Protecting Coastal Wetlands and Estuaries: Tools for State and Local Governments

by

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A RESEARCH REPORT

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1.0 Background

In the United States, the practice of coastal zone management developed during the late 1960s and early 1970s in response to growing awareness of environmental crises affecting coastal waters and shorelines. Some of these crises–fish kills, oil spills, shellfish harvesting and beach closures–were symptoms of a changing coastal environment resulting from natural trends affected by human activities. Increased population in coastal areas and associated development, municipal and industrial waste disposal in estuaries and coastal waters, dredging and filling of sensitive wetlands and other habitats, and blocking of traditional public access to beaches and coastal waters were issues that raised concern among the public and the coastal management community alike. States responded with a variety of coastal management initiatives.

In 1972, these state efforts received additional support with the passage of the federal Coastal Zone Management Act (CZMA). The CZMA provided states with funds to help develop and implement programs according to federal standards. In addition, the CZMA promised "federal consistency" with state coastal policies once states' management programs were approved by the Secretary of Commerce. All 35 eligible coastal states and territories participated and today, 31 states covering 98% of the U.S. shorelines have approved coastal management programs and three of the remaining states have reactivated their program development efforts.

Evaluation of state coastal program performance in meeting CZMA goals has been an important part of the federal oversight role. In addition to required CZMA §312 evaluations, state coastal programs have been evaluated by other federal and congressional agencies and in numerous academic studies. Most national studies have focused on institutional arrangements or examined coastal management program processes. None examined the on–the–ground effectiveness of coastal programs in terms of resources protected, hazards avoided, access provided, or port and other appropriate development facilitated. This shortcoming led the NOAA Office of Ocean and Coastal Resources Management to initiate the National Coastal Zone Management Effectiveness (CZME) Study in 1995. The main objective of the CZME study was to determine the on–the–ground effectiveness of state coastal management programs in addressing the core objectives of the federal CZMA. Five of these core objectives were selected for examination: protecting coastal wetlands and estuaries; protecting beaches and dunes; providing for public access; revitalizing urban waterfronts; and providing for ports and coastal dependent uses.

For most of the 29 state coastal programs evaluated in the CZME study, on–the–ground outcome data were insufficient to determine outcome effectiveness. For the coastal wetland and estuary protection component of the study, there was sufficient information to make "probable" effectiveness determinations for only 12 of 29 states (Good *et al.* 1997). However, to really understand the effectiveness and significant contributions of state coastal programs in wetland and estuary management, one needed to go beyond numbers or areas and look at actual case examples of the innovative policies, processes, and tools states had invented or developed. For example, coastal management fostered the development of special area management planning in Greys Harbor, Washington, a tool that has been applied to other areas with intense user conflicts and sensitive resources.

The wetland and estuary portion of the CZME study identified more than 40 such state innovations that warranted highlighting. These case examples included tools and programs from five categories of policies, processes, and tools states use to manage coastal wetlands: research, mapping, and assessment; regulatory; planning; nonregulatory; and coordination.

One of the principal recommendations in the wetland portion of the CZME study was to further document and publish exemplary case studies of the most important processes and tools. If some or a portion of these processes and tools could be applied in other locations with similar problems or opportunities, wetland and estuary management would be strengthened and outcomes improved. This report is in response to this recommendation.

This report is organized as follows. First, a model state coastal program for coastal wetland and estuary protection is presented. This model is based largely on the "most important policies, processes, and tools" for coastal wetland management determined in the CZME study (Good *et al.* 1997). The model also serves as the framework for selecting the 16 case studies that follow discussion of the model. Case studies are organized into five management categories following the organization of the model: information and research, regulation, planning, nonregulatory, and coordination.

1.1 A Model State Coastal Management Program for Estuary and Coastal Wetland Protection

The case studies in this report describe tools from a range of management approaches. This approach was deliberate, as wetland and estuary protection is complex and warrants a broad range of management actions. A conceptual model (figure 1-1) combining wetland and estuary programs, processes, and tools provides the underlying framework for the case studies. This model— developed as an evaluation tool in the CZME Study—assumes that the issue of estuary and wetland protection is highly important and historic wetlands loss rates were high, and subsequently describes management elements necessary for wetland and estuary protection. The model is conceptual because no single state contains all of the tools and programs outlined in figure 1-1. However, state coastal management programs have successfully implemented individual management programs and tools of the model. Additionally, all state programs have at least one management program or tool from each of the five main management categories.

Not all state coastal programs may need to contain each individual program or tool discussed in figure 1-1 to be considered strong and effective. States have varying levels of resources available to address their particular coastal wetland and estuary protection needs; these needs and resource issues also vary. For example, a state with a relatively low level of historic wetland loss might not devote as many resources to a restoration program as would a state with historically high wetland loss. Thus, for purposes of this report, the model is not intended to be evaluative. The model does provide a supporting framework for the case studies. Case studies were selected to describe elements of this model

Information and Research Element

A **recent, accurate wetland inventory** and **GIS-based mapping** support regulatory, planning, and other program elements. The inventory includes **wetland function assessments** and the state periodically **monitors changes in wetland extent**. Data is incorporated into readily accessible **databases.**

Regulatory Element

The state has regulatory **permit programs** for tidal and nontidal waters and wetlands through a coastal use permit or a resource-specific program. Programs are state-administered or at the local level with strong state oversight. Permit decisions are the basis for **federal consistency** and **401 water quality certifications**. **General permits** streamline the process, but no exemptions lead to significant cumulative impacts. The state implements **no-net-loss** policy through sequenced "avoid-minimize-compensate" **mitigation** requirement that prioritizes restoration over creation. Mitigation replaces both area and functions lost to permitted projects, at greater than 1:1 ratio. Only water-dependent projects are allowed in wetlands adjacent to navigable waters. Single purpose dock permits have declined in favor of community moorage. Regulatory program has strong compliance monitoring and enforcement. Reliable **outcome data** is available through databases and GIS, demonstrating that permitted loss of wetlands and violations losses are low with favorable trends. Permitted loss area, mitigation area, and violation area/numbers quantify on-the-ground regulatory effects.

Planning Element

Local land use plans based in part on state standards to protect estuaries and wetlands are in place. In areas with particularly important resources, many competing uses, and/or significant development versus conservation conflicts, intensive planning exercises have succeeded using **special area management planning** (SAMP) or similar processes. Alternatively, the state has designated **GAPCs, AECs, or critical areas** and developed plans to protect coastal waters and wetlands. Reliable **outcome data** show that the most valuable estuarine and wetland areas are protected through zoning or special area designations that severely limit alterations; less important but still sensitive areas have moderate protection, while areas especially suited for port and other water-dependent development are set aside for these uses.

Nonregulatory Element

The state has **strong public, landowner, and professional education programs** to support and promote wetland protection and nonregulatory restoration. Partnerships with higher education and Sea Grant programs are pursued. Based on a **goal of net-gain-of-wetland area and function**, the state has a significant **nonregulatory wetland restoration** program. **Acquisition** is important but has limited focus to areas most at risk. These include resource areas needed to preserve endangered species, critical habitat for other important fish and wildlife species, and other highly functional areas. **Fee-simple purchase**, mostly using **other-than-coastal management funds** is the most important tool, with coastal management **assisting** by identifying wetland areas for acquisition or facilitating transfers. Less-than-fee acquisition through **conservation easements** has also been an important tool. Reliable **outcome data** show that a significant percentage of historically impacted wetlands have been restored, and there are plans for more as funding and willing landowners become available. Acquisition outcome data show acreage and habitat types acquired using different tools as well as subsequent management information.

Coordination Element

Using **memoranda of agreement**, **joint permit applications and notices** with the federal §404 program, and **preapplication conferences**, the state has effective interagency coordination and a communication link with the development community to **expedite the permit process and promote compliance.**

Figure 1-1. Model program for wetland and estuary protection (after Good *et al.* 1997).

program, in part to illustrate that it is possible to have such a wetland and estuary protection program.

The model resulted from discussions with state estuary and wetland managers. We asked managers to rank the most important tools used in their particular state for estuary and management protection. These rankings were combined to provide a national overview of the most important wetland and estuary protection tools used by state coastal programs. We combined tools from this list with best professional judgement to develop the model program described in figure 1-1. The model also includes outcome effectiveness indicators, or data to illustrate the on–the–ground impact of wetland and estuary protection programs. For the CZME study, this model served as a reference standard for evaluating the 29 individual state coastal programs and their on–the–ground effectiveness.

An important limitation with the outcome effectiveness indicators included in this model is that they focus on wetland and estuary protection in terms of area rather than function. Maintaining ecological function is the true goal of wetland and estuary protection programs. For example, while a permit program may show an increase in wetland area through the use of mitigation, it is not possible to examine area data alone and determine that wetland functions have been preserved as a result of the permit program. Additional data on function is needed to make such a conclusion. However, function protection data is nonexistent at the statewide level, in large part due to our limited understanding of wetland function. Data on the amount of area protected may provide some indication of function protection. The CZME study depended on area data, limited in availability as it was, to determine the on–the–ground effectiveness of state coastal programs. This limitation of outcome data is an important caveat to interpreting the effectiveness of the case studies in this report.

Due to the complexity of wetland and estuary management, it is important to consider each of the case studies as operating within a larger context. For example, regulating development in coastal wetlands is often based on land use plans and requires accurate wetland inventories and an understanding of the functional importance of different types of wetlands. Regulatory programs are given real strength through the inclusion of compliance monitoring and enforcement.

In addition to describing elements of the model program for coastal estuary and wetland protection, two other criteria were considered in selecting case studies for this report. First, programs and tools with attributable on–the–ground outcome data were selected. While many coastal states have strong tidal wetland permit programs, for example, only a few have on–the–ground outcome data. Second, case studies that illustrate different approaches to wetland restoration and functional assessment were chosen. These two topics are current areas of management focus and debate and are weak in many states. Consequently, it is useful to see successful examples of these two management practices.

1.2 Report format

The case studies are also roughly organized by management category, with the caveat that individual case studies may contain elements of multiple tool categories. Information and research tools are described first, since you have to know where resources are and what their valued functions are to adequately protect them. Regulatory programs are a key component of many wetland and estuary protection efforts and follow the information and research tools. Planning efforts, often implemented through regulatory programs, are the next section. Nonregulatory programs, described next, often provide wetland and estuary protection beyond traditional regulatory and planning programs. The final section is a section on coordination activities that have resulted in wetland and estuary protection.

The case studies briefly describe the particular social, political, and ecological setting and issues that led to the development of the management program or tool. How the program or tool is implemented is then described, illustrating how the program or tool responded to a management issue. Where applicable, on–the–ground outcome data is used to substantiate discussion of the program or tool's success and effectiveness. Transferability issues, or considerations for adopting a particular tool elsewhere, are also included in the discussion.

2.0 Information and Research Tools

The CZME Study found that wetland inventories were used by every state coastal program and were one of the ten most important management tools in use nationally (Good *et al.* 1997). Inventories often operate in support of more visible elements of coastal wetland and estuary programs such as permitting and planning. This "behind–the–scenes" characterization does not diminish the importance of these tools.

A national methodology such as the National Wetlands Inventory (NWI) should be customized as necessary to include all wetlands within an individual state. For example, the *Wisconsin Wetlands Inventory (WWI)* uses modified NWI mapping techniques to include unique wetlands such as ridge–and–swale and red clay complexes. The WWI is availabile in Geographic Information System (GIS) and database format, increasing its utility. The WWI provides a solid information base for Wisconsin's wetland protection efforts and wetland change monitoring.

Wetland inventories provide information regarding wetland location but not necessarily wetland function. Two approaches to wetland function assessment are described in this report. *The North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS)* uses GIS analysis techniques to rate wetland function at a landscape scale. The result of this process are maps of wetland "significance" providing information to developers and resource managers in the regulatory process.

In response to a need for a wetland restoration program, the Washington Department of Ecology developed a *database of potential wetland restoration sites* for a moderately sized river basin in the Puget Sound region. This database can be queried to provide information regarding the potential for a particular wetland to provide a function. For example, if flood water retention is a concern, the database can supply a list of potential restoration sites most likely to provide this function.

These case studies illustrate the important information inventories and function assessments can provide. These tools often lay the foundation for other elements of coastal wetland and estuary protection.

2.1 The Wisconsin Wetlands Inventory

Summary

Wetland inventories provide basic location information used in wetland regulation and planning. The Wisconsin Legislature recognized the need for an accurate wetland inventory when it enacted several wetland protection laws in the 1970s. The Wisconsin Wetland Inventory provides an accurate accounting of the state's wetland base. The inventory uses National Wetlands Inventory classifications adapted to identify unique Wisconsin wetlands. This inventory is used by resource managers, developers, and the public for a variety of purposes. Inventory maps are updated on a scheduled basis and are available from the state for a nominal fee, either as hard copy or a data file.

Background

Wisconsin's 15 coastal counties comprise about 19% of the state's area, but with a population of about two million, these counties have half of the state's residents. Cities and ports such as Milwaukee and Green Bay are large population centers along the mostly rural coast of Lake Superior and Lake Michigan. Dairy farming, forestry, agriculture, and tourism are major economic activities in Wisconsin's coastal zone. These activities in addition to residential and commercial development historically impacted Wisconsin wetlands. Wisconsin has approximately 5.3 million acres of wetlands remaining from an estimated 10 million acres prior to European settlement (figure 2-1), with 23% of this loss (1.215 million acres) in the 15 coastal counties (WDOA 1992).

In response to these losses, the Wisconsin Legislature has adopted a number of state wetland protection programs, including shoreland wetland zoning and a navigable waterways protection program. When these programs were adopted, it was clear that accurate, detailed wetland maps accounting for Wisconsin's unique wetland resources were needed to support them. Consequently, wetland regulation activities in Wisconsin

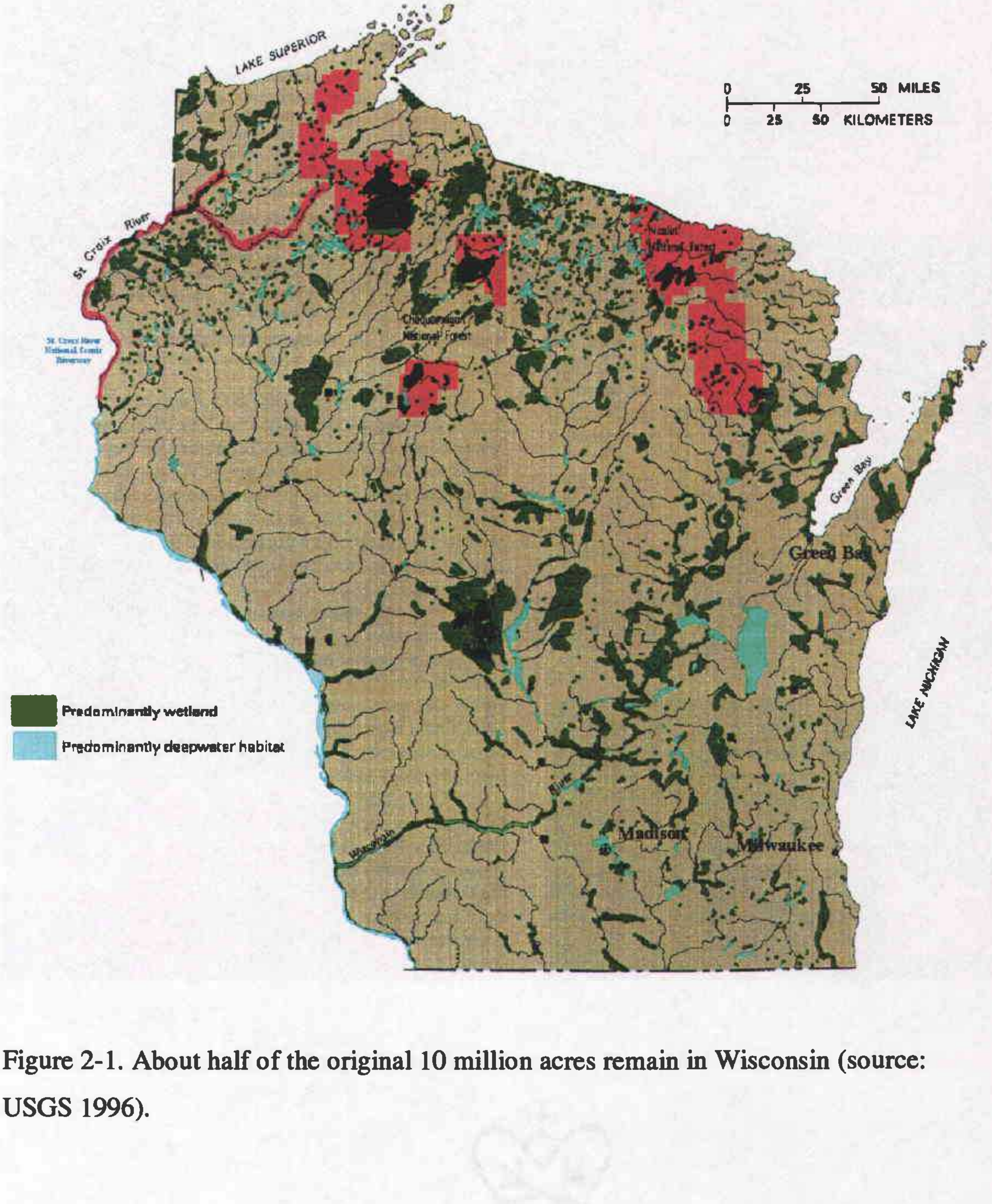

Figure 2-1. About half of the original 10 million acres remain in Wisconsin (source: USGS 1996).

rely on another program adopted by the Wisconsin Legislature in 1978 to inventory all Wisconsin wetlands—the Wisconsin Wetlands Inventory (WWI).

General WWI description

The Wisconsin Legislature charged the Wisconsin Department of Natural Resources (WDNR) with providing an accurate assessment of the types and amounts of wetlands in Wisconsin. The initial mapping process lasted from 1978 to 1984, as WDNR analyzed more than 32,000 aerial photographs statewide. The result of this analysis was a record of wetland location, size, and type, using a modified Cowardin classification system (Cowardin *et al.* 1979), at a cost of about $2.5 million (WDNR 1992a). The WWI is the only source of statewide wetland maps in Wisconsin.

Much of the information used in the WWI process comes from aerial photography. Since aerial photography may not provide all of the necessary information, soil surveys, topographic maps, and previous inventories are also used in the wetland inventory and classification process. WWI maps are field checked for accuracy and to complete maps for areas where photography is inconclusive.

The WWI includes wetlands larger than two or five acres, depending on the county. Wetlands are mapped and classified according to vegetation, hydrology, and "special modifiers." These classifications together comprise a wetland's classification code, indicated on WWI maps. Smaller wetlands are marked with a symbol on WWI maps but not classified. Open water greater than six feet deep, mining ponds, and floodplain areas do not meet the state definition of a wetland and are not included in the WWI.

Wetland vegetation is classified by determining vegetation types covering at least 30% of a wetland. All vegetation types covering more than 30% of an area are listed. Eight vegetation classes are used in the WWI, divided into descriptive sub-classes (table 2-1).

Vegetation Class (Letter designation)	Sub-class
Aquatic bed (A)	1 Submergent 2 Floating 3 Rooted Floating 4 Free floating
Moss (M)	
Emergent/wet meadow (E)	1 Persistent 2 Narrow-leaved persistent 3 Broad-leaved persistent 4 Nonpersistent 5 Narrow-leaved non-persistent 6 Broad-leaved non-persistent
Scrub/shrub (S)	1 Deciduous 2 Needle-leaved deciduous 3 Broad-leaved deciduous 4 Evergreen 5 Needle-leaved evergreen 6 Broad-leaved evergreen 7 Dead 8 Needle-leaved 9 Broad-leaved
Forested (T)	1 Deciduous 2 Needle-leaved deciduous 3 Broad-leaved deciduous 4 Needle-leaved evergreen 5 Dead 6 Needle-leaved
Flats/unvegetated wet soil (F)	0 Subclass unknown 1 Cobble/gravel 2 Sand 3 Mud 4 Organic 5 Vegetated pioneer
Open water (O)	0 Subclass unknown 1 Cobble/gravel 2 Sand 3 Mud 4 Organic
Upland (U)	

Table 2-1. WWI vegetation classes and sub-classes (WDNR 1992b). WWI maps use class letters and sub-classes numbers to describe wetland vegetation.

Each wetland classification code also contains letters designating hydrologic modifiers: "L" for standing water as in a lake; "R" for flowing water as in a river; "H" for standing water present for much of the growing season; and "K" for wet soils that don't have surface water for prolonged time periods (WDNR 1992b). Finally, each wetland classification code contains a "special modifier" describing human impacts or unique wetlands (table 2-2). Thus, a mapped wetland identified with the code "E1Ka" is an

Modifier (letter designation)	Description
Abandoned (a)	Areas which appear to have been cultivated in the past which appear to have been abandoned but have reverted to wetland vegetation
Cranberry bog (c)	Artificially constructed cranberry bogs
Exposed flat complex (e)	Exposed flats and secondary river channels too small to individually delineate
Farmed (f)	Land cultivated during drought years; classified by Soil Conservation Service as poorly drained at supporting wetland vegetation
Grazed (g)	Wetlands used for pasturing livestock
Central Sands complex (j)	Mainly in central Wisconsin, where small areas of peat, wet sand, and dry sand ridges are closely intermingled
Mats (m)	Wetland vegetation floating on water rather than rooted in soil
Red clay complex (r)	Unique wetland to Wisconsin; old lake plains adjoining Lake Superior with closely intermingled wet and dry clay soils
Ridge and swale complex (s)	Mainly along the Lake Michigan coast where narrow beach ridges formed parallel to the shore as Lake Michigan water level fluctuated. Depressions (swales) between the ridges contain wetland vegetation, but ridges are dry.
Vegetation recently removed (v)	Vegetation recently removed by clearing or other means
Floodplain complex (w)	Floodplains with seasonal wetlands, wet meander scars, oxbow lakes, and areas of upland, all too small to delineate individually
Excavated (x)	Wetlands that have been artificially excavated
Evidence of muskrat activity (z)	Photographs with detectable muskrat lodges

Table 2-2. WWI special modifiers (after WDNR 1992b). Letters are used on WWI maps for descriptive purposes.

emergent wetland with persistent vegetation lacking surface water that appears to have been farmed in the past (figure 2-2).

WWI mapping process

The wetland mapping process begins with acquisition of aerial, black and white, infrared photography at a scale of 1:20,000. Photographs overlap allowing three–dimensional viewing using a stereoscope. Infrared film allows a trained photo interpreter to detect tone, texture, reflectance, and ground vegetation patterns for wetland vegetation identification (WDNR 1992a). Interpreters then draft wetland boundaries and classifications directly on photographic base maps at a 1:24,000 scale. Municipal boundaries, waterways, and major highways are also identified on these 24" by 24" base maps. There are 1,800 maps covering the entire state available from WDNR (WNDR 1992). Figure 2-3 is the result of this process for a ridge-and-swale complex near Kenosha on the southern Lake Michigan coast.

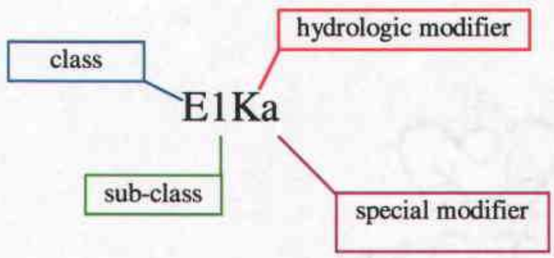

Figure 2-2. Classification code for an emergent/wet meadow with persistent vegetation lacking surface water that has been previously cultivated.

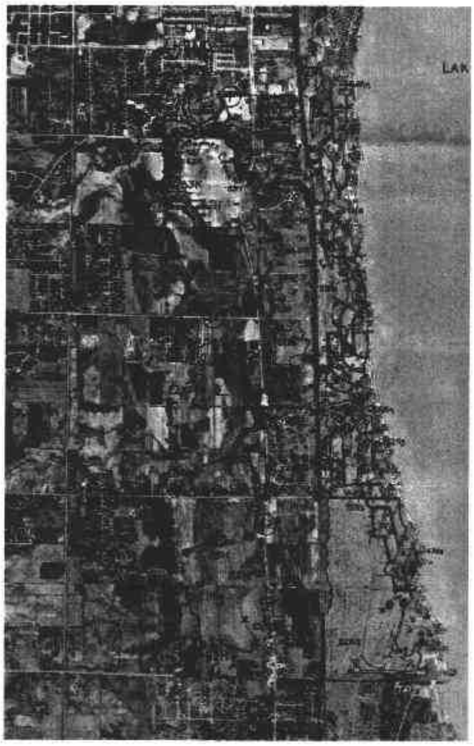

Figure 2-3. WWI map for the Kenosha area. Maps are available from WDNR.

Maps are also digitized by mounting them on a digitizing table, tracing wetland polygon boundaries, and labeling wetland polygons with the proper wetland codes. WWI maps are available from WDNR in digitized format in ARC/INFO Export Format and AUTOCAD DXF, allowing for computer assessments and Geographic Information System (GIS) overlay analysis. Figure 2-4 is digitized output for the same area as figure 2-3.

The WWI for the entire state was initially completed in 1984. While Wisconsin statute requires map updates every ten years, the realistic goal for WWI updates is every twenty years (Stoerzer, personal communication 1998). Funding for WWI updates comes in part from the Wisconsin Coastal Management Program.

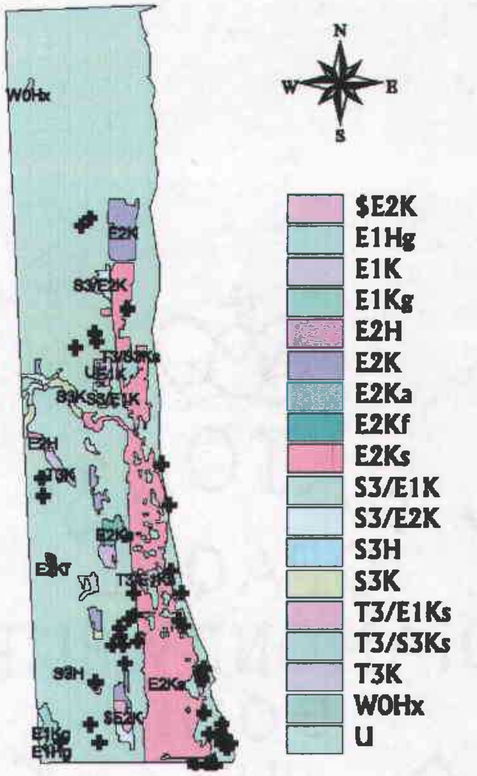

Figure 2-4. ARCVIEW GIS output for same area as figure 2-3. Crosses represent wetlands smaller than two acres. GIS data from the WWI is available from WDNR.

Uses of the WWI

The WWI is used by the various state and federal regulatory agencies (WDNR, Wisconsin Department of Transportation, US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and Natural Resources Conservation Service) in the regulatory permit review process and as a planning tool to avoid impacts to wetlands. Local zoning administrators rely on WWI maps to administer local zoning programs (WDNR 1992a). Members of the development community and property buyers consult WWI maps to assure compliance with wetland regulations.

The WWI also enables general trend analysis since inventory data is digitized. Table 2-3 indicates the potential for this type of analysis, showing general trends in Wisconsin coastal county wetlands since those counties began keeping records. If based on accurate data, these trend analyses can be used for multiple purposes including identification of wetlands needing particular protection. Such analyses could easily be done in any state with GIS–compatible inventory information.

An accurate inventory is the first step in protecting and conserving wetland resources—you have to know where they are to protect them. The WWI illustrates the importance of tailoring inventory methodology to include all appropriate habitats. The uses of an accurate, user-friendly inventory are widespread, as shown by the WWI. Having an inventory such as the WWI also makes it possible to take advantage of the analysis capability of technology such as GIS.

Wetland type	**Coastal county acreage**	**Trend (acres)**	**Percent loss**
Open water marsh	12,684	-10	0.1
Emergent/wet meadow	87,437	-848	0.1
Shrub/scrub	247,606	-413	0.1
Forested	866,852	-237	<0.1
Aquatic bed	222	0	0
Flats/unvegetated soils	474	-26	5.5

Table 2-3. General trend in five wetland types found in Wisconsin coastal counties (data from Wisconsin coastal program World Wide Web site, http://www.doa.state.wi.us/deir/coastwet.htm, 1998). Timespan varies according to when coastal counties began records; acreage figures current as of 1996.

2.2 Wetland functional assessment in North Carolina

Summary

Wetland function assessments provide important information about the role of wetlands within their larger ecosystem. Like inventories, wetland function assessments are often designed to provide information in support of other wetland protection programs. An important component of North Carolina's Wetlands Conservation Plan is the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS). Designed to be an information tool for resource managers, NC-CREWS is a geographic information system–based assessment methodology to assess wetland function. Thirty nine wetland parameters are examined and rated to develop maps showing "rankings" of wetland significance.

Issue and background

The 9000 square mile North Carolina coastal area contains extensive areas of bottomland hardwood swamps, salt marsh, and unique peat wetlands called pocosins. Wetlands have been a major management focus of the North Carolina coastal management program because of their roles in water quality, flood control, erosion prevention, and fish and wildlife habitat. North Carolina regulates impacts to tidal wetlands through the North Carolina Dredge and Fill Act and coastal program permitting (figure 2-5). However, nontidal, freshwater wetlands are not specifically protected under North Carolina state law, and few local land use plans contain freshwater wetland protection policies.

A 1992 assessment of the North Carolina coastal program identified the lack of protection for freshwater, nontidal wetlands as a major concern (NCDCM 1992). The state was also concerned with the perception that the federal Clean Water Act §404 wetland permit program treated all freshwater wetlands the same regardless of their ecological significance (Sutter and Wuenscher 1998). Developers had expressed a concern with a

Figure 2-5. The North Carolina coastal management program regulates tidal wetlands (photo source: Lonnie Shelton, North Carolina Division of Coastal Management).

lack of predictability in the §404 process. While development and economic stimulus is a prime goal of North Carolina's rural coastal counties, many coastal wetlands provide important ecosystem functions. Protection of these wetlands is vital to maintaining the coastal area's environmental quality.

These concerns led to a North Carolina coastal program proposal in 1992 to improve wetland protection and permitting through a coastal Wetlands Conservation Plan. One of the cornerstones of this Plan was the development of a wetland functional assessment procedure to help determine ecologically significant wetlands (Sutter and Wuenscher 1998). Called the North Carolina Coastal Region Evaluation of Wetland Significance (NC-

CREWS), this procedure was designed to provide wetland managers and others with information to help avoid impacts to wetlands and increase the predictability of the permit process. The functional assessment process was also designed to help with other components of the Wetlands Conservation Plan, including development of new local and state wetland protection policies. In 1992, the North Carolina coastal program began the task of developing the NC-CREWS procedure that continues to date.

Development of NC-CREWS methodology

The North Carolina coastal program received federal coastal management funds in 1992 to develop the NC-CREWS methodology. Funding through the US Environmental Protection Agency Advance Identification program was also used for a NC-CREWS pilot project in Carteret County. A portion of this grant ($45,000) was issued directly to Carteret County for development of a geographic information system (GIS).

The goal of NC-CREWS was to provide information about wetland ecological importance on a watershed–by–watershed basis. Rather than serving as the sole basis for regulatory decisions, data would identify ecologically important wetlands where development permits might be difficult to obtain (Sutter and Wuenscher 1998). Developers would benefit from this enhanced predictability while key wetlands would be protected.

A project team comprised of state agency representatives involved in wetlands planning and management was organized to assist the North Carolina coastal program in developing the NC-CREWS procedure. Approval of NC-CREWS and its methodology from these agencies was necessary to ensure the project's utility. A group of technical experts–wetland scientists, hydrologists, soils scientists, and water quality experts–was also convened to ensure the process was based on sound science. The variety and complexity of wetland types in the North Carolina coastal area also made this technical knowledge critical to the project's success (figure 2-6). For the Carteret County

Figure 2-6. NC-CREWS had to assess a variety of wetlands, from salt marshes to the pocosin shown here (photo courtesy of Lori Sutter, NOAA Coastal Services Center).

pilot project, members of an environmental group, the Homebuilders Association, the county Economic Development Council, and other interested local citizens made up a local advisory group.

Three main issues drove the development of the conceptual methodology of NC-CREWS:

- determining wetland function could not be based on site-specific field visits, as the project area (the twenty county coastal area) was too large and the budget too small
- the assessment procedure had to be based on the best available wetland science
- the procedure had to consider wetland functions on a site-specific and watershed scale, recognizing that wetland functions result from the interaction of a wetland with its surrounding landscape (Sutter and Wuenscher 1998)

GIS technology was an obvious choice to address these issues. NC-CREWS is thus "a GIS-based, landscape-scale procedure for predicting the...ecological significance of wetlands...to determine the functions of wetlands within their watersheds." (Sutter and Wuenscher 1998)

Using GIS technology meant that the procedure would have to be based on geo-referenced spatial data in order to take advantage of GIS analytical techniques (Sutter and Wuenscher 1998). The ten data layers used in NC-CREWS (table 2-4) were available through the North Carolina Center for Geographic Information and Analysis (CGIA) or were acquired through other projects. Developing GIS data was not a major cost to the

Data layer	Source
Wetland boundary and types	DCM GIS wetland mapping using digitized maps of the National Wetlands Inventory, soils, and land use/land cover.
Soils	Digitized National Resource Conservation Service (NRCS) maps by NRCS or CGIA with help from USGS, DCM, and NOAA Coastal Services Center.
Land use and land cover	Albemarle Pamlico Estuarine Study, using satellite imagery.
Hydrography	1:24,000 USGS digital line graphs converted to ARC/INFO format. Stream order was determined manually as an addition.
Watershed boundaries	Hydrologic units delineated by NRCS and digitized by CGIA through contract with DCM.
Endangered species occurrences	North Carolina Natural Heritage Program
Estuarine primary nursery areas	North Carolina Division of Marine Fisheries
Anadramous fish spawning areas	North Carolina Division of Marine Fisheries
Water quality classifications	North Carolina Division of Water Quality classifications based on 1:100,000 scale hydrography; digitized by CGIA
North Carolina priority protection areas	North Carolina Natural Heritage Program

Table 2-4. GIS data layers utilized in NC-CREWS (from Sutter and Wuenscher 1998).

NC-CREWS project, although there was expense involved in developing the GIS database.

Another main component of NC-CREWS is the inclusion of wetland functional classifications following the hydrogeomorphic (HGM) procedure developed by Brinson (1993) to allow coarse inferences regarding wetland function. For the NC-CREWS procedure, wetlands are classified as one of three broad HGM categories: riverine, headwater, or depressional (Sutter and Wuenscher 1998). Functions in wetlands classified as depressional differ significantly from riverine and headwater wetlands primarily due to landscape position and hydrology. As a result, NC-CREWS uses one set of criteria to assess the functional significance of riverine or headwater wetlands and different criteria for depressional wetlands. NC-CREWS incorporates additional inferences on wetland function by classifying wetlands according to the Cowardin system (Cowardin *et al.* 1979). The use of HGM and Cowardin classifications limits NC-CREWS to assessment of wetlands in North Carolina. Adapting the NC-CREWS procedure outside of the southeastern U.S. would require adaptation to fit wetland types of other regions.

The general structure of NC-CREWS is illustrated in figure 2-7. The result of the NC-CREWS process is a rating of a wetland's overall ecological significance as "beneficial", "substantial", or "exceptional." This rating is based on combining ratings of wetland water quality, hydrologic, and habitat functions. The risk factor describes a wetland's rarity and susceptibility to impact from surrounding land uses, and can be used to prioritize wetland protection.

