescheir et al. 1987). Other wetlands also provide habitat for rare or endangered terrestrial species, and are part of North Carolina's natural and cultural heritage.

When wetlands are converted to other uses, not only are the above uses eliminated, but pollutant-generating activities often replace them. For example, new marinas and residential developments can cause exceedances of State water quality standards for coliform bacteria (see sections of this report on marinas and onsite wastewater disposal systems). Row-crop agriculture generates increased phosphorus and nitrogen from fertilization. For example, analysis of nutrients in large canals draining farmland on the A/P Peninsula shows significantly increased loadings (above background) of 8.4 pounds per developed acre per year total nitrogen and 0.62 pounds per developed acre per year total phosphorus (FCF 1985).

Most of the wetland conversions in the A/P region occurred prior to 1980, with agriculture and forestry being the major resulting land uses. For example, in four counties on the A/P Peninsula--Washington, Hyde, Tyrrell, and Dare--net land clearing totalled approximately 218,000 acres between 1940 and 1980, including both wetland and nonwetland acres (McMullan 1984). The rate of wetland conversion to agricultural uses has subsided greatly due to a combination of factors, including the assumption that Section 404 applies to these lands and the Swampbuster provisions of the Food Security Act of 1985, which prohibits federal payments or loans to farmers who drain wetlands. However, there is general agreement that the recently proposed goal of "no net loss of wetlands" is not being attained.

B. EXISTING PROGRAMS

Due to the increasing recognition of wetland losses, as well as some pressure from EPA, and the increased availability of funding, North Carolina and other States are reexamining their protection programs. As a result of this process, and recent changes in Federal programs, wetlands management is in period of transition. The following review and evaluation examines State and Federal programs as of late 1989; in some cases these programs function quite differently than they did just a year or two ago, and it can be expected that they will continue to evolve.

There is currently no comprehensive wetlands management program in North Carolina. Rather, a mix of regulatory programs in different State and Federal agencies address wetland protection. Each program has its own mandate and area of jurisdiction. The major State wetland programs (or programs requiring State participation) are:

- Section 404 "dredge and fill" program
- State 401 Certification process
- CAMA permit program

B. 1. Section 404 Permit Program

Section 404 of the Clean Water Act (CWA) regulates the discharge of dredged or fill material into waters of the United States (Note that drainage per se is not covered). While it is not a wetlands protection program, the Section 404 process is the primary regulatory program addressing wetlands in North Carolina, and it is administered by the Wilmington District, U.S. Army Corps of Engineers (COE). Within this program, the U.S. Environmental Protection Agency (EPA) provides technical guidance, reviews permit applications, conducts certain enforcement actions, and has authority to veto COE permit decisions. Review and consultation on 404 permits is also provided by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Various State agencies in North Carolina also provide review and consultation, notably those within DEHNR.

Defining Wetlands. In the past, there has been considerable controversy over how to determine whether properties are 404 wetlands. A notable example of this was the wetlands determination for Tract I of First Colony Farms holdings, located south of Lake Phelps. COE originally found this 33,000-acre tract to be predominantly uplands, but later EPA ruled that all but a few thousand acres are wetlands. Such problems should be eliminated now that a common wetlands delineation procedure has been announced by the COE, EPA, and FWS.

Types of Section 404 Permits. Two types of Section 404 permits are issued, individual and general permits. Individual permits are required for all projects involving 10 or more acres of wetlands, or for smaller projects that are not appropriate for a general permit (e.g., due to potential impacts). An application for an individual permit triggers a detailed review of the specific project. General permits are issued for certain types of projects on a regional or national level, and do not usually have reporting requirements. In North Carolina, general permits have been issued by COE for such activities as constructing and repairing boat ramps, docks, piers, and jetties; emergency construction of primary dunes; construction and repair of bridges; and installation of utility lines.

A "Nationwide" permit is a type of general permit which covers common or standard types of activity such as fishing with pound nets and crab pots; installation of tide gages and buoys; bank stabilization; or construction of minor road crossings. The most important Nationwide permit from a wetlands protection standpoint is Nationwide Permit 26, which allows COE to authorize any project involving less than 10 acres of wetlands. COE requires a predischarge notification by applicants under Nationwide 26. No notification or permit is required for projects of less than one acre.

