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The Delaware Inland Bays Estuary Program

Using a Nonprofit Organization to Implement a CCMP

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- Imperial, Mark T., Sally McGee, and Timothy Hennessey, *The Narragansett Bay Estuary Program: Using a State Water Quality Agency to Implement a CCMP*, A technical report prepared to support a final report to the National Academy of Public Administration as part of their Learning from Innovations in Environmental Protection Project (Washington, DC: National Academy of Public Administration, August 2000).
- Imperial, Mark T. and Katheryn Summers, *The Tillamook Bay National Estuary Program: Using a Performance Partnership to Implement a CCMP*, A technical report prepared to support a final report to the National Academy of Public Administration as part of their Learning from Innovations in Environmental Protection Project (Washington, DC: National Academy of Public Administration, August 2000).
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Copies of the report and the supporting case studies can be obtained from:

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List of Acronyms Used in the Report

APDP	Action Plan Demonstration Project
BMP	Best Management Practice
BPB	Business People for the Bays
CAC	Citizens Advisory Committee
CAFO	Confined Animal Feeding Operation
CARE	Comprehensive Agricultural Resource Effort
CCMP	Comprehensive Conservation and Management Plan
CES	Cooperative Extension System
CIB	Center for the Inland Bays
CNCP	Coastal Nonpoint Pollution Control Program (Section 6217)
COE	Corps of Engineers, United States Army
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
CZARA	1990 Coastal Zone Act Reauthorization Amendments
CZM	Coastal Zone Management
DBEP	Delaware Bay Estuary Program
DDA	Delaware Department of Agriculture
DelDOT	Delaware Department of Transportation
DGA	Delaware General Assembly
DHSS	Department of Health and Social Services
DIB	Delaware Inland Bays
DIBEP	Delaware Inland Bays Estuary Program
DNREC	Department of Natural Resources and Environmental Control, Delaware
DPI	Delmarva Poultry Industry, Inc.
DSPO	Delaware State Planning Office
E.O.	Executive Order
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ERES	Exceptional Recreational or Ecological Significance
FEMA	Federal Emergency Management Agency
FSA	Farm Service Agency
FTE	Full Time Equivalent
FY	Fiscal Year
GIS	Geographic Information System
GTFIB	Governor's Task Force on the Inland Bays
HUA	Hydrologic Unit Area
IAD	Institutional Analysis and Development
IBMC	Inland Bays Monitoring Committee
IBRI	Inland Bays Recovery Initiative
IBSG	Inland Bays Study Group
IGM	Intergovernmental Management
IRS	Internal Revenue Service
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NEP	National Estuary Program
NEPPS	National Environmental Performance Partnership System
NGO	Nongovernmental Organization
NOAA	National Oceanic and Atmospheric Administration
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service, USDA
OSDS	Onsite Sewage Disposal System
OWOW	Office of Wetlands, Oceans and Watersheds, EPA

RARE	Regional Applied Research Effort
SAV	Submerged Aquatic Vegetation
SCAT	Sussex County Association of Towns
SCD	Sussex Conservation District
SCS	Soil Conservation Service
SGP	Sea Grant Program
SOB	Save Our Bays
STAC	Science and Technical Advisory Committee
TMDL	Total Maximum Daily Loading
USDA	United States Department of Agriculture
USGS	United States Geological Service
USFWS	United States Fish and Wildlife Service
WWW	World Wide Web

The Delaware Inland Bays Program: Using a Nonprofit Organization to Implement a CCMP

Abstract This case study examines the Delaware Inland Bays Estuary Program's (DIBEP's) efforts to develop and implement a Comprehensive Conservation and Management Plan (CCMP) pursuant to the U.S. Environmental Protection Agency's (EPA's) National Estuary Program (NEP). These efforts were then assessed using evaluative criteria provided by the National Academy of Public Administration. The analysis concluded that the DIBEP's efforts improved the governance of the watershed by developing a new nonprofit organization, the Center for the Inland Bays (CIB). The CIB is a collaborative organization that improved the capacity for governmental and nongovernmental actors to address the problems in the watershed. The CIB is also involved in developing three tributary strategies that will be used to implement a total maximum daily loading (TMDL) for the watershed. However, the actors have had some difficulty in moving beyond a project-based approach to one that systematically addresses specific environmental problems. The CIB has also had limited success in addressing problems due to residential development and agriculture because it is designed to serve as a neutral forum. Moreover, some respondents reported being dissatisfied that the CIB has not become a strong advocate for addressing these problems.

Introduction

This case study examines the Delaware Inland Bays Estuary Program's (DIBEP's) efforts to develop and implement a Comprehensive Conservation and Management Plan (CCMP) for the watershed. The DIBEP is one of 28 programs¹ in the National Estuary Program (NEP)² administered by the United States Environmental Protection Agency's (EPA's) Office of Wetlands, Oceans, and Watersheds (OWOW).³ The NEP is a voluntary program that provides federal funds (with a 25 percent nonfederal match) and technical assistance to develop a CCMP. Each CCMP is required to address three general issues: water and sediment quality; living resources; and, land use and water resources. Each CCMP must also address other appropriate problems.⁴ The general objective of each CCMP is to improve the management of water quality and living resources in an estuary.⁵ While the NEP relies on a relatively well funded and structured approach to developing a CCMP, individual estuary programs have the flexibility to determine how their plans will be implemented and financed. The NEP was not intended to develop a new program. Rather, it was designed to work within the existing institutional framework of federal, state, regional, and local environmental protection and natural resource management programs.⁶

Each estuary program is required to create a Management Conference that will supervise the development of the CCMP and establish and support a program office or its equivalent. The Management Conference is a collection of advisory and decision making committees, which contain appropriate federal, state, and local government officials, representatives of the scientific and academic community, industry representatives, and concerned members of the general public.⁷ While the management conference structure varies among the programs, most estuary programs use a policy committee,⁸ management committee,⁹ science and technical advisory

committee (STAC), and citizens advisory committee (CAC).¹⁰ The objective of the Management Conference is to:

- Stimulate the transfer of scientific, technical, and management experience and knowledge among management conference participants
- Enhance the general public's and the decisionmaker's awareness of the environmental problems
- Provide opportunities to discuss and propose solutions to environmental problems
- Provide a way to synthesize input in decision making processes
- Provide a forum to build partnerships and obtain commitments necessary to implement the CCMP¹¹

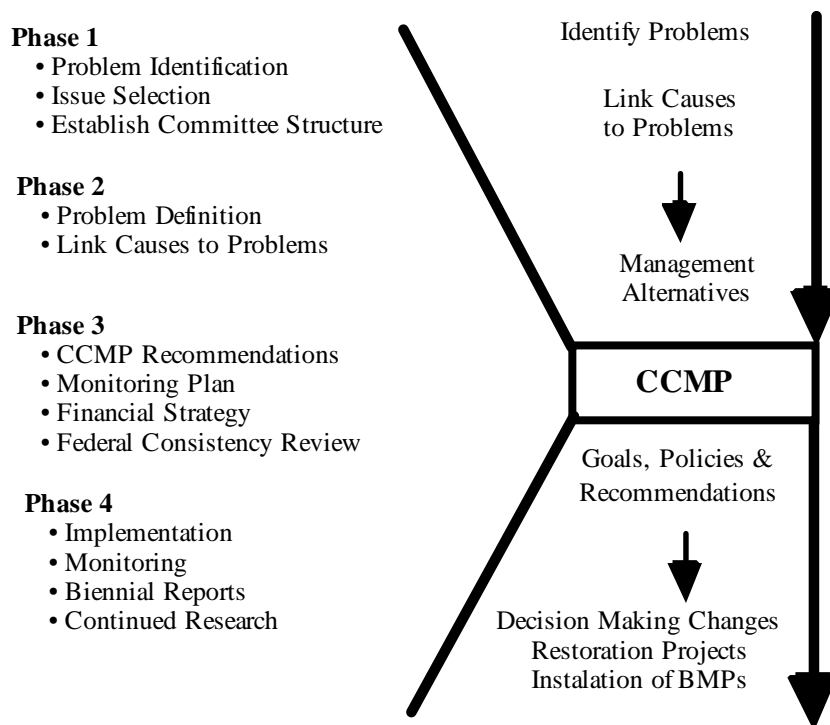
The Management Conference participants are expected to use a structured planning process¹² that is designed to satisfy the seven statutory purposes contained in Section 320 of the Water Quality Act of 1987:

- Assess trends in the estuary's water quality, natural resources, and uses
- Identify causes of environmental problems by collecting and analyzing data
- Assess pollutant loadings in the estuary and relate them to observed changes in water quality and natural resources
- Recommend and schedule priority actions to restore and maintain the estuary and identify the means to carry out these actions (the Comprehensive Conservation and Management Plan or CCMP serves this purpose)
- Ensure coordination on priority actions among federal, state, and local participants in the management conference
- Monitor the effectiveness of actions taken under the CCMP
- Ensure that federal assistance and development programs are consistent with the goals of the plan¹³

The planning process consists of series of interrelated federally mandated steps that emphasize problem definition, provide flexibility in issue selection, and promote rational, watershed-based planning [Figure 1].¹⁴ The programs are also expected to employ whatever forms of information gathering, public education, and public involvement needed to develop consensus on management actions and ensure the CCMP's implementation.¹⁵ Each estuary program is also encouraged to take early action where problems and solutions have been identified and implement action plan demonstration projects (APDPs), which test, on a small scale, the effectiveness of strategies and technologies that may become part of the CCMP.¹⁶ It should be noted that the planning process is intended to be iterative in nature with problems continually redefined and the development of a CCMP often begins prior to the completion of the characterization phase.¹⁷

This planning process culminates in the development of a Comprehensive Conservation and Management Plan (CCMP) for the EPA's approval. The CCMP contains action plans that address the priority problems identified by the management conference. It also identifies lead agencies for implementation activities, the sources of implementation funding, and a schedule for implementation. The CCMP must also include a federal consistency report and plans for its

Figure 1: The NEP's Planning Process



Modified from: Mark T. Imperial and Timothy M. Hennessey, "An Ecosystem-Based Approach to Managing Estuaries: An Assessment of the National Estuary Program," *Coastal Management* 24 (no. 1, 1996): 121.

coordinated implementation. A monitoring plan that can be used to evaluate the effectiveness of implementation activities is also required.¹⁸

The EPA provides limited implementation funding, approximately \$300,000 per year, for CCMP implementation, which goes primarily to maintaining a small core staff and a program office. Accordingly, the challenge for each estuary program is to develop an effective implementation structure that can monitor and coordinate implementation efforts and leverage or develop the resources necessary to support these activities.¹⁹ The EPA provides each estuary program with a great deal of flexibility in these efforts and monitors progress through the approval of annual work plans and requires each estuary program to undergo a Biennial Review that examines implementation efforts.²⁰

Objectives of this Case Study

This case study examines the development of the Delaware Inland Bays Estuary Program's (DIBEP's) Comprehensive Conservation and Management Plan (CCMP) and its recommendations for addressing nutrient loadings and protecting, restoring, and managing

habitat. The report begins with a brief discussion of the methods used to collect and analyze the data and the literature used to frame and guide our inquiry. The following section examines the planning environment including the Delaware Inland Bays (DIB) ecosystem, the nature and extent of the environmental problems affecting the watershed, the institutional arrangement governing the watershed, and the history of watershed planning in the region. The next section examines the development of the DIBEP and its CCMP. This will be followed by a discussion of the Center for the Inland Bays (CIB), which is a collaborative nonprofit organization created to oversee the CCMP's implementation. These activities are then assessed using evaluative criteria provided by the National Academy of Public Administration. The criteria are described in more detail in our final report entitled *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*. The case study also briefly discusses an additional innovation that may be of interest to the Academy in this or future projects, the Delaware Department of Natural Resources and Environmental Control's (DNREC's) Whole Basin Management initiative. This discussion is contained in Appendix C of this report.

Methods

This case study was developed using systematic and generally accepted methods of qualitative research. Qualitative approaches²¹ are often recommended when trying to understand how a process occurs or to examine complex relationships between decision-making processes, physical settings, community characteristics, stakeholders' interests, existing institutional arrangements, availability of resources, and the capacities of state, regional, and local actors.²² As a result, qualitative approaches tend to be descriptive and focus on explaining why a process is, or is not, effective and how different contextual factors influence the success of that process.

Three distinct streams of research provide the theoretical foundation for guiding our inquiry, identifying potential cause and effect relationships, and making recommendations to the Academy. The first line of research is environmental policy research on place-based or community-based management programs, which includes the growing research on ecosystem-based management and watershed management as well as the literature on integrated environmental management, integrated coastal zone management, and adaptive management. There is also great deal of environmental policy research in diverse areas such as collaborative decision making, stakeholder involvement and public participation, and the role of science in the policy process that informed our assessment. Unfortunately, this literature often ignores or downplays the administrative and institutional challenges associated with developing and implementing watershed management programs.²³ Accordingly, the second stream of research is the growing public administration literature on intergovernmental management (IGM) and networks, which is broadly defined here to include the literature on policy formation and implementation, interorganizational theory, policy networks, social networks, and federalism. The final line of research is the institutional analysis literature. In particular, the study draws upon the Institutional Analysis and Development (IAD) framework developed by Elinor Ostrom and her colleagues.²⁴ Of related interest is research on assessing implementation "success" and measuring institutional or network performance. A more detailed review of this literature can be found in Appendix A of our final report *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*.

Data was collected from several sources. Utilizing different data sources is important because it allows investigators to use a strategy of triangulation to improve the validity of our findings.²⁵ Documents and archival records were an important source of data. A bibliography of these materials can be found in Appendix C of our final report *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*. Field interviews with 54 individuals representing various organizations were the second source of data. The interviews were confidential and recorded on tape to ensure the accuracy of the data collected. Given the controversial nature of evaluation findings, steps were also taken to protect the identity of our informants. Follow-up telephone interviews were conducted with individuals who could not be reached in the field while email and telephone inquiries were used to clarify responses from the field interviews and to obtain additional information. The final source of data was direct observation of various activities. The steps taken to collect and ensure the validity of this data and its analysis are documented in Appendix B of our final report entitled *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*.

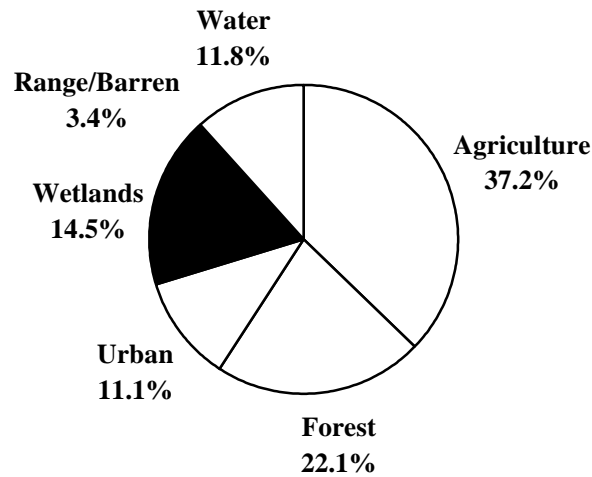
Systematic qualitative techniques (e.g., coding) were used to analyze these data. Codes were derived both inductively and deductively from the data and generated based on a start list derived from previous research. As coding continued, patterns emerged and codes were used to dimensionalize concepts. When coding the data, quotes and short vignettes were identified to add context to the case studies. As the analysis continued, tables, figures, matrices, and network displays were used to identify trends and make observations.²⁶ The basic approach was one of synthesizing interpretations and looking for themes that cut across the cases.²⁷ These comparisons (i.e., cross-case analysis) helped deepen our understanding of this case and allowed us to determine the extent to which the findings extended beyond individual cases.

To ensure the validity of the findings, the strategy of triangulation was used. Triangulation uses independent measures derived from different data sources to support, or at least not contradict, a research finding. The analysis also explored potential rival explanations for the findings and their consistency with the data. Arguments and alternative explanations were compared with one another to identify logical inconsistencies.²⁸ The chain of events was then examined to help determine causality. In some cases, this involved developing detailed timelines. Potential threats to the validity of the findings were then analyzed.²⁹ Additional steps were taken to address the particular threats to the validity of the findings created by our past involvement with the actors in this case [See Appendix B of the final report].

The Planning Environment

In order to understand the development and implementation of the CCMP for the Delaware Inland Bays (DIB) watershed, it is important to have some familiarity with the planning environment. The following sections discuss the Inland Bays ecosystem, the nature and extent of the environmental problems affecting the ecosystem, the institutional framework of federal, state, and local government programs that manage these resources, and the previous history of watershed planning efforts.

Figure 2: Land Use in the Delaware Inland Bays Watershed

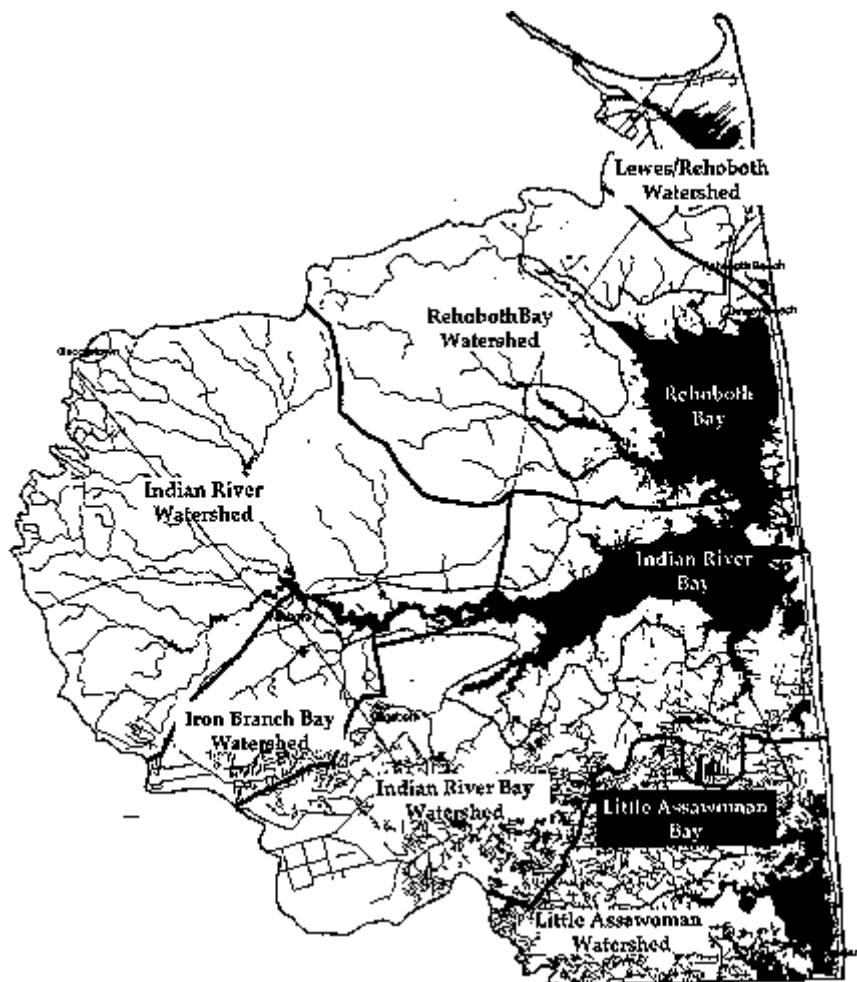


The Delaware Inland Bays Ecosystem

The Inland Bays are located along the southeastern coast of Delaware. The Delaware Inland Bays (DIB) and their tributaries cover about 32 square miles and drain a 300 square mile watershed located entirely within Sussex County, Delaware.³⁰ Agricultural lands accounted for approximately 37 percent of the watershed, while forest (22 percent), urban (11 percent), wetlands (14.4 percent), range/barren (3.4 percent), and water (11.7 percent) account for the rest of the area [Figure 2].³¹ Since 1982, farmland area decreased more than 10 percent through conversion to residential and commercial development. Historically, Sussex County was predominantly a rural, agrarian community. However, improved highway access beginning in the 1950s and 1960s increased accessibility of the region's beaches and estuaries, which in turn spawned increased residential and tourism development.³² Presently, agriculture, tourism, construction, and manufacturing are the main sources of employment.³³

The Inland Bays consist of three interconnected bodies of water – Indian River Bay, Little Assawoman, and Rehoboth Bay. Rehoboth and Little Assawoman Bays are estuaries built on sand bars while Indian River Bay is a drowned river valley [Figure 3]. The Inland Bays are a unique, productive biological resource where oceanic saline water and freshwater meet. The bays are shallow with an average low-water depth of between three and eight feet. There is also some evidence that the bays are getting shallower due to sedimentation and other factors. Freshwater enters the bay through tributaries, surface runoff, and groundwater discharges.³⁴ About 6 to 9 million gallons of groundwater enter the Inland Bays daily. Nutrient laden groundwater discharges are an important source of nutrients to the Inland Bays and the residence time for groundwater is estimated to be between 15 and 40 years, which means that nutrients that enter the groundwater today might not enter the Inland Bays for up to 40 years. The tidal range is around three feet but tidal flushing varies considerably throughout the watershed because of

Figure 3: The Delaware Inland Bays Watershed



restricted connections such as the Lewes and Rehoboth Canal, Roosevelt Inlet, and Assawoman Canal.³⁵ As a result, the eastern end of Indian River Bay and the southern side of Rehoboth Bay are well flushed twice a day. Other waters are replaced at a much slower rate. For example, residence times average 90 – 100 days for many parts of Indian River Bay and 80 days for Rehoboth Bay and no direct estimates are available for Little Assawoman Bay.³⁶

This natural variability gives rise to a rich biological environment dependent on tidal influence.³⁷ The Inland Bays are important spawning and nursery grounds for many species of fish including the summer flounder, bluefish, American eel, blue crabs, and hard clams. There is a large recreational fishery consisting primarily of summer flounder, bluefish, and weakfish and the bays are also home to a sizable offshore recreational sport fishing fleet. The Inland Bays also support a commercial hard clam and blue crab fishery. The wetland areas are home to waterfowl, migratory birds, shore birds as well as game and nongame wildlife. The region is

also home to the Peregrine Falcon, Bald Eagle, and Osprey. However, much of this habitat has been lost or degraded as a result of residential and commercial development. Increasing resource use is causing additional environmental problems and user conflicts. Moreover, the poorly-flushed nature of the Inland Bays make them particularly susceptible to eutrophication due to excessive nutrient loadings.

Problems Affecting the Delaware Inland Bays

Like many mid-Atlantic estuaries, the Inland Bays are affected by two priority problems: eutrophication due to excessive nutrients and habitat loss or modification due to erosion, sedimentation, and dredge and fill activities.³⁸ Overall, the Inland Bays are highly eutrophic with a clear trend towards nutrient enrichment over the last 40 years. For example, using a classification scheme developed for the Chesapeake Bay, the Inland Bays ranked higher than the 32 sub-estuarine systems in Chesapeake Bay with Middle and Upper Indian River Bay being more nutrient enriched than any segment of Chesapeake Bay.³⁹ Eutrophic conditions have caused nuisance algae blooms (sea lettuce and other species), fish kills, large daily swings in dissolved oxygen, loss of submerged aquatic vegetation (SAV) and phytoplankton blooms, some of which are potentially toxic such as red tides.⁴⁰ *Pfiesteria* has also been detected in Indian River and Bay, although not in its harmful life stages.⁴¹ However, *Pfiesteria* has been linked to massive fish kills in Indian River as far back as 1988.⁴²

The main sources of nutrient loadings in the watershed are septic systems, sewage treatment plants, stormwater runoff, and agricultural operations. As indicated in Table 1, the sources of nutrients vary among the three sub-watersheds. Little Assawoman Bay and Indian River Bays are classified as degraded to healthy while Rehoboth Bay water quality is characterized as fair to healthy.⁴³ Because of the long residence times, poor flushing, high turbidity in the upper portions of the tributaries, and a large influx of summer tourists, the water quality declines between Memorial Day and Labor Day. While the water quality data and trends are unclear, it appears that over the past 20 years nutrient enrichment has slowed.⁴⁴ In part, this can be attributed to increased tidal flushing as a result of the stabilization of the Indian River Inlet.⁴⁵ Upgrades to sewage treatment plants, expansion of central sewers and the removal of septic systems, and use of best management practices (BMPs) on agricultural lands also reduced nutrient loadings.

Approximately nine square miles of wetlands surround the Inland Bays and provide important habitat. Historically, much of the wetland habitat in the Inland Bays watershed has been lost as a result of deforestation and wetland alteration. Between 1938 and 1973, 2,074 of the 8,646 acres (24 percent) of tidal wetlands were destroyed as a result of logging, dredging, filling, and sedimentation.⁴⁶ This resulted in the loss of permanent habitat and temporary feeding, nesting, and foraging grounds for wildlife.

The Inland Bay's aquatic habitats have also undergone drastic modifications. Prior to 1930s, the Bays were mostly freshwater as the inlet to the ocean would periodically open and close and migrated along the barrier island. However, between 1935 and 1937, the main link to the ocean closed, destroying marine and estuarine organisms and their habitats which were then replaced by freshwater organisms and habitat. By 1940, a new permanent channel to the ocean,

Table 1: Sources of Nutrient Inputs to the Delaware Inland Bays

Sources	Indian River Bay		Rehoboth Bay		Assawoman Bay	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Boating	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Forest	11.0%	19.2%	7.4%	9.4%	6.7%	19.5%
Rainfall	6.2%	8.6%	8.8%	6.9%	12.8%	11.5%
Septic Tanks	16.0%	9.3%	11.2%	3.8%	14.6%	5.6%
Urban	9.8%	8.6%	11.7%	5.9%	11.2%	10.8%
Point Sources	12.5%	15.0%	27.3%	56.9%	0%	0%
Agriculture	44.6%	39.4%	33.0%	17.0%	54.7%	52.6%

Source: Delaware Inland Bays Estuary Program (DIBEP), *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix F, Characterization Summary* (Lewes, DE: Center for the Inland Bays, June 1995), 2-35

the Indian River Inlet, was created and provided the first stable connection to the ocean. This created a permanent estuary that could support a number of estuarine dependent species.

However, the cross-sectional area of the inlet has increased several times since 1939, most notably in 1941, 1969, and 1988 as a result of dredging and stabilization work performed by the Army Corps of Engineers (COE).⁴⁷ As the cross-sectional area increased, so to has the tidal surge passing through the inlet. This increased the tidal range and increased the volume of saline ocean water flowing into the system. This has had a profound effect on the Inland Bays ecosystem as it is now largely a marine-dominated system.⁴⁸ Dredging and deepening of navigation channels also contributed to the migration of salt water further into the tributaries. Traditional spawning runs of anadromous fish such as the alewife, herring, shad, and striped bass have declined as a result of this loss in freshwater habitat. The oyster, soft clam, and bay scallop fisheries have also declined for various reasons including disease, changing environmental conditions, and over harvesting. Despite these changes, the Inland Bays remain an important nursery and grow area for many estuarine dependent species such as menhaden, spot, and winter and summer flounder. Hard clams and blue crabs are the only shellfish species of commercial or recreational importance that are now found in the Inland Bays. Of the thirty square miles of the Inland Bays classified as shellfish waters, only 19 square miles are approved or conditionally approved for harvesting due to bacterial contamination.⁴⁹

The Inland Bays have undergone other hydromodifications that altered habitats. Beginning in 1816, public drainageways known as tax ditches were dug to drain wetland areas. While it is unclear how much wetland area was lost, there are currently 225 miles of ditches affecting some 35,000 acres. The tax ditches also serve as conduits that increase the flow of nutrients to surface waters.⁵⁰ Sedimentation resulting from upland erosion is also a problem that has reduced flushing in some areas and erosion is further exacerbating nutrient loading problems.⁵¹ There are also approximately 26 miles of dead-end lagoons or finger fill canals. The construction of these “hardened” shorelines destroyed wetland areas. The canals are also

poorly flushed and low-oxygen or anoxic waters and “red tides” have caused a number of fish kills.⁵²

Eutrophication and habitat loss and degradation are the result of two factors. The first is the rapid pace of population growth and development, which will continue into the foreseeable future. The second is the nature and scope of the agricultural operations in the watershed. Both of these activities are discussed briefly in the following sections.

Land Development

Sussex County is a large, rural county encompassing the southern half of the state and covers 2,429 square km.⁵³ The western portion of the county is primarily rural and agricultural. The Inland Bays watershed covers much of the eastern third of the county. The seaward side of the watershed is heavily developed with beachfront resort communities with large seasonal influxes of affluent tourists during the summer months.⁵⁴ The recreation and tourism industry generates more than \$250 million annually.⁵⁵ As a result, there is heavy recreational use of the region’s waterways and beaches. The inland portion of the watershed is more rural in character and is largely oriented towards an agricultural community and supports much of the watershed’s year round residents. Because of the relatively small year round population and the rural character, it is a tight knit community that places high value on personal relationships and is often guarded when it comes to dealing with “outsiders”. The county’s year round residents also include a sizable low-income and fixed income (e.g., retirees) population with a median household income in 1993 of \$28,722, which is significantly lower than the state’s \$36,002.⁵⁶

Like many coastal counties, Sussex County experienced explosive growth over the last 30 years. The County’s natural amenities and moderate climate stimulated second home development and a large tourism industry. With the completion of the Chesapeake Bay Bridge and an improved highway system, the County became readily accessible by automobile in the early 1960s to urban centers in Pennsylvania, Maryland, the District of Columbia, New York, New Jersey, and Virginia.

Growth in the Inland Bays watershed has consistently outpaced the national average. The population of Sussex County increased from 80,356 in 1970 to 131,000 in 1998 (63 percent) and increased more than 23 percent between 1990 and 1998 alone.⁵⁷ The population is expected to increase an additional 55 percent by 2020.⁵⁸ The number of households is projected to increase from 43,483 in 1990 to 73,282 in 2020.⁵⁹ In 1996 alone, 1,491 building permits were issued and 95.9 percent of them were for residential dwellings.⁶⁰ The value of this new construction in 1996 was estimated to be over \$161 million.⁶¹ Up until the mid-1990s, most of the growth occurred in the coastal communities and the coastline of the Inland Bays and its tributaries.⁶² The large seasonal population which can increase the population by more than 200 percent on peak summer weekends combined with the fast pace of development and shifting demographic patterns make it difficult to get accurate population numbers.⁶³ Some estimates put the seasonal population at 120,000 with a year round population of more than 50,000 with an average population density of 126 people per square mile.⁶⁴

In the mid-1990s, the growth pattern in Sussex County changed. The number of new building permits inside and outside of the watershed began to balance out as growth along the highway corridors and other areas of the county increased. Moreover, the watershed is filling in now that valuable coastal property is developed. Development has shifted inland away from beachfront areas that are largely built out. Development has also shifted to moderately priced homes, large subdivisions, and golf course communities, many of which serve a growing year round population that includes many retirees who are attracted to the area because of its natural environment and low property taxes that have not increased for nine consecutive years.⁶⁵ There has also been growth in the region's Hispanic population, which mostly consists of immigrants attracted by the availability of jobs in the construction, agricultural, and service sectors.

The rapid pace of development caused a number of environmental problems. Wastewater treatment plants serve approximately 28 percent of the County's population are an important source of nutrient discharges.⁶⁶ For example, the Rehoboth sewage plan accounts for 52 percent of the phosphorus that enters that bay.⁶⁷ More than 18,000 onsite sewage disposal systems (OSDSs) are permitted in the basin and discharge as much as 480,000 pounds of nitrogen and 250,000 pounds of phosphorus to soils annually with much of the nitrogen entering groundwater. This is important because 100 percent of the region's drinking water and irrigation water coming from groundwater. More than 23 percent of all wells in the basin now have nitrate levels that exceed the drinking water standard (10 mg/l).⁶⁸ This nutrient rich groundwater is also discharged to surface waters.⁶⁹ Bacterial loadings have also led to significant closures in shellfish harvesting waters in Rehoboth Bay (2,470.1 of 9,994.7 acres), Indiana River Bay (4,145 of 9,957.2 acres), and Little Assawoman (933.7 of 2,277.2 acres).⁷⁰ Development has resulted in the loss and alteration of sensitive habitat and increased other nonpoint sources (NPS) of pollution such as stormwater runoff. The large influx of boaters and resources users during the summer months has led to degraded habitat, increased turbidity in shallow and poorly flushed areas, and causes user conflicts.

Population growth has had other impacts as well and increased demand for other county services (e.g., libraries, transportation, etc.). County officials have generally been supportive of growth and development because it increases the tax base allowing expanded services without a corresponding increase in property taxes. In many respects, development in the Inland Bays watershed has been a "cash cow" that funds county services in other rural and impoverished areas. Much of this growth has been in unincorporated areas of the county adjacent to existing beachfront communities that are now experiencing increased demand on their infrastructure and services with no corresponding increase in their tax base. The development and lack of coordination with the Delaware Department of Transportation's (DelDOT's) decisions regarding road construction have caused major traffic problems. As a result, many residents feel that the development and all of its associated social and environmental impacts are degrading the quality of life in the watershed. As one respondent commented: "The charm is gone. All you get here now is people being impatient, rude, and nasty."