The NC-CREWS assessment process

The first step in the assessment procedure is to determine if a wetland is riverine/headwater or depressional. A separate assessment procedure is utilized for depressional wetlands than for riverine/headwater wetlands. Following this determination,

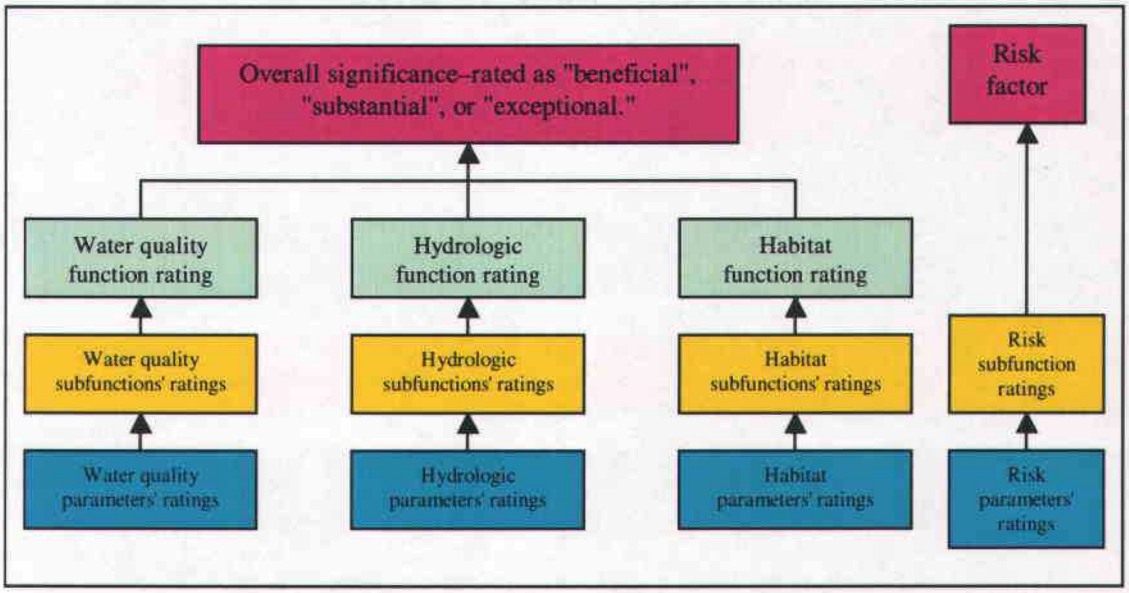

Figure 2-7. NC-CREWS structure. Individual parameters are rated; ratings are combined in a hierarchical manner to rate subfunctions, functions, and finally overall "wetland significance." The risk factor is calculated separately in a similar fashion (from Sutter and Wuenscher 1998).

NC-CREWS GIS data is utilized to evaluate and rate wetland parameters as "exceptional", "substantial" or "beneficial." Parameter ratings are combined into a "exceptional", "substantial", or "beneficial" rating for each sub-function; sub-function ratings are similarly combined for an overall functional rating. Functional ratings are combined to determine a rating of wetland ecological significance. Different combinations of parameter rankings result in various sub-function and function ratings. These ratings are based on ecological principles and relationships between wetlands and their landscape. Figure 2-8 shows the parameters examined to rate the water quality function.

Additionally, if a wetland is adjacent to a wetland with an overall rating of "exceptionally" significant, it may not be rated as less than "substantially" significant.

A total of 39 parameters are examined in the assessment process; 21 relate to wetland landscape position and 18 to internal wetland characteristics (Sutter and Wuenscher 1998.) Certain parameters are indicators, rather than measurements, of wetland function.

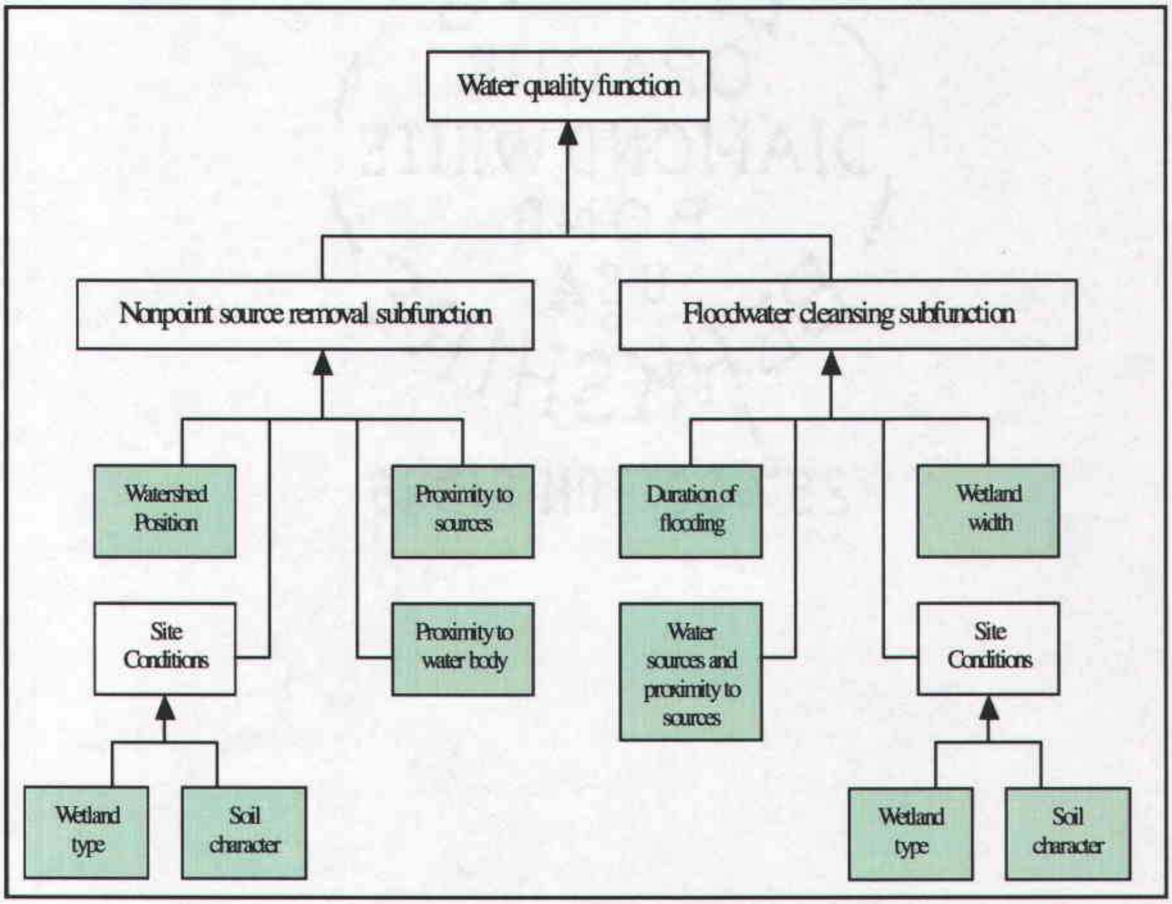

Figure 2-8. Parameters (shaded boxes) rated to determine water quality function (from Sutter and Wuenscher 1998).

However, for general planning and management purposes, NC-CREWS is a valuable tool, producing output such as maps of wetland significance (figure 2-9).

The NC-CREWS procedure has been evaluated and re-evaluated during the first five years. All aspects of NC-CREWS are the result of substantial review and input from the technical experts, project team, and local advisory group. For example, during 1993 and 94, field assessments of 400 wetland sites were used to supply data for a preliminary model run and to compare results with a water quality assessment procedure utilized by the North Carolina Division of Water Quality. The project team examined NC-CREWS results to ensure the utility and validity of its process and outcome. In 1995 the model was used in all of Carteret County with an ecological significance rating determined for each wetland. In 1997, the risk factor was removed from the calculation of the overall rating of ecological significance (although it is still determined and presented).

Inclusion of other resource agencies in the NC-CREWS development process has been an important part of its development. This has also meant having to respond explicitly to their concerns. For example, wildlife agencies had concerns with how pine flat habitat was considered (Sutter, personal communication 1997). Additionally, the original assessment procedure resulted in wetlands being categorized overall as “High”, “Medium”, or “Low.” The US Environmental Protection Agency expressed concern with this system of naming and suggested the "beneficial-substantial-exceptional" significance classification instead.

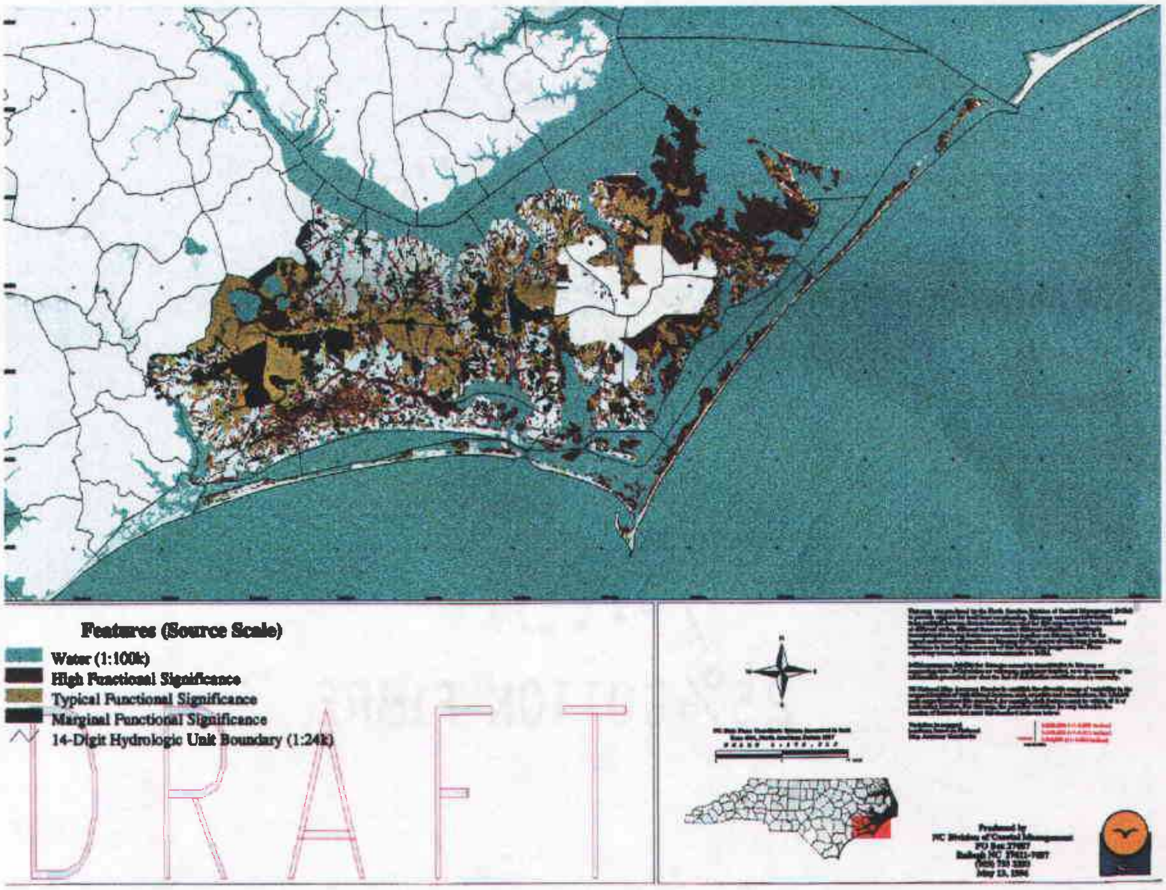

Figure 2-9. Sample GIS output for NC-CREWS procedure in Carteret County (source: North Carolina Division of Coastal Management).

Application of NC-CREWS

A current challenge is how to present assessment results. A single overall rating may not provide enough information; it may be more useful to local planners and others to provide final ratings for each function (hydrologic, water quality, and habitat). The functional assessment process has already provided helpful information, especially for identifying wetlands suitable for acquisition with public funds (Kirkman, personal communication 1998). The assessment procedure could become more important in the future if it were to be utilized in mitigation site selection. These issues are policy decisions that the state is continuing to examine.

By mid–1998, the NC-CREWS procedure had been fully run for 51 watersheds along the coast, ranging in size from 5000 to 50,000 acres, with all coastal counties scheduled to be completed by January 1999 (Stanfill, personal communication 1998). NC-CREWS assessments will be performed as local land use plans are reviewed by the state. Current state guidelines require local land use plans to contain policies protecting "wetlands identified as of the highest functional significance on maps supplied by the Division of Coastal Management (where available)" (NC Administrative Code §T15A:07B.0212). North Carolina is also exploring an expansion of NC-CREWS beyond the coastal area to the Piedmont and other regions of North Carolina. For example, the newly developed North Carolina Wetland Restoration program has embraced NC-CREWS (Sutter, personal communication 1998). This program will be using NC-CREWS to aid in wetland restoration throughout the state.

Development of NC-CREWS has required a substantial investment of time, expertise, and money. This work has led to an assessment procedure capable of assessing many wetland types found in the North Carolina coastal region (figure 2-10). In the future, NC-CREWS will likely find more widespread use. The information from NC-CREWS will help the state to address its concerns for balancing wetland conservation with development needs.

Application of NC-CREWS methodology outside of North Carolina is certainly possible. The general hierarchy and structure of NC-CREWS could be emulated. Of course, important details such as HGM and Cowardin classifications, and the parameters and subfunctions in the rating process, would have to be consistent with a region's ecology.

Figure 2-10. The assessment capability of NC-CREWS extends to wetlands such as this pine savanna (photo courtesy of Lonnie Shull, North Carolina Division of Coastal Management).

2.3 River-basin scale wetland restoration assessment in Puget Sound

Summary

Wetland functional assessments potentially have a variety of uses. In the Puget Sound region, a pilot wetland functional assessment program has been developed to help support wetland restoration. The Washington Department of Ecology led a multi–agency work group in developing a program to assess wetland restoration potential. The program uses geographic information system technology to develop a list of wetlands in a Puget Sound watershed and their potential for providing certain functions. The assessment methodology examines many ecological aspects and relationships, both at an on-site and landscape scale, to help identify restoration opportunities.

Issue and background

In response to concerns with Puget Sound biological health and diversity, the 1987 Washington Legislature ordered the development of a Puget Sound Water Quality Management Plan. In 1991, the plan was revised to include a strategy for restoring Puget Sound wetlands. This strategy called on the Washington Department of Ecology (WDOE), US Environmental Protection Agency (EPA), US Fish and Wildlife Service (FWS), and the US Army Corps of Engineers (COE) to develop a voluntary, community-based Puget Sound Wetland Restoration Program to help improve water quality and fish and wildlife habitat.

Budget constraints led to little action until 1994, when an interagency work team was formed to develop the program's conceptual framework. This team consisted of state and federal agency experts in wetlands ecology and restoration, fish and wildlife habitat, and water quality. A stakeholders group of local, state, and federal government, tribal, agricultural, timber, and conservation interests was convened to ensure that ecological and landowner needs were addressed (Gersib 1997). The interagency work team used stakeholder group recommendations in developing a geographic information system (GIS)–based methodology to evaluate wetland restoration potential at a river basin scale.

Considerations in developing the restoration assessment methodology

The restoration program seeks to help protect the biological health and diversity of Puget Sound by solving identified ecological problems and meeting community needs important to river basin residents. Since certain wetland functions could help address the various ecological issues in the Puget Sound region, the assessment methodology was designed to consider multiple functions. The restoration program was designed to be a cooperative, non-regulatory initiative seeking full public participation to be most successful. Furthermore, despite the complexity of wetland ecology and the multi-function focus, the program had to "make sense" to local participants.

The Stillaguamish River basin (figure 2-11) was selected as the test basin because of its anadramous fish runs, water quality issues, conducive political environment, and moderate size (~444,400 acres; figure 2-12) (Gersib 1997). During the project, the interagency work group contacted landowners, businesses, industry, individuals, and other local interests to gain an understanding of community issues in the Stillaguamish basin. The WDOE wanted to show that the agency could work cooperatively with landowners and overcome the perception that WDOE was solely a regulatory agency (Gersib, personal communication 1998).

The technical work group selected a river-basin scale to assess wetland restoration potential in part due to the high number of smaller management units in the Puget Sound drainage (18 river basins compared to about 200 watersheds) and a shortage of funds and staffing. The group wanted to use GIS technology to take advantage of its analysis

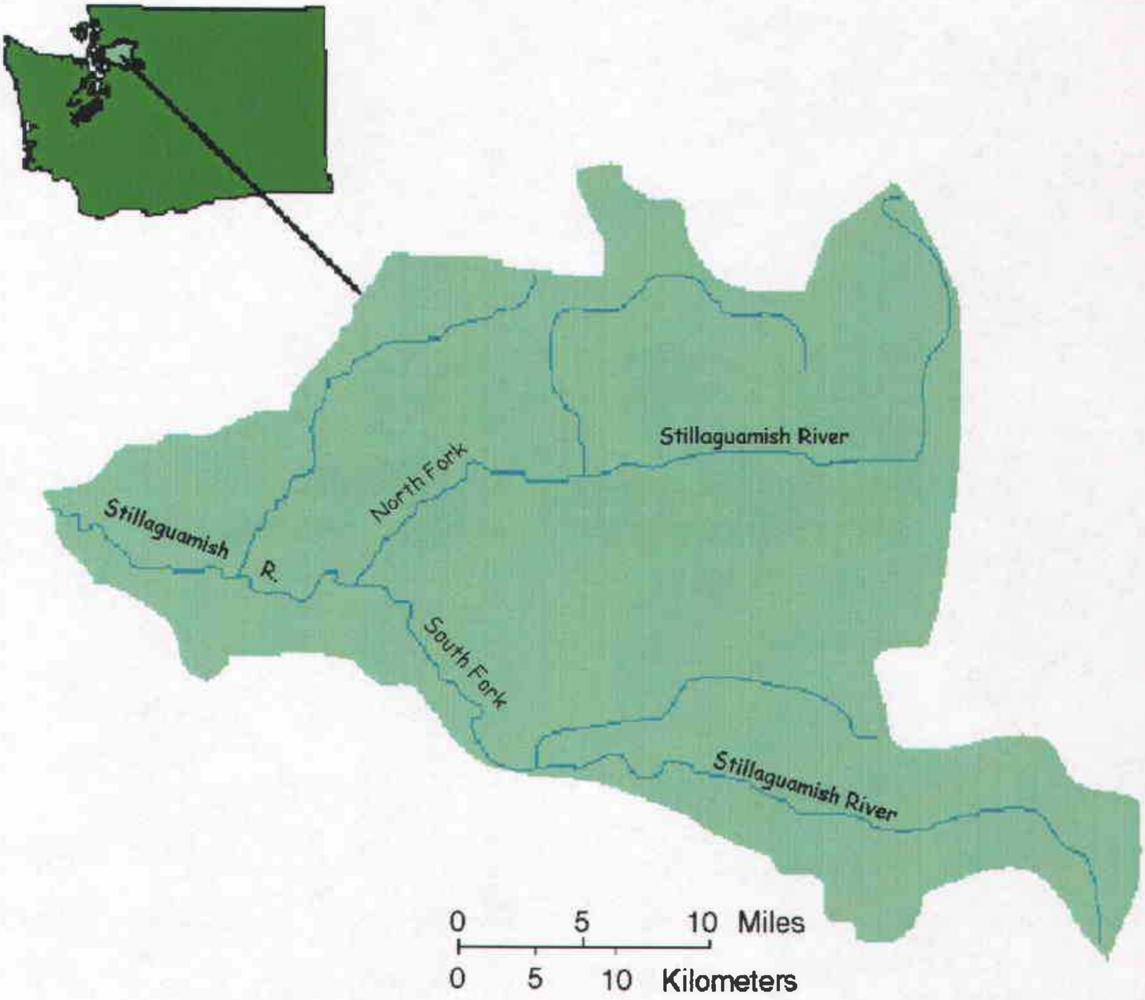

Figure 2-11. Stillaguamish River basin (source: USGS water resources of Washington State WWW page http://wwwdwatcm.wr.usgs.gov/wrd-home.html).

Figure 2-12. The Stillaguamish River drains predominantly forested and agricultural lands (photo courtesy of Dick Gersib, Washington Department of Ecology).

capabilities (Gersib 1997). The group also recognized that wetland functions are dependent on their landscape position, water source, and hydrodynamics, variables dictated by geology, geomorphology, climate, and hydrology. Understanding these variables, and their headwater to estuary interactions to form and maintain wetlands and their functions, was the foundation for characterizing wetland function.

Description of the assessment process

The wetland restoration assessment procedure was designed to use GIS-based analysis to develop a list of wetland restoration sites with potential to provide particular functions. The assessment procedure is not intended to replace site visits but will direct site visits to locations with the greatest potential for providing key functions. Combining the assessment process with subsequent field verification will increase wetland restoration success.

The work group determined that any wetland restoration assessment procedure must be part of a larger process of wetland restoration that begins with the development of partnerships with local stakeholders. In the Stillaguamish, it was important to include local jurisdictions, tribes, and natural resource managers in the analysis prior to implementation of specific restoration projects. The hiring of a local resident and the initiation of the Natural Resource Conservation Service Wetland Restoration Program in Washington State were also important (Gersib, personal communication 1998).

An early step in this process was the identification of ecological problems and community needs important to Stillaguamish basin residents. An informal survey was sent to 250 area residents asking them to identify ecological issues that potentially could be addressed through wetland restoration (Gersib 1997). Technical reports on water quality and quantity were used with survey results to develop a list of basin-wide ecological problems. Wetland functions were then matched to these issues using best professional judgment.

Developing an assessment methodology on the river-basin scale required extensive scientific and technical information, much already available through existing studies and agencies. A substantial amount of time was spent compiling existing river basin technical information and GIS data layers. For example, GIS coverages included: river basin, watershed, and drainage boundaries; USGS 7.5 minute quadrangles; transportation networks; landuse/landcover; soils; surficial geology; digital elevation models; floodplains, streams, and lakes; existing and potential wetlands; fish and wildlife resources; rare, threatened, and endangered species; dikes and levies; groundwater; public ownership; and precipitation (Gersib 1997). As the assessment methodology was developed, unanticipated data needs were identified, and additional data had to be gathered.

Since the National Wetlands Inventory (NWI) was known to contain errors, particularly for forested wetlands, NWI data was combined with Washington Department of Fish and Wildlife Priority Habitats and Species data, US Forest Service wetland inventory data, and local wetland inventories to arrive at a single wetland coverage (Gersib 1997). Floodplain, watershed, and river basin boundaries were also compiled. GIS coverages were developed for hydric soils, surficial geology, dike and levee location, stream reaches with solar exposure, land use, springs, and timber production areas (Gersib 1997). These GIS coverages facilitated river basin characterization, wetland classification, and the characterization of wetland functions. The development and use of GIS was an essential component of the analysis procedure.

Potential wetland restoration sites were identified by overlaying the hydric soils and wetland coverages. When the existing wetland polygon was greater than 90% of the potential wetland area (i.e., hydric soils polygon) the site was considered a potential preservation site. When the existing wetland area was less than 90% of the hydric soils area, the site was considered a potential restoration site. About 1600 potential restoration sites were identified for the Stillaguamish (Gersib, personal communication 1998).

The more technically complex aspect of the assessment process began with a characterization of the river basin to understand the processes involved in wetland formation and maintenance. Gersib (1997) identifies this step as the most critical in the basin analysis, but also notes that it "has no defined boundaries, only limited guidelines, and requires a diverse background." The purposes were to understand where and why wetlands occur, how wetlands contribute to basin functions, and how human activities and land use (figure 2-13) impact wetlands (Gersib 1997). An understanding of the effect of surficial geology, soils, and geomorphology on wetland ecology was needed to answer these questions. It was important to work with local scientists to understand local hydrology, and its relationship to wetlands and surface water movement. Putting this information together required a general understanding of hydrology, geology, soils, geomorphology, groundwater movement and storage, ecology, watershed processes, wetland functions, land use, and other elements of river basin scale processes (Gersib 1997). While complicated, this step was critical for identifying the wetland–landscape interactions considered when evaluating restoration potential.

To predict how a wetland would function after restoration, restoration sites were classified based on their anticipated physical attributes following restoration (Gersib 1997) using adapted classification methodology developed by Brinson (1993). Each potential wetland restoration site was characterized and mapped according to its hydrogeomorphic (HGM) class and subclass using GIS data (table 2-5). Initial HGM classifications established through GIS analysis were verified using aerial photography. A review of photo-

Figure 2-13. The assessment methodology assessed the effects of human activity and land use on Stilaguamish River basin wetlands (photo courtesy of Dick Gersib, Washington Department of Ecology).

interpreted sites using best professional judgement resulted in classification corrections for 10-20% of all sites (Gersib 1997).

This characterization was enhanced by the development and application of GIS-based wetland function models to each potential restoration site. These models identified

Class	Subclass	GIS overlay/characterization method
Fringe	na*	*Overlay NWI data onto potential wetland site data. Identify all lacustrine and estuarine systems and palustrine systems designated as unconsolidated bottom or open water greater than 20 acres in size. Fringe wetlands are all aquatic bed, emergent, scrub-shrub, or forested wetlands adjacent to these identified systems.*
	Estuarine Fringe	*Use dike and levee data and local expertise to identify plant composition influenced by tides and ocean water.*
	Lacustrine Fringe	*Remaining fringe wetlands*
Peat	na*	*Overlay soils data onto potential wetland data and select all sites mapped as peat soil.*
	Peat Open	*Overlay stream data onto sites identified as peat soil. Sites with a surface outflow to a stream are classified as extensive peat open.*
	Peat Closed	*Extensive peat wetlands without surface outflow to a stream.*
Riverine and Open Depressional	Depressional Open	*Overlay GIS stream data and anadramous fish data to identify sites not identified as peat or fringe wetlands and with a surface water connection. Use appropriate GIS layers to identify sites classified in the NWI as palustrine/unconsolidated bottom or lacustrine, having a lake or shoreline boundary, lake or marsh designation, or lacking a stream inlet. These are depressional open.*
	Riverine Open	*Sites with surface water connection to stream not meeting depressional open criteria.*
	Riverine Closed	*Use GIS floodplain coverage to identify unclassified sites within the floodplain.*
	Depressional Closed	*Remaining sites outside the floodplain.*
Slope		*No identified procedures using river basin scale GIS data.*

na*= not applicable

Table 2-5. HGM classes, subclasses, and GIS analysis methods for assessing site functions (from Gersib 1997).

wetlands with the greatest potential to perform specific functions by examining a site's physical, chemical, biological, and land use aspects. Function models used information from the river basin characterization, wetland classification, existing function characterizations, and professional judgment (Gersib 1997). Models were used to identify sites with the greatest potential to provide each function.

These function models identified wetland sites with greatest probability of providing a certain function. The assessment process also identified sites with the greatest probability for wetland area gain, as well as sites suitable for preservation, by comparing hydric soils and wetland polygons as discussed previously. Restoration sites were ranked for each function, based on the equation: Score = 0.25(existing area) + (Potential area - existing area). This equation was developed to emphasize the potential gain in wetland area and corresponding gain in function through restoration (Gersib 1997). The first term of the equation reflects the understanding that restoration will increase the functional capacity of the existing wetland. Lists of potential scores were developed to identify sites with the greatest potential increase for each function.

Assessment results were entered into a database that can be queried to find potential restoration sites with the highest probability of providing specific functions. This database includes information on each potential site, including the site number, HGM class and subclass, existing wetland area, the difference in potential and existing wetland area, and wetland functions. Copies of the database are available free of charge to interested parties within the Stillaguamish basin.

In sum, the assessment process follows these steps (Gersib 1997):

1. Develop partnerships with local stakeholders.
2. Identify basin ecological problems that can be addressed by wetland restoration
3. Develop an understanding of river basin water movement and wetland function.
4. Identify wetland restoration sites with potential to address basin problems.
5. Develop a database of these sites and their potential for providing functions.

Application of the assessment methodology

Restoration using this assessment methodology has just begun in the Stillaguamish and will be monitored to examine successes and weaknesses in providing targeted functions. Also, assessment methodology will be evaluated and field verified by an independent third party (Gersib, personal communication 1998). Results to date have been encouraging, including the communication and cooperation among state and local agencies. Developing local partnerships has also been important, as this has led to diverse sources of technical and financial support for restoration activities. These partnerships have also been important because many potential restoration sites are on private property (figure 2-14).

WDOE has focused its efforts on providing technical information and support to local agencies and groups to facilitate restoration project implementation (Gersib 1997). WDOE has provided leads for funding opportunities in addition to providing money itself.

Figure 2-14. Many potential wetland restoration sites in the Stillaguamish River basin are on private property (photo courtesy of Dick Gersib, Washington Department of Ecology).

For example, WDOE gave Snohomish Conservation District a $13,000 grant to learn to use the database and evaluate its utility. County personnel have used this money and a $40,000 grant from USFWS to use the database to identify restoration sites and work with landowners on specific restoration projects. Since this initial assistance, the Snohomish Conservation District has also acquired additional outside funding to maintain a full-time wetland restoration staff position for at least one additional year (Gersib, personal communication 1998).

While the development of the methodology in the Stillaguamish was time-consuming, this groundwork will enable more rapid analysis of wetland restoration potential in the future. Gersib (1997) estimated that basin analysis could take six months preceded by 4-6 months of initial public participation. To facilitate program implementation and success, Gersib (1997) also estimated a need for: a river basin resident hired for 9-12 months to facilitate public involvement, a technical coordinator, 500 hours of GIS support, and a half time position for three to five years.

This WDOE wetland restoration assessment program is expanding in application, as the Nooksack River basin is currently undergoing the assessment process. Future applications could occur within the Puget Sound and elsewhere. For example, the assessment process could be used to help implement Washington's §6217 Nonpoint Source Control Program or used in US Forest Service watershed analysis. The work in the Stillaguamish has laid the groundwork for application of the assessment procedure in the many other regions where wetland restoration is an issue. The assessment process would have to be tailored to fit a different region's ecology, but the general methodology and scope could be adapted.

3.0 Regulatory processes and tools

In the CZME Study, we found that five of the top ten tools for wetland and estuary protection were parts of regulatory programs. These five tools included state permits for tidal and nontidal wetland development, enforcement of regulations, compensatory mitigation, and the use of federal consistency (Good *et al.* 1997). The CZME Study also found that while estuary and tidal wetland regulation is generally a strong component of state coastal programs, nontidal wetland regulation was relatively weak. Additionally, enforcement and mitigation efforts were often lacking, and the monitoring of on–the–ground results of regulatory decisions was also weak. Few states had comprehensive data allowing them to determine how their overall regulatory programs were affecting wetland and estuary resources. At the same time, many programs could document the on–the–ground impact of a facet of their regulatory programs and consequently are excellent role models for other states.

For example, tidal wetland and estuary protection is a priority of the *San Francisco Bay coastal program.* Strong policies, few if any significant exemptions, strong mitigation and enforcement, and streamlined processes are elements of this regulatory program found in the model program (figure 1-1). The program also has historic outcome information showing drastic decreases in the area of tidal wetlands lost to development.

Maryland and New Jersey are clear exceptions to the CZME Study conclusion that nontidal wetland regulation was generally weak. *Maryland's freshwater wetland protection program* was developed to provide protection beyond that of the federal regulatory program. From 1991-1995, the Maryland regulatory program had an increase in freshwater wetlands area. In Louisiana, the *Geologic Review Process* was developed in response to concerns with the impacts of oil and gas development in coastal wetlands. This case study is an excellent illustration of how an identified management issue was resolved through collaboration with other agencies. With a computer–based permit tracking system, Louisiana has documented a dramatic decrease in permitted wetland loss since the development of the Geologic Review Process. *New Jersey mitigation* requirements, an important model program (figure 1-1) component, are used to help offset permitted wetlands losses. Finally, a compliance monitoring and enforcement program implemented by the Pennsylvania coastal program has resulted in reduction of wetland violations to nearly zero.

These case studies represent elements of the model program for coastal wetland and estuary protection. Each case study is also complex and multi-faceted, thus illustrating that regulatory programs have many components necessary for their success.

3.1 Tidal wetland regulation in San Francisco Bay

Summary

Tidal wetland regulation is often a focus of coastal management programs. Only some have on–the–ground outcome data to begin assessing their effectiveness. One program with excellent record–keeping is in San Francisco Bay. Development in the San Francisco Bay area historically had a severe impact on the area's tidal wetlands. With the development of the San Francisco Bay Plan and ensuing regulatory program implemented by the San Francisco Bay Conservation and Development Commission since 1969, this loss trend has been reversed. Through the use of mitigation, on–the–ground results of the regulatory program have resulted in a net gain in tidal wetland area since the late 1970s.

Issue and background

San Francisco, San Pablo, and Suisun Bays form the largest estuary in California (figure 3-1). The estuary (Bay) has a roughly 1,600 square mile surface area and drains over 40% of the state (BCDC 1993). About 7.5 million people live in the Bay area; much of the Bay is bordered by urban development and infrastructure to support this population. Diking and filling for development and agriculture historically impacted Bay wetlands. In 1987, only 55 of the original 300 square miles of Bay tidal marsh remained, representing an 82% loss (BCDC 1993). Because of this development and in response to natural processes such as tidal-fresh water mixing, South San Francisco, San Pablo, and Suisun Bay tidal wetlands vary in character. In South San Francisco Bay, mudflats and salt ponds predominate; salt marsh and diked/farmed wetlands are common in San Pablo Bay; and two thirds of the brackish wetlands in Suisun Marsh are diked and used for recreation and agriculture (BCDC 1993). All Bay area wetlands are considered ecologically important, providing bird and fish habitat, water quality maintenance, and other functions, as well as offering scenic and recreational values (figure 3-2).

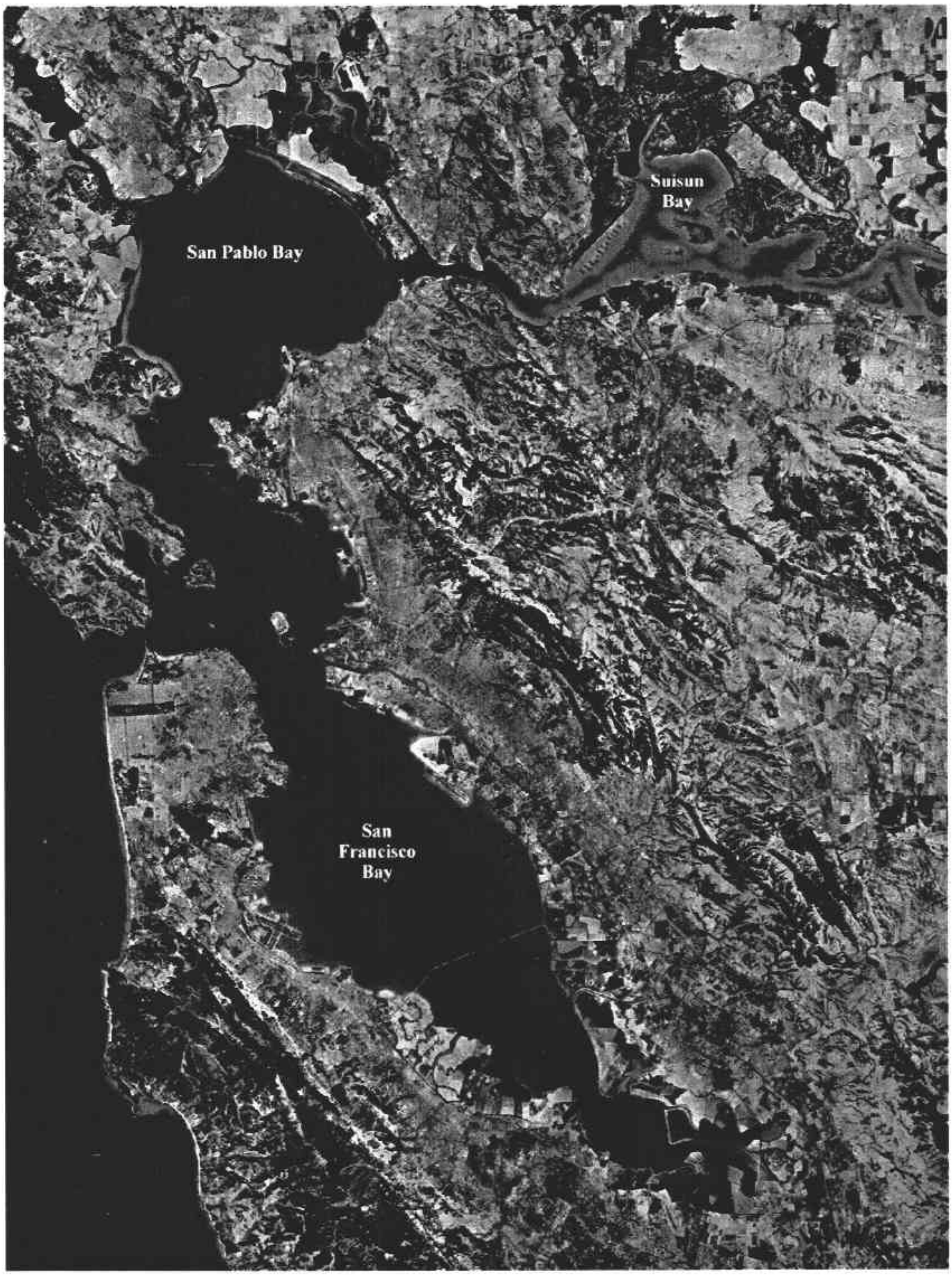

Figure 3-1. Aerial view of the San Francisco Bay, San Pablo Bay, and Suisun Bay estuary (from BCDC 1969).

