# INLAND BAYS POLLUTION CONTROL STRATEGY

## MAY 2008

DELAWARE TRIBUTARY ACTION TEAMS

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

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# Pollution Control Strategy

**For the Delaware Inland Bays—Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay and their tributaries**

## FORWARD

This document details a Pollution Control Strategy (Strategy) for Delaware's Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay and their tributaries—Delaware's Inland Bays. It was developed through a collaborative public process involving multiple interests in the watershed. The Inland Bays Tributary Action Team (Team), comprised of local government representatives, business people, environmentalists, farmers, and residents, gathered public input during seven public forums eliciting comments from 130 residents on which they based their recommended Strategy. The goal of the Strategy is to reduce nutrient loading in order to achieve State Water Quality Standards for dissolved oxygen and nutrients (nitrogen and phosphorus) and protect the designated uses of the waters of the Inland Bays. The Team presented their Strategy to the Delaware Department of Natural Resources and Environmental Control (Department) and recommended implementation of its elements.

After two sets of workshops, a group of interested parties including the Delaware Farm Bureau, the Delaware Realtors Association, the Positive Growth Alliance, and the Delaware Homebuilder's Association lobbied the General Assembly to intervene in this process. The Department met with these parties for a year in order to incorporate their concerns and presented the revised Strategy at a third round of public workshops. During the workshops, members of the scientific community raised substantive concerns relating to the buffer portion of the regulation. In the Spring of 2007, the Department held public hearings on a proposed regulation that reserved the buffer provisions in anticipation of a county-wide buffer regulation later that year. This approach, however, was not well received. The Department spent several months investigating buffer provision options that would provide several alternatives for developers while still providing benefits to water quality. Although changes have been made, this Strategy is substantially based upon the recommendations offered by the Team for the Inland Bays.

Various organizations provided the assistance to the Department in assigning nutrient load reduction efficiencies to various Best Management Practices (BMPs) through the Pollution Control Strategy Workgroup, a collection of representatives from Soil and Water Conservation Districts, the Delaware Nutrient Management Commission, the University of Delaware and various Department programs.

Based on the recommendations from these groups, the Department now proposes to promulgate a Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay (the Inland Bays) and their tributaries. The Department wishes to thank the residents who volunteered thousands of hours towards the development of a Pollution Control Strategy through their participation on the Inland Bays Tributary Action Team. The Department also wishes to recognize and thank the multiple agencies, programs, and local governments that participated in the effort.

# EXECUTIVE SUMMARY

Nutrient over-enrichment has long been a concern in Delaware's Inland Bays, specifically in the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay and their tributaries. Residents, tourists, fish and wildlife have noticed the signs: decaying seaweed, harmful algal blooms and fish kills. Many plans have been made in order to correct these problems, but few were as contentious as the Total Maximum Daily Load (TMDL) regulations promulgated by the Delaware Department of Natural Resources and Environmental Control (Department). TMDLs are the maximum amount of a pollutant that a waterbody can assimilate and still achieve water quality standards. They were established for the Indian River, Indian River Bay and Rehoboth Bay in December, 1998 (Appendix A) and for the Little Assawoman Bay in January 2005 (Appendix B). These TMDLs called for the systematic elimination of all point sources of nutrient loading to those waterbodies along with a 40-65% reduction in nonpoint phosphorus loading and a 40-85% reduction in nonpoint nitrogen loading. The TMDL also calls for a 20% reduction in atmospheric deposition of nitrogen through implementation of the Clean Air Act. An implementation plan, or a Pollution Control Strategy (Strategy), was to be developed by a Tributary Action Team, a diverse group of citizens and government agency personnel and presented to the Department for promulgation (Appendix C). This document reflects those recommendations made by the Inland Bays Tributary Action Team (Team) based on a consensus-seeking process.

The process used to generate this Strategy, "*Public Talk-Real Choices*," places importance on putting the public first in policy-making (Appendix D). The Tributary Action Team, through consultation with the general public, recommended a Pollution Control Strategy, a set of actions for achieving the TMDL, to the Department. This Strategy is based on general principles developed by the public during seven public forums held within the TMDL watersheds. These principles, or common ground, are the foundation that the Team used in building their Strategy. The Strategy itself addresses several areas for nutrient loading reductions:

- Point sources
- Nonpoint sources
    - Agriculture
    - Urban/Residential
        - Development
        - Onsite Wastewater Treatment and Disposal Systems
        - Stormwater
- Concurrence

Elements of this Strategy are both voluntary and regulatory in nature. The Strategy is designed to reduce nutrient loadings from current and future land practices. This combination of actions will lead to the achievement of the TMDL.

Scientific literature and experts in the pertinent fields were consulted and assisted the Department in estimating the nutrient reductions that would be achieved through the promulgation of this Strategy. These estimates are shown throughout this document and specific documentation is provided in Appendix E. In addition, the Strategy reviews the

various costs associated with the recommended actions (Appendix F). The Strategy also recommends funding mechanisms and implementation schedules where appropriate as well as identifies responsible parties. Finally, the Strategy reviews the agencies and programs that are charged with implementing elements of the Strategy.

Full implementation of this Strategy will cost at least twenty-five million dollars per year not including additional funding that will be needed for resultant administrative and programmatic cost increases. The Department intends to review the Strategy in ten years to assure progress towards achieving water quality standards. Table 1 summarizes the various voluntary and regulatory actions considered in this Pollution Control Strategy.

**Table 1: Pollution Control Strategy Action Items**

| PCS Action | Voluntary | Regulatory |
|---|---|---|
| POINT SOURCE | | |
| ***Systematic elimination of all point sources of N and P to the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay.*** | | **X** |
| Water Quality Trading shall be considered as one of several options in reducing phosphorus and/or nitrogen in the Inland Bays, so long as any trading is tightly regulated to ensure true net reductions within the Inland Bays Watershed. | **X** | |
| Where the point source chooses to engage in water quality trading in order to comply with the TMDL, the amount of nutrients reduced from nonpoint sources must equate to at least twice the level that the point source discharges. The nutrient load reduction involved in the trade must constitute reductions that occur beyond the baseline or the point or nonpoint source nutrient reductions required under the TMDL and this Pollution Control Strategy. | | **X** |
| Lewes Wastewater Treatment Plant to acquire water quality credits for 2.5% of its discharge after implementation of more stringent nutrient removal technology. | | **X** |
| Systematic elimination of the Millsboro Wastewater Treatment Plant discharge | | **X** |
| Systematic elimination of the Rehoboth Beach Wastewater Treatment Plant discharge | | **X** |
| AGRICULTURE | | |
| ***The agriculture sector should implement additional best management practices (BMPs) such that water quality standards are achieved. This Strategy will establish goals for implementation levels of various BMPs.*** | **X** | |
| Full compliance with the NMA; all agricultural acres (53,827) should have a nutrient management plan by 2007. | | **X** |

| PCS Action | Voluntary | Regulatory |
|---|---|---|
| Annual goal of 37,637 acres in cover crops, preferably planted one week before the published date of the first killing frost, and not fertilized. | **X** | |
| Goal of planting additional 3,037 acres of riparian forested buffers (209 acres already exist). | **X** | |
| Goal of restoring additional 4,147 acres of wetlands in areas that were previously converted to cropland (29 acres already exist). | **X** | |
| Maintain the existing 134 acres of wildlife habitat, grassed waterways and grassed filter strips. | **X** | |
| Goal of planting additional 1,718 acres of grassed buffers (55 acres already exist). | **X** | |
| Continue to use poultry manure storage sheds and composters and build an additional 50 structures. | **X** | |
| Increase the annual quantity of manure relocated or put into an alternative use from 20,347 to 20,909 tons. | **X** | |
| Continue the use of feed amendments, such as phytase, and to minimize calcium di-phosphate in poultry feed in order to reduce nutrients in poultry manure. | **X** | |
| Implement additional Water Control Structures to treat 450 acres of cropland and maintain the 1,530 acres currently treated by these structures. | **X** | |
| URBAN LAND USE | | |
| ***Decrease nutrient loading from urban nonpoint sources.*** | **X** | |
| Designation of the Inland Bays Watershed as a 'Critical Environmental Area.' The entire Inland Bays Watershed shall be managed for nutrient reductions consistent with TMDL load reductions, or reductions attributed to 'best available technologies' (BATs). | **X** | |
| The Strategies for State Policies and Spending and other incentive/disincentive tools shall be specifically tied to natural resource protection goals in the Inland Bays Watershed. | **X** | |
| Establish buffers of 100 feet landward from State-regulated wetlands, or landward from the mean high water line of all tidal waters, whichever extends farther upland, and landward from the ordinary high water mark of all other primary water features. Establish buffers of 60 feet landward from the ordinary high water mark of all secondary water features. These buffers shall be clearly demarcated, designated, and recorded on final site plans or final major subdivision plats and demarcated on the ground with signs or other kinds of markers. | | **X** |