Agriculture

The other major source of nutrients to groundwater and surface water is agricultural activities, which continue to be the major sources of employment for year round residents in Sussex County. There are 1,515 farms in the county covering 305,000 acres with approximately 61 percent of farm operators reporting farming as their principal occupation.⁷¹ Many of the farms are relatively small with 50 percent covering less than 50 acres and only 10 percent are over 500 acres.⁷² This is due to the presence of a large number of poultry growing operations, which are often part-time or supplemental income operations that are not land intensive. In 1992, Sussex County ranked 28th nationally with \$408 million in agricultural sales and 46th in average sales per farm of \$269,114.⁷³ The major portion of these sales, 85.5 percent, came from livestock and poultry products while 14.5 percent came from crops.⁷⁴

Most agricultural activity is connected to the broiler hen industry. The Delmarva Peninsula is home to one of the largest broiler hen industries in the world. In 1998, there were approximately 2,600 growers and 6,100 poultry houses on the Delmarva Peninsula.⁷⁵ From 1962 to 1998, industry growth and the demand for new chicken houses have remained constant.⁷⁶ Over 609 million broiler hens were produced on the Delmarva Peninsula in 1998, which equates to 3.14 billion pounds of chicken and over 700,000 tons of manure.⁷⁷ It is a \$1.6 billion business that employs some 21,000 individuals directly.⁷⁸ It is a highly competitive industry with growers in the Inland Bays watershed competing with others on the Delmarva Peninsula and growers in Arkansas, Georgia, Alabama, North Carolina, and Mississippi. Production costs tend to be lower in other areas of the country because of lower labor and heating costs. However, the growers on the Delmarva Peninsula have a geographic advantage, they are located closer to the population centers along the eastern seaboard. Net returns to poultry processors seldom top more than 10 cents a pound and in some years profits have been measured in the tenths of a cent.⁷⁹ In Delaware, farmers typically earn between 3.5 and 20 cents a bird depending on market conditions.⁸⁰ In recent years, farmers averaged around 16 cents a bird.⁸¹

The industry is an important part of the region's culture. In fact, the modern broiler hen industry started in the Inland Bays watershed in Ocean View, DE. In 1923, Cecile Long Steele ordered 50 chicks to replace the losses in her laying flock. She was sent 500 chicks by accident. Instead of returning the chicks, she raised them and sold them to a local buyer for a large profit.⁸² The next year she ordered 1,000 chicks and a new industry was born. By 1928 there were approximately 500 growers and residents in Southeastern Sussex County had found a new source of badly needed income. Over the years, the poultry industry has prospered because it offered stable incomes while crop farming was often unpredictable with big highs and lows.

The industry has had a significant impact on the economy and culture of the Delmarva Peninsula. The industry drastically altered agricultural patterns in the region and even ended up changing the nation's eating habits.⁸³ Sussex County is home to this multi-billion dollar industry and produces more than 250 million birds annually, nearly twice the number of the number two county, Cullman County, Alabama. This equates to approximately 8 percent of the broilers produced annually in the United States.⁸⁴ Moreover, nearly half of the jobs in Sussex County have direct or indirect ties to poultry growing and processing with approximately 7,000 people working in the county's 12 processing facilities, feed mills, and related plants.⁸⁵

It is estimated that approximately 82 million chickens are produced in the Inland Bays watershed annually.⁸⁶ Production also varies within the watershed with 2,904 birds/acre of cropland in the Little Assawoman watershed compared to 954 birds/acre of cropland in Indian River Bay and 248 birds/acres of cropland in Rehoboth Bay.⁸⁷ The growers vary in size from large corporate growers to small “mom and pop” operations that might raise the chickens for supplemental income. Not much land is required for the poultry growing operations. However, many growers also raise corn and soybeans that are typically used for chicken feed.

It is important to understand the way the industry is organized. Each grower contracts with one of the five integrators such as Townsends, Tyson, or Purdue and is guaranteed a minimum amount, no matter how the flock turns out. Each of these vertically integrated firms controls all aspects of production. The integrators own the birds and the growers are supplied with everything they need including chicks, feed, vitamins, bedding material, heating oil, and medicine as well as general supervision and technical assistance. Integrators also take care of the catching and delivery to the plant for processing and work with growers to guarantee loans and provide cost-share funds. Broiler chickens reach maturity in approximately 7 weeks while roasters take about 10 weeks. The grower is then paid an agreed upon price and the integrator processes, markets, and distributes the birds worldwide. The grower is left to dispose of the two things the integrator does not want – dead birds and chicken manure. Manure disposal is an important economic problem for the grower because if they pay to truck their waste more than 5 to 7 miles, their profits might disappear.⁸⁸ Accordingly, manure is often used on their adjacent farmland while dead birds are composted.⁸⁹ Otherwise, organizations such as the Delmarva Poultry Industry, Inc. (DPI) help match growers with one of the 320 farmers in the watershed that are in need of fertilizer.

Manure disposal is also an important ecological problem. The cumulative application of manure (i.e., nutrients) to farmland over the decades have impacted groundwater and surface waters and are a major cause of eutrophication problems in the Inland Bays. One estimate suggested that the manure generated from Delaware’s 257 million broiler chickens contained as much phosphorus as the waste from 7.8 million people and as much nitrogen as 2.5 million people per year. As many as 10 million dead chickens also had to be disposed of on an annual basis.⁹⁰ A 1997 report by the University of Delaware concluded that as a result of the cumulative effect of these nutrient loadings, 92 percent of the farm fields in Sussex County are so soaked with phosphorus that they should receive no more fertilizer for years. The USDA also ranked Sussex County 11th among all counties in excess phosphorus.⁹¹ As a result, instead of staying attached to soil particles, phosphorus is beginning to act like nitrogen and become mobile because the soils are so saturated and changes the requirements for BMPs.

Estimates of the magnitude of this nutrient “problem” vary and the results of research examining nutrient loadings from agricultural activities have become highly politicized with organizations such as the DPI and the Farm Bureau challenging researchers' assumptions and conclusions. The DPI has even funded its own research examining the nutrient loading from poultry growing operations. In essence, the problem is a large mass balance problem that covers the entire Delmarva Peninsula. The quantity of manure generated by the poultry industry on the

Delmarva Peninsula is simply greater than what can be consumed in fertilizer on agricultural operations and it is not cost-effective to ship it long distances.

Institutional Framework Managing the Delaware Inland Bays Watershed

A number of organizations manage the Inland Bays watershed. To simplify the discussion, only the central actors are discussed. These include: Delaware Department of Natural Resources and Environmental Control (DNREC); Sussex Conservation District (SCD); University of Delaware; agricultural interest groups; and local government. A number of other organizations also played important roles in either the development or the implementation of the CCMP such as the U.S. Environmental Protection Agency (EPA), Sierra Club, and Audubon Society. Given the rural nature of the community, certain individuals also played important roles. The activities of these and other actors will be noted as appropriate.

Department of Natural Resources and Environmental Control (DNREC)

The Delaware Department of Natural Resources and Environmental Control (DNREC) implements a wide range of delegated EPA programs in various areas such as air quality, water quality, and hazardous waste. A number of these programs have been involved to varying degrees in the development or implementation of the DIBEP's CCMP. The Section 319 Nonpoint Source (NPS) Management Program administers a grant program that has provided funding to help install best management practices (BMPs).⁹² The Division of Soil and Water Conservation implements the state's erosion and stormwater control program, however, most of the permitting activities have been delegated to other actors such as the SCD and the Delaware Department of Transportation (DelDOT).⁹³ The Division of Parks and Recreation manages the park facilities in the DIB watershed. It also administers the state's Open Space Program created in 1990.⁹⁴ The Division of Water Resources has perhaps been most involved and administers a number of regulatory programs for point source discharges, septic systems, marina construction and operation and maintenance⁹⁵, dredge and fill operations⁹⁶, and alterations to wetlands and submerged tidal lands. It also staffed the DIBEP throughout the planning process.⁹⁷

The DNREC has actually been involved in two estuary programs, the DIBEP and the Delaware Bay Estuary Program (DBEP). Due to these and other experiences, DNREC has embraced the watershed approach and in recent years has been more receptive to the use of collaborative approaches to addressing environmental problems. This is evidenced by their continued commitment to the two NEPs, the development of an internal watershed planning initiative called Whole Basin Management⁹⁸, and the development of the Pea Patch Island Special Area Management Plan⁹⁹ pursuant to the state's federally approved coastal zone management (CZM) program.¹⁰⁰ The DNREC has also developed a conditionally approved Section 6217 Coastal Nonpoint Pollution Control Program (CNPCP) pursuant to the 1990 Coastal Zone Act Reauthorization Amendments (CZARA) and merged it with the Section 319 NPS Management Program.¹⁰¹ More recently, as a result of a lawsuit by the American Littoral Society and the Sierra Club, DNREC developed a total maximum loading (TMDL) for the DIB watershed.¹⁰² DNREC is now working with the DIBEP in a collaborative, community based effort using tributary teams to develop pollution control strategies for the three subwatersheds that will implement the TMDL's recommendations. DNREC has embraced performance-based

management and increased their focus on customer satisfaction.¹⁰³ It was also the first state in EPA Region III to participate in the National Environmental Performance Partnership System (NEPPS).¹⁰⁴ DNREC expects the Whole Basin Management initiative will facilitate future performance-based management and data integration efforts while providing information to support future watershed planning efforts [For more discussion of the Whole Basin Management initiative see Appendix C].

Sussex Conservation District (SCD)

The Sussex Conservation District (SCD) was created in 1943 and has received numerous national awards for its programs and conservation efforts.¹⁰⁵ The SCD administers a variety of programs designed to promote the conservation, wise use, and development of soil, water, and related resources. These programs are designed to conserve natural resources, assist landowners in determining the capability of soil and water resources, and promote resource development within these capabilities. The SCD also undertakes efforts to inform, instruct, cooperate with, and provide assistance to all landowners, organizations, agencies, and groups in matters pertaining to the conservation of Sussex County's natural resources. Moreover, unlike many conservation districts, the SCD has its own staff and does not rely exclusively on the United States Department of Agriculture's (USDA's) Natural Resource Conservation Service (NRCS) for staff support.

The SCD's voluntary programs are typically designed to implement BMPs and provide technical assistance and education to landowners (e.g., farmers).¹⁰⁶ The SCD often works closely with the University of Delaware's Cooperative Extension System (CES) and the NRCS to implement these programs. The SCD also implements a regulatory program to administer Delaware's erosion and stormwater control regulations for Sussex County. The regulations apply to all parcels greater than 5,000 square feet and all land disturbing activities must be preceded by an approved sediment and stormwater management plan. The SCD works closely with Sussex County when it reviews and approves projects. The SCD also receives funding and technical assistance from the DNREC and is subject to periodic oversight of its permit and enforcement activities. The stormwater management program does not retrofit existing development.¹⁰⁷

University of Delaware

A number of faculty from the University of Delaware have been actively involved in the DIBEP since its inception and have served on various advisory committees and performed scientific studies for the DIBEP. Many of the faculty members involved in this and other planning efforts in the Inland Bays watershed are affiliated with the University of Delaware's Cooperative Extension System (CES), the Sea Grant Program (SGP), the College of Marine Studies, and other departments. The CES and the SGP also administer public education and technical assistance programs that supported the CCMP's development and implementation. More recently, the CES and SGP have assisted the DIBEP by serving as facilitators for the tributary teams.

Agricultural Organizations

There are a number of organizations that represent the interests of the agricultural industry or are involved in addressing environmental problems emanating from these activities. One of the major actors is the Delaware Department of Agriculture (DDA). Agriculture is the largest industry in Delaware and the DDA has a number of regulatory and nonregulatory programs and administers a farmland preservation program. The agency also administers programs designed to manage and protect the state's forests. Other agencies with programs that provide financial support and technical assistance to farmers in the watershed are the NRCS, SCD, DNREC's Section 319 NPS Management Program, and the CES. Of particular interest is the NRCS's Hydrologic Unit Area (HUA) program that provided significant funding to install BMPs during the planning process. There are also a number of nongovernmental organizations (NGOs) involved in the DIBEP and generally work to protect agricultural interests such as the Grange and Farm Bureau. The Delmarva Poultry Industry, Inc. (DPI) is a trade group represents the industry and helps to market its products. The DPI also lobbies at the federal and state level to protect the interests of the industry. It has been very involved throughout the DIBEP process, although it often questioned the link between poultry farms and degraded water quality. In recent years, DPI has set aside \$1 million to study the causes of water quality pollution in southern Delaware.¹⁰⁸ The DPI is also co-located with the CES and maintains a close working relationship with this organization. Individual farmers and poultry growers as well as representatives from the integrators are also involved in the DIBEP and the tributary teams.

Local Government

The entire watershed is located in Sussex County, Delaware. The County's budget in Fiscal Year (FY) 1999 was around \$62 million.¹⁰⁹ The county has five council members. However, only one member has a district located in the Inland Bays watershed. The county also has a county administrator who was actively involved in the DIBEP. The county's engineering department has developed considerably over the past decade as a result of growth pressures and the corresponding expansion of county services (i.e., sewers). However, the county's planning department is less developed and is largely oriented towards reviewing development projects. Typically, the county contracts out planing work such as the development of revised comprehensive land use plans. It is also important to note that in Delaware the vast majority of roads are state roads and the county does not control transportation decisions that influence growth patterns. DelDOT makes these decisions. This limits the county's ability to control this infrastructure investment and complicates its ability to manage traffic problems.

Sussex County also contains 25 incorporated municipalities, of which all or portions of 12 communities are located in the Inland Bays watershed. In general, Sussex County does not interfere in local issues. Local governments are also mostly islands surrounded by unincorporated areas and thus there is little direct involvement with adjacent communities. The local governments have less capacity for addressing environmental problems than the county and generally were not involved in developing the DIBEP's CCMP.¹¹⁰ Most have outdated or unsophisticated comprehensive land use plans.¹¹¹ Most of the towns have only a few full-time professional staff and lack any professional planning staff. Accordingly, elected officials typically represent the towns in various interagency processes. During the development of the

DIBEP, the towns organized the Sussex County Association of Towns (SCAT). The SCAT has provided a forum for information sharing and providing elected officials with the training they need to better manage local governments. The SCAT has also become a mechanism for enhancing local government involvement in the DIBEP's implementation efforts.

Efforts to Improve the Management of the Delaware Inland Bays

These actors have been involved in a series of watershed based planning efforts that date back to the late 1960s. In many respects, these efforts mirror the development of watershed and coastal planning in the United States [Table 2]. Understanding this history is important because these efforts had a strong influence on the development and implementation of the CCMP. The environmental problems due to increased residential development first began to attract the attention of state officials in the late 1960s. In 1967, the Delaware State Planning Office (DSPO), Sussex County, and the SCD began developing a comprehensive plan for Sussex County. In 1969, the *Comprehensive Development Plan: Sussex County Delaware* was completed and subsequently was approved by the Sussex County Council in 1970.¹¹²

In 1969, Governor Russell Peterson also held a meeting attended by representatives of various state public works and natural resources agencies to discuss the problems affecting the Inland Bays. The Governor then directed the staff to examine the factors causing ecological degradation and to recommend a program for preserving and enhancing the Bays. The product of these efforts was a report entitled *Environmental Study of the Rehoboth, Indian River, and Assawoman Bays* in 1969.¹¹³ Among other things it concluded: "The tremendous influx of summer residents, the increased populations of the towns in the basin, and the impact of the day use areas have added to the nutritional load of the bays to the extent where there is need now to be alarmed. There has to be a point of no return . . . Therefore, we should take proper steps to prevent this from happening."¹¹⁴ Much of the report focused on the problems due to shoreline development, dredging and habitat alteration, the problems resulting from point source discharges and the need for adequate wastewater treatment facilities to serve the growing population.¹¹⁵

These findings combined with the passage of the Clean Water Act (CWA) in 1972 led to several planning efforts during the 1970s that focused primarily on providing adequate waste treatment facilities. In 1975, the *Sussex County River Basin Water Quality Management Plan* was completed pursuant to Section 303(e) of the CWA. Sussex County also completed the *South Coastal Land Use Plan* pursuant to Section 205 of CWA, which was used to justify the federal construction grant money used to construct the South Coastal Regional Wastewater Treatment Plant. In 1976, Sussex County adopted a *South Coastal Land Use Plan* and county engineers, consultants, DNREC, and the SCD began work on the *Coastal Sussex Water Quality Program* pursuant to Section 208 of the Clean Water Act, which was adopted in 1978.¹¹⁶

In 1981, concerns over the deterioration of environmental and water quality in Rehoboth, Indian River, and Little Assawoman Bays led to the formation of the Inland Bays Study Group (IBSG). This effort was relatively informal and comprised mainly staff from DNREC and other state and local agencies and a few citizens. The purpose of the IBSG was to explore the development of a resource management plan for the Inland Bays.¹¹⁷ It commissioned several

Table 2: Timeline of Selected Events Related to the Governance of the Inland Bays

Date	Events/Activities
1658	First Settlement in Sussex County is in Lewes
1816	Public Drainageways (Tax ditches) began to be dug to drain wetlands
1923	Cecile Steele begins the modern broiler industry in Ocean View
1940	Indian River Inlet is stabilized
1940 - 1945	WW II stimulates demand for chicken; Black market creates opportunities for profit
1959	Townsend's is the first vertically integrated company in the region and is in the watershed
1967	280 million chickens grown on the Delmarva Peninsula
1969	Delaware State Planning office finishes the <i>Comprehensive Development Plan</i>
1970	Sussex County adopts the <i>Comprehensive Development Plan</i> ; population is 80,356
1974	DNREC delegated the NPDES program by EPA
1975	<i>Sussex County River Basin Water Quality Management Plan</i> completed
1975	<i>Sussex Coastal Land Use Plan</i> Completed
1976	<i>South Coastal Land Use Plan</i> adopted
1977	380 million chickens grown on the Delmarva Peninsula
1978	<i>Coastal Sussex Water Quality Management Plan</i> is completed
1980	Population of Sussex County is 98,000
1981	Inland Bays Study Group is established
1983	Sea Grant issues its report <i>Decisions for Delaware: Sea Grant Looks at the Inland Bays</i>
1983	Governor's Task Force on the Inland Bays is established by Executive Order
1984	GTFIB issues its final Report; Governor's Inland Bays Monitoring Committee established
1987	490 million chickens grown on the Delmarva Peninsula
1987	The Delaware Inland Bays are designated an estuary of national significance
1988	DIBEP officially becomes a member of the NEP
1988	Sussex County adopts the <i>Coastal Sussex Land Use Plan</i>
1989	Governor's Inland Bays Monitoring Committee ends; CAC is formed
1990	Population of Sussex County is 113,229; Inland Bays Recovery Initiative; HUA project
1991	Sussex Conservation District begins regulating stormwater in addition to erosion control
1992	James Farm site is donated to Sussex County
1992	Review of different versions of a draft CCMP begins
1994	Center for the Inland Bays (CIB) is established by the DGA
1994	Final CCMP is prepared and generates conflict with agriculture and EPA
1995	CCMP is approved by the EPA; CIB hires its first Executive Director
1996	TMDL lawsuit filed against the EPA and DNREC; summer Algae blooms
1997	CIB participates in its first EPA Biennial Review; algae blooms; <i>Pfiesteria</i> found
1997	<i>Sussex County Comprehensive Land Use Plan</i> is adopted
1998	Population of Sussex County is 131,000; 609 million chickens grown on the Peninsula
1998	DNREC begins developing a Whole Basin Management Plan for the Inland Bays
1998	TMDL for the Inland Bays is promulgated; work begins on Tributary Strategies
1999	CIB participates in its Second EPA Biennial Review; Restoration work at James Farm
1999	Water Use Plan adopted by CIB; Implementation begins
2020	Population of Sussex County is projected to be over 181,000

studies and produced some issue papers. In 1983, the University of Delaware's SGP issued the report *Decisions for Delaware: Sea Grant Looks at the Inland Bays*.¹¹⁸ This report examined the point and NPS water quality problems and the alteration and degradation of habitat. Significantly, the report began to draw attention to the nutrient loading to groundwater and the impact of that agricultural operations may have on nutrient loadings to the Inland Bays. The report then recommended two simultaneous strategies. First, DNREC should be required to comment and provide testimony at all Sussex County planning and zoning hearings. Second, the Governor should create a task force by executive order to develop a strategy for the comprehensive management of the watershed.¹¹⁹ Meanwhile, the IBSG joined the SGP in highlighting the importance of adequate sewage treatment, development controls, and the impacts of NPS pollution.¹²⁰ The *Delaware Conservationist*, which is published by DNREC, also produced a special issue dedicated to the problems confronting the Inland Bays.¹²¹

In response, Governor du Pont signed Executive Order Number 133 in October 1983 and created the Governor's Task Force on the Inland Bays (GTFIB) and appointed a group of individuals with diverse backgrounds representing the public and private sector. The GTFIB addressed many of the issues addressed in previous reports prepared by the IBSG and the SGP and identified some new issues. The GTFIB met 13 times and received input from 43 experts and knowledgeable citizens. The SGP was also asked to assist the GTFIB by preparing responses to a series of questions pertaining to the management of the Inland Bays.¹²² On July 4, 1984, the task force issued its final report *Protecting Delaware's Inland Bays: Charting a Course for Change*, which contained more than 45 recommendations. The report recommended the development of a sound land use plan for the area and a renewed look at the feasibility for a centralized wastewater treatment system. It also recommended a number of actions addressing problems due to shellfish closures, salt water intrusion, septic systems, wetlands alteration and habitat protection, dredging, erosion, agricultural NPS pollution, and public education. Governor du Pont then signed Executive Order to create the Inland Bays Monitoring Committee (IBMC) that would last for five years with the purpose of monitoring the actions of federal, state, and local agencies. The effort was budgeted at approximately \$200,000 a year, which paid for a DNREC staff person, some secretarial support, and funded some studies.¹²³ The effort produced annual reports on the progress towards implementing the recommendations.

The five-year collaborative effort achieved a number of notable successes and provided a foundation for the DIBEP to build upon. Almost immediately after the GTFIB's report was issued, Sussex County began work on a revised *Coastal Sussex Land Use Plan* that was completed in 1988 and later adopted zoning changes that included buffer zone requirements designed to protect the Inland Bays. The DNREC revised its regulations governing the siting and design of onsite sewage disposal systems and its submerged lands regulations. In 1988, Sussex County began requiring erosion and sediment control plans be submitted to the SCD for all proposed subdivisions and large development projects. The state established a cost-share program to help farmers implement best management practices to address NPS pollution. A number of public education and involvement activities were implemented. The state also established a research program that sponsored a number of projects designed to provide additional information on the issues raised in the GTFIB's report. Moreover, the SCD was awarded federal funding in 1986 to conduct a Coastal Sussex River Basin Study that provided

additional research funding to evaluate the need for BMPs and then was award funding to support implementation efforts.¹²⁴

The Delaware Inland Bays Estuary Program (DIBEP)

The Delaware Inland Bays Estuary Program (DIBEP) program followed on the heels of the GTFIB and the IBMC. Table 2 contains a timeline of key events in the development of the DIBEP, while a more detailed timeline can be found in Appendix A. Unlike many estuary programs, the DIBEP did not compete with other estuaries to join the National Estuary Program (NEP) through the EPA's governor's nomination process.¹²⁵ Rather, the reauthorization of the Clean Water Act (CWA) in 1987, which created the NEP, designated the Delaware Inland Bays (DIB) as one of twelve estuaries of national significance. The state then submitted a nomination package to EPA requesting to be included in the NEP.¹²⁶

The DIB's designation as an estuary of national significance was no accident. DNREC staff and other officials believed being included in the NEP would provide the funding necessary to continue the work that was currently under way as a result of the GTFIB and the IBMC. There was also the belief that this designation might help the actors to attract additional federal resources to address the problems confronting Delaware Bay and the Inland Bays. Accordingly, DNREC worked closely with Senator Roth of Delaware to lobby the EPA Region III administrator for the placement of Delaware Bay and the Delaware Inland Bays in the NEP. In addition, Senator Roth was closely involved in both Senate and House deliberations concerning the reauthorization of the CWA and was instrumental in ensuring that both estuaries were included in the final version of the statute.¹²⁷

When reading this case, it is important to keep in mind that the DIBEP was a Tier II estuary program. The DIBEP was operating in uncharted waters and faced challenges that subsequent estuary programs did not have to confront. It was also undertaking a more structured planning process than had been used by the actors in the past. There is also more diversity in the approaches that were taken to fulfill the NEP's requirements by the early Tier I (e.g., Narragansett Bay) and Tier II (e.g., Delaware Inland Bays) programs than the Tier III – V estuary programs. Accordingly, the experiences, both positive and negative, of early programs such as the DIBEP helped define the requirements that added structure to the NEP's planning process overtime.¹²⁸ The lessons also helped the EPA identify better candidates for inclusion in the NEP through the Governor's Nomination Process. The NEP has also tried to shorten the planning process over time and spends somewhat less money proportionately on scientific research. The technical assistance available to newer estuary programs in areas such as conflict resolution, managing collaborative decision-making, and incorporating performance measures into the programs also was unavailable to early programs such as the DIBEP.¹²⁹ Moreover, while there continues to be diversity in approaches to institutionalizing CCMP implementation, subsequent estuary programs such as Tampa Bay (Tier III) and Tillamook Bay (Tier IV) also had the opportunity to learn from the experiences of earlier programs such as Narragansett Bay (Tier I) and the Delaware Inland Bays (Tier II). Accordingly, while the following sections describe some problems with respect to how the DIBEP's planning process unfolded, we believe that these problems should be viewed in constructive terms as subsequent estuary programs were often the beneficiaries of these lessons.

The Planning Process

Over \$2 million was spent between 1988 and 1995 by the EPA and the State of Delaware to support the activities and research that led to the creation of the Comprehensive Conservation and Management Plan (CCMP) for the Delaware Inland Bays (DIB).¹³⁰ During the planning process, the program was housed within DNREC, which provided support in a manner similar to the GTFIB and IBMC. It served as the hiring entity until the CCMP was approved and the Delaware General Assembly (DGA) created the Center for the Inland Bays (CIB) to oversee the CCMP's implementation.

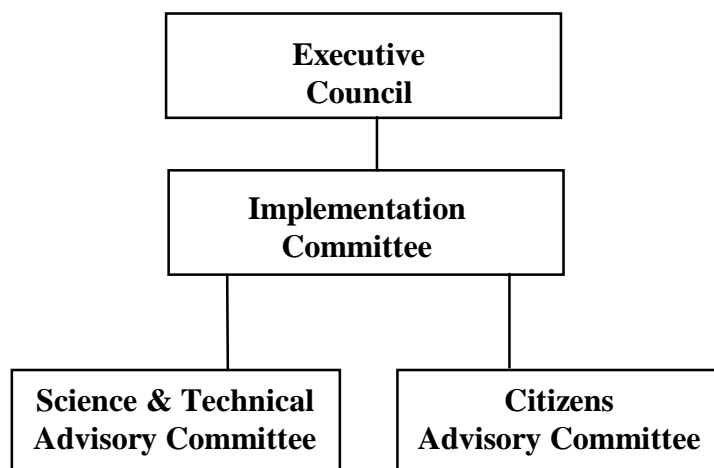
Previous watershed planning efforts and other studies had already identified and characterized the major problems affecting the watershed. They were eutrophication due to excessive nutrient loadings from various point and nonpoint sources and habitat loss and alteration. The previous watershed planning initiatives had also done a good job of identifying and involving the major stakeholders which allowed the DIBEP to leverage and build upon the existing social capital that developed as a result of this history of interactions. Accordingly, the early years of the DIBEP went relatively smooth. Instead of starting from scratch like many estuary programs, the DIBEP picked up where the IBMC left off and completed the characterization work that had already started pursuant to earlier efforts such as the *Coastal Sussex River Basin Study*. The early years of the program were largely oriented towards doing research on the problems affecting the Inland Bays while later years focused on developing the CCMP, getting the plan approved by the EPA, and developing the CIB.

Establishing the Management Conference

One of the first steps in the planning process was for the DIBEP to establish its Management Conference (i.e., committee structure). The DIBEP utilized a Management Conference structure similar to that of other estuary programs in that it consisted of a high level Executive Committee, an Implementation Committee, a Science and Technical Advisory Committee (STAC), and a Citizens Advisory Committee (CAC) that consisted mainly of the members of the Inland Bays Monitoring Committee [Figure 4].¹³¹

The Executive Council consisted of what several respondents characterized as the “big boppers” and included the Secretaries of the DNREC and the Delaware Department of Health and Social Services (DHSS), and EPA Region III representative, and the Sussex County administrator.¹³² The Executive Council set the program's priorities, policies, and general direction. Two absences are worthy of attention. The Delaware Department of Transportation (DelDOT) did not participate at all and is still largely uninvolved.¹³³ While the lack of involvement caused no problems it likely has resulted in missed opportunities for environmental improvements. Almost all roads are state roads and DelDOT's decisions have a direct impact on land use and development. DelDOT also has federal money that can be used for environmental improvements and it has also been delegated authority by DNREC to review and approve stormwater permits for road projects.

Figure 4: The DIBEP's Management Conference Structure



The second absence was the Delaware Department of Agriculture (DDA), which was not represented on the Executive Committee. As one respondent noted: “It turns out that in the construction and original designing of the NEP, for some reason the Secretary of Agriculture was not included on the Executive Committee and as a result, interaction with the agricultural community was not as good initially as it should have been.” The oversight was not intentional. Instead, it reflected an early focus on water quality rather than land use and the sources of NPS problems. While the DDA played an important role in resolving conflicts with the agricultural industry at the end of the planning process and is active today, more involvement at higher levels earlier in the planning process might have avoided some of the conflicts that emerged.¹³⁴

The Implementation Committee served as the operational center of the management conference.¹³⁵ It evaluated the results of research projects, approved annual work plans, and helped to set the objectives and priorities of the program.¹³⁶ Its membership consisted of what some respondents characterized as the “movers and shakers” or mid-level managers and the chairs of the Science and Technical Advisory Committee (STAC) and the Citizens Advisory Committee (CAC).¹³⁷ Representatives of DNREC (8), the DDA (3), federal agencies (5), the SCD (2), Sussex County (3), and the DGA (4) comprised the 32-member committee. This committee served as a forum for consensus building and supervised the work of the STAC and CAC.

The STAC was originally designed to have four working groups: *Coastal Sussex River Basin Study*; water quality; living resources; and information and data management. Eventually this merged into one group. Some respondents referred to this group as the “brain train” and it consisted of university scientists and technical experts from various federal, state, and local agencies. This group selected technical and scientific proposals and demonstration projects, evaluated alternatives for management actions, and provided the scientific information necessary to justify policy decisions.¹³⁸ The STAC was also responsible for overseeing the preparation and completion of the Inland Bays characterization report. During the early years of the program, water quality and fisheries specialists dominated committee membership. It was not until later in

the planning process that there was increased involvement from the CES and other agricultural and land use specialists.

This oversight was not deliberate. Rather it reflected the program's early emphasis on water quality rather than the causes of the problems.¹³⁹ Despite this early problem, the STAC developed into an effective group. It continues to meet regularly and serves as a forum for state and local officials to get technical advice on the likely impacts of policy decisions. The STAC has proven to be particularly effective in helping local officials evaluate options for removing or eliminating nutrient loadings from wastewater treatment facilities. It has also served as a useful forum to address emerging environmental problems such as the recent algae blooms (i.e., sea lettuce) and the potential for a *Pfiesteria* outbreak.

The program also had a very active CAC which some respondents referred to as the "loose cannons". During the early years of the DIBEP, the IBMC served as the CAC and their role was to "push, cajole, and threaten action" on the plan that they had in place. When the IBMC expired in 1989, many of these individuals became involved in the CAC while others joined other committees. The new CAC had broader public and interest group representation and served as a "sounding board" for the other committees and DNREC staff involved in developing the CCMP. The CAC also provided a forum for the general public and interest groups to review, discuss, and make recommendations to the Implementation Committee. It also served as a mechanism to help explain the results of research projects and the rationale behind CCMP recommendations to the public and special interest groups.¹⁴⁰ It also designed and conducted public involvement and education activities and even got engaged in its own fund-raising efforts. Near the end of the process there were proposals to turn the CAC into a nonprofit advocacy organization, although this did not occur.

Characterization Phase

One of the reasons that the NEP's planning process was so lengthy, in this case around 6 years, is that the DIBEP invested a considerable portion of its financial resources in research that attempted to link specific causes to environmental problems. The product of this effort was a status and trends (characterization) report, which was included as an appendix to the CCMP.¹⁴¹ Some of the informants noted that the improved understanding of the problems affecting the Inland Bays was one of the successes of the program. However, those more closely involved with the CCMP's development often had a more critical view. As one DNREC official commented: "Characterization was a *really* bad experience."

The basic criticism was that the EPA's characterization requirements slowed the program down and diverted attention away from implementation. When the DIBEP entered the NEP, the general feeling among many management conference participants was that the program had already fulfilled the CWA characterization requirements. Many felt that the work of the IBSG, SGP, the GTFIB, the IBMC, and the ongoing research associated with *Coastal Sussex River Basin Study* was sufficient to satisfy these requirements.¹⁴² As one participant recalled:

"We had some really confident people at the university who knew the issues very well, some confident people in the agency that had done a lot of work in the inland bays so we

felt like we were good to go. The characterization was almost an afterthought and almost a harassment to us because it was something we had to do. . . . We have all of these assessments of the Inland Bays. We considered our nomination package to be an adequate characterization of the Inland Bays and it was like why would we want to spend \$120,000 to have someone come in here and look at our data?"

However, the EPA insisted on spending a majority of its financial support during the early years of the DIBEP on additional characterization work. Fortunately, the DIBEP made good use of this funding because previous watershed management efforts resulted in a focused research agenda and the information needs of decisionmakers were known.¹⁴³

Accordingly, the DIBEP appeared to be relatively effective in funding research that was useful in CCMP deliberations or ended up supporting future implementation activities. The DIBEP funded several studies looking at the scope of recreational activities and their impacts on the Inland Bays. These studies ended up forming the foundation of the water use plan developed to implement a CCMP recommendation.¹⁴⁴ Another example is the development of the volunteer water quality monitoring program for the Inland Bays in 1991. The Delaware Sea Grant Marine Advisory Service provides intensive training to approximately 50 citizens who monitor 30 sites around the bays. The Sea Grant staff then analyze the samples and perform the requisite quality assurance-quality control and work with DNREC to provide the data in a form that is useful to the agency.