Figure 3-2. Bay area wetlands provide a variety of functions, including habitat for birdlife (photo courtesy of BCDC).

High rates of wetland degradation and filling of San Francisco Bay led to public concern for the Bay's health in the early 1960's. As a result, in 1965 the California Legislature adopted the McAteer–Petris Act to create a San Francisco Bay Conservation and Development Commission (Commission), a 27 member body of public, state and federal agency, county, and city representatives. The McAteer–Petris Act directed the Commission to develop a plan to guide protection and development of San Francisco Bay and its shoreline.

Development of a San Francisco Bay tidal wetland regulatory program

From 1965 to 1968, the Commission oversaw development of the *San Francisco Bay Plan* (Plan), a process that involved studying twenty five critical Bay issues from marshlands to port development (BCDC 1993). The Commission completed the Plan in 1968 and submitted it to the Legislature in 1969. The Plan required protection of Bay resources while ensuring development of the Bay and its shoreline to its highest potential. In 1969, the Legislature gave the Commission permanent responsibility for carrying out the Plan.

The Commission has authority from the south end of the Bay to the Golden Gate and east to the Sacramento River, up to the mean high tide line. Commission jurisdiction includes marshlands between mean high tide and the five foot contour line; a 100 foot band landward from the shoreline; and saltponds, duck hunting preserves, game refuges, and agricultural areas diked off from the Bay during the 1960s (CA Government Code, Title 7 §66610).

The Plan gives first priority to uses of the Bay that provide substantial public benefits (BCDC 1969). The Plan allows Bay filling for projects with public benefits as long as projects: are either water–oriented or involve minor fills to maximize public access; minimize Bay filling; and could not occur without filling. Examples of potentially allowed activities include port development, industrial development requiring access to shipping channels, and public access and recreation such as parks and hiking/biking paths (BCDC

1969). Additionally, airport runway and bridge expansion may include Bay fill if no alternative sites exist. In the 100 foot shoreline area, the Plan identifies priority uses: ports, water-related industry, airports, wildlife refuges, and water-related recreation.

The Plan contains specific tidal wetland policies relating to fish and wildlife, water pollution, water surface area and volume, and marshes and mudflats. The Plan states that "marshes and mudflats should be maintained to the fullest extent possible" and filling or diking is allowed only if there is no reasonable alternative" (BCDC 1969). Fill, dike, or pier proposals are modified to minimize harmful impacts to marshes and mudflats. Proposals are reviewed to ensure minimal effect on water circulation and minimal reduction of Bay surface area and volume. The Plan also contains policies identifying the Bay as a last resort for dredge material disposal.

The Plan designates specific habitats that are especially important for protection as "Wildlife Areas" on Plan maps. These maps and others are an important component of the Plan, delineating salt ponds, wildlife refuges, ports, tidal marshes, and the location of water related industry (figure 3-3). Maps also identify shoreline areas set aside for priority uses.

Implementation of Plan policies

The Commission addresses Bay conservation and development through planning and a regulatory program. The regulatory program is implemented through a project approval process. Any project including fill or dredging of the Bay requires a Commission-approved

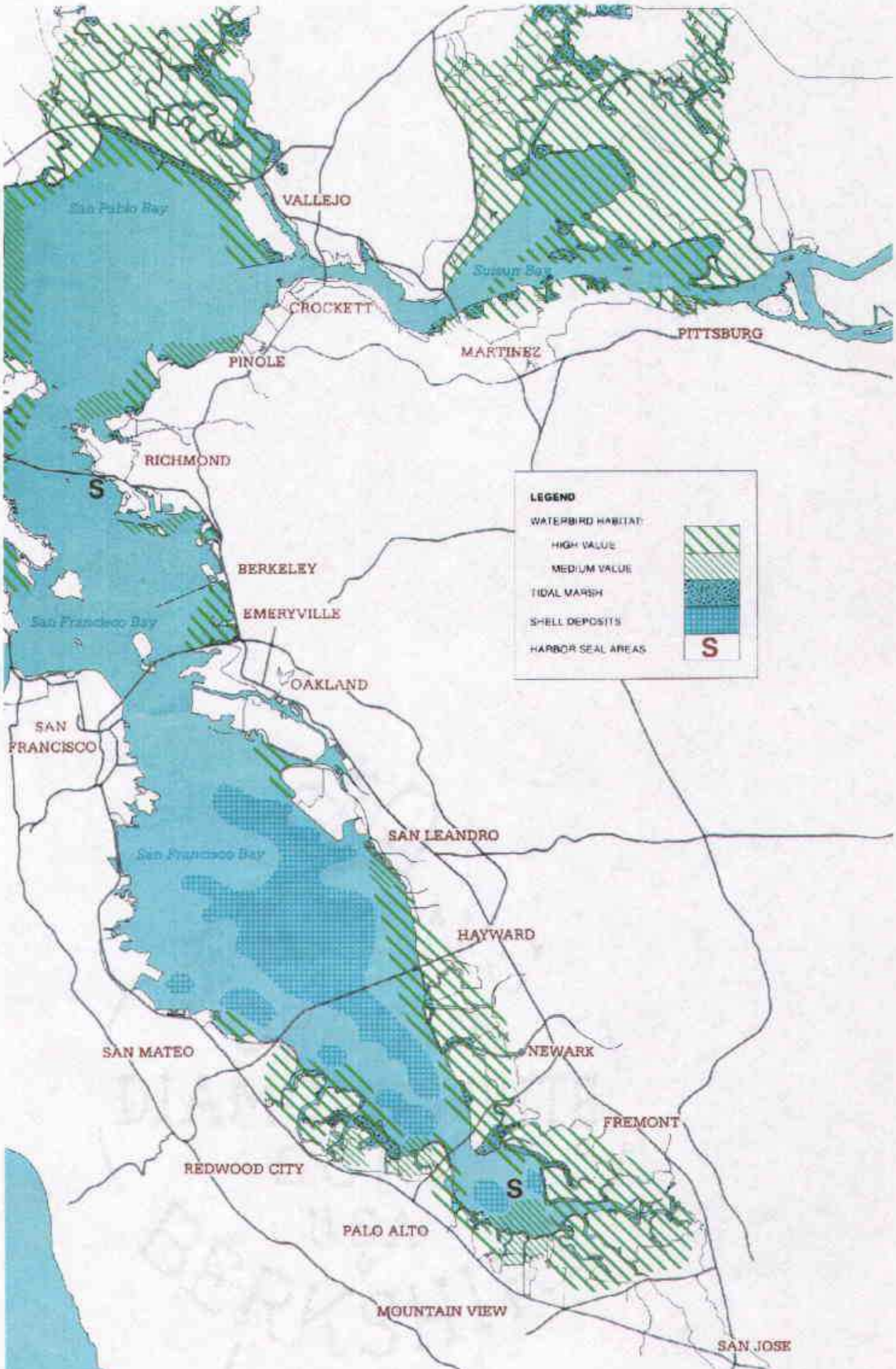

Figure 3-3. Plan maps identify areas of important wildlife habitat; additional maps show port areas and priority use areas (from BCDC 1969).

permit (BCDC 1969). Commission staff review permit applications against Plan policies and suggest permit approval or denial and project modifications to minimize adverse impacts to Bay resources. In an advisory role, a Design Review Board reviews proposed fills for accordance with Plan policies regarding appearance and scenic views. The Commission is ultimately responsible for permit decisions. Permits are approved only if fill is minimized and the project does not violate Plan policies.

The Plan enables use of mitigation for approved fill projects with unavoidable impact. Mitigation can address water surface area, volume or circulation; fish and wildlife habitat; or marshes and mudflats depending on the impact (BCDC 1969). Mitigation is preferentially of the "in-place, in-kind" variety and is to be commensurate with the project's adverse impacts. If on-site mitigation is not possible, the closest suitable site is selected.

Permits in the 100 foot shoreline area are processed under the same system. Permits in shoreline priority use areas or salt ponds and other managed wetlands are reviewed according to Plan policies (BCDC 1969). Outside the priority use areas, projects are approved if they provide maximum feasible public access to the Bay consistent with the project's scope.

All permits must be acted on within 90 days, but specific timelines vary according to the type of permit. A system of five permit types has been developed: major, administrative, regionwide, abbreviated, and emergency. An emergency permit is issued when the Commission has determined that a situation exists that requires immediate attention. Emergency permits are still required to be consistent with the Plan. Abbreviated and administrative permits apply to certain repair and maintenance activities. Administrative permits are the most common type and are granted within 30-60 days (McAdam, personal communication 1998). Examples of projects processed as administrative permits are listed in table 3-1. Major permits involve larger projects than administrative and are usually

Activities in San Francisco Bay: • construction of a single boat dock no larger than 1,000 ft^2 or a multiple dock no larger than 5,000 ft^2. • placement of outfall pipes approved by the Regional Water Quality Control Board. • placement of utility cables on or under the bottom of the Bay. • routine repairs and maintenance that do not involve substantial enlargement or change in use. • minor fill for improving shoreline appearance that does not exceed 1,000 ft^2.
Activities in the 100 foot shoreline area: • construction of one- and two- family residences on lots subdivided prior to 1987, as long as physical or visual access is not adversely affected. • routine repairs and maintenance that do not involve substantial enlargement or change in use. • installation of new shoreline protection such as bulkheads and rip-rap to stabilize existing dikes or provide habitat.
Activities in salt ponds and managed wetlands: • reconstruction of existing power towers and walkways to such towers. • repairs to protective works to stabilize existing dikes or provide habitat.
Activities in Suisun Marsh: • removal of vegetation • grading of materials

Table 3-1. Examples of activities processed as administrative permits.

approved or denied in 60-90 days. Commission staff notify appropriate local governments of proposed projects to allow local government comment. Major permits also require a public hearing.

In 1996, the Commission adopted a series of general permits, or regionwide permits, to help streamline the permit process and allow the Commission to focus on more important issues. Fourteen regionwide permits have been adopted for projects such as minor repair and reconstruction of shore protection structures, replacement of utility lines and outfall pipes, seismic retrofitting of roads and bridges, routine maintenance dredging of no more than 100,000 cubic yards, and installation of temporary facilities in place less than 180 days. Regionwide permits are reviewed by Commission staff within 14 days of receiving an application.

Evolution of tidal wetlands regulation

The Plan provides guidelines for Plan updates and revisions. Since many Plan policies and maps are rather generalized, more specific applications of the Plan, such as "special area plans" can be developed. Adoption of these plans and other changes to the Plan can occur with a two thirds vote of the 27-member Commission after a public comment period.

One of the earliest and largest additions to the Plan was the 1976 adoption of the Suisun Marsh Protection Plan. Legislation passed in 1974 required the development of a plan to preserve the integrity of wildlife habitat in Suisun Marsh, the largest single wetland

(85,000 acres) remaining in the Bay area (BCDC 1976). The Suisun Marsh Plan and Suisun Marsh Preservation Act give the Commission regulatory authority below the ten foot contour. Upland grasslands and surrounding agricultural lands are included in "secondary management area" as a buffer (BCDC 1976). In this area, local governments have primary regulatory authority. Other special area plans with a focus on wetland protection include the 1990 White Slough Protection and Development Plan. Currently, a North Bay special area plan is being developed to guide protection, restoration, and development in North Bay diked wetlands and other open space areas.

In 1977, the federal government approved the Plan and the Commission as the coastal management program and implementing agency for San Francisco Bay. As a result, the Commission is responsible for federal consistency determinations, which are processed in the same manner as other permits. As with other federally-approved state coastal programs, federal actions are required to be consistent with Plan policies to the maximum extent practicable.

An additional change to Commission authority occurred in 1989, when the Legislature amended the McAteer-Petris Act to give the Commission the ability to assess civil fines for violations. Fine money is deposited to the Bay Fill Clean-up and Abatement Fund for fill removal or other Bay resource enhancement activities.

The Commission has also been involved with the development of a long–term management strategy for dredging and dredge disposal. Initiated by the US Army Corps of

Engineers in 1991, and in partnership with the US Environmental Protection Agency, Regional Water Quality Control Board, and California State Lands Commission, this project led to a formal Dredge Material Management Office (DMMO) to review dredging projects (McAdam, personal communication 1998). The DMMO recommends permit actions to the Commission.

Regulatory program results

Table 3-2 contains regulatory program outcome data for major permits issued by the Commission. Figure 3-4 is a graphical representation of the drastic decline in wetlands loss since the beginning of the tidal wetland regulatory program in 1969. Mitigation has often involved breaching dikes that historically separated diked baylands from the Bay (BCDC 1993). This data is for only major permits, not administrative, emergency, or regionwide permit data. These figures do not include any violations data. Additionally, wetland area protection may not necessarily translate into protection of wetland function. Despite these caveats, the total net gain of 619 acres of tidal wetland from 1976-1995 is impressive. It is also impressive that the Commission has been keeping this sort of data since its inception. This data illustrates Commission success in reversing historically high rates of tidal wetland loss in the Bay region, at least in terms of wetland area.

Various coordination efforts have contributed to the Commission's on-the-ground success. Coordination with the US Army Corps of Engineers (Corps) is particularly important. The Corps has issued a regional permit for Commission administrative permits. The Corps and

YEAR	1976	77	78	79	80	81	82	83	84	85	86
Permits (#)	14	20	24	34	20	23	26	23	18	16	20
Approved (#)	14	20	23	34	19	23	26	23	15	15	20
Denied (#)	0	0	1	0	1	0	0	0	3	1	0
Bay area lost (acres)	2.2	27.7	7.8	17.8	25.4	5.1	24	4	17	30	11.4
Bay area replaced (acres)	0	44.5	5.9	21.2	55.4	49.6	286	9	29	90	22.4
Net loss/gain (acres)	**-2.2**	**16.8**	**-1.9**	**3.4**	**30**	**44.5**	**262**	**5**	**12**	**60**	**11**

YEAR	1987	88	89	90	91	92	93	94	95	Totals
Permits (#)	18	18	17	18	9	11	9	12	15	**337**
Approved (#)	16	17	17	17	8	10	8	11	15	**324**
Denied (#)	2	1	0	1	1	1	1	1	0	**14**
Bay area lost (acres)	5.4	**nd***	**nd**	**nd**	**nd**	**nd**	**nd**	**nd**	**nd**	**177+**
Bay area replaced (acres)	3.2	**nd**	**nd**	**nd**	**nd**	**nd**	**nd**	**nd**	**nd**	**594+**
Net loss/gain (acres)	**-2**	**152**	**1.7**	**-1.5**	**-0.7**	**-1.6**	**50.1**	**1.6**	**-0.4**	**619**

*nd=no data

Table 3-2. Major permit data (from BCDC 1987 and BCDC 1995).

Commission signed an agreement to ensure inter-agency consistency whereby the Corps issues its permit after Commission action. The Commission has also signed Memoranda of Understanding (MOU) with other agencies regarding work divisions and other details.

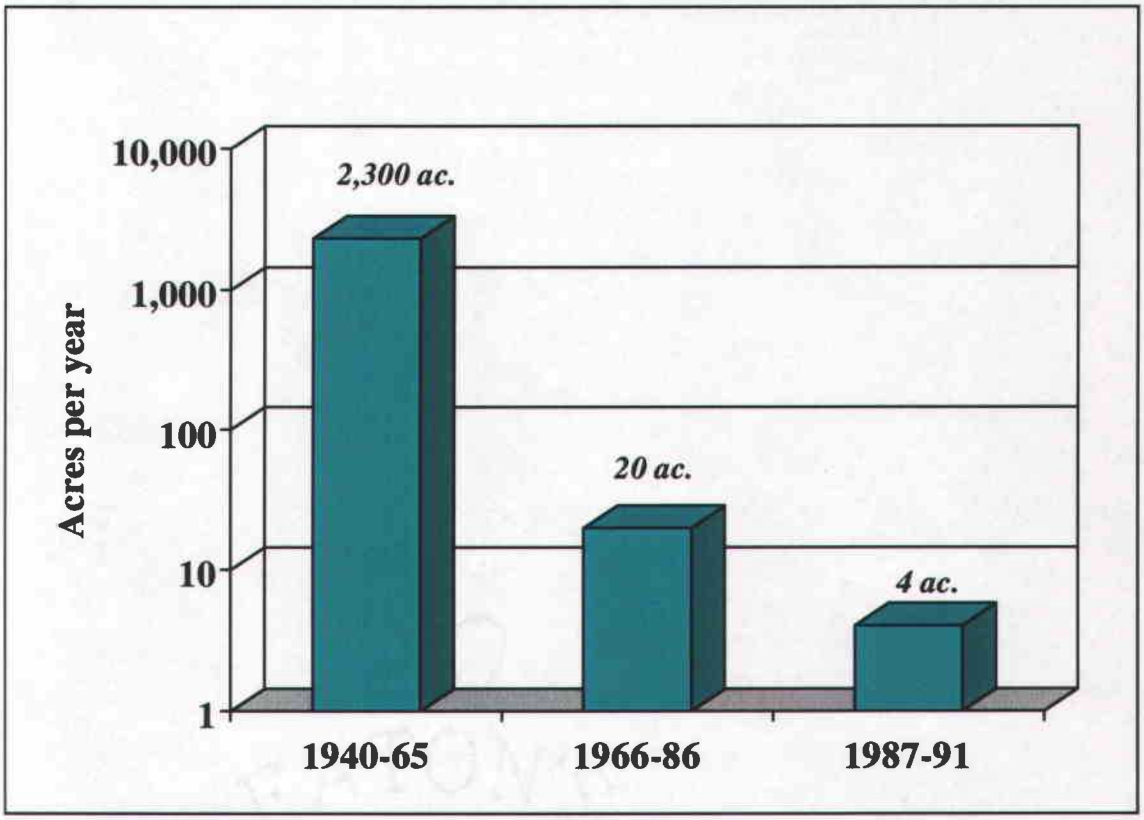

Figure 3-4. Trends in annual wetland loss in the San Francisco Bay region since 1940.

Joint agency meetings are commonly used to set up mitigation requirements. Furthermore, as mentioned previously, a multi–agency team (the DMMO) now reviews dredging projects. The DMMO developed a joint permit application for dredge projects that may be expanded to other project types, although jurisdictional differences between agencies may make further joint permitting difficult (McAdam, personal communication 1998). Commission staff often hold informal meetings with agency representatives and local government to resolve issues regarding individual permits.

The Commission and its staff have also worked on their relationship with developers. While few developers propose a project certain to be denied a permit, Commission staff work with developers to redesign proposals to minimize adverse effects, saying "Yes, but..." instead of "No" (McAdam, personal communication 1998). Developers also appreciate dealing with regional regulators. The regulatory program has existed long enough to allow developers a sense of predictability, since the Commission generally approaches its duties from a consensus-oriented approach in a rational decision-making process. An illustration of this support occurred when 1995 legislation that would have abolished the Commission was opposed by developers.

Significant issues still arise over policy matters, however, especially regarding transportation. As Bay area development continues, and transportation project siting becomes more difficult, the Commission relationship with the California Transportation Department (CalTrans) has at times been strained (McAdam, personal communication 1998). In response, CalTrans and the Commission have drafted an MOU to review CalTrans projects early in the project planning process. CalTrans also funds a Commission engineering position to assist in project review.

All of this activity is done by a 27-member Commission and a staff of about 30 with an annual budget of about $2.7 million. Commission funding comes from the California General Fund, coastal management funds, and other sources. A recent legislative change in the Commission's budget allows fine moneys to be used to fund enforcement staff; currently three positions are involved in enforcement of unpermitted activities.

Given continued population growth in the Bay area, the Commission's role in tidal wetlands permitting will remain an important component of Bay area resource conservation (figure 3-5). Certain elements of the Plan may be revisited. For example, fish and wildlife policies do not specifically address endangered species dependent upon the Bay. It may be suitable for Commission authority to be expanded in certain areas to protect critical habitats, even beyond the 100 foot shoreline band. In part to address such

Figure 3-5. As population growth continues in the Bay region, protecting wetlands and other natural resources will become more critical (photo courtesy of BCDC).

issues, updates to Plan maps and additional special area plans, including the North Bay and Oakland and San Francisco waterfronts, are likely to be adopted.

Another looming issue is public access to wetlands, as some area residents claim that public access is harming tidal wetland habitat for certain bird species. This issue could prove interesting for the Commission to resolve, since public access and resource conservation are both major policy goals of the Plan and the federal CZMA.

3.2 Protecting Freshwater Wetlands in Maryland

Summary

While the CZME Study generally concluded the freshwater wetland protection was weaker than protection of tidal wetlands, the case in Maryland stood out as a strong exception. A perception that the federal wetland regulatory program was not providing sufficient protection for freshwater wetlands drove the development of the 1989 Nontidal Wetlands Protection Act, which contained a "no–net–loss" policy for freshwater wetlands. The state now regulates development activity in freshwater wetlands through a three tiered permit system. Using mitigation, the no-net-loss goal has been nearly achieved. Freshwater wetland trends have been reversed from annual losses of 800 acres before 1989 to a net gain of almost 2.5 acres from 1991-1995.

Background

Maryland has approximately 300,000 acres of freshwater wetlands in the state's coastal zone (Tiner and Burke 1995). Many of these wetlands serve important water quality functions, filtering sediments, fertilizers, and other chemicals from water draining into Chesapeake Bay. Many tidal wetlands areas bordering Chesapeake Bay and its major tributaries (e.g., the Susquehanna and Potomac) originally were fringed with freshwater wetlands (figure 3-6). Development historically impacted these wetlands through agricultural conversion, pond construction, and draining and filling for urban, commercial, and residential development.

Maryland protected its waterways and 100-year floodplains beginning with the 1933 Maryland Water Resources Act. This program did not explicitly include protection for freshwater wetlands, although indirect protection could be given to wetlands adjacent to waterways. The main source of freshwater wetland protection was the federal §404

Figure 3-6. Freshwater wetlands often fringe Maryland rivers (source: USGS 1996).

program, but the perception in Maryland was that §404 was not effective in preventing the destruction of freshwater wetlands. An estimate of annual loss rates under §404 was as high as ~800 acres in the early 1980s (Burke, personal communication 1997).

In response to these concerns, in the early 1980's a few local programs directed at freshwater wetland protection were started. The state also contracted with the U.S. Fish and Wildlife Service for trend analysis studies to quantify wetland losses and provide quantitative evidence that freshwater wetlands were being lost. Protecting Chesapeake Bay also proved to be a powerful motivator for enhancing wetland protection efforts. When the tri–state Chesapeake Bay Agreement was signed in 1987 to improve water quality in Chesapeake Bay, Maryland made a commitment to increase freshwater wetland protection.

In 1988, amid continued concern for freshwater wetland protection, the Governor of Maryland created a task force to develop a comprehensive freshwater wetland program. The task force contained members of various interests, included agriculture, forestry, residential and commercial development, and state, federal, and local agencies. The task force ultimately recommended a new regulatory program for nontidal, freshwater wetlands. Legislation for the freshwater wetland regulatory program was adopted in the 1989 legislative session. The bill was controversial in part because it was one of the first pieces of state legislation in the country to explicitly call for a "no-net-loss" policy for wetlands.

Implementing the Nontidal Wetlands Protection Act

The Maryland General Assembly declared that the goal of the Nontidal Wetlands Protection Act was to "attain no net overall loss in nontidal wetland acreage and function and to strive for a net resource gain in nontidal wetlands over present conditions" [Maryland Environment Article Title 5, §5-902(b)]. To accomplish this goal, the Act sets up a permit program to regulate activities in and within 25 feet of freshwater wetlands. Around Nontidal Wetlands of Special State Concern (mostly wetlands under the Natural Heritage Program or containing threatened species), this upland buffer is 100 feet. Mitigation is required for activities causing freshwater wetlands loss. Similar to the federal §404 program, the Maryland Nontidal Wetland Act regulates activities such as removal, excavation, or dredging of wetland soils; filling, dumping, or discharging of material in freshwater wetlands; and alteration of existing topography from grading or removal of material. The Act goes beyond §404 by regulating the removal of wetland vegetation and inclusion of buffer requirements. The Act also regulates isolated wetlands greater than one acre in size that may fall under federal jurisdiction.

The freshwater wetland permit program contains three levels of project approvals: permits, letters of authorization, and exemptions. Exempted activities include those listed in table 3.3 and do not require state approval. These activities are also exempt from mitigation requirements.

1. Forestry activities
2. Agricultural activities
3. Approved mitigation projects
4. Activities within farmed nontidal wetlands and their buffers
5. If these activities do not result in cumulative direct or indirect impacts, then they are exempt:
   a. Mowing on existing rights of way
   b. Control of noxious weeds
   c. Landscape management
   d. Soil investigations
   e. Percolation tests for sewage disposal fields
   f. Maintenance of utilities, railroad beds, road beds, bridges, dams, dikes, and wastewater control structures.

Table 3-3. Examples of activities exempt from the freshwater wetlands permit program (Maryland Administrative Rule §26.23.01.02)

If a proposed activity has a minimal affect, impacting less than 5,000 feet (<.11 acre), it may be eligible for a letter of authorization. A letter of authorization does not require an alternative site analysis or public notice, although wetlands delineations are field–verified. The applicant must implement best management practices to avoid and minimize impact, and, outside the Maryland Critical Area, the State is responsible for mitigating wetland loss. Within the Critical Area, the applicant is responsible for mitigation. Perhaps 75% of all activities that have been reviewed by the State have fallen under this category (Setzer, personal communication 1998).

Permits apply to activities not in the previous two categories. In this situation, the state will review an applicant's proposed activity, alternative site analysis, and mitigation plan. Permits require public notice during the review process. For a permit to be approved, the applicant must show that the proposed activity is water dependent or has no upland alternative. The activity is also reviewed to "minimize alteration or impairment of...existing topography, vegetation, fish and wildlife resources, and hydrologic conditions" [Maryland Environment Article Title 5, §5-907(a)(2)].

Within 45 days of receipt of a permit application, the State must respond to an applicant indicating if the application is considered complete and the wetland delineation correct. After a permit application is completed and accurate, the State issues a public notice for the project. If requested, an informational public hearing is held within 45 days of the public notice date. The State is required to decide on the permit within 30 days of the close of the hearing record if a public hearing is held, or within 60 days of the close of the comment period if there is no hearing. Letters of authorization do not require public notice and are generally issued within 60 days of proposal receipt (Setzer, personal communication 1998).

The “no net loss” goal of the Nontidal Wetlands Protection Act is addressed by the Act’s mitigation requirements, which fall into two categories: permittee mitigation and programmatic mitigation. Permittee mitigation comprises about 75% of mitigation under the program (Setzer 1996) and is required for projects impacting greater than 5,000 square feet of wetlands. The State requires monitoring of these mitigation projects for five years following construction. Vegetation must cover 85% of a site; hydrology is monitored to demonstrate long–term viability. Permittees are required to submit annual monitoring reports.

If mitigation is not possible or unsuitable, the applicant may be allowed to pay a fee to the State Nontidal Wetland Compensation Fund. Money from this Fund is used for programmatic mitigation, or mitigation projects carried out by the state. The amount spent varies annually, from $280,000 to almost $500,000 per year (Setzer, personal communication 1998). Programmatic mitigation is required to insure that all permitted impact is replaced and the no–net–loss goal is achieved. When appropriate, Maryland may use Nontidal Wetland Compensation Fund money to match other government or private funds for wetland projects beyond that required for mitigation purposes.

The Act allows local governments to assume partial responsibility for the freshwater wetland regulatory program. If a local watershed management plan is developed according to state regulations, the plan then becomes the basis for regulatory decisions. Watershed plans have been developed for one watershed on the Maryland Eastern Shore and have been initiated in three others.

A main argument for passage of the Nontidal Wetlands Protection Act was the promise of streamlining the wetland regulatory program. In 1991, federal consistency determinations according to the federal CZMA were added to the program. In 1992, the Nontidal Wetlands Division and the Waterway Construction Division were combined to create the Nontidal Wetlands and Waterways Division. Finally, in 1995 the federal Clean Water Act §401 Water Quality Certification was folded into the freshwater wetlands regulatory program to enable "one–stop permitting."

Coordinating with the US Army Corps of Engineers

Working with the Maryland Department of the Environment (MDE), the US Army Corps of Engineers installed a permit tracking system to ensure a common database for regulatory actions within Maryland. A Permit Service Center was also developed by the State to now distribute wetland permit applications to federal and state agencies.

The MDE was required to examine assumption of the §404 program to improve agency coordination and streamline the permit process. Legislation for outright assumption of the

§404 program was proposed in 1994 and 1995 but not adopted by the Maryland General Assembly. Since the Corps and the State had joint responsibility for regulating activities in nontidal wetlands and waters, the Corps issued a general permit for Maryland freshwater wetland permitting activities in 1991. When this general permit was evaluated for re-authorization a few years later, the Maryland freshwater wetland regulatory program was determined to be quite effective. However, the State was concerned that the permitting process was duplicative. Consequently, in 1996 both resource protection and customer service were combined when the Corps issued the Maryland State Programmatic General Permit (MSPGP) (Setzer, personal communication 1998). The goals of the MSPGP were to maintain protection of wetlands, reduce the administrative burden on the Corps and the State, decrease permit response time, and add predictability to the regulatory program (Setzer 1996). To achieve these goals, a system of permit categories each with separate state-federal responsibilities was included in the MSPGP (table 3-4).

The MSPGP is intended to reduce duplication and increase permit processing efficiency by relying on the Maryland Nontidal Wetlands Protection Act. As a result, Corps staff has the time to be involved with other projects such as wetland delineations, watershed planning, functional assessments, and other projects concerned with wetlands protection.

On-the-ground effect of the regulatory program

The MDE feels strongly about the regulatory program's success in reducing freshwater wetlands losses, and they have area data to support the claim. Table 3-5 summarizes the

Category and included activities	Responsibilities
I: Activities with minimal impacts.	State processes applications; reported quarterly to Corps.
II: Activities conducted within 150 feet of a federal navigation channel, adjacent to/within a federal project, or grandfathered under the State program.	Corps reviews projects to determine MSPGP eligibility.
III: Activities requiring public notice.	Jointly evaluated by the State and Corps. The State processes applications and conducts joint interagency meetings. Information from these meetings, comments from public notice, and application information used by Corps to determine eligibility for MSPGP authorization.
IV: Activities with more than minimal impacts.	Coordinated review by the State and Corps. Permits issues separately.

Table 3-4. Permit categories and responsibilities under the MSPGP (from Setzer 1996)

net loss and gain of wetlands in coastal counties through the regulatory program. Given freshwater wetland loss estimates of as much as 800 acres annually before 1989, the net gain of 2.42 acres in freshwater wetlands since 1991 is striking.

MDE also maintains a statewide database of impact, mitigation (both permittee and State programmatic), and net gain/loss data. From January 1, 1991 to December 31, 1996, the database shows a net gain of 130.06 acres of nontidal wetlands (unpublished data, Maryland Department of the Environment 1998). Losses from unauthorized activities or

Activity	1991*	1992*	1993*	1994	1995	Total
Approved permits (#)	190	334	496	626	656	2,302
Authorized wetlands losses (acres)	6.22	30.08	34.12	24.29	43.37	138.03
Wetlands replaced through mitigation (acres)	1.63	20.95	57.42	20.07	40.38	140.45
Net loss/gain (acres)	-4.59	-9.13	23.3	-4.22	-2.99	**2.42**

*data does not include impacts in the Chesapeake Bay Critical Area until 10/1/93.

Table 3-5. On–the–ground results of the nontidal wetland regulatory program for all coastal counties and two counties outside the coastal zone (data from the Wetlands and Waterways Program, MDE).

"natural" impacts to nontidal wetlands (i.e., from sea level rise) are not included in these figures. Additionally, the protection of wetland area may not necessarily translate into protection of wetland function. However, it appears that the nontidal wetlands regulatory program has proven effective in protecting Maryland's freshwater wetland base, at least on an area basis.

In the future, efforts to streamline the regulatory program will continue. The goal is to maintain environmental protection while improving permit processing time and allowing staff to focus on larger development proposals or other projects. The effectiveness of these streamlining activities and the MSPGP will be closely monitored to ensure that they do not compromise wetland protection (figure 3-7). Watershed plans may also be a

Figure 3-7. Future streamlining measures are not intended to weaken freshwater wetland protection in Maryland (photo courtesy of Jeff Thompson, Maryland Department of Natural Resources).

management focal point, as the State would like to move in the direction of managing on a watershed scale (Clarke, personal communication 1997).

3.3 Agencies Can Cooperate: the Louisiana Geologic Review Process

Summary

Many of the tools included in the model program for estuary and wetland protection have multiple components contributing to their success. An example illustrating this complexity and the importance of building partnerships is the Geologic Review Process in Louisiana. One of the biggest issues facing the Louisiana coastal program is balancing wetland protection and oil and gas development. The Geologic Review Process was developed to increase state agency coordination in reviewing oil and gas development proposals. The Louisiana Geological Survey's expertise in petroleum geology is an integral part of this process. The relationship between the state regulatory agencies and the oil and gas industry has also improved. Use of the Geologic Review Process has helped to drastically decrease permitted wetland losses due to oil and gas development.

Background

Louisiana has about 3.2 million acres of coastal wetlands (figure 3-8), approximately 25% of the continental U.S. total (Louisiana Department of Natural Resources 1992). These marshes provide many functions, including habitat for fisheries and shrimp that constitute about 30% of the nation's fisheries catch and habitat for two thirds of the Mississippi Flyway's wintering waterfowl.

At the same time, $10s of billions in crude oil and natural gas are extracted annually from wells drilled in coastal Louisiana wetlands. While a mainstay of the Louisiana economy, these oil and gas extraction activities also have a significant effect on Louisiana wetlands. By 1985, pipelines, petroleum access canals, and spoil banks had caused the destruction or degradation of an estimated 192,000 acres of coastal wetlands (Louisiana Department of Natural Resources 1992). In 1982 alone, oil and gas extraction impacted about 1,500 acres of vegetated wetlands.