| PCS Action | Voluntary | Regulatory |
|---|---|---|
| Buffer widths may be reduced when combined with stormwater provisions and with the creation of a development-wide nutrient management plan created by a certified nutrient consultant and implemented by a certified nutrient handler. | | **X** |
| When development-wide nutrient management plans are required, the homeowners association must retain the plan on file, maintain records of nutrient applications, and submit a summary of nutrient application records to the Department of Agriculture, Nutrient Management Program on an annual basis. | | **X** |
| No landowner or their representative shall extend lot lines into buffers. | | **X** |
| Encourage the planting of trees and other plants adjacent to all waters and wetlands. | **X** | |
| For new developments subject to State review under the Preliminary Land Use Service law, the Department will produce a nutrient budget. The nutrient budget will illustrate how the future land use will reduce or increase nutrient loading. Results will be available upon request. | **X** | |
| Develop a program that addresses practices that may result in nutrient reductions on parcels of 10 acres or less where nutrients are applied. These shall include, but are not limited to: establishing nutrient budgets for homeowners, technical support for small landowners, and education. | **X** | |
| Land maintained as open space under County or municipal ordinances or codes should be managed to minimize nutrient loading. | **X** | |
| WASTEWATER | | |
| ***Improve regulation and maintenance of onsite wastewater disposal systems such that nutrient loadings from them are reduced. This will require the use of advanced nitrogen removal systems as well as the conversion of some onsite systems to central sewer.*** | | **X** |
| Permanent holding tanks shall not be permitted within the watershed. A permanent holding tank is a tank that will be in use for 4 years or more. | | **X** |
| Maintain the existing Holding Tank inspection program. | | **X** |
| No new drainfields on parcels recorded 30 calendar days or more after the publication of these final Regulations in the Delaware Register of Regulations may be present within 100 feet landward from State-regulated wetlands, or landward from the mean high water line of all tidal waters, whichever extends farther upland, and landward from the ordinary high water mark of all other primary | | **X** |

| PCS Action | Voluntary | Regulatory |
|---|---|---|
| water features. | | |
| All properties utilizing an OWTDS that are sold or otherwise transferred to other ownership shall have their systems pumped out and inspected prior to the completion of the sale. For transfers of a new property, the certificate of completion will fulfill the requirements of this section. If an inspection has occurred within the previous 36 months and the property owner can provide documentation of such pump out and inspection, then such documentation will fulfill the requirements of this section. If the owner of an individual OWTDS provides proof of a licensed operator or has an annual service contract with a certified service provider then the requirements of this section have been met. | | **X** |
| All new or replacement on-site wastewater disposal systems must be designed to achieve performance standards as specified in the PCS regulation. These standards vary based on system size. | | **X** |
| Sussex County converts an additional 2,359 individual onsite systems to central sewer. | **X** | |
| Economic assistance for those in need will be available through the Financial Assistance Branch. | **X** | |
| STORMWATER | | |
| ***Stormwater runoff shall be managed for nutrient reduction when practicable.*** | | **X** |
| When the Delaware Sediment and Stormwater Regulations require the creation of a permanent sediment and stormwater management plan, that plan shall be designed and implemented to reduce nutrient contributions to be consistent with the Pollution Control Strategy. Several methods are available to determine compliance. Consistency will be determined at the conceptual stormwater plan process. Compliance will be determined before approval of final site or subdivision plans. | | **X** |
| Innovative designs such as rain gardens, natural landscaping, and constructed wetlands are encouraged where appropriate. | **X** | |
| Develop a program to assist homeowners' associations in the creation of a stormwater maintenance plan as well as to assist in the establishment of a funding mechanism to meet financial obligations for related stormwater facility maintenance. | **X** | |
| Encourage Sussex County to create a stormwater utility for the Inland Bays Watershed. This utility will collect fees for the construction of stormwater management | **X** | |

| PCS Action | Voluntary | Regulatory |
|---|---|---|
| structures where needed. | | |
| Create stormwater management facilities for 4,500 acres of urban and residential lands developed pre-1990. | **X** | |
| Institute tax incentives that encourage an increase in open space (green areas) in commercial developments, thus, reducing the percentage of impervious surface and reduce nutrient contributions. | **X** | |
| CONCURRENCE | | |
| ***A higher level of government accountability is necessary if nutrient reductions are to be affected. There exist numerous instances of government inconsistencies and lapses in application and enforcement of policies, laws, and regulations. A mechanism shall be established to ensure concurrence of policies, laws, and regulations within, between, and among government and other agencies.*** | **X** | |
| Form a task force to examine laws, regulations and ordinances that are in effect within the Inland Bays Watersheds. This group will then identify areas where adjustments are needed in order to have concurrence. | **X** | |
| All water quality impacting permits shall be consistent with the Surface Water Quality Standards (SWQS). The Department will begin creating a process to ensure that all wastewater and stormwater permits meet these standards. | **X** | |
| The use of advanced nutrient reduction technology on lots subdivided after the promulgation of the Pollution Control Strategy shall not be used as justification for reductions in isolation, set-back and/or separation distances. | | **X** |

# INTRODUCTION AND BACKGROUND

The Inland Bays are an important ecological, economic and recreational resource for the people of Delaware and deserve special protection. The Inland Bays and its watershed provides important habitat and spawning grounds for migrating birds, finfish and shellfish (DNREC, 1995) and are becoming increasingly urbanized and degraded with encroaching development (Ames and Dean, 1999; DOSPC, 1999). In December 1998, the Delaware Department of Natural Resources and Environmental Control (Department) promulgated Total Maximum Daily Loads (TMDLs) for nitrogen and phosphorus for the Indian River, Indian River Bay and Rehoboth Bay (Appendix A). The TMDLs for the Little Assawoman Bay were promulgated in early 2005 (Appendix B). These TMDLs require reductions in point and nonpoint source loading of nutrients into these waters. In order to achieve these TMDLs, the Inland Bays Tributary Action Team, a group of government representatives and citizens with diverse interests, recommended actions for inclusion in this Pollution Control Strategy (Appendix C).

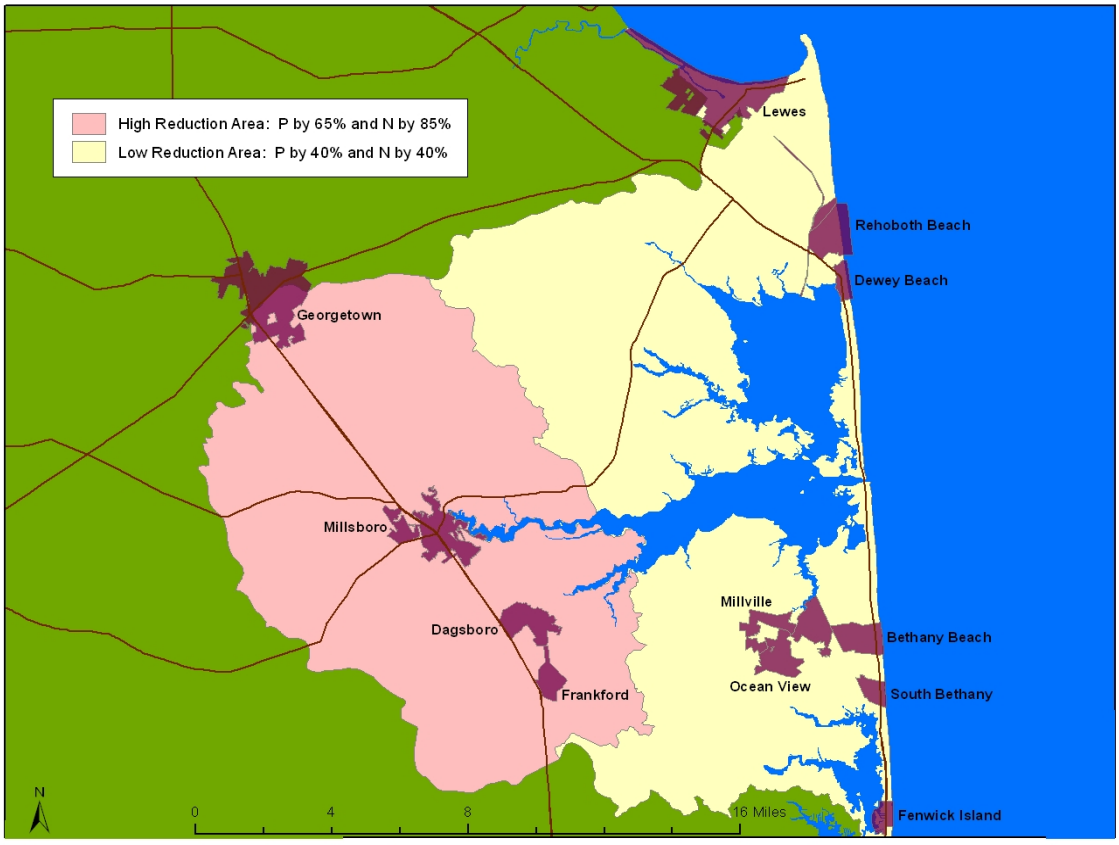
After two sets of workshops, held in January, February, and May 2005, a group of interested parties including the Delaware Farm Bureau, the Delaware Realtors Association, the Positive Growth Alliance, and the Delaware Homebuilder's Association lobbied the General Assembly to intervene in this process. The Department met with these parties for a year in order to incorporate their concerns and presented the revised Strategy at a third round of public workshops in August and September 2006. During these workshops, members of the scientific community raised substantive concerns relating to the buffer portion of the regulation. In the Spring of 2007, the Department held public hearings on a proposed regulation that reserved the buffer provisions in anticipation of a county-wide buffer regulation later that year. This approach, however, was not well received. The Department spent several months investigating buffer provision options that would provide several alternatives for developers while still providing benefits to water quality. Although changes have been made, this Strategy is substantially based upon the recommendations offered by the Team for the Inland Bays. The contents of this document are based on those recommendations. The document presents the Pollution Control Strategy as well as provides technical justification for its elements.

The Indian River Bay, Rehoboth Bay, and Little Assawoman Bay and their tributaries, Delaware's Inland Bays, are located in the southeastern part of the State, in Sussex County (Figure 1). The Inland Bays Watershed encompasses approximately 32 square miles of water area, and drains a land area of about 320 square miles.