However, some of the research was somewhat less useful. At the instance of the EPA, the DIBEP was required to spend a considerable proportion of its characterization funds on a hydrodynamic and water quality model of the Inland Bays. It was adapted from the Chesapeake Bay model and measured three basic elements: hydrodynamic functions; water quality; and sediment interactions. In order to provide the data necessary to build, calibrate, and verify the model, DNREC and its contractors began an intensive three-year monitoring program between 1988 and 1990. However, it was of little use in the development of the CCMP or the tactics recommended in the action plan.¹⁴⁵ Accordingly, some respondents cited the development of this water quality model as an example of an ineffective use of estuary program resources. As one participant recalled: "We just thought we could use a simpler modeling tool, something less costly, less involved . . . I mean this sucker was built on a really high-speed, powerful mainframe computer. . . . I bet all total we probably spent about \$900,000 on that sucker." Interestingly, while the model was not particularly useful in developing the CCMP, it helped them to develop the total maximum daily loading (TMDL) in 1998 for the Inland Bays watershed. On the surface, this appears to have been a fortuitous turn of events. However, it also meant that the DNREC was forced to use a model based on old data. While the DNREC and others sought extensions to the deadlines imposed by the judge to collect new data, these extensions were not granted and the TMDL was developed using the old data.¹⁴⁶

The DIBEP did experience two interrelated problems during the characterization phase that influenced the development of the CCMP. When the program started, its focus was primarily on water quality modeling, not on land use and the sources of water quality problems. The EPA was partly to blame for this. As one DIBEP staff member recalled: "the people we were working with [at EPA] were both water people so the focus was water and every time we

tried to go upland, they would drag us back to water and modeling.” As a result, during the early years of the process the STAC was dominated largely by water quality specialists and had little involvement from agricultural specialists and other familiar with the nutrient loading problems resulting from land use activities.¹⁴⁷ However, by the end of the process the emphasis had shifted more towards land use and the sources of nutrient loadings. In the end, the DNREC staff and STAC members ended up learning a great deal about the sources of nutrient loadings and the extent of the problems in the watershed.

The second problem was that the science linking nutrient loadings to agricultural activities became highly politicized. Representatives of organizations such as the Farm Bureau and the Delmarva Poultry Industry, Inc. (DPI) routinely challenged many of these scientific findings by criticizing the data, methods, and any conclusions drawn by researchers that suggested that agricultural activities were a major source of nutrient loadings. They also questioned conclusions that phosphorus from agricultural operations is a major source of nutrient loadings, since previous research had always suggested that nitrogen was the major factor in estuarine systems and that phosphorus was not that mobile. The DPI also set aside \$1 million to do its own studies of water quality problems in southern Delaware.¹⁴⁸ This politicization of science remains an ongoing problem and source of controversy.

Other Notable Activities

While the technical work was going on, the DIBEP and its partners were busy in other areas. The DIBEP sponsored a number of demonstration projects. These included: on farm demonstrations of improved nutrient management practices; two demonstrations of a side-dressing poultry manure applicator; a study of the flooring of poultry houses to identify conditions likely to lead to groundwater contamination; a construction of an artificial wetland and pond system; construction of a sand filter stormwater control BMP; and a demonstration of two alternative forms of shoreline stabilization. Some of these projects involved researching new BMPs (e.g., sand filter) while others success (e.g., alternative forms of shoreline stabilization) caused them to become tactics in the CCMP.

While these activities were notable, the DIBEP was involved in two sustained initiatives designed to install BMPs and change DNREC’s decision making. The first was the Inland Bays Recovery Initiative (IBRI) started by Governor Castle and DNREC Secretary Toby Clark in March 1990. The goal of the IBRI was to begin taking actions that would start to address the problems in the watershed. Many of these activities followed-up on the efforts of the GTFIB and the IBMC. The IBRI had several notable successes before ending in 1992 including:

- Updated conservation plans covering 32,000 acres and over 16,700 acres were covered by complete conservation plans (in conjunction with HUA project)
- 436 nutrient management budgets were developed, 35 manure spreaders were calibrated (in conjunction with HUA project)
- Provided technical assistance through programs such as “We C.A.R.E.” and financial assistance that resulted in 6 larger, two-stage dead bird composters, 11 poultry storage structures, 11 agricultural waste management systems, and 8 water control structures (in conjunction with HUA project)

- Hired a total of four conservation planners to work with farmers (in conjunction with HUA project)
- Developed Sediment and Stormwater Regulations under Senate Bill 359 that became effective July 1991, funded a position in the SCD, and established a training and certification program
- DNREC promulgated new regulations governing the construction and operation of marinas, which included requirements for preparing and implementing operation and maintenance plans
- A shellfish harvest area that had been closed since 1979 was conditionally reopened
- DNREC began working with Sussex county to provide central sewers and by 1992 some 4,000 OSDSs were replaced
- Developed a buildout map for the watershed
- Organized a Save Our Bays (S.O.B.) team to promote better public education on the use of crab pots
- Began replanting SAV, although with varying degrees of success
- Began to update the Natural Heritage inventory

These activities helped build support for the DIBEP among federal, state, and local officials who collaborated in these efforts. It also helped build internal support within DNREC for the program. As one respondent recalled: “It was one of the neat galvanizing activities we had during that time. We had a sector of the department that was 150 percent behind the NEP.” It also helped the DIBEP demonstrate to the public that it was “doing something” and was more than just a research or planning effort.

These efforts were also designed to work in conjunction with a second major initiative, the Natural Resource Conservation Service’s (NRCS’s) Hydrologic Unit Area (HUA) Project for the Inland Bays. The Delaware Inland Bays were one of 36 hydrologic unit areas (HUAs) targeted by the USDA for accelerated technical and financial assistance that lasted between 1990 and 1998.¹⁴⁹ The effort was undertaken in cooperation with the DNREC, SCD, CES, DDA, DPI, Farm Service Agency (FSA), Sussex County, and the DIBEP. The plan outlined a series of goals for the implementation of specific types of BMPs. The HUA program provided over \$2.5 million in federal funds to pay for staff and to implement BMPs to address agricultural problems.¹⁵⁰ Prior to 1991, historical levels of farmer participation in conservation programs in the watershed were low to moderate with little money targeted at nutrient problems from agriculture.¹⁵¹ The HUA project focused on developing individualized conservation plans or WE C.A.R.E. (Comprehensive Agricultural Resource Effort) plans. The idea was to provide a comprehensive document that included information and planning for all natural resources on a farm including cropland, nutrients, and forestry. The WE C.A.R.E. concept was also developed as a marketing tool to build support for conservation efforts in the agricultural activities and it included a wide range of outreach materials including videos that explained the merits of various conservation practices. It also involved a lot of one-on-one contact and breakfast meetings with farm organizations and their members to build support for the installation of BMPs and improved nutrient management.¹⁵²

The HUA project for the Inland Bays was very effective. While there were no demonstrated water quality improvements, that may be due to the fact that it may take 15 to 40

years for nutrients applied to land to enter the Inland Bays through groundwater. However, the estimates are that the HUA project reduced nitrogen loading by approximately 2,700 tons during the project.¹⁵³ This was achieved by developing nutrient management plans for 48,000 acres or 78 percent of the cropland in the watershed. The effort also calibrated 70 manure spreaders, performed 203 manure analyses, conducted 3,620 soil tests, installed 94 waste structures, 69 dead bird composters, and 100 waste systems.¹⁵⁴ The data collected to evaluate the effectiveness of the project indicates that the “personal touch” of one-on-one planning was the desired method by most farm operators and proved to be the most effective.¹⁵⁵ However, there is some question about the extent of compliance with the nutrient management plans with the lowest estimate being 40 percent and other compliance rates being substantially higher.¹⁵⁶ One of the major obstacles that hindered the effort was the inability to package federal cost-share funds available to applicants because of administrative rules and regulations. The loan caps were also much smaller than those under the USDA’s Environmental Quality Incentives Program (EQIP) were. This ended up causing the NRCS to turn back a substantial portion of the federal HUA funds that were available for the implementation of BMPs.¹⁵⁷

Developing the CCMP

The technical foundation of the plan was built through sound scientific information coupled with what many respondents characterized as a long and time consuming process of reaching agreement on the scope and substance of the CCMP’s action plans. As one respondent recalled: “We ran around like chickens with our heads chopped off because it is so difficult to try and do everything by committee.” Most respondents agreed that decisions were made by consensus, particularly near the end of the process. However, there was no clear definition of what constituted consensus.¹⁵⁸ In general, most respondents were satisfied with the process used to develop the CCMP, albeit not necessarily the end result. One of the strengths often cited was the improved collaboration among various actors. One respondent noted: “I think the most important aspect of these collaborations is that it helps people get to know each other and try to work together. That to me is the #1 benefit.” Others cited the improved relationships among the actors involved in the management of the Inland Bays. As one respondent noted: “It brings everybody to the table in a neutral setting where we can discuss these issues and bring good, science-based information, to all of these managers. The funny thing is none of these folks even knew the problems existed and even today there is some challenge on whether or not some problems exist, especially with agriculture.” Most respondents also felt that they had a great deal of influence over the CCMP’s development. However, there was some dissatisfaction with how disputes surrounding the final CCMP were resolved.

The first major public event in the development of the DIBEP was a workshop in March 1989 called “Back to the Future” that included citizens, political leaders, and state and federal agency officials. The workshop was used to summarize the history of previous planning efforts and the progress that had been made. Government officials explained the NEP requirements, discussed the DIBEP’s nine goals, and then provided time for public comment. This started a six-year process involving countless committee meetings, meetings with interest groups, educational seminars, and public meetings. In addition, five Vision Workshops were held for the sole purpose of determining the tactics in the action plans that would be used to address the priority problems. Nearly 300 citizens and government officials participated in these meetings

and over 200 individuals served on the various advisory committees that comprised the Management Conference.

The process of writing the CCMP started in January 1990 when three public meetings were held to discuss the results of a public opinion survey of Sussex County residents that was issued in November 1989.¹⁵⁹ By September 1992, a preliminary draft CCMP had been produced that was the culmination of the early work of the advisory committees. The DNREC staff then held a series of meetings between November 1992 and July 1993 in which public input forms were distributed to gauge public support for actions in the CCMP. The public was generally supportive of the preliminary CCMP.

The process that followed consisted of developing subsequent versions of the draft CCMP. Each new version included some additional information and contained modifications in the tactics based on public input and comments from stakeholder groups such as the Sierra Club and the Farm Bureau. After each draft, there was a comment period and the DIBEP staff held public meetings as well as individual meetings with concerned parties to discuss their comments and concerns. At each stage of the process recommendations and tactics were revised as DNREC staff responsible for developing the CCMP worked to find consensus among the diverse interests (e.g., environmental groups and the agricultural industry).¹⁶⁰ This process resulted in an April 1993 addendum to the preliminary CCMP, an October 1993 draft CCMP, and a July 1994 final draft that went out for public comment. Public meetings were also held in August 1994 to explain the CCMP's contents and to get additional public input. DNREC staff then made revisions, which resulted in an October 1994 final draft CCMP. While this process was underway, DNREC staff were developing ten supporting Appendices designed to satisfy the EPA's approval requirements.

The October 1994 final draft would still be subject to extensive written comment. The EPA informed the DIBEP that additional information would be needed for them to approve the CCMP. Groups such as the Farm Bureau, Delaware Audubon Society, Sierra Club, and other citizens and agency officials also had comments, many of which conflicted with one another. For example, the Farm Bureau raised a number of concerns and wanted the rules governing agricultural activities in the Inland Bays watershed to be no more stringent than those in other regions such that the farmers would not be placed at a competitive disadvantage. Meanwhile, the Sierra Club sought bans on some activities and greater regulation of agricultural activities.

At this point, the DIBEP staff felt the current document reflected the best possible consensus and finalized the document for the Governor's signature and EPA's approval. In the end, the DNREC staff was able to find common ground on most issues and received support from nearly all of the management conference participants.¹⁶¹ However, two actors objected to the scope and substance of the final CCMP: 1) the poultry industry; and, 2) EPA Headquarters officials. The staff at DNREC and other committee members then became involved in a series of activities designed to resolve these conflicts and get the EPA's final approval so that the newly created Center for the Inland Bays (CIB) could turn its attention to CCMP implementation.

The Poultry Industry Objects to the Draft CCMP: The poultry industry's concerns first surfaced at a February 1993 meeting to discuss the draft CCMP.¹⁶² At the meeting, the Farm Bureau questioned the picture of agricultural contributions of nutrients suggested by the 1986 report prepared by Ritter that graphically depicted nutrient contributions in a pie chart that illustrated that agriculture was a major source of nutrient loadings.¹⁶³ As one respondent recalled: "agriculture did not like what they saw in those pie charts and they really made big noise about how that conclusion was made. They really got into the process of that study and they tried to discredit it because they didn't want to be seen as 60 percent of the problem . . . It looked real bad in public and it really got them going. . . . The community as a whole tried to discredit the study." This began a process that politicized the results of any research that suggested that nutrients from agricultural operations caused a "problem". In fact, as late as 1998 agricultural representatives questioned whether they were the cause of nutrient loadings.

Once the draft CCMP was completed in fall 1993, DIBEP staff spent over a year trying to get the farmers to agree to the draft CCMP. The DNREC staff made numerous concessions and changes in the CCMP as a result of the written comments it received and meetings with members from the agricultural industry. As the process came to a close, many participants thought the agricultural groups were on board. While the environmental groups remained quite vocal during CAC meetings until the end, the agricultural industry largely remained silent and appeared to agree with the final plan. However, the industry's concerns had not been addressed.

The conflict came to a head when the Secretary of DDA walked into the DIBEP Director's office one day to discuss what type of governance arrangement would be appropriate. He then dropped the CCMP into the empty metal trashcan next to his desk and said something to the effect of "this is what I think about your CCMP". Many of the problems surrounded a controversial pie chart that portrayed the industry as the major source of nutrient loadings to the Inland Bays. As one participant recalled: "What happened was it wasn't in print that on a gross acreage basis agriculture is the largest land use and has the largest impact. . . . Because they saw this one little piece they didn't like, everything was removed." The Governor, who did not like controversy or interagency fighting, had recently appointed a new Secretary of DNREC. Had the former Secretary Toby Clark been around, he might have been willing to fight a battle with the agricultural industry. However, the new Secretary was more sensitive to the industry's concerns.

The DIBEP staff worked with staff from DNREC's Division of Soil and Water Conservation, which had a better relationship with the agricultural industry, to resolve the conflict. A committee proceeded to rewrite the controversial section of the CCMP. The controversial "pie chart" was removed and the wording of the description of the problems was "softened" until a common ground was found. As one participant recalled: "There were 2 – 3 meetings on the issue. I won't use his name, but when the so-called 'godfather of the farming community' was brought in and his words were 'I can live with this' there was relief."

However, the meetings occurred behind closed doors and some committee members did not learn of the changes until they saw the final CCMP. As a result, several respondents complained about secrete deals behind closed doors while others involved in the meetings were quick to dispel these perceptions. As one participant noted: "They [Farm Bureau] had some genuine concerns about how agriculture was being portrayed. It was not what agriculture was

being asked to do.” Another participant noted that: “To the best of my knowledge, the action plan tactics never changed. If they had, it would have been the smoke filled room.” Other respondents were angry and suggested that what occurred was standard operating procedure, arguing that the agricultural industry had a history of waiting until the end of the process to attack and utilize its political power to “water down” the plan. Conversely, one participant noted: “For someone to think it was subterfuge of the whole process I disagree. They met with key farmers from the watershed and said just give us a fair shake at the beginning and we’ll do what’s right. We’re already doing a lot of what’s right. It’s our water. Some of us boat, fish, swim, and crab as well. But we don’t want to be regulated.” Other respondents reported being surprised by agriculture’s opposition. Many assumed they supported the CCMP since they were relatively silent throughout the planning process and appeared to support the final plan. As one CAC member observed: “[I]t was surprising to find out that the farm people were upset with what was in there [CCMP]. . . . I found it hard to understand because they had representatives there every meeting. It isn’t like we shunned them or kept them out. They were there every meeting and should have been reporting back to the respective organization what was going on. Evidently, that wasn’t done.”

Accordingly, many respondents reported being disappointed that changes to the CCMP were made and declared it the unfortunate result of “Delaware Politics”. For many respondents, these changes were the only source of dissatisfaction with the process. As one participant noted: “The only negative comment I would have [about the planning process] is that a lot of the plan got changed in the final hours.” While many understood why it happened, they were disappointed that the Governor and DNREC “caved in” to the pressure from the agricultural industry. Many respondents pointed to this as one example of the lack of political will to address the Inland Bays problems. Other respondents felt as if their time was wasted. This disappointment and the dissatisfaction with consensus-based processes even caused the Sierra Club to withdraw from the CAC following the CCMP’s approval. Moreover, it joined the American Littoral Society in suing the EPA and DNREC to force the development of a total maximum daily loading (TMDL) for the DIB watershed in 1998.¹⁶⁴

In retrospect, there are several possible explanations for the industry’s silence. Some respondents suggested that agricultural members felt uncomfortable “talking in front of other citizens and airing the dirty laundry about bad actors and the poultry manure and those kind of things.” Others felt that many CAC members were hostile towards their industry and were unwilling to listen to their views. Thus, “groupthink” may have caused committee members to assume that there was more support than actually existed. The agricultural industry is also very diverse and it is unlikely that several individuals could represent that broad range of views.

It is also understandable why the industry was concerned about its portrayal. Some industry officials were concerned that the CCMP might provide the EPA or DNREC with the justification needed to begin regulating poultry growers.¹⁶⁵ Others distrusted the EPA and DNREC and feared that new voluntary efforts would be the precursor to new regulatory efforts.¹⁶⁶ It is also easy to understand why the industry is opposed to new regulation. It is a competitive industry and farmers do not want to be at a competitive disadvantage.¹⁶⁷ Many farmers are also under pressure to move from crop production to intensive livestock operations or to sell their land to developers. Many agricultural communities are concerned that additional

regulation will lead to loss of farmland and increased urbanization, the current trend. Others feel farmers are being used as a scapegoat for the problems resulting from decades of unchecked and poorly planned development. They feel that equal attention should be paid to nutrient loadings from urban sources and the loss of habitat due to residential development. As one respondent noted:

“There’s denial on all parts about the complexity and depth of the issues. The problem started 30 years ago with nutrients in the water. Development has been going on. They are blaming it [nutrients] on each other. . . . All groups are doing what they can; we need to do more. . . . All the easy issues were tackled 20 – 30 years ago. Now they are slicing little pieces of the pie that’s left. I think everybody with the fast paced technology, everyone wants it not. That’s changed expectations. Everyone thinks if we do something now, it’s solved. That’s not the case.”

Other respondents noted that these rural communities are tight-knit and there is often great suspicion of outsiders coming in to tell them what to do and were particularly skeptical of scientists and the advice they provide because it keeps changing. As one respondent noted: “They [farmers] also don’t like to be told something and then be told to something else because the research didn’t bear it out. That’s what happened with the nitrogen and phosphorus. The farming community feels betrayed. We have tried like hell to control the nitrogen. We were told phosphorus bound to the soil.” Now scientists have found that phosphorus is more mobile than previously thought and farmers are now being told that they should have been working to control the application of phosphorus. Farmers are also inherently risk adverse and make most of their major business decisions on a year to year basis. As a result, they are often reluctant to change practices without a lot of certainty that they will be successful. Conversely, many government officials lack the evidence to demonstrate the effectiveness and the cost advantages associated with the installation of BMPs.¹⁶⁸ When BMPs provide economic benefits or increase productivity, many times farmers are unaware of them. The only source of this information tends to be CES, the SCD, or NRCS. However, most farmers get their information from the integrators, DPI, and other growers.¹⁶⁹ Accordingly, information about the advantages of BMPs and behavior changes is not communicated effectively. In other cases, government officials underestimate the behavioral changes and costs associated with changing practices. Finally, many farmers are located miles inland and genuinely do not believe they have an impact on bay, the same way homeowners located an equal distance do not believe that they impact the bays.

The EPA Threatens to Reject the CCMP: Resolving the conflicts with the agricultural industry still left one hurdle to clear. The EPA Headquarters staff decided to override Region III’s recommendation for approval and recommended that Carol Browner, the EPA’s Administrator, should reject the CCMP when it was submitted for approval.¹⁷⁰ Headquarters’ problems were the CCMP’s failure to address some of the requirements in its guidance documents. EPA Headquarters staff was also generally disappointed with the quality of other required materials such as the federal consistency report, base program analysis, status and trends report, and monitoring chapter. EPA also wanted more detail for each recommendation in the CCMP such as who would be responsible for the action and how much it might cost.¹⁷¹ As one EPA Headquarters official noted: “The DIB, we came close to flunking them. They had to work hard to get their CCMP up to our standards.” Another EPA official described it as a

“tortuous process between EPA Headquarters, the EPA Region, and the DIB program to document minimal consistency with key program requirements such as financing and monitoring plans.”

According to one EPA official, the CCMP should represent “the ultimate product of our funding” and it should have lots of information about the problems affecting the bays and detail specific actions that should be taken to address environmental problems. However, the DIBEP participants wanted a much shorter document similar to previous reports (e.g., GTFIB’s final report) that outlined a series of actions that the participants would work towards over the next few years. Conversely, while the EPA wanted a “comprehensive” plan that was formal in structure and quite expansive the DIBEP participants viewed the CCMP as more of a “strategic” plan that was more general and no more than 75 – 80 pages in length with most of the material contained in appendices.¹⁷² While the DIBEP added some information to address EPA’s concerns to the draft CCMP such as who would be responsible and what it would cost, these changes did not satisfy the EPA headquarters staff.

This was just the latest in a long line of conflicts with the EPA during the planning process. As one participant characterized the process: “it was all just bumps and scrapes with the EPA the whole way because they wanted the seven purposes and we didn’t want to do the purposes because we had already been there and done that.” The EPA’s concerns regarding the form and substance of the CCMP’s recommendations was simply the latest in a series of minor conflicts with DNREC. The source of DNREC’s frustration was apparently their belief that the EPA kept “changing the rules of the game” while the CCMP was being developed. Many of the DIBEP participants stated that when they entered the NEP, the EPA made it clear that they had the flexibility to structure the process and develop a CCMP that fit their needs. However, as the NEP developed the planning process became more structured as the EPA began to ask all of the estuary programs to do things in particular ways. As one respondent recalled:

“[W]hen we started out I remember without any question that we were told more than once as we were starting the program that the document that we came up with was our own document and we felt it was important having our own document and we discussed what was going to be in our document and how long we would try to keep it. But as we were going on with our process, EPA was going on with several of theirs. One of which was developing checklists and requirements for this and requirements for that . . . So we get to the point where we have a preliminary draft but by this time they are developing a whole set of standards by which they want to approve these things. So, the ground rules had changed while we were in the process and it really stuck in our crawl very badly. We thought we were in control, that it was a grassroots program and we were evolving our own grassroots solutions and all of a sudden EPA is coming in with their command and control of this whole thing.”

Thus, it was like trying to hit a moving target as the DIBEP struggled to make changes to the CCMP that would satisfy new requirements. Many participants also resented having to develop documents and to prepare analyses that were of little use to them and were developed for the EPA’s consumption. As a result, the DIBEP was continually looking for ways to cut corners and

tried to use existing reports or documents satisfy these requirements. The EPA in turn viewed this activity negatively as if it were a sign of a “lack of quality”.

In the end, the EPA’s efforts to control the content of the final CCMP resulted in a lost sense of ownership over the plan. As one participant noted: “In my opinion, EPA wants this command and control. They want to be in charge. They want to feel like they have control of things but at the same time they want no accountability and they want the NEPs to feel like they have buy-in to this whole thing. Boy, they are shooting themselves in the foot there. But, they are gaining what they want, but not all of what they want because . . . they [estuary programs] feel like they have just been doing it for somebody else, not themselves.” Accordingly, near the end of the process, it appeared to the DIBEP participants that they were developing a plan for the EPA rather than for those that live in the Inland Bays watershed. Others were frustrated with the EPA’s general attitude and approach, which failed to view the effort as a partnership, appeared to look down upon the state and its institutions, and discounted or failed to appreciate the previous history of watershed management efforts because it was only a “small program in a small state”.

Other participants reported being frustrated with the conflicting advice they received from the EPA’s Headquarters and Regional staff. The DIBEP also had a succession of EPA Headquarters liaisons, which also tended to be staff who had recently joined the agency. As a result, they often gave advice that conflicted with that of previous EPA staff and sometimes lacked the ability to make decisions.¹⁷³ They also tended to lack any knowledge about the history of the DIBEP, other EPA programs, or the institutions governing the Inland Bays watershed.

These minor conflicts and frustration continued to build as the DIBEP moved closer to submitting its final CCMP. It became clear to the DIBEP that the EPA Headquarters staff did not like the CCMP after they presented an earlier draft and staff “just tore them up” for what they considered to be a “wishy-washy” plan. Since it became apparent to many DIBEP participants that the EPA’s Headquarters staff was determined to reject their CCMP, they began mounting their own offensive to make sure EPA would approve the plan.

The conflict came to a head when the EPA submitted its comments on the final CCMP. A meeting was scheduled at EPA’s Headquarters to discuss the comments. Attending the meeting were EPA staff from Headquarters and Region III, the Secretary of DNREC and various staff, the Secretary of DDA, the President of Farm Bureau, and two local farmers. The Delaware officials drove together to the meeting and used the drive to discuss how they would approach EPA. However, EPA officials quickly made it clear that they did not intend to approve the CCMP saying something to the effect of ‘we’re going to have CCMPs that we just can’t approve. We’re going to support you. We’ll give you this follow-up money to keep things alive. . . . but there are just going to be CCMPs that just can’t be approved.’ Interestingly, this event became a galvanizing event for the DIBEP. As one meeting participant recalled: “Despite all of the differences between DNREC staff, the farmers, our two secretaries, the environment and whatever, despite all of those differences and approaches and attitudes and political status and everything else, it just brought us together. And it was like we had found the enemy.” In some respects this event provided the foundation for the CIB. For the first time, all parties were truly

working together to advance a common goal – the actors were determined to force EPA to approve the CCMP.

After the meeting, the DIBEP staff finished up the CCMP and lined up EPA Administrator Carol Browner for a signing ceremony in June 1995 that would be attended by various elected officials including the Governor. The Governor was briefed on the situation and hand wrote a personal message on the bottom of the cover letter for the final CCMP's submittal saying that he hoped for an expeditious approval. The fate of the CCMP literally hung in the balance up until the morning of the signing ceremony, which was going to be well attended by the public and the local media. Most DIBEP participants assumed that the EPA would reject the CCMP because of their previous comments. It also turns out that EPA Headquarters staff recommended rejecting the CCMP right up until the end. The morning of the signing ceremony, DNREC staff called the EPA project officer and told them that the ceremony would be called off if they did not have a signed piece of paper saying the CCMP was approved. However, the key event appears to be a personal phone call from the Governor to the EPA Administrator the morning of the signing ceremony. The phone call triggered a flurry of activity in EPA that culminated with Browner driving to the signing ceremony. The EPA formally approved the CCMP at the June 1995 signing ceremony.

In the end, the EPA achieved some of the changes it sought in the CCMP. For example, the EPA required the CIB to prepare an updated monitoring plan. However, the EPA's actions soured the relationship between DNREC and EPA at the time. As one DNREC respondent noted: "at the end of the program I was so really turned off and disgusted with EPA that I never wanted to have anything else to do with them at all." Another DIBEP participant suggested "[w]e probably just should've never asked for federal money." Others felt that the EPA was too focused on process and characterization and did not have enough emphasis on implementation. As one respondent commented: "I think maybe we milked a little bit of government money in a process which I felt I would rather have seen more money go to actual demonstration projects and implementation."

Interestingly, it does not appear that any of the problems the EPA had with the CCMP's form or content had any bearing on the CCMP's implementation or lack thereof. The relationship between EPA and DNREC has also improved and EPA Headquarters staff characterized the DIBEP as "a good small program" during our interviews. Nevertheless, it is unclear why the EPA has such highly detailed CCMP approval requirements when there is effort to intervene or control implementation efforts which EPA believes are primarily a state and local responsibility. While the CWA clearly places implementation responsibility with state and local governments, it is unclear why the federal government tries to control planning activities or the content of CCMPs. It appears that a more appropriate relationship is to have a strong or a weak role in both planning and implementation depending on one's view of federalism. A strong role in one and weak role in the other appears to make less sense.

The CCMP

The final CCMP contained 17 specific action plans for improvement in five areas of concern: education and outreach (1); agricultural sources (5); Industrial, municipal, and septic systems, sources (2); land use (2); and, habitat protection (7). It also specified a number of actions designed to support the governance of the watershed [Appendix B]. Each action plan included tactics that describes the specific steps that should be taken, the parties best suited to address the issue, and a proposed implementation schedule. The tactics have various time frames, although none goes past 2000. The tactics were designed to help achieve the nine goals that were outlined at the March 1989 workshop (other estuary programs tend to call these priority actions). In order of priority these are:

- Establish and implement a comprehensive nonpoint pollution control program
- Protect, restore, and enhance living resources by improving water quality and protecting and enhancing habitat
- Develop and implement comprehensive zoning ordinances, laws, and regulations at all levels of government that promote environmentally sound land use
- Establish and implement a comprehensive wastewater management program
- Develop and implement a groundwater management program that protects and improves drinking water supplies
- Develop and implement a water use plan
- Establish and implement a shoreline protection program that addresses both natural processes and human activities
- Coordinate Inland Bays management with existing solid waste, air pollution, and toxics programs
- As much as possible, ensure that all public participation, information, and education are part of planning and management activities related to the Inland Bays.¹⁷⁴

The DIBEP estimated that the full implementation of the tactics would cost over \$39 million between 1996 and 2000, excluding infrastructure investment.¹⁷⁵

Developing an Organization to Oversee CCMP Implementation

Early in the planning process, the DIBEP participants focused their attention on the question of how to organize an implementation arrangement to oversee CCMP implementation. Several options were considered in 1992:

- DNREC lead
- Sussex County lead
- Public/private group lead
- Implementation Council lead¹⁷⁶

Each of these arrangements had various strengths and weaknesses.¹⁷⁷ At the December 1992 Vision Workshop, there was broad support for the Implementation Council option.¹⁷⁸ Members of the proposed Implementation Council included the Secretary of DNREC, Sussex County Administrator, Secretary of DHSS, Secretary of the DDA, President of SCAT, and the

chairs of the STAC and CAC, which would be retained as formal advisory committees. The Implementation Council also began organizing in 1994 before the CCMP was completed and decided that an executive director and staff should report directly to the Council.¹⁷⁹ A task force was then created to begin developing an *Inland Bays Protection Act* and a state planning/conservation development office. During 1993, the task force and DIBEP participants worked to develop and refine the Implementation Council concept. For example, it was decided that a nonprofit organization or foundation was needed to acquire and raise funds and award grants and proposals. It was also decided that the CAC should be incorporated as a 501(c)(3) nonprofit organization. It was also decided that public education should be enhanced. Moreover, it would be necessary to develop broad political support.¹⁸⁰

The Implementation Council ended up meeting three times between March and June 1994 to establish organizational procedures and other administrative decisions. These included adding the SCD to the Council and supporting a bill introduced by Representative John Schroeder entitled the *Inland Bays Watershed Enhancement Act*, which established the Center for the Inland Bays (CIB) administered by a Board of Directors consisting of the Implementation Council members. The Implementation Council also drafted bylaws for the CIB.¹⁸¹ The legislature approved the act in June 1994. The CIB held its first meeting in September 1994.

Center for the Inland Bays (CIB)

The *Inland Bays Watershed Enhancement Act* specified that was to coordinate the CCMP's implementation and that it shall receive federal monies and raise private grant monies to support educational, restoration, and land acquisition efforts. It also established the CIB as a nonprofit organization and directed it to apply for nonprofit status with the Internal Revenue Service (IRS). The CIB is administered by a Board of Directors comprised of the Secretary of DNREC, the Secretary of the DDA, a representative of the SCD and SCAT, the Sussex County Administrator, and the chairs of the STAC and CAC. In addition, the President Pro Tem and the Speaker of the House in the DGA each designate one resident from Sussex County to serve on the Board. Originally, they were designated as non-voting members. However, at the CAC's request, at the first CIB Board of Directors meeting the DGA was asked to make them voting members and did so during the 1995 session.¹⁸² The EPA and other federal agencies can serve on the board, but only do so as non-voting, ex-officio members.

The Board is required to meet at least quarterly. All meetings are required to be open to the public and are subject to the state's open meeting requirements. The CIB is also required to submit an annual progress report to the DGA.¹⁸³ The CIB was given a great deal of flexibility in determining its activities and operations. However, its goals are to:

- To sponsor educational activities, restoration efforts, and land acquisition programs that lead to the present and future preservation and enhancement of the inland bays watershed
- To build, maintain, and foster partnership among the general public, the private sector, and local, state, and federal governments, which is essential for establishing and sustaining policy, programs, and the political will to preserve and restore the resources of the inland bays watershed.

- To serve as a neutral forum where inland bays watershed issues may be analyzed and considered for the purposes of providing responsible officials and the public with a basis for making informed decisions concerning the management of the resources of the inland bays watershed.¹⁸⁴

The day-to-day activities of the CIB are administered by an Executive Director, which hired a support staff. The Executive Director and staff report directly to the Board of Directors. In addition to carrying out projects, managing staff, and overseeing budgetary matters, the Executive Director serves as liaison to ensure effective communication among the Board members, committees, and staff. In addition to the CAC and STAC, the Board of Directors also established a third standing Committee, the finance committee, to focus on budgetary and fund-raising issues.

Early implementation efforts were hampered by the lack of funding, inadequate staff resources, and other issues associated with the development of any new organization. The CIB hired its first full-time Executive Director in October 1995, who was not involved at all in the development of the CCMP and was unfamiliar with Delaware “politics”. Accordingly, the Director’s early efforts involved meeting with each board member to better understand their concerns and priorities and completing the tasks necessary to complete the CCMP, get it published, and to submit the necessary information to EPA.