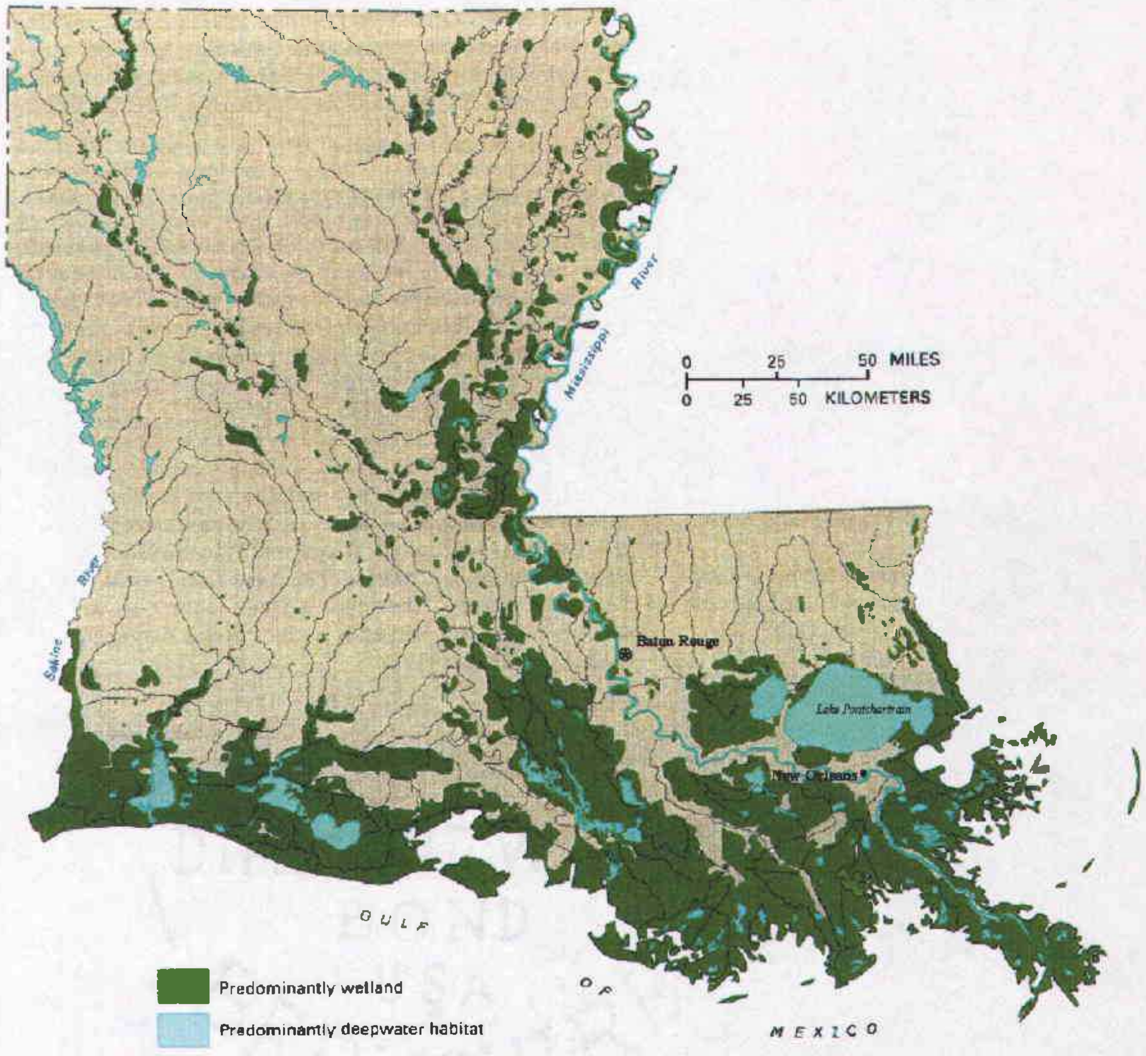

Figure 3-8. Coastal Louisiana is predominantly wetland (source: USGS 1996).

Concern for oil and gas activity impacts to fisheries, bird habitat, and other wetland functions was growing in the early 1980s. At the same time, the economic importance of oil and gas development to coastal Louisiana was clear. The issue was how to reduce wetland impacts from oil and gas activities while minimizing economic disruption.

Development of the Process

In 1978, the Louisiana Legislature established the Louisiana Coastal Resources Program. In 1980 the Louisiana coastal program was federally approved, and the Coastal Management Division (CMD) within the Louisiana Department of Natural Resources began processing Coastal Use Permits. Oil and gas development activities fell under the authority of this regulatory program.

However, the CMD did not have the expertise in petroleum geology and engineering to critically examine oil and gas development applications. These applications can include proposals for well canals, well drilling, slips to accommodate oil drilling rigs, and access roads, all potentially involving wetland excavation and/or fill (figure 3-9). While CMD

Figure 3-9. Oil and gas development proposals, including infrastructure, can be complex (photo courtesy of Rocky Hinds, Louisiana Department of Natural Resources).

would question the need for certain proposal elements, regulators lacked the expertise to suggest feasible alternatives. At the same time, oil and gas companies were concerned with delays in the permit process and wanted assurance that permits would be processed in a timely manner.

In a culminating case, a sportfishing group appealed a CMD-issued permit out of concern for a fishing hot spot. While the appeal did not result in a reversal of the permit approval, the delay caused the oil company to lose its opportunity to drill. The sportfishing group was specifically concerned that the CMD didn't fully comprehend the data included with the permit application. Recognizing that this concern needed to be addressed, in 1982 the CMD began looking for an answer.

Collaboration with the Louisiana Geologic Survey (Survey) and its petroleum geologists and engineers was a logical solution. The CMD would receive technical assistance and advice from the Survey, including a review of geologic, engineering, and economic information on all aspects of oil and gas extraction applications. This review would assure that oil and gas extraction proposals would result in a minimal amount of environmental impact (Johnston *et al.* 1989). The CMD, Survey, other state agencies (Louisiana Department of Wildlife and Fisheries and Louisiana Department of Environmental Quality, Water Pollution Control Division), and the applicant would meet to discuss the proposal, and a single permit recommendation for the project would be issued. The permit process would increase in efficiency while hopefully leading to a reduction of wetland impact. This permit review process became known as the Geologic Review Process.

The Geologic Review process

The Geologic Review Process begins when a meeting with the applicant is necessary. State rules require a meeting to be held when a proposed oil and gas development site will impact vegetated wetlands (Louisiana Administrative Code §43:I.724[B][3]). Permit applications include maps, photographs, and construction plans; site visits are not a necessary component of the Process (Dunham, personal communication 1997). Meetings are set according to the schedule of the involved agencies, particularly the CMD, and the applicant. Not all agencies attend all meetings, but meeting outcomes are public and easily available.

Meetings follow a general format where the agencies ask a series of questions (table 3-6). After the applicant responds, agencies meet separately to review the permit information and reach accord on permit conditions and approval. These agreements usually include the concerns of all the involved agencies (Johnston *et al.* 1989). Upon agreement, the applicant and agency representatives re-convene to discuss the final recommendation. At this point, if disagreements still exist it is possible to discuss any aspect of the permit, including additional mitigation elements or even permit approval or denial. If all necessary information is available, the entire meeting process generally lasts an hour (Rives, personal communication 1998).

1. General information: *well name and location; type and dimensions of proposed project (dredging, filling, direction drilling, etc.); applicant name; associated permits in the area.*

2. Lease and regulatory information: *lease maps, contractual obligations.*

3. Geologic information: *Drilling/oil production objectives; structural maps and cross sections; fault maps; oil/gas/water levels; production in nearby wells.*

4. Engineering information: *Depth of well; mud disposal program proposal; proposed casing and cementing program; information on other wells in area including history of well trouble.*

5. Future plans: *Best estimate of future work if well is either successful or a failure.*

6. Economic data: *Expenditure for proposed well and cost if well was drilled directionally.*

Table 3-6. Geologic Review Process meeting topics (from Johnston *et al.* 1989).

Evolution of the Geologic Review Process

For the first few years following the inception of the review process in 1982, much time was spent building trust between oil companies and the various agencies, as well as among the agencies themselves. Due to the competitive nature of their business, oil companies were concerned with keeping their geologic data private. As one person involved in developing the Geologic Review Process put it, "At first there were more lawyers than anyone else." Including the Survey was important in the trust-building process, since the oil companies were more willing to accept the Survey as objective (Hinds, personal communication 1998). However, in the beginning negotiation skills and persistence were needed to develop a working relationship.

In 1984 the New Orleans District of the US Army Corps of Engineers joined the Process, a major addition that brought the federal regulatory agencies (Corps of Engineers, US Fish and Wildlife Service, Environmental Protection Agency, and National Marine Fisheries Service) to the same table as the state agencies. At one setting, then, the applicant could discuss projects with state Coastal Use Permit regulators and federal regulators for the Clean Water Act §404 and Rivers and Harbors Act §10. If the project required only a federal permit, only federal regulators met but still reviewed the proposal using the Geologic Review Process.

In 1987, the CMD developed general permits for certain low impact oil and gas activities, in part to encourage applicants to pursue less damaging alternatives. Important to the adoption of these general permits was that the Geologic Review process still be utilized in their review. In 1988, the New Orleans Corps District followed suit by adding a provision to their permit process requiring Geologic Review meetings for all wells impacting wetlands, including those under general permits.

Changes in the 1990s involved fine-tuning the review process. In addition to reviewing how oil wells will be drilled and the construction of access canals, infrastructure associated with oil and gas development is now also examined (figure 3-10). Impact avoidance and minimization from all infrastructure is also pursued, and mitigation is required to replace wetlands unavoidably impacted (Rives, personal communication 1998). Mitigation proposals are openly discussed early in the permit review process to allow oil companies to plan and develop mitigation activities. Care is used in discussing mitigation proposals to avoid biasing the permit decision.

Inclusion of the New Orleans Corps District has resulted in cost sharing between the CMD and the Corps. The current annual cost of the Geologic Review Process is $95,000 for 120-150 meetings per year, with the CMD providing about $35,000 from federal coastal management funds. The New Orleans Corps District pays the remaining $60,000, funding meetings that include the Corps (either joint federal-state agency or federal agency meetings only).

Successes of the Process

The Geologic Review Process has become a key component of the CMD regulatory

Figure 3-10. The Geologic Review Process examines oil and gas development–related infrastructure (photo courtesy of Rocky Hinds, Louisiana Department of Natural Resources).

program. Figure 3-11 illustrates the striking decline in wetlands losses since 1982, the first year geologic review was used. Following 1984 when the New Orleans Corps District joined the process, the decline in wetlands loss is particularly noticeable. Johnston *et al.* (1989) offered another illustration of the success of the review process, noting that in 1986 only 42 percent of the dredging and filling footage requested by applicants was permitted. From 1982 to 1988 the average length of oil and gas canals in the coastal area declined by 78 percent (Johnston *et al.* 1989). At least in terms of area, the Geologic

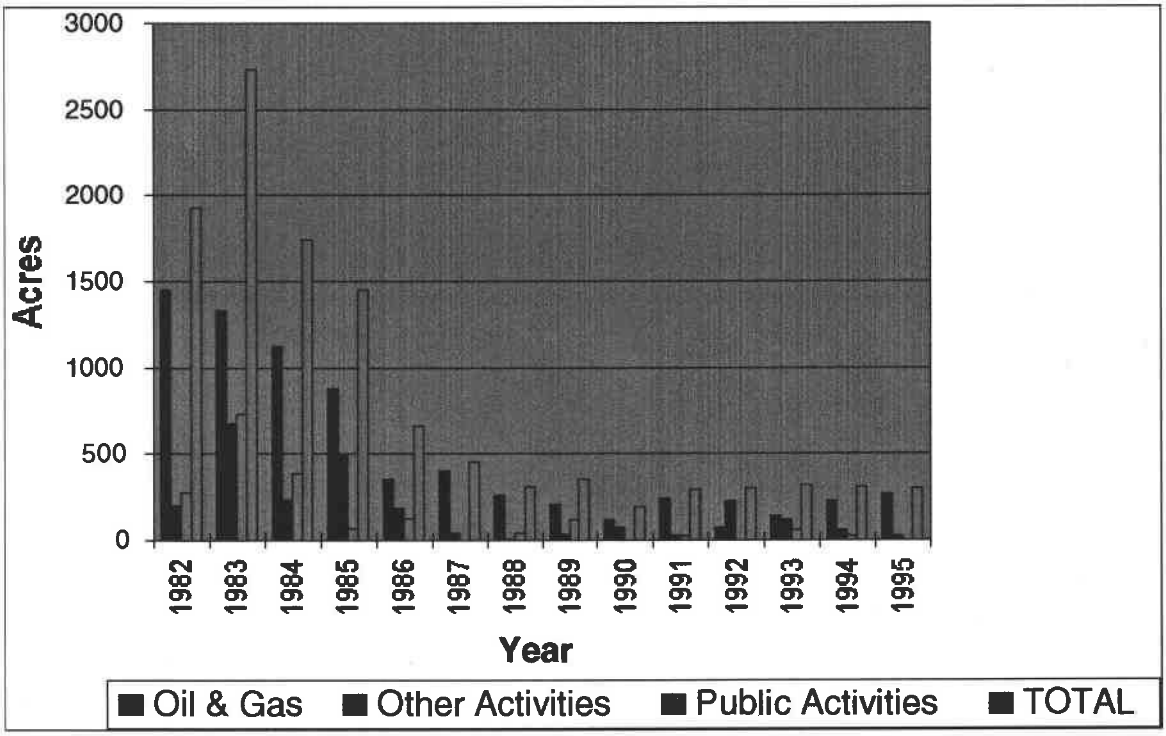

Figure 3-11. Area impact on vegetated wetlands from various permitted activities 1982-1995 (data from Louisiana Department of Natural Resources, Coastal Management Division permit database).

Review Process has resulted in a substantial reduction of wetland impact by identifying technically, economically, and environmentally feasible oil and gas development activities. Additional research would be necessary to translate this area information into indications of the level of protection of wetland function.

Another illustration of the success of the Geologic Review Process is that it is being expanded as part of an agreement with the New Orleans Corps District. The Galveston, Texas District and Vicksburg, Mississippi Corps Districts can partake in up to 50 Geologic Review Process meetings per year (Hinds, personal communication 1998).

This on-the-ground success has been greatly facilitated by the development of inter–agency cooperation and cooperation with oil companies. Agency coordination has resulted in a minimization of agency conflicts, as permits are not issued unless all site issues have been resolved (Rives, personal communication 1997). The permit process has been streamlined, since the regulatory agencies now convene to discuss permit applications. The education of agencies and the oil and gas industry has also been an important part of the Geologic Review Process success. Agencies have increased their understanding of oil and gas development technology, geology, and engineering; oil companies have gained knowledge of wetland protection issues and regulatory program requirements. The expertise and objectivity of the Louisiana Geologic Survey has been a key component to bringing the agencies and industry together.

The Geologic Review Process has proven successful in providing a forum to help reduce impacts to Louisiana's coastal wetlands base (figure 3-12). It has resulted in the development of a close working relationship between the state and a major industry. It has also resulted in close cooperation among state and federal wetland regulatory agencies. It is a good example of how agencies can coordinate with industry and improve coastal ecosystem protection.

Figure 3-12. The Geologic Review process has helped enhance protection of Louisiana coastal wetlands benefiting species dependent on these habitats (photo courtesy of Rocky Hinds, Louisiana Department of Natural Resources).

3.4 Mitigating impacts to New Jersey wetlands

Summary

According to the CZME Study, the use of mitigation in wetland regulatory programs was overall a weak point in state coastal programs. An exception to this finding is in New Jersey. New Jersey has strong regulations protecting tidal and nontidal wetlands. Development in wetlands is not completely prohibited, however. An essential component of the state's regulatory program has been the use of mitigation to replace wetlands lost through permitted projects. Databases have been used to track mitigation projects and to help examine mitigation effectiveness. Mitigation area data for individual permits indicates that required mitigation area exceeded wetland impact area by 53 acres from 1988 to 1993.

Background

Back bay waters, salt marshes, red maple swamps, pine barrens, and other wetlands cover a large portion of New Jersey—1,000,000 acres, or about 19% of the state (Tiner 1985; see figure 3-13)— and provide valued functions such as habitat, water quality maintenance, and flood mitigation. However, 75% of New Jersey's original salt marsh and 20% of its freshwater wetlands have been destroyed (Tiner 1985). New Jersey has the highest population density of any U.S. state; residential housing needs and business relocation from expensive cities put development pressure on wetlands (ORP 1992). New Jersey's location in the northeast U.S. transportation corridor, proximity to New York and Philadelphia, and history of industrial development have also led to wetland losses.

Recent federal and state regulatory programs have drastically reduced wetland losses. New Jersey has regulated tidal wetlands since the Wetlands Act of 1970 and freshwater wetlands since the 1987 Freshwater Wetlands Protection Act. Both programs have stringent requirements for avoiding and minimizing wetland impacts and have had success

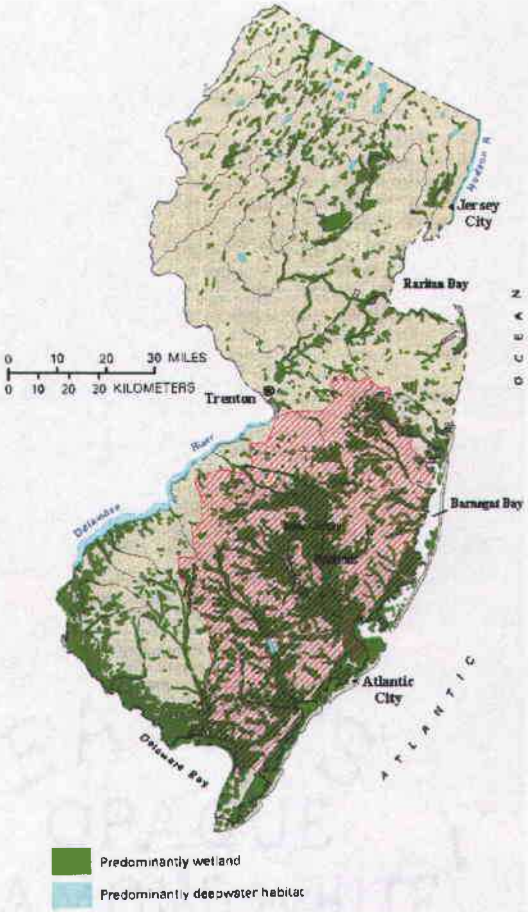

Figure 3-13. Wetlands cover a significant portion of the New Jersey landscape, even away from the coast (source: USGS 1996).

in reducing wetlands loss. For example, coastal wetlands losses averaged about 3,200 acres per year before the 1970 Act, decreasing to 50 acres annually from 1970 to 1985 (Tiner 1985) and even lower since 1985 (Fanz, personal communication 1998). However, development in wetlands is not absolutely prohibited, and mitigation is used for approved projects that cannot avoid wetland impacts.

Development of New Jersey's mitigation program

Mitigation was first mandated in the 1970 Wetlands Act, but statutory language was somewhat unclear. The 1987 Freshwater Wetlands Act included more detailed language, in part since it was intended to assume the role of the federal wetland regulatory program. The 1987 Act required that mitigation provide ecological value equal to that lost from the permitted project, but did not specify the amount or type of mitigation required. The New Jersey Department of Environmental Protection (DEP) used rule of thumb mitigation ratios of 2:1 (area created: area impacted) for wetland creation, a 1:1 restoration ratio, and varying enhancement ratios. The 1987 Act also established a Mitigation Council to help promulgate the development of mitigation banks.

In 1988, mitigation was being more commonly used for permitted development in wetlands. However, DEP and the development community were concerned with the lack of predictability and clarity in mitigation requirements and unsure about the effectiveness of mitigation projects in restoring lost wetland function. In response, New Jersey coastal program funds were used to identify potential mitigation and mitigation bank sites. DEP also began a project to establish mitigation guidelines and a mitigation database.

A database including data on mitigation projects since 1970 was an early result of this work. This database was a historic record to identify mitigation sites for field visits, presumably allowing DEP to identify successful and not–so–successful mitigation projects (Fanz, personal communication 1998). However, data from 1970 to 1987 was incomplete, leading to difficulty in identifying project-specific mitigation requirements. Consequently, on-the-ground determination of mitigation success was difficult at best.

In 1990-91, DEP developed a new database solely for mitigation information called "WETMIT." This database contained mitigation information for all state regulatory programs, including both wetland regulatory programs. In use today, WETMIT contains information about individual mitigation projects, such as types and areas of wetlands disturbed, proposed mitigation goals and acreage, and other information (table 3-7). The information included in WETMIT gives DEP the ability to go into the field to examine mitigation effectiveness and determine compliance.

To clarify mitigation requirements, the DEP also developed mitigation guidelines. The guidelines state that mitigation is required for all individual permits and can occur as wetland restoration, creation, enhancement, or payment into the state Wetlands Mitigation Bank; a proposed rule change would also allow the purchase of credits from mitigation

- New Jersey and US Army Corps of Engineers permit numbers
- Acreage and type of wetland (palustrine, open water, intertidal shallow) disturbed
- Acreage and type of wetland (palustrine, open water, intertidal shallow) proposed in mitigation
- Acreage and type (creation, restoration, enhancement) of mitigation required in permit
- Mitigation project contact/company name
- Mitigation project site
- Years of site monitoring required and receipt of annual monitoring reports

Table 3-7. Information included in the WETMIT mitigation database.

banks. "Restoration" includes projects that address wetland impact within six months from the time of impact. Mitigation that addressed an impact six months after it occurred was termed “creation” (figure 3-14). The rule–of–thumb mitigation ratios developed by DEP were adopted for use in the other regulatory programs.

The mitigation process

Permits are reviewed prior to mitigation proposals to avoid issuing a permit solely on the

Figure 3-14. Mitigation of wetland impacts more than six months old is termed creation (photo courtesy of Dave Fanz, New Jersey Department of Environmental Protection).

basis of a mitigation proposal. Rather, the permit is reviewed first and if approved, mitigation of wetland impacts is required. The permit applicant must then develop a mitigation proposal. Mitigation guidelines outline the information a proposed mitigation plan must include, such as a detailed description of the mitigation project, a mitigation site plan, and monitoring plan (table 3-8). Monitoring of the mitigation site is required for at least three years following initial work to ensure at least 85% vegetation cover of the site; annual monitoring reports are submitted to DEP. The mitigation proposal must contain deed restrictions or easements to protect the site in perpetuity. Mitigation guidelines also specify the process for mitigation site selection. In proposing a mitigation project, the applicant must first look on site. If there are no suitable on site locations, mitigation is

- Associated permit and required mitigation acreage
- Location description, photographs, and USGS quad map; includes wetland delineations
- Description of current site hydrology and proposed hydrologic regime
- Functions/values that mitigation proposal is targeting
- Mitigation acreage proposed
- Cost estimate
- Vegetation planting plan
- Mitigation site monitoring plan (annual monitoring reports are required for at least three years)
- Deed restriction/easement maintaining mitigation site in perpetuity

Table 3-8. Required elements of a mitigation proposal.

required in the same watershed as the development project and, if a proposed rule change is adopted, could include the purchase of credits from mitigation banks within that watershed. In the rare event that this alternative is still not suitable, the applicant may go before the Mitigation Council to seek authorization for a cash contribution to the Wetlands Mitigation Bank. The Mitigation Council decides the payment amount based on the "value" of the impacted wetland. Payments have been generally about $80,000 per acre (Fanz, personal communication 1998). In most cases it is possible to mitigate either on site or within the watershed.

On-the-ground mitigation impact

In terms of mitigating for the area of wetlands impacted, mitigation in New Jersey appears to be successful. Data from the WETMIT database (table 3-9) indicates a net gain in wetland area from 1988 to 1991, with an overall mitigation ratio of about 1.4:1. There are a few caveats with this data, however. The data is not all field-verified and does not contain information about the types of mitigation used. Furthermore, data reflects only individual permit impacts, since state law requires mitigation only for individual permits (Torok *et al.* 1996). However, New Jersey also has general permits for activities with smaller impacts, and only one general permit requires mitigation. There is concern about the unmitigated loss of wetlands from the other general permits (Torok *et al.* 1996). Data in table 3-9 does not include impacts from general permits and thus underestimates wetlands losses. A final consideration is that the question of how well mitigation projects

Drainage basin	Wetland area disturbed (acres)	Wetland area mitigated (acres)	Total area change (acres)
Wallkill River	1.47	2.89	+1.42
Passaic River	11.63	12.98	+1.35
Raritan River	42.28	63.19	+20.91
Arthur Kill	18.08	33.70	+15.62
Atlantic Coastal	31.09	31.92	+0.83
Delaware River	33.18	44.42	+11.24
Delaware Bay	1.74	3.48	+1.74
Total	**139.47**	**192.58**	**+53.11**

Table 3-9. Wetland mitigation from July 1, 1988 to December 31, 1993 (from Torok *et al.* 1996).

replace lost wetland function is critical requires additional study (Torok *et al.* 1996). If recovering a lost wetland's function is possible, it may be years before such recovery is complete (figure 3-15).

For developers, the mitigation guidelines have resulted in desired predictability. The guidelines and ratios have never been challenged in court, indicating at least some level of comfort with them.

The future of the mitigation program

A current effort is to increase enforcement of mitigation projects. In the past, few mitigation projects have been field visited, leading to uncertainty about on–the–ground

Figure 3-15. Assessing how effective mitigation sites are at replacing lost wetland function is a research question beyond examining area lost: area replaced information (photo courtesy of Dave Fanz, New Jersey Department of Environmental protection).

mitigation results. The DEP has the assigned a staff person to work exclusively on mitigation to address these concerns. This position is also assigned to update WETMIT and produce summary statistics to enable further identification of mitigation successes and issues.

New Jersey's mitigation bank guidelines are also being reviewed. A proposed rule change includes the purchase of credits from wetland mitigation banks as a mitigation option. With the oversight of the Mitigation Council, the State hopes to continue encouraging the development of wetland mitigation banks. If the Mitigation Council and the State are involved with the regulation of these banks, hopefully their quality will be increased to improve mitigation success. It is more effective to have experienced, qualified people doing wetlands creation and restoration than many inexperienced people doing perhaps inappropriate projects. It is also easier for the state to regulate a few large sites. Additionally, it may be more ecologically sound to create and enhance larger wetlands than to have hundreds of small mitigation sites.

3.5 Compliance monitoring in Pennsylvania yields results

Summary

Compliance monitoring was another area of wetland regulation that the CZME study concluded could be improved in many states. Emulating the Pennsylvania coastal program's compliance monitoring and enforcement would address this weakness. Historic development in the Pennsylvania coastal zone along the Delaware River had resulted in extensive losses of historic wetlands. Remaining wetlands are regulated according to state and federal law. However, no program for monitoring compliance with these laws existed until the Pennsylvania coastal program began the Delaware Estuary Wetland Enforcement Initiative in the late 1980s. This Initiative has reduced wetland violations to practically zero.

Issue and background

Pennsylvania's coastal zone includes a 57 mile long stretch of 33,000 acres along the Delaware River estuary and 63-miles (53,000 acres) along Lake Erie (figure 3-16). While

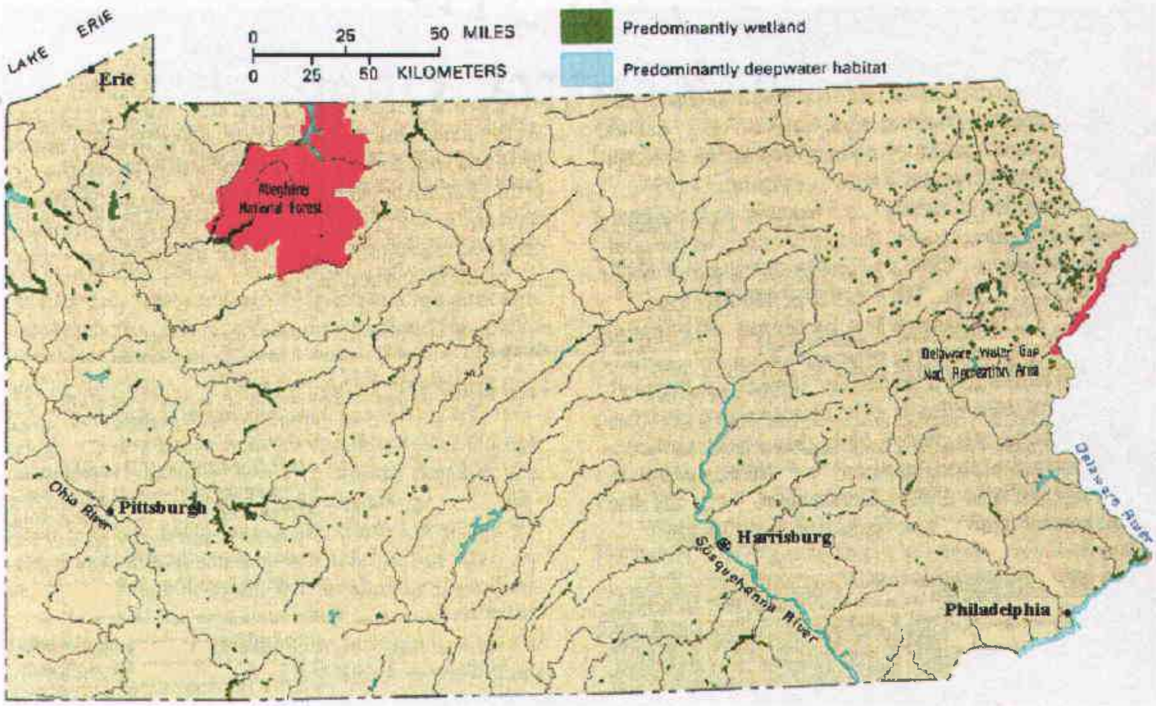

Figure 3-16. The Pennsylvania coastal zone is along the Delaware River and along Lake Erie. Wetlands along the Delaware River have almost all been lost (source: USGS 1996).

much of the Lake Erie (LECZ) coastal zone is agricultural in nature, the Delaware estuary coastal zone (DECZ) is highly developed, including the city and port of Philadelphia. Intensive industrial, commercial, transportation, and manufacturing development has reduced tidal freshwater marsh area along the Delaware River to about 500 acres from a historic base of about 13,000 acres. This large reduction in wetland area led to corresponding reductions in societally valued wetland functions including pollution filtration, floodwater retention, and habitat for fish and wildlife.

Development in the mid-1980s continued to impact estuarine wetlands along the Delaware River, and protecting remaining wetlands increased in importance. Pennsylvania and federal regulations developed in the 1970s required permits for development activity affecting wetlands. However, prior to the mid-1980s there was no program to monitor compliance with these regulations.

Development of a compliance monitoring program

Since the National Wetlands Inventory (NWI) mapping process for the DECZ was not completed, prior to 1984 field visits by state regulators to proposed development sites were a common part of the wetland permit review process in Pennsylvania. While participating in these site visits, wetland specialists from the Pennsylvania Coastal Zone Management Program noticed violations such as illegal wetland fills on nearby sites. However, regulators were restricted to responding to official complaints about proposed development sites only. There was no formal process for verifying or resolving suspected violations.

To determine if violations were indeed occurring, Pennsylvania coastal program personnel proposed a project to perform wetland monitoring in the DECZ via low altitude, color infrared aerial photography to identify wetland regulation violations. Coastal program staff would then compile field reports for each site, including maps, aerial photographs, videos, and property owner and tax parcel information (Malone, personal communication 1998). These field reports would then be given to appropriate state and federal agencies for necessary enforcement activity. Funding for this work came from the Pennsylvania coastal program.

How the enforcement process works

Pennsylvania coastal program staff compared mid-1970s and 1986 aerial photography to determine wetland losses in the DECZ over this time period. Photograph comparisons were done using a Zoom90 stereoscope, enabling the identification of wetland polygon changes at various spatial scales. A trend analysis examining the types of wetlands lost and the activities causing these losses was also developed. This wetland loss information was compared to state records of permitted projects and activities to identify illegal fill activities affecting wetlands.

In 1986, with the assistance of the US Fish and Wildlife Service this first wetland monitoring project was completed, creating a base map for future photo interpretation and comparison. This map was actually a series of photo interpretation sheets of individual aerial photographs (Malone, personal communication 1998). The initial loss and trend analysis showed over 100 wetland violations in the DECZ between the mid–1970s and 1986. Since many of these losses occurred prior to adoption of Pennsylvania's wetland regulatory program, and state agencies lacked clear direction, none of these sites were acted upon (Malone, personal communication 1998).

In 1989, the Pennsylvania coastal program developed a full-scale enforcement program, called the Delaware Estuary Wetland Enforcement Initiative, through a partnership with the US Army Corps of Engineers (Corps), US Environmental Protection Agency (EPA), and the Pennsylvania Department of Environmental Protection. The US Fish and Wildlife Service was also included in an advisory role in this program. The Pennsylvania coastal program assumed responsibility for convening the Enforcement Initiative group.

Members of the enforcement initiative selected 30 sites with particularly egregious violations. The state, Corps, and EPA each were designated as the lead agency on ten violations. Potential violation sites were visited to examine the extent of illegal activity (figure 3-17). After site visits, enforcement measures were pursued according to the applicable regulation. In allocating violations to agencies, possible political ramifications for each agency were reduced as much as possible. Additionally, violations were given to the agency with the strongest authority for each site. While one agency generally was designated as lead, all agencies worked together on each site. If difficulties arose for the lead agency, responsibility could shift to one of the other agencies.

Figure 3-17. Visits to potential violation sites are an integral part of the Enforcement Initiative (photo courtesy of Shamus Malone, Pennsylvania Department of Environmental Protection).

Results of the enforcement initiative

Major violations in the DECZ were from industrial and commercial activities. Several of the larger violations were at the Philadelphia Airport and were some of the first to be pursued. Much publicity surrounded the disclosure of these violations and the ensuing resolution discussions from these high-profile violations. Resolution of these violations sometimes took years, eventually resulting in fines, site restoration, or after-the-fact permits and mitigation.

Aerial photographs were taken annually beginning in 1989, and the photointerpretation and site visit process repeated each year. The Enforcement Initiative partnership group remained intact. The Enforcement Initiative was also expanded to the Lake Erie coastal zone using the same analysis process. Since there are few wetland impacts in the LECZ, mostly from residential development, the Enforcement Initiative is less formal in this area (Malone, personal communication 1998).

At the commencement of the enforcement project, a large number of violations were detected through the photointerpretation and subsequent on site verification process in both the DECZ and LECZ (table 3-10 and figure 3-18). By 1995, the number of identified violations in the DECZ had decreased to zero, with similar results for the LECZ by 1993 (table 3-10 and figure 3-18). Summary data for wetland area destroyed or restored, fines levied, or the results of other enforcement action are currently being

Region	**Number of violations**							
	1980-85	1980-85 per year	1986-89	1986-89 per year	1990-93	1990-93 per year	1994	1995
Delaware River	100	16.7	50	12.5	24	6	3	0
Lake Erie	35	~6	10	2.5	2	<1	0	0
TOTAL	**135**	**~24**	**60**	**15**	**26**	**6.5**	**3**	**0**

Table 3-10. Number of detected violations, 1980-1995 (data from Malone 1995 and Malone 1998).

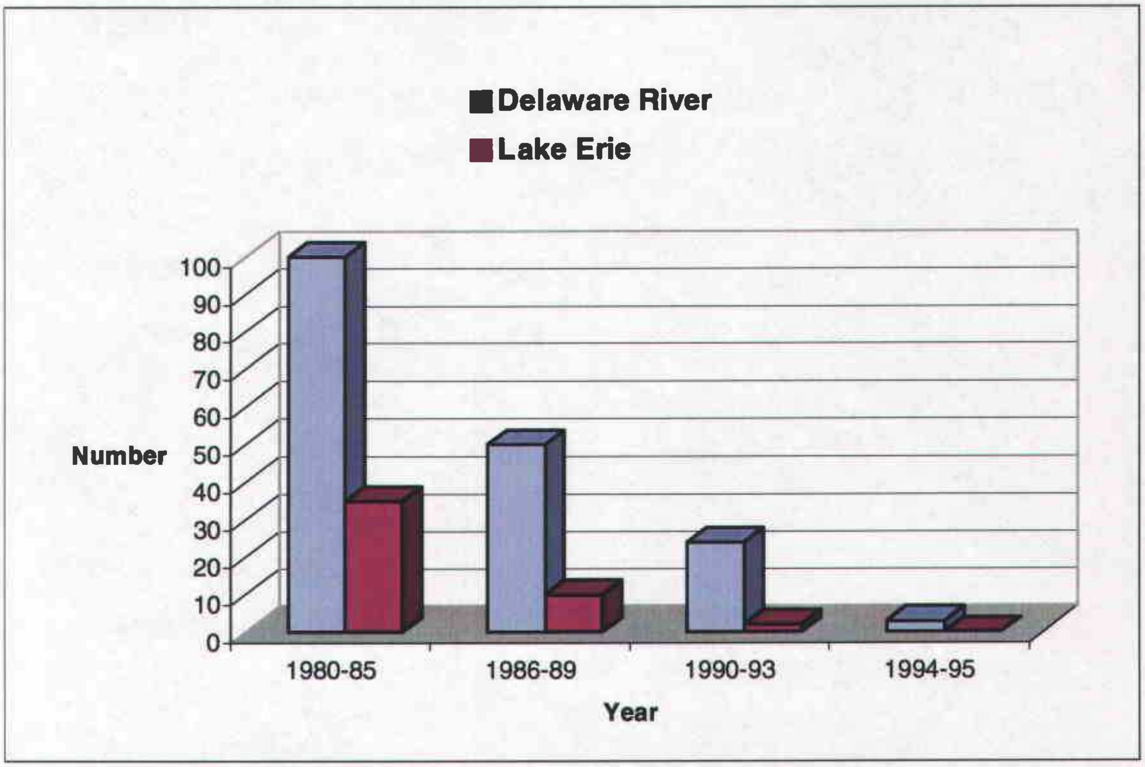

Figure 3-18. Violations trends along the Delaware River and Lake Erie coastal zones.

prepared. However, the data in table 3-10 helps support the contention that the Enforcement Initiative has been successful in identifying and remedying violations. With the publicity generated from the larger violations, word of the Enforcement Initiative has spread (Lapp, personal communication 1998 and Malone, personal communication 1998). The trend of decreasing numbers of violations suggests that the development community knows that wetland regulations are being enforced. This knowledge is presumably stopping those who might otherwise engage in illegal wetland activities.