The Inland Bays Watershed provides tourist-based income and recreation for Delaware's economy (Wang et al., 2001; Hopkins, 2001 ). Many thousands of visitors enjoy going to the beach, fishing, pleasure boating, crabbing, hunting and other recreational pursuits. Residents and visitors use public lands for hiking, hunting, wildlife watching and other outdoor activities. Decline in water quality can threaten the area's tourism industry, as fish stocks become depleted, odors from decaying macroalgae fill the air, and incidents of harmful algal and toxic dinoflagellate blooms such as *Pfiesteria* and *Chattonella* occur.

Improving the water quality of the Inland Bays is vital to maintaining the tourism and recreation of eastern Sussex County and Delaware's beaches.

**Figure 1: Map of the TMDL Low and High Reduction Areas**




The Inland Bays are a shallow estuarine ecosystem, with an average depth of 3 to 8 feet, and are poorly flushed by tidal movement (Cerco et al., 1994), which makes them especially sensitive to environmental changes. Freshwater enters the tributaries and bays through ground and surface (runoff and stream) water discharges and atmospheric deposition (Andres, 1992; Horsley and Witten, 1998; Scudlark and Church, 1999). Salt water enters the bays mainly through the Indian River Inlet. The Lewes and Rehoboth Canal at the northern end, and Assawoman Canal at the southern end of the bays provide additional sources of salt water to the bays. The Bays are highly enriched with the nutrients nitrogen and phosphorus, the contaminants having the greatest impact on the surface and ground waters of the Inland Bays Watershed. While nitrogen and phosphorus are essential for plant and animal growth, when excess amounts enter the bays, water quality can deteriorate as aquatic plant growth accelerates and the level of oxygen is reduced (Boesch et al., 2001; EPA, 2002). This process of overenrichment is called eutrophication. The primary activities accelerating eutrophication in the Inland Bays are agriculture and urbanization.

The watershed's groundwater, generally available within 10 feet below the surface, is an invaluable asset to development and commerce; but this very availability of ground water and its continual movement through the dynamic water cycle make this water resource extremely vulnerable to nutrient contamination, especially nitrogen. The Columbia, Pocomoke, and Manokin aquifers provide nearly 100-percent of the region's drinking and irrigation water supplies. The Pocomoke and Manokin aquifers tend to act as confined aquifers throughout the Inland Bays Watershed; however there are locations where the aquifers can be inter-connected with the overlying unconfined Columbia (or water table) aquifer. The Columbia aquifer also supplies base-flow to the streams, rivers and the bays in the watershed (Andres, 1992).

Phosphorus enters the bays primarily through soil erosion and runoff (Ritter, 1986). About a third of the phosphorus loading comes from point sources (DNREC, 1998). Nitrogen enters through a variety of pathways such as point source discharges, atmospheric deposition, and distributed sources such as erosion, runoff and ground-water discharge. As much as 25 percent of the total nitrogen entering the bays is estimated to be deposited from the atmosphere, while point sources such as wastewater treatment facilities with discharge pipes to surface waters account for approximately 8 percent, and the remaining nitrogen loading coming from non point source land use activities (Ritter, 1986; DNREC, 1998; Horsley and Witten, 1998; Scudlark and Church, 1999; DNREC, 2000b).

Two of the most important criteria that are used to determine whether a waterbody is "impaired" under EPA guidelines are whether there is enough dissolved oxygen to support aquatic life and whether bacterial levels are low enough to support recreational use. According to the 2002 305(b) report, only 29% of the streams feeding the Inland Bays fully support the aquatic life designated use (DNREC, 2002).

Given their ecological, economic and recreational importance, the Inland Bays have received much attention from State and Federal governments and have been given many designations. In the Delaware Surface Water Quality Standards, the Inland Bays were designated "waters of exceptional ecological and recreational significance" (DNREC, 2004). The Delaware Nutrient Management Commission (DNMC) has identified the watershed as a "critical area target" because of water quality concerns (DNMC, 2005). In addition, the Bays are part of the National Estuary Program. The Center for the Inland Bays (Center) is the management body that was formed in order to implement the Comprehensive Conservation and Management Plan (CCMP) for these waters (DNREC, 1995). Thus, the Inland Bays have been and will continue to be a focus for federal, State and local environmental policy and programs.

This document will review land use and water quality trends in the Inland Bay Watersheds along with the TMDLs and the specific pollution sources requiring reduction. The process used to develop the Pollution Control Strategy will be described. The document will then outline the progress that has been made to date towards TMDL implementation. Also, the authority on which the Strategy will be promulgated is discussed. The centerpiece of the document are the additional actions that need to occur

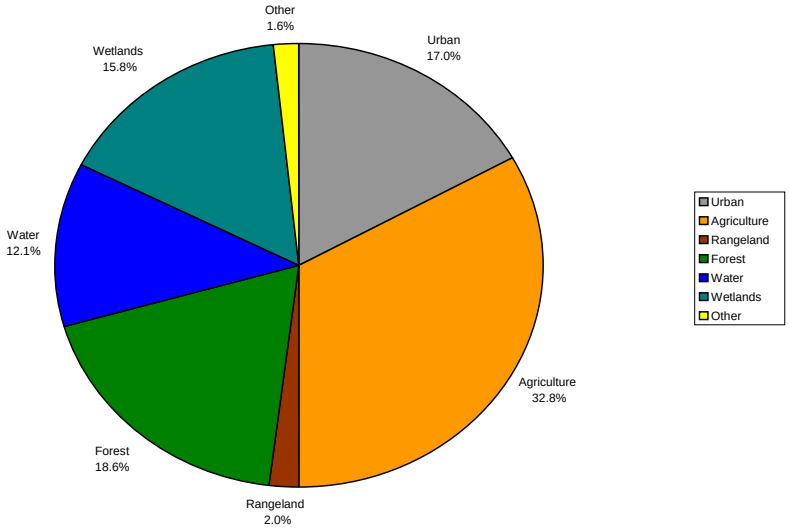
in order to achieve water quality standards—the Strategy. Finally, the document reviews the organizations that will be tasked with implementing the Strategy.

## LAND USE

When formulating an action plan to address nonpoint source pollution in the Inland Bays Watershed, land use must be considered. As water runs over the landscape, it picks up pollutants which are discharged into streams through runoff. Additionally, water runs through the soils, carrying pollutants with it into the groundwater. The polluted groundwater then seeps into the surface water providing another conduit for nonpoint source pollution (Fetter, 1994). Thus, activities that occur on the land impact the quality of our ground and surface waters.

Figure 2 shows major land uses in the Inland Bays sub-basin based on a 2002 land use survey (DOSPC, 2002). As can be seen from Figure 2, agriculture (cropland) is the major land use in the Inland Bays Watershed covering 32.8% of the watershed. Other major land uses in the sub-basin include: forested (18.6%), urban (17.0%), and wetland (15.8%) (Figure 2).

**Figure 2: 2002 Land Use in the Inland Bays**

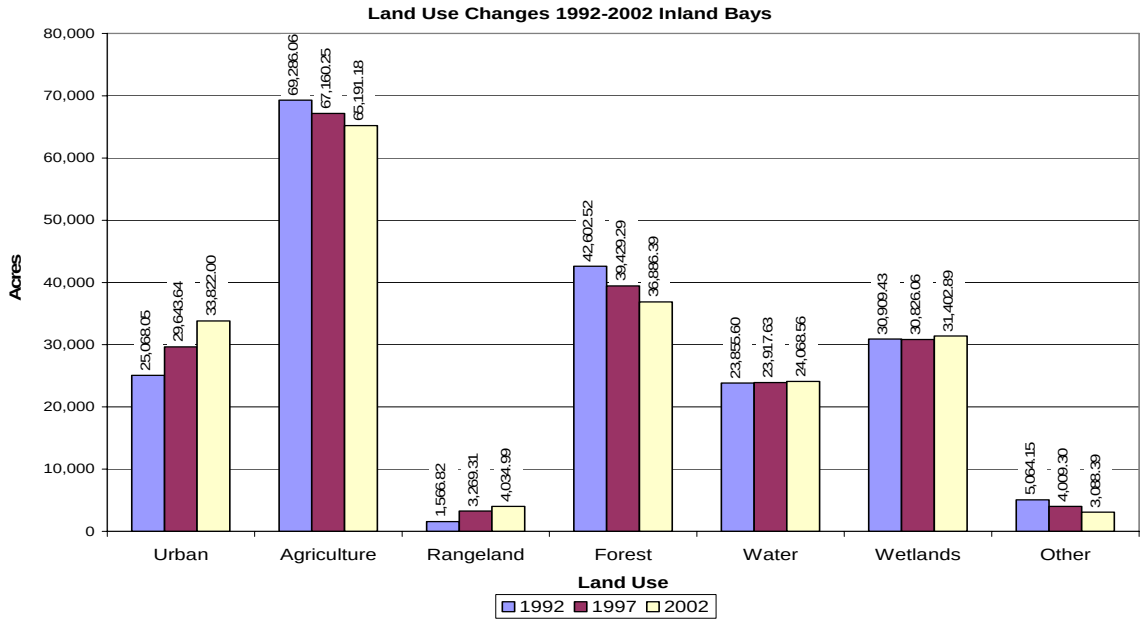



Examining date from 1992 and 2002, a drop in both agricultural and forest lands is noticed as can be seen in Figure 3. During that time period, over 5,700 acres of forested areas and 4095 acres of agricultural land have been lost. However, urban areas have rapidly grown during the same 10-year time period, increasing 35%. Census data from 2000 show that the Inland Bays Watershed is the fastest growing region of the State.