Rather than using Nationwide 26 for all projects under 10 acres, the Wilmington District COE often requires individual permits for projects greater that about 2 to 4 acres, and denies permits for larger projects which do not pass a public interest review. For example, condominium projects involving fill in more than a few acres of wetlands are typically denied permits, while highway projects to increase public safety are more likely to be allowed.

COE issues individual permits for about 200 acres of wetland development per year in North Carolina. Roughly 300 acres per year are permitted under Nationwide 26. No figures are available for losses from projects that are less than than one acre in size, or due to exempted activities.

Exempted activities. The following activities are exempted from 404 requirements:

- Normal ongoing farming, silviculture or ranching activities
- Maintenance of currently serviceable structures such as dikes, dams, or levees
- Construction or maintenance of farm or stock ponds or irrigation ditches, or the maintenance of drainage ditches
- Construction of temporary sedimentation basins on construction sites
- Farm roads or forest roads.

B. 2. 401 Certification Program and Antidegradation

401 Certification. Under Section 401 of the Clean Water Act, applicants for any Federal permit (such as a Section 404 Permit) must

provide the permitting agency with a certification from the State that the project will comply with key provisions of the Act. Such a certification indicates, for example, that water quality standards will be maintained by the project. In States without wetlands regulatory programs, the 401 Certification process may be the only way in which a State can exert direct control over wetlands projects (U.S. EPA 1989b).

In North Carolina, all projects that require Section 404 permits are reviewed by the Division of Environmental Management (DEM) to determine if 401 certification is needed. DEM cannot deny certification for individual projects covered by 404 general permits. However, DEM can find that a project does not qualify for a general permit (e.g., if the project is not water dependent), and refuse to grant certification on that basis. DEM can also place conditions on certification to force modifications to a project.

Key to effective use of 401 certification are the State's water quality standards and 401 implementing regulations (U.S. EPA 1989b). Prior to 1989, DEM focused primarily on the potential of a project to violate numerical water quality standards, notably the turbidity standard. Certification was seldom used to prevent a wetlands project because it was difficult to assess potential turbidity violations if the project complied with the conditions of its sediment and erosion control plan.

However, recent developments at the State and national level are making 401 certification a more effective tool. First, the N.C. turbidity standard has recently been modified to make it more clearly applicable to nonpoint sources of pollution, such as wetlands conversion projects. Second, North Carolina's antidegradation policy has been strengthened and is being applied to protection of wetlands as "waters of the State." This has the effect of looking at the impact of a project on the wetland itself rather than looking only at downstream impacts. Third, State water quality regulations (NCAC 2H.0109) have also been amended to include the use of 404(b)(1) guidelines in making certification decisions. These guidelines deal with the need to explore practicable alternatives to wetlands projects and the need for a project to be water dependent before being eligible for a 404 permit. In fact, the water-dependency criterion is one of the strongest tools available to regulatory agencies (Houck 1988). EPA regulations state that:

> Where the activity associated with a discharge which is proposed for a special aquatic site...does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. (40 CFR 230.10(a)(3))

EPA has issued guidance regarding these and other changes to strengthen State 401 certification programs (U.S. EPA 1989b).

A fourth recent development is Governor Martin's second of a motion calling for a national goal of no net loss at the 1989 National Governors'

Conference. Such a policy could greatly reduce the number of 401 certifications issued because mitigation would be required for most projects.

Antidegradation Rules. EPA requires that all States adopt an antidegradation policy as part of their water quality standards regulations. North Carolina's policy states that existing uses (and the water quality to protect these uses) will be protected; projects which will not protect existing uses will not be permitted. Also, the State will not permit degradation of waters having quality higher than the standards to the point where existing and anticipated uses would be undermined.

The effectiveness of using 401 Certification and the antidegradation policy to protect wetlands hinges on the question of wetlands as "waters of the State." While North Carolina statutes refer to "swamps" as waters of the State, the term "wetland" is not addressed explicitly. The Attorney General's Office has issued an informal opinion that wetlands are waters of the State. Final clarification is expected in the next triennial water quality standards review. By late in the summer of 1990, DEM plans to have draft wetland water quality standards, classifications, and uses ready for EMC review and approval to take to public hearing (pers. comm. J. Dorney, DEM).