Interagency coordination and collaboration has been a critical component of this successful program. Agencies speaking with one voice has been a key success factor (Lapp, personal communication 1998). The partnership between federal and state agencies has provided some "protection in numbers" as no one agency has had to receive all political pressure. The broad range of agency expertise has also been valuable to the program.

With the success of the Enforcement Initiative and reduction in number of detected violations, the need for convening the regulatory agencies every year has decreased. Enforcement Initiative funds could also be used for many other needed projects. As a result, the interagency group will convene every five years to continue the site-visit and violation resolution process. However, aerial photography will still be obtained for both the LECZ and DECZ every year. Aerial photography is now taken at a 1:24,000 scale to enable more detailed analysis. The program will also be expanded to examine mitigation sites to ensure that compensatory mitigation requirements are being followed.

In the future, advances in new aerial photography will allow same frame coverage between years, which will make photo interpretation easier (Malone, personal communication 1998). The Pennsylvania's coastal program Geographic Information System (GIS) contains scanned images of this aerial photography enabling computer-assisted wetland polygon change analysis.

4.0 Planning tools

The CZME study found planning programs to be a commonly used management practice to protect estuaries and wetlands. Local land use planning and special area management planning were among the ten most important tools used by state coastal programs (Good *et al.* 1997). Particularly when implemented through regulatory programs, planning programs form a backbone of the model program for wetland and estuary protection (figure 1-1). Planning can provide advance protection of particularly sensitive or important habitats. Calculation of the area set aside for protection can begin to describe the effectiveness of planning programs.

An *Oregon system of local land and water use planning*, based on state standards, has been successful in directing non water–dependent development away from sensitive coastal wetland and estuarine areas. In this system, estuaries and surrounding shorelands are classified and zoned for allowable uses. An alternative approach is the designation of areas of state environmental concern, as is the case with the *Maryland Critical Area Program.* All land within 1000 feet of mean high tide or the landward edge of tidal wetlands is included in this Critical Area. Local land use plans, following Critical Area guidelines, specify types and intensities of allowable development.

Special area management planning can be used in areas with competing uses, particularly important resources, or intense development/conservation conflicts. An example is the *Interstate Management Plan for the Pawcatuck River and Little Narragansett Bay,* forming the border between Connecticut and Rhode Island. This planning process helped improve communication between the two states. Area residents also were educated on contentious issues such as marina siting.

These three case studies represent elements of the model program for coastal wetland and estuary protection. Identifying on–the–ground effects of these planning programs is complicated by the need for tracking their implementation (i.e., permit) decisions. However, examining the planning process and its preliminary outcomes, including zoning designations and area classifications, offers good indications of the success of planning programs.

4.1 Land and water use planning to protect Oregon's estuaries

Summary

Local land use planning was one of the ten most important tools for coastal wetland and estuary protection identified in the CZME Study (Good et al. 1997). To provide adequate protection and suitably site development, Oregon developed a locally implemented system of estuary and shoreland planning. The Oregon coastal economy historically revolved around estuaries and their uses as ports and other components of a natural resource–based economy. Now, Oregon estuaries are a key component of a growing tourism industry. In the twenty five years of its existence, this planning program has protected valued estuarine resources and located development in appropriate sites.

Issue

Oregon estuaries, except for the Columbia River, are small; 17 major estuaries (figure 4-1)

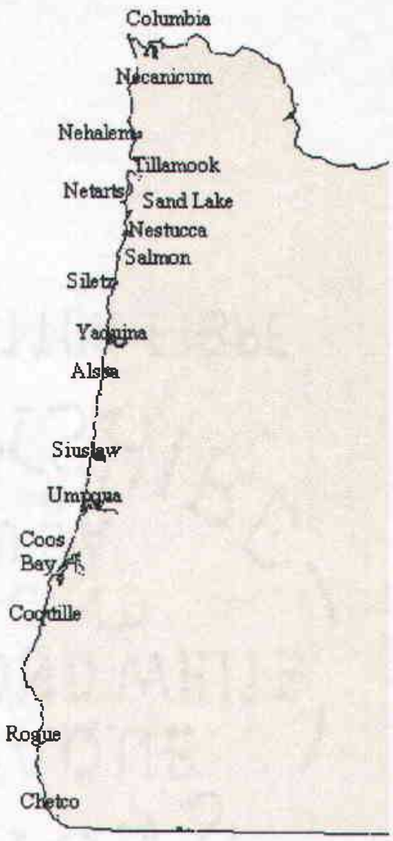

Figure 4-1. Except for the Columbia River, Oregon estuaries are small compared to eastern U.S. estuaries.

comprise about 130,000 acres in surface area. The Columbia is about 61% of this total or about 80,000 acres (Cortright *et al.* 1987). Almost all coastal population centers are located on estuaries. Many of Oregon's estuaries and fringing tidal wetlands were historically dredged, filled, and otherwise altered to provide for transportation and other infrastructure. Historically, Oregon estuaries were economically important as ports for commercial fisheries and commerce (figure 4-2). With recent declines in the coastal natural resource economy, estuaries have become an important attraction for a growing tourism industry. At the same time, Oregon estuaries were and are highly valued for their scenic quality as well as for providing fish and wildlife habitat, various hydrologic functions including floodwater storage, and water quality maintenance.

Figure 4-2. Commercial fishing fleets are based in several of Oregon's estuaries.

Public concern with adverse impacts to Oregon's estuaries heightened throughout the 1960s, leading to a moratorium on estuary filling in 1970. In 1971, a new regulatory program, the Oregon Removal/Fill Law, was adopted to regulate fill activity in wetlands and estuaries. Further concerns with coastal population growth led to the 1971 Legislative creation of the Oregon Coastal Conservation and Development Commission (OCCDC) to write a natural resource management plan for the Oregon coast. The work of the OCCDC helped increase awareness of the important role of Oregon estuaries to coastal fisheries and overall coastal ecosystem health. In 1973, Oregon's landmark statewide land use planning program was adopted by the Legislature, and in 1976 OCCDC coastal plan recommendations were added to this program. In response to the concern for protecting Oregon estuaries, the Oregon legislature incorporated two major estuary protection policies into Oregon's land use program. Statewide Land Use Goal 16 set up a system of estuary classification and management, and Goal 17 contained policy goals and requirements for coastal shorelands.

Estuary classification and management

Goal 16 set in place an estuary classification system based on the natural resources and the level of development in each estuary (table 4-1). The classification system was designed to preserve and promote both environmental diversity and development in Oregon's estuaries and to site future development in estuaries that could support additional development (Cortright *et al.* 1987).

Classification category	Description
Natural	Estuaries without maintained jetties and channels; usually have limited areas of development for residential, commercial, or industrial uses. May have altered shorelines as long as these altered shorelines are not adjacent to an urban area. Shorelands around natural estuaries generally are reserved for agriculture, forestry, recreation, and other rural uses.
Conservation	Estuaries lacking maintained jetties or channels but are within or adjacent to urban areas with altered shorelines adjacent to the estuary.
Shallow Draft Development	Estuaries with maintained jetties and main channels (not entrance channels) maintained by dredging at 22 feet or less.
Deep Draft Development	Estuaries with maintained jetties and a main channel maintained by dredging to deeper than 22 feet.

Table 4-1. Estuary classification categories and descriptions from Goal 16 (from Cortright et al. 1987).

The classification system generally defines the most intensive level of development permitted in each estuary. After being classified, estuaries were divided into management units: natural, conservation, or development. As outlined in Goal 16, each management unit contains a management objective and set of permissible uses (table 4-2). An estuary's overall classification specifies the intensity and type of permitted development. Estuaries classified as natural can only have natural management units. Estuaries classified as conservation can have natural and conservation management units. Shallow– and deep–draft development estuaries have natural, conservation, and development management units. Figure 4-3 is a general representation of an estuary's classification.

Management unit	Management objective	Permissible uses
Natural	Assure the protection of significant fish and wildlife habitats, continued estuarine biological productivity, and scientific research and educational needs. Managed to preserve the natural resources, recognizing the dynamic nature of natural processes.	• Low intensity recreation • Research/educational observation • Navigation aids (buoys, beacons) • Passive restoration activities • Dredging necessary for maintenance of existing tidegates and associated drainage channels • Riprap for protection of: uses existing as of October 1977; unique natural resources; historical/archeological values; public facilities. • Bridge crossings
Conservation	Provide for long-term uses of renewable resources that do not require major alterations to the estuary (except for restoration purposes). Managed to conserve natural resources and benefits.	Uses allowed in natural management units plus: • Aquaculture not involving dredge/fill of estuary (except for incidental harvest) • Communication facilities • Active restoration of habitat or water quality • Boat ramps for public use not needing dredge/fill • Pipelines, cables, and utility crossings • Installation of tide gates in existing functional dikes • Bridge crossing support structures
Development	Provide for navigation and public, commercial, and industrial water-dependent uses consistent with the level of alteration allowed by the overall estuary classification.	• Dredge or fill (in compliance with other regulations) • Navigation and water-dependent development • Marinas • Aquaculture • Extraction of mineral resources • Restoration

Table 4-2. Estuary management units, objectives, and permissible uses (from Cortright *et al*. 1987).

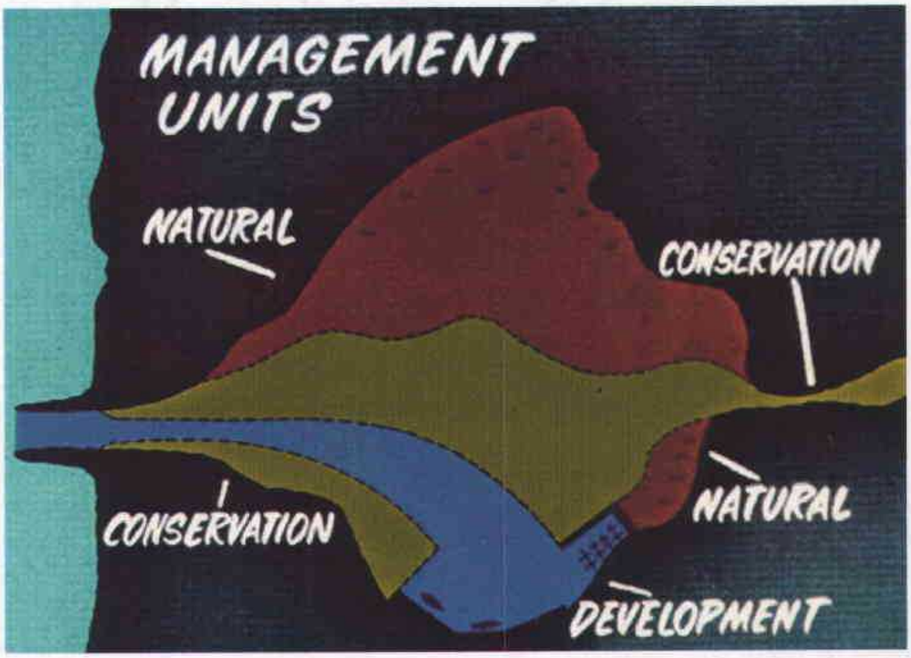

Figure 4-3. Schematic of how an Oregon estuary might be classified. Development units include channels and port areas; natural units include mud flats, tidal wetlands, or other habitats.

Estuary classifications and designations were done during the local comprehensive plan development process in the late 1970s and early 1980s. Local governments and ports worked with state and federal agencies on these designations, which were based in part on estuary habitat maps developed by the Oregon Department of Fish and Wildlife. Assessments of development needs, review of estuary studies, and lengthy negotiations and public involvement were also key parts of the designation process. Related issues addressed during this process included identifying potential dredge material disposal and wetland mitigation sites to support water dependent development. The Oregon Land

Conservation and Development Commission had final authority for approving local plans, but the plans are implemented through the land use authorities of local government.

Shoreland planning requirements

Goal 17 requires local governments to develop plans for all coastal shorelands. Coastal shoreland boundaries extended from the estuary shoreline to a landward limit determined by including all important natural resources within 1000 feet of the estuary shoreline. Coastal shoreland width varies but is a minimum of 50 feet. Coastal shorelands include areas subject to ocean flooding, areas of geologic instability, riparian vegetation, significant wetland habitat, areas of exceptional aesthetic or scenic quality, and areas needed for water dependent development (Cortright *et al.* 1987). Lands subject to estuary or riverine flooding–on the Oregon coast, predominantly diked agricultural lands–are not required to be designated as coastal shorelands, but often are.

In general, while local comprehensive plans detail development restrictions placed upon coastal shorelands, development proposals within coastal shorelands are subject to a higher level of scrutiny. Certain shoreland sites are also set aside for water-dependent development, mitigation sites, and protection of significant habitat (Cortright *et al.* 1987).

Implementation of estuary plans

Local land use authorities are primarily responsible for implementing estuary and shoreland plans. These plans are periodically reviewed by the state to ensure their continued effectiveness. Oregon and federal agencies maintain regulatory authority for dredge, fill, and other estuary alterations through the Removal/Fill Law and the §404 permit process.

Activities designated as permissible uses for each management unit (table 4-2) are generally considered consistent with the overall management objective of each management unit (Cortright *et al.* 1987). These activities are subject to a "dredge/fill" test. To be allowed, the activity must:

- minimize adverse affects
- be required for navigation or other water-dependent use
- show a demonstrated need
- not unreasonably interfere with public rights
- show that there is no alternative upland site

Other activities in estuaries, called resource capability uses, may or may not be consistent with the natural capabilities of the estuary and the purposes of the management unit. These activities are subject to review by local governments to determine their effect on other estuary uses, natural resources, and the management objective of the unit (Cortright *et al.* 1987). Impact assessments are used to facilitate review of a proposed activity.

Mitigation is required for activities that include dredge or fill in intertidal areas but is not considered justification for allowing estuarine dredge or fill (Cortright *et al.* 1987). Mitigation requirements are set after the permit review process, usually by state wetland regulators implementing the Removal/Fill Law.

Changes since program initiation

For an estuary planning program as complex as Oregon's, it is somewhat surprising that so few alterations have occurred. From 1977 to 1991, local comprehensive plans–including estuary plans–were developed and approved by the state for the seven coastal counties and 33 cities. Estuary designations were reviewed on an estuary–wide and jurisdiction–by–jurisdiction basis.

A current area of focus is the designation of water–dependent shorelands according to Goal 17. In the early 1980s, about 2,000 acres coast–wide were designated strictly for water–dependent uses. As of 1998, only 10 of these acres had been actually developed (DLCD 1998). At the same time, the coastal economy has changed from being predominantly natural resource–based to increasingly tourism dependent. These two factors combined have increased pressure to relax the water–dependent standard to allow non-water dependent uses. The Oregon coastal program convened a working group to examine the issue and possible policy changes (Oswalt, personal communication 1998).

Estuary planning results

Oregon estuary classifications, shown in table 4-3, illustrate that over half of Oregon's estuaries allow only natural or conservation uses. Only the historic large ports of the Columbia River, Yaquina Bay, and Coos Bay allow deep draft development. A more detailed examination of the outcomes of the planning process shows that most estuarine areas are designated as natural or conservation management units (figure 4-4). In general, the only areas that qualified as development management units were existing developed areas and navigation channels (Cortright *et al.* 1987). These area figures indicate that estuarine habitats such as vegetated wetlands and mudflats receive a significant level of protection (figure 4-5). Development for water-dependent industry is allowed, but activities are located in the most suitable areas and adverse impacts mitigated. Identifying dredge material disposal and wetland mitigation sites was an important part of the planning process.

Classification	Estuary
Natural	Sand Lake Salmon River Elk River Sixes River Pistol River
Conservation	Necanicum River Netarts Bay Nestucca River Siletz Bay Alsea Bay Winchuk River
Shallow draft development	Nehalem Bay Tillamook Bay Depoe Bay Siuslaw River Umpqua River Coquille River Rogue River Chetco River
Deep draft development	Columbia River Yaquina Bay Coos Bay

Table 4-3. Oregon estuary classifications.

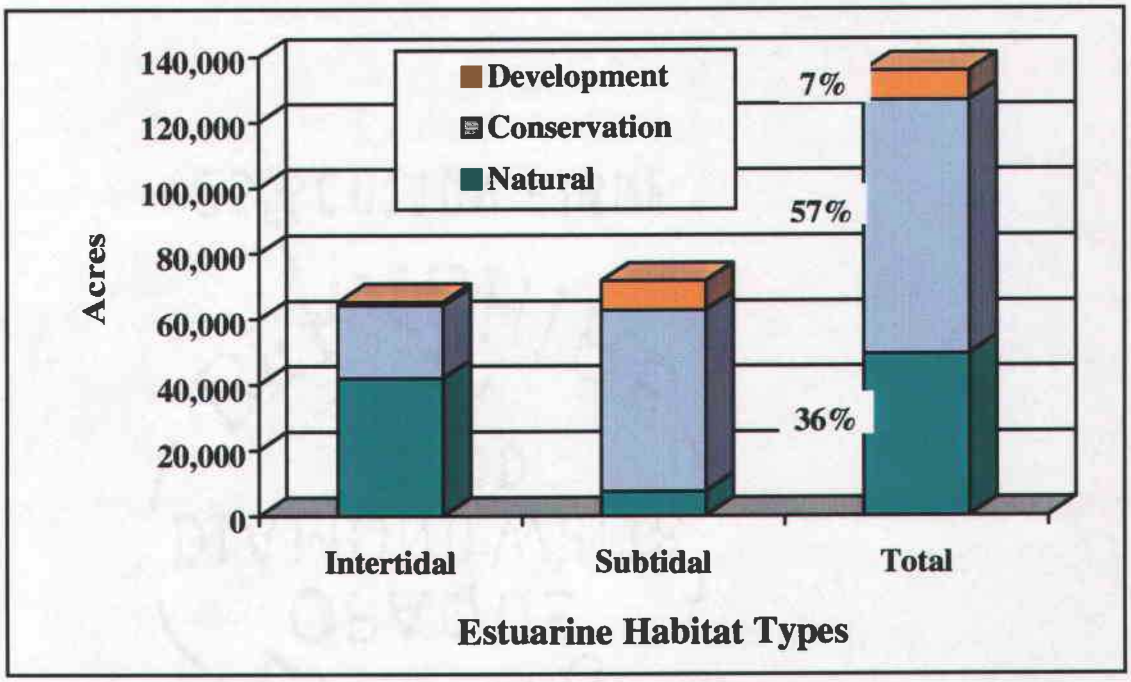

Figure 4-4. Management designations for Oregon estuary habitats.

Figure 4-5. Mudflats and other important habitats have generally received a high amount of protection through estuary planning.

Another success of Oregon's estuary planning process is that the overall program has survived relatively intact (Oswalt, personal communication 1998). Reviews and updates to local plans have generally been sufficient to address any issues that have arisen. An exception to this is the shoreland water dependent standards. These regulations are being reviewed now in part because they were so stringent in limiting development.

4.2 Comprehensive shoreland planning: Maryland's Critical Area Program

Summary
Another state–wide planning approach that is used to protect coastal wetlands and estuaries is the designation of areas of environmental concern or critical areas. Protection of Chesapeake Bay and future growth prospects were main factors behind the development of Maryland's Critical Area Program in the early 1980s. This comprehensive land use program is composed of local land use plans, developed according to state guidelines. Approximately 80% of the 640,000 acre Critical Area receives a high degree of resource protection through this land use program. Farming and timber land uses along the shore are also protected.

Background

Chesapeake Bay is the largest and most productive estuary in the United States. The Bay drains a 64,000 square mile watershed extending south from the Finger Lakes in New York. Intense and varied development around Chesapeake Bay includes metropolitan areas, industrial and commercial centers, shipyards, agriculture, and residential areas. About 4.7 million people live in the Maryland portion of the Bay watershed alone. Population growth has led to continued development pressure; a 16.5 percent increase in developed acreage accompanied a 7.5 percent population increase in Maryland from 1970 to 1980 (Critical Area Commission 1996). This development has impacted the health of Chesapeake Bay, as pollutants can remain in the Bay for an extended time due to the Bay's shallow, mostly enclosed form.

In 1975, the US Environmental Protection Agency (EPA) began investigating environmental problems in the Bay. In 1983, the EPA released the publication *Chesapeake Bay: A Framework for Action*, a report citing population growth, habitat degradation, and non–point source pollution as major impacts to Bay water quality. Habitat loss and decreasing water quality was blamed for declines in anadramous fish, crustaceans, wildlife, and waterfowl. That same year, the Governors of Maryland, Virginia, and Pennsylvania and the Mayor of the District of Columbia signed a landmark agreement to pursue measures to clean up Chesapeake Bay.

Development of the Maryland Critical Area Program

In 1983, a group of Maryland state agency directors and members of the Governor's Office began meeting to develop a program for Chesapeake Bay. The group recognized that urban areas such as Baltimore and Washington D.C. would continue to grow, and consequently any program would have to include a growth management element (Sullivan 1989). The group drafted a shoreland planning program in late 1983 as the centerpiece of Maryland's proposals to clean up and protect Chesapeake Bay (Sullivan 1989). The Maryland General Assembly adopted legislation enacting the program in 1984.

The legislation designated all lands within 1,000 feet of tidal water or from the landward edge of tidal wetlands (about 640,000 acres statewide) as a state "Critical Area." (Maryland Natural Resources Article §8-1807). This arbitrary line was a political compromise designed to balance protection of Chesapeake Bay with recognition of local autonomy (Sullivan 1989). A Critical Area Commission was charged with developing specific criteria to:

- minimize water quality impacts from non-point sources
- conserve fish and wildlife habitat

- establish Critical Area land use policies to accommodate growth and address the fact that growth causes adverse environmental impacts even if pollution control measures are taken (Maryland Natural Resources Article §8-1808).

The purpose of this program not to create a state "super-zoning" agency. Rather, local governments (16 counties and 44 municipalities) with jurisdiction in the Critical Area were required to develop and implement local plans following standards designed by the Critical Area Commission. The Commission was responsible for review and approval of local plans. The Commission also retained authority to appeal local decisions if the Commission felt a decision was inconsistent with a local plan, and to review state agency projects in the Critical Area.

The Critical Area Program criteria

The Maryland General Assembly required the Critical Area Commission to develop criteria to identify issues that local plans would address. The Commission examined many aspects of Critical Area development, resource extraction, and preservation to develop these criteria. After a series of public hearings, the Commission presented a draft of the criteria to the General Assembly in late 1985. On the last day of the 1986 Assembly Session, the criteria were approved.

These criteria address three main concerns: future growth and development; sensitive utilization of natural resources; and preservation of certain resources (COMAR §27.01 et seq.) Local Critical Area plans, mostly through local zoning and subdivision ordinances

(Serey, personal communication 1998), specify how Critical Area Program criteria will be met. If development occurs within the Critical Area, it must be in accord with the local plan.

The entire Critical Area contains habitat protection requirements. The most important is a 100-foot buffer landward of mean high water (MHW), tidal wetlands, and freshwater tributaries within the Critical Area. Only water–dependent development is allowed in this buffer area (COMAR §27.01.09.01). This buffer is intended to filter sediments, nutrients, and pollutants from entering Chesapeake Bay and to maintain transitional habitat between aquatic and upland communities (DEPRM 1996). Agricultural activities (not including vegetation clearing) are permitted in this buffer if a twenty-five foot vegetated area is maintained between the activity and MHW (figure 4-6). Selective timber harvest is allowed to within 50 feet of MHW if a buffer management plan is approved by the Maryland Forestry Program. In urban areas, where the 100 foot buffer would not provide desired functions, Buffer Management Areas with alternative protective measures are mapped. Nontidal wetlands originally had a twenty-five foot buffer, but this requirement has been removed with the enactment of the Maryland Nontidal Wetlands Protection Act.

Local Critical Area plans address additional habitat protection issues including threatened and endangered species habitat, water-bird nesting sites, interior forest bird habitats, Natural Heritage Areas, and anadramous fish habitat. Local plans must include maps of these habitat areas as well as agricultural lands, wetlands, forest resources, and land classifications.

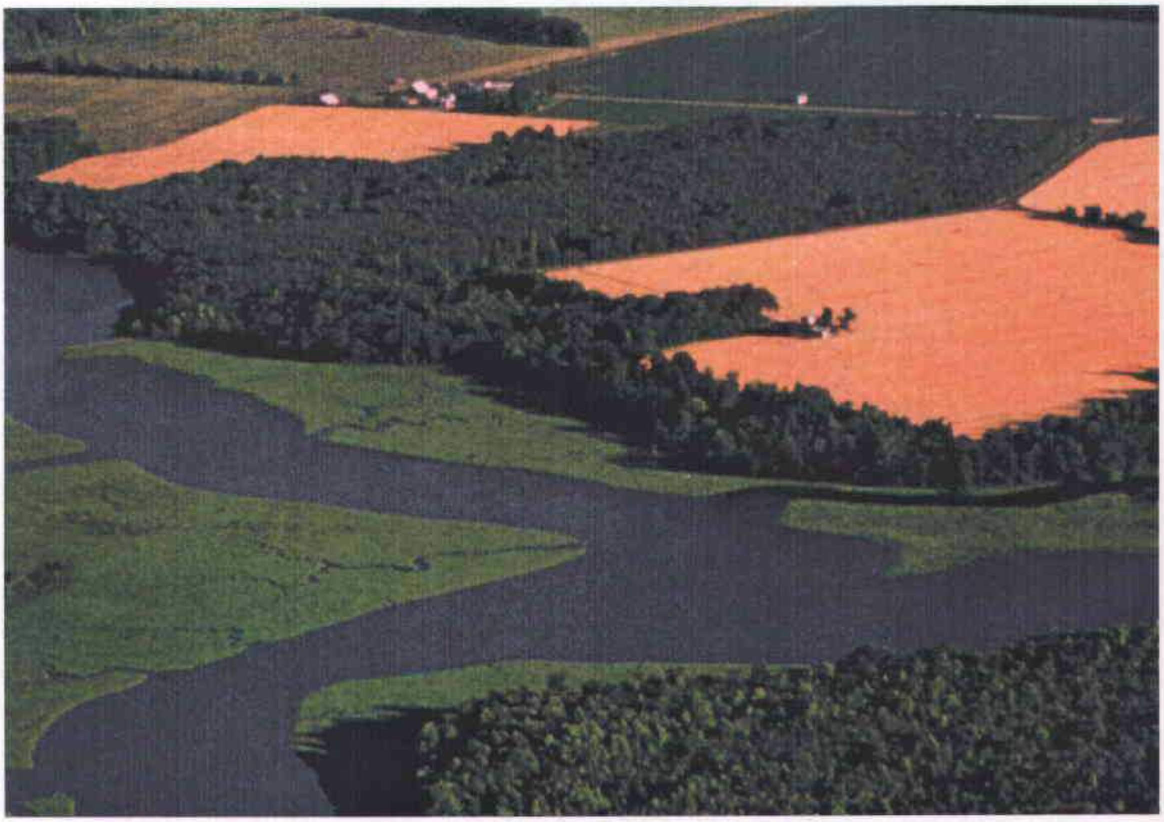

Figure 4-6. Agricultural activity is allowed in the Critical Area with a minimum 25 foot vegetated buffer between the activity and MHW (photo courtesy of Ren Serey, MD Critical Area Program).

Since land in the Critical Area varies in intensity and type of development, land within the Critical Area is classified as either Intensely Developed Areas, Limited Development Areas, or Resource Conservation Areas. Local governments classify land within their jurisdiction when developing local plans. Original land classifications were based on maps of land uses as of December 1, 1985. Each land classification has its own set of rules governing new development.

Areas that had residential housing densities of four dwellings per acre or higher were classified as Intensely Developed Areas (IDAs). IDAs are thus areas where residential, industrial, or commercial development predominates. New development in an IDA must be accompanied by best management practices (BMPs) reducing water quality impacts from stormwater runoff (Kumble *et al.* 1993a). BMPs must sufficiently reduce pollutant loads to at least 10% below the pollutant load from the same site prior to development, based on phosphorus measurements (Kumble *et al.* 1993b). Critical Area Program regulations do not specify how this 10% reduction is achieved. If BMPs are not sufficient to achieve the 10% reduction level, off-site mitigation can occur in the same watershed (Kumble *et al.* 1993b). Figure 4-7 is a generalized illustration of an IDA.

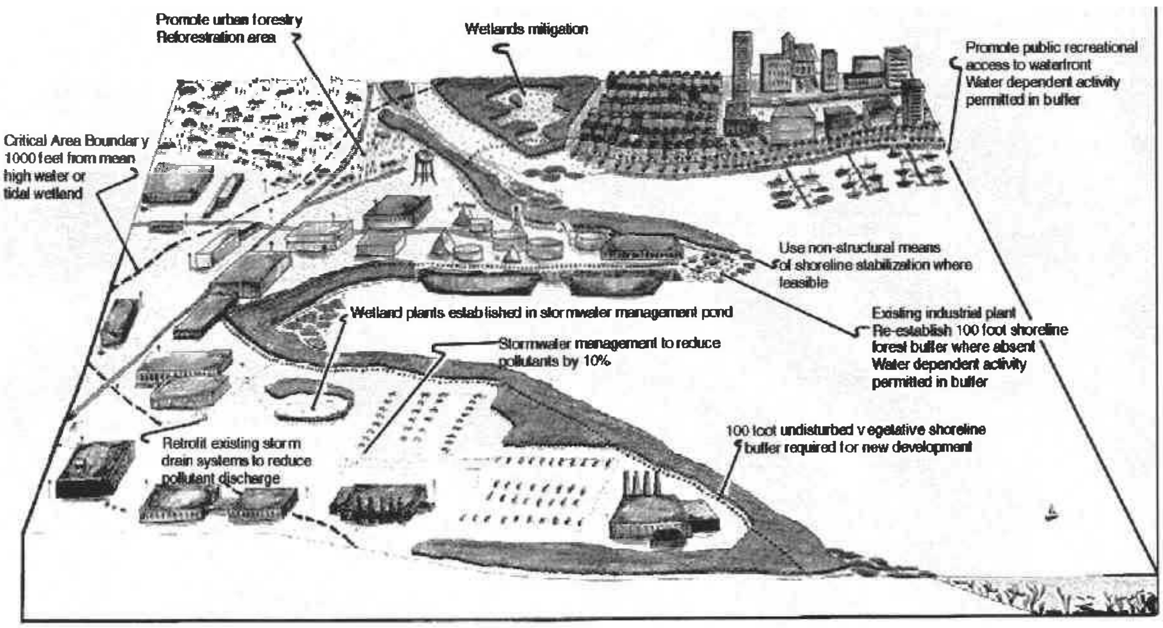

Figure 4-7. Idealized IDA. Residential, commercial, and industrial uses are predominant (source: Critical Area Commission 1993).

Areas with housing densities from one dwelling unit per five acres to four dwelling units per acre, and that were not dominated by agriculture, wetland, or open space, were classified as Limited Development Areas (LDAs). Areas with IDA characteristics but smaller than 20 acres are also classified as LDA. Impervious surfaces are limited to 15-25% of a land parcel (Critical Area Commission 1993). New development can not change the prevailing character of the area and must not reduce total forest acreage on any land parcel. Slopes greater than 15% cannot be disturbed unless there is no other way to maintain or improve the stability of the slope (COMAR §27.01.02.04 6[b]). Figure 4-8 illustrates a general LDA area.

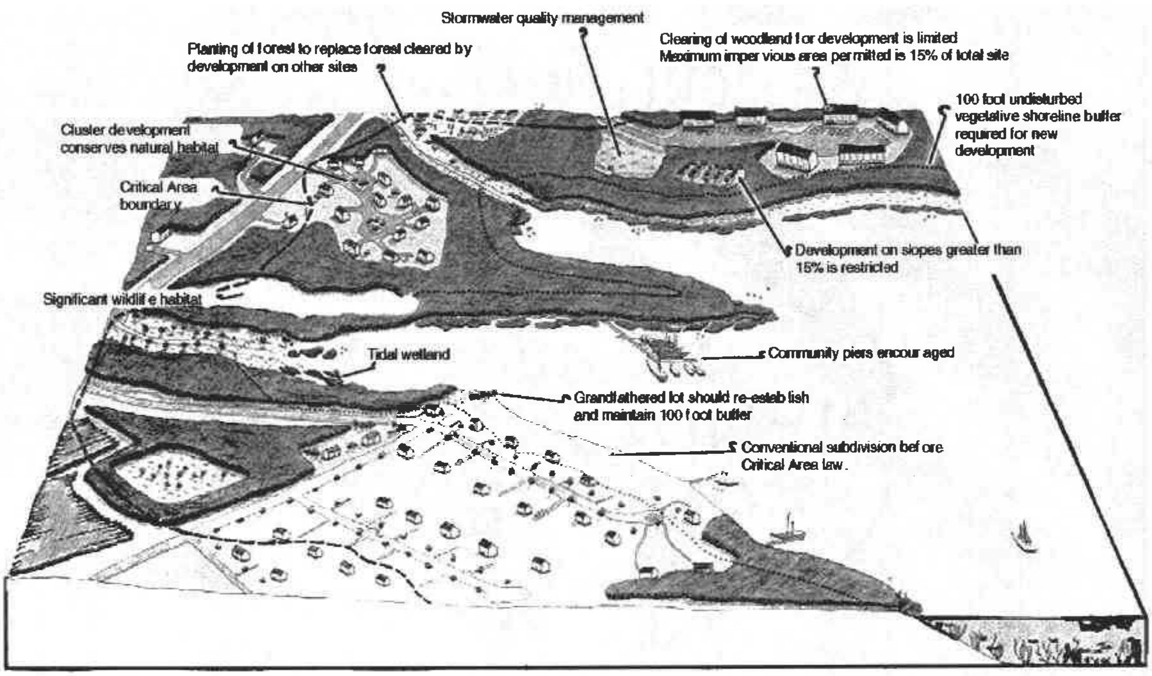

Figure 4-8. Idealized LDA. Management focuses on conserving the natural and cultural landscape (source: Critical Area Commission 1993).

Development requirements in LDAs also apply to Resource Conservation Areas (RCAs). RCAs are characterized by natural environments (wetlands, forests) and resource utilization activities (agriculture, forestry, or fisheries) and were mapped to include areas with housing densities less than one dwelling per five acres (COMAR 27.01.02.05). New development is limited to one dwelling unit per 20 acres. Figure 4-9 is a general illustration of an RCA. New commercial and industrial facilities are not allowed in RCAs unless a process called "growth allocation" is used.