Since the CCMP was not written with the CIB in mind, it quickly became apparent that there was a need to prioritize implementation strategies and provide focus to the CIB’s activities. Short-term priorities (immediate to six months) were determined to be land use in Sussex County and incorporation of the CCMP strategies into the revised comprehensive land use plan, emphasis on BMPs in agriculture and demonstration projects, public participation and education, farmland preservation, and fund-raising and resource development. Medium-term priorities (six months to two years) were determined to be continued emphasis on BMPs, procuring a multi-use building for the CIB, assisting in land acquisition efforts, emphasizing poultry-manure demonstration projects, and ensuring that the CCMP and land use ordinances are consistent. All other tactics were considered long-term priorities.¹⁸⁵ The priorities guided the Executive Director’s daily activities and helped the Board of Directors prioritize proposals for demonstration projects and to help develop grant proposals and the annual budget.¹⁸⁶

Implementation Progress

The DIBEP has had a focus on implementation since the program started as it followed on the heels of the IBMC. Moreover, the IBRI and the HUA project allowed the DIBEP to achieve a number of notable success before the CCMP was completed. However, it is less clear to what extent these and other activities have led to measurable changes in environmental conditions. In part, this is due the nature of the ecological system in which nutrients are discharged to ground water which may not discharge to surface waters for 15 to 40 years. Water quality and other environmental monitoring data is lacking and evaluating trends in the data is hampered by the large fluctuations in the data due to such factors as changes in weather patterns (e.g., variation in rainfall and storm events) and the tremendous change in population during summer months. The water quality trends are unclear with some analyses suggesting that water

quality improved since previous studies in 1993 and 1996¹⁸⁷ while more recent studies suggest that water quality continues to deteriorate¹⁸⁸ while many of the waters currently violate state water quality standards.¹⁸⁹ Given the uncertainty of these trends and the difficulty associated with linking management strategies to changes, our analysis here and in subsequent sections of this report focuses primarily on activities that offered some possibility of environmental improvements through direct (e.g., restoration projects, or infrastructure investment) or indirect (e.g., public education, changes in decision making, or new research) actions.

Many of the activities and initiatives started during DNREC's IBRI and the HUA project continued during the CCMP's implementation. In other instances, the work of the GTFIB, IBMC, IBRI, HUA project and other efforts provided the foundation for CCMP recommendations and subsequent implementation efforts. As a result, it is often hard to disaggregate those activities that were designed to specifically implement CCMP recommendations and no attempt will be made to do so. Historically, all of these efforts have involved collaborative efforts between various governmental and nongovernmental actors and the efforts from one initiative often are related to the efforts in subsequent initiatives. Moreover, state and local officials often viewed these activities as being part of one unified watershed management effort.

One of the major goals of the CCMP was to develop a water use plan that would address problems stemming from recreational activities and user conflicts. The CIB contracted with staff in the University of Delaware's SGP to develop the *Comprehensive Water-Use Plan for Delaware's Inland Bays*. The process began early in 1997 and involved a wide variety of stakeholders representing governmental and nongovernmental organizations as well as interested citizens. Many of these participants were new to the efforts to protect the Inland Bays. The plan evolved over a series of meetings to get input, feedback, and develop the recommendations contained in the plan. The *Comprehensive Water-Use Plan for Delaware's Inland Bays* was completed in June 1999.¹⁹⁰ The CIB approved the plan at its March 1999 meeting and created an advisory committee to oversee the plan's implementation.

Another high priority strategy was to eliminate all point source discharges to the Inland Bays and to encourage the installation of central sewer systems to remove nutrient loadings resulting from OSDs. Since 1990, three facilities have eliminated their surface water discharges: Frankford Elementary School; Colonial East Mobile Home Park; and, the Delaware State Housing Authority¹⁹¹. In addition, a recent agreement between Sussex County and DNREC will result in the removal of the point source discharge at Delaware Seashore State Park and its sewage will no longer be dumped into the Indian River Inlet. The DNREC has agreed to pay Sussex County a one-time fee of \$300,000 and \$72,314 annually to ship the waste to the South Coastal sewage treatment plant. The DNREC will also have to pay as much as \$500,000 to build a pump-station at the park. This should remove around 1 percent of the total nitrogen and phosphorus discharged to the Inland Bays. Rehoboth is currently exploring options for removing its point source discharge to the Inland Bays.

Another tactic that has been pursued by the DIBEP partners is to extend central sewers to remove onsite sewage disposal systems, which are a significant source of nutrient loading to groundwater. Since 1988, the central sewer systems in Sussex County have been expanded by

almost 200 percent and are expected to grow by another 11 percent in the coming three years as a result of projects currently under way. It is estimated that by 2001, more than \$158,169,000 will have been spent over this 13-year period to expand sewer service areas and remove more than 14,000 OSDS.¹⁹² Since 1988, projects have been completed at Long Neck and Dagsboro-Frankfort with more recent efforts targeted at expanding the West Rehoboth district and serving the areas around Red Mill Pond. Future efforts include the Ocean View region and expanding the West Rehoboth area to serve the area around Love Creek.¹⁹³

Sussex County has revised its comprehensive plan two times during the CCMP's development and implementation. As a result of the *1988 Coastal Sussex Land Use Plan*, conservation districts were created that established a minimum one acre lot size unless the property was served by central water and sewer and increased the minimum frontage requirement along tidal water bodies to 150 feet.¹⁹⁴ They also created a fifty foot buffer zone for wetland and tidal and nontidal waters. Sussex County further strengthened its land use policies when it revised its *Comprehensive Land Use Plan* in 1997. The revised comprehensive plan explicitly referenced the CCMP and adopted its nine goals.¹⁹⁵ However, Sussex County decided not to implement some of the cluster zoning regulations recommended by a consultant who prepared a report as part of DNREC's IBRI.

Delaware has also had aggressive open space and farmland preservation programs that helped advance the CCMP's goals and have helped to protect habitat in the Inland Bays watershed. The Open Space Program is administered by DNREC and was created in 1990.¹⁹⁶ It has been funded through \$30 million in bonds and an additional \$20 million appropriation in 1994. On average, the program has been able to protect \$1.81 worth of land for every \$1 spent.¹⁹⁷ As of May 1996, the program had preserved approximately 1,592 acres at a cost of over \$13 million in the Inland Bays watershed.¹⁹⁸ Other groups such as the Nature Conservancy have also acquired significant land holdings in the watershed.¹⁹⁹ Meanwhile the farmland preservation program created in 1991 and administered by the DDA has preserved more than 37,594 acres in Sussex County from future residential and commercial development.

The HUA program and other efforts by NRCS, DNREC, and SCD have continued to install BMPs and develop conservation plans to manage nutrient loadings from agriculture. Conservation plans have now been developed for 60,000 acres of farmland. The cost share program initiated in 1985 continues and is being supplemented with other USDA (e.g., EQIP) and EPA Section 319 funding.²⁰⁰ The DDA's Delaware Forest Service has managed and planted thousands of acres of the watershed with trees and vegetation.²⁰¹ In 1999, the EPA promulgated standards that would begin regulating some poultry growers. The federal program requires growers with flocks of more than 100,000 birds to obtain permits and file management plans for the use of manure. It also applies to all growers along sensitive rivers and streams, which includes most of the growers on the Delmarva Peninsula. The EPA also threatened to impose its own rules on Delaware if lawmakers did not take steps to curb excess nitrogen and phosphorus runoff. In 1999, the DGA passed legislation to begin regulating the poultry industry despite complaints that the legislation favors the farm lobby. The legislation created an industry dominated Nutrient Management Commission with farmers holding seven of the fifteen seats with three other seats reserved for related industries. The panel will operate as an independent arm of the DDA.

The DNREC developed a TMDL as a result of a lawsuit by the American Littoral Society and the Sierra Club for the Inland Bays in 1998.²⁰² The TMDL recommended removing all point source discharges of nutrients, reducing nitrogen and phosphorus loads from NPS by 40 to 85 percent (from the baseline period of 1988 to 1990), and reducing the atmospheric deposition of nitrogen by 20 percent.²⁰³ In order to develop a pollution control strategy to implement the TMDL recommendations, DNREC merged its TMDL advisory committee with the CIB's three newly created tributary teams, one for each sub-basin. Staff from the SGP and the CES are facilitating these meetings while the public outreach coordinator from the CIB is providing staff support to the tributary teams. The tributary teams are a community-based effort that is trying to involve representatives of various interest groups and the general public, many of which are new to the efforts to protect the Inland Bays. Accordingly, the effort has a strong public education component in addition to trying to develop pollution control strategies tailored to the particular nutrient loading problems in each sub-basin.

While the DIBEP partners have been engaged in these activities, the CIB staff has focused its efforts on its mission of conducting restoration, research, and education. The CIB have focused considerable attention on habitat restoration and protection efforts. Several demonstration projects have been used to try and restore submerged aquatic vegetation and to experiment with transplantation methods with varying degrees of success. The CIB has also worked with other organizations such as an AmeriCorps youth team and the SCI Boot Camp to conduct various restoration and education activities in the watershed.

The most notable accomplishment in terms of habitat restoration is likely the work at the James Farm site, a 150 acre tract of land on the Inland Bays that abuts a 475 acre tract of undeveloped land purchased by the state through its Open Space Program. The land was donated to Sussex County in 1992 with the requirement that the land not be used for residential or commercial development and that it be used for environmental or agricultural studies, parks and recreation, or to protect wildlife habitat. In 1997, the CIB leased the land from Sussex County for five years at \$1 per year after a restoration plan had been developed. In 1999, the CIB began making improvements to the property and secured donations of materials, equipment, and labor from local businesses to begin making improvements to the site such as clearing and marking trails, constructing walkways, building viewing platforms, and creating a parking area. The CIB also organized a tree-planting day where over 100 volunteers helped federal, state, and local officials planted more than 5,000 trees and shrubs to begin reforesting the site. It is expected that the restoration coordinator hired by the CIB in 1998 will help expand restoration efforts at the James Farm site and to initiate other projects in the watershed.²⁰⁴

The CIB also maintains an active research agenda focused on persistent environmental problems (e.g., eutrophication) as well as emergent problems such as algae blooms or *Pfiesteria*. The volunteer monitoring program continues to provide scientists and DNREC officials with much needed water quality data. The CIB has been instrumental in helping DNREC and the local governments deal with the algae blooms of sea lettuce in 1996 and 1997 that hurt local businesses. They also provided a mechanism to deal with the public concerns that resulted from "red tides," "brown tides," and *Pfiesteria*. The STAC has developed into a very effective mechanism for discussing these problems and communicating information to the public. It has

also begun to serve as a forum where local and state officials can go to for advice regarding scientific and technical questions. For example, the STAC has been very helpful in helping Rehoboth to explore options for removing its point source discharge from the Inland Bays.

The CIB also serves an important public education function. Its meetings and activities are well covered by the local press and a local radio station. It has produced numerous educational materials such as a newsletter that is distributed to more than 2,000 readers and a World Wide Web (WWW) site that contains minutes of meetings. The CIB staff make numerous presentations to other governmental and NGOs. The CIB also participates in special events with educational displays and has worked with local schools to develop educational curriculum and to take school kids out to learn about environmental problems.²⁰⁵ The CIB meetings, CAC, STAC, tributary teams, and volunteer monitoring program as well as special events such as the tree planting at the James Farm site provide opportunities for the public to get involved in these institutions.

During the early years of implementation, the CIB's Executive Director was the only full-time staff member and several respondents noted that it was a challenge just to "keep his head above water". During this period, the CIB's operations were funded by several special appropriations by the DGA and by the EPA. In recent years, the EPA's funding has stabilized, which allowed the CIB to expand its staffing by hiring full-time restoration and outreach coordinators. The pace of implementation activity has improved dramatically with the expansion of the staff.²⁰⁶ We expect this trend to continue into the foreseeable future now that the program's resources appear to have stabilized and the staff has been expanded.

In FY 1998, the CIB had a budget of \$559,450, which included \$312,000 in federal funds. The CIB has also been reasonably effective in leveraging resources from other sources to fund its operations. In addition to its NEP funding, the CIB received over \$782,090 in funding from other sources including:

- \$100,000 three year grant for SAV restoration and a grant for \$210,000 for project management
- \$175,000 three year EPA Regional Applied Research Effort (RARE) grant for examining the impacts of nutrients and toxics on fish
- U.S. Fish and Wildlife Partners for Wildlife grant for \$10,210 to purchase 8,600 trees and shrubs for the James Farm site²⁰⁷

In recent years, the CIB has been able to get a \$125,000 state line item included in the DNREC's budget to fund CIB operations. In 1996, the DGA approved a new specialty license plate that generates revenue for the CIB. The CIB has also received grants from a private foundation (e.g., Crystal Trust). The CIB developed Friends of the Bay, which provides paid memberships and donations to support educational activities. The volunteer efforts and donations for restoration work are also significant. For example, the \$1 a year lease on the James Farm site is valued at more than \$45,000 per year while the volunteer monitoring program provides more than \$60,000 in free labor for the program.²⁰⁸ The CIB also estimates that the volunteer hours dedicated to reforestation, trail maintenance, and facility development at the James Farm site was worth around \$5,500.²⁰⁹ The CIB has also been fortunate to get donations in labor, supplies, and

equipment from contractors and construction companies to support restoration work, which saved the CIB additional money. While the CIB has not aggressively been involved in fund-raising efforts, it did receive an estate gift valued at \$80,000 earmarked for the CIB.²¹⁰

It should be mentioned that in some cases, the activities discussed above do not clearly relate to the action plans contained in the CCMP. There are several reasons why this is the case. Several events have transpired since the CCMP's adoption that changed the priorities for various actors. The TMDL lawsuit and the development of pollution control strategies to implement the TMDL for the Inland Bays are now the focus for NPS control efforts instead of the CCMP's recommendations. The DNREC's Whole Basin Management Program and the development of the Whole Basin plan for the Inland Bays started in 1998. This will further reorient that agency's priorities [Appendix C].²¹¹ The DGA passed legislation during the 1999 session that will result in the regulation of nutrients from agricultural operations as will the new confined animal feeding operations (CAFO) standards adopted by EPA. This is now the focus and attention form many in the agricultural community. Other emerging issues such as the algae blooms and *Pfiesteria* have become high priorities for the CIB. The opportunity presented by the acquisition of the James Farm site has become the focus of restoration efforts. Moreover, it is important to point out that while the CIB was created to implement the CCMP, the CCMP was not designed to be implemented by the CIB. As a result, the CCMP is not necessarily an effective document for guiding the CIB's operations or decision making today. Accordingly, many of the actions by the CIB partners that are designed to "implement" the CCMP are not necessarily the actions described in the document.

Nevertheless, significant progress has been made towards some of the tactics contained in the CCMP's action plans. The CIB's recent *1999 Biennial Review Document* contained an updated "Report Card" that summarized progress towards the more than 50 strategies contained in the CCMP's action plans [Table 3 and Table 4].²¹² Due to the lack of specific and quantifiable targets, the determinations in Table 3 are necessarily subjective in nature. The "full/ongoing" category means that the activities are currently under way or have been completed. The "substantive" category means that substantive progress has been made. The "moderate" category means that there is good progress towards while the "none/unknown" category in Table 4 indicates that implementation may or may not be occurring. Based on this categorization, it appears that some action has been taken towards most of the tactics in the CCMP's action plans.

These accomplishments have been recognized by the EPA, which issued the CIB a "passing" grade for its 1997 Biennial Review, which made them eligible for \$300,000 in baseline funding in FY 1998 and FY 1999. The EPA's main criticisms during this review were: 1) the need for additional staff; 2) improved CCMP tracking mechanisms; 3) the need for long-term funding from state and local agencies; and, 4) additional implementation of some CCMP recommendations by lead agencies. In response, the CIB hired on two additional staff members. It has developed a tracking system, however, greater attention to this recommendation is clearly needed. The CIB has been able to get a line item for the CIB included in the DNREC's budget and is working to guarantee that the funding goes to the CIB. Finally, the development of the TMDL has changed implementation priorities.²¹³ The CIB recently submitted its second Biennial Review document and the indication is that it will receive another passing grade.²¹⁴

Future Challenges

The DIBEP is a complicated case. On the one hand, the DIBEP and the CIB made some notable progress in implementing the CCMP and addressing the environmental problems in the Inland Bays watershed. The CIB also expanded the capacity for public education, scientific research, and habitat restoration. On the other hand, the CIB is designed to be a neutral forum. While it can serve as a forum for discussing controversial issues such as development and agriculture and can elevate these issues on the policy agenda, the CIB is limited in terms of its ability to address the issues directly. This is a source of frustration for many DIBEP participants who hoped the CIB would directly address these controversial issues. Thus, the case reveals some of the strengths and weaknesses of using collaborative organizations to address environmental problems at a watershed level. It also reveals some of the unrealistic expectations that participants in a watershed management effort often have. Given the persistent nature of the environmental problems associated with development and agriculture and the failure of existing institutions to address them over the last three decades, it is questionable whether the CIB should be faulted for having similar difficulties, particularly when one considers the limited implementation funding. Thus, while significant progress has been made, important challenges remain.

Developing and Managing a Collaborative Organization

The CIB facilitates communication among the actors, sponsors research, educates the public, encourages volunteerism and civic involvement, and increases the capacity for habitat restoration. However, there are still problems surrounding the CIB's operation, many of which are to be expected given the development of any new organization. For example, there is still a lack of staff capacity to meet all of the expectations of the public and agency officials. Some board members are concerned that the CIB's operations were heavily dependent on EPA funds. It is also unclear what would happen to CIB operations if EPA funding were unavailable. Some respondents were also critical that the CIB has not utilized its nonprofit status more effectively and begun an aggressive fund-raising effort to become more self-reliant.

There have also been problems with the CAC.²¹⁵ Some CAC members were unhappy with the way the CCMP was modified to appease the agricultural industry. The CAC's problems may also reflect the lack of a clearly defined role or mission during the implementation phase. Many CAC members are also frustrated because they do not see what good it does them to make recommendations to the CIB on these confrontational issues when it will not act on them.

Other DIBEP participants complained that the CIB is too focused on planning (e.g., preparation of the water-use plan and tributary strategies) and noncontroversial activities like public education and habitat restoration, noting that the CIB rarely takes a position on anything controversial and many votes are marked by numerous abstentions. Interest groups, single-issue organizations, and private citizens often pressure the CIB and its staff to join in their causes. Not surprisingly, the CIB's neutrality is the source of frustration for these groups. As one respondent commented: "[T]hey ought to change their name or go out of business because the Center has not taken one stand or done one thing that is useful *for* the Inland Bays." As one respondent observed:

“the criticism the Center is getting is that we don’t have much more with the Center than we had without it because the Center is made up of all of the heads of various departments in the state that were there before and the center will not take sides on an issue. . . . The role of the center has not become embroiled in policy-making or decision-making and I am not sure that is so easy to accept for people who have been with the department [DNREC] for an extended period of time because they saw the center as maybe the final test to get some hard issues resolved that involve politics and other people like to get mixed up in the controversy but it hasn’t come to that. It is good for getting dollars to do research or to study matters or to do public relations and try to get groups together.”

Maintaining the CIB’s neutrality has also become a constant challenge for board members and staff. As one respondent observed:

“I’ve got a lot of respect for Bruce [CIB’s Executive Director]. He’s got the toughest job around next to the Board of Directors. You’ve got the Agriculture Secretary sitting next to the Natural Resources Secretary. They work very closely together, but they have to look at issues from two different directions. Sometimes they agree, sometimes they disagree. You’ve got the County Administrator sitting there with the economic viability of the county through the tax base at issue. You’ve got someone from water resources [DNREC] saying our fish our dying. You’ve got farming members there who are waiting for the first time you point a finger or cause a black eye . . . It’s a very fragile partnership right now.”

Moreover, it can be a challenge to appear neutral and nonpartisan in a rural community where the mere presence at a political, public, or special interest group event can easily be misconstrued by other actors.

Thus, there are many challenges associated with managing this new collaborative organization and determining where the CIB can play a constructive role. At the same time, the CIB cannot be expected to address every issue and probably will be limited mostly to focusing on win-win and win-no-lose situations. Thus, while the CIB can provide a forum for discussing issues and elevating them on the policy agenda, it probably will not play a strong leadership role in addressing controversial issues such as those surrounding development and agricultural activities. Instead, the CIB is more likely to have a supporting role such as when it recently provided testimony before Sussex County in support of Purdue Farms’ plan to build a chicken waste processing plan in the Blades-Lauren area that would handle 80,000 tons of manure per year.

Improved Performance Monitoring

The CIB also monitors implementation activities on a regular basis [Table 3 and 4]. However, there are several ways that performance monitoring can be improved. The CIB’s efforts to monitor environmental conditions consist primarily of reporting on the work of other organizations, not actually monitoring.²¹⁶ As a result, it is dependent upon existing

Table 3: The CIB's Report Card on CCMP Implementation

	Full/Ongoing	Substantive	Moderate	Some
A G R I C U L T U R E	<ul style="list-style-type: none"> ▪ Examine pesticide regulations/improve enforcement 	<ul style="list-style-type: none"> ▪ Enhance monitoring and response strategies 	<ul style="list-style-type: none"> ▪ Manage application & handling of fertilizers, pesticides, herbicides, manure, sediment, animal carcasses, & other contaminants ▪ Decrease potential for fish kills 	<ul style="list-style-type: none"> ▪ Establish & implement NPS control program ▪ Adopt BMPs to protect surface and groundwater
L A N D U S E	<ul style="list-style-type: none"> ▪ Protect waterways, groundwater, natural areas, open space, and wetlands 		<ul style="list-style-type: none"> ▪ Develop & implement zoning ordinances, laws, & regulations 	<ul style="list-style-type: none"> ▪ Develop & implement marina design criteria ▪ Provide adequate setbacks and buffers to attain maximum wetlands protection ▪ Integrate projected sea level rise into shoreline planning and zoning
H A B I T A T	<ul style="list-style-type: none"> ▪ Achieve maximum use attainability ▪ Acquire public access land ▪ No net loss of wetlands 	<ul style="list-style-type: none"> ▪ Promote recurrence of SAV 	<ul style="list-style-type: none"> ▪ Restore finfish and shellfish populations ▪ Develop & implement a water use plan 	<ul style="list-style-type: none"> ▪ Protect, restore, & enhance living resources ▪ Enhance/restore impacted shallow and nearshore habitats ▪ Strengthen marine related enforcement activity
I N D U S T R I A L	<ul style="list-style-type: none"> ▪ Address soaps, detergents, petroleum products, and household chemicals ▪ Replace leaking UST's & ensure new installations meet criteria ▪ Remove household hazardous waste 	<ul style="list-style-type: none"> ▪ Establish & implement comprehensive wastewater management priorities ▪ Establish wastewater management priorities ▪ Strive to reduce point source discharges to zero ▪ Coordinate management with existing solid waste, air, toxics programs 		<ul style="list-style-type: none"> ▪ Provide for safe disposal of infectious wastes

Source: Center for the Inland Bays (CIB), *Center for the Inland Bays: 1999 EPA Biennial Review Document* (Nassau, DE: CIB, April 1999)

Table 3: The CIB's Report Card on CCMP Implementation (Cont.)

Full/Ongoing	Substantive	Moderate	Some
<p>E D U C A T I O N</p>	<ul style="list-style-type: none"> ▪ Educate public & industry regarding waste minimization and pollution prevention 	<ul style="list-style-type: none"> ▪ Provide education programs statewide 	<ul style="list-style-type: none"> ▪ Protect groundwater recharge areas ▪ Address nitrates and other contaminants ▪ Develop policy for use of riprap & vegetation for shoreline protection ▪ Encourage recycling ▪ Establish speakers bureau
<p>A L L</p>	<ul style="list-style-type: none"> ▪ Coordinate mgt. decisions among all levels of government ▪ Explore financing alternatives for implementation ▪ Utilize and build on monitoring committee (CAC) 	<ul style="list-style-type: none"> ▪ Ensure accountability for implementation ▪ Identify user groups and their leadership ▪ Develop programs involving senior citizens and other special interest groups 	<ul style="list-style-type: none"> ▪ Ensure planning & management activities involve public participation, information, & education ▪ Examine feasibility of biological resource atlas for use in management decisions

Source: Center for the Inland Bays (CIB), *Center for the Inland Bays: 1999 EPA Biennial Review Document* (Nassau, DE: CIB, April 1999)

environmental monitoring programs that suffer from a lack of funding and other common problems (e.g., insufficient number of sites, gaps in time-series data, etc.). Data is stored in different locations and is in different forms. Delaware is also only in the early stages of developing environmental indicators so the CIB cannot build upon these activities.²¹⁷ While the CIB has expended some effort to coordinate, track, and communicate progress, the information is still not well integrated or accessible to the general public and agency decisionmakers.²¹⁸ As a result, it is difficult to get an accurate picture of the changes in the Inland Bays environmental conditions over time.

Efforts to monitor implementation performance could also be improved and linked to changes in environmental conditions. As indicated in Table 4, there are a number of areas where the CIB has no idea of the progress made or whether the lack of progress is a good thing (i.e., priorities have changed) or a bad thing (i.e., actors are shirking their responsibilities or lack funding). Monitoring progress is also hampered by the fact that there is a lack of specificity in the measures contained in Tables 3 and 4. Therefore, assessments of progress are subjective and it is unclear when you have actually completed a task. There is also no systematic attempt to track statistics like OSDs removed, building permits issued, BMPs installed, or conservation

Table 4: No Progress Reported or Progress is Unknown by the CIB

No Progress/Progress Unknown	
Agriculture	<ul style="list-style-type: none">▪ Develop & implement groundwater management program
Land Use	<ul style="list-style-type: none">▪ Form critical environmental areas checklist▪ Identify existing use patterns and develop preferred use areas▪ Determine use capacities based on public safety & environmental concerns
Habitat	<ul style="list-style-type: none">▪ Establish & implement shoreline protection program▪ Develop regulations to protect non-tidal wetlands▪ Strengthen enforcement of wetland protection regulations
Industrial	<ul style="list-style-type: none">▪ Ban solid and industrial waste disposal and non-biodegradable products▪ Mitigate damage from superfund sites in Inland Bays region▪ Identify, evaluate, and consolidate emergency response capabilities and plans
Education	
All	<ul style="list-style-type: none">▪ Explore financing management strategies with user fees and other innovative methods

Source: Center for the Inland Bays (CIB), *Center for the Inland Bays: 1999 EPA Biennial Review Document* (Nassau, DE: CIB, April 1999)

plans developed that would allow the CIB or the public to evaluate trends and compare efforts from year to year. The lack of specificity also hinders the development of shared expectations and prevents a more effective peer pressure mechanism from developing. Clearly defined performance measures are also needed because the CCMP's goals are really a set of priority actions.

Moving from Projects to Systematically Address Specific Problems

Most of the implementation efforts to date other than the installation of sewers are primarily project-based because the CIB relies primarily on leveraging other federal and state funding sources. As a result, the priorities, cost-share requirements, grant restrictions, and award procedures tend to drive implementation efforts rather than CCMP priorities. While individual projects may offer environmental benefits and other sources of public value, the danger is that when viewed over the long term the projects will amount to nothing more than what the respondents in Tillamook Bay referred to as "random acts of environmental kindness". That is, the individual projects may offer benefits but are too limited in scope, scale, magnitude, duration, or number to significantly change the underlying problems. The focus on individual projects funded by short-term discretionary grant money (i.e., "soft money" creates other problems in that it often results in a heavy reliance on outside contractors instead of building organizational capacity and the job insecurity for staff working on "soft-money" often leads to high turnover.

The lack of specific, quantifiable performance measures combined with an absence of a significant and stable source of implementation funding will make it difficult for the CIB to make the transition from its current project-based approach to one that systematically addresses specific environmental problems or provides specific ongoing public services. The CIB could also better link its activities to those of other actors in order to better mitigate the cumulative and secondary impacts of development and agricultural activities (e.g., stormwater runoff, erosion, flooding, habitat loss, and user conflicts).

The development of specific performance measures would also help the CIB address a related problem in that the CCMP is increasingly becoming out of date with the TMDL, new CAFO regulations, the acquisition of the James Farm site, summer algae blooms, and *Pfiesteria* displacing many of the CCMP's priorities. Moreover, the CCMP was never developed with the CIB in mind and has not necessarily been an effective or useful document for guiding its decision making. One respondent noted the danger this historic lack of focus can cause: "We've never been able to follow one issue to completion to anyone's satisfaction." Moreover, because the CIB is a collaborative organization there is always the danger that it will be pulled in different directions. As one participant noted: "You've got the CAC and some of the environmental organizations saying the center needs to take a stand on this. We want to stop this. These are on zoning issues and projects. Then we've got the center people saying we are to be a resource for everybody – a common ground. Right now with TMDLs, *Pfiesteria*, every issue you can imagine."

The danger is that the CIB's limited staff and financial resources are spread too thin to make significant progress in addressing any specific issue. Over the long-term, this could lead to a lack of public or community support if key constituency groups do not believe that significant improvements have occurred. Thus, we believe that CIB needs to carefully consider what its future role and mission given its current level of staff and financial resources and should consider developing some sort of streamlined policy document with some quantifiable performance measures that can be used to direct and guide future activities. The development of performance measures will also make it possible for the CIB to more clearly demonstrate the progress that has been made in addressing the Inland Bays' environmental problems.

Challenges Associated with Addressing Environmental Problems

The environmental challenges confronting federal, state, and local officials are formidable. A 1998 EPA report concluded that the Inland Bays still have some of the highest nitrogen loads in the world.²¹⁹ The TMDL calls for drastic reductions in nutrients that will be difficult to achieve. It is unclear how costly it will be to remove the point source discharges. While many BMPs reduce nutrients in surface runoff, the options for reducing leaching to groundwater are more limited. Respondents indicated that there are no BMPs or combination of practices that will cost-effectively reduce nitrogen input by the recommended 50 percent. There are still questions about the process of phosphorous transport and the effective methods of controlling these inputs.²²⁰ It is also unclear how nutrient loadings from atmospheric deposition can be reduced by the recommended 20 percent. Thus, the DIBEP participants face a formidable set of challenges associated primarily with development and agricultural activities.

Development continues at a rapid pace and is fueled, in part, by the installation of sewer lines. Increased development is causing a number of traffic problems, is changing community demographics, and is increasing the demands for county services while also creating other environmental problems. As a result, the County must raise taxes or use growth to pay for the new services – it has chosen growth. It is also difficult to get strong growth controls put in place. Development in the relatively affluent Inland Bays watershed subsidizes services in other rural and more impoverished parts of the County. The lack of political representation for the Inland Bays region on the Sussex County Council is another obstacle. Only one of the five Council members represents the watershed and the four representatives from the western portion of the county tend to be strong supporters of private property rights and are generally opposed to government regulation. Many of our respondents were critical of this arrangement and the County's corresponding lack of concern regarding the development in the Inland Bays watershed. As one respondent commented: "All I can say is shame on the county council. Everything they have ever done has been strictly for the constituencies of the other four council members. They have never treated this area right, they have never given it enough respect." However, using growth in some parts of a county to fund services in other areas is a common practice and one can make an argument that it is not in the county's overall best interest to restrict growth when other social issues are considered.

Sussex County also does not view itself as being the lead in addressing environmental issues. Historically, state agencies have taken the lead in environmental and infrastructure issues and the county often defers to the comments it receives from DNREC, DelDOT, and other state agencies. The county's position is that it is the state's responsibility to stop development on environmental grounds since it does not have the technical expertise to review these impacts. However, state regulations rarely serve as a barrier to development and do not account for the cumulative and secondary impacts associated with development activities. It also appears that the state believes it is the County's responsibility to restrict growth.

It is easy to see why many of our respondents were frustrated by the inability to address development issues – everyone believes it is someone else's responsibility. Moreover, it is unclear if the DGA has the political will to step in and restrict development, perhaps by creating a regional planning commission with regulatory authority. This stalemate frustrated many respondents. As one respondent observed: "[T]he one thing people have got to get through their heads is Delaware is the next to smallest state in the Union and the one thing it can never do is grow. All you can ever do is fill it up and you've got to decide what o ant to fill it up with. You don't have to keep people out but you ca concentrate your development in sensible places where there is water, where there is sewage treatment." At a minimum, greater collaboration between DNREC, DelDOT, SCD, and Sussex County will be needed to better manage growth. However, it also appears that additional action by the DGA may also be needed to address these problems.

The one area where the county has taken the lead is in expanding central sewers, which has been a priority in virtually all of the previous plans prepared for the Inland Bays region. However, development appears to be following the sewer expansion. Thus, while the DIBEP partners have been effective in removing OSDs, increased development has resulted in growing environmental (e.g., stormwater runoff, erosion, habitat loss, flooding, user conflicts) and social (e.g., traffic, changing public service demands, changing culture and community demographics)

problems. Over the long term, additional growth is inevitable. For the growth to be sustainable, the CIB partners will need to pay greater attention to the tradeoffs between environmental and social issues and do a better job of mitigating the cumulative and secondary impacts of development. This will require coordinating infrastructure investment decisions such as road construction (DelDOT) and sewer construction (Sussex County and local government), preserving farmland (DDA), and open space acquisition (DNREC) and improving the regulation of OSDSSs, erosion, stormwater runoff, marina construction, dredging, and wetlands alteration (DNREC, DelDOT, SCD, COE). With increased resource users, greater attention will also be needed to address user conflicts and manage access and use of the beaches, bays, and shoreline areas such that it minimizes user conflicts and prevents the environmental degradation.