Table 12-1 shows components of State 401 programs that successfully protect wetlands and how North Carolina stands in implementing these components. The list of components is taken from a recent EPA guidance document (U.S. EPA 1989b).

B. 3. Coastal Area Management Act

Salt marshes and wetlands subject to tidal flooding (including normal wind tides) are designated as Areas of Environmental Concern under North Carolina's Coastal Area Management Act (CAMA). Projects in these wetlands are handled jointly by COE and the Division of Coastal Management. The COE Wilmington Office has issued a general permit for such activities in the 20 coastal counties covered by CAMA. The "CAMA general permit" also incorporates applications and processing for the CAMA Major Development Permit and State 401 Certification (Gale et al. 1985). After federal and State agency review of such a project, the Division of Coastal Management may issue a CAMA permit including any COE conditions, in which case COE notifies the applicant that Section 404 requirements have been satisfied.

Although perhaps 90 percent of applicants are issued CAMA permits, the actual wetland loss due to these projects is limited to only about 2 acres per year. Most approved projects are very small, and the CAMA permitting process has been effective in preventing the types of large fill projects in marshes which occurred prior to the Act.

A more complete discussion of the CAMA permitting process is provided in Chapter 11 (Critical Habitat Protection).

TABLE 12-1. EVALUATION OF N.C.'S SECTION 401 WETLAND PROTECTION ELEMENTS

1. Wetlands explicitly included as waters of the State in WQS and 401 regulations?	Currently, no; DEM planning to propose such modifications to the EMC in 1990.
2. Other language in the above regulations address wetlands?	Again, to be considered in 1990
3. Effective use made of narrative WQS and antidegradation regs in 401 certifications to protect wetlands?	DEHNR has recently begun denying or conditioning permits based on narrative standards; the antidegradation and dredge-and-fill rules were strengthened in 1989.
4. Good inventory of wetlands available?	The National Wetlands Inventory is still under development for A/P region (currently being ground-truthed).
5. Designated uses reflect wetlands functions?	Planned for 1990.
6. Wetlands included in highest tier of WQS?	No. Outstanding Resource Waters do not currently include wetlands, but but may in the future.
7. Wetlands and 401 certification incorporated into other water quality programs (e.g., CZM, point/NPS controls, mgmt plans)	To a limited extent. DEM has reviewed dam removal impacts on wetlands and considered effects of NPDES discharges on wetlands surrounding receiving streams.

C. PROGRAM EVALUATION

C. 1. Tractability of the Problem

The task of wetlands protection has become increasingly tractable over the last several years with (1) general agreement between the COE, EPA and FWS on what constitutes and wetland and (2) increasing availability of information on where wetlands are located (e.g., the FWS's National Wetlands Inventory). The effects of wetlands loss and conversion have been well-documented and increasingly are recognized by the general public. However, many people think of wetlands as marshes and swamps, whereas some wetland types on the A/P Peninsula (e.g., bottomland hardwoods, pocosins) resemble upland areas to the untrained eye except during the wettest conditions.

The target population, while of manageable size (i.e., landowners holding wetlands who would like to develop their property), is nevertheless often located in remote areas traditionally immune from government interference. Remoteness and dispersion of the target population makes surveillance and inspections difficult. The behavior to be regulated generally consists of clearing and land drainage, so it is not highly diverse. Finally, wetland protection rules can have a large negative impact on property values, and where large-scale development is concerned, owners have considerable incentive to resist or challenge the rules.

C. 2. Clarity and Substance of Program Goals

Although preservation of wetlands is mentioned in the North Carolina Constitution, no State law clearly mandates wetland protection. CAMA mandates protection only of tidally influenced marshes. Section 404 provides a system for reviewing and permitting dredge and fill projects, and does not even mention wetland protection as a goal. The 404 program's wetland protection function has evolved into its current status only after years of judicial review. Even North Carolina's water quality standards do not explicitly identify wetlands as waters of the State or identify their important functions (uses), thereby entitling them to protection under the State's antidegradation policy. This situation could be remedied during the 1990 triennial review of North Carolina's water quality standards.