Growth allocation reflects the Commission's recognition that growth is inevitable (Critical

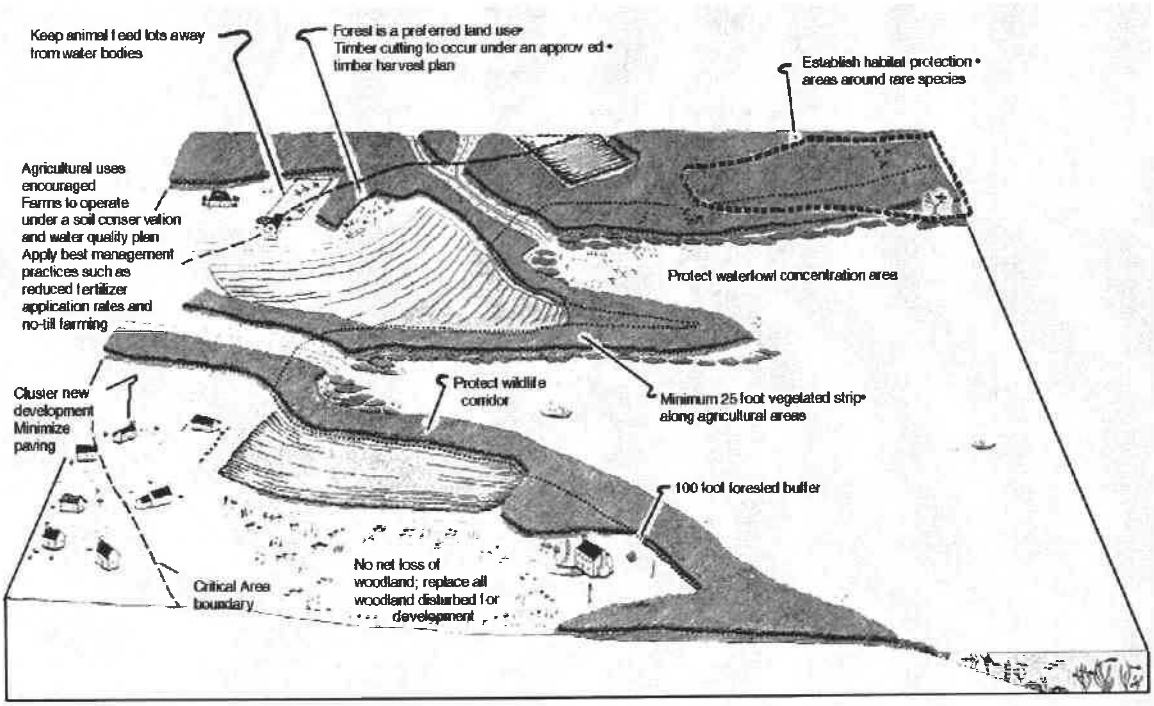

Figure 4-9. Idealized RCA; the natural environment predominates (source: Critical Area Commission 1993).

Area Commission 1993). To accommodate future growth and allow flexibility in siting development, IDA and LDA area may be expanded within a local jurisdiction. The area expanded may not exceed 5% of the county's land area classified as RCA.

Critical Area criteria also include requirements for agricultural and forestry activities. Before cutting in the Critical Area, a timber harvest plan must be approved by the Maryland Forestry program. Harvests more than 5,000 square feet require a sediment control plan. Farms require a soil conservation and water quality plan developed by farmers and Soil Conservation Districts.

Critical Area guidelines grandfathered certain land uses not compatible with Critical Area rules. Land uses existing as of December 1, 1985, were allowed to continue within the Critical Area, with expansion of these uses subject to local government approval (Critical Area Commission 1993). Any undeveloped lot subdivided prior to December 1, 1985, could have a single family residential home added, provided that construction complied with the local Critical Area plan.

Implementation of the Critical Area Program

After 1986 passage of the Critical Area criteria, local governments and the Critical Area Commission worked to develop local plans. While local plans had flexibility provided they met Critical Area Program criteria, difficult questions arose. For example, it was not clear how the 100 foot buffer applied to urban areas (Farr, personal communication 1998). Baltimore developed a Buffer Management Plan to resolve this issue. Local governments also had issues with downzoning of property and impervious area restrictions within the larger land use issue of state vs. local control (Ziegler, personal communication 1998). By 1990, all local plans had been approved. Since 1990, the Commission has focused on fine-tuning and streamlining local plans during periodic reviews. These reviews are statutorily supposed to occur every four years, but it has taken eight years to review all county and most town plans (Serey, personal communication 1998).

In 1987, the Critical Area Program was incorporated into the federally–approved Maryland Coastal Zone Management Program. As a result, federal consistency requirements became applicable. This generally meant that federal permitting actions had to be consistent with Critical Area criteria.

Sixteen people staff the Critical Area Program, funded by $850,000 annually from the Maryland General Fund for salaries, publications, and office operations (Serey, personal communication 1998). These funds are also used for three positions in the Maryland Office of Planning Assistance who work with about 25 cities and towns on Critical Area Program activities. Since 1990 about $750,000 annually in federal coastal management funds have been passed through to local jurisdictions for implementing local programs (Serey, personal communication 1998).

The Critical Area Program has been revised as needed. In 1993, nontidal wetland guidelines were replaced by the Maryland Department of the Environment (MDE) nontidal wetlands regulatory program. This change was widely supported since many local governments lacked staff to enforce wetland regulations (Serey, personal communication 1998). In 1996, the Maryland General Assembly adopted regulations allowing harvest in buffer areas coinciding with habitat protection areas, as long as the fifty foot setback was maintained for tidal waters and tidal wetlands and there were no adverse impacts.

The Commission's responsibility for reviewing state agency projects is a time-consuming task. Coordination with MDE on tidal wetlands issues is also common as Commission and MDE staff meet several times a month and go on site visits to review development proposals. Commission staff have also been working with local jurisdictions on the growth allocation process.

Success of the Critical Area Program

Table 4-4 summarizes Critical Area land in IDA, LDA, and RCA categories. About 80% of the 640,000 acre Critical Area is designated as RCA. Intensive development is allowed in only 5% (32,000 acres) of the Critical Area, with over 58% of this total in metropolitan area around Baltimore and the upper western shore. While permit data could provide more information regarding development and its impact within the Critical Area, such data is not available. All the same, table 4-4 data is evidence of the Critical Area Program's focus on resource protection.

Several factors seem to be crucial to the Critical Area Program's success. At the program's inception, the 1983 EPA report, public concern over the health of Chesapeake Bay and political support from the Governor were keys to developing the Critical Area

Region	Acres in IDA/ percent of total*	Acres in LDA/ percent of total*	Acres in RCA/ percent of total*
Upper Western Shore (includes Anne Arundel, Baltimore, and Harford Counties and City of Baltimore)	17,499/19	30,023/34	40,251/47
Lower Western Shore (includes Calvert, Charles, Prince George's, and St. Mary's Counties)	5,109/4	15,768/14	95,173/82
Upper Eastern Shore (includes Carolina, Cecil, Kent, and Queen Anne's Counties)	3,094/3	21,634/18	97,243/79
Lower Eastern Shore (includes Dorchester. Somerset, Talbot, Wicomico, and Worcester Counties)	3,963/1	28,410/9	282,598/90
TOTALS	**29,665/5**	**95,835/15**	**515,265/80**

*at time of data collection, eight plans had not received final approval and area estimates are used.

Table 4-4. Acreage in Critical Area categories (data from Sullivan 1988).

Program (figure 4-10). Using performance standards gave local governments necessary flexibility in plan development, a process that also benefited from sufficient funding from the Maryland General Assembly. Relying on the expertise of state and federal agencies, interest groups, and others, local jurisdictions compiled existing information and minimized the amount of new work necessary to develop local plans.

Since local plans have been in place, the flexibility in the performance standards and public support for cleaning up Chesapeake Bay have remained important factors behind the acceptance of the Critical Area Program. The performance standards are specific enough

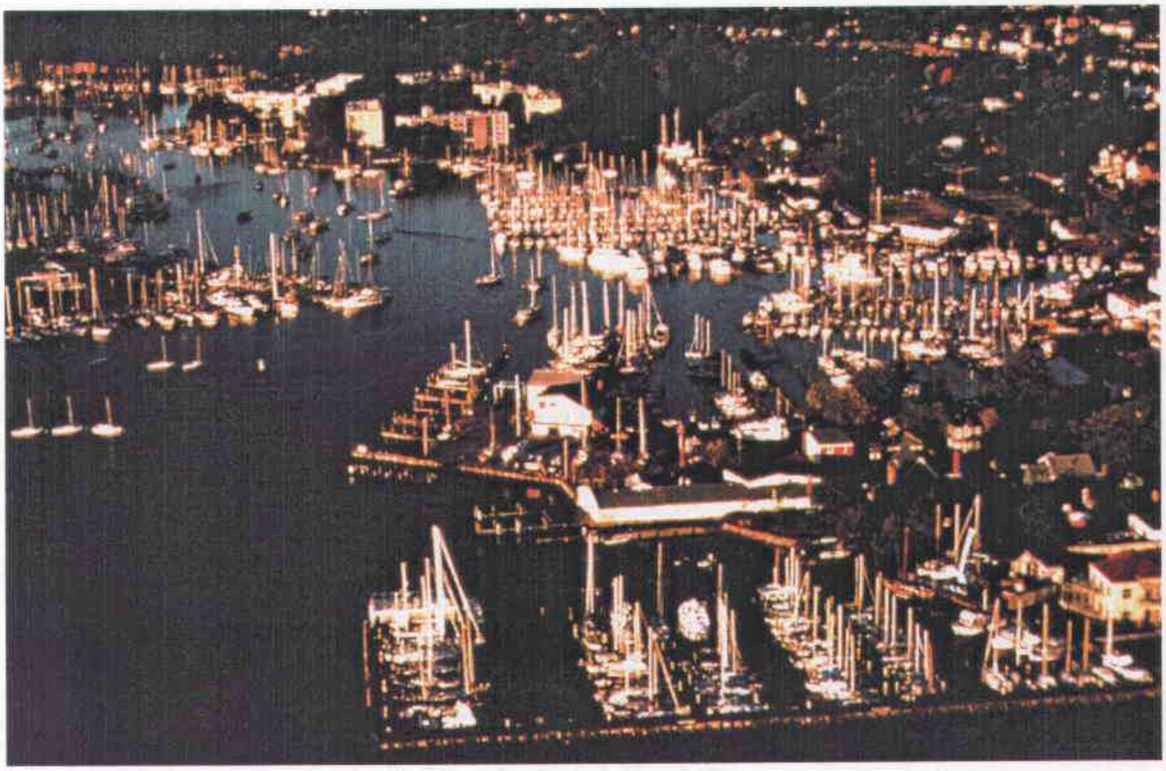

Figure 4-10. Recreational use of Chesapeake Bay is only one of the reasons people are concerned with its health (photo courtesy of Ren Serey, MD Critical Area Commission).

that developers have a sense of predictability during the development review process (Serey, personal communication 1998). Including components such as retention of forest cover and the impervious surface requirements has also been valuable. For example, residential development was resulting in the annual loss of 17 acres of forestland in Calvert County; the Critical Area Program has reversed this trend (Brownlee, personal communication 1998).

Much of the future success for this program hinges on the relationship between Commission staff and local governments. The Critical Area Program staff would like to become more of a technical advisor to its local partners (Serey, personal communication 1998). Since the Critical Area Program is implemented at the local level, it's very important for the Commission and its staff to support local jurisdictions and serve in such an advisory role.

4.3 A Connecticut–Rhode Island Interstate Management Plan for the Pawcatuck River and Little Narragansett Bay

Summary

Special area management planning is a tool that can be used to resolve intense resource or multi–user conflicts. Concerns with water quality and other impacts to the Pawcatuck River and Little Narragansett Bay estuary led to the 1992 development of an Interstate Management Plan by the Connecticut and Rhode Island coastal programs. This plan recommends estuary management activities at the state level and for the municipalities of Westerly and Stonington. A key outcome of the plan development process has been the increased communication between Connecticut and Rhode Island agencies.

Issue

The Pawcatuck River and Little Narragansett Bay form the border of Connecticut and Rhode Island (figure 4-11) and drain mostly rural uplands and small, lightly developed

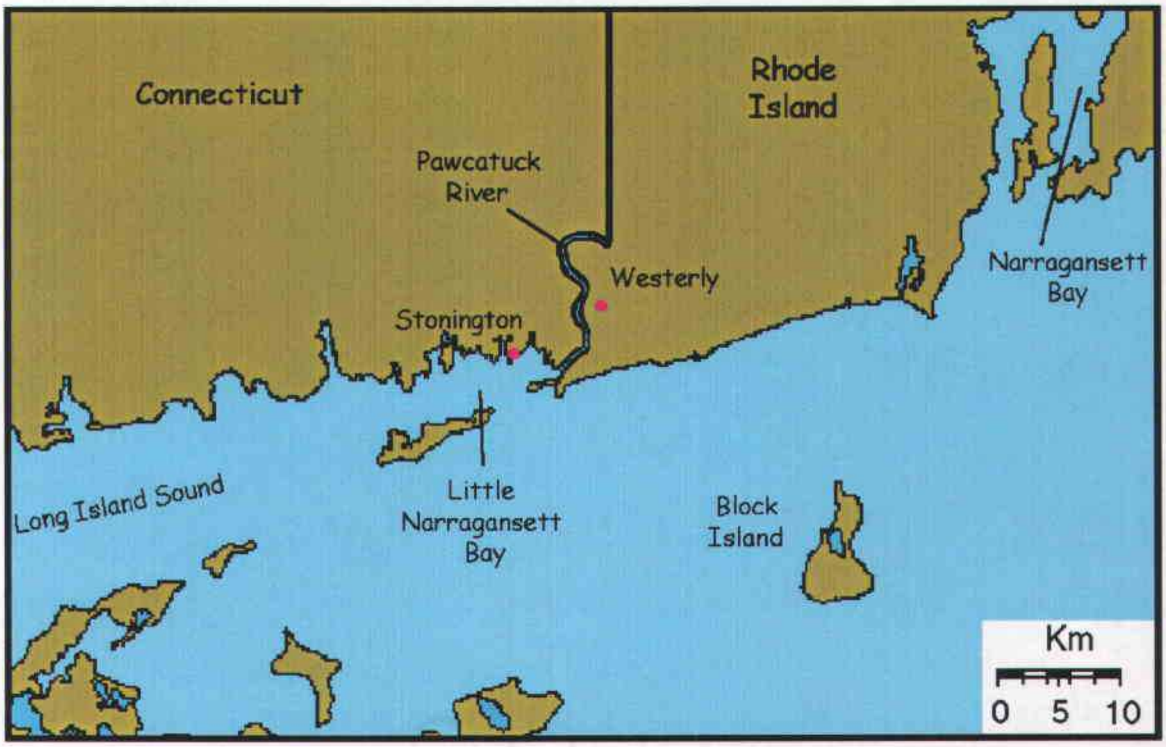

Figure 4-11. The Pawcatuck River separates Connecticut and Rhode Island.

towns. The Pawcatuck River's watershed is 486 km^2, a third of Rhode Island (Dillingham *et al.* 1992). Development is most intense in Stonington, Connecticut and Westerly, Rhode Island (figure 4-12), and generally decreases down river. The estuary is an important recreation resource, with 60,000 boaters using it each summer (Dillingham *et al.* 1992). Water quality in the Pawcatuck River and Little Narragansett Bay is consistent with state and federal regulations, except for fecal coliforms. Fecal coliform levels have exceeded shellfish harvesting criteria since the late 1940s, leading to prohibitions on shellfish harvesting (Dillingham *et al.* 1992). Potential fecal coliform sources include septic tanks (figure 4-13), storm drains, boats, and two sewage treatment plants.

A regional surge in development in the 1980s raised additional concerns for the health of

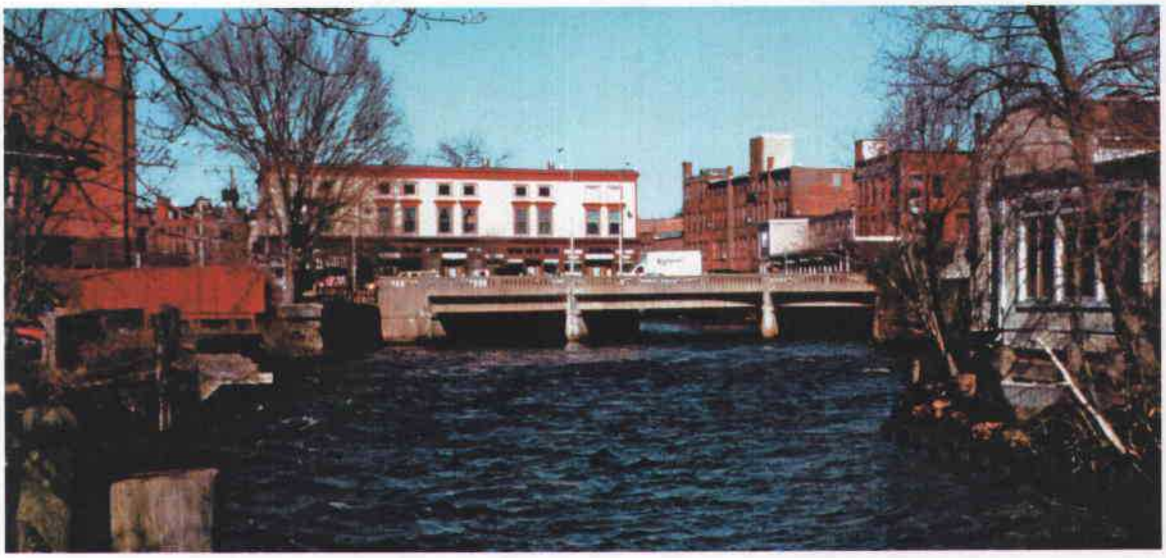

Figure 4-12. The town of Westerly is built on a tributary of the Pawcatuck River (photo courtesy of Alain Desbonnet, Rhode Island Coastal Resources Center).

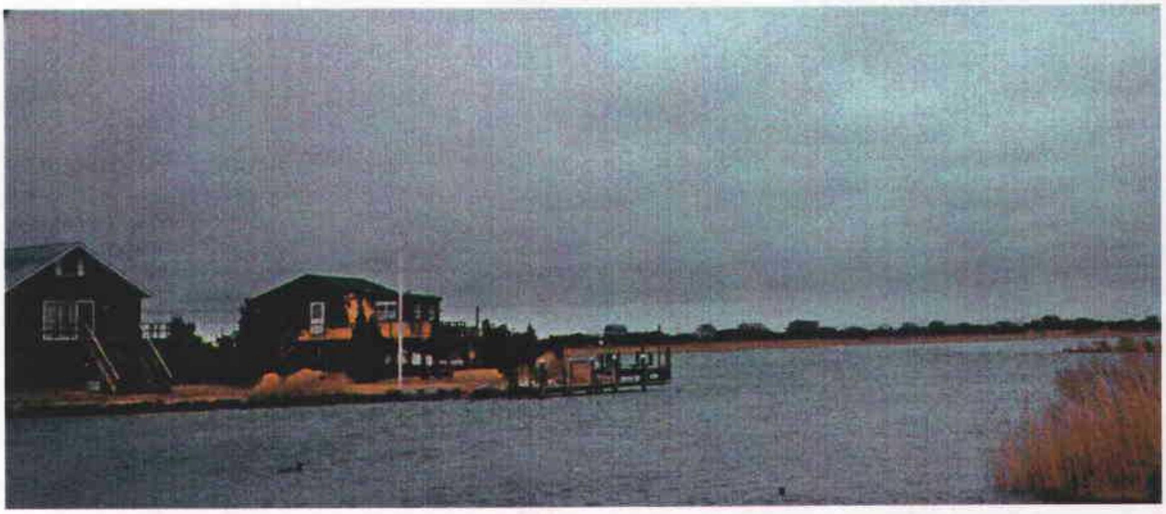

Figure 4-13. Residential dwelling septic tanks from may be a source of fecal coliforms to the Little Narragansett Bay/Pawcatuck River estuary (photo courtesy of Alain Desbonnet, Rhode Island Coastal Resources Center).

the river/estuary system. In addition, questions about communication between the two states arose, in particular after 1987 when a marina on the Connecticut side was allowed to dredge at the same time as Rhode Island was working to restore anadramous fish runs (Hart, personal communication 1998). In 1989 discussions were held to address these concerns, leading to a joint Rhode Island–Connecticut project to develop a special area management plan for the estuary.

Development of the Interstate Management Plan

The plan development process was based on three main goals (Dillingham *et al.* 1992):

1) Evaluate the current uses and status of estuary resources to encourage a level and mix of use consistent with protection of the estuary's natural and cultural resources.

2) Facilitate and establish consistent goals and policies for Rhode Island, Connecticut, Westerly, and Stonington to guide future development in and adjacent to the estuary.

3) Develop coordinating mechanisms for implementing goals and policies through joint-agency development review.

Underlying these goals was the need to improve communication between the states. Both the Rhode Island and Connecticut coastal programs provided staff support and helped facilitate plan development. A Citizen's Advisory Committee (CAC) was appointed to develop the special area plan. The CAC had members from Westerly and Stonington, including private citizens, town planners, a marina representative, and a representative from the local watershed association.

With public input, the CAC identified six broad issues for the plan to address: water quality; habitat protection; restoration; recreational uses; public access, open space and protection of scenic value (figure 4-14); and coordination of resource management programs (Dillingham *et al.* 1992). State agency staff produced a series of technical reports describing the region in terms of these issues. Using these reports, the CAC developed the goals, policies, and management strategies that make up the Interstate Management Plan for the Pawcatuck River estuary and Little Narragansett Bay.

Figure 4-14. Protection of open space and scenic value was identified as a key issue for the plan to address (photo courtesy of Alain Desbonnet, Rhode Island Coastal Resources Center).

The Interstate Management Plan structure and content

The Interstate Management Plan (Plan) contains a series of broad policy goals developed for each issue (table 4-5). The Plan also contains chapters with further detail on each of the issues, including findings, the status of each issue, and recommendations for management regulations and initiatives. For example, the water quality chapter discusses natural features and land uses affecting water quality and includes recommendations to address these issues. Suggested water quality regulations and initiatives also include: watershed controls for surface water runoff; regional wastewater management; controls for managing recreational boat sewage; a marina non-point source pollution management program; interstate

Issue area	Goal(s)
♦ Water quality	Protect existing water quality, prevent its degradation, and work to remediate existing pollution sources to improve water quality.
♦ Habitat protection and restoration	1. Protect and where possible restore aquatic and shoreline areas of significant value: shellfish areas; anadramous fish pathways, spawning, and nursery areas; and migratory bird resting areas. 2. Ensure state and municipal policies and regulations protect habitats and resources from in-water, shoreline, or inland impacts. 3. Coordinate state and municipal policies and regulations to provide maximum resource and habitat protection.
♦ Recreational uses	1. Maintain a balance among coexisting, diverse estuary activities and uses such as open space, wildlife areas, and small boat sailing and fishing. Accommodate traditional activities and development of new water dependent uses while maintaining the preservation of the estuary. 2. Ensure marina development occurs in appropriate areas; implement innovative solutions to demands for moorage and dockage. 3. Ensure marina development does not exceed water quality standards and the capacity of shoreline support facilities or degrade scenic beauty.
Public access, open space, and scenic value	1. Expand physical and visual access to the estuary. 2. Retain visual diversity and quality of water areas and the shoreline.
♦ Coordination of management programs	1. Integrate land use policies. 2. Evaluate state and local programs; establish consistent policies and regulations on allowable uses, evaluation procedures, and in-water restrictions. 3. Provide a complete and accurate information base for use in management decisions.

Table 4-5. Plan goals developed by the CAC for each issue area (from Dillingham *et al.* 1992).

coordination on discharge regulation and water quality management; and controls on freshwater withdrawal (Dillingham *et al.* 1992). Similar formats are used for the chapters dealing with the other four issues.

The Interstate Plan culminates in a recommended Plan of Use that includes specific recommended uses for delineated reaches of the estuary. The Plan of Use also provides area-specific land designation recommendations, including marine commercial development zones, conservation areas, and low intensity use areas. Like the rest of the Interstate Management Plan, the Plan of Use is a set of recommendations only.

Application of the Interstate Management Plan

It may be too soon to fully evaluate the Interstate Management Plan's on-the-ground impacts. Since the Interstate Management Plan contains only recommendations, additional action is required for many of these recommendations to become regulations. Rhode Island coastal program staff are currently drafting the Plan of Use into a regulatory document for approval by the Rhode Island Coastal Resources Management Council (Council) (Willis, personal communication 1998). After public review, the Council will presumably take action on the regulatory document. If adopted, the Plan of Use would be added to Rhode Island's coastal program regulations. Westerly would then have to ensure that its ordinances were consistent with the Plan of Use. Westerly's current activities are already generally consistent with the Plan of Use and the Interstate Management Plan (Willis, personal communication 1998).

There have been other changes to the Rhode Island coastal program due to the development of the Interstate Management Plan. Discussion of marinas led to the development of a "Marina Perimeter Program" in Rhode Island where maintenance work on marinas can occur without a Rhode Island coastal program permit within a designated area around the marina (Willis, personal communication 1998). Marina expansion, an issue that raised concern among some local Pawcatuck River–area residents, remains under state authority. The planning process also helped clear up misconceptions about what was allowed in marina expansion and may have helped reduce conflicts regarding marinas (Desbonnet, personal communication 1998). Marinas in Westerly were also made aware of their eligibility to dispose of dredge material in in-water disposal sites in Connecticut (Hart, personal communication 1998). This was important since Rhode Island lacked in-water disposal sites and upland disposal was difficult.

On the Connecticut side of the estuary, the Plan has been used as a reference for the development of the Stonington Harbor Management Plan (Wagner, personal communication 1998). Plan guidelines are being followed in the development of a land use plan for a 30 acre property in Stonington designated for open space (Hart, personal communication 1998).

Fecal coliform issues remain unresolved. The Plan development process included funding for studies attempting to identify the source of fecal coliform in the estuary. These studies failed to pinpoint the source, however. The Rhode Island coastal program also funded studies examining dissolved oxygen patterns in the Pawcatuck River that showed that freshwater input from the Pawcatuck was the main factor behind dissolved oxygen levels in the estuary. These studies were important for educating local citizens about the estuary even if they did not resolve all water quality issues (Wagner, personal communication 1998).

For both state agencies, perhaps the most important result of the planning process has been increased communication and coordination. There is now a notification system whereby both states are notified of activities or proposed projects affecting the estuary (Desbonnet, personal communication 1998). The planning process resulted in increased consistency between the two state agencies, particularly important since there is no bi-state commission or similar entity (Hart, personal communication 1998). The Interstate Plan also is a useful reference document for both states, containing data on estuary recreational uses, description of impacts, and other information that sets a baseline for future projects.

The planning process and approach used in the development of the Interstate Management Plan could be readily adapted for use elsewhere. Although such an intense planning project is time–consuming, it may result in various intangible benefits such as increased public education and agency planning. These planning efforts also may lay the groundwork for future projects.

5.0 Nonregulatory programs

The CZME Study found that education and outreach in the nonregulatory tool category was one of the ten most important tools used for coastal wetland and estuary protection. However, another tool in the nonregulatory category, restoration, was surprisingly underused (Good *et al.* 1997). Every state has degraded wetlands that are potential restoration possibilities. Many state programs also use acquisition in some form, but its costs probable limit its widespread utility.

Despite these drawbacks, there are some impressive nonregulatory programs with different approaches. There are many ways to implement these programs. For example, the *California State Coastal Conservancy* is an entire state agency devoted to this type of work. The Coastal Conservancy was legislated in the early 1970s to provide a nonregulatory approach to resource conservation in California. Its mandates direct it to be a participant in and provide funding for restoration, acquisition, conflict resolution, and other activities. This example is a centralized, programmatic approach to nonregulatory activities. Another approach is taken with *wetland restoration in Connecticut.* The Connecticut coastal program has restored tidal wetlands through a mostly passive, opportunistic approach: taking advantage of multiple funding sources to restore tidal flow and remove dikes. *Delaware wetland restoration* has multiple components, from a plan to restore an urban wetland corridor to the application of open marsh water management. In contrast to the case in Connecticut, Delaware wetland restoration activities often have multiple management objectives, such as mosquito control, habitat, and others. In a similar fashion, *Washington's education and outreach program* has various objectives, aiming publications at different target audiences as warranted.

Outcome data such as wetland area restored and acquired can be used to gauge the effectiveness of a state's nonregulatory wetland and estuary protection program. However, it is nearly impossible to directly link on–the–ground outcomes to many nonregulatory programs—such as public education and outreach and conflict resolution. Perhaps this fact is the unfortunate reason why these types of programs are often the first victims of budget cuts. However, this does not diminish the importance of these programs.

5.1 A nonregulatory resource agency: the California State Coastal Conservancy

Summary

The model program for estuary and coastal wetland protection (figure 1-1) recognizes the importance of nonregulatory programs. Particularly with concerns about property rights issues, nonregulatory efforts at resource protection may be more important in the future. For example, in 1976 when the California Legislature adopted the California Coastal Program, they recognized that regulation alone was insufficient to resolve all of the coast's resource issues. The California State Coastal Conservancy was formed to provide a nonregulatory response to resource conflicts. This state agency is involved with mediation and conflict resolution, and also has wide latitude to perform projects such as wetland restoration and acquisition. Often working in partnership with nonprofit organizations and other public/private entities, the California State Coastal Conservancy has been involved in hundreds of projects totaling over 37,000 acres. The agency's conflict resolution activities, while difficult to quantify, are equally as important.

Background

The 1,100 mile long California coast is a national treasure, extending from northern redwood forests to southern palm trees. With metropolitan areas such as San Francisco and Los Angeles and numerous smaller cities, California coastal counties contain over 17 million people (SCC 1992). With this population comes the potential for impacts to valued resources, as in 1969 when an oil spill off Santa Barbara led to oiling of beaches and loss of fish and wildlife.

These factors helped fuel public concern with coastal resource degradation and Proposition 20 in 1972, a statewide referendum creating a California Coastal Commission to prepare a coastal resource protection plan. The 1976 Coastal Act enacted this plan and designated the Coastal Commission as the primary implementing agency. This program's cornerstone is local government regulation of development following the adoption of Local Coastal Plans (LCPs).

This program resulted in a broad new set of regulations for coastal development. Given the sheer size and varying issues along the California coast, however, it was clear that a regulatory program alone would not provide adequate results. At the same time, the Coastal Act and LCPs contained the potential for negative effect on landowners. As a result, in 1976 the California Legislature created a nonregulatory agency—the California State Coastal Conservancy (SCC)—to complement state regulatory efforts in the coastal zone.

The State Coastal Conservancy's mandate

The Legislature gave the SCC responsibility for resolving land use conflicts; developing enhancement and restoration projects for coastal wetlands, estuaries, dunes, beaches, and other valued coastal resources; facilitating environmentally sound development; and providing public access (SCC 1992). Initial SCC funding was provided through $10 million from general obligation bonds approved by California voters in 1976. Subsequent funding for SCC staff has been mainly from bonds with very little funding from the California State General Fund. The Legislature also set up a seven–member board of directors, including three agency representatives and four public members, to guide the SCC. Legislative oversight is from six members of the Legislature as ex-officio SCC board members.

The Legislature gave the SCC certain capabilities resulting in broad flexibility for the SCC to resolve resource issues. The SCC has substantial leveraging authority, allowing the agency to maximize the use of other funds (SCC 1986). The SCC generally takes an active role in resolving coastal resource issues, seeking and responding quickly to opportunities to implement a broad range of projects. The SCC provides technical assistance and serves as consultants to seek environmentally sound solutions to potential conflicts such as flood control and riparian habitat, or wetland protection and development siting (Denninger, personal communication 1998). SCC staff is also required to be receptive to original ideas and actively search for opportunities (SCC 1986 and Denninger, personal communication 1998). The agency seeks alternative solutions to resource conflicts.

The work of the SCC

The SCC has undertaken hundreds of projects along the California coast (figure 5-1). Projects start upon request from public agencies, local governments, community groups, or sometimes the Legislature; SCC staff also initiates many (SCC 1986). Many local planners, environmental groups, and city councilors turn to the SCC when a situation turns into a crisis (Denninger, personal communication 1998). Projects involving SCC mandates were historically undertaken as opportunities arose. Recent funding limitations have led to more rigorous prioritization of projects since not all can be funded. However, a more common limitation to project implementation is the pattern of land ownership in an area (Denninger, personal communication 1998). Private land owners are not always willing to sell their land or have a conservation easement placed on their property.

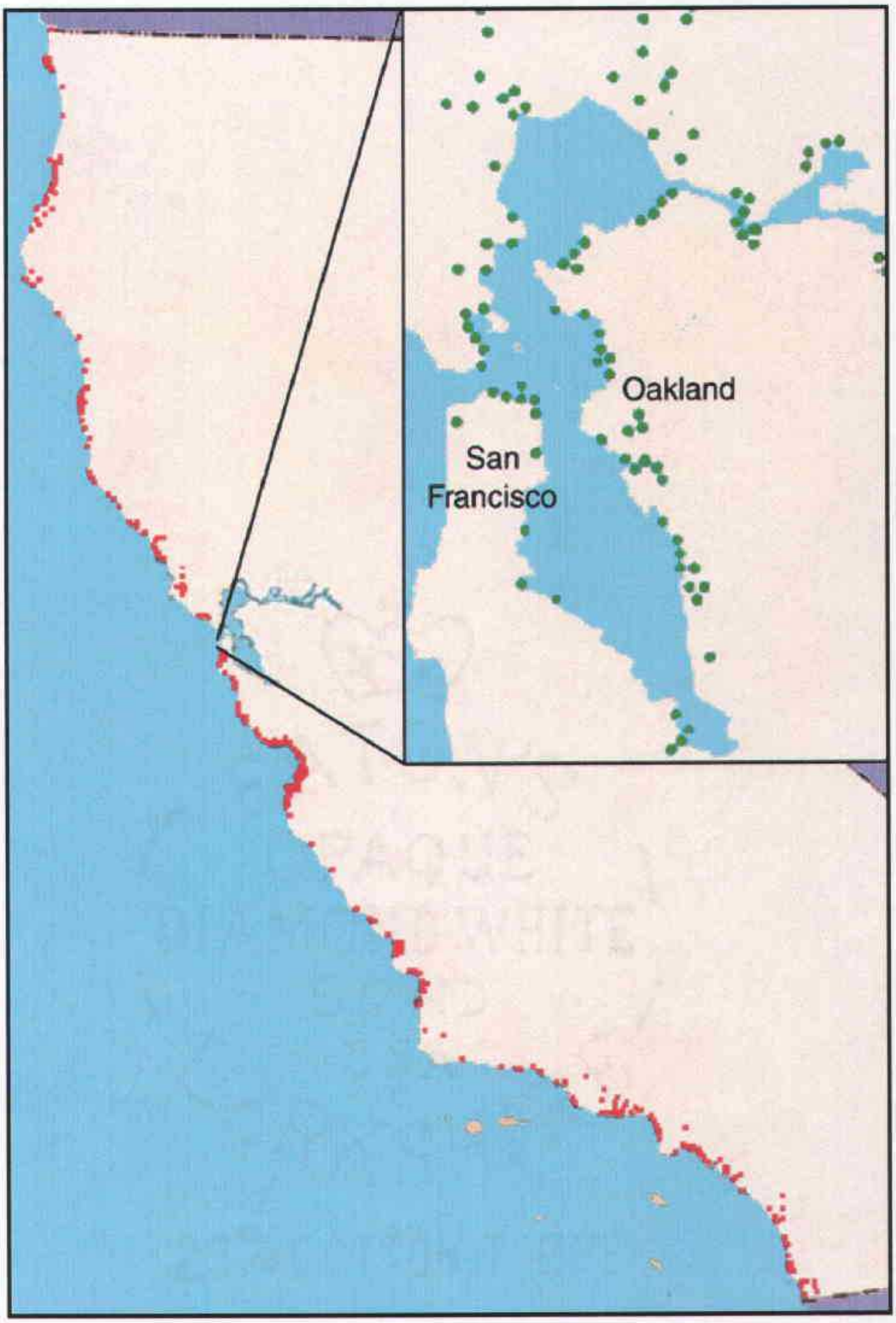

Figure 5-1. SCC projects have been carried out up and down the California coast (from SCC WWW site: http://www.coastalconservancy.ca.gov/pandp.htm).