In an attempt to quantify land use change since 2002, a GIS analysis was done to estimate the land use changes since the 2002 land use coverage was produced. Sussex County maintains a polygon shapefile of "communities," or the larger subdivisions, which was last updated in November 2005. This file was clipped to the Inland Bays Watershed and

the 2002 land use coverage was then clipped to it. Any lands not already classified as urban in this layer are assumed to have been developed between 2002 and 2005. This analysis reveals that urban areas have continued to increase (by approximately 20% since 2002).

**Figure 3: Land Use Change in the Inland Bays Watershed**




Given the large portion of the watershed engaged in agriculture and the consistent growth in urban/residential acreage, this Strategy can only be successful if agriculture is addressed and provisions are included to ensure that development occurs in a manner that is protective of surface and ground water quality.

## WATER QUALITY CONDITIONS OF THE INLAND BAYS

Intensive water quality monitoring and assessment studies performed by the State, Federal government, various university and private researchers, and citizen monitoring groups have shown that waters of the Inland Bays are highly enriched with nitrogen and phosphorus (DNREC, 2002; Ullman et al., 2003; CIB, 2004). Although adequate levels of available nutrients are essential elements for plants and animals, their presence in excessive amounts cause undesirable conditions and significant negative impacts to fish and other aquatic life (EPA, 2002).

Symptoms of nutrient enrichment in the Inland Bays include excessive macroalgae growth (sea lettuce and other species), frequent phytoplankton blooms (some potentially toxic), large daily swings in dissolved oxygen levels, loss of Submerged Aquatic Vegetation (SAV), and fish kills. These symptoms threaten the future of the Inland Bays and their significant natural, ecological, and recreational resources, which may result in adverse impacts to the local and State economies through environmental degradation and habitat loss leading to reduced tourism, a decline in property values, lost revenues and a

diminished quality of life. Hence, excessive nutrients pose a significant threat to the health and well being of people, animals, and plants living within the watershed.

Nutrient over-enrichment was ranked as the top environmental problem of the Inland Bays during a comprehensive water quality assessment conducted for the U.S. Environmental Protection Agency's (EPA's) National Estuary Program (NEP) (Weston, 1993). The study concluded that habitat loss is the other major environmental concern in the Inland Bays. Based on this finding, which was supported by other studies, nutrient load reduction was considered as a major goal for the Inland Bays Comprehensive Conservation and Management Plan (CCMP), which was adopted in 1995 (DNREC, 1995).

Furthermore, nutrient overenrichment and violation of water quality standards have been documented by the State's Watershed Assessment Reports (Clean Water Act Section 305(b) Reports) since 1996. These reports summarize the designated uses for waters in the State and indicate whether those uses are being achieved. According to the 305(b) reports, the aquatic life and primary contact recreation uses are not supported in the Little Assawoman Bay, Indian River Bay and portions of the Rehoboth Bay. In the limited areas where shellfish harvesting is allowed, water quality only partially supports that use. The primary pollutants and/or stressors causing violation of water quality standards are high concentrations of nutrients, low levels of dissolved oxygen, and high levels of bacteria.

Designated uses, such as aquatic life use and primary contact recreation, must be met through having the water meet certain water quality standards. When these standards are not met, the waters are required to have Total Maximum Daily Loads (TMDLs) established.

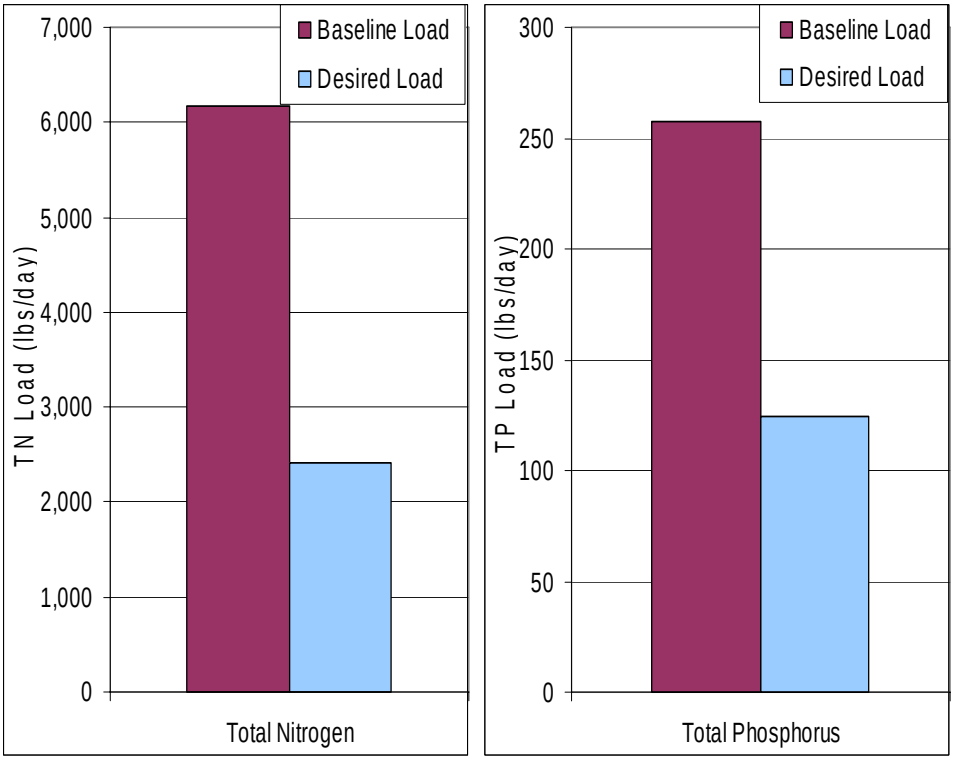
**TOTAL MAXIMUM DAILY LOADS (TMDLS)**

In December 1998, the Delaware Department of Natural Resources and Environmental Control (DNREC) promulgated regulations, which established Total Maximum Daily Loads (TMDLs) for total nitrogen (TN) and total phosphorus (TP) for the Indian River, Indian River Bay and Rehoboth Bay (Appendix A). The TMDLs for the Little Assawoman Bay were completed in January 2005 (Appendix B). TMDLs are calculated such that the waterbody can achieve water quality standards once the target loads are achieved. The standards are based on the designated uses for the particular water body. In the case of the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay and their tributaries, waters need to achieve standards for fish and aquatic life use.

In order to achieve the water quality standards, these TMDL regulations require the systematic elimination of all point source discharges of TN and TP into these waterways. In addition, stringent reductions in nonpoint source loading are required: 85 percent reduction in nonpoint source TN and 65 percent reduction in nonpoint source TP for the Upper Indian River and 40 percent reductions in both TN and TP nonpoint source loading for the remaining water bodies (Figure 1). Also, these regulations address reductions in atmospheric deposition of nitrogen and assume that implementation of the Clean Air Act

Amendments of 1990 will achieve a 20% reduction in nitrogen loading. The implementation tool was to be a Strategy initiated and developed by the Department's Whole Basin Management Team along with the affected public. This document proposes the Pollution Control Strategy required by Articles 8 and 3 of the 1998 and 2005 regulations, respectively. Since the TMDL cannot be achieved without changing the way people interact with their land and their waste, the Strategy was developed with public assistance from the Inland Bays Tributary Action Team. In total, the actions within the Strategy must achieve a reduction of 3,764 lbs/day in nonpoint source TN loading and 133 lbs/day reduction in TP loading (Figure 4).

**Figure 4. Nonpoint Nutrient Load Reductions**




## SOURCES OF POLLUTANTS

Excessive nutrients, i.e., nitrogen and phosphorus, are pollutants of concern for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay and cause violations of water quality standards. Removing these pollutants is the goal of this Strategy. The sources of nutrient loading to the Bays include point source discharges from municipal and industrial wastewater treatment plants, surface runoff from agricultural, urban, and other land use activities in the sub-basin, ground water discharge, atmospheric deposition, and contributions from nutrient-rich coastal waters (Cerco et al., 1993).

### *POINT SOURCES*

During the base-line period of the TMDL analysis (1988 through 1990), thirteen municipal and industrial wastewater treatment plants were discharging to the waters of the Indian River Bay, Rehoboth Bay and their tributaries (Table 2). Discharge of

pollutants to the waters of the State is regulated through the Department's administration of the National Pollution Discharge Elimination System (NPDES) Permits Program. Section 402 of the Clean Water Act requires each discharger to apply and obtain a NPDES Discharge Permit prior to initiation of its discharge. A NPDES permit covers a five-year period and regulates the quality and quantity of pollutants that can be discharged into the surface waters of the State. It also establishes the requirements for effluent monitoring and reporting. Table 2 lists point source discharges in the Indian River Bay, Rehoboth Bay and their tributaries, the discharge permit numbers, the receiving streams, and the nitrogen and phosphorus loads during the base-line period (1988 through 1990).