Using Rosenbaum's (1981) criteria for rating the specificity of wetland regulations (see Chapter 3, part B), the Section 404 program does not rank high: basic objectives are ambiguous, evolving as they have over many years and court decisions; geographic boundaries (i.e., what is a wetland) have been subject to much dispute, although this should improve in the future; and permit approval criteria are ambiguous and leave a great deal open to interpretation (Tripp and Herz 1988). On the positive side, exemptions are clearly stated (e.g., normal farming and silviculture activities).

While it is by no means a panacea, the recently proposed goal of "no net loss" is important precisely because it provides a clear and unifying objective for the array of programs and activities that either protect or degrade wetlands. Unlike other environmental problems that are amenable to numeric standards, there are no definitive "standards" for wetlands protection. As a result, wetland programs have been plagued by conflicts over questions such as the avoidability of impacts, the need for mitigation, and the wetlands values to be lost or restored (Davis 1989). This goal is beginning to be incorporated into statutes. For example, the State of Maryland enacted a non-tidal wetlands law that incorporates the concept of "no overall net loss."

C. 3. Sound Theoretical Basis

The lack of clear program objectives for wetlands protection (with the exception of the CAMA program) makes it difficult to construct sound technical procedures to accomplish goals. Important assumptions underlying the current 404/401/CAMA wetlands program are: (1) wetlands can be clearly identified; (2) any alterations of important wetlands are subject to review; and (3) review procedures incorporate standards or criteria to ensure that important wetland functions will be maintained. Assumption number 1 has been addressed by several recent developments, however 2 and 3 remain problematic under current programs.

Wetlands identification. Previous inventories by the U.S. Soil Conservation Service, the National Oceanic and Atmospheric Administration, and others have focused on soil types, on wetlands bordering estuaries, and other specialized topics. Now, however, a comprehensive wetland inventory is being completed by the U.S. Fish and Wildlife Service with ground-truthing assistance from the N.C. Division of Soil and Water Conservation. The National Wetlands Inventory (NWI) is based on areal photography from the winter of 1982-83.

In addition, the new wetlands determination procedure agreed to by the COE, EPA and FWS will help immensely with the issue of wetlands identification. Such site-specific analysis will remain important even after the NWI is completed because the NWI is not suitable for making individual permit decisions (S. Leonard, personal communication).

Review of any alteration of important wetlands. Clearly, large nonexempted activities in wetland areas fall under the COE regulations. However, often filling may occur on smaller isolated wetlands, under current 404 regulations. For wetlands of less than one acre, no permit is required; for wetlands under 10 acres, only circulation of a pre-discharge notification is required. Recent evidence has shown that small isolated wetlands **cumulatively** perform extremely valuable functions in removing nutrients and sediment. Kuenzler (1988) concluded that these small wetland areas "may be at immediate risk of loss, with serious implications for both water quality and habitat values... Critical study is urgent in order that such systems not be filled, drained, or otherwise destroyed before their values are fully recognized."

Adequacy of standards to maintain wetland functions. When wetlands are developed, most of the important functions of these areas (habitat, flow moderation, pollution reduction, etc.) are lost. In some cases however, the "functional" effects of wetland development are not so clear. Monoculture pine plantations, which are allowed (with some restrictions) under Section 404, can function like pocosin wetlands in terms of hydrology and pollutant loadings. (Clearly, habitat values to terrestrial species are changed, but terrestrial habitat uses are largely ignored under current regulatory programs, most of which sprang from the Clean Water Act). The silviculture exemption under Section 404, which allows wetland conversion to pine plantations, may be the greatest single wetlands issue affecting the A/P region, at least in terms of acreage of natural wetlands lost. Another example of lack of clarity in the functional effects of wetland projects is the drainage of existing ponds or lakes. While aquatic life uses are changed in such cases, they are not eliminated.

As mentioned above, one of the most critical standards for review of wetland development is the "water dependency" criterion (see B.2., above). However, to date very few courts have been willing to apply this criterion forcefully (Houck 1988). More fundamentally, recent court decisions have indicated that whether an alternative site is available or not, denial of development rights may constitute a "taking" for which compensation is required. One effect of these decisions may well be to discourage State regulators from exercising their authority.