Long term environmental improvements will also require bridging the gap between the agricultural community and the residents located in the urbanized beachfront areas. The tendency is to blame each other rather than appreciating the complexity of the issues and accepting that each is part of the problem and the solution.²²¹ Many coastal communities would like to blame the nutrient problems on the poultry industry and de-emphasize the other problems caused by residential and commercial development. For example, the Mayor of Rehoboth, which is faced with a potential \$11 million upgrade to its sewage treatment plant, told a local paper that he did not want to “pick a fight” with farmers but called on state regulators to look at other sources before burdening tourist towns with expensive upgrades and stringent regulation. Meanwhile, many agricultural communities feel that they are unfairly being blamed for all of the problems because they are visible, small in number, are the subject of negative “stereotypes”, and do not feel that the steps they have taken to address these problems have been appreciated. Clearly, all share responsibility for the environmental problems in the Inland Bays and all will be part of any solution to these problems.

The CIB has made some inroads into bridging this gap by providing a forum for getting stakeholders from the different constituency groups to interact (e.g., tributary teams and Board of Directors). The CIB also serves a useful forum for discussing problems and keeping the issues elevated on the policy agendas of state and local decisionmakers. However, some respondents reported that there is still a lack of support and antagonism from some sectors of the agricultural community and related interest groups (e.g., Farm Bureau). For example, when the CIB issued a report by Horsley & Witten, Inc. suggesting agriculture was the major source of nutrient loadings to the Inland Bays (the report also contained its own controversial pie chart), several lawmakers who were farmers tried unsuccessfully to retaliate by “wiping the CIB’s budget off the books”.²²² Once the presence of *Pfiesteria* was detected in the Inland Bays, the gap further widened when the media pointed to agriculture as the culprit instead of a more balanced view that noted the problems resulting from residential and commercial development, which may actually prove to be more pervasive and problematic over the long-run.²²³ Moreover, the development of EPA’s CAFO standards and the DGA’s 1999 legislation regulating agricultural operations has further exacerbated these tensions.

While regulation will lead to some reduction in nutrient loadings, it is questionable whether regulation alone is the answer. The current approach is one that works directly with individual farmers to get them to install BMPs and adopt nutrient management plans. One problem is that the farmers who produce the manure are often not the one’s who apply it as

fertilizer. This will complicate the development of an effective regulatory system. Moreover, the approach fails to take advantage of the way the poultry industry is organized and the strong role that the five integrators play. It might prove to be more effective to work directly with the integrators to establish an incentive structure that encourages nutrient management since they control all aspects of the production process. A helpful analogy would be the problem of reducing automotive emissions. The current regulatory approach for CAFOs is analogous to working with each car owner to get them to install a catalytic converter. The alternative approach was to work directly with the major automakers (e.g., the integrators) to figure out ways to address the problem through the production process or changes in the fuel content.

There are many ways this could occur. For example, the integrators could agree to pay slightly lower prices to growers that fail to adopt nutrient management practices.²²⁴ The DGA or the federal government could create financial incentives for the integrators to centralize the disposal of manure and dead birds as it has other facets of the production process. This would not be unprecedented since tax payers have long subsidized the construction of facilities to treat human and industrial waste (e.g., sewage treatment plants) that result in economic benefits to industry. Another example would be a small tax on poultry products nationwide and then using the revenue to pay for BMPs. This would let growers and integrators in each region of the country determine how to best address their particular problems.²²⁵ Other changes to the IRS tax code could create incentives such as new tax credits or shortening depreciation schedules.

A number of options for reducing the amount of poultry manure are being explored. Recently, the CIB has begun discussions with Townsends Poultry, the largest integrator in the watershed, to examine the opportunities for pelletizing fertilizer and other options.²²⁶ The CIB also testified before the Sussex County Council in support of Purdue Farms' plans to build a chicken waste processing plant. The application was approved in 1999 and AgriRecycle's pelletizing plant is expected to handle 80,000 tons of manure per year. This plant would process a little less than half of the manure generated by Purdue's growers. The Governors of Maryland and Delaware have announced plans to examine the feasibility of burning manure at a Conectiv power plant in Vienna, MD. Research is also underway to genetically alter the broiler hen so that it would excrete less phosphorus in its waste. Others are examining whether the corn can be genetically modified to store its phosphorus in a more available form while others are examining the feasibility of adding enzymes to the feed. Other researchers are exploring whether simply adding alum to poultry house litter may help to reduce phosphorus loadings in nonpoint runoff.²²⁷

In the end, reducing nutrients through the production process and finding more efficient uses of manure use or disposal may be more effective at "solving" this problem than the imposition of new regulatory requirements on individual farmers. At the same time, the regulatory requirements changed the incentive structure for the poultry industry to find these innovative solutions and the industry may be more likely to collaborate with other actors to address these problems in the future.

Analysis

The analysis of this case study is divided into two sections. The first identifies those factors that appear to influence the success of a watershed management initiative, whether it be positively or negatively. In some cases, the Academy requested we explore the importance of certain factors (e.g., public and community involvement). In other cases, the factors emerged from our comparative analysis and review of the applicable literature. The second section examines the institutional performance of the Delaware Inland Bays Estuary Program (DIBEP) using criteria provided by the Academy.

Components of a Successful Watershed Management Program

Our comparative analysis suggested that the following factors had some influence on the development and implementation of watershed management programs: 1) a program's contextual situation; 2) public and community involvement; 3) use of science and other technical information; 4) well managed decision making process; 5) program administration; 6) collaboration; 7) EPA's programs and action forcing mechanisms; and, 8) performance-based management. The following sections discuss the importance of each factor. For a more detailed discussion of the definitions and concepts discussed in this analysis can be found in our final report entitled *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*.

Context Matters

We concluded that contextual factors influenced the development and implementation of the DIBEP's CCMP. Some of these factors included the history of previous planning efforts and the configuration of the watershed. We also concluded that it is important for practitioners to understand the "ecology of the governance system". That is, the tradeoffs among environmental problems and other social problems and how these institutions function and interact with one another. It also requires understanding how industry is organized. This understanding of the governance system helps practitioners design effective policies, identify potential negative consequences of policies, and can help identify opportunities for collaboration. While a detailed analysis of these factors is beyond the scope of this analysis, several examples are provided with others noted in subsequent sections of the report.

It is important to understand the configuration of the watershed which reinforces the "us versus them" split with the residential population centered in the beachfront areas and the agricultural operations being located across the bays on the inland portion of the watershed. These divisions are further reinforced by an income and a cultural divide. The growing retiree population and the summer tourists are often more affluent, more educated, more cosmopolitan, have loose ties to the community because they have moved there recently or live there seasonally, and have no sense of the region's history. This is very different than the agricultural community that is more rural and tight-knit. There are many family farms and many residents have ties that go back generations. Many of these communities also have sizable populations with lower income and educational levels than their beachfront counterparts. Moreover, as development has

moved inland, these tensions have increased as the perceived “quality of life” in the rural areas declined as a result of increasing urbanization and a growing year round population.

It is also important to understand the ecology of the governance system. There is relatively little overlap among the various institutions that govern the Inland Bays watershed. Sussex County controls land use, stormwater regulation is implemented by the SCD and DelDOT, DNREC regulates OSDs, water quality, and other environmental issues, and DelDOT controls most road decisions. Local governments are surrounded by unincorporated area and the authority of county and local government is clearly divided. As a result, there is little overlap among these agencies in their operational decision making.

This may be one reason why there is a long history of planning efforts in the basin. Planning has become the many strategy to encourage interactions, find ways to coordinate decision-making process, and to find opportunities to collaborate and work together. The long history of watershed planning efforts also influenced the development of the DIBEP. The relatively rural nature of the watershed allowed many of the key officials and stakeholders to develop personal relationships over the years. The DIBEP was able to leverage and build upon this social capital (i.e., trust) in its efforts. Previous planning efforts also identified the issues and stakeholders while many of the state, local, and university officials had developed a “culture of collaboration” in both planning and implementation efforts. Thus, many of the DIBEP participants had a shared definition of the problems and the necessary solutions before the process even started. However, the agricultural community was less involved in previous efforts and it had a different perspective on these problems. While many assumed that the agricultural industry would adopt their shared definition of the problems, this was not the case and much work remains to be done in this area.

It is also important to understand how particular institutions function. Once it is known that only one of the five county council members represents the Inland Bays watershed and that property tax revenues from this relatively affluent area subsidize services in impoverished areas, it becomes easy to understand why the County has not taken steps to significantly restrict development. The lack of capacity of local governments also serves as a barrier as the County lacks a professional planning staff with environmental planners that could support and assist to local communities. Accordingly, local government has historically relied on DNREC and other agencies (e.g., SCD, CES, SGP, STAC, CIB) to provide technical assistance. It is also important to understand how industry is organized. For example, the vertically integrated nature of poultry production creates opportunities for addressing nutrient loading problems beyond simply working with individual farmers.

It is also important to understand the tradeoffs between environmental and social problems. Several tradeoffs are noted in the report. The installation of sewers to remove OSDs appears to have exacerbated the development pressures by opening up areas that were unsuitable for OSDs. It has also allowed development at greater densities. Thus, while sewers have reduced nutrient loadings from OSDs the increased development is causing other environmental problems. The use of property tax revenue resulting from new development to provide other county services is an example of how actions to address environmental issues are often inherently linked to other social issues.

Moreover, while development is causing environmental problems it is also causing other social problems that need to be understood. Newer residents are now living adjacent to farms and then complain about odors from agricultural activities to local officials and have negative stereotypes of “farmers”. They are also demanding higher levels of county services, which place pressure on Council members to approve more development since the same residents do not want to pay higher taxes. As the population has grown and development moved inland, it has changed the rural character of these communities, created new problems (e.g., traffic) and placed pressure on farmers to sell their land to developers.

Public and Community Involvement

The NEP places great importance on public and community involvement. Programs are expected to use a complex advisory committee structure, provide opportunities for public involvement, and to develop effective public education programs. The underlying assumption is that these activities improve an estuary program’s effectiveness. Our analysis suggests that there was a great deal of public and community involvement during the development and implementation of the DIBEP’s CCMP.

Most of the major stakeholder groups were involved throughout the planning and implementation process. There were a few examples of stakeholders that were not involved, however, this lack of involvement did not appear to directly cause problems. While Sussex County was involved on numerous committees throughout this process and previous planning efforts, there was only limited involvement by public officials from smaller communities. This has changed in recent years with growing involvement of local officials. During the early years of the planning process, there was also some lack of representation on the STAC by agricultural and land use specialists. However, this oversight was largely due to a focus on water quality and has since been corrected. Another omission is the general lack of involvement by DelDOT. While this omission has caused no problems, it likely reduced opportunities for collaboration.

The DIBEP had strong public involvement during the CCMP’s development. Most of the respondents indicated that they felt that they had an influence on the content of the CCMP. There were a number of public “vision” workshops to get the public involved in the CCMP’s development and the CIB continues to emphasize public involvement by: holding an annual public forum; Board of Director’s meetings; CAC and STAC meetings; interactions with the organization Business People for the Bays (BPB); interactions with SCAT; regular reports to the Sussex County council and other state committees; and presentations to groups such as the American Association for Retired People.²²⁸ Efforts such as the development of the *Comprehensive Water-Use Plan for Delaware’s Inland Bays*, tributary strategies, and the James Farm restoration project provide other opportunities for civic involvement and volunteerism. It is less clear what effect this involvement had on the substance of the plans or in public support for the CCMP or the CIB. Since the “public” is often synonymous with “environmentalists”, it is even possible that strong public involvement may have exacerbated conflicts between the residential and agricultural communities.

There have also been some problems with the CAC as it has searched for a mission during the CCMP's implementation. One respondent commenting on the CAC during the years following the CCMP's approval noted: "And thank God they [CAC] are meeting only four times per year because they were four meetings per year that were absolutely worthless. We didn't have staff for the committee. We didn't have anybody implementing anything. . . . this thing was walking backwards. That was frustrating in and of itself." Several attempts were made to revitalize the CAC, but it appears to lack a clearly defined role or mission in the implementation efforts and the CIB's focus on being a neutral forum continue to be a source of frustration. It also appears that the CAC has in many respects been supplanted by other committees such as the tributary teams.

It was also unclear how effective the CIB's public education efforts have been. The CIB appears to be effective at informing the public about its general activities and receives good press coverage. The staff makes numerous presentations to community groups and participates in other civic organizations such as the local chambers of commerce and has worked with schools to improve environmental education. The CIB has focused less effort on trying to educate transient summer residents about environmental problems. Efforts targeted at changing the behavior of homeowners or landowners that might lead to environmental improvements have also been more limited. Instead, the CIB relies on the existing education programs by actors such as DNREC, SCD, CES, and SGP. The CIB has also had some trouble keeping its internet site updated and could do better job of making its meeting minutes and all of its previous work products (e.g., CCMP, technical reports, Biennial Review reports, etc.) available using this technology.

Another finding related to public education is the challenge of communicating information about BMPs or behavioral changes to farmers. In part this is due the politicization of science and technical information. But it also appears that an agency like DNREC may be the wrong messenger since there is so much distrust that the information is often discounted. The historical reliance has been on CES, NRCS, and SCD. While the respondents we interviewed certainly indicated a higher degree of trust with these actors, their information can also be discounted because they are from "the government" or they are "scientists". In these rural areas, they are often viewed as outsiders. Many of the farmers have also seen the advice given by these individuals change over the years, which gives them further reason to question the advice. Finally, it is clear, that these actors are not the major source of information to farmers, which tends to be the integrators, DPI, Farm Bureau, and other farmers.²²⁹ This suggests that more research is needed to better understand how to diffuse this information. It also suggests that groups like CES, SCD, and NRCS need to work more closely with the integrators and industry officials to transmit information to farmers.

It is also unclear if expanding stakeholder involvement could have reduced the problems the agricultural community had surrounding the CCMP. One mistake a have been assuming that interest groups or organizations such as DPI, Farm Bureau, SCD, NRCS, CES, and DDA would be adequate to represent the wide range of interests. These may not have been the "correct people"²³⁰ and more effort to involve the opinion leaders in these organizations and the community may have been necessary. Greater involvement from the integrators is also needed because they play a pivotal role and have the ability to create strong incentives for growers.

However, it still is unclear if these changes would have prevented the problems that occurred at the end of the planning process given the politics at that point in time and the fears that EPA might regulate the industry.

Two lessons emerged from this analysis. First, in a consensus-based process there is always the possibility that one set of interests may take advantage of its power if asymmetries of power exist. In this instance, the agricultural industry could force changes because of their strong political influence and the lack of a countervailing political influence that could protect the environmental interests. Thus, the industry negotiated the best CCMP they could get and when that was not good enough they exited the process and took advantage of their best alternative to negotiation. Similarly, the Sierra Club exited the process when they were dissatisfied with the CCMP and the lack of attention to nutrient loadings and sued the EPA and DNREC to force the development of a TMDL. The second lesson is the need to work directly with collaborators and to not fall into the trap of thinking that a special interest group or agency will represent the interests of those that you want to collaborate with and the importance of involving opinion leaders within various industries and interest groups.

Use of Science and Other Technical Information

One of the major features of the NEP is that estuary programs are given substantial resources during the planning process to do the research necessary to develop, modify, and refine management strategies. This is one reason that the DIBEP spent a disproportionate amount of its funding on planning when compared to implementation. Estuary Programs are also encouraged to maintain an active research agenda during the implementation phase, although they are expected to leverage this research money from other sources. We concluded that science can play an important role, particularly when it is “nested” in the decision-making process. The case also illustrates the problems that can develop when the science gets politicized.

The DIBEP did a good job of nesting science within agency decision-making processes. This is likely due to the fact that the previous planning efforts left the participants with a focused research agenda. There was also good interaction between the STAC and other committees. For example, at one point the DNREC staff had the STAC and CAC rank the issues (nutrients, habitat loss, etc) and they matched up perfectly. Moreover, the fact that DNREC staffed the planning effort ensured that the research addressed their needs. For example, when the decision was made to put off the development of the water use plan until the implementation process, studies were funded that provided information to support later efforts. When the EPA forced the DIBEP to develop a computer model, DNREC’s involvement ensured that it would be developed in a manner that filled needs later in the implementation process (e.g., TMDLs). As a result, the DIBEP was effective in filling important gaps in information and gained a better understanding of the problems affecting the Inland Bays. One area where improvement could be made is in making more of these reports available over the internet. The CIB could also do a better job of synthesizing the research and environmental monitoring data and provide it in a form useful to decisionmakers.

The STAC did experience a few minor problems because agricultural scientists were not part of the STAC during the early years of the CCMP’s development.²³¹ However, the STAC

developed into an effective mechanism for synthesizing scientific and technical information. It continues to provide a forum for federal, state, and local officials to discuss the problems affecting the Inland Bays and serves as a forum for local officials to get technical advice. For example, the STAC is working with Rehoboth to examine the options associated with removing its point source discharge to the Inland Bays. The STAC also provides a forum for addressing emerging environmental problems. For example, the STAC was instrumental in determining how to deal with the algae blooms that occurred during the summers of 1996 and 1997. It also helped the CIB develop a research agenda to examine the potential for a *Pfiesteria* outbreak and is helping identify sources of atmospheric deposition of nitrogen. As a result, the CIB continues to maintain a research agenda targeted on the issues of concern to federal, state, and local decisionmakers. The STAC and the tributary teams have also created a tighter working relationship between the CES, SGP and technical staff in various agencies.

An interesting problem that emerged was the way science became politicized. This has complicated efforts to address the nutrient loadings from agriculture. There are several reasons why science became politicized. With each subsequent planning initiative, pressure on the agricultural industry increased and beginning in the late 1980s, the EPA and DNREC placed increasing focus on NPS pollution. These actions elevated the possibility that these activities might be regulated if voluntary efforts were unsuccessful. Meanwhile, agriculture is the state's dominant industry and is politically powerful. Thus, it is understandable why the industry might challenge research that might be used as the basis for new regulations. The industry is also well organized, has its own technical experts, and the integrators have the financial resources to hire consultants to challenge some of this research. In fact, the DPI set aside \$1 million to fund its own research on water quality problems.

The nature of the ecological system in which nutrients are discharged into groundwater that has residence times ranging from 15 to 40 years before discharging to surface waters also makes it relatively easy to challenge the research. The scientific understanding of how nitrogen and phosphorus enter groundwater and surface water is still emerging. This makes it hard to establish causal connections. It also means that the farmers received mixed messages from scientists and extension agents over the years and many naturally questioned the credibility of many scientists and agency technical staff. It also allows agricultural groups to say that if you were wrong once you might be wrong again.

Another factor that allowed the industry to challenge the research findings was the lack of good data and high level of scientific uncertainty. The groundwater system is poorly understood and is expensive to monitor. Water quality data is of varying quality and deviates based on a wide range of natural factors (e.g., rainfall patterns). There is also a lot of variation in the sources of NPS pollution. Nutrient discharges from sewage treatment plants vary during the course of the year due to fluctuations in the seasonal population. The impact of OSDs varies based on their location (e.g., soil conditions), proximity to surface waters, technology used, and the use pattern in the household. The impact of stormwater runoff varies based on site conditions and the combination of BMPs used. There is also tremendous variation in the size and scope of poultry operations and in how farmers apply fertilizer to the fields. Since no study has measured all of these individual sources, researchers are forced to make generalizations and assumptions to calculate nutrient loadings. Thus, studies such as the CIB's Horsley & Witten

report and the DNREC's TMDL only present generalizations and it is easy to attack the assumptions made by researchers or the data that was used in the studies.

Well Managed Decision-Making Process

We also concluded that it was important to have a well-managed decision-making process. Overall, it appears that the DIBEP staff did a good job of managing the process used to develop the CCMP. Previous planning efforts such as the GTFIB provided the participants with well-focused problems. The DIBEP partners also had a clear vision of what they wanted in their CCMP as a result of these efforts. However, their "vision" was different from that of the EPA, which was the heart of the conflict surrounding the EPA's approval of the CCMP. As a result, they ended up with a compromise document and had to spend considerable staff resources preparing documents that were largely for the EPA's consumption and were not of much use in developing the CCMP or in supporting the CIB's operations. Our analysis suggests that the problems the DIBEP staff encountered were due to two main factors. One was the lack of staff experience in managing this type of collaborative, committee-based process. The second was EPA changing the rules of the game during the CCMP's development. It is unclear what actions, if any, could have prevented the agricultural industry from exiting the process and forcing the changes it desired in the CCMP.

The previous history of collaborative planning helped the DIBEP develop and administer an effective committee structure. There was good representation of affected stakeholder groups and good interaction among DIBEP staff and the various committees. The DIBEP staff also figured out a way to involve the general public throughout the process (i.e., the vision workshops). The process was also consensus-based. While the DIBEP was able to eventually develop a CCMP that reflected a "consensus" document, the case also demonstrates a potential problem with a consensus-based process in that it often involves tradeoffs and compromises and can result in a vague document that does not threaten vested interests. As one respondent observed: "The Delaware CCMP is really a nothing document. It is vague, it is loose, and maybe that is, in retrospect, all we could have gotten with the process we used." Other respondents questioned the wisdom of using a consensus-based process in this situation. One respondent went so far as to say "I think the word consensus has done more damage than any word in the last two years."

It is questionable whether a consensus-based collaborative process was appropriate in this case. Addressing the two main sources of nutrient loadings involve win-lose situations and there are few clear incentives for the participants to become engaged in collaborative activities. There was a fundamental disagreement on core issues and the DIBEP was unable to develop a shared definition of the problems affecting the Inland Bays. Thus, it was unlikely that they would be able to develop consensus on management actions to address the two central problems. The DIBEP also had no way to prevent actors like agriculture or the Sierra Club from going outside of the process to force the changes they desired. In both cases, these actions were the result of factors that were largely beyond the control of the DIBEP staff.

The development of the CIB also illustrates the importance of how such things such as the membership of a collaborative organization, its decision-making rules, and the social norms

and pressures that come from membership influence the nature of implementation activities. The structure of the CIB ensures that it must remain neutral on controversial issues if it is to be effective. Addressing controversial issues will divide the membership and make it difficult for the partners to work together in areas where there is broad agreement. Moreover, taking stands on these issues could cause the CIB to lose political support in the DGA (e.g., release of the Horsley & Witten report caused several legislators to try and block the CIB's line-item appropriation). Thus, the CIB focuses mostly on nonpartisan and politically neutral activities – public education, habitat restoration, and scientific research. Given the general lack of capacity for addressing these issues, the CIB fills an important niche. The structure of the CIB and its annual reporting requirements also create a peer pressure mechanism that encourage additional implementation activities and helps to keep issues elevated on the political agendas of state and local decisionmakers.

Leadership also played an important role in developing and implementing the CCMP. Early efforts such as the GTFIB and the IBMC cultivated a group of individuals in various state and local agencies, the university, and the general public who were knowledgeable about the problems affecting the Inland Bays. Many of these individuals went on to play important roles in developing and implementing the CCMP and now serve as either Board members or serve on various committees (e.g., CAC, STAC, tributary teams, water use plan). This type of experience helps maintain the institutional memory as many of these efforts are poorly documented. The leaders also help motivate others to act and make the commitments necessary for the CIB's activities to proceed. Leadership is also important given the large role that volunteers play in the CIB's implementation activities (e.g., development of tributary strategies). While this leadership has been important, one of the challenges confronting the CIB is to cultivate a new generation of leaders who can carry on these efforts into the next century. Moreover, the CIB is still largely based on individuals. For it to succeed and last into the future, the CIB will also have to move beyond relying on individuals and personal relationships and “institutionalize” the social norms and informal priorities, policies, and rules that have developed among individuals involved in these efforts.

Program Administration

There is also no substitute for well-managed program and building an effective organization. Factors such as having an effective program director, staffing (e.g., recruitment, hiring, retention, training) and personnel management (e.g., personnel evaluations, grievance procedures), budgeting, grants management, and contracting procedures had an important affect on the DIBEP. During the planning process, DNREC was the hiring agent and the DIBEP did not suffer any significant personnel or management problems and benefited from combining experienced and entry level staff. Moreover, the staffing arrangement was similar to previous efforts such as the GTFIB and the IBMC so it was one that was familiar to DNREC, the DGA, and management conference participants.

The creation of the CIB also illustrates these points. The CIB is a very different organizational model in that it is a collaborative organization and the staff work directly for the board rather than for one of the member. Developing the CIB involved more than simply implementing a CCMP; it involved developing a new organization. This required determining

how the organization would function, what each partner's role would be, and how they would work together, make decisions, and supervise CIB staff. These developmental issues are still the focus of CIB staff and Board Members. Issues such as getting a line-item in the state budget, finding a permanent home, fund-raising, developing a contingency or reserve fund, creating personnel positions, hiring procedures, employee benefits, incorporation as a 501(c)(3) organization, and the indemnification of Board Members are important issues that dominated a great deal of time during the CIB's development. The CIB is also a work in progress and is still in the process of defining itself and where it will go into the future now that the CCMP is becoming dated and is less useful for guiding decision making and other events (e.g., TMDLs) have transpired since the CCMP was completed.

The case study also demonstrates the importance of having flexible and stable resources. The CIB's ability to collaborate with other partners improved dramatically when its slack resources increased and staff expanded to include a restoration coordinator and an outreach coordinator. With just an Executive Director and some part time clerical staff, it was a challenge for the CIB to meet all of its commitments. Activities such as the James Farm project and tributary teams would not have been possible without additional staff support. However, now that the staff resources have become committed and involved in new efforts, it has again become difficult for the CIB to meet all of the demands being placed on limited staff resources.

Our analysis also suggests that stability and flexibility in funding might be more important than the actual amount of funding. The stabilization in the NEP grant allocations and the development of line item in the state budget have improved the CIB's ability to plan into the future. Prior to this, the CIB operated primarily off "soft money" and mostly contracted out services. While this allowed the CIB to complete many of its tasks, it can present problems and also means that there is little development in organizational capacity. The increase in resources combined with the stability of these funds allowed the CIB to expand its staff and increase its organizational capacity. However, the heavy reliance on other federal and state grant money to fund implementation efforts has made it difficult for the CIB to move beyond a project-based approach to systematically address specific problems. It also means that the priorities, cost-share requirements, grant restrictions, and award procedures, which often change frequently, tend to drive implementation rather than watershed priorities.

Collaboration and Building Effective Partnerships

We also concluded that collaboration can be a useful tool or strategy for addressing watershed problems or enhancing watershed governance. However, its value hinges on its ability to develop, manage, and sustain collaborative relationships that add public value as a result of working together rather than separately. Thus, it is important not to view collaboration as an "end", but rather as "a means to an end."

The history of the planning efforts in the Inland Bays watershed indicate that state and local officials have often used participatory planning as a mechanism for improving the coordination of existing programs, finding new areas for collaboration, identifying necessary policy or program changes, and encouraging policy change. This may be due to the lack of overlap in operational decision making because state and local agency responsibilities are clearly

divided. While there is little duplication and overlap, it also means that there are few opportunities for routine interaction that might otherwise stimulate policy development or identify opportunities for collaboration. These interagency planning efforts and implementation committees fill this need. One of the major strengths of the CIB is that it has institutionalized this interaction and provides opportunities to explore opportunities for collaboration. The CIB also continues to use participatory planning as a tool for encouraging interactions and identifying areas for collaboration.

Collaboration is also a dominant implementation strategy. At the operational or project level there is collaboration among the partners in research projects, public education efforts, and restoration projects such as the James Farm site. There is also collaboration among groups such as SCD, DPI, NRCS, and CES in trying to address the nutrient loading issues. There are also some examples of collaboration in the review of development projects in Sussex County with the SCD reviewing the erosion and stormwater requirements of development projects to satisfy both DNREC and county requirements.

At the policy level, the CIB has been engaged in a different set of collaborative activities. The CIB's meetings provide a forum for partners to discuss policy issues and to find opportunities for collaboration at the operational level. The STAC is an effective organization in its own right for discussing technical issues and providing guidance to various agency officials. Other activities at this level would include the CIB's reporting on implementation efforts (e.g., "Report Card") which create peer pressure for the partners to continue or expand their efforts. However, the CIB has missed some opportunities for collaboration at this level. CIB activities could be linked better to other programs such as the installation of sewers, land acquisition, farmland preservation, and efforts to install BMPs on farmland. One way this could be accomplished would be through a set of shared policies or performance measures.

Perhaps the major accomplishment of the DIBEP was the development of the CIB, which is a collaborative organization that oversees and encourages collaborative activities at the other two levels. Collectively, these collaborative activities have added public value in various ways. Activities such as the restoration at the James Farm site offer the potential for improved environmental outcomes or the ability to achieve these improvements in a quicker time frame. The same holds true for many of the collaborative efforts that have led to land acquisition, the installation of BMPs and conservation plans on farms, or other efforts. The CIB has leveraged resources from a variety of sources and its partners have made some significant commitments in terms of staff and resources. The presence of an estuary program also helped CIB partners leverage additional funding. For example, one researcher at the University of Delaware reported "I have received quite a bit of money from the EPA that I probably wouldn't have received if it weren't for the NEP." The heavy reliance on volunteers has other benefits. Donations of labor and materials saves the CIB money while encouraging volunteerism and civic involvement. The development of the CIB has also created additional institutional infrastructure that other organizations can build upon in the future.

Several factors influenced the ability to use collaboration as an implementation strategy. Previous efforts such as the GTFIB and the IBMC produced a culture of collaboration so there was often support among many staff and mid-level managers for collaborative efforts. Slack

resources were also important. As the CIB increased staff resources it was able to undertake additional collaborative activities. However, other CIB participants also need to have slack resources if they are able to collaborate effectively. Another lesson was that you need the right people to represent stakeholders in the process. In terms of government actors this means having directors and other key staff who are leaders within the organization. In terms of interest groups, it is important to have opinion leaders representing the organizations. A related lesson is that it is important to understand how an industry or activity is organized and then to work directly with the potential collaborators. Finally, it appears to help when the actors have an incentive for participation in the collaborative effort. One of the problems that hindered collaboration with the agricultural industry is that the industry has had little incentive to collaborate. It will be interesting to see if the recent imposition of regulatory requirements will reverse the incentive structure and create new opportunities for collaboration.

EPA's Role in Watershed Management

Another observation was that the role of EPA and DNREC (i.e., its state counter part) and their various water quality programs and action forcing mechanisms (e.g., TMDLs) varied within the case. During the CCMP's development, DNREC was heavily involved and staffed the DIBEP. For the most part, staff was from the water quality programs. The Section 319 NPS Management Program had sporadic involvement, which consisted primarily of grants for demonstration projects and other implementation activities targeted primarily at agricultural activities. While significant Section 319 funds continue to be utilized, significant cost-share funding is also allocated by the DGA as well as by various NRCS programs such as the HUA project and EQIP. The EPA's continued threats to regulate agricultural operations over the last few years helped to get the Governor, DGA, and agricultural industry to finally agree on legislation that will finally result in the regulation of nutrient loadings from poultry operations.

The clean water state revolving fund (CWSRF) program has been less important in the sewer construction in Sussex County than one might think. Local officials reported a preference for selling their own bonds and relying on federal funding available for sewer construction pursuant to the USDA's Rural Utility Service because you can finance the loan over 40 years compared to the CWSRF's 20 years. This results in lower user fees and more flexibility in formulating repayment schedules. However, the CWSRF program has played an important role in providing over \$2 million in low interest (3 percent) loans to poultry growers and farmers in the last 5 years for installing BMPs.

The relationship with the TMDL program in Delaware is also interesting. There was no involvement during the planning process and the threat of TMDLs did not serve as any sort of action forcing mechanism. However, since the CCMP was adopted, a TMDL has been developed for the Inland Bays watershed. The TMDL was in response to a lawsuit filed, in part, because the Sierra Club was dissatisfied with the DIBEP's CCMP process and that it lacked tough restrictions on nutrient loadings. DNREC ended up using a computer model that the EPA coerced it into developing during the DIBEP's planning process to develop the TMDL. The upside was that the model ended up being used so the EPA's money was not wasted. The TMDL was also developed with a better water quality model and data than would otherwise have been possible. The downside was that these data were old (1988 – 1990) and because the

information existed, the judge was unwilling to give the DNREC and extension to collect new data. The CIB has also been instrumental in helping the DNREC to begin developing the pollution control strategies (i.e., tributary strategies) necessary to implement the TMDL's recommendations. As a result, the DNREC is able to build upon the social capital that developed as a result of previous watershed management efforts. This demonstrates the benefits that can occur when there is a history of collaboration in place prior to developing a TMDL.

The EPA program that had the biggest role in this case was the NEP. The program played several constructive roles. The funding provided the DIBEP with a chance to fill existing gaps in technical knowledge and refined the technical basis for decision making. It also provided Delaware with the resources to build upon previous efforts such as the GTFIB and the IBMC. During the implementation phase, the NEP implementation funding provides some stability and allowed the CIB to expand its staff.

While the EPA certainly played a constructive role, many respondents were critical of the NEP process, or at least the EPA's efforts to manage and control the process. A former DNREC Secretary even referred to the NEP as "a bureaucrats wet dream". The EPA's efforts control the DIBEP's planning process and the content of the CCMP was responsible for many of the problems and some of the conflict that surrounded the final CCMP. It is also questionable whether any of the changes the EPA wanted would have had any lasting value or would have improved implementation efforts. The research team did not identify any evidence that suggested that the changes the EPA insisted upon did anything to enhance or reduce the likelihood of implementation or changed the way implementation occurred. The conflicts also appeared to be unproductive because it caused divisions between Headquarters, Regional office, and DNREC staff. DNREC was also forced to spend additional time preparing information that would only be used for EPA's consumption.