**Table 2: Point Source Discharges to the Inland Bays (Baseline Period 1988-90)**

| Facility Name | NPDES No. | Receiving Stream | Total Nitrogen Load (lb/d) | Total Phosphorus Load (lb/d) |
|---|---|---|---|---|
| Bayshore Mobile Home Park | DE0050750 | White Creek | 0.57 | 0.13 |
| Colonial East Mobile Home Park | DE0050709 | L&R Canal | 2.51 | 0.40 |
| Colonial Estates | DE0020061 | Indian River | 1.98 | 0.37 |
| Delaware Seashore State Park | DE0021857 | Indian River Inlet | 3.01 | 0.66 |
| Delaware State Housing Authority | DE0050903 | L&R Canal | 2.07 | 0.35 |
| Delmarva Power and Light (currently Conectiv) | DE0050580 | Island Creek | 1.17 | 3.70 |
| Frankford Elementary School | DE 0050237 | Tributary of Vines Creek | 0.59 | 0.11 |
| Georgetown | DE0020257 | Eli Walls Ditch (Stockley Branch) | 75.61 | 1.06 |
| Lewes | DE002151 | L&R Canal | 1.78 | 0.43 |
| Millsboro | DE0050164 | Tiger Branch | 26.11 | 6.25 |
| Rehoboth Beach | DE0020028 | L&R Canal | 56.67 | 36.15 |
| Townsends, Inc. (currently Mountaire, Inc.) | DE0050164 | Swan Creek | 319.51 | 1.14 |
| Vlasic Food, Inc. (currently Pinnacle Foods) | DE0000736 | Iron Branch | 10.54 | 0.31 |
| Total Load | | | 502.12 | 51.05 |

***NONPOINT SOURCES***

Pollutant loads not associated with discrete discharges are categorized as nonpoint sources. In contrast to continuous discharge from treatment plants, loading from nonpoint sources is typically intermittent, diffuse and difficult to track back to specific sources. Depending on the type of land use and physiographic characteristics of a watershed, nonpoint source pollution may account for a significant portion of the total load within the watershed (Cech, 2002), as it is in this case.

Nonpoint sources of pollution can come from most land uses through overland flow. However, nonpoint source pollution can also leach into the ground water and

subsequently enter surface water. Since 80 percent of the freshwater entering the Bays and their tributaries comes from ground water (Johnston, 1976; Andres, 1992), we need to curb all types of nonpoint source pollution. For the purposes of this Strategy, the following types of nonpoint sources will be addressed:

- agriculture,
- urban land use,
- wastewater, and
- stormwater.

When land is developed, nutrient loadings can come from multiple sources, such as yard maintenance, wastewater disposal, stormwater runoff and soil erosion, and increases in impervious cover (Herlihy et al., 1998). Given the growth, pressures from development, and tourism in this watershed, this Strategy must address these sources of nutrient loading. In addition, agricultural practices lead to nutrient pollution via their use of fertilizers and manures (Jordan et al., 1997). Upwards of 30 million chickens are produced annually in the watershed and their waste is primarily used as fertilizers on some of the 62,728 acres of agricultural lands. Thus, this Strategy addresses the existing Best Management Practices (BMPs) that can be employed to reduce the impacts from these activities. The Strategy can adapt to changes in technology and new BMPs as science and pilot programs prove their functionality and reliability in the field.

***ATMOSPHERIC DEPOSITION***

There are several forms of nitrogen to consider when estimating an atmospheric deposition rate: nitrate ($NO_3^-$), which comes from high temperature combustion sources like coal-fired power plants and motor vehicles; ammonium ($NH_4^+$) and ammonia ($NH_3$) gas, which are largely produced by agricultural practices; and organic nitrogen (ON), whose sources have not been well quantified. The estimated atmospheric nitrogen load directly deposited to Delaware's Inland Bays is based on the findings reported in Scudlark and Church (1999) and Scudlark (2002), which produce a different atmospheric load than originally used in the 1998 TMDL analysis document. Both of these reports make use of the data generated at the long-term (20+ years) precipitation chemistry sampling site at Cape Henlopen State Park, Lewes, Delaware (NADP, 2003). The more recent study additionally examined the spatial gradient in $NO_3^-$ and $NH_4^+$ concentrations in precipitation and the dry deposition of $NH_3$ gas across the Inland Bays Watershed. The wet and dry deposition rates reported for these species produce a total nitrogen deposition rate ranging from 12.9-14.7 kg N/ha/yr when summed. The average deposition rate (12.3 lb/acre/yr) can be applied to the surface area of the bays (19,811 acres) to yield a nitrogen load of 243,408 lb N/year, or 667 lb N/day. This estimated load considers only direct atmospheric deposition to the bay surface waters and does not take into account deposition to the watershed. The contribution from this latter component will ultimately be reflected in surface and ground water loads.

The 1998 TMDL calls for a 20 percent reduction in the atmospheric deposition of nitrogen, which will reduce the daily load to surface waters to 534 lb N/day. Since the sources of organic nitrogen are currently uncertain, strategies to reduce this component of atmospheric N deposition have not yet been developed. It is believed that the wet and

dry nitrate fractions, on the other hand, can be reduced through the implementation of the 1990 Clean Air Act Amendments and other pending (e.g., Ozone SIP Call) legislation. Since the sources of atmospheric ammonia and ammonium are largely locally derived (e.g., poultry agriculture), emission reductions of these two nitrogen species will require the implementation of agricultural BMPs. A number of BMPs for each stage of poultry litter management are available and there is an ongoing effort to better understand the benefits and make the technologies more cost effective to allow for wider implementation.

For example, research has shown that ammonia emissions can be reduced by altering the poultry feeding strategy in a number of ways, and talks are underway in Delaware to allow cost sharing for this practice. Farmers have also found that the best way to reduce ammonia emissions during production is to keep the litter dry. In addition, amendments are added to litter during the early stages of production to reduce $NH_3$ losses, which has an added benefit of reducing energy costs while improving poultry performance. Ammonia can also be scrubbed out through the use of biomass walls, biofilters, wetscrubbers, or with vegetative filter strips (Malone, personal communication). Storing covered litter for a period of time prior to spreading is also believed to reduce net ammonia emissions. The last stage of litter management where ammonia emissions can be reduced is during the spreading of litter onto cropland. If the litter is rapidly incorporated into arable land, rather than remaining on the soil surface, ammonia emissions will be less (Webb et al., 2005).

Reactive ortho-phosphate ($o\text{-}PO_4^{3-}$) was also measured in precipitation samples collected at the Cape Henlopen rain site (NADP, 2003). While $o\text{-}PO_4^{3-}$ concentrations were significantly less than the nitrogen counterparts, the atmospheric loading of P may be environmentally significant during certain times of year and in certain locations of the bays when primary production in bay surface waters is P limited (Jennings et al., 2003). Deposition rates of total phosphorus are currently being established.

## THE POLLUTION CONTROL STRATEGY DEVELOPMENT PROCESS

The Pollution Control Strategy presented is based on the recommendations produced during 4 years of work by the Inland Bays Tributary Action Team and the Inland Bays/Atlantic Ocean Whole Basin Team. The Pollution Control Strategy workgroup was convened in order to assist in the assigning of nutrient load reduction efficiencies to various agricultural BMPs. Together, these groups used opinions, local knowledge and professional expertise from the general public, farmers, environmentalists, municipalities, developers, businesses, Sussex County, multiple Department programs, Natural Resource Conservation Service, the Soil and Water Conservation Districts, University of Delaware Cooperative Extension, and the Delaware Nutrient Management Commission in order to develop this Strategy.

The primary process for the Pollution Control Strategy development was the Tributary Action Team Strategy, initiated by the Center for the Inland Bays (Center). The Center, a non-profit organization created through State law to oversee the implementation of the Inland Bays' National Estuary Program Comprehensive Conservation and Management

Plan (CCMP), convened the Inland Bays Tributary Action Teams in the fall of 1998. The CCMP was the product of seven years of work by various government agencies and members of the public after the Inland Bays were designated as a National Estuary Program site. The main goals as stated in the CCMP were to reduce nutrient flow into the Bays and to protect and restore habitat (DNREC, 1995). In order to implement the CCMP, the Center initiated a program that they felt could generate the political will to implement tough policies needed to reduce nutrient loading. The Tributary Action Team Strategy was the method for generating nutrient reduction policies for the Inland Bays.

After the first two meetings of the Team, the Center approached the Department about merging the Department's TMDL Advisory Committee with the Tributary Action Team Strategy. The Department had been involved in a federal lawsuit and had been forced to enact Total Maximum Daily Loads (TMDLs) for nitrogen and phosphorus for the Bays (Appendixes A and B). As a result of a federal lawsuit, Delaware was party to a Memorandum of Understanding with the Environmental Protection Agency which includes a schedule of when Delaware would complete TMDLs for the State's impaired waters. The TMDLs for the Indian River, Indian River Bay and Rehoboth Bay were first promulgated by the State in 1998.

As part of this effort, Department created a TMDL Advisory Committee to comment on actual nutrient load reductions and to create a strategy to achieve these reductions. After discussing the potential merger at a couple of meetings, the two groups decided to combine efforts. This affected the Team process in that the target nutrient reduction reflected the TMDL, a more stringent reduction than called for in the CCMP, and expanded its membership. The Inland Bays Tributary Action Team submitted three sets of recommendations to the Department for consideration as parts of the Strategy and can be read in their entirety in Appendix C.

The process used by the Team to generate the recommended Strategy was called "*Public Talk—Real Choices, Real Strategies*" (Appendix D). Bill McGowan, a University of Delaware Cooperative Extension Service Director, experienced with facilitation and collaborative decision-making processes, primarily designed this process with assistance from Joe Farrell, Marine Advisory Service, Ed Lewandowski, Center for the Inland Bays, and Lyle Jones and Katherine Bunting-Howarth, DNREC. This model includes six steps: Organization of Work Team, Education, Issue Framing, Evaluation of the Issue Framework, Public Forums/Choice Work, and Recommendations. It is an alternative to the "workshop" model of public participation and convening a "blue ribbon" panel of experts. According to the process model, in the usual business of government, the public/community becomes involved after the strategies to reduce pollution have been developed. In the "*Public Talk*" model, the public is put first and allowed to work with their neighbors as well as the experts to design a Pollution Control Strategy for their watershed.