C. 4. Adequate Resources for Implementing Agencies

Resources allocated to implementing the Section 404 program and the Section 401 certification program are inadequate. Currently, EPA Region 4 has only one experienced staff member to handle wetlands determinations in North Carolina, and his activities have been hampered by a limited travel budget. FWS staff are able to visit very few sites, and comment on only the most critical projects; FWS's response to nearly all permit applications is a form letter to COE stating that a full review is not possible due to staff limitations.

The Wilmington District COE's 404 program has suffered each year from cutbacks in personnel allocations. COE's budget for FY90-91 looks more favorable, and up to 13 field personnel may be on duty in North Carolina within a year, with a new field office in Washington, N.C. A temporary but significant problem will be the lack of experience in the recently announced wetlands delineation methodology. The workload in several agencies will increase significantly as a result of the new wetland delineation methodology. COE estimates that their 404 jurisdiction will increase by roughly 30 percent (W. Wright, COE, personal communication). Furthermore, the proposed "no net loss" policy could require tremendous efforts to asses wetland values and set defensible mitigation requirements.

DEHNR staffing allocated to wetlands-related programs is also inadequate, especially in light of recent initiatives described above under "401 Certification." DEM's expanded interpretation of 401 authority will require closer review of 404 applications and the development of permit conditions (project changes and mitigation); these initiatives will greatly increase staffing requirements. Only in the summer of 1989 did the first DEM staff member receive the training needed to make wetland determinations.

C. 5. Adequate Incentives and Sanctions

Violators of 404 permit conditions can be assessed civil penalties of up to $25,000 per day. Such penalties and the high visibility of the 404 program are believed to have greatly reduced the number of significant projects attempted without a permit. During FY88, the COE took action against 151 unpermitted projects representing 93 acres of damaged wetlands; much of this acreage has been or will be restored to wetlands through permit conditions and enforcement actions (pers. comm. W. Wright, COE).

EPA has authority to assess administrative penalties in such cases, but COE generally handles them without referral to EPA. For example, COE often issues after-the-fact permits for small projects, where such projects would likely have been permitted if proper procedures had been followed. By issuing such permits without penalties, COE forfeits the opportunity to use these case as a deterrent to other potential violators. However, because of the shortage of staff for enforcement (in both the Corps and EPA) and the relatively small acreage lost due to violators who are "caught in the act," assessment of such penalties is a low priority at this time.

One area where sanctions are uncertain is in the application of the State's antidegradation policy to conditions placed on 401 certification. Until wetland uses are included in the State's water quality standards, 401 conditions (e.g., mitigation to result in no net loss), and indeed denials of 401 certification may be challenged as an unfair taking of private property. The State's defense against such challenges would be greatly strengthened by the explicit inclusion in water quality standards of (1) wetlands as waters of the State; and (2) wetland uses.

C. 6. Access to Supportive Constituency Groups

Despite the fragmented nature of the current wetlands program, there are good opportunities for access by the public and other supportive groups. All applications for Section 404 individual permits as well as COE/CAMA general permits are open for review and comment by the public. Citizens and groups may request to be included on the COE's mailing list to receive public notices; also, public notices are usually published in a local newspaper as this is a requirement for CAMA permits and 401 certifications. Where public interest is strong, the COE or the State may hold public hearings, allowing greater opportunities for access. While Section 404

decisions may not be appealed, as for other sections of the Clean Water Act, there is an opportunity to file a citizen suit.

C. 7. Adequate Training, Technical Assistance and Education

An effective wetlands program must encompass: (1) trained program staff, (2) technical assistance, particularly to local governments who enforce land use and development controls, and (3) education for developers and the general public on the value of wetlands and the need for restrictions on their use. Probably because the current regulatory situation is fragmented, these needs often are not being met. While the COE staff includes trained field technicians, the State DEM has a shortage of personnel with the education (soils, botany, ecology) and experience to implement an effective program. Ideally, someone in each DEM Regional Office should be able to identify wetlands, assess project impacts, and assess proposed mitigation measures.

Technical assistance or training for local government officials is also rarely provided. In many cases, local governments are the first and only line of defense against development in small isolated wetland areas. They should be provided with, at a minimum, maps and guidelines for determining whether a development may impinge on wetland areas.