The relationship with EPA has improved in recent years. The CIB also appears to be viewed in more positive terms by EPA Headquarters and Region III staff. The problems noted now are more operational in nature such as EPA could play a more constructive role in helping the CIB find grant funding,²³² the need to streamline the reporting process, and providing more travel money for regional and national staff to attend CIB meetings and evening programs.²³³ Nevertheless, the negative experience left a lasting tension that was evident in many of our interviews. Many respondents continue to be critical of the attitude of some EPA staff who act as if agencies such as the DNREC and CIB work for EPA. Other respondents were critical of EPA staff that act as if they are more knowledgeable than state and local officials about how things should be done in Delaware. Many of our respondents were also critical of the EPA's "boiler plate" mentality where states are required to do things the same way and the "command and control" mentality where EPA tells states how to do things. Most of the respondents wished that the EPA, including staff from the NEP office, would adopt more of a "team approach"²³⁴ or "partnership mentality", in which they recognized the important role that these programs play and the valuable experience that staff have. Many respondents also wished that EPA staff had a greater appreciation of the efforts of other federal, state, and local actors and recognized that in many cases EPA is just one of many players and often is not, and should not, be the major player. Finally, many of the respondents were critical of the EPA's obsession with process (e.g., planning, reports, work plans, etc.) rather than results. As one DNREC official commented: "It

looks to us as EPA really puts a lot of emphasis on motion. To them motion is progress but motion is not progress if you really analyze it.” Accordingly, many state and local officials wished that EPA staff had a greater appreciation of how these “process-related” activities detract from their ability to actually make progress by utilizing precious slack resources

Performance-Based Management

The CIB has had limited reliance on performance-based management techniques. The nature of the ecological system makes it difficult to monitor environmental changes and the lack of data and financial support for environmental monitoring efforts complicates the process. The CCMP and the CIB lack any clearly defined goals or objectives. The CCMP’s goals are really a list of priority actions rather than specific goals or targets related to changes in environmental conditions. This makes it difficult to monitor or track the progress of implementation efforts. The CIB does issue an annual “Report Card” in which it describes its accomplishments and the progress towards various tactics [Tables 3 and 4]. One advantage of this reporting combined with the collaborative structure is that it helps to create a peer pressure system that encourages actors to maintain or expand their commitments to CCMP implementation. While this is a positive first step, the lack of specificity in these measures means that progress is evaluated in subjective terms. It also allows the actors to claim that almost any activity is implementing CCMP recommendations. Moreover, the content of the annual reports typically describes what the CIB did during a year and describes its current activities. There is no systematic attempt to track statistics like septic systems removed, building permits issued, BMPs installed, or conservation plans developed that would allow the actors and the public to evaluate trends and compare efforts from year to year. This limits the effectiveness of the peer pressure mechanism created when the CIB was established and should be an area for future attention by the CIB. The CCMP is also getting increasingly out of date and is less useful in guiding the CIB’s decision making with each passing year. An effort to develop performance measures might serve to create a set of core priorities that will guide CIB decision making.

Institutional Performance

When examining the performance of an institutional arrangement, it is important to use several criteria to understand its strengths and limitations. It is also important to recognize that there may be a disconnect between the performance of an institutional arrangement and its ability to achieve environmental outcomes.²³⁵ For example, you could have a well functioning institutional arrangement but the underlying policy is flawed and unable to achieve the desired outcomes. The nature of watershed management also makes it difficult to determine causality. Numerous federal, state, regional, and local programs have an impact on the outcomes of interest (i.e., changes in water quality and habitat). It is difficult to disaggregate the effects of each program let alone determine which marginal changes in these programs were due exclusively to a watershed management program. Moreover, given the collaborative efforts employed, it is important to assess performance from the perspective of different actors since measures of success might change as you move from actor to actor.

Our analysis relies primarily on criteria provided by the Academy. These criteria included: 1) risk reduction; 2) potential for short- and long-term gain; 3) cost-effectiveness; 4)

predictability of the process; 5) certainty of effect; 6) accountability; 7) equity; 8) adaptability; and, 9) capacity building. A more detailed discussion of the definitions, concepts, criteria, and the application of these criteria can be found our final report entitled *Environmental Governance in Watersheds: The Importance of Collaboration to Institutional Performance*.

Risk Reduction

This criterion is concerned with the question of whether the DIBEP demonstrated an ability to achieve the desired environmental outcomes. The nature of the ecological system in which nutrients enter groundwater with a residence time of 15 – 40 years before discharging to surface waters and the lack of good environmental monitoring data make it difficult to determine clear trends in environmental conditions. The data that is available seems to suggest that water quality may have declined. The increased rate of development has also certainly led to habitat loss or degradation.

Given the rapid rate of development and the long history of implementation actions, it would be difficult to link any particular activity to changes in environmental outcomes. Moreover, the interrelated nature of watershed planning efforts make it difficult, if not inappropriate, to associate particular implementation activities with specific watershed planning efforts or government programs. Accordingly, we focused primarily on the direct and indirect actions that offered some possibility of future environmental improvements. Our approach was also to err on the side of being inclusive rather than exclusive when determining what constituted an “implementation activity”.

When viewed from this perspective, the results are more encouraging and a number of direct and indirect activities offered some promise of improved environmental conditions. Sussex County expanded its central sewer system by more than 200 percent and will have spend more than \$158 million by 2001 and has removed more than 14,000 OSDs. The point source discharge at Delaware Seashore State Park will be removed. The Open Space Program has acquired more than 1,592 acres at a cost of more than \$13 million. The HUA project reduced more than 2,700 tons of nitrogen. The James Farm site is being reforested. The partners have also been engaged in a number of indirect actions that have the potential for improving environmental conditions. During the IBRI, DNREC changed a number of its regulations. Sussex County has amended its Comprehensive Land Use Plan. Conservation plans have been developed for more than 60,000 acres of farmland in the watershed. New EPA and state regulations will begin to regulate the use of manure from poultry operations. The TMDL for the watershed should influence the DNREC’s review of NPDES permits. The parties are working to develop tributary strategies to implement the TMDL’s recommendations. Accordingly, while water quality has declined and development and agricultural activities continues to cause environmental problems, there have been numerous activities designed to mitigate some of the cumulative and secondary impacts associated with these activities.

Potential for Short- and Long-Term Gains

It also appears that there is a reasonably high potential for continued environmental improvements over the short-term (3 – 5 years). Sussex County remains committed to expanding central sewers. Rehoboth is exploring ways to remove its point source discharge, which would result in more than a 50 percent reduction in phosphorus loadings to Rehoboth Bay. Work continues on installing BMPs on agricultural operations and the promise of new regulations will create additional incentives for the installation of BMPs and the adherence to conservation plans. The increase in the CIB staff has led to a noticeable increase in implementation activity. Thus, there is reason to believe that while work at the James Farm site may continue, restoration work is likely to expand to other areas. The development of the pollution control strategies (i.e., tributary strategies) to implement the TMDL's regulations also offer some promise that additional action will be taken to reduce nutrient loadings to the Inland Bays. At the same time, development continues at a rapid pace and agricultural activities remain important contributors of nutrients. Thus, it is unclear if any improvements in environmental conditions will be observed over the short-term.

We are less optimistic about what will happen over the long term (i.e., 5 – 20 years) if nothing is done to address the rapid rate of development in the watershed. While much of the attention has been focused on the problems of point source discharges and agricultural operations, the problems resulting from residential and commercial development may be much more pervasive and harder to correct over the long term. Sewage treatment plants will have to be expanded to handle this growth. Stormwater runoff and erosion are likely to cause increasing water quality and flooding problems. It will be difficult to replace all of the lost and degraded habitat. While the DDA's Farmland Preservation Program and DNREC's Open Space Program have had some notable accomplishments, additional land acquisition will be necessary if development continues at its present pace. Moreover, it will become increasingly important to systematically look for opportunities to restore habitat to offset the loss and degradation of habitat in other areas. The increased population will support a growing number of resource users (e.g., boaters, fishermen, shellfishermen, crabbers, and beachgoers) who each have an impact on the Inland Bays.²³⁶ This will exacerbate existing user conflicts and may increase pressure to dredge the bays and make them more accessible. Moreover, development is changing the social fabric of the community and is creating new social problems (e.g., traffic). Many of these problems will be difficult, if not impossible to reverse. Moreover, given the pervasiveness of these problems, the CIB's mission as a neutral forum, and the existing political and institutional realities in Sussex County, addressing these problems is likely to require intervention by the DGA.

Addressing the nutrient loadings due to the poultry growing operations is also a long-term issue. Here we are actually more optimistic. However, the introduction of new EPA regulatory requirements or the recent adoption of a new regulatory effort by the DGA is not the cause of our optimism. While these efforts will lead to some reduction in nutrient loadings, it is doubtful that the nutrient reductions recommended in the TMDL will be achieved through regulation alone. Instead, a long-term solution to the nutrient loading problem from agriculture is likely to require the development of some cost-effective approach to reduce phosphorus during the production process or finding an economical way to dispose of manure. This will not happen

overnight and it will take time. But it is one that can be solved and the preservation of this agricultural land will help limit the urbanization of the watershed. Accordingly while regulation may not solve the problem, it may finally create positive incentives for government and industry to work together to find a cost-effective mechanism to address this waste disposal issue in a manner that causes as little economic dislocation as is possible.

Cost-Effectiveness

Efficiency is an important principle of public administration. We are concerned with how the DIBEP used its resources compared to the benefits generated. What complicated the analysis was the wide range of intangible costs and benefits associated with these activities as well as the transaction costs involved with developing and implementing the CCMP.

One of the features of the NEP is that it invests a disproportionate amount of an estuary program's resources in planning when compared to implementation with a large proportion of an estuary program's planning funding allocated to research, technical work, and public participation. Accordingly, judgements about the cost-effectiveness of the planning process largely depends on judgements about the cost-effectiveness of these expenditures. In both cases, it appears that the DIBEP fares reasonably well. Previous efforts such as the GTFIB and the IBMC left the participants with a well defined set of issues, a targeted research agenda, and a history of working together. This reduces transaction costs. The resources expended on scientific research also appeared to be well spent. The major exception might be the development of a \$900,000 computer model that was of little use in developing the CCMP. However, it did end up saving the DNREC money later when required to develop a TMDL for the watershed.

The CIB receives less funding for implementation. Essentially, it maintains a small core staff. In our view, the measure of the CIB's cost effectiveness during the implementation process is whether it does more than simply spend EPA's small appropriation of \$300,000 per year. To date the CIB appears to have been effective in leveraging resources for CCMP implementation. A number of partners such as DNREC, SCD, NRCS, University of Delaware, and Sussex County continue to contribute resources to implementation activities specified in the CCMP. The CIB has also been effective in leveraging resources from a variety of other federal, state, and private sources. It has also received significant contributions of volunteer and donations to support its efforts. Accordingly, the implementation efforts appear to also satisfy the cost-effectiveness criteria reasonably well.

Predictability of the Process

Institutional performance can be judged in terms of the predictability of the process. In our analysis we are concerned with two related questions: 1) the ability of the planning process to produce the intended result; and, 2) whether the program creates predictable conditions or requirements that allow its participants to plan and budget with confidence. One of the strengths of the NEP is that it employs a predictable process that results in the development of a voluntary CCMP. However, the DIBEP did not have the benefit of the NEP's guidance during its formative years. As a result, the planning process was somewhat less predictable than that of

subsequent estuary programs. This uncertainty was detrimental to the DIBEP and was the source of some of the conflicts between the EPA and the DIBEP surrounding the CCMP's approval.

From an implementation standpoint, one could conclude that the CIB partners can budget with confidence because none of the parties is actually required to allocate funding to implementation activities and there are no clear goals or policies that require specific financial commitments. There also appear to be no clear social norms or expectations for a specified level of implementation activity. As a result, some partners feel that other actors should be "more committed" or be "doing more" to implement the CCMP. The lack of specific goals and a systematic monitoring and reporting processes reinforces the differing expectation levels since many partners and the public are not aware of the full scope of implementation activities. Thus, while the CIB developed a peer pressure mechanism to support implementation activities, it lacks specific performance measures that would allow it to work more effectively. Meanwhile, the lack of systematic monitoring and reporting creates the possibility that other partners are shirking their responsibilities, although this did not appear to be the case.

The EPA's funding and the small state line item means that the DIBEP has some stability from a staffing standpoint. However, it is still largely reliant on federal grants to fund implementation activities. This limits the CIB's ability to plan far in advance because the priorities and availability of grant funds changes frequently in what some respondents characterized as a "flavor of the month" mentality. This means that federal priorities largely drive the CIB's implementation activities rather than watershed priorities. It also forces the CIB to be more reactive than proactive and limits its ability to systematically address specific problems or commit to ongoing programs.

Certainty of Effect

One measure of success for any planning effort is whether the "plan" was actually implemented. This involved making two distinct judgements. First, we determined whether the action plans recommended in the CCMP were implemented or were likely to be implemented. Second, if the recommended actions were not implemented, we determined whether the participants have been engaged in a substitute set of activities designed to achieve the CCMP's goals.

Some of the CCMP recommendations have been implemented or substantive progress has been made [Table 3]. The actors were also engaged in other activities that are consistent with the "spirit" of the CCMP's recommendations. In other cases, the actors continue to make progress towards some CCMP recommendations that have long been a challenge (e.g., dredging management plan). Overall, despite the voluntary nature of the CCMP, significant progress has been made. Some of the factors that improved the certainty of the plan's implementation in this case appear to be: the history of previous planning efforts in the basin; the focus on implementation during the planning process (e.g., HUA project and IBRI); and the peer pressure mechanism that developed as a result of the CIB.

However, the CCMP is becoming outdated and there is reason to question whether it really is driving implementation efforts at this point in time. In fact, many respondents were

unaware of specific CCMP recommendations and action plans. This was not surprising because a wide range of events have transpired since the CCMP was developed (e.g., development of the TMDL) that altered the priorities of the DIBEP partners. These new priorities as well as other opportunities (e.g., James Farm site) are now the focus of most implementation efforts. The CIB has also been forced to focus attention on problems that have received a lot of public attention such as algae blooms and *Pfiesteria*.

These observations raise questions about the NEP's planning requirements that encourage the development of very detailed action plans and recommendations. In this case, the EPA almost disapproved the DIBEP's CCMP because it lacked the desired level of specificity. The DIBEP partners had been through several similar initiatives and knew this detail was unnecessary given the realities of the implementation process. It is voluntary in nature. There is a heavy reliance on federal funds and these priorities will drive what can be done and often will place constraints on how it can be done. Federal, state, and local policies, priorities, and funding processes change frequently. Continued research and experience leads to a continual evolution of knowledge with respect to how the ecological system functions and what constitutes effective BMPs. All of these factors mean that the actors have to be flexible and recognize that many recommendations will only be applicable for a short period of time. Thus, there is reason to question the EPA's emphasis on detailed action plans if they are simultaneously going to require voluntary plans. A more strategic approach that focuses on measurable goals and objectives that are tied to routine government actions (direct or indirect) or changes in environmental conditions instead of detailed action plans may be a more effective approach. Thus, when the good ideas symbolized by the plan's recommendations have been supplanted by new ideas and practices, the measurable goals and targets can still guide implementation efforts.

Accountability

It is important that there are mechanisms to hold officials accountable for their actions and the allocation of scarce resources. A wide range of accountability mechanisms have already been highlighted in the report:

- The CIB board's control and oversight over the staff as well as the CAC and STAC
- EPA's oversight of the DIB through the Biennial Review and the approval of annual work plans
- Peer pressure and monitoring by also improves accountability
- Professional accountability is enhanced by having the CIB board of directors defer to staff and the STAC on technical issues
- Political accountability is enhanced through provisions such as open meetings (i.e., sunshine requirements), provisions for public notice on some CIB activities, setting aside time for public comment at meetings, and publishing the meeting minutes on the internet, and maintaining a CAC

We concluded that the DIBEP had a high degree of accountability with respect to implementing the CCMP. The main areas for improving accountability would be to develop performance measures or measurable goals or policies. The absence of these provisions makes it difficult to hold the CIB accountable for its actions. In essence, the CIB can undertake any activity it wants

as long as it does not hurt the Inland Bays. This is a weak standard for holding the CIB accountable for what is accomplished as a result of public expenditures.

Equity

Another useful criterion for examining institutional performance is equity or fairness. There are many ways to view equity. Fiscal equivalence holds that those who benefit from a service should bear the burden of financing it. Thus, those who derive greater benefits are expected to pay more. Redistributive equity concerns structuring program activities around differential abilities to pay. Considerations about the equality of the process and the equality of the results are also important. Overall, the DIBEP did a good job of minimizing equity problems. However, there are some minor equity problems or potential problems that deserve mention and may be of interest to the Academy.

Several issues stem from using watersheds as a unit of analysis. One of the obstacles to managing growth in the watershed has been that this has been the growth center within Sussex County. It also tends to have higher property values than other County land. The growth in property tax revenue therefore subsidizes services in other less affluent portions of the county. Therefore, restricting growth could have other impacts outside the watershed. A related question concerns the political representation for the residents in the Inland Bays region, which only has one of the five Council members representing their interests.²³⁷ Many respondents questioned the “fairness” of this arrangement.

Another issue involves the question of whether it would be fair to hold poultry growers in the Inland Bays watershed to a higher standard than growers in other parts of the state or the country. There is reason to question why these farmers should be forced to pay higher production costs than farmers who happen to be located in another watershed. The same would hold true for treating farmers on the Delmarva Peninsula differently than those in North Carolina, Arkansas, or Georgia. This is one indicator that this may not be a “watershed level” problem and that it might be more effective to address the problem at the industry level (i.e., federal or state level) so that the requirements do not provide economic advantages to some growers and disadvantage others. A related issue is whether farmers should be subsidized for implementing BMPs and disposing of manure. Many of the respondents representing environmental groups or tourism interests did not feel that the farmers should receive these subsidies. However, many of those associated with the agricultural community suggested that they should be subsidized like many other businesses.

Adaptability

Unless institutional arrangements have the capacity to respond to their ever-changing environments, institutional performance is likely to suffer. Reflected here are concerns similar to those who argue for adaptive approaches to ecosystem-based or community-based management. In some respects, the DIBEP could be considered to be highly adaptive. The CIB employs an opportunistic strategy where by it goes after available grant money. While this activity could be viewed as adaptation, it could also be viewed as a sign that the organization lacks focus and direction. This is a different form of adaptation than implied by the criteria.

We are more concerned with the program's ability to adapt its efforts to achieve better policy outcomes. The CIB has yet to develop much capacity for this type of adaptation. There is no systematic effort to monitor environmental conditions. The CIB does produce an annual report card on various implementation activities. However, it acknowledges some difficulty in tracking progress [Table 4]. It also does not systematically monitor or track progress in specific areas (e.g., numbers of BMPs installed, numbers of septic systems installed, numbers of building permits issued, etc.) in a manner that would allow these trends to be evaluated. The CIB also lacks measurable goals or policies upon which to measure progress or adapt in order to achieve additional environmental improvements. The CIB also maintains a rather loose relationship with other regulatory and nonregulatory programs implemented by DNREC, DDA, SCD, and Sussex County, primarily through their membership on the board. However, the CIB is not gathering or synthesizing information that can be used to improve their decision-making process or to monitor progress towards their goals. The CIB could also better integrate its efforts (e.g., habitat restoration) with other programs (e.g., land acquisition and farmland preservation programs). Therefore, the CIB appears to lack much of the capacity for engaging in the type of adaptive management activity implied by the criteria.

Capacity Building

The final criterion was whether the DIBEP was effective at building capacity for solving the complex environmental problems. There are a number of areas where the CIB was effective at building the capacity to solve environmental problems. These include:

- Filling important gaps in science and technical information needed to make management decisions
- Creating a volunteer water quality monitoring program that now provides decisionmakers with valuable information that can help improve decision-making processes
- Improved communication among scientists and technical staff and created new opportunities for collaboration through the STAC
- Legitimizing and rewarding ongoing collaboration at the project level (e.g., habitat restoration)
- Providing a forum for encouraging collaboration and creating a peer pressure mechanism that creates incentives for additional project level collaboration
- Providing a forum for improving communication and coordination among the actors
- Improving the capacity for conducting restoration and education projects

These improvements were important because of the lack of capacity that still exists at the local level. There is also little overlap among state and county programs. Accordingly, the CIB serves as an important forum to stimulate communication and coordination between state and local officials. The CIB also has the ability to help resolve conflicts and stimulate collaboration between the actors.

Summary and Conclusions

This case study provides a glimpse of the considerable progress that has been made in addressing the problems in the Delaware Inland Bays watershed. It also reveals some of the formidable obstacles that confronted those who participated in these efforts and the challenges that remain in addressing the problems affecting the watershed. The CIB is still developing as an organization and is likely to experience growing pains for some time to come as it continues to evolve. It is also clear that the rapid rate of residential and commercial development and nutrient loadings associated with agricultural activities remain vexing problems.

The DIBEP is interesting because it illustrates the strengths and limitations of the watershed approach and utilizing collaboration as an implementation strategy. The DIBEP prompted a wide range of implementation activities and the CIB certainly improved the capacity for public education, habitat restoration, and research. At the same time, the CIB is designed to be a neutral forum that can discuss controversial issues associated with development and agriculture, which can help elevate them on the policy agendas of state and local decisionmakers. However, the CIB is inherently limited in its ability to address controversial issues. Accordingly, while many DIBEP participants viewed the CIB in favorable terms they were simultaneously frustrated because it is unable to address these controversial issues. As one environmental advocate commented: “The thing that’s been the most upsetting for me is the setting up of the Center for the Inland Bays. I thought it would be the once thing that would take over all of the things that I was doing. . . . They are the biggest waste of taxpayers’ money I’ve ever heard of in my life. . . . It has not been effective at all because of the way they are set up. They are set up with a board appointed by the state that is there to protect their own turf and they don’t give a continental damn about the Inland Bays.” Others frequently complain that it appears that “all we do is talk and there is no action” or argue that “everybody is spinning their wheels.”

Our view is more positive. We concluded that the DIBEP was an effective watershed management effort in that it improved the capacity for addressing environmental problems and stimulated a wide range of activities that have some potential for improving environmental conditions and enhancing watershed governance. While many DIBEP participants may be frustrated by the CIB’s neutrality, its statutory mandate and structure as a collaborative organization make it unlikely that it could be effective if it took stands on controversial issues.

These frustrations also reflect false expectations about what can be accomplished when collaboration is the dominant implementation strategy. Collaboration will not be an effective strategy for addressing all environmental problems. The structure of our federal system creates opportunities for collaboration but it also create constraints on how much governmental and nongovernmental organizations can or should be willing to collaborate. Collaboration is not a substitute for other activities such as unilateral action by various federal, state, or local governments, judicial challenges, or legislative action. Addressing the complex problems affecting the Inland Bays is likely to include all of these strategies. Therefore, we do not believe that the problems, criticisms, disappointments, and other shortcomings of the CIB should overshadow what has been accomplished. Moreover, it is questionable whether the DIBEP should be blamed for failing to correct problems that other federal, state, and local programs have been unable to address (or actually caused) over the past three decades when one considers

the limited implementation resources devoted to the effort. Rather, we believe the watershed management activities in the Inland Bays watershed are notable and worthy of future attention.

One thing is clear. The problems affecting the Inland Bays watershed are complicated and developed over decades. It will likely take an equally long period of time to take the actions and develop the institutions necessary to address these issues to the satisfaction of federal, state, and local decisionmakers and the general public. The CIB is just one step in this evolutionary process and it is unlikely that it will “solve” these problems on its own. Future efforts and institutions may be needed and the CIB can play an important role in these activities.

Endnotes

¹ The EPA identifies nationally significant estuaries threatened by pollution, development, or overuse and assists estuary projects with the preparation of a Comprehensive Conservation and Management Plan (CCMP). The NEP currently has 28 estuary projects in 18 states and the commonwealth of Puerto Rico. The estuaries comprise a diverse set of ecosystems including both heavily urbanized and rural watersheds. The latest group of programs (Tier Five) entered the program in 1995 through a streamlined Governors nomination process. For more information on the governors nomination process see: EPA, *The Streamlined National Estuary Program: Instructions on the Preparation of a Governor's Nomination* (Washington, DC: Environmental Protection Agency, Office of Water, December 1994); and, EPA, *The National Estuary Program: Final Guidance on the Contents of a Governor's Nomination* (Washington, DC: EPA, Office of Water, January 1990).

² For more information on the history of the NEP and its development see: Mark T. Imperial, *Developing Integrated Coastal Resource Management Programs: Applying the NEP's Experience to Developing Nations* (Kingston, RI: University of Rhode Island, Coastal Resources Center, July 1995); Mark T. Imperial, *Public Participation in the National Estuary Program: A Descriptive and Empirical Analysis*, Masters Thesis (Kingston, RI: Department of Marine Affairs, University of Rhode Island, May 1993); Mark Imperial, Timothy Hennessey, and Donald Robadue, Jr., “The Evolution of Adaptive Management for Estuarine Ecosystems: The National Estuary Program and its Precursors,” *Ocean and Coastal Management* 20 (no. 2, 1993): 147-180; Mark T. Imperial, Donald Robadue, Jr., and Timothy Hennessey, “An Evolutionary Perspective on the Development and Assessment of the National Estuary Program,” *Coastal Management* 20 (no. 4, 1992): 311-341; EPA, *The National Estuary Program After Four Years: A Report to Congress*, EPA 503/9-92/007 (Washington, DC: EPA, Office of Water, April 1992); EPA, *Progress in the National Estuary Program: Report to Congress*, EPA 503/9-90-005 (Washington, DC: EPA, Office of Water, February 1990).

For more information on the development and implementation of individual estuary programs see: Renu Khator, “Networking to Achieve Alternative Regulation: Case Studies from Florida's National Estuary Programs,” *Policy Studies Review* 16 (no. 1, Spring 1999), 66 – 85; Katrina Smith Korfmacher, “Invisible Successes, Visible Failures: Paradoxes of Ecosystem Management in the Abermarle-Pamlico Estuarine Study,” *Coastal Management* 26 (no. 3, 1998): 191 – 211; Ames Borden Colt, “The First Step in Comprehensively Evaluating Implementation of an Integrated Estuarine Management Plan: Developing Evaluation Criteria,” *Ocean and Coastal Management* 24 (1994): 85-108; Michael Healey and Timothy M. Hennessey, “The Utilization of Scientific Information in the Management of Estuarine Ecosystems,” *Ocean & Coastal Management* 23 (1994): 167 – 191; W. S. Touhy, “Neglect of Market Incentives in Local Environmental Planning: A Case Study in the National Estuary Program,” *Coastal Management* 22 (1994): 81 – 95; W. S. Touhy, “Characterizing the San Francisco Estuary: A Case Study in Science Management in the National Estuary Program,” *Coastal Management* 21 (1993): 113 – 129; Katherine Fletcher, “Protecting Puget Sound: An Experiment in Regional Governance,” *Washington Law Review* 65 (1990): 359 – 375; and, Thomas M. Leschine, “Setting the Agenda for Estuarine Water Quality Management: Lessons from Puget Sound,” *Ocean and Shoreline Management* 13 (1990): 295 – 313.

³ Since the program's inception, the EPA Headquarters office has devolved a great deal of the day to day responsibility for supervising the individual programs to the EPA's Regional offices.

⁴ EPA, *The National Estuary Program After Four Years*; and, EPA, *Progress in the National Estuary Program*.

⁵ 33 U.S.C.S. § 1330 et. seq.

⁶ Mark T. Imperial and Timothy M. Hennessey, “An Ecosystem-Based Approach to Managing Estuaries: An Assessment of the National Estuary Program,” *Coastal Management* 24 (no. 1, 1996): 115 – 139.

⁷ 33 U.S.C.S. § 1330 (c).

⁸ The members of this committee are the ultimate signatories of the CCMP and direct the activities of the management conference. See: Imperial and Hennessey, “An Ecosystem-Based Approach.”

⁹ While the policy committee oversees management conference activities, it is the management committee, which is the focal point of consensus building. The members of the management committee represent state water quality and natural resource management agencies, members of the regulatory community, as well as representatives of the general public and interest groups. Some of the typical responsibilities of the management committee include: the identification and definition of environmental problems in the estuary; advising the policy committee on major decisions such as funding priorities and the development of annual work plans; and, guiding the development and approval of the CCMP. The management committee also supports and monitors activities of the other standing committees or work groups which reflect the local jurisdictional conditions, attitudes, and requirements of individual estuary programs. See: Imperial and Hennessey, “An Ecosystem-Based Approach.”

¹⁰ Imperial and Hennessey, “An Ecosystem-Based Approach.”

¹¹ Ibid.

¹² For more discussion of the EPA’s requirements see: EPA, *National Estuary Program Guidance: Base Program Analysis*, EPA 842-B-93-001 (Washington, DC: EPA, Office of Water, March 1993); EPA, *Comprehensive Conservation and Management Plans: Content and Approval Requirements*, EPA 842-B-92-002 (Washington, DC: EPA, Office of Water, October 1992); EPA, *The Economics of Improved Estuarine Water Quality: An NEP Manual for Measuring Benefits*, EPA 503/5-90-001 (Washington, DC: EPA, Office of Water, September 1990); EPA, *Saving the Bays and Estuaries: A Primer for Establishing and Managing Estuary Programs Appendices G, H, and I*, EPA 503/8-90-005 (Washington, DC: EPA, Office of Water, September 1990); EPA, *Saving the Bays and Estuaries: A Primer for Establishing and Managing Estuary Projects*, EPA/503/8-89-001 (Washington, DC: EPA, Office of Water, August 1989); and, EPA, *Guide for Preparation of Quality Assurance Project Plans for the National Estuarine Program*, Interim Final, EPA 556/2-88-001 (Washington, DC: EPA, Office of Marine and Estuarine Protection, June 1988).

¹³ 33 U.S.C.S. § 1330 (b).

¹⁴ The EPA defines seven key activities and products of a management conference: 1) Identification of priority problems based on public or other input; 2) An inventory of applicable federal programs that identifies potential conflicts with the CCMP; 3) An analysis of the scope and effectiveness of existing federal, state, and local resource management programs to evaluate gaps, target opportunities, and have the potential to be leveraged as part of the effort to develop and implement the CCMP; 4) A financing plan based on state and public input that considers the costs and benefits of pollution control options and identifies how the options will be financed; 5) Final reports on the estuary’s status and trends, probable causes of environmental problems, and pollutant loadings; 6) A Draft CCMP that includes a federal consistency report and plans for its coordinated implementation and monitoring; and, 7) A final CCMP that identifies action plans for implementing the CCMP including a discussion of their likelihood for success, lead implementation agencies; funding required and the sources of this funding, and a schedule for implementation (TBEP, *Tampa Bay National Estuary Program Management Conference Agreement* (St. Petersburg, FL: TBEP, March 25, 1991), 4).

¹⁵ For more discussion of the NEP’s public participation requirements and the effectiveness of these efforts see: Imperial, *Public Participation in the National Estuary Program*.

¹⁶ Imperial and Hennessey, “An Ecosystem-Based Approach.” For more information on the use of these demonstration projects see: EPA, *A Summary of Implementation and Demonstration Projects in Bays and Estuaries* (Washington, DC: EPA, Office of Water, November 1992).

¹⁷ Imperial and Hennessey, “An Ecosystem-Based Approach”; and, EPA, *Saving the Bays and Estuaries*.

¹⁸ For the EPA’s guidance on monitoring implementation activities see: EPA, *Measuring Progress of Estuary Programs: A Manual*, EPA 842-B-94-008 (Washington, DC: EPA, Office of Water, November 1994); EPA, *Volunteer Estuary Monitoring: A Methods Manual*, EPA 842-B-93-004 (Washington, DC: EPA, Office of Water, December 1993); and, EPA, *Monitoring Guidance for the National Estuary Program*, EPA 842-B-92-004 (Washington, DC: EPA, Office of Water, September 1992).

¹⁹ The choice of strategies is left up to the estuary programs. Many states are attempting to leverage existing Clean Water Act (CWA) grants (e.g., §104(b)(3), 604(b), and §319(h)) or use state revolving funds to implement CCMP recommendations. Others have used new taxes to help finance water pollution control efforts. For example, a cigarette tax finances the implementation of the Puget Sound Water Quality Management Plan (Puget Sound’s CCMP). Finally, estuary projects could design their CCMP such that it is implemented through existing programs. For more information see: Imperial and Hennessey, “An Ecosystem-Based Approach.”

²⁰ For EPA’s guidance on financing and organizing implementation activities see: EPA, *Beyond SRF: A Workbook for Financing CCMP Implementation*, EPA 842-B-96-002 (Washington, DC: EPA, Office of Water, August 1996); EPA, *Case Studies: Organizational Structures Relevant to Implementation of Comprehensive Conservation and Management Plans*, EPA 842-B-95-003 (Washington, DC: EPA, Office of Water, July 1995); EPA, *Using Nonprofit Organizations to Advance Estuary Program Goals*, EPA 842-B-093-008 (Washington, DC: EPA, Office of Water, November 1993); and, EPA, *Financing Marine and Estuarine Programs: A Guide to Resources*, EPA 503/8-88/001 (Washington, DC: EPA, Office of Marine and Estuarine Protection, September 1988).

²¹ Qualitative research employs an intense investigative process that contrasts, compares, replicates, catalogues, and classifies objects and events to provide decisionmakers with the information necessary to improve program performance. For more information on approaches to qualitative analysis see: Norman K. Denzin, and Yvonna S. Lincoln (eds.), *Strategies for Qualitative Inquiry* (Thousand Oaks, CA: Sage Publications, 1998); Norman K. Denzin, and Yvonna S. Lincoln (eds.), *Collecting and Interpreting Qualitative Materials* (Thousand Oaks, CA: Sage Publications, 1998); Joseph A. Maxwell, *Qualitative Research Design: An Interactive Approach* (Thousand Oaks, CA: SAGE Publications, 1996); Sharon L. Caudle, “Using Qualitative Approaches,” in Joseph S. Wholey, Harry P. Hatry, and Kathryn E. Newcomer (eds.) *Handbook of Practical Program Evaluation* (San Francisco, CA: Jossey-Bass Publishers, 1994); Matthew B. Miles and Michael A. Huberman, *Qualitative Data Analysis: An Expanded Sourcebook*. Second Edition (Thousand Oaks, CA: SAGE Publications, 1994); Mary Ann Scheirer, “Designing and Using Process Evaluation,” in Joseph S. Wholey, Harry P. Hatry, and Kathryn E. Newcomer (eds.) *Handbook of Practical Program Evaluation* (San Francisco, CA: Jossey-Bass Publishers, 1994); Anselm Strauss and Juliet Corbin, *Basics of Qualitative Research: Grounded Theory Procedures and Techniques* (Newbury Park, CA: SAGE Publications, 1990); and, Michael Quinn Patton, *Qualitative Evaluation and Research Methods*, Second Edition (Newbury Park, CA: SAGE Publications, 1990).