During the education portion of the process, the Team listened to presentations on multiple topics such as wastewater treatment plants, septic systems, stormwater, golf courses, and agriculture. It became evident that agriculture was a major concern for the

Team. However, the Team did not address agriculture since a new Nutrient Management law was being written and enacted during the development of the recommendations for the Strategy. Since agriculture needed to be included in the Strategy, a Pollution Control Strategy Workgroup for Agriculture was convened. This workgroup included representatives from multiple programs within the Department, the Delaware Nutrient Management Commission (DNMC), the USDA Natural Resource Conservation Service, the Kent and Sussex Conservation Districts and the University of Delaware Cooperative Extension Service. The workgroup met in order to "devise a method to estimate how existing agricultural practices have already contributed to achieving the TMDL mandated nutrient load reductions." The DNMC and the Scientific and Technical Advisory Committee of the Center for the Inland Bays then reviewed the decisions made by this workgroup. The methods were then used to calculate progress that had been made toward the TMDL through the implementation of agricultural BMPs since the TMDL baseline period of 1990. Then, the Department was able to set goals for agricultural BMP implementation that will be presented in this Strategy.

In the first half of 2005, the Department held six public workshops on two drafts of this Strategy. Due to concern from the development and agricultural communities, the Department agreed to meet with the "Coalition," a group of interested parties including the Delaware Farm Bureau, Sussex County Farm Bureau, the Delaware Association of Realtors, the Home Builders Association of Delaware, First State Manufactured Housing Association, the Positive Growth Alliance (PGA), and the PGA Subcommittee for Engineering & Planning Issues, to further discuss and consider their concerns. A revised Strategy was presented at a third round of public workshops in August and September 2006. During these workshops, members of the scientific community raised substantive concerns relating to the buffer portion of the regulation. In the Spring of 2007, the Department held public hearings on a proposed regulation that reserved the buffer provisions in anticipation of a county-wide buffer regulation later that year. This approach, however, was not well received. The Department spent several months investigating buffer provision options that would provide several alternatives for developers while still providing benefits to water quality. Although changes have been made, this Strategy is substantially based upon the recommendations offered by the Team for the Inland Bays.

## PROGRESS TO DATE

Ten years have passed since the TMDLs for the Indian River, Indian River Bay and Rehoboth Bay were promulgated. Eighteen years have passed since the baseline period on which the TMDL was calculated. Since that time, population and pressures from development have increased along with the intensity of agricultural production. However, stormwater and wastewater treatment has improved, and farmers have increased their use of best management practices (BMPs). Increased use of BMPs in all sectors reduces nutrient loading and contributes to making progress towards achieving water quality standards.

***POINT SOURCES***

The TMDL calls for the systematic elimination of all point sources of nutrient loading. Since 1990, nine facilities in the Inland Bays Sub-basin have effectively eliminated their surface discharge. These facilities are: Bayshore Mobile Home Park, Colonial East Mobile Home Park, Colonial Estates, Delaware Seashore State Park, the Delaware State Housing Authority, Frankford Elementary School, Georgetown Wastewater Treatment Plant, Mountaire, Inc., and Pinnacle Foods. In addition, due to refinements in wastewater treatment processes, the towns of Lewes, Millsboro, and Rehoboth Beach have made substantial reductions in their nutrient loadings, especially for phosphorus.

Total Progress to Date:

Estimated Nutrient Reductions: 416 lbs/day TN; 42.2 lbs/day TP
Estimated Annual Cost: Figures not available.

***NONPOINT SOURCES***

Estimated water quality improvement from the installation of best management practices, after the TMDL baseline, was calculated. Various databases were used to gather the number of practices in place. Scientists researched the nutrient load reduction efficiencies associated with these practices in order to estimate pollution reductions. Appendix E documents those calculations and Appendix F estimates the associated costs.

Agriculture

Since the baseline period, the agriculture community has reduced a significant amount of nonpoint source nitrogen and phosphorus loading, leading the efforts to curtail nonpoint source nutrient loading. From the baseline to 2005, multiple Best Management Practices (BMPs) have been implemented, and the Delaware Nutrient Management Act was passed. As of January 2007, all farms that apply nutrients to 10 acres or more are required to have Nutrient Management Plans (NMPs). The 2002 Farm Bill has led to unprecedented funding levels of cost-share programs for BMPs that protect the environment, especially water quality. In addition, the DNMC has been running a manure relocation program over the past four years. This program pays for the relocation of tons of manure from farms with either high phosphorus soils or from farms where there is not enough land to spread the manure under a NMP. The parties receiving the manure must also have a NMP to apply the manure to the ground.

**Table 3. Implemented Agricultural Best Management Practices (BMP)**

| BMP | Acre/ton | TN reduced (lbs/day) | TP reduced (lbs/day) |
|---|---|---|---|
| NMP | 23,543 | 277.51 | NA |
| Liquid waste management | 1 | NA | NA |
| Animal waste storage | 44 | NA | NA |
| Composters | 48 | NA | NA |
| Phytase | All feed | NA | 8.24 |
| Relocation | 7,878 | | |
| Alternative use | 12,469 | 311.99 | 33.21 |
| Grass buffer | 26 | 1.96 | 0.08 |
| Filter Strips | 29 | 2.19 | 0.08 |
| Forest and riparian buffers | 209 | 24.08 | 0.80 |
| Wetlands | 29 | 3.30 | 0.11 |
| Wildlife habitat | 134 | 3.12 | 0.07 |
| Cover crops | 3,056 | 104.38 | 0.33 |
| Water control structures | 1,530 | 29.03 | NA |

Total Progress to Date:

Estimated Nutrient Reductions: 759 lbs/day TN; 42.9 lbs/day TP

Estimated Annual Cost: $636,850

Onsite Wastewater

Several pilot programs have demonstrated the effectiveness of wastewater system compliance and inspection programs.

*Standard Onsite Wastewater Treatment and Disposal Systems*

Funds from the 6217 Coastal Nonpoint Source Program and the 319 Nonpoint Source Program were used to pilot a compliance and inspection program for on-site wastewater disposal systems. The program provided cost-share funds for homeowners to have their septic systems pumped and employed an inspector to inspect individual residential systems and educate the homeowner about their system and how it should function and be maintained. A total of 210 septic systems were pumped out and inspected. Seventy percent were in satisfactory condition.

*Holding Tank Compliance*

A holding tank compliance program brought compliance rates from 51 percent to 92 percent. The program was funded in the first year by Sussex County and the Delaware General Assembly, and EPA funds have been used to continue the effort. This program continues to be fully implemented in Sussex County using funds from the EPA.

Total Progress to Date:

Estimated Nutrient Reductions: 22.5 lbs/day TN; 8.45 lbs/day TP

Estimated Annual Cost: $771,120

*Conversion to Central Sewer*

In addition, since the 1990 baseline time period, 13,494 on-site wastewater systems were taken offline and their waste load was transferred into central sewer systems. These systems had their effluent diverted to either a spray irrigation facility (Wolf Neck) or the ocean outfall (South Coastal).

Connection of Wolf Neck—impacting 10,869 septic systems
- Total N reduction = 281 lb/day
- Total P reduction = 23.9 lb/day
- Cost per equivalent dwelling unit = $11,367.00
- Annual cost over 20 years with $200/year maintenance fee = $768.35
- Cost of N removed = $79.74 per lb
- Cost of P removed = $937.68 per lb

Connection to South Coastal—impacting 2,625 septic systems
- Total N reduction = 75.4 lb/day
- Total P reduction = 6.41 lbs/day
- Cost per equivalent dwelling unit = $11,367.00
- Annual cost over 20 years with $200/year maintenance fee = $768.35
- Cost of N removed = $79.74 per lb
- Cost of P removed = $937.68 per lb

Estimated annual cost = $10,368,115

Stormwater

In June 1990, the Delaware legislature passed the Sediment and Stormwater Law to help correct the State's water quality and quantity problems. The implementing program was initiated in July of 1991 and addresses sediment control during construction and post-construction, stormwater quantity and water quality control. From 1990 to 2005, more than 243 BMPs for stormwater have been implemented and more are constructed each year. In fact, there is currently a backlog of roughly 3,000 data points that still need to be entered into the stormwater BMP database. The nutrient load reductions associated with those practices, unfortunately, are not included in the stormwater calculations at this time. The Sediment and Stormwater regulations are currently being revised to promote the use of stormwater management techniques that are more efficient at reducing nutrient loading and promote Green Technology or stormwater management practices based on low impact development and conservation design.

Total Progress to Date:
- Estimates Nutrient Reductions: 17.5 lbs/day TN; 1.29 lbs/day TP
- Estimated Annual Cost: $688,580

Overall nonpoint source load reduction progress

All sectors have taken steps to improve water quality through the implementation of laws, regulations and BMPs. Analysis using a basic land use loading rate model shows that, to date, nonpoint sources of TN and TP have been reduced by 31 percent and 62 percent, respectively. The total reductions and costs are discussed in more detail in the section titled, "Analysis for TMDL achievement and costs" on page 51.

## AUTHORITY

The authority to create a Strategy comes from the Delaware Code, Title VII, Chapter 60. The General Assembly found multiple reasons why regulation of natural resources was needed including recognizing that "[t]he regulation of the development and utilization of the land, water, underwater and air resources of the State is essential to protect beneficial uses and to assure adequate resources for the future" (7 Del. Code §6001(a)).