Finally, the development of public support for wetlands protection will require greater efforts. In several States, public interest committees have been formed to build consensus and support for wetlands programs (e.g., Illinois and Washington State; see N.C. EDF (1989a) and Puget Sound Water Quality Authority 1989).

C. 8. Implementation Assigned to Agencies that are Committed to Program Objectives

All of the implementing agencies are committed to program objectives as they see them. However, since there is no clearly stated wetland protection objective (in either Federal or State regulations), the level of commitment to protection may vary.

Until quite recently, the COE appears to have operated the 404 program as a system for permitting wetland development while minimizing damage due to drainage and filling. Although the program has reduced the rate of wetland loss in North Carolina, the COE has been reluctant to make the 404 permit process into a wetlands protection program. In keeping with this view, until recently the COE advised developers of technicalities that would enable them to avoid the 404 process (see letters reprinted in N.C. EDF (1989a)). While this practice was renounced by the Wilmington District in 1989, the philosophy behind the practice leaves open the question of the COE's commitment to wetland protection per se.

12: Wetlands Protection

In spite of the past practices mentioned above, the COE Wilmington District has a good reputation relative to other districts. More than other districts, Wilmington relies on trained biologists (rather than engineers) to review 404 proposals; the district also has a good record of accepting conditions from the Marine Fisheries Service (Mager and Hardy, undated). Statewide losses of wetlands by projects where COE has authority are now measured in terms of a few hundred acres per year as opposed to thousands of acres per year in previous decades.

The FWS has been active in wetlands protection for decades, opposing most wetlands development projects. Both DEM and DCM appear to have a growing commitment to wetlands protection as evidenced by the broad policy changes being contemplated and the initiatives taken over the last 18 months. Better evidence of commitment will be increasing resources devoted wetland-related program activities.

While there is widespread commitment to each agency's own efforts at wetland protection, there is room for increased commitment to work together. COE's interpretation of 404 program objectives has led to disagreement with other agencies. FWS, for example, objects to many permits issued under 404 on the basis of unacceptable impacts. DEM would prefer that civil penalties be assessed for projects that receive after-the-fact permits; as mentioned above, assessment of civil penalties is an EPA function.

D. ISSUES OF CONCERN

The following issues are just the highlights of many issues that remain to be resolved in this complex area.

D. 1. Longstanding Issues, Largely Resolved

- Agricultural and peat-mining conversion projects. Historically, most wetland loss in the region has resulted from clearing and conversion to row crop agriculture. The 404 and Swampbuster programs have virtually halted the loss of wetlands to agriculture. It is unlikely that any agricultural project could survive the costly and protracted EIS process, the extensive mitigation requirements, and the loss of federal farm subsidies (a Swampbuster provision). The question of peat mining is "resolved" in that the largest tracts of peat in the region (formerly First Colony Farms' holdings) are now under protection by the Conservation Fund and the FWS. Nearly all remaining peatlands are classified as wetlands, thus subjecting any proposed project to extensive review under the 404 and EIS processes and to extensive mitigation requirements.

- Delineation of wetlands. A major issue for years, the agreement among EPA, COE and FWS on a wetlands delineation procedure should resolve this long-standing issue, unless the State chooses to use a more expansive definition of wetlands.

- Wetlands Inventory. The National Wetlands Inventory will be completed in the near future and should be used as a resource to provide at least a screening level "advance identification" of wetlands for all State and local agencies.

D. 2. Ongoing Issues

- Cumulative impacts. The cumulative impacts of many small wetland conversions are unknown and difficult to assess. The case-by-case nature of wetland regulations frustrates the goal of protection since individual permits by definition cannot be cumulative. Also, there is no readily-accessible source for information on projects permitted, exempted projects, types of wetlands involved, geographic locations of projects, etc. This lack of a comprehensive data source means that resource managers must rely on their own limited data or unsubstantiated information from interested parties.

- Enforcement. There is a lack of knowledge about the extent of illegal wetland conversion projects or about the extent of serious permit violations among permittees.

- Lack of trained staff. Agencies responsible for 404 permit review and 401 certification need to hire or otherwise allocate more staff to effectively carry out these mandates.