Because the SCC is involved in cost-sharing for many of its projects, SCC relationships with other public agencies are important. The SCC works closely with the Coastal Commission, San Francisco Bay Conservation and Development Commission, US Army Corps of Engineers, and other agencies to ensure SCC proposals are approved (Denninger, personal communication 1998). As many SCC projects are situated in wetlands, on beaches, or other regulated areas, maintaining a healthy relationship with these agencies is a key to SCC success.

Following its legislative mandate, the SCC has done projects for public access, urban waterfront restoration, acquisition, planning and implementing coastal resource restoration and enhancement projects, and agricultural land preservation, and provided extensive assistance to nonprofit organizations. Limitations in bond usage and other budget reductions have diminished the recent scope of SCC activity; for example, the urban waterfront restoration program and the agricultural land preservation program have been discontinued. Projects with a particular wetland/estuary protection focus include natural resource conservation planning, nonprofit assistance, and non-regulatory restoration, enhancement, and acquisition.

SCC role in wetland/estuary restoration/enhancement and acquisition

The SCC has been involved in restoration and enhancement activities in at least 150 sites totaling 37,000 acres. Included in this total are 59 sites (21,400 acres) that the SCC has acquired and subsequently restored. These projects are non-regulatory, although the SCC also has been involved in 11 mitigation projects and two mitigation banks (Holderman, personal communication 1996). A study by Josselyn *et al.* (1993) indicated that 60% of a selected subsample of SCC wetland restoration projects were successful in either meeting project goals or National Research Council restoration criteria (NRC 1992).

The SCC often works with other agencies and nonprofit groups to leverage additional funds. In 1997 the SCC, US Army Corps of Engineers, and US Geological Survey funded a study that will lead to enhancement of 40,000 acres of the Napa–Sonoma Marsh near the Napa River (SCC WWW site: *http://www.coastalconservancy.ca.gov/new.htm*). The SCC contribution of $200,000 will help the $1.2 million study understand physical and biological marsh functions by studying water movement, salinity, and water quality in the Napa River, Sonoma Creek, and the marsh. Results of this study will help guide future restoration activities.

In an example of SCC acquisition activity, in 1988 the SCC gave the Solano County Farmlands and Open Space Foundation a grant toward the $1.4 million purchase of 2,070 acres of Suisun Marsh south of the city of Fairfield (SCC 1988). A portion of the grant was also dedicated to a plan for habitat restoration and public access for this large tidal marsh area. The SCC worked with representatives of Solano County, the California Department of Fish and Game, the San Francisco Bay Conservation and Development Commission, and the Suisun Resource Conservation District to develop this plan.

In most cases, the SCC does not retain ownership of land it acquires but transfers title to project partners. These partners can include public agencies as well as nonprofit groups such as the Nature Conservancy. Additionally, some acquisitions recover significant portions of SCC expenditures to allow reinvestment of this money in the future (SCC 1991). As a result, and by working with other agencies and interest groups, the SCC is able to maximize its acquisition capabilities.

SCC assistance to nonprofit organizations

In 1982, the SCC formally established one of the first major state programs for providing resource protection grants directly to nonprofit organizations. The goal is to enhance the skills of nonprofits (SCC 1991). The SCC sets up workshops and is available for consultation with developing nonprofits. The SCC also published the *Nonprofit Primer*, a "how-to" book for developing groups with pertinent legal information and suggestions for technical and financial assistance (SCC 1989). While their role as a nonprofit information clearinghouse, the SCC's work with nonprofits has been as important as their other activities.

Often, a nonprofit group is the project lead with SCC in a supportive role. Locally led projects often move more quickly and can be less expensive than projects led by a state agency (SCC 1988). Local commitment to a project is likely to increase its chance of getting started and ultimately succeeding. At the local level, nonprofit groups may be perceived more favorably than public agencies.

Because of these factors, the SCC takes an active role in funding on–the–ground projects through nonprofit organizations (SCC 1988). Between 1983 and 1996, the SCC provided

209 grants totaling $43 million to 87 nonprofit organizations. An example of such a project is the 1988 Suisun Marsh acquisition mentioned previously. Another example was the 1996 allocation of $118,000 to the nonprofit organization Heal the Bay for a volunteer pollution monitoring program in Malibu Lagoon (SCC WWW site: *http://www.coastalconservancy.ca.gov/new.htm*). This project's goal was to train volunteers to identify and map pollution sources and provide this information to agencies charged with reducing pollution of Santa Monica Bay.

SCC planning activities

SCC planning activities focus on project identification rather than general land use planning (Denninger, personal communication 1998). SCC planning efforts mostly involve understanding a watershed, identifying existing issues or problems, and then developing site-specific measures or projects to address these issues. Since 1982, the SCC has invested $19 million to assist in the development of 55 river, watershed, and other plans.

An example of this activity was the development and subsequent implementation of the Elkhorn Slough Wetland Management Plan in 1988 (figure 5-2). The SCC worked with a broad coalition of scientists, farmers, environmentalists, and other government representatives to develop a plan for public acquisition and enhancement of Slough wetlands (SCC 1991). As a result of this work, the SCC developed several large projects including the acquisition of a 343 acre ranch by the Nature Conservancy. The SCC gave the Nature Conservancy $2.2 million to help with this acquisition, which removed an area

Figure 5-2. Aerial view of Elkhorn Slough (photo courtesy of Mark Silberstein, Elkhorn Slough National Estuarine Research Reserve).

with highly erodible slopes from agricultural production (SCC 1991—see figure 5-3). A public trail was opened in this area once natural vegetation was restored. This project is a good example of how SCC planning activities result in the initiation and development of specific projects.

Successes of the SCC

The SCC has been involved in the acquisition, restoration, and enhancement of at least

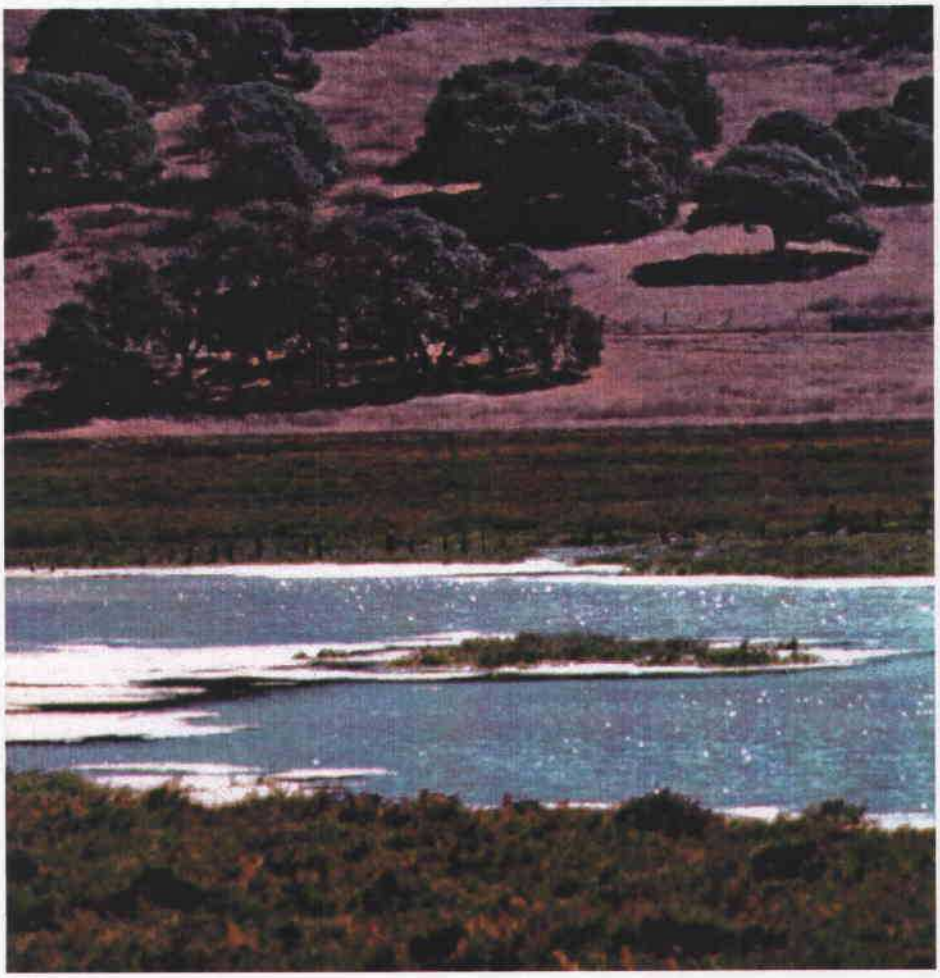

Figure 5-3. The acquisition of a large ranch helped remove an area of steep slopes from agricultural production (photo courtesy of Kenton Parker, Elkhorn Slough National Estuarine Research Reserve).

37,000 wetland and estuary acres. This number is significant on its own, but the SCC may be one example where measuring on–the–ground results is insufficient to describe an agency's success. The SCC's role in conflict resolution and enabling the success of nonprofit groups has likely been just as important as other SCC activities, although in a less tangible way, to the protection of California coastal wetlands and estuaries and other resources.

The SCC spends a lot of time helping to resolve conflicts with regulations and essentially helps dissipate opposition to these regulations. Because of the often conflict-ridden nature of wetland regulation, this aspect of the SCC is especially valuable. More importantly, these activities should be emulated elsewhere. It may not be enough to just regulate development and have a grant program at the state level. To enhance resource protection, it may be necessary to have a galvanizing force such as the SCC to bring together local activists.

The SCC represents a particularly proactive way of resolving resource issues. The SCC has considerable freedom to actively seek out projects rather than waiting for a permit application (complete with developer pushing the project) to land on their desk. There are a multitude of opportunities for resource restoration and enhancement along the California coast. Without the SCC, these activities would be greatly diminished.

5.2 Connecticut's "keep it simple" approach to wetland restoration

Summary

Wetland restoration was identified in the CZME Study as an under–utilized tool for estuary and coastal wetland protection (Good et al. 1997). A significant exception to this finding is in Connecticut. Tidal wetlands in Connecticut were historically impacted by urban, residential, and transportation system development, leading to direct marsh impact or causing replacement of salt marsh vegetation by invasive species. The state has taken advantage of these opportunities for tidal wetland restoration. Over 1500 acres of salt marsh has been restored in the past two decades, largely through projects involving tidal flow restoration. By keeping projects relatively simple and low–cost, funding opportunities have been maximized.

Issue and background

A history of tidal wetland degradation in Connecticut predated recognition of their importance for habitat, water quality, and other functions important to society. Tide gates drained marshes for millponds, wildlife impoundments, mosquito control, flood control, or salt marsh hay. In many areas, salt marsh grass was replaced by freshwater or low salinity–tolerant species such as narrow-leaved cattail (*Typha angustifolia*) and common reed (*Phragmites australis*), resulting in monocultures with low habitat value. Early roads, railroads in the 1800s, and interstate highway construction often involved filling tidal wetlands. Wetlands around ports were filled for infrastructure or dredged for deep water channels. An estimated 30% of Connecticut's tidal wetlands were lost before 1969 with higher losses around major ports such as Bridgeport, New Haven, and New London (Rozsa 1995a). Of an original tidal wetland base of 22,265 to 26,500 acres, Connecticut is now estimated to have 17,608 acres (Rozsa 1995a—see figure 5-4).

Concern over tidal wetlands loss led to the 1969 passage of the Connecticut Tidal

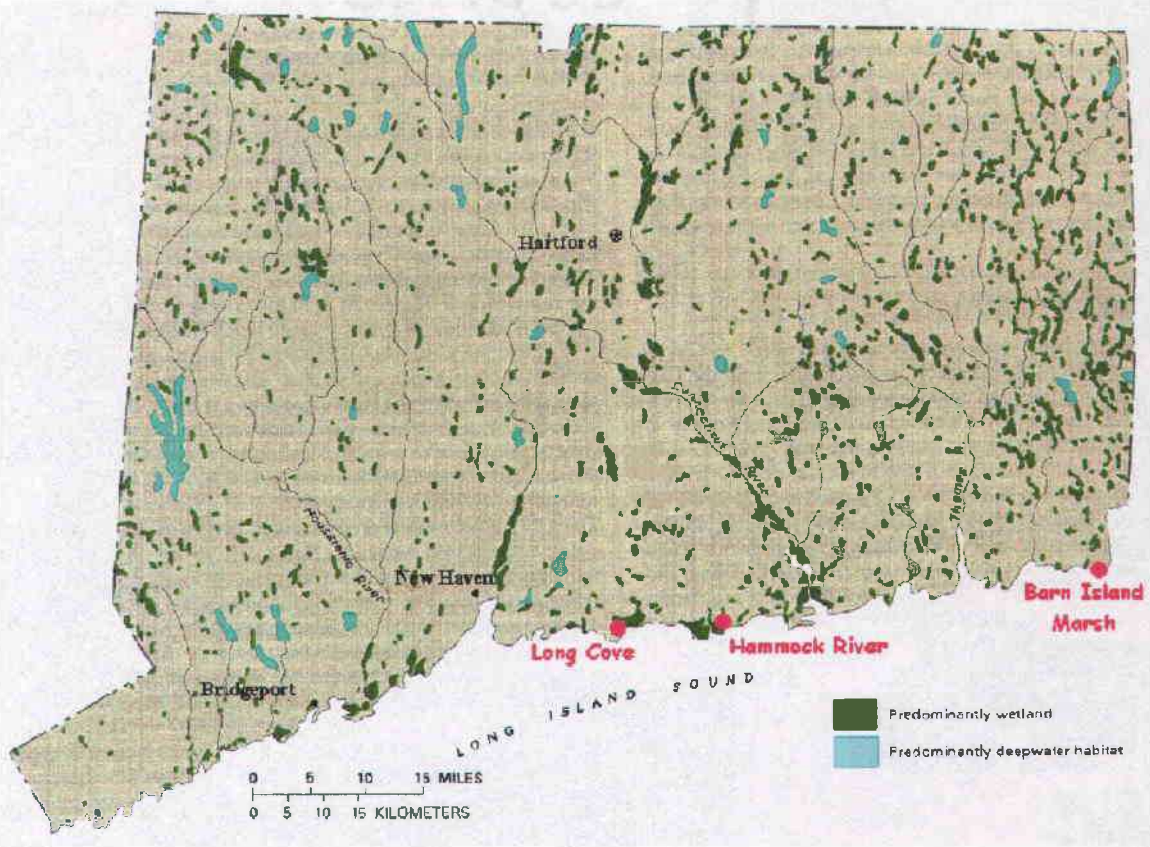

Figure 5-4. Tidal wetlands in Connecticut are protected by the state Tidal Wetlands Act (source: USGS 1996).

Wetland Act, a regulatory program prohibiting activities that destroy or degrade these wetlands. While the Tidal Wetlands Act was effective in halting tidal wetlands loss, it did not establish a systematic process for restoring the thousands of acres of degraded tidal wetlands.

Development of Connecticut's tidal wetland restoration program

The 1980 Connecticut Coastal Management Act included a policy to encourage the restoration and rehabilitation of degraded tidal wetlands. This policy provided the impetus for the Connecticut Coastal Area Management Program (now the Office of Long Island Sound Programs–OLISP) to begin a program for restoring degraded tidal wetlands (Rozsa, personal communication 1998). Additionally, Connecticut College received funding to examine tidal wetland degradation along the Connecticut coast and produced a publication on wetland ecological importance and historic impacts.

One of the first restoration projects undertaken by the State was a waterfowl impoundment at the Barn Island Wildlife Management Area in Stonington (figure 5-5). This tidal wetland had been diked for waterfowl habitat and mosquito control. By the 1970s, *Phragmites* and narrow-leaved cattail were dominating impounded areas of the

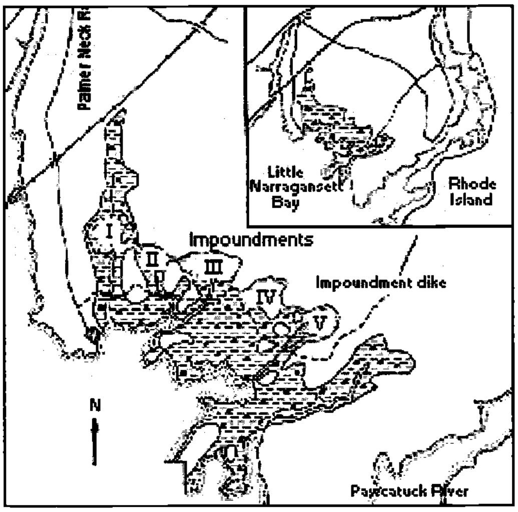

Figure 5-5. Barn Island Marsh. Tidal flow was restored to impoundment I (source: Conn. Coll. WWW site: http://camel2.conncoll.edu/ccrec/greennet/arbo/publications/34/).

marsh (Rozsa 1995b). In 1982, the Connecticut Legislature adopted a bill that mandated the restoration of one of these impoundments (impoundment I in figure 5-5). After the installation of a four–foot diameter pipe led to only partial restoration of the marsh, the Connecticut Department of Environmental Protection (DEP) put in a larger seven–foot diameter culvert to study the effects of tidal flow restoration. Salt marsh vegetation re-established itself in the impoundment through periodic flooding and increased soil salinities due to the larger culvert's enhanced tidal flow. Today, salt marsh vegetation has been restored to nearly all of Barn Island Marsh, and the height and area of the remaining *Phragmites* continues to be reduced. Additional coastal management funds have been used to study restoring other Barn Island Marsh impoundments, now in various stages of restoration. This passive approach to marsh restoration was applied elsewhere.

In 1984 the US Army Corps of Engineers informed the Connecticut Department of Health's Mosquito Control Division that maintenance ditching was no longer an acceptable management practice. In 1985, OLISP and the Mosquito Control Division developed a new strategy for mosquito control that included open marsh water management and tidal wetland restoration. Under this strategy, the Mosquito Control Division would reintroduce tidal flow to restore the marsh and then re-evaluate the need for mosquito control. It was soon realized that restoring drained and subsided marshes brought back former marsh vegetation and reduced mosquito breeding. Rarely has it been necessary to augment marsh restoration with other open marsh water management techniques (Rozsa, personal communication 1998). Results from this strategy indicate that wetland restoration takes about 15-20 years (Rozsa, personal communication 1998).

A 300 acre tidal wetland along the Hammock River (figure 5-6) was one of the first projects under this new open water marsh management program. This marsh had been drained for hay production and mosquito control by diking and four tide gates; its vegetation had been largely replaced by replaced by *Phragmites* (figure 5-7). One of the tide gates was opened to restore tidal flow and enable re-establishment of salt marsh vegetation while reducing open water areas (ideal mosquito breeding habitat). By the early 1990s, *Phragmites* had been displaced by salt marsh vegetation at lower elevations, but additional tidal flow was required for the remaining area. A second culvert was opened, and by 1997 the formerly dense *Phragmites* was being replaced by *Spartina alterniflora* (figure 5-8).

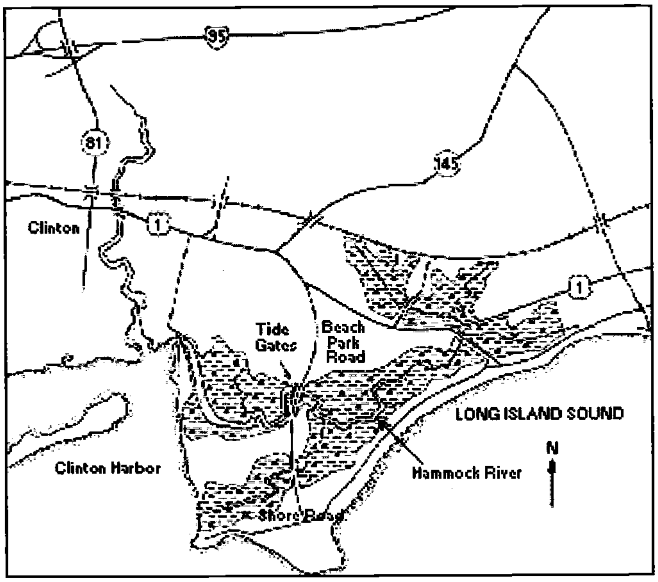

Figure 5-6. Re-introducing tidal flow restored Hammock River marsh (source: Conn. Coll. WWW site: http://camel2.conncoll.edu/ccrec/greennet/arbo/publications/34/).

Figure 5-7. Draining the marsh along the Hammock River had led to nearly monodominant stands of *Phragmites* (photo courtesy of Ron Rozsa, OLISP).

Figure 5-8. Salt marsh vegetation was re-established and mosquito habitat reduced after one of the Hammock River tide gates was opened (photo courtesy of Ron Rozsa, OLISP).

A project in Long Cove near Guilford (figure 5-9) also dealt with re-establishing tidal flow. A road across the Long Cove marsh channel had included a tide gate/culvert system for mosquito control. *Phragmites* had replaced most of the original marsh vegetation. Public concern about the marsh deterioration led to a partnership between the Town of Guilford, the Guilford Land Trust, the DEP, and the Mosquito Control Division, the first such partnership in Connecticut for tidal wetland restoration (Rozsa 1995b). Guilford received a small coastal management grant to restore tidal flow by re-opening a culvert that had been filled when the mosquito control system was installed. The Mosquito Control Division assisted in the project by clearing debris from a series of marsh ditches (figure 5-10). Five years later, *Phragmites* had been replaced by salt marsh vegetation in certain areas and was declining throughout Long Cove marsh (figure 5-11).

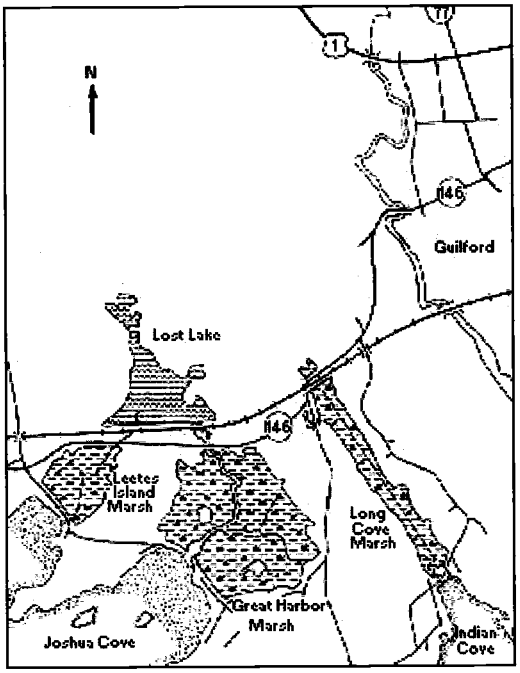

Figure 5-9. A tide gate/culvert system degraded Long Cove marsh (source: Conn. Coll. WWW site: http://camel2.conncoll.edu/ccrec/greennet/arbo/publications/34/).

Figure 5-10. Debris removal helped restore tidal flow (photo courtesy of Ron Rozsa, OLISP).

Figure 5-11. Tidal flow re–established marsh vegetation (photo courtesy of Ron Rozsa, OLISP).

To ease the State's permitting process, the US Environmental Protection Agency (EPA), US Army Corps of Engineers, and the US Fish and Wildlife Service (USFWS), were invited to review restoration plans early in the planning stages. Federal agency concerns could thus be addressed up front and incorporated into restoration plans. With the growing success of DEP's restoration program, in the late 1980s federal agencies allowed tidal wetland restoration activities to be included in the list of eligible activities for a State Programmatic General Permit, thus helping to reduce the state's permit burden. In the early 1990's, Connecticut adopted a Certificate of Permission for minor activities including wetland restoration, further streamlining the restoration project permit process.

Funding tidal wetland restoration

In the early 1980's, the Connecticut Legislature passed legislation for a pilot coves and embayments restoration program. One of the program's projects included an embayment dominated by a drained and degraded tidal wetland. Following the success of this pilot program, the Legislature enacted the Coves and Embayments Program, creating a $2 million fund to repay local communities for up to half of a restoration project's cost. However, this program was seldom utilized by smaller rural areas because of the startup costs of restoration projects. With the Connecticut–New York Long Island Sound Program underway, in 1990 the Legislature replaced the Coves and Embayments Program with the multi-million dollar Long Island Sound Cleanup Fund. Several million dollars of this Fund are designated for restoration projects, and there is no matching requirement.

Since most of the restoration projects that have been pursued have been relatively inexpensive ($50,000 or less), OLISP has been able to take advantage of various funding sources and partnerships. Projects done in cooperation with the Mosquito Control Division reduced costs by utilizing Mosquito Control's specialized equipment; since some wetland restoration projects were done in the name of mosquito control, these projects were done at no cost to DEP or local communities. Funding for restoration projects is usually about 50% from the state, with the remainder from federal, local, or non-profit sources. Long Island Sound Cleanup Fund money is often used to match available federal funds. This is especially important since federal funds are often available only on a match basis. Since 1990 the USFWS has provided about $30,000 annually for tidal wetland habitat restoration. Connecticut was the first state to apply for funding from the Intermodal Surface Transportation Efficiency Act, which requires only 20% state matching funds (Rozsa, personal communication 1998). One restoration project has begun and another is being developed using these funds.

Results

Connecticut has restored an estimated 1500 acres of salt marsh since the late 1970s, mostly through DEP supervision with the assistance of the Connecticut Coastal Management Program and OLISP (Rozsa 1995b). Restoring degraded salt marsh and reducing *Phragmites* monocultures by tidal flow re-establishment have been emphasized. A current $150,000 project excavating an old fill site near Groton with help of the US Fish and Wildlife Service Partners for Wildlife Program is an exception, but for the most part these restoration projects do not involve a lot of construction or heavy equipment.

The approach to tidal wetland restoration in Connecticut involves reconnecting salt marshes to the estuary, re-establishing tidal flow, and letting nature take its course (Rozsa, personal communication 1997). Project goals are along the lines of "make it better" rather than "reduce the area of *Phragmites* by 90%." The effort is to restore natural conditions as much as possible, not to restore particular hydrologic regimes or functions. A result of this approach is the need for patience, as it may take decades for a degraded area to approach its former state.

An important factor behind the success of restoration projects has been the involvement of the scientific community. Connecticut College is currently studying in restored wetland functionality and the manner in which *Phragmites* invades marshes. These questions will become more important as Connecticut expands its restoration program to address *Phragmites* invasions into tidal brackish and freshwater marshes. This team approach with academia and other federal and state agencies has been crucial to bringing the best available science and information to restoration projects.

Future wetland restoration efforts

Through the CZMA §309 Enhancement Grants Program, OLISP has developed a draft restoration plan for the Connecticut coast with the identification and general prioritization of potential restoration sites. A joint Connecticut–New York–EPA Long Island Sound restoration plan has resulted in geographic information system (GIS) maps identifying potential restoration sites. In conjunction with these projects, OLISP is also developing a wetland restoration GIS to map restored areas and identify potential restoration sites (figure 5-12). While these activities have been useful and the identified priorities will be followed where possible, restoration opportunities may not always match on-paper priorities (Rozsa, personal communication 1997). As success in restoring tidal wetlands continues, the state has recently begun to focus attention on the invasion of *Phragmites* in tidal brackish/freshwater marshes.

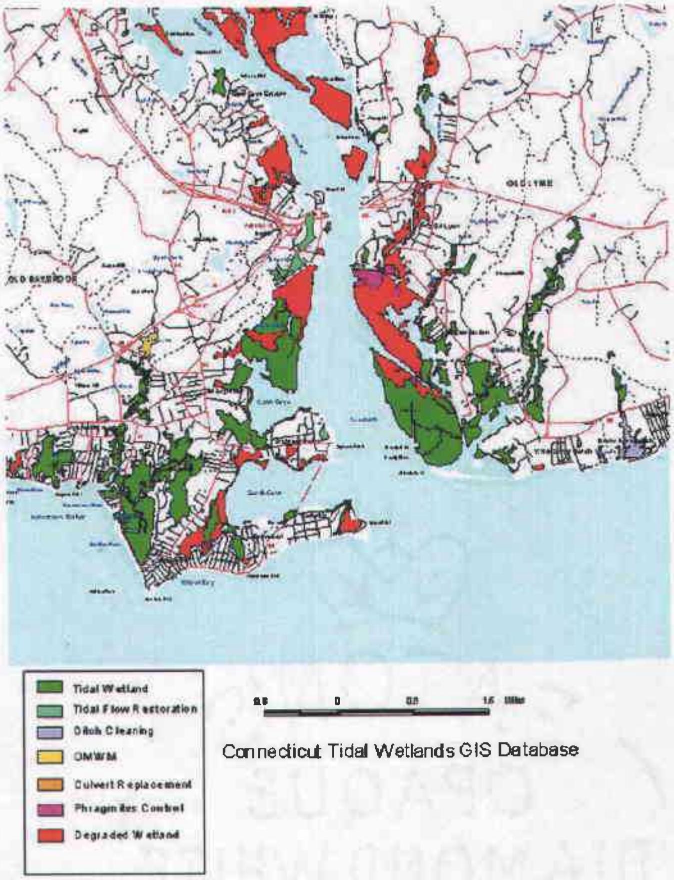

Figure 5-12. GIS technology will be used to identify current and potential restoration projects.

5.3 A Multi-Faceted Approach to Wetland Restoration in Delaware

Summary

The nonregulatory element of the model program for coastal wetland and estuary protection (figure 1-1) can be achieved through various approaches. For example, there are many opportunities for wetland restoration in Delaware, as tens of thousands of acres of wetlands have been impacted since early European settlement. The state has responded by embarking on several wetland programs, notably a program to create an urban wetland corridor along the Delaware and Christina Rivers and an open marsh water management program. In northern Delaware, 880 acres in four sites have been restored, with 13 additional sites (3800 acres) in the implementation or planning phase. Open marsh water management techniques have been implemented on 7000 acres of tidal wetlands that had been grid-ditched for mosquito control. Control of Phragmites and restoring impounded wetlands have also been pursued.

Issue and background

Coastal Delaware historically had large expanses of tidal salt marshes and tidal freshwater wetlands covering approximately 100,000 acres, about half of the state's wetland base (figure 5-13). As was common throughout the eastern U.S., early European settlement included diking and impounding coastal wetlands for agriculture and flood control purposes. In the 20th century, impoundments for waterfowl habitat enhancement, ditches for mosquito control, tide gate installation for flood control, and fill for residential, commercial, and transportation development have led to the degradation or destruction of tens of thousands of wetland acres.

Various state and federal laws now protect coastal wetlands in Delaware, so that impacts from new development have been largely curtailed. These regulations did not contain wetland restoration programs, however. New wetland issues that are difficult to address through wetland regulation have emerged in Delaware in recent decades. The spread of

Figure 5-13. Wetlands still cover a significant portion of Delaware (source: USGS 1996).

the Common Reed (*Phragmites australis*) to form monodominant stands over many former diverse marsh plant communities has become a large management concern, as *Phragmites* may not provide the habitat or the biodiversity of original marshes. Thus, restoring Delaware coastal wetlands involves issues beyond the removal of constructed ditches, dikes, or tide gates.

Development of restoration programs

In the early 1980s, Delaware began an intensive five year monitoring and evaluation project to determine the extent and health of salt marshes and freshwater wetlands and identify degraded wetlands. The Delaware Coastal Management Program also provided funding for examining impoundments in state–owned marshes and identifying restoration needs. Separate issues also began increasing the need for wetland restoration. For example, due to the multi-ownership pattern of many wetlands, wetland protection through acquisition was not perceived to be cost-effective. Additionally, while the state had historically relied on pesticide spraying for mosquito control, the public was growing increasingly uncomfortable with this practice. Ironically, other mosquito control activities such as ditches in some cases had exacerbated the mosquito problem by increasing ponded areas—ideal mosquito habitat.

Discussions of wetland restoration included improving water quality of the Delaware River and the need for waterfowl habitat. Groups such as Ducks Unlimited were strong voices in favor of wetland habitat for ducks and other migratory bird species of the Atlantic Flyway. As the Delaware River was being cleaned up, anadramous fish species such as striped bass (*Morone saxatilis*), shad (*Dorosoma cepedianum*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*) were returning but needed spawning habitat.

In response to these concerns, Delaware has developed a variety of restoration programs. Strong leadership and political support from former governors and a Secretary of the Delaware Department of Natural Resources and Environmental Control (DNREC) has been important to the development and continuation of these restoration programs. These programs have been an exercise in "adaptive management"— the State has had to monitor individual projects closely to ensure restoration goals are met (Carter, personal communication 1998). Most restoration projects have expressly stated goals, although predicting how wetland systems will be affected may be difficult. Major restoration programs include the Northern Delaware Wetlands Rehabilitation Program (NDWRP) and the use of Open Marsh Water Management.

The Northern Delaware Wetlands Rehabilitation Program

In 1992, in response to concern with the loss of over 6,000 acres of tidal wetlands along the Delaware and Christine Rivers in northern Delaware (figure 5-13), the governor and DNREC secretary introduced the Northern Delaware Wetlands Rehabilitation Program (NDWRP). The NDWRP is an ambitious program to establish an urban wetland corridor by rehabilitating more than 10,000 acres of degraded tidal freshwater and brackish wetlands at 31 sites along the Delaware and Christina Rivers (Hossler 1994b). The DNREC is responsible for the program's implementation with other federal, state, and local agencies serving as advisors.

The NDWRP began with the development of an overall restoration plan, completed in 1994 and funded in part by Delaware's coastal program. The plan serves as long-term guidance for wetland restoration along the Christina and Delaware Rivers. The plan is based on three principles:

- restoration should achieve multiple regional objectives
- include appropriate public and private representatives in the project development process
- use a watershed approach to guide individual restoration projects, culminating in the formation of an urban wetland corridor (Hossler 1994b)

The plan includes a list of 31 potential restoration sites (totaling over 10,000 acres) and assessment of their rehabilitation potential. The plan also includes guidelines for preparing detailed, site-specific restoration plans. A NDWRP Steering Committee made up of representatives of various DNREC divisions and the New Castle County Conservation District develops plans for individual restoration projects. An adjunct committee comprised of various federal and state agency representatives and other stakeholders serves the Steering Committee in an advisory role. The plan directs that specific restoration plans should be based on ecological evaluations of each site and its surrounding landscape (Hossler 1994b).

In defining project objectives, certain regional objectives must be considered (table 5-1).

•Water quality improvement in rivers and wetlands through tidal exchange and wetland filtering
•Restoration and improvement of spawning, nursery, and feeding sites for fish
•Increased biological diversity; improved wetland and associated upland habitat.
•Protection and enhancement of existing habitat and populations of threatened/endangered species
•Increased diversity of shallow water habitat and emergent vegetation
•Control of nuisance and exotic plant species
•Control of mosquito populations by water management where practical, reducing insecticide use
•Flood management through increased storage capacity, timely releases, and other means.
•Reduction of shoreline erosion using environmentally acceptable techniques
•Improvement of recreational opportunities and aesthetics
•Increased environmental education opportunities for the general public and school groups

Table 5-1. Regional objectives of the NDWRP (from Hossler 1994b).

Generally, the goal of restoration projects is not to restore marshes to their original condition, as the land use pattern in much of this urbanized area does not make such restoration possible. Instead, project goals focus on restoration of certain functions or habitats.

Funding for NDWRP projects has come from a variety of sources (table 5-2), indicating the public and private support for the program and the opportunistic nature of the NDWRP. The NDWRP has a program manager and funding for five part-time staff and seasonal employees.

One of the first NDWRP projects, Broad Dyke Marsh, was started in 1994. Broad Dyke

Source	Amount (dollars)
Army Creek Superfund Natural Resources Damages	600,000
Ciba-Geigy	310,000
Delaware Department of Transportation	300,000
EPA Section 319 Non-point Source Pollution Grant	180,000
DCMP—CZMA Section 309 Grant	128,000
Trustees of New Castle Commons	113,700
Brand Mid-Atlantic	100,000
State bond bill (appropriated in 1993)	50,000
EPA Delaware Estuary Program Grant	41,500
Fine monies	17,000
Presidente Rivera oil spill fine monies	13,000
DNREC Division of Fish and Wildlife	8,160
DuPont	5,000
Delmarva Power	4,926
US Fish and Wildlife Service Mini-Grants	9,000
TOTAL	**$1,580,286**

Table 5-2. NDWRP funding since 1992 (from Hossler 1994b and Hossler, personal communication 1998).