²² Maxwell, *Qualitative Research Design*; Miles and Huberman, *Qualitative Data Analysis*; Scheirer, “Designing and Using Process Evaluation”; and, Patton, *Qualitative Evaluation and Research Methods*.

²³ Mark T. Imperial, “Analyzing Institutional Arrangements for Ecosystem-Based Management: The Institutional Analysis and Development Framework,” *Environmental Management* 24 (1999): 449 – 465.

²⁴ For some discussion of the IAD framework and its application in environmental settings see: Elinor Ostrom, Roy Gardner, and James Walker, *Rules, Games, & Common-Pool Resources* (Ann Arbor, MI: The University of Michigan Press, 1994); Elinor Ostrom, Larry Schroeder, and Susan Wynne, *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective* (Boulder, CO: Westview Press, 1993); Elinor Ostrom,

Governing the Commons: The Evolution of Institutions for Collective Action (New York, NY: Cambridge University Press, 1990); Elinor Ostrom, "An Agenda for the Study of Institutions," *Public Choice* 48 (no. 1, 1986): 3 – 25; Mark T. Imperial, "Analyzing Institutional Arrangements for Ecosystem-Based Management: The Institutional Analysis and Development Framework" *Environmental Management* 24 (1999), 449 –465; Mark T. Imperial, "Analyzing Institutional Arrangements for Ecosystem-Based Management: Lessons From the Rhode Island Salt Ponds SAMP," *Coastal Management* 27(no. 1, 1999): 31 – 56; Sue E. S. Crawford, and Elinor Ostrom, "A Grammar of Institutions," *American Political Science Review* 89 (no. 3, September 1995): 582 – 600; Timothy M. Hennessey, "Governance and Adaptive Management for Estuarine Ecosystems: The Case of Chesapeake Bay," *Coastal Management* 22 (1994): 119 – 145; Mark H. Sproule-Jones, *Governments At Work: Canadian Parliamentary Federalism and Its Public Policy Effects* (Toronto, Canada: University of Toronto Press, 1993); William Blomquist, *Dividing the Waters: Governing Groundwater in Southern California* (San Francisco, CA: ICS Press. 1992); and, Larry L. Kiser and Elinor Ostrom, "The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches," in Elinor Ostrom (ed.) *Strategies for Political Inquiry* (Beverly Hills, CA: Sage, 1982), 179 – 222.

²⁵ Triangulation involves using independent measures derived from different sources to support, or at least not contradict, a research finding. For more information see: Miles and Huberman, *Qualitative Data Analysis*; and, Robert K. Yin, *Case Study Research: Design and Methods*, Second Edition (Thousand Oaks, CA: SAGE Publications, 1994).

²⁶ Miles and Huberman, *Qualitative Data Analysis*.

²⁷ Ibid.

²⁸ Yin, *Case Study Research*.

²⁹ Thomas D. Cook and Donald T. Campbell, *Quasi-Experimentation: Design and Analysis Issues for Field Settings*. (Boston, MA: Houghton Mifflin Company, 1979).

³⁰ Delaware Inland Bays Estuary Program (DIBEP), *Delaware Inland Bays Comprehensive Conservation Management Plan* (Lewes, DE: Center for the Inland Bays, June 1995)

³¹ Delaware Department of Natural Resources and Environmental Control (DNREC), *Total Maximum Daily Load (TMDL) Analysis for Indian River, Indiana River Bay, and Rehoboth Bay, Delaware* (Dover, DE: DNREC, Watershed Assessment Section, Division of Water Resources, December 1998), 1-6. For alternative land use statistics see: Sussex County, *1997 Sussex County Comprehensive Plan*, (Sussex County, DE: Sussex County, 1997), 3.

³² Ibid., 3.

³³ For more discussion of land use, the economy, and history of Sussex County see: Sussex County, *1997 Sussex County Comprehensive Plan*; Sussex County Planning and Zoning Commission, *The Coastal Sussex Land Use Plan March 1988*; and, Sussex County Planning and Zoning Commission, *Western Sussex Land Use Plan: Sussex County, Delaware* (Sussex County, DE: Sussex County Planning and Zoning Commission, December 27, 1990).

³⁴ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*; and, Horsley & Witten, Inc., *Assessment of Nitrogen Loadings to the Delaware Inland Bays* (Sandwich, ME: Horsley & Witten, Inc, 1998), 2.

³⁵ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 2.

³⁶ Horsley & Witten, Inc., *Assessment of Nitrogen Loadings*, 2.

³⁷ Between 1935-1939 many marine organisms and habitats were destroyed when there was no free connection to the Atlantic Ocean. This is indicative of the fragility of the Inland Bays.

³⁸ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 9.

³⁹ *Ibid.*, 9.

⁴⁰ DNREC, *Total Maximum Daily Load (TMDL) Analysis*, 1-6 – 1-7; Horsley & Witten, Inc., *Assessment of Nitrogen Loadings*, 5; Price, Kent S., “A Framework for a Delaware Inland Bays Environmental Classification,” *Environmental Monitoring and Assessment* 51 (1998), 285 – 298; and, DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*.

⁴¹ For more discussion of *Pfiesteria* and the problems associated with the outbreaks of this toxic dinoflagellate see: Center for Environmental Science, *The Cambridge Consensus: Forum on Land-Based Pollution and Toxic Dinoflagellates in Chesapeake Bay* (Cambridge, MD: University of Maryland, Center for Environmental Science, October 1997).

⁴² Murray, Molly and Jeff Montgomery, “Poultry Industry Endangers Health of State Waterway,” *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁴³ Delaware Inland Bays Estuary Program (DIBEP), *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix F, Characterization Summary* (Lewes, DE: Center for the Inland Bays, June 1995), 3-9.

⁴⁴ Center for the inland Bays (CIB), *Center for the Inland Bays: 1999 EPA Biennial Review Document* (Nassau, DE: CIB April 1999); and, Center for the Inland Bays (CIB), *Center for the Inland Bays 1998 Report Card: State of the Bays* (Lewes, DE: CIB, Undated), 3.

⁴⁵ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 9.

⁴⁶ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix F*, 3-30.

⁴⁷ *Ibid.*, 7, 3-75

⁴⁸ *Ibid.*, 6.

⁴⁹ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*.

⁵⁰ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix F*, 2-5.

⁵¹ *Ibid.*, 7.

⁵² DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*.

⁵³ Gaquim, Dierdre A. and Mark S. Littman (eds.), *1998 County and City Extra: Annual Metro, City, and County Data Book* (Lanhan MD: Bernan Press, 1998).

⁵⁴ For statistics on recreational usage see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Proposal to Develop an Estuarine Conservation and Management Plan for Delaware’s Inland Bays* (Dover, DE: DNREC, 1987); Falk, James, Alan Graefe, Ellen Drogin, John Confer, and Lee Anne Chandler, *Recreational Boating on Delaware’s Inland Bays: Implications for Social and Environmental Carrying Capacity* (Newark, DE: University of Delaware, Sea Grant College Program, December 1992); and, Sea Grant Marine Advisory Service, University of Delaware, *Comprehensive Water-Use Plan for Delaware’s Inland Bays, A Report Prepared for the Center for the Inland Bays and the Environmental Protection Agency* (Lewes, DE: University of Delaware, Sea Grant Marine Advisory Service, January 8, 1999).

⁵⁵ Delaware Department of Natural Resources and Environmental Control (DNREC), *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*, Summary (Dover, DE: DNREC, 2000).

⁵⁶ Gaquim, and Littman, *1998 County and City Extra*, 99

⁵⁷ DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*; DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 4; Sussex County, *1997 Sussex County Comprehensive Plan*, 4; and, Gaquim, and Littman, *1998 County and City Extra*, 97.

⁵⁸ DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*. Another estimate has population increasing 38 percent during the same period. See: Delaware Population Consortium, *1998 Delaware Population Projection Series* (Dover, DE: Delaware State Data Center, 1998). The uncertainty reflects the fact that development is occurring so fast that projects are revised frequently.

⁵⁹ Sussex County, *1997 Sussex County Comprehensive Plan*, 4.

⁶⁰ Gaquim, and Littman, *1998 County and City Extra*, 105.

⁶¹ Ibid.

⁶² Sussex County, *1997 Sussex County Comprehensive Plan*, 3.

⁶³ According to 1985 Sussex County records, the DIB watershed contained 28,000 dwelling units and growth averaged 4% per year between 1970 and 1985. For more discussion see: DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 40.

⁶⁴ CCMP; Sussex County, *1997 Sussex County Comprehensive Plan*, 3; DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 40.

⁶⁵ The property tax rate in unincorporated areas in the county is 44.5 cents per \$100 of assessed value. For more information see: Sussex County Council, *Fiscal Year 1999 Budget* (Georgetown, DE: Sussex County, May 1998).

⁶⁶ Sussex County, *1997 Sussex County Comprehensive Plan*, 21.

⁶⁷ Murray, Molly and Jeff Montgomery, "Poultry Industry Endangers Health of State Waterway," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁶⁸ DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*.

⁶⁹ DNREC, *Total Maximum Daily Load (TMDL) Analysis*, 2-9.

⁷⁰ DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*.

⁷¹ Gaquim, and Littman, *1998 County and City Extra*, 103 - 104. The 1,515 farms ranked 33rd nationally in 1992.

⁷² Ibid., 103

⁷³ Ibid., lxix.

⁷⁴ Ibid., 104.

⁷⁵ Williams, Walter H., *Delmarva's Chicken Industry: 75 Years of Progress* (Georgetown, DE: Delmarva Poultry Industry, Inc., 1998), 115.

⁷⁶ In 1991, 161 new chicken houses were completed, 62 other were started, and financial approval was granted for 13 additional houses. The capacity of each house averaged 26,500 birds and cost approximately \$100,000. See: Williams, *Delmarva's Chicken Industry: 75 Years of Progress*, 91).

⁷⁷ Williams, *Delmarva's Chicken Industry: 75 Years of Progress*, 115; Goodman, Peter S., "Who Pays for What is Thrown Away," *Washington Post* August 3, 1999, A1.

⁷⁸ Ibid.

⁷⁹ Montgomery, Jeff and Molly Murray, "Waste Battle Squeezes Farmers," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁸⁰ Ibid.

⁸¹ Murray, Molly and Jeff Montgomery, "Poultry Boom Said to Have Saved Farms in Delaware," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁸² Williams, *Delmarva's Chicken Industry: 75 Years of Progress*, 11 - 13.

⁸³ For a discussion of the history of the region and its impact on local culture see: Williams, *Delmarva's Chicken Industry: 75 Years of Progress*.

⁸⁴ Information provided by Delmarva Poultry Industry, Inc.

⁸⁵ Montgomery, Jeff and Molly Murray, "Del. Poultry Writes Own Rules," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁸⁶ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 9.

⁸⁷ Horsley & Witten, Inc., *Assessment of Nitrogen Loadings*, 5.

⁸⁸ Montgomery, Jeff and Molly Murray, "Waste Battle Squeezes Farmers," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁸⁹ There is actually some question what happens to the more than 10 million birds that die annually in Sussex County.

⁹⁰ This is an estimate compiled by the Delaware News Journal. Montgomery, Jeff, "Poultry May No Longer Rule the Roost," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> in one of its Special Report series. The Washington Post estimated that the production of manure on the Delmarva Peninsula was equivalent to the nutrients generated by a population of more than 4 million. See: Goodman, Peter S., "An Unsavory Byproduct: Runoff and Pollution," *Washington Post* August 1, 1999, A1.

⁹¹ Murray, Molly and Jeff Montgomery, "Poultry Industry Endangers Health of State Waterway," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

⁹² For more information on this program see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware nonpoint Source Pollution Program* (Dover, DE: DNREC, May 1995).

⁹³ For more information on these erosion and stormwater control requirements see: Sussex Conservation District, *Sussex County Sediment Control and Stormwater Management Program Handbook* (Georgetown, DE: Sussex Conservation District, 1991); and, Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware Erosion and Sediment Control Handbook for Development* (Dover, DE: DNREC, 1989).

⁹⁴ Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware's Open Space Program: A Five Year Report* (Dover, DE: DNREC, May 1996).

⁹⁵ For some information on marina operation and maintenance see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Best Management Practices for Delaware Boat Maintenance Facilities* (Dover, DE: DNREC, May 1997).

⁹⁶ For information on the Delaware's dredging plan for the Inland Bays see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Inland Bays Dredging Study Volume I: Goals and Objectives Creek Evaluation Dredging Criteria* (Dover, DE: DNREC, April 1986).

⁹⁷ For a general discussion of the Division of Water Resources programs see: Delaware Department of Natural Resources and Environmental Control (DNREC), *1997 Annual Report: A Year in Review* (Dover, DE: DNREC, Division of Water Resources, February 1998).

⁹⁸ Delaware Department of Natural Resources and Environmental Control (DNREC), *Whole Basin Framework Document* (Dover, DE: November 1997, Revised March 1998).

⁹⁹ Delaware Department of Natural Resources and Environmental Control (DNREC), *Pea Patch Island Heronry Region Special Area Management Plan* (Dover, DE: DNREC, July 1998).

¹⁰⁰ For more information on the activities of Delaware's coastal zone management program see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware Coastal Zone: Environmental Goals and Associated Issue Characterizations* (Dover, DE: DNREC, January 1999); Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware Coastal Management Program Draft Section 309 Enhancement Strategy* (Dover, DE: DNREC, April 7, 1997); Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware Coastal Management Program Draft Section 309 Enhancement Assessment* (Dover, DE: DNREC, January 1997); Delaware Department of Natural Resources and Environmental Control (DNREC), *Comprehensive Update and Routine Program Implementation: Program Summary Supplement to 1979 Document* (Dover, DE: DNREC, March 1993); National Oceanic and Atmospheric Administration (NOAA), *Evaluation Findings for the Delaware Coastal Management Program: March 1995 through May 1998* (Silver Spring, MD: NOAA, 1998); National Oceanic and Atmospheric Administration (NOAA), *Evaluation Findings for the Delaware Coastal Management Program: January 1992 through February 1995* (Silver Spring, MD: NOAA, 1998);

¹⁰¹ Delaware Department of Natural Resources and Environmental Control (DNREC), *Delaware's Coastal Nonpoint Pollution Control Program, Volume 1* (Dover, DE: DNREC, July 1995)

¹⁰² DNREC, *Total Maximum Daily Load (TMDL) Analysis*.

¹⁰³ DNREC, *1997 Annual Report: A Year in Review*.

¹⁰⁴ Delaware Department of Natural Resources and Environmental Control (DNREC), *Environmental Partnership Agreement between Delaware Department of Natural Resources and Environmental Control and US Environmental Protection Agency Region III for Fiscal Year 1999* (Dover, DE: DNREC, November 2, 1998); Delaware Department of Natural Resources and Environmental Control (DNREC), *Environmental Partnership Agreement between Delaware Department of Natural Resources and Environmental Control and US Environmental*

Protection Agency Region III for Fiscal Year 1997 (Dover, DE: DNREC, September 9, 1996); and, Delaware Department of Natural Resources and Environmental Control (DNREC), *Environmental Partnership Agreement between Delaware Department of Natural Resources and Environmental Control and US Environmental Protection Agency Region III for Fiscal Year 1996* (Dover, DE: DNREC, November 2, 1995);

¹⁰⁵ Sussex Conservation District (SCD), *The Conservation Times: 50th Anniversary Issue* (Georgetown, DE: SCD, December 1994)

¹⁰⁶ For more a more detailed discussion of these activities see: Sussex Conservation District, *1995 Annual Report* (Georgetown, DE: Sussex Conservation District, 1995); Sussex Conservation District, *1996 Annual Report* (Georgetown, DE: Sussex Conservation District, 1996); and, Sussex Conservation District, *1997 Annual Report* (Georgetown, DE: Sussex Conservation District, 1997).

¹⁰⁷ For more discussion of this program see: Sussex Conservation District, *Sussex County Sediment Control and Stormwater Management Program Handbook*.

¹⁰⁸ Murray, Molly and Jeff Montgomery, "Poultry Industry Endangers Health of State Waterway," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

¹⁰⁹ Sussex County Council, *Fiscal Year 1999 Budget*.

¹¹⁰ Lewes is probably the most sophisticated and proactive in terms of regulating growth, minimizing storm damage, and maintaining its historic character. It was recently designated by the Federal Emergency Management Agency (FEMA) as a Project Impact community. For more information on Project impact see: Federal Emergency Management Agency (FEMA), *Project Impact: Building a Disaster Resistant Community* (Washington, DC: FEMA, Undated).

¹¹¹ For an example of a local comprehensive land use plan see: Rehoboth, City of, *Comprehensive Long Range Plan – Public Hearing Draft* (Rehoboth, DE: City of Rehoboth, June 10, 1996).

¹¹² Delaware State Planning Office, *Comprehensive Development Plan: Sussex County Delaware* (Dover, DE: Delaware State Planning Office, 1969).

¹¹³ Delaware State Game and Fish Commission, *Environmental Study of the Rehoboth, Indian River, and Little Assawoman Bays*, A report presented to Governor Russell W. Peterson (Dover, DE: State Game and Fish Commission, November 1969).

¹¹⁴ *Ibid.*, 24.

¹¹⁵ The report was not silent on problems from agricultural operations. It noted that there were problems from the point source discharges from the processing facilities. It was less clear on whether nutrient loadings from agricultural operations merited concern.

¹¹⁶ For a summary of the highlights of these plans see: DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 6 – 7.

¹¹⁷ DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 5.

¹¹⁸ Scotto, Susan L., Robert B. Biggs, Betsy Brown, and Andrew T. Manus, *Decisions for Delaware: Sea Grant Looks at the Inland Bays* (Newark, DE: University of Delaware, College of Marine Studies, SGP, February 1983).

¹¹⁹ *Ibid.*

¹²⁰ Moyer, William F., *Delaware's Inland Bays: Summary Report of the Inland Bays Study Group to the Governor's Task Force on the Inland Bays* (Dover, DE: DNREC, December 1983).

¹²¹ *Delaware Conservationist, Inland Bays Special Issue* 26 (no. 2).

¹²² Scotto, Susan L., Robert Biggs, Andrew Manus, Jerome Lewis, Dan Kuennen, Steve Hastings, John Stapleford, *University of Delaware Inland Bays Colloquium Paper*, (Newark, DE: University of Delaware, Sea Grant College Program, March 1984).

¹²³ DNREC staff ended up being the ones who actually drafted the proposal to enter the NEP.

¹²⁴ For more information on these accomplishments see: Governor's Inland Bays Monitoring Committee, *Cleaning Up Our Inland Bays: A Progress Report* (Dover, DE: DNREC, June 1985); Governor's Inland Bays Monitoring Committee, *Second Annual Report: Cleaning Up Our Inland Bays* (Dover, DE: DNREC, 1986); and, Governor's Inland Bays Monitoring Committee, *1988 Annual Report: Delaware's Inland Bays* (Dover, DE: DNREC, September 1988).

¹²⁵ EPA, *The Streamlined National Estuary Program: Instructions on the Preparation of a Governor's Nomination* (Washington, DC: Environmental Protection Agency, Office of Water, December 1994); and, EPA, *The National Estuary Program: Final Guidance on the Contents of a Governor's Nomination* (Washington, DC: EPA, Office of Water, January 1990).

¹²⁶ DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*.

¹²⁷ *Ibid.*

¹²⁸ EPA, *Monitoring Guidance for the National Estuary Program*; EPA, *National Estuary Program Guidance: Base Program Analysis*; EPA, *Comprehensive Conservation and Management Plans: Content and Approval Requirements*.

¹²⁹ For example, the directors of the individual estuary programs did not meet as a group for the first time until 1990. At this meeting, the directors complained that more time was needed to complete their plans, the EPA needed to provide greater technical assistance in developing management strategies, and that greater training in facilitation and other meeting skills was needed for staff and committee chairs. See: "Estuary Directors Meet in Texas, Propose NEP Changes to Davies," *Coastlines* 1 (no 2, Oct. – Nov. 1990), 1, 9.

¹³⁰ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*.

¹³¹ For more discussion of the formation of these committees see: DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 46 – 52.

¹³² "Role of Citizens in Estuary Planning Explored at Four-Day National Workshop," *Coastlines* 1 (no. 3, Dec. – Jan. 1990 – 1991), 10 – 12.

¹³³ Poole, Stephanie, *Assessing National Estuary Programs (NEPs): Improving the NEP Process through Development of Evaluative Criteria*, Unpublished Masters Thesis (Newark, DE: University of Delaware, Spring 1998), 41.

¹³⁴ *Ibid.*

¹³⁵ DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 48.

¹³⁶ *Ibid.*, 49.

¹³⁷ "Role of Citizens in Estuary Planning Explored at Four-Day National Workshop," 10 – 12.

¹³⁸ Ibid.

¹³⁹ Poole, Stephanie, *Assessing National Estuary Programs (NEPs)*, 41.

¹⁴⁰ DNREC, *Proposal to Develop an Estuarine Conservation and Management Plan*, 49.

¹⁴¹ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix F*.

¹⁴² Governor's Inland Bays Monitoring Committee (GTFIB), *1988 Annual Report: Delaware's Inland Bays*, 3.

¹⁴³ Delaware Department of Natural Resources and Environmental Control (DNREC), *Proposal to Develop an Estuarine Conservation and Management Plan for Delaware's Inland Bays: Appendices* (Dover, DE: DNREC, 1987).

¹⁴⁴ Falk, et al., *Recreational Boating on Delaware's Inland Bays*.

¹⁴⁵ The completed model did provide some assistance in developing a pollution control strategy for the basin, which guided DNREC permit decisions. However, while the model provided some support and justification for the pollution control strategy, the model was not necessary for its development.

¹⁴⁶ For more discussion of the hydrodynamic model and the TMDL see: DNREC, *Total Maximum Daily Load (TMDL) Analysis*.

¹⁴⁷ Poole, *Assessing National Estuary Programs (NEPs)*, 42.

¹⁴⁸ Murray, Molly and Jeff Montgomery, "Poultry Industry Endangers Health of State Waterway," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

¹⁴⁹ For more information on the HUA program see: Natural Resource Conservation Service (NRCS), *Inland Bays Hydrologic Unit Area Project: Final Report* (Dover, DE: NRCS, October 1998); and, Soil Conservation Service (SCS), USDA, *Inland Bays Hydrologic Unit Area: USGS Hydrologic Unit Code 02060010, 1995 Annual Report* (Georgetown, DE: SCS, 1995).

¹⁵⁰ NRCS, *Inland Bays Hydrologic Unit Area Project: Final Report*, 6.

¹⁵¹ Ibid., 1-2.

¹⁵² Ibid.

¹⁵³ Ibid., 3.

¹⁵⁴ Ibid., 6.

¹⁵⁵ Ibid., 5.

¹⁵⁶ Ibid., 4.

¹⁵⁷ Ibid., 5.

¹⁵⁸ There was some voting early in the planning process but as the CCMP moved towards the final stages of development, there was more emphasis on consensus.

¹⁵⁹ Hollander, Cohen Associates, Inc., *Sussex County Residents Report Their Uses of and Environmental Concerns for Waters of the Inland Bays* (Preliminary draft), Prepared for the Inland Bays Estuary Program (Baltimore, MD: Hollander, Cohen Associates, Inc., November 1989)

¹⁶⁰ For more discussion of the evolution of these drafts and how the DIBEP staff responded to the comments of various constituency groups see: DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C, Public Input and Response Summary* (Lewes, DE: Center for the Inland Bays, June 1995)

¹⁶¹ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C.*

¹⁶² For a discussion of these ongoing comments see: DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C.*

¹⁶³ Ritter, William F., *Nutrient Budgets for the Inland Bays, A Report for the Department of Natural Resources and Environmental Control* (Newark, DE: University of Delaware, Agricultural Engineering Department, 1986).

¹⁶⁴ *American Littoral Society, et al. V. United States Environmental Protection Agency, et al.* (Civil Action No. 96-5920)

¹⁶⁵ Llvento, Tom and Angela Watson, *Poultry Growers Speak Out: A Survey of Delmarva Poultry Growers, Executive Summary* (Newark, DE: University of Delaware, Cooperative Extension, December 1997); and, Michel, Kristin, J. Richard Bacon, Conrado M. Gempesaw II, John H. Martin, Jr., *Nutrient Management By Delmarva Poultry Growers: A Survey of Attitudes and Practices*, FREC RR96-01 (Newark, DE: University of Delaware, Department of Food and Resource Economics, August 1996).

¹⁶⁶ There is great distrust of DNREC among farmers due to several well-publicized enforcement incidents.

¹⁶⁷ Some parts of the country already grow chicken at $\frac{3}{4}$ of a cent per pound less than Delaware (Montgomery, Jeff and Molly Murray, "Waste Battle Squeezes Farmers," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed).

¹⁶⁸ Because of the annual nature of the farming enterprise it can take years to develop solid evidence of a BMP's impacts on farm operations.

¹⁶⁹ Llvento and Watson, *Poultry Growers Speak Out*; and, Michel, et al., *Nutrient Management By Delmarva Poultry Growers*.

¹⁷⁰ The EPA regional office had some concerns with the final draft of the CCMP but felt these could be worked out once the implementation process started.

¹⁷¹ For a discussion of EPA's concerns and how they were addressed over time see: DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C.*

¹⁷² DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C.*

¹⁷³ This is contrasted with more steady involvement from EPA region III staff who had longer tenure in the agency.

¹⁷⁴ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan, 2*

¹⁷⁵ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan.*

¹⁷⁶ *Ibid.*, 84 – 85.

¹⁷⁷ Ibid.

¹⁷⁸ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 77; and, DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan Appendix C*, 2.

¹⁷⁹ DIBEP, *Delaware Inland Bays Comprehensive Conservation Management Plan*, 78.

¹⁸⁰ Ibid., 80 – 81.

¹⁸¹ Ibid., 80 – 82.

¹⁸² In 1995, the DGA amended the *Inland Bays Watershed Enhancement Act* to have the legislative appointees changed from ex-officio nonvoting members to voting members.

¹⁸³ Center for the Inland Bays (CIB), *By-laws of the Delaware Center for the Inland Bays* (Lewes, DE: CIB).

¹⁸⁴ Ibid.

¹⁸⁵ Center for the Inland Bays (CIB), *Center for the Inland Bays: 1997 EPA Biennial Review Document* (Lewes, DE: CIB, June 1997), 4 – 5.

¹⁸⁶ Ibid.

¹⁸⁷ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*; and, CIB, *Center for the Inland Bays 1998 Report Card*, 3.

¹⁸⁸ DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*.

¹⁸⁹ DNREC, *Total Maximum Daily Load (TMDL) Analysis*.

¹⁹⁰ James Falk, James Poling, Alan Graefe, and Bennett Anderson, *Comprehensive Water-Use Plan for Delaware's Inland Bays*, A report prepared for the Center for the Inland Bays, DEL-SG-02-99 (Newark, DE: University of Delaware, Sea Grant College Program, June 1999).

¹⁹¹ DNREC, *Total Maximum Daily Load (TMDL) Analysis*, 2-9.

¹⁹² DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*; and CIB, *Center for the Inland Bays 1998 Report Card*, 5.

¹⁹³ CIB, *Center for the Inland Bays 1998 Report Card*, 5.

¹⁹⁴ Sussex County, *1997 Sussex County Comprehensive Plan*, 26; and, Sussex County Planning and Zoning Commission, *The Coastal Sussex Land Use Plan March 1988*; and, Sussex County Planning and Zoning Commission, *Western Sussex Land Use Plan*.

¹⁹⁵ Sussex County, *1997 Sussex County Comprehensive Plan*, 24.

¹⁹⁶ The Delaware Land Protection Act (7 Del. Code, Chapter 75) was passed in July 1990.

¹⁹⁷ DNREC, *Delaware's Open Space Program*, 4.

¹⁹⁸ Ibid., 78.

¹⁹⁹ CIB, *Center for the Inland Bays: 1997 EPA Biennial Review*.

²⁰⁰ CIB, *Center for the Inland Bays 1998 Report Card*, 2.

²⁰¹ *Ibid.*, 2.

²⁰² DNREC, *Total Maximum Daily Load (TMDL) Analysis*.

²⁰³ *Ibid.*, 3-10.

²⁰⁴ CIB, *Center for the Inland Bays 1998 Report Card*, 9.

²⁰⁵ *Ibid.*, 5.

²⁰⁶ For a detailed discussion of these accomplishments and the progress towards specific CCMP recommendations see: CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*; CIB, *Center for the Inland Bays 1998 Report Card*; CIB, *Center for the Inland Bays: 1997 EPA Biennial Review*; Center for the Inland Bays (CIB), *Center for the Inland Bays: Report Card for 1996* (Lewes, DE: CIB, Undated).

²⁰⁷ CIB, *Center for the Inland Bays: 1997 EPA Biennial Review*, 17; and, CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 36 - 37.

²⁰⁸ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 37.

²⁰⁹ *Ibid.*

²¹⁰ *Ibid.*, 38.

²¹¹ DNREC has now completed the preliminary assessment. See: DNREC, *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*.

²¹² CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*.

²¹³ *Ibid.*

²¹⁴ One should not read too much into the fact that the DIBEP received a passing grade. The odds of getting a passing grade are actually quite good since the EPA has only issued one failing grade.

²¹⁵ CIB, *Center for the Inland Bays: 1997 EPA Biennial Review*, 10.

²¹⁶ *Ibid.*, 12.

²¹⁷ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*.

²¹⁸ For examples see: CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*.

²¹⁹ CIB, *Center for the Inland Bays 1998 Report Card*, 6.

²²⁰ *Ibid.*

²²¹ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 51.

²²² Horsley & Witten, Inc., *Assessment of Nitrogen Loadings*.

²²³ Reducing nutrients from agricultural operations is a monetary issue from the standpoint that you could always build some sort of plant to dispose of the manure much the same way you do domestic sewage. Moreover, it is one that can be reversed, albeit it may take a long period of time. Development is a much more complicated and

pervasive problem that may have irreversible impacts. Development will permanently destroy habitat and there are a wide range of complicated cumulative and secondary impacts associated with these activities (e.g., stormwater runoff) and each house supports additional resource users that will use the beaches, take their boats and wave runners into shallow creeks and destroy submerged habitat, and harvest fish and shellfish. In the end, these problems may be difficult to address and may be hard to reverse.

²²⁴ This strategy was employed by the Tillamook County Creamery Association (a cooperative) to facilitate the adoption of BMPs pursuant to the Rural Clean Water Program. In this instance, the Creamery decided to pay dairy farmers less for their milk if they had not adopted the recommended animal waste strategies.

²²⁵ For a while the National Broiler Council considered a self-imposed tax of a half-cent per pound to raise money for pollution control measures. This would have raised around \$161.5 million a year for BMPs.

²²⁶ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 44.

²²⁷ Montgomery, Jeff and Molly Murray, "Waste Battle Squeezes Farmers," *Delaware News Journal*. Obtained from <http://www.delawareonline.com/> on August 12, 1998 from their Special Report Series on nutrient problems in the Inland Bays watershed.

²²⁸ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 42.

²²⁹ Llvento and Watson, *Poultry Growers Speak Out*; and, Michel, et al., *Nutrient Management By Delmarva Poultry Growers*.

²³⁰ Poole, *Assessing National Estuary Programs (NEPs)*, 42.

²³¹ Ibid.

²³² CIB, *Center for the Inland Bays: 1997 EPA Biennial Review*, 9.

²³³ CIB, *Center for the Inland Bays: 1999 EPA Biennial Review*, 56.

²³⁴ Ibid., 57.

²³⁵ Imperial, "Analyzing Institutional Arrangements for Ecosystem-Based Management: Lessons"; and, Imperial, "Analyzing Institutional Arrangements for Ecosystem-Based Management".

²³⁶ Of particular note is the advent of the "Wave Runner" and "Jet Ski" have dramatically increased the size of the boating population and made it more accessible to day trippers and lower income populations.

²³⁷ The reason that there is only one representative is that representation is decided largely based on registered voters who tend to be year round residents and the Inland Bays region has a large number of seasonal residents.