- Silvicultural exemptions. Normal, ongoing silvicultural activities are exempt from 404 permitting requirements. EPA has interpreted this to include conversion of wetland forests to pine plantations provided there is a documented management plan and the land retains its wetland characteristics. Many people see such conversions as causing a loss of wetland functions, and this exemption as potentially a major source of losses for certain types of wetlands on the A/P Peninsula because of the large landholdings of timber companies. The scope of these possible conversions, and their impacts on wetland uses and aquatic life, are not known at this time.

- Drainage without fill. Under Section 404, ditches may be dug in wetlands without a permit if all material is hauled offsite for disposal. This technique is difficult to apply successfully but is possible in limited cases. COE may have resolved the issue by a policy announced early in 1989. COE now notifies developers that permits are likely to be needed, and that any unauthorized

discharge of fill will be treated as a willful violation of the law. This policy should severely limit the number of such projects attempted, but the effects will not be known with certainty for some time. Developers may also try to drain wetlands by constructing off-wetland ditches. DEM is seeking to stop such projects on the basis of removal of uses, but there are questions about whether existing statutes support this position.

- State's authority under 401 and antidegradation rules. The limits of the State's authority to deny or condition 401 certification has not been tested since DEM's expanded 401 policy has gone into effect. The State may not have authority to regulate many projects outside the scope of Section 404. This is because nonpoint source discharges from wetlands are outside DEM's current authority to regulate "discharges of waste," which are interpreted to mean point source discharges. The use of 401 certification to protect wetlands from nonpoint sources is an ongoing issue that will probably be tested in court.

  No North Carolina wetlands have received ORW protection, nor has 401 certification been denied for wetlands projects under the antidegradation policy. A major reason is that the State has not developed the necessary designated uses and standards to be preserved.

- Implementing no net loss. A no net loss policy has been suggested for adoption in North Carolina. Issues are bound to arise around equity to small landowners and adequacy of mitigation technology. The no net loss policy favors large landowners and companies who have the financial and land resources to mitigate, for example by creating artificial wetlands. Also, there may be no acceptable mitigation methods for many types of wetlands, thus ruling out some projects even if the applicants have sufficient resources to mitigate. Other issues are the precise definitions of what constitutes losses or gains; the geographic scope of the "netting" process (Statewide, basin-by-basin, or watershed-by-watershed); and the appropriate metric for accounting purposes (function, acreage, or both).

E. RECOMMENDATIONS

With one exception (E. 6.), the following recommendations address only the existing regulatory programs evaluated in this chapter. While there may be numerous advantages to a new State statute directly aimed at wetland protection, issues associated with new legislation are not addressed.

E. 1. Improve Existing Wetland Protection Programs

Recent initiatives in DEHNR, COE and EPA offer the potential for eliminating or mitigating significant losses of wetlands in the A/P region. Five actions that would help cement a strong wetlands protection function follow.

- DEHNR should make a clear statement about the need for wetlands protection, and about the policies its agencies will follow in permit review and certification efforts.

- The EMC should specifically recognize wetlands as waters of the State, and should create a classification for wetlands, with an associated set of uses and of narrative and numerical standards. This would clarify and improve the 401 certification process.

- More State staff should be hired or trained to work in wetland identification and protection.

- DEHNR should work with the Legislative Study Commission to develop a model wetland protection ordinance for local governments.

- The CRC should consider revising local land use planning guidelines to require that plans designate wetlands as conservation areas.

E. 2. Promote Advanced Identification of Wetlands

- Current protection efforts rely to a large extent on case-by-case decisions regarding the location and resource value of wetlands. As a result, developers as well as local and State government agencies often are not fully aware of potential restrictions. The State should consider taking the lead in conducting "advanced identification" studies in critical areas to delineate wetlands and provide maps, with accompanying information, to regulatory and planning agenicies.

- CAMA land use plan updates should include mapping of wetlands and a statement of local policy with respect to wetland protection.

E. 3. Develop a Public Education Program

- Informed citizens can help prevent unnecessary losses of wetlands as well help identify possible violations. Also, protection efforts will be enhanced when the public becomes aware of the many different types and functions of wetlands, rather than the common misperception that all wetlands are marsh-like. The State should provide a variety of informational and educational materials including: (1) news releases and public notices, (2) posters and

proposed curricula for schools, and (3) brochures that spell out wetland policies and regulations and the implications of buying and building in wetlands (these could be distributed to trade associations, real estate firms and municipal and county planning groups).