Marsh is a 210 acre tidal freshwater wetland connected to the Delaware River north of the city of New Castle, surrounded to the north and west by housing developments and an industrial area (figure 5-14). Dikes and water management practices had resulted in 53% of the marsh being converted to *Phragmites*, a reduction in wetland water quality, and an increase in mosquito breeding sites (Hossler 1994a). In partnership with the Trustees of New Castle Common, New Castle Immanuel Church, US Environmental Protection Agency, NOAA, Delaware Ducks Unlimited, New Castle County, and New Castle

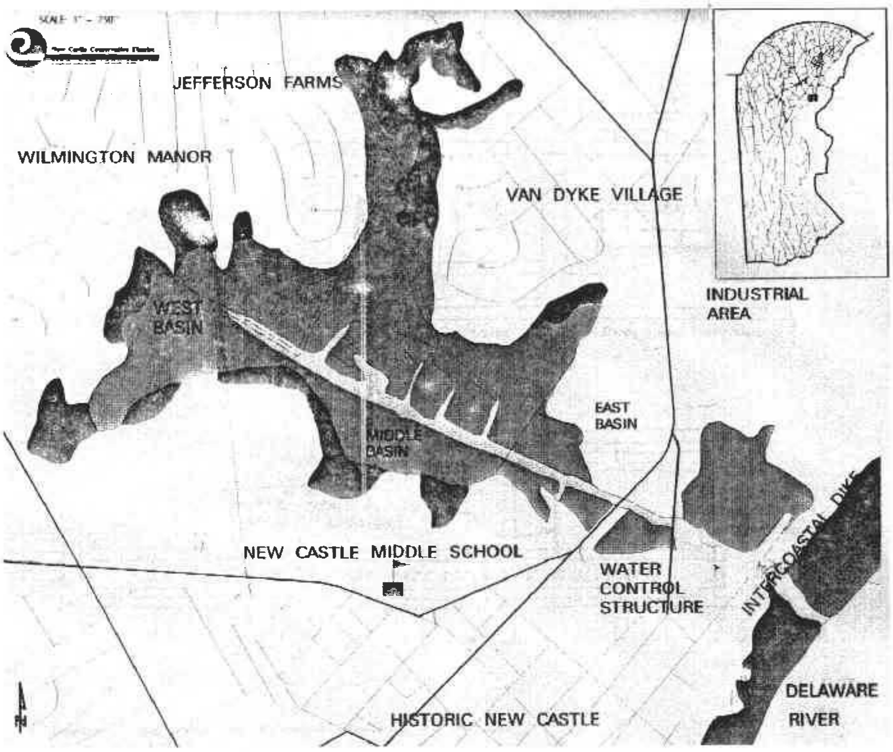

Figure 5-14. Broad Dyke marsh was one of the first sites targeted for restoration under the NDWRP (source: Hossler 1994a).

Conservation District, DNREC developed a restoration plan for Broad Dyke Marsh. The purposes of the Broad Dyke Marsh restoration project were many: to improve water quality both in the marsh and in the Delaware River; to increase biological diversity and wetland/upland habitat; to control *Phragmites* and other nuisance species; to reduce stormwater flooding; increase environmental education opportunities; and to increase recreation opportunities. To address these goals, the project proposed to install an automated water control structure with a lift gate and automatic sensors to enable daily tidal exchange; implement a water management plan to restore habitat while reducing the duration and severity of storm flooding; install 1,800 feet of boardwalk with interpretive signs, an observational platform, and a canoe launch; install duck boxes and waterfowl nesting platforms; control *Phragmites* through periodic herbicide application followed by controlled burns; and plant beneficial species (Hossler 1994a). Only four years after this work, the project seems be achieving its goals. Fish diversity has increased from 12 to 28 species, *Phragmites* now is monodominant over only 4.3% (nine acres) of the marsh, mosquito control spraying has been cut in half, and wood duck nesting success has increased (unpublished data from DNREC 1998).

Other NDWRP projects include similar goals of reintroduction of tidal flow and *Phragmites* control. An impressive amount of effort has gone into the NDWRP since 1994. As of January 1998, the NDWRP had completed restoration activities for 880 acres in four sites, and had 6 more sites (1,813 acres) in the implementation phase, 3 sites (1,404) acres in the final design phase, and 4 sites (550 acres) being actively planned (unpublished data from DNREC 1998).

Ownership patterns are an issue, as some marshes are largely privately owned. To address private landowner concerns, DNREC holds public meetings with landowners prior to project commencement. The public can also comment on project plans during the US Army Corps of Engineers permit review of the restoration proposal. For one project, DNREC developed a partnership agreement with 31 marsh landowners outlining State responsibilities. By working with landowners and openly discussing project uncertainties, DNREC has been able to pursue NDWRP restoration projects on private land.

Open Marsh Water Management

Given the size of the mosquito population in Delaware, it is no surprise that mosquito control has been a big issue. By the 1930s, an estimated 60,000 acres of tidal wetlands in Delaware had been grid-ditched for mosquito control purposes (Meredith, personal communication 1998). Concerns with the use of insecticides led Delaware to return to a variation of the "source reduction" approach. For example, in 1979 the Delaware Coastal Management Program formally endorsed Open Marsh Water Management (OMWM) instead of insecticides for mosquito control. In 1980, the DNREC Division of Fish and Wildlife (DFW) hired three staff members to begin implementing OMWM. Of the 60,000 acres of grid-ditched tidal wetland, approximately 15,000 acres were identified as target areas for restoration and treatment with OMWM. The Delaware coastal program provided seed money for much of the OMWM work.

The purpose of OMWM is to return water to the marsh by creating a series of open ponds connected by small waterways, ideal habitat for mosquito larva–eating fish. In Delaware, the general process of OMWM begins with the identification of candidate sites through field visits and aerial photography. Once a site is selected, a series of ponds and ditches are staked out to indicate where removal of small potholes (typical mosquito breeding grounds) and fill of old ditches in favor of larger, fish-bearing ponds should occur. At this point, members of the Delaware Mosquito Control Advisory Committee (including US EPA, US Army Corps of Engineers, NMFS, USFWS, DFW, State Natural Heritage Program, and the State Archeologist) visit the site to examine the need and layout of the ditches. At first the Advisory Committee was sometimes hesitant to accept the proposed ditch layout. Trust has now been developed to the point where the Corps has issued a general permit for OMWM activities.

Following Advisory Committee approval, DFW uses excavation equipment to create the ditch/pond system. An amphibious rotary excavator that spreads a thin slurry over 50-100 feet of marsh is often used to avoid mounding of excavation material. Following initial excavation, the site is replanted and monitored for up to two years for vegetation recovery. About a third of the time, DFW will return to the site for touch-up work (Meredith, personal communication 1998). A project is considered a success if vegetation recovers and mosquito populations drop.

As of early 1998, about 7,000 acres had been treated using OMWM techniques (Meredith, personal communication 1998). This first round of OMWM projects will be completed in five years, after which the state will apply OMWM techniques to additional sites. Expansion of the OMWM program is likely given the popularity of the program, although some do not like impact to salt marsh for any reason. Previous governors and legislatures have supported the program, providing funding from the Delaware General Fund.

Other Delaware wetland restoration activities

In addition to the NDWRP and OMWM, other restoration activities have been pursued by the state. The Delaware coastal program provided $70,000 annually over four years for a project aimed at *Phragmites* control. The project included the development of a herbicide-and-burn technique to encourage the re-establishment of native plant species, and led to a 50:50 cost share program with private landowners. An estimated 10,000 acres of wetland have been treated with this technique (Meredith, personal communication 1998). The Delaware coastal program also funded an inventory of potential wetland restoration sites on state-owned lands. This project has resulted in the identification of 20 sites totaling 400 acres on state wildlife lands with restoration potential. As of mid-1996, two projects totaling about 40 acres had been implemented.

A major boost to the *Phragmites* control program came from Public Service Electric and Gas (PSE&G), who gave the state $10.5 million in a settlement over use of Delaware River water for a nuclear power plant in New Jersey. About $2 million of this settlement has been used for *Phragmites* control. The Legislature developed a "Delaware Marsh Management Trust" using an additional $1 million of the PSE&G money. Interest from this fund will be used to keep restoration projects going in the future. The Delaware coastal program funded a project to identify restoration projects in high–level impoundments created to enhance waterfowl habitat and control mosquitoes. Salinity buildup in these impoundments killed marsh vegetation, resulting in expanses of bare mudflat. PSE&G money was used for projects restoring tidal flow. Vegetation is returning to these areas, now managed for a variety of purposes, including fish and bird habitat, mosquito control, water quality, and recreational fishing.

While the PSE&G settlement certainly has made funding these projects easier, Delaware had clearly showed a previous commitment to wetland restoration. Wetland restoration in

Delaware is governed by a variety of management objectives, which can often seem to make matters overly complicated. However, efforts such as the NDWRP and OMWM have shown that wetland restoration can achieve multiple objectives.

5.4 Wetland protection through public outreach in Washington

Summary

Education and technical assistance was one of the ten most important tools used by state coastal programs to protect estuaries and coastal wetlands. While it is difficult to directly associate on–the–ground outcomes with these tools, this fact does not diminish their importance. The Washington Department of Ecology has invested considerable time and resources in its public outreach program. Many publications, workshops, and other forms of education have resulted from this effort. In particular, a project educating teachers has been a valuable component of Washington's efforts to protect wetlands. Other publications have been directed to the business community, industries, and other target groups.

Background

Washington was one of the first states in the country to adopt legislation specifically for managing coastal resources. The 1971 Shoreline Management Act (SMA) established a locally-implemented planning and permitting system for Washington shorelines, with the state oversight from the Washington Department of Ecology (WDOE). In part, this legislation was a response to historic wetland losses, particularly in tidal wetlands.

The SMA definition of wetlands includes all wetlands within 200 feet of the ordinary high water mark; floodways and associated floodplains within 200 feet; and marshes, bogs, swamps, and deltas associated with streams, lakes, and tidal waters. These areas include perhaps 25% of the wetlands in Washington (figure 5-15). Local permits are required for activities within these areas. The WDOE has authority through the SMA to determine which wetlands are under SMA jurisdiction and to review certain local government permitting decisions. However, protection of wetlands through the SMA is primarily implemented by local governments. This regulatory program also does not extend

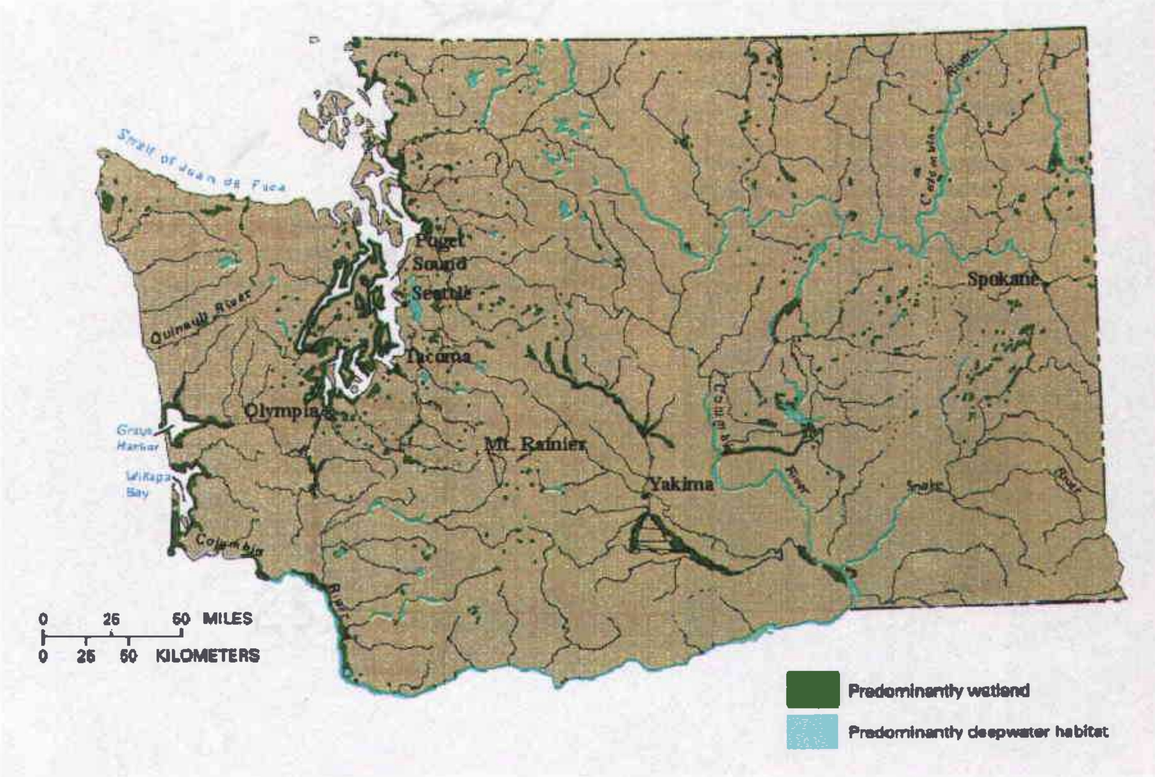

Figure 5-15. Perhaps 25% of Washington's wetlands are included in the SMA definition (source: USGS 1996).

coverage to isolated wetlands not associated with waters of the state. As a result of both factors, WDOE has developed alternative wetland conservation programs.

Development of a public outreach program

In 1984, a Wetlands Section within WDOE was created to pursue the general goals outlined in table 5-3. To achieve these goals, the Wetlands Section has provided technical

- protection of wetland resources and ecology
- better administration of the SMA as it relates to wetlands
- promotion of informed wetland planning and decision-making at all government levels
- provision of assistance to local governments
- increasing public awareness of wetland values

Table 5-3. Goals of the WDOE Wetlands Section (from WDOE 1986).

assistance to various federal, state, and local agencies and developed many public outreach projects.

The third person hired in the Wetland Section was to provide education and public outreach in recognition of the importance of these activities. The Wetlands Section increased in size through the 1980s to about 30, and staff work often included outreach and education. Thus, outreach and education became a major part of the Wetland Section's work. Wetland Section products have also been emulated in other states.

As Lynn (1992) points out, one of the key reasons for this success was the time spent developing an education strategy. The first step used in developing this strategy was the identification of education needs and target audiences in Washington. The Wetlands Section sent an informal survey to wetland experts in agencies, tribes, local governments, and other groups asking for a list of target audiences (Lynn 1992). Survey responses indicated that the top six priority audiences in Washington were local decision-makers, wetland property owners, agricultural large-lot owners and interest groups, developers, and local planners (Lynn 1992). Many Wetlands Section publications subsequently have been aimed at these groups.

The next step in developing an education strategy was determining how the Wetlands Section could address education needs. This step was important to avoid poor allocation of staff resources and funding or duplication of other education efforts. Lynn (1992) identifies several roles of the Wetlands Section in its education efforts (figure 5-16). An agency's role should depend on the target audience and coordinate with other agencies and groups. The Wetlands Section has often worked in partnership with other agencies (Washington Department of Wildlife, US Fish and Wildlife Service, US Army Corps of Engineers, Washington State University Extension Service, and others) to produce public education materials.

These partnerships are particularly important since funding often limits agency workloads. During the1980s, the Wetlands Section relied primarily on federal coastal management funds and the Washington State General Fund. Until recently, funding was available for the education position as well as from $20-80,000 annually to cover printing costs (Lynn, personal communication 1998). Lynn (1992) offers suggestions for maximizing funding,

1. ***Coordinator***–agency periodically convenes wetlands education practioners to outline roles and coordinate efforts. Essential for avoiding duplication and maximizing efficieny.
2. ***Facilitator***–agency encourages other government programs or agencies to fund education projects or include a wetlands component in current education activities.
3. ***Supporter***–agency provides funding and advice, or serves as an information clearinghouse for other efforts.
4. ***Program developer and disseminator***–agency develops publications for distribution. Allows agency goals to be directly addressed and utilizes in-house expertise.
5. ***Hands-on practitioner***–includes training workshops and public involvement programs. Direct involvement with the public is often time-consuming and expensive, but may be the most effective means of education.

Table 5-4. Roles for state agencies in education efforts (from Lynn 1992).

including:

- ensure each publication has well-defined target audiences
- use existing resources whenever possible, even from other states
- cooperatively fund or develop projects with other agencies
- use various distribution points (schools, libraries, environmental centers, and others)
- enhance effectiveness by training people who will then teach others.

Funding, as always, should be examined closely when developing an education program strategy.

A final step in the strategy process is developing an action plan detailing short– and long–term activities. The Wetlands Section took a broad approach to this step, developing a large list of education activities while keeping a target audience in mind for each publication (Lynn, personal communication 1998). This approach meant that not all listed projects would be funded, but as funding opportunities arose ideas were already in place.

Education and outreach products

The Wetlands Section has produced an astonishing array of technical assistance and education materials (table 5-5), including brochures, slide shows, traveling displays, school curriculum, workshops and conferences, and training sessions. Training workshops and conferences have introduced people to wetland management and topics such as restoration techniques. Traveling displays have included panels describing Washington wetlands and their functions. Despite the

Wetlands Regulations Guidebook (1988)
Wetlands Preservation–An Information and Action Guide (1990)
Wetland Buffers: Use and Effectiveness (1992)
Designing Community Environmental Education Programs–A Guide for Local Governments (1992)
Washington's Wetlands (1992)
Designing Wetlands Preservation Programs for Local Governments: A Guide to non-Regulatory Protection (1992)
Restoring Wetlands in Washington: A Guidebook for Wetland Restoration Planning and Implementation (1993)
Video: "Fabulous Wetlands!"

Table 5-5. A few of the many Wetlands Section publications.

wide range of topics, each publication was written for a specific target audience as appropriate. The publications are written to avoid overly bureaucratic language. For example, the "Fabulous Wetlands!" video contains off-beat humor and is not standard agency fare.

One project is innovative enough to warrant a particular highlight. The "Discover WILD Wetlands" teacher workshop program gives middle– and high–school teachers information and teaching resources regarding wetlands (Lynn and Usher 1993). In the early 1990s, the Wetlands Section and Washington Department of Wildlife, in conjunction with a private environmental educational consulting firm, sponsored teacher workshops as part of this program. In 1992, facilitators were trained to schedule and develop workshops, organize guest speakers, and lead these workshops. Workshops generally included field trips, hands-on activities, and discussion of local wetland issues (Lynn and Usher 1993). The goal was an interactive workshop rather a series of lectures. The "Discover WILD Wetlands" program had a true "trickle-down" effect as teachers brought the information gained through the workshop to the classroom.

Results

While it is impossible to directly link on-the-ground wetland protection to education and outreach activities, it is clear that the Wetland Section has been successful in reaching target audiences. For example, the "Discover WILD Wetlands" program had about 500 teachers participate from 1990-1993. A 1992 evaluation of 1990 workshops found that almost 90% of respondents taught between 1 and 10 wetland activities each year (Lynn and Usher 1993). Additionally, about two thirds had conducted a wetlands field trip, and 95% said that "their professional and personal practices concerning wetlands changed in a positive way as a result of the workshop" (Lynn and Usher 1993). This illustrates the multiple benefits of such a program.

Many of these publications and programs have been emulated or used outright in other states. In Washington, education and outreach has been particularly important due to the limitations of the SMA wetland regulatory program. Recent budget reductions have led to drastic reductions in Wetlands Section staff and capability for new educational materials. Staff pursue opportunities as they arise and continue to work with other groups. For example, the 1996 *Stewardship Guide* was developed in conjunction with the University of Washington Extension Service. This shows that it is possible to continue an education and outreach program even after reduced funding.

6.0 Coordination programs

Coordination processes and tools are an important feature of the model program for coastal wetland and estuary protection (figure 1-1). Local–state–federal coordination is vital to protecting coastal wetlands and estuaries, since all three layers of government have authority and decision–making powers affecting these resources. While it may be difficult to correlate on–the–ground effects to a coordination program, this fact does not diminish the importance of these tools.

There are a variety of means that inter–governmental coordination can be increased. Joint permitting and permit applications, pre–application meetings, and joint notices can be used as a coordination element for a regulatory program. Coordination can occur beyond the regulatory program, however, as is shown by the *state agency–higher education relationship in Virginia*. The Virginia Institute of Marine Science (VIMS) is an important part of Virginia's wetland management activities, including the regulatory program. VIMS reviews the technical aspects of development proposals and also obtains state funding for various projects related to wetland and estuary management in Virginia. This type of symbiotic relationship between state government and higher education should be emulated elsewhere.

6.1 A State government–University Partnership in Virginia

Summary

A unique example of the coordination element of the model program for coastal wetland and estuary management (figure 1-1) exists in Virginia. Virginia state resource agencies and the Virginia Institute of Marine Science (VIMS) have a complementary relationship. VIMS is relied upon for objective assessments of development proposals in wetlands and performs research to help manage Virginia wetlands. In turn, VIMS receives a significant amount of funding from the state in support of these activities. This is the type of symbiotic relationship between state agencies and higher education that should be repeated elsewhere.

Background

The Virginia coastal area includes about 350,000 acres of tidal wetlands and 385,000 acres of nontidal wetlands (Mason, 1993; see figure 6-1), but also contains about 60% of Virginia's population—nearly 4 million people (Virginia Council on the Environment 1992). Development supporting this population led to historic losses in tidal wetlands as high as 800 acres per year (OCRM 1985) and perhaps even higher losses of nontidal, freshwater wetlands. Concern with tidal wetland losses led to passage of the 1972 Wetlands Act. This Act enacted a tidal wetlands permit program carried out by local Wetland Boards with state oversight from the Virginia Marine Resources Commission.

Relying on local Wetland Boards for the wetlands protection program raised concern with ensuring that these Boards received proper technical and scientific assistance. As a result, the 1972 Wetlands Act also required the Virginia Institute of Marine Science (VIMS) at the College of William and Mary to provide assistance to public resource managers and the public on environmental issues (VA Code §28.2-1100). VIMS works with state and local agencies in three main areas: education and outreach, development of wetlands and

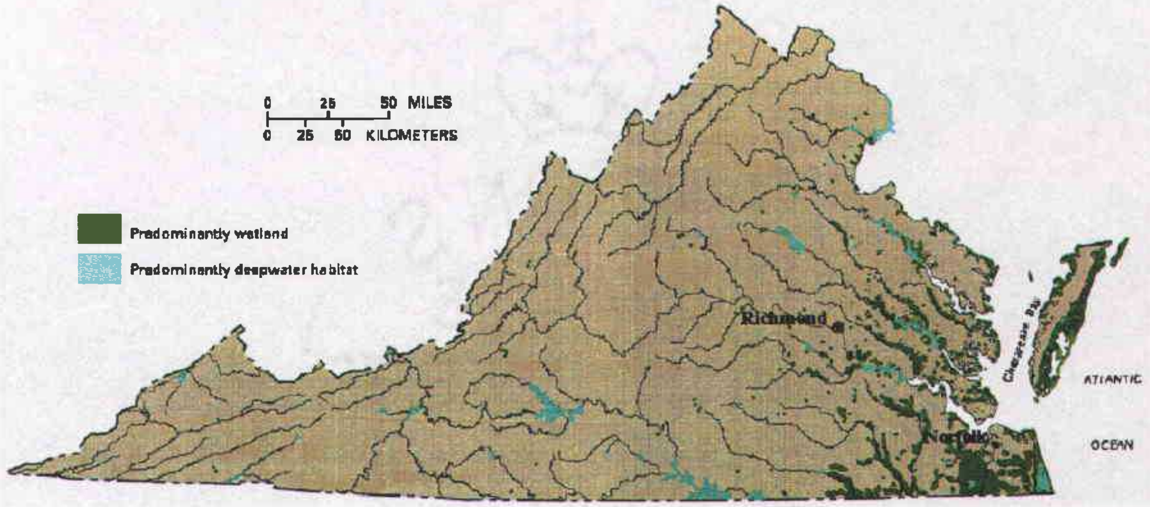

Figure 6-1. The vast majority of Virginia's wetlands are found in the coastal area (source: USGS 1996).

subaqueous lands guidelines and other technical support, and environmental assessments of development proposals.

VIMS and environmental assessments

VIMS serves as an independent assessor for wetland permits for projects in tidal wetlands, subaqueous lands, and in dune/beach areas. Permit applications are submitted to the Marine Resources Commission or a local Wetlands Board and then forwarded to VIMS. Once VIMS receives a copy of a permit application, they have at least 21 days, but generally longer (30-45 days), to review the permit. Seven staff members at VIMS are responsible for reviewing permits in addition to other duties, spending perhaps a quarter of their time on permit assessments. Projects involving dredging, placement of fill, or other activities are among the projects VIMS assesses.

The VIMS permit review process almost always includes a site visit (Barnard, personal communication 1998). VIMS staff then prepare a report describing the type and area of wetland affected, listing potential impacts from the project and possible alternatives. Depending on the size and complexity of the proposal, the report may range from a page to a more lengthy, detailed report (Watkinson, personal communication 1998). The report is then sent to the appropriate agencies (local Wetland Board, Marine Resources Commission, or others) for review and made available to the public. The report is advisory only–it is the responsibility of the regulatory agencies to decide how to utilize the assessment or what particular elements to focus on. VIMS staff may appear at permit review meetings to offer further explanation or answer questions about their review. After a permit is issued, certain projects involve VIMS in follow–up work, such as monitoring of dredge disposal sites.

As illustrated in figure 6-2, permit reviews by VIMS have steadily increased since the 1970s to almost a thousand in 1997. The value of this process is in the separation of the evaluation of a permit from the decision-making. People accept the impartiality of VIMS, since VIMS does not follow particular agency guidelines but "writes it like they see it." (Barnard, personal communication 1998). VIMS staff pride themselves on their independence, seeing their role as giving the decision-makers an environmental view of the potential impacts of a project (Barnard, personal communication 1998).

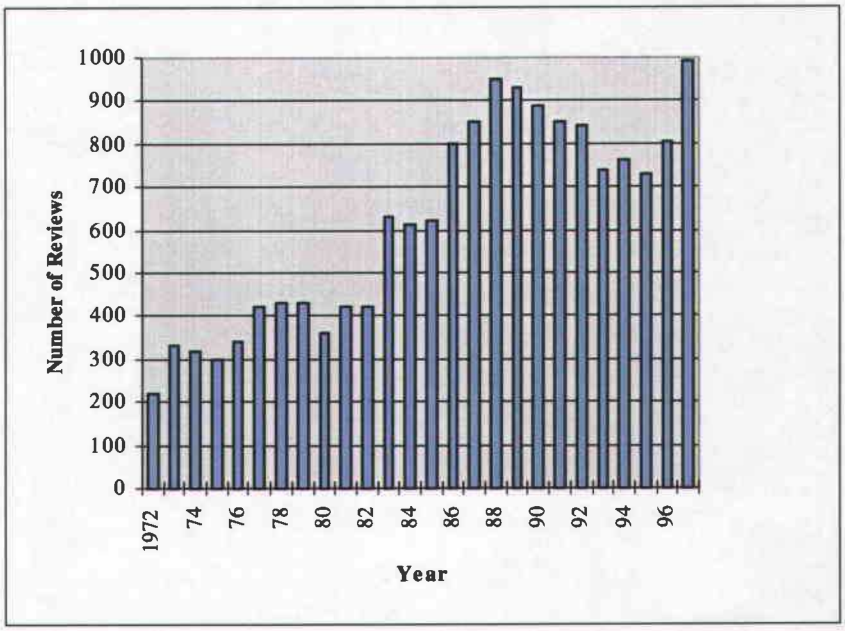

Figure 6-2. Shoreline permit application reviews, 1972-1997 (data courtesy of Tom Barnard, VIMS).

VIMS staff have access to other resources at VIMS, including an extensive library and various research departments. For example, VIMS faculty studying toxic chemicals and the behavior of toxics in sediments provide information on dredge material disposal. In another example, a permit application for a large marina included a water quality model that was reviewed by VIMS staff with the help of VIMS fluid mechanics experts (Barnard, personal communication 1998). In this way, projects with high technical content can be properly assessed.

Recently, VIMS has been developing a permit tracking database for monitoring and trend analysis of reviewed projects. This database began in 1988 as a pilot project that included data for total area of wetlands impacted and impact per specific wetland type (table 6-1).

Software advances have allowed VIMS to expand the pilot database to include data from 1988 to present. Once updated, the database will allow trend analysis of wetland loss and provide annual summaries.

Other technical support and education activities

In addition to permit assessments, VIMS has been involved in other activities to assist the public and management communities. In conjunction with the Marine Resources

Wetland type	Area impacted (acres)
Saltmarsh cordgrass	0.9
Saltmeadow hay	0.3
Black needlerush	0.2
Saltbush	0.4
Big cordgrass	0.2
Reed grass	0.2
Freshwater mixed vegetation	0.3
Brackish water mixed vegetation	2.0
Intertidal beach	2.4
Sand flat	4.7
Sand/mud mixed flat	5.1
Mud flat	4.3

Table 6-1. Pilot database information, showing impacts in 1988 by wetland type (data from Priest *et al.*, 1990). This data will be expanded to include annual information from 1988 to present.

Commission, VIMS developed publication such as *Wetlands Guidelines* and *Subaqueous Guidelines* to provide guidance to permit applicants. Both publications include discussion of the ecological importance of various wetland/submerged habitat communities, as well as describing criteria used in the permit review process. The *Wetlands Guidelines* also contains descriptions of wetland types and functions (figure 6-3). In 1997 VIMS also completed *Tidal Wetland Mitigation Guidelines* for the tidal wetland mitigation program.

For a more general audience, from 1985 until late 1997 (when it was discontinued due to a

Type I. Saltmarsh Cordgrass Community

Dominant vegetation: Saltmarsh cordgrass (*Spartina alterniflora* Loisel).

Associated vegetation: Saltmeadow hay, saltgrass, black needlerush, saltwort, sea lavender, marsh elder, groundsel tree, sea oxeye.

Growth habit: Stout, erect grass; long, smooth leaves, often with attached periwinkle snails; located at the waters edge. Tall form 4 to 6 feet along the water; short form 1 to 2 feet at or slightly higher than MHW.

Physiographic position: Ranges from mean sea level to approximately mean high water.

Average density: Usually 20 plants per square foot. Can range from 10 to 50 plants.

Annual production and detritus availability: Average yield is about 4 tons per acre per annum; optimum growth up to 10 tons per acre. Daily tides flux nearly throughout this community. Available detritus to the marine environment is optimum. This type of marsh is recognised as an important spawning and nursery ground for fish.

Waterfowl and wildlife utility: Roots and rhizomes eaten by waterfowl. Stems used in muskrat lodge construction. Nesting material for Forsters tern, clapper rail and willet.

Potential erosion buffer: Most salt marshes and brackish water marshes are bordered by saltmarsh cordgrass along the waters edge. A marsh/water interface of this type is highly desirable as a deterrent to shoreline erosion. Underlying peat with a vast network of rhizomes and roots is very resistant to wave energy.

Water quality control and flood buffer: Marshes of this type can also serve as traps for sediment that originate from upland runoff. This also includes large debris that may accumulate on the marsh surface.

SUMMARY: Considering the many attributes of this type of marsh community, its conservation should be of highest priority.

Figure 6-3. VIMS wrote the *Wetlands Guidelines*, containing descriptions of wetland communities as shown above, as guidance for permit applicants (source: VIMS and VMRC 1993).

lack of funding) the VIMS Wetlands Program issued *The Virginia Wetlands Report*, a quarterly publication on topical wetland research and issues. Until 1997 VIMS also published a bimonthly series on plants in the coastal area for resource managers and others. Additionally, since 1990 VIMS has issued Technical Reports on a range of topics to disseminate research results, including *Animals of Intertidal Sand and Mud Flats*, *Tidal Wetland Values*, *Tidal Freshwater Swamps of the Lower Chesapeake Bay*, *Current Trends in Ecologic-Economic Valuation of Wetlands*, and many others. VIMS also holds workshops and field classes for local, state, and federal resource managers on topics such as wetlands delineation and human impact to wetland ecosystems.

In 1991, VIMS staff compiled relevant Virginia wetlands, sand dune and beach, mitigation, and submerged lands material and published the *Virginia Wetlands Management Handbook*. Updated in 1995, this massive volume includes state regulations and ordinances, published guidelines, descriptive papers published by VIMS, VIMS Technical Reports, Virginia Attorney General opinions, and other information about wetland management in Virginia.

Funding for these programs comes mainly through the VIMS budget (from the Virginia General Fund) with significant contribution from the Virginia Coastal Management Program. Since 1992, the Virginia coastal program has funded over $340,000 of VIMS projects, as listed in table 6-2.

Project	Amount
• Wetlands management technical support	$18,000
• Wetlands management training project	$77,040
• Protecting nontidal wetlands	$50,000
• Permit tracking database	$8,000
• Beneficial uses of dredged material	$66,675
• Tidal wetlands management technical support	$62,173
• *Virginia Wetlands Management Handbook* update	$19,036
• Development of GIS/ARCVIEW products supporting regulatory review process	14,968
• Historical wetlands habitat losses	$24,710

Table 6-2. VIMS projects receiving Virginia coastal management funding from 1992 to 1997(information courtesy of Tom Barnard, VIMS).

Additionally, the Virginia coastal program provides an annual grant of about $20,000 for operational funds to help in the permit assessment process.

Conclusion: this partnership works

VIMS' relationship with state management agencies has proven mutually beneficial. VIMS receives funding to pursue research addressing management issues in Virginia. The state benefits from this research and the technical expertise of the VIMS staff. The experience in Virginia has shown that the scientific and management communities can work together. Given the success in Virginia, hopefully partnerships like this can develop in other areas of the country.

7.0 Conclusion

Wetland and estuary resources in this country continue to decline, although at a decreased pace from previous decades. Management programs developed and implemented since the 1970s have undoubtedly contributed to this reduction in the loss rate. An additional factor has been society's increasing understanding of the importance of wetland and estuary systems in providing important, valued functions. However, the continued loss of wetland and estuary ecosystems indicates the need for enhancing current management programs to address identified weaknesses. Monitoring on–the–ground outcomes of these management programs is one way of identifying these weaknesses.

The CZME Study clearly underscored the need for a national program to monitor on–the–ground outcomes of state coastal management programs. The current lack of on–the–ground outcome data makes quantitative evaluation of state coastal management programs difficult. This result is not surprising, since state coastal programs have not been asked to maintain such data. Consequently, the success or effectiveness of coastal wetland and estuary protection is difficult to evaluate. A monitoring program could be used to evaluate management programs and identify areas in need of improvement. Such a monitoring program could also help illustrate successful and innovative approaches to coastal wetland and estuary management.

Since this type of monitoring program does not exist, case studies can be used to describe innovations and successes of coastal management programs. Case studies are also useful because they can help show why one program is a success while a similar program elsewhere is not so successful. While every situation varies, case study elements or approaches can be adapted to address common ecological issues. In general, issues in wetland and estuary protection are not that dissimilar from one region to the next, although details vary. Knowing the background and issues behind the development and implementation of a management tool increases the opportunity for adapting the tool for use elsewhere.

The case studies also shown that it is possible to have on–the–ground monitoring information (from databases, geographic information systems, and the like) to provide indications of program success and need for improvement. Protection of wetland and estuary function is the true measure of a program's success and hopefully will be available as our understanding of wetland and estuary ecology advances. In the meantime, area data can provide at least some indication of on–the–ground effectiveness.

The case studies in this report also help illustrate elements the model program for coastal wetland and estuary protection (figure 1-1). This model is a set of management practices considered necessary for effective wetland and estuary protection (Good *et al.* 1997). The model includes proactive approaches to wetland and estuary protection (e.g., planning) and management tools that are reactive in nature, as in regulatory programs. The model also includes tools that are under–utilized, such as wetland restoration. The case studies are examples of these management practices that have proven successful or innovative. In this manner, the case studies also show that it is possible to have a wetland and estuary protection program similar to the model.

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