The related policies and purposes are also broad in their coverage (§6001(b, c)). Section 6010 (a) states that the "Secretary may adopt, amend, modify or repeal rules or regulations, or plans, after public hearing, to effectuate the policy and purposes of this chapter." Thus, control of pollution and protection of resources are legitimate regulatory goals.

Article 8 of the Total Maximum Daily Loads (TMDLs) for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay, Delaware regulation and Article 3 of the Total Maximum Daily Loads (TMDLs) for the Little Assawoman Bay regulation require the development and implementation of a Pollution Control Strategy. In addition, Section 5.6 of the Surface Water Quality Standards (SWQS) regulations calls for the establishment of a Pollution Control Strategy for waters of exceptional recreational or ecological significance (ERES waters). The Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay are all designated as ERES waters. Additionally, the SWQS state that all "human induced nonpoint sources, subject to control through the use of best management practices or otherwise, shall be required to remove nutrients to the extent necessary to prevent excessive growth of photosynthetic organisms." The TMDL has determined that level, and this Strategy outlines the actions for achieving that level of water quality. Finally, in Section 5.6, the SWQS state that the Department may adopt best management practices that provide for the control of the addition of pollutants which reflects the greatest degree of pollutant reduction achievable including, where practicable, standards requiring no discharge of pollutants.

# THE POLLUTION CONTROL STRATEGY

This Pollution Control Strategy (Strategy) is divided into four sections. The first outlines the general principles on which the Strategy is based. The second outlines the implementation of Point Source reductions. The third details the voluntary and regulatory actions needed to achieve the nonpoint source pollutant reductions. The final section describes recommendations for concurrence between government entities and between existing laws and regulations. All of these actions are necessary if the waters of the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay are to meet the TMDL and achieve water quality standards.

## GENERAL PRINCIPLES

These principles were outlined by the Inland Bays Tributary Action Teams and were used as a basis for their recommendations. Recognizing the importance of these principles, they are being included in the Strategy.

- A public policy of incentives, when strengthened with the threat of regulation, should allow people to innovate within their own financial constraints.

- Education needs to be applied "across the board" with emphasis on the younger generation.

- The Strategy should adapt to changes in scientific knowledge, but not allow the need for scientific certainty to prevent action from taking place immediately.

- Policy development and implementation requires community participation, as well as expert and professional input.

- Cost-benefit analyses are important tools, yet they should be used efficiently, within bounds, and not as a delay tactic.

- "Political players" are important in accomplishing Pollution Control Strategies.

- Citizens want to know where their tax money is being applied.

**POINT SOURCES**

***General Action:*** **Systematic elimination of all point sources of N and P to the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay.**
Point source discharges of nutrients into the waters of the Inland Bays are measurable and controllable sources of pollutants. Reducing and/or eliminating point source pollution through management practices to the greatest extent practicable will have a significant impact on total nutrient loads in the Inland Bays Watershed. Several point source discharges have already been eliminated. The Pollution Control Strategy will recommend actions to further the systematic elimination of existing point sources.

*Implementation mechanism*: NPDES permit renewal
*Schedule*: Varies with individual permitted party
*Monitoring*: Daily, weekly, quarterly monitoring by the permitted party reported to DNREC
*Funding*: Parties, SRF, Federal and State grants
*Responsible Organization*: Permitted party
*Estimated Load Reduction:* 502 lb/day of TN
51.1 lb/day of TP

***Elimination in Fact:***
Bayshore Mobile Home Park
Colonial East Mobile Home Park
Colonial Estates Mobile Home Park
Delaware Seashore State Park
Delaware State Housing Authority
Frankford Elementary School
Georgetown
Mountaire, Inc. (2 point sources)
Pinnacle Foods

***Results***: This section addresses how the point source loading of nutrients will be effectively eliminated through the use of new technology or water quality trading.

***Action:*** **Water Quality Trading shall be considered as one of several options in reducing phosphorus and/or nitrogen in the Inland Bays, so long as any trading is tightly regulated to ensure true net reductions within the Inland Bays Watershed and is subject to approval by the Department. Where the point source engages in water quality trading in order to comply with the TMDL, the amount of nutrients reduced from nonpoint sources must equate to at least twice the level that the point source discharges. The nutrient load reduction involved in the trade must be reductions that occur beyond that required under the TMDL where the TMDL serves as the baseline for trades. All trades should be compliant with EPA's Trading Policy of 2003.**

*Implementation mechanism:* Trading scenarios shall be incorporated into NPDES permits such that there is an enforcement and accountability mechanism.

*Schedule:* This recommendation will be implemented on a case-by-case basis as conditions warrant.
*Monitoring:* Trades will be monitored and tracked through NPDES requirements.
*Funding:* Regulated party.
*Responsible organizations*: The permitted organizations and DNREC.
*Estimated load reductions:* The point source would be required to offset their permitted discharge through reducing nonpoint sources by at least twice the quantity of pollutant loading. The reduction in nonpoint source loading is over that required by the waste load allocation of the TMDL and the provisions of this Pollution Control Strategy.
*Estimated cost:* NA

***Action:*** **Lewes Wastewater Treatment Plant to acquire water quality credits in order to account for 2.5% of its discharge after implementation of more stringent nutrient removal technology.**

*Implementation mechanism:* NPDES permit renewal.
*Schedule:* The City of Lewes's NPDES permit was renewed in September 2004.
*Monitoring:* Specifics are addressed in the permit.
*Funding:* Sources of funding will be made available.
*Responsible organizations*: City of Lewes
*Estimated load reductions:* 1.78 lb/day TN
0.43 lb/day TP
*Estimated cost:* NA
*Comment*: Originally, the TMDL required the elimination of the discharge of nutrients from the Lewes Wastewater Treatment Plant. However, the City of Lewes conducted studies to determine the contribution of their wastewater treatment plant to the nutrient loads to Rehoboth Bay. The Department and the City agree that only 2.5 percent of their effluent reaches the Rehoboth Bay on average. Ultimately, the City agreed, in concept, to upgrade the wastewater treatment plant to handle 1.5 million gallons per day, install state-of-the-art filtration and biological nutrient removal systems, and to offset the nutrient load reaching Rehoboth Bay by reducing loads from nonpoint sources.

***Action:*** **Systematic elimination of the Millsboro Wastewater Treatment Plant discharge.**

*Implementation mechanism*: NPDES permit renewal
*Schedule:* Their permit expired on 5/31/05.
*Monitoring:* NPDES permit require monitoring of the effluent.
*Funding:* Grants and loans are available for the Town to eliminate their discharge.
*Responsible organizations:* Town of Millsboro
*Estimated load reductions:* 26.1 lb/day TN
6.25 lb/day TP
*Estimated cost:* NA

***Action:*** **Systematic elimination of the Rehoboth Beach Wastewater Treatment Plant discharge.**

*Implementation mechanism:* NPDES permit renewal and consent decree
*Schedule:* The City of Rehoboth Beach, pursuant to a consent decree, will be given two years from the issuance of their NPDES permit (10/1/05) to achieve a 25 percent reduction from the currently permitted levels by trading and/or technical refinements at the WWTP. Within 2.5 years from the issuance of the permit, the City will determine the technical and economic feasibility of elimination in fact of the nitrogen and phosphorus discharges. If elimination in fact is achievable, then the City will have 8 years to complete the removal. If trading is used to achieve the reductions, this shall be accomplished within 6 years from the issuance of the permit.
*Monitoring:* Their NPDES permit will require that their discharged effluent be monitored.
*Funding:* Grants and loans will be made available for some upgrades. User fees will also be used to fund related projects.
*Responsible organizations:* City of Rehoboth Beach
*Estimated load reductions:* 56.7 lb/day TN
36.2 lb/day TP
*Estimated cost:* NA

## NONPOINT SOURCES

Nutrient loading from nonpoint sources is typically intermittent and driven by storm events. However, nonpoint source pollution comes from both overland runoff and groundwater discharges. In this watershed, approximately 80 percent of watershed runoff is estimated to come from groundwater discharging to the streams and rivers feeding the bays, thus, a sizable portion of nonpoint source pollution is groundwater derived. Because of the types of land use and physiographic characteristics in the watershed, nonpoint source pollution accounts for a majority of the total nutrient load within the Inland Bays Watershed.

Two very different land use activities, poultry farming and development, thrive in the watershed. Since the 1960s, a massive influx of people from neighboring states has continued to swell the basin's seasonal and permanent populations. At the same time, the poultry industry has experienced enormous growth. The rapid growth of both activities has contributed to dramatic changes in land use and degradation of the watershed's land and water resources. As a result of the multitude of land uses within the Inland Bays, nonpoint source nutrient loading comes from several sources, specifically:

- Agriculture
- Urban Land Use
- On-site Wastewater Treatment and Disposal Systems
- Stormwater

This Strategy will address these nutrient sources by recommending best management practices and other actions that will reduce the impacts from these activities on water quality. Costs associated with these actions will be addressed where possible and may be seen compiled in Appendix F. Keep in mind, atmospheric deposition is also a source of nonpoint source pollution. Due to the complexity of this issue on a local scale and that best management practices to reduce the local contributions are in their infant stage of development, this Strategy will not make additional recommendations for reductions in atmospheric deposition at this time. However, the TMDL calls for a 20% reduction from atmospheric loads through implementation of the Clean Air Act. In the future, the Strategy may need to be revised to address local sources such as automobiles, trucks and buses, construction equipment, off-road vehicles, boats, lawnmowers and other lawn equipment, poultry production, electric power generation and industrial sites.