E. 4. Evaluate Enforcement under Section 404

- There is uncertainty as to whether stronger enforcement of the 404 program is needed. A study is recommended to determine (1) if significant losses are occurring because violators who do not apply for permits go undiscovered, and (2) if violators of permit conditions are causing significant impacts on wetlands.

E. 5. Evaluate/Quantify Wetland Losses

Much of the impetus for increased wetland protection stems from the perception that existing wetland losses are significant and unacceptably high. At some point (perhaps during development of legislation), these assertions will be challenged and accurate figures on recent wetland losses in North Carolina will be needed. Particular emphasis should be placed on quantifying losses due to the various 404-exempted activities, since 404 and CAMA seem to have greatly stemmed the loss of wetlands under their jurisdiction.

- The State should evaluate whether significant losses of wetland functions are occuring as a result of Section 404's exemption for forestry operations, Nationwide Permit 26, and other exemptions.

E. 6. Expand State Acquisition of Wetlands

- State acquisition of (or purchase of easements or development rights for) critical wetlands should be increased through the N.C. Natural Heritage Trust. Additional funding for this effort could be obtained through a State tax on new residential and commercial construction; a tax or fee on real estate transfers (restricted to the transfer of undeveloped lands); or increased building permit fees.

E. 7. Investigate the Consolidation of Existing State Wetland Protection Programs

- North Carolina's efforts regarding wetland identification and protection might be strengthened by integrating them into a single organizational entity to take advantage of the relatively few trained staff in this area. The North Carolina EDF report (1989, xii) suggests the creation of an "Office of Natural Areas and

Wetlands" to include functions of the Natural Heritage Program, the State Wetlands Office and portions of the Wildlife Resources Commission Nongame and Endangered Species Program.

While there may be several disadvantages to such a consolidation, a primary advantage of an integrated program would be the development of core expertise in project review, technical assistance to local governments and developers, and public education concerning wetland values. A study of the advantages and disadvantages of such a change is recommended.

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LIST OF ABBREVIATIONS

A/P	Albemarle-Pamlico
ACSP	N.C. Agriculture Cost Share Program
AEC	Area of Environmental Concern
ASCS	Agricultural Stabilization and Conservation Service
BMP	Best management practices (usually agricultural)
BOD	Biological oxygen demand
CAMA	Coastal Area Management Act
COE	U.S. Army Corps of Engineers
CRC	Coastal Resources Commission
DCA	N.C. Division of Community Assistance
DCM	N.C. Division of Coastal Management
DEH	N.C. Division of Environmental Health
DEHNR	N.C. Department of Environment, Health, and Natural Resources
DEM	N.C. Division of Environmental Management
DLR	N.C. Division of Land Resources
DMF	N.C. Division of Marine Fisheries
DNRCD	N.C. Department of Natural Resources & Community Department
DSWC	N.C. Division of Soil and Water Conservation
EMC	N.C. Environmental Management Commission
EPA	U.S. Environmental Protection Agency
FTE	Full time equivalents
FWS	U.S. Fish and Wildlife Service
GPD	Gallons per day
ha	hectare (1 acre equals approximately 0.4 hectares)
JOC	Judicial Order by Consent (issued to NPDES permittees)
LPP	Low pressure pipe system (nonconventional septic system)
MGD	Million gallons per day
NCAC	North Carolina Administrative Code
NCSU	North Carolina State University
NCGS	N.C. General Statute
NCWRC	N.C. Wildlife Resource Commission
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NSW	Nutrient Sensitive Waters (a classification for waters)
OGC	DEHNR Office of General Council
ORW	Outstanding Resource Waters (a classification for waters)
PNA	Primary nursery area
SAV	Submerged aquatic vegetation
SCC	Sedimentation Control Commission
SCS	U.S.D.A. Soil Conservation Service
SNA	Secondary nursery area
SOC	Special Order by Consent (issued to NPDES permittees)
SPCA	The Sedimentation Pollution Control Act of 1973
SWCD	Soil and Water Conservation District
WRC	N.C. Wildlife Resources Commission
WRRI	N.C. Water Resources Research Institute
WTOCC	Wastewater Treatment Operators Certification Commission