Appendix A

Timeline of Environmental Governance Activities in Delaware and the DIB

1658	First settlement in Sussex County was founded at Lewes
1728	1,750 residents in Sussex County
1750	Lumber is the leading export of Sussex County. Agriculture is largely subsistence crops of wheat, corn, and buckwheat
1790	20,488 residents in Sussex County
1800	Farming begins to decline because of soil exhaustion due to poor farming techniques. Earliest fertilize consists of lime from burned oyster shells and remains of menhaden
1810	27,750 residents in Sussex County
1816	Public drainageways (tax ditches) were dug to drain wetlands. Today there are 225 miles of tax ditches affecting 35,000 acres
1820	24,057 residents in Sussex County
1830	Land around Georgetown is drained for cultivation and manure is applied
1840	25,093 residents in Sussex County
1850	Most of the land suitable for agriculture had been cleared. Crops shifted from subsistence crops to vegetable farms and orchards
1855	Chemical fertilizer goes into widespread use in the region
1859	Delaware Railroad pushed south to Delmar on the Delaware-Maryland boundary line, which connected the region to urban centers along the eastern seaboard
1860	29,615 residents in Sussex County
1880	36,018 residents in Sussex County
1891	Pilot channel for the Assawoman Canal linking Indiana River Bay and Little Assawoman Bay was excavated
1900	42,276 residents in Sussex County
1908	At least 300 men were taking crabs from the bays
1911, 1912, 1915	Inlet closed
1913	Lewes and Rehoboth Cabal was opened
1920	43,741 residents in Sussex County
1923	Inlet closed

Delaware Inland Bays Estuary Program

- 1923 Cecile Long Steele in Ocean View, Delaware is sent 500 chicks by accident (she ordered 50). Instead of sending them back, she raised them and sold them to a local buyer at a tremendous profit. The next year she ordered 1,000 chicks and the modern broiler industry was born.
- 1924 As many as 60,000 crabs were taken daily from the bays. Fish, clams, and oysters were also harvested in considerable numbers
- 1925 - 1928 Inlet closed. This closure was particularly catastrophic for local marine life and caused hundreds of watermen to lose their jobs and an estimated loss of more than \$1 million to the local economy. Dredging initiated to reopen the inlet. Due to lack of funds, the inlet remained closed until the following year
- 1925 University of Delaware is supplying a full-time poultry specialist to work with farmers and provide technical assistance
- 1925 More than 50,000 chickens are being raised in Sussex County
- 1928 More than 500 poultry growers in the region
- 1929 Local concerns succeed in cutting a new channel and dredging the inlet
- 1931 Inlet shoals and closes again. State highway department uses dynamite to blast the inlet open
- 1933 Delmarva Peninsula hatcheries are unable to secure enough eggs for all of the fall and winter orders for broiler chicks
- 1933 Inlet closes again. The State Highway Department redredged the inlet
- 1935 – 1937 Indian River inlet is closed and there is no open connection to the sea. Kills much marine life and causes watermen to lose their jobs. State Highway Department redredged the inlet again. Federal project to stabilize the inlet is approved
- 1936 Senator John Townsend's youngest son Preston invested in a local grower's operations and received a good return on his investment. He then begins to get more involved in the industry.
- 1936 Sussex County produced an estimated 66 percent of the nation's broiler hens
- 1938 Federal project to stabilize, widen, and deepen the Indiana River Inlet begins
- 1938 Townsends briefly operates a chicken processing plant but shuts it down when it proves unprofitable
- 1938 First poultry dressing plant was established by Jacob Udell of Frankford. Prior to this, birds were shipped live to markets in places such as New York and Philadelphia
- 1940 52,502 residents in Sussex County
- 1940 Average American family eats 124 pounds of beef and only 14 pounds of chicken
- 1940 Federal project is completed and a new permanent channel to the ocean, the Indian River Inlet, provides first stable connection to the sea

Delaware Inland Bays Estuary Program

1940	Townsend, Inc was growing chickens on its own land. By 1945 he has his own feed mill.
1941	General Assembly creates an annex of the University of Delaware's Agricultural Experiment Station on a 310 acre farm near Georgetown, DE in Sussex County, just outside the DIB watershed
1941 – 1945	World War II increases demand for chickens. Government price ceilings create a vibrant "black market" for bootleg chickens that allows some growers to make significant profits
1942	Delmarva grew 90 million broilers compared to Arkansas with 11 million and Georgia with 10 million
1944	Sussex Conservation District is organized
Late-1940s – Early 1950s	Regional and national companies begin to attach themselves to the large number of growers through an evolving contracting system
1948	Nearly one third of Rehoboth Bay is leased as oyster growing areas
1948	First Delmarva Chicken Festival is held in Georgetown, DE
1948	95 million birds grown on the Delmarva Peninsula
1955	Soft shell clam population nearly disappears
1955	Delmarva Poultry Industry, Inc. (DPI) is created. It expands the activities of the organization created to organize the annual Delmarva Chicken Festival
1956	Oyster grounds decimated by disease. Attempts at reintroduction fail. Many switch to claming.
1956	Commercial hard clam production peaks. Total harvest 35 years later declines by 98 percent
1956	Townsend begins construction on its own processing plant east of Millsboro, DE in the Inland Bays watershed
1957	Indian River Inlet is dredged
1957	180 million chickens grown on the Delmarva Peninsula
1959	No significant oyster production in the bays beyond this point
1959	26 Delmarva companies were moving towards vertical integration combining feed-mills, hatcheries, and growing operations. Drive towards vertical integration was the increasing competitiveness of the industry
1959	Townsend is processing more than 13 million broiler hens at its Millsboro facility and completed the process of vertical integration. While not the first vertically integrated poultry processor (that honor belongs to Jesse Jewell's operation in Georgia in 1954), it quickly changed the industry as competitors worked towards vertical integration.
1960	73,195 residents in Sussex County

Delaware Inland Bays Estuary Program

March 1962	Most destructive Noreaster' ever, the "Ash Wednesday Storm" causes significant flooding, erosion, and storm damage throughout the watershed and along the barrier beaches
1963	Indian River Inlet is dredged following the 1962 Noreaster
1967	Over 280 million chickens grown on the Delmarva Peninsula
1967	First shellfish survey of the lower bays
1967	State and county planning agencies and the Sussex Conservation District began developing a comprehensive development plan for Sussex County
1968	State initiated a dredging program in the Inland Bays to open new channels and help attract more visitors and permanent residents
July 1969	Meeting held on July 25, 1969 attended by former Governor Russell Peterson and representatives of several state public works and natural resource agencies. It was suggested that the factors leading to environmental degradation be studied and a program for the preservation and enhancement of the natural environment in the bay be recommended. The product of these efforts was a report entitled <i>Environmental Study of the Rehoboth, Indian River, and Assawoman Bays</i> in 1969
1969	Delaware State Planning Office developed the <i>Comprehensive Development Plan – Sussex County Delaware</i>
1970	80,356 residents in Sussex County
1970	Sussex County adopts the <i>Comprehensive Development Plan – Sussex County Delaware</i>
1972	Clean Water Act and Coastal Zone Management Act are passed
1972	Delaware Coastal Zone Law is passed
1974	DNREC is delegated the NPDES program by the EPA pursuant to the Clean Water Act
1975	<i>Sussex County River Basin Water Quality Management Plan</i> was completed. It was a five-year plan developed pursuant to Section 303(e) of the Clean Water Act that required water management plans for all navigable waters in the state. This plan was designed to improve and maintain the water quality of the streams, rivers, and tributaries
1975	<i>South Coastal Land Use Plan</i> was completed pursuant to Section 205 of the Clean Water Act to justify federal construction grant money for the South Coastal Regional Wastewater Treatment Plant
1975	Sussex County Council receives a two year federal grant to prepare a <i>Coastal Sussex Water Quality Program</i> pursuant to Section 208 of the Clean Water Act
1976	Sussex County adopts the <i>South Coastal Land Use Plan</i>
1976	DNREC promulgates wetlands regulations to minimize the dredging and filling

Delaware Inland Bays Estuary Program

- 1976 Sussex Conservation District and the USDA Soil Conservation Service begin working with land owners for the management and disposal of animal waste
- 1976 County Engineers, consultants, and the SCD began work on *Coastal Sussex Water Quality Program* pursuant to Section 208 of the Clean Water Act. Special emphasis is placed on the land application of treated effluent on cropland through spray irrigation
- 1977 380 million chickens grown on the Delmarva Peninsula
- 1977 Clean Water Act is amended
- 1977 University of Delaware Researcher F. N. Robertson identified poultry farming as a worrisome pollution source in a report entitled "The Quality and Potential Problem of Ground Water in Sussex County"
- 1978 *Coastal Sussex Water Quality Management Plan* is completed pursuant to Section 208 of the Clean Water Act
- 1978 Sussex Conservation District's #1 concern is drainage and its #2 requests are for animal waste management plans
- 1978 A second Section 205 plan for the North Coastal Area of the County was prepared. While completed in 1979, it was never adopted
- 1980 98,000 residents in Sussex County
- 1980 State, local, and private contributions for conservation work in Sussex County is estimated at more than \$1.3 million
- 1981 *Delaware's Comprehensive Water Resources Management Planning Program* was initiated
- 1981 Sussex Conservation District developed guidelines for the implementation of the district's Erosion and Sediment Control Program and the program went into effect
- July 1981 Inland Bays Study Group was established which was made up of DNREC, other state and local agencies, and the public. The purpose of the group was to explore the development of a resource management plan for the Inland Bays. Its recommendations
- 1982 Inland Bays Study Group issues a series of issue paper and their recommendations are used as the starting point for the Governor's Task Force
- 1983 Five volume report entitled *Delaware's Comprehensive Water Resources Management Planning Program* was issued. It was designed to serve as a resource document and several of its recommendations pertain directly to the Delaware Inland Bays
- 1983 DNREC publishes a special issue of the *Delaware Conservationist*
- February 1983 Sea Grant program issues a report entitled *Decisions for Delaware: Sea Grant Looks at the Inland Bays*. The report looked at the problems facing the bays and offered two specific recommendations
- September 1983 Governor du Pont held the first Conference on the Inland Bays

Delaware Inland Bays Estuary Program

October 1983	Governor du Pont signed Executive Order Number 133 which created the Governor's Task Force on the Inland Bays and appointed a group of individuals with diverse backgrounds representing the private and public sector
October 1983	Rehoboth places a moratorium on new sewer connections. It has the affect of stalling development in and adjacent to the community
December 1983	Inland Bays Study Group issues its summary report to the Governor's Task Force on the Inland Bays
1984	First active show of public concern for the environmental quality of the Inland Bays. The DNREC, EPA Region III, and the City of Rehoboth were considering designs for the upgrade of the Rehoboth Beach Treatment Plant and recommended discharge into the Rehoboth Canal. Following comments from a group called Sussex County Environmental Concerns Association, further investigation of land treatment alternatives were investigated
July 4, 1984	Task Force on the Inland Bays issues its final report that addressed the issues recommended by the Inland Bays Study Group and added some of its own. Its final report <i>Protecting Delaware's Inland Bays: Charting a Course for Change</i> included more than 45 recommendations
July 1984	Governor du Pont issues Executive Order No. 143 and created the Inland Bays Monitoring Committee to oversee the implementation of the Task Force's recommendations. It meets quarterly and issues annual reports on its progress.
September 1984	Sussex County hires consulting firm to begin developing a land use plan for eastern Sussex County
1985	DNREC amends its Water Quality Standards for Streams and includes a new classification for waters of exceptional recreational or ecological significance (ERES) with inputs from point or nonpoint sources significantly restricted in these waters. The Delaware Inland Bays and their tributaries are designated as ERES waters.
1985	DNREC amended its regulations governing the design and installation of onsite sewage disposal systems
1985	Sussex Conservation District requested that a <i>Coastal Sussex River Basin Study</i> be conducted on the Coastal Zone area pursuant to Section 6 of the Watershed Protection and Flood Prevention Act (Public Law 83 – 566). The Sussex Conservation District and DNREC begin work on the study. Production of four pre-authorization reports as prerequisites for project implementation are authorized.
1985	Delaware General Assembly begins authorizing cost share monies to assist in the implementation of Best Management Practices (BMPs)
1985	Work begins on <i>The Coastal Sussex Land Use Plan: Sussex County Delaware</i>
1985	DNREC revises its regulations governing construction on submerged tidal lands.
February 1985	Sussex County Environmental Concerns Association and other environmental groups file a law suit to block the construction of a new sewage treatment plant that would dump wastewater into the Lewes and Rehoboth canal

Delaware Inland Bays Estuary Program

April 1985	Rehoboth enters into an out of court settlement with the environmental groups that allows work on the new plant to proceed. EPA agrees to study the feasibility of land application of waste water and the parties agreed to use that disposal option if it is cheaper and more environmentally sound
April 14, 1985	Voters reject the referendum on extending the sewer district based on the cost of the sewage treatment plan. Sussex County and DNREC begin exploring less costly alternatives
June 1985	200,000 copies of the first Annual Report of the Inland Bays Monitoring Committee were released and distributed
November 1985	Residents along Herring Creek show up at a public hearing to protest the construction of a 72 slip marina that they claim will increase NPS pollution and destroy habitat
December 1985	Sussex County Council votes to sell \$45 million in general revenue bonds to be used for public sewer construction and improvements and help unincorporated communities address their wastewater problems
1986	Coastal Sussex River Basin study was approved
1986	The Governor's Inland Bays Monitoring Committee issues its second report. Fifteen or 32 percent of the Task Force's recommendations have been implemented
January 1986	Consultant submitted a draft comprehensive plan to the Sussex County Planning and Zoning Commission and begins public review and making changes to the plan
October 1986	Delaware's Supreme Court rules that Sussex County's land use plan has the force of law. The Court also criticized the County for arbitrarily rezoning property and warned that they must adequately notice such changes. The impact of the ruling is that County is likely to be more cautious and "water down" some provisions that are in the comprehensive plans currently being revised
1987	490 million chickens grown on the Delmarva Peninsula
1987	Clean Water Act amended and the Section 319 Nonpoint Source (NPS) Management Program and the National Estuary Program (NEP) were established
1987	The Delaware Inland Bays are nominated to the National Estuary Program by Governor Michael N. Castle
1987	Sussex Conservation District is awarded first place in the 39 th Annual Goodyear Conservation Award Program. This was the sixth time the district was a grand award winner. A distinction shared with only four other districts in the nation. The district received other awards that year as well.
1987	First time references to waste utilization as being a major factor in maintaining or improving water quality began appearing
1987	Researchers find that nitrate levels exceed federal safe drinking water standards in 34 percent of the 200 wells sampled in southern Delaware
January 1987	Draft pre-authorization report for the Love Creek Watershed was distributed for public review

Delaware Inland Bays Estuary Program

March 1987	Voters in Long Neck vote to create a sewer district and construct a \$28.7 million sewer system that will remove more than 4,000 homes that are served by septic systems
March 1987	A group of residents located along Herring Creek sued to overturn DNREC's approval of a new 72 slip marina
May – June 1987	Massive fish kills in Indian River during red tides
September 1987	Draft pre-authorization report for Indian River Bay Basin is developed
1988	EPA approves the state's Section 319 program. It is the first program approved in the U.S.
1988	Delaware Inland Bays are officially designated to the EPA's National Estuary Program and the Delaware Inland Bays Estuary Program (DIBEP) is created
1988	First dead bird disposal demonstration project was implemented
1988	Towns of Millville and Ocean View vote down sewer district because of their cost
March 1988	Sussex County adopts <i>The Coastal Sussex Land Use Plan: Sussex County Delaware</i>
April 1988	Sussex County Council and the Delaware Department of Transportation (DelDOT) signed a memorandum of understanding (MOU) to coordinate land development decisions
May 1988	The SCD implements its first dead bird disposal demonstration project
May – June 1988	Massive fish kills in Indiana River during red tides. Later on it will also be linked to <i>Pfiesteria</i>
June 1988	At the request of the Sussex County Council, the Sussex Conservation District executed a MOU with them to develop a Stormwater Management handbook
June 1988	The EPA released a study that recommended potential sewer districts and disposal options for the area from west Rehoboth to the North Shore of Indian River
July 1988	Sewer line extending from Bethany Beach to North Bethany was completed. This area was previously served by holding tanks since the soils were unsuitable for septic systems
September 1988	Governor's Inland Bays Monitoring Committee issues its third annual report for the years 1987 and 1988. At this point 28 or 61 percent of the Task Force's recommendations have been implemented
September 1988	The Towns of Frankford and Dagsboro approved the creation of a sewer district and the construction of collection, transmission, and treatment facilities.
1989	Governor's Inland Bays Monitoring Committee holds its final meeting. Many of the members join the newly created Citizens Advisory Committee. Other members joining the Executive Council, the Implementation Committee, or the Science and Technical Advisory Committee.
1989	Collaborative process to develop CCMP begins

Delaware Inland Bays Estuary Program

1989	Water Use Plan started by the DIBEP is dropped when it becomes too controversial
March 1989	First major event of the DIBEP is a conference called “Back to the Future: The Inland Bays Estuary Program Workshop”
May 1989	Final report the land use recommendations of the Governor’s Inland Bays Monitoring Committee is issued
November 1989	Results of public opinion survey of Sussex County residents released
Late 1980s	Integrators and poultry growers begin having problems filling labor needs. This apparently leads to a large growth in the region’s Hispanic population
1990	113,229 residents in Sussex County
1990	Permanent sand-bypassing plant using jet pumps to transfer approximately 100,000 cubic yards of sand per year from the south beach to the north beach adjacent to the inlet is constructed. This helps minimize erosion problems along the beaches and sedimentation in the inlet and bays.
1990	The Delaware Erosion and Sediment Control Law (Ch. 40, Title 7, Delaware Code) was amended to include stormwater management
1990	The Delaware Inland Bays were one of the 36 hydrologic unit areas (HUAs) targeted by the USDA for accelerated technical and financial assistance. This is a five year water quality initiative program
January 1990	Three public meetings to discuss the results of the public opinion survey
March 1990	Governor Michael Castle and DNREC Secretary Edwin “Toby” Clark announced the Inland Bays Recovery Initiative (IBRI) – a two year action now agenda
March 1990	DNREC promulgated new regulations governing the construction and operation of Marinas
July 1990	DNREC’s Open Space Program was established by the General Assembly
November 1990	<i>Indian River Bay Protection Plan</i> (P.L. 566) was authorized for funding. This was a five year program to improve water quality in the Indian River Bay by reducing the quantities of agricultural nitrates entering groundwater and surface water. The Sussex Conservation District is the sponsor of this program
December 1990	Sussex County adopts the <i>Western Sussex Land Use Plan: Sussex County, Delaware</i>
June 1991	Sussex County Council passed Ordinance No. 769 adding stormwater management to the Sussex Conservation District’s review process
July 1991	DNREC promulgates Sediment and Stormwater Regulations that go into affect pursuant to Senate Bill 359
July 1991	Sussex Conservation District begins reviewing stormwater management in addition to erosion and sediment control
1992	Sussex Conservation District receives a 7 th first place grand award at the 45 th Annual Goodyear Conservation Award Program

Delaware Inland Bays Estuary Program

1992	Mary Lighthipe donates 150 acre tract of land on the Inland Bays known as James Farm to Sussex County with the requirement that the land not be used for residential or commercial development and that it be used for environmental or agricultural studies, parks and recreation, or to protect wildlife habitat. Land abuts a 475 acre tract of undeveloped land purchased by the state through its Open Space Program.
September 1992	Preliminary draft CCMP was released
September 1992	DNREC staff workshop to begin exploring the Whole Basin Management concept
December 1992	Fourth vision workshop was convened to discuss the concerns that had be generated at the earlier public meetings and vision workshops. Broad public support for the creation of an Implementation Council
Nov. 1992 – July 1993	Public meetings and public input forms were distributed
February 1993	DIBEP staff meet with Farm Bureau and Citizens for Affordable Sewers
Spring 1993	Shellfish harvest area was conditionally reopened after being closed since 1979
April 1993	Addendum to the preliminary draft CCMP
May to July 1993	Public comments on the Addendum to the preliminary draft
July 1993	Fifth vision workshop was convened to address gaps in the CCMP and to set the process for completing the draft CCMP and its 10 appendices. A strategy for getting the support necessary for the Implementation Council is agreed upon
October 1993	Draft CCMP released
1991 – 1995	CCMP development
1994	Implementation Committee is disbanded and replaced with a new Implementation Council. The initial mission of the Implementation Council was to create an organization that would see to the restoration and enhancement of the Inland Bays. The Implementation Council immediately began the task of forming the Center for the Inland Bays
1994	Inland Bays Watershed Enhancement Act is passed by the Delaware General Assembly establishing the Center for the Inland Bays
March – June 1994	Implementation Council meets 3 times and agrees to support legislation introduced by to create the CIB
June 1994	General Assembly passes the Inland Bays Watershed Enhancement Act, which created the CIB
July 1994	Final draft CCMP is issued
August 1994	Public meetings held on the final draft CCMP to explain the CCMP and get public comments
August – Sept. 1994	Public comment period for final CCMP
September 1994	EPA presents a list of additional information for the CCMP to be approved

Delaware Inland Bays Estuary Program

September 1994	CIB has its first Board of Directors meeting
October 1994	Revisions to final draft CCMP
1995	Inland Bays Watershed Enhancement Act is amended to make technical modifications
1995	Section 319 plan is updated
February 1995	CCMP is submitted to the Governor for signature
March 1995	CCMP is submitted to the EPA Administrator for approval
June 1995	CIB hosts the signing ceremony for the CCMP with Governor Carper, EPA Administrator Browner, and Representative Schroeder
June 1995	General Assembly makes technical modifications to the Inland Bays Watershed Enhancement Act to change make the two legislative appointees voting members
October 1995	CIB hires its first Executive Director
November 1995	Whole Basin Coordinator is selected. Whole Basin Management coordination team for the Piedmont Basin is created and work begins
1996	State creates a special license plate and a portion of the registration fees goes to the Delaware Estuary Program and the CIB
1996	University of Delaware study reported that a typical 100 – acre Delaware Poultry farm produces more than 27 tons of surplus nitrogen and 10 tons of surplus phosphorus a year, most of which is left in the soil.
March 1996	CIB co-sponsors the second Delmarva Coastal Bay Watershed Conference. Over 300 people attend
Spring 1996	Sussex County holds a series of public information meetings to begin development of a revised <i>1997 Sussex County Comprehensive Land Use Plan</i>
May 1998	First CIB newsletter is mailed to 1,100 interested people
Summer 1996	Sea Lettuce washes up along the shores of Rehoboth Bay. It's rotting in the sun creates such a stink that renters in Dewey Beach demand refunds
August 1996	James R. May, Esq., Director of the Environmental Law Clinic at Widener University School of Law on behalf of the American Littoral Society (and its affiliate, Delaware River Keeper Network) and the Sierra Club, filed a complaint charging the EPA with the failure to implement provisions of the Clean Water Act. The complaint focused on Delaware's Section 303(d) list and asked that no NPDES discharge permits be approved for discharges into listed waters until total maximum daily loadings (TMDLs) for these waters have been prepared (<i>American Littoral Society, et al. v. United States Environmental Protection Agency, et al.</i> (civil Action No. 96-5920))
September 1996	CIB holds fund raiser and poster release party. CIB's first paid membership drive with about 100 people and local media present
December 1996	Delaware's 1996 303(d) list is approved

Delaware Inland Bays Estuary Program

1997	<i>Pfiesteria piscicida</i> , a toxic microbe is found in the Chesapeake Bay. It is also found in Indian River and Bay, although not in its toxic form. The microbe is now blamed for fish kills in Indiana river as far back as 1988.
January 1997	CIB proposes to Sussex County to use the land at James Farm for habitat restoration and conservation. Idea of using the land as a home for the CIB is also discussed
February 1997	CIB begins work to develop a water use plan for the Inland Bays. Initial meetings are primarily with agency staff.
March 1997	Public hearing on revised <i>1997 Sussex County Comprehensive Land Use Plan</i>
Summer 1997	Sea lettuce returns. DNREC researches plan to harvest the sea lettuce and remove it before it begins rotting
June 1997	Public meetings with advisory committee members begin on the development of the water use plan for the Inland Bays
June 1997	CIB approves a management plan for the James Farm site and presents the plan to the Sussex County Council
June 1997	CIB participates in the EPA's first Biennial Review and receives a passing grade
July 1997	Settlement was reached in the TMDL lawsuit and DNREC Secretary Tulou and EPA Region III Administrator McCabe sign an MOU. DNREC and EPA agree on a 10-year schedule to ensure that TMDLs for all 1996-listed waters will be completed by 2006
October 1997	Sussex County Council adopts the revised <i>1997 Sussex County Comprehensive Land Use Plan</i>
1998	609 million chickens grown on the Delmarva Peninsula
1998	Population of Sussex County is 131,000
1998	Process to develop the DNREC's Whole Basin Management plan for the DIB's begins
Summer 1998	CIB creates three tributary teams, one for each subbasin. It is designed to stimulate local involvement and begin developing strategies to address the water quality problems in the rivers, streams, and creeks that enter the Inland Bays
June 1998	Maryland announces new regulatory requirements for the use of chicken manure as fertilizer and begins tighter regulation of poultry growing and processing operations
August 1998	Draft TMDL for the DIB watershed is released for public comment
September 1998	Public hearing on draft TMDL is held
December 1998	Final TMDL for the DIB watershed is issued by DNREC
March 1999	CIB approves the <i>Comprehensive Water-Use plan for Delaware's Inland Bays</i> and creates an advisory committee to oversee the plan's implementation
April 1999	CIB participates in its second EPA biennial review
November 1999	Third Delmarva watershed conference was attended by over 300 people

Appendix B

Summary of the DIB CCMP

Action Plans in the CCMP

Public Participation

1. Implement the Inland Bays Comprehensive Public Participation and Education Plan

Agriculture

1. Develop and implement conservation plans for all farms in the Inland Bays Watershed
2. Develop nutrient utilization and distribution alternatives
3. Manage and plan forested/vegetative buffers
4. Continue and enhance a tracking system for the implementation of conservation plans and best management practices
5. Continue research to determine if there is a significant relationship between nutrient movement and poultry houses

Industrial, Municipal, and Septic Systems

1. Implement the pollution control strategy (get a copy)
2. Tie new and certain existing development to appropriate sewage treatment infrastructure

Land Use

1. Ensure that land use and development are consistent with the goals of the CCMP
2. Require environmentally sensitive development

Habitat Protection

1. Develop a comprehensive habitat protection plan
2. Develop Sussex County habitat protection ordinances
3. Establish an Inland Bays comprehensive water-use plan
4. Establish a shoreline building-setback line
5. Expand public land acquisition, protection, and access
6. Promote natural alternatives to bulk-heading
7. Review, upgrade, and codify the Inland Bays Dredge Plan

Governance

1. Issue an annual Inland Bays "Report Card"
2. Issue annual report to the General Assembly (Get copies)
3. Sponsor an annual public forum
4. Hold workshops on specific areas of conflict/concern
5. Develop grant proposals to seek external funding and fundraising
6. Prepare/update a detailed 5-year programmatic strategy (get a copy)
7. Implement a media/outreach campaign
8. Develop/implement a target audience program
9. Support all public education

Appendix C

Additional Environmental Innovations of Interest to the Academy

In addition to the DIBEP case study, the research team uncovered one additional innovation that may be of interest to the Academy, the Delaware Department of Natural Resources and Environmental Control's (DNREC's) Whole Basin Management initiative.¹ Unlike other watershed management efforts that involve collaboration with other governmental and nongovernmental organizations (NGOs) or stakeholder involvement, the Whole Basin Management initiative is an internal attempt to improve the delivery of DNREC's programs by organizing operations and data on environmental problems at the watershed level. The objective is to monitor and assess biological and physical conditions within each of the state's four main basins, identify problems, and then target agency efforts to address these problems. The hope is that this will allow DNREC to improve existing programs and to better address problems that have not been addressed by traditional programs.

The effort is being phased in over time by moving from basin to basin. The efforts began in 1996 in the Piedmont Basin, followed by the Chesapeake, Inland Bays/Atlantic Ocean,² and Delaware Bay and Estuary basins with a new process started each year. This was done so that DNREC can apply the lessons learned in one basin to efforts in subsequent basins. It is also being phased in to build support among management and line staff, which may or may not look forward to this new "team-based" approach. Each process begins by creating a basin team comprised of representatives of almost all of the DNREC's programs including other media such as air quality and hazardous waste. The effort then progresses through several phases including planning, assessment, problem identification and prioritization, public participation, resources protection, and strategy development and implementation. Overall, the process is expected to take approximately five years and the effort is designed to work around existing programs and agency priorities. To date, no plans have been completed.³

Thus far, the results appear promising. Our interviews with DNREC staff indicate that the vast majority of staff favor the new approach. It has also won over some staff that initially were skeptical or hostile to collaborative or team-based planning efforts. Some of the benefits cited by our respondents were improved information for decision making, better data integration, improved access to data, better input to other program's decision-making processes, improved programmatic decision making, and the development of new interpersonal relationships. It has also increased the staff's knowledge of other agency programs. This allowed them to better represent the agency and answer questions when placed in these situations. The effort has also allowed staff to utilize skills that are not needed in their current jobs. For example, there was a hydrologist doing solid waste training who is now a data integrator. The Whole Basin Management effort has helped DNREC uncover some of these hidden talents and figured out ways to better deploy existing personnel resources. Many respondents also indicated that it improved their job satisfaction.

However, the effort has its critics. The EPA has been less than fully supportive and as one DNREC official recalled: "they really thought we were pulling the wool over their eyes and taking their money." Within the agency the critics tend to cite the lack of integration with the

information needs of programs. Others simply dislike the idea of having to work in teams or see no benefits to their program so they are reluctant to allocate staff to basin teams. As one respondent commented: “When you ask the people on the basin teams, they adamantly believe there has been a lot of getting to know other people in the department and what they do say is that is the number one benefit. I recognize the importance of that, but . . . making friendships is not in my job application.” While some hope that the basin plans will eventually lead to a reorganization of DNREC, it is unclear how it could be reorganized to better support and implement basin plans given that the current organizational structure is largely related to the organization of EPA’s programs.

Endnotes

¹ For more discussion of the DNREC’s Whole Basin Initiative see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Whole Basin Framework Document* (Dover, DE: DNREC, November 1997, Revised March 1998).

² Delaware Department of Natural Resources and Environmental Control (DNREC), *Inland Bays Environmental Profile: An Environmental Assessment of Southeastern Delaware*, Summary (Dover, DE: DNREC, 2000).

³ The DNREC has completed its first preliminary assessment. For an example see: Delaware Department of Natural Resources and Environmental Control (DNREC), *Piedmont Basin: Preliminary Assessment Report* (Dover, DE: DNREC, 1997).

About the Contributors to the Report

Mark T. Imperial graduated with a Master of Arts in Marine Affairs from the University of Rhode Island in 1993. From 1991 to 1994, Imperial worked as a policy analyst with the Rhode Island Coastal Resources Management Council. Mark is currently a Ph.D. candidate in the Public Affairs program at the School of Public and Environmental Affairs, Indiana University. His concentrations are Public Management and Policy Analysis with a minor in Environmental Science. His dissertation research focuses on collaboration in the development and implementation of watershed management programs. In addition to these activities, Mark has had articles published in the journals *Coastal Management*, *Ocean and Coastal Management*, *Environmental Management*, and *Public Works Management and Policy*.

Timothy M. Hennessey is a Professor of Political Science and Marine Affairs and the Associate Director of the Rhode Island Public Administration Program at the University of Rhode Island. He has over twenty years of experience studying the management and governance of coastal and estuarine ecosystems. In 1985, he and his colleagues at the Coastal Resources Center at the University of Rhode Island conducted a five-year Sea Grant funded comparative analysis of the governance structure and process in five estuaries; Narragansett Bay, Galveston Bay, San Francisco Bay, Albermarle-Pamlico Sound, and Puget Sound. More recently, Hennessey conducted a major study of the Chesapeake Bay Program and worked with Mark Imperial on a research project examining the National Estuary Program. He has also studied the role of science in the management of estuaries through a comparative analysis of Puget Sound and the Fraser River Estuary in Canada. Professor Hennessey has published numerous articles in journals such as *Marine Policy*, *Coastal Management*, and *Ocean and Coastal Management* as well as chapters in edited books.

Derek Kauneckis received a Masters of Science degree in International Development with an emphasis on Natural Resource Management and Policy in 1997 from the University of California, Davis. Currently he is a Ph.D. student in Public Policy at the Department of Political Science and the School for Public and Environmental Affairs at Indiana University, Bloomington. Derek's professional experience includes working with the US Forest Service in Alaska on Cultural Resource Management and Community Development programs, the Division of Natural Resources at Winrock International Institute for Agricultural Development and various environmental consulting firms in the Western United States. Derek's dissertation research uses a comparative approach to examine the effect of political decentralization on local public policy decision-making regarding natural resource management.

Leslie Koziol graduated Magna Cum Laude from Northland College, Ashland, Wisconsin, with a Bachelors of Science degree. Leslie has received numerous awards and achievements including the Aldo Leopold Award in Environmental Ethics, The Northern States Power Environmental Achievement Award, and Distinction in the Social Sciences. Leslie is currently pursuing a Masters degree in Environmental Science at Indiana University. Her research interests include Wetland Ecology and Environmental Policy and she has worked as an

assistant instructor and a lab assistant at Indiana University for the Indiana Clean Lakes Program. Prior to her graduate work, Leslie conducted research on acid mine drainage sites in Southwest Colorado. In particular, the research focused on the philosophical underpinnings of science and its role in policy formulation. Leslie has also worked as an Assistant Environmental Specialist at the Bad River Department of Natural Resources, Olanah, Wisconsin.

Katheryn Summers received a Bachelor of Science degree, with a concentration in Zoology and a minor in Wildlife Ecology, from the University of Florida in 1994. From 1994 to 1995, she conducted research at the University of Florida's Neurobiology Lab and provided staff support at the National Biological Survey's Sirenia Project. Katheryn then worked for The Nature Conservancy's in Gainesville, Florida where she produced the 1995 Eglin Air Force Base Annual Research Report, a compilation of inventory, monitoring and research conducted in support of ecosystem management. She also participated in the development of an agreement to conduct joint ecosystem management on 750,000 acres near Eglin Air Force Base. In 1996, she began her graduate studies at Indiana University and graduated in May 1999 with a Master of Environmental Science and a Master of Public Affairs, concentrating in Environmental Policy and Natural Resource Management. Katheryn is also working as a research assistant at the Center for the Study of Institutions, Population, and Environmental Change (CIPEC) on a project examining the private ownership of forested lands in Indiana.

Sally McGee is a graduate of Smith College where she received her B.A. in economics in 1989. She lived in Washington, DC for several years, working with environmental groups including Greenpeace and Conservation International. This work inspired her to experience the marine environment first hand, so she left Washington to study and then work for Sea Education Association in Woods Hole, MA. Sally has worked aboard a number of traditionally rigged sailing vessels and has sailed the eastern seaboard of the US and Canada, the Caribbean, and in the North and South Pacific. She returned to the US in 1997 and worked for Mystic Seaport (Mystic, CT) before entering the Marine Affairs Program at the University of Rhode Island in the Fall of 1998. The focus of her studies at URI is environmental conflict resolution.