## Agriculture

***General Action:*** **The agriculture sector should implement additional best management practices (BMPs) in order to achieve water quality standards. This Strategy will establish goals for implementation levels of various BMPs.**
Agriculture contributes significant amounts of nitrogen and phosphorous to the Inland Bays Watershed through field applications of manure, litter, and commercial fertilizers that are ultimately transported to the water. Agriculture is the largest land use in the watershed, accounting for 33 percent of the land. In 2005, more than 33 million chickens were raised in the watershed, generating more than 36,000 tons of manure and litter that are typically applied to the land. Most of the croplands are devoted to growing corn and soybeans. If nutrients are over-applied to agricultural sites, the excess may be transported to surface waters. Implementation of comprehensive nutrient management plans and agriculture best management practices (BMPs) can significantly reduce nutrient losses from agricultural activities.

Since the Delaware Nutrient Management Act gives the authority to regulate the application and generation of nutrients in order to achieve water quality standards to the DNMC, the Inland Bays Team did not specifically address agriculture in their Strategy recommendations. However, since the technical analysis of existing agricultural BMPs and required nutrient management plans do not do enough to achieve the TMDL, this Strategy does address agricultural practices other than NMPs. In December 2003, the DNMC agreed to the concept of implementation goals for agriculture, as well as other sectors. Agriculture has already taken significant strides towards improving water quality. Appendix E states how nutrient loading to waters can be estimated through the use of BMPs.

*Results:* To date, agriculture significantly reduced nonpoint source nutrient loads in order to achieve the TMDL reductions—20 percent of the needed TN reduction and 32 percent of the needed TP reduction. This has been done at a relatively inexpensive cost of an average $4.74/lb of TN reduced and $297/lb TP reduced. Because of the diversity of cost-share programs available, the farmer or producer bares little to none of these costs. Under this Strategy, agriculture will be responsible for reducing 3,272 lbs, or 87 percent of the TN reductions and 80.1 lbs, or 60 percent of the TP reductions needed.

***Action:*** **Full compliance with the NMA; all agricultural acres should have a nutrient management plan.**

*Implementation mechanism:* The Delaware Nutrient Management Act and the Delaware Nutrient Management Commission.
*Schedule:* All agricultural operations (where nutrients are applied to 10 acres or more) are required to have Nutrient Management Plans as of January 1, 2007.
*Monitoring:* The DNMC has authority to oversee the implementation of the requirements of the Act.

*Funding:* Farmers and producers are responsible for having a certified nutrient planner design the plans. Cost-share funds are available from the DNMC and the Sussex Conservation District.
*Responsible organizations:* DNMC, farmers and producers.
*Estimated load reductions:* The Strategy workgroup determined that TN loading is reduced by 20.5 percent. Assuming that NMPs will be implemented on 53,827 acres (23,543 exist), a total of 635 lbs/day of TN will be reduced.
*Estimated cost*: Farmers are eligible for cost share and the amount varies depending on the number of acres enrolled. An average cost share value is $4.35 per acre for a 3-year plan. This amounts to an annual cost of $78,049 or $0.34 per lb TN reduced.

***Action:*** **Annual goal of 37,637 acres in cover crops, preferably planted one week before the published date of the first killing frost, and not fertilized.**

*Implementation mechanism:* The Sussex Conservation District will provide cost-share for this BMP. The Department will assist the DNMC and Conservation Districts to promote the use of cover crops and the cost-share program.
*Schedule:* 25% of the acres should be implemented by 2007; an additional 25% by 2008 and the total amount by 2010.
*Monitoring:* The District will monitor farms involved in the cover crop cost-share program.
*Funding:* The Conservation District will provide cost-share funds. However, the EQIP program also has funds available.
*Responsible organizations:* Farmers, producers, NMC, and the District
*Estimated load reductions:* The Pollution Control Strategy workgroup (PCS workgroup) used a formula that recognized the differing efficiencies associated with different crop species. The group recommends 59 percent reduction in TN and a 4.9 percent reduction in TP. TN will be reduced by 1,286 lbs/day and TP by 4.06 lbs/day.
*Estimated cost*: Cover crops cost about $35/acre ($1,317,292 annually for the above planting goal) or $2.81/lbs TN removed. However, farmers can receive $30-$40/acre for planting cover crops. Since some species that are more efficient at reducing nitrogen loading to the water can be planted at less than $35/acre, an opportunity exists for the farmer to benefit from this best management practice.
*Comment*: The Sussex Conservation District continues to add new incentives to their cover crop program in order to increase participation. In 2005, they offered bonuses for early planting. In 2006, they are piloted a "commodity" cover crop program, which allowed farmers to harvest the crops.

***Action:*** **Goal of 3,246 (209 of which already exist) acres of riparian forested buffer.**

*Implementation mechanism:* The Conservation District along with the DNMC and DNREC will promote this practice and the relevant cost-share programs.
*Schedule:* 25% should be installed by 2007, and additional 25% by 2008 and 100% by 2011.

*Monitoring:* The Conservation District will monitor farms included in cost-share programs.
*Funding:* Cost-share funds will be available through the CRP, EQIP and CREP programs.
*Responsible organizations:* Farmers, producers, NMC, and the District
*Estimated load reductions:* The PCS workgroup recommended that forest buffer be assigned efficiencies of 62 percent reduction in both TN and TP. Each acre of buffer has nutrient reduction associated with a land use change for the actual area in the buffer and reductions for reducing runoff from two upland acres. TN will be reduced by 374 lbs/day and TP will be reduced by 12.4 lbs/day.
*Estimated cost:* Cost-share programs such as CREP provide funding for planting, maintenance and land rental. Thus, the farmer bares no costs associated with this BMP. However, the annual cost of this action is $579,747 or $4.25/lb TN reduced.

***Action:*** **Goal of restoring 4,175 (of which 29 already exist) acres of wetlands in areas that were previously converted to cropland.**

*Implementation mechanism:* The Conservation District along with the DNMC and the Department will promote this practice and the relevant cost-share programs.
*Schedule:* 25% should be installed by 2007, and additional 25% by 2008 and 100% by 2011.
*Monitoring:* The Conservation District will monitor farms included in cost-share programs.
*Funding:* Cost-share funds will be available through the CRP, EQIP, WRP and CREP programs.
*Responsible organizations:* Farmers, producers, NMC, and the Conservation District
*Estimated load reductions:* The PCS workgroup recommended that wetlands be assigned the same efficiencies as those used for forest buffers, 62 percent reduction in both TN and TP. Each acre of wetland has nutrient reduction associated with a land use change for the actual area in wetland and reductions for reducing runoff from two upland acres. TN will be reduced by 481 lbs/day and TP will be reduced by 16.0 lbs/day.
*Estimated cost*: Cost-share programs such as CREP provide funding for planting, maintenance and land rental. Thus the farmer bares no costs associated with this BMP. However, the annual costs are $1,192,332 or $6.80/lb TN reduced.

***Action:*** **Maintain the existing 134 acres of wildlife habitat, grassed waterways, and grassed filter strips.**

*Implementation mechanism:* The Conservation District along with the DNMC and DNREC will promote this practice and the relevant cost-share programs.
*Schedule:* The goal has been achieved and will require maintenance.
*Monitoring:* The Conservation District will monitor farms included in cost-share programs.

*Funding:* Cost-share funds are available through the CRP, EQIP and CREP programs.
*Responsible organizations:* Farmers, producers, NMC, and the Conservation District
*Estimated load reductions:* The PCS workgroup recommended that wildlife habitat and grassed waterways be assigned nutrient reductions due to the change in land use, the change from cropland to grasslands. These 134 acres of BMPs are estimated to be responsible for 3.12 lbs/day of TN reductions and 0.07 lbs/day of TP reduction.
*Estimated cost*: Cost-share programs such as CREP provide funding for planting, maintenance and land rental. Thus, the farmer bares no costs associated with this BMP. However, the annual cost is $14,093 or $12.39/lb TN removed.

***Action:*** **Goal of 1,772 acres (54.5 of which already exist) of grassed buffers.**
*Implementation mechanism:* The Conservation District along with the DNMC and DNREC will promote this practice and the relevant cost-share programs.
*Schedule:* 25% should be installed by 2007, and additional 25% by 2008 and 100% by 2011.
*Monitoring:* The Conservation District will monitor farms included in cost-share programs.
*Funding:* Cost-share funds will be available through the CRP, EQIP, and CREP programs.
*Responsible organizations:* Farmers, producers, NMC, and the Conservation District.
*Estimated load reductions:* The PCS workgroup recommended that grass buffers be assigned efficiencies of 46 percent reduction in TN and 54 percent reduction in TP. Each acre of buffer has nutrient reduction associated with a land use change for the actual area in buffer and reductions for reducing runoff from two upland acres. TN will be reduced by 135 lbs/day and TP will be reduced by 5.19 lbs/day.
*Estimated cost*: Cost-share programs such as CREP provide funding for planting, maintenance and land rental. Thus the farmer bares no costs associated with this BMP. However, the annual costs are $297,960 or $6.05/lb TN reduced.

***Action:*** **Continue to use and support the construction of poultry manure storage sheds and composters.**
*Implementation mechanism:* Promotion by the Conservation Districts, DNMC and the Department.
*Schedule:* As soon as possible
*Monitoring:* The Conservation District monitors those structures where cost-share and low interest loans were received for their construction.
*Funding:* Cost-share is provided by the Conservation District through EQIP and by the Financial Assistance Branch of the Department through SRF.
*Responsible organizations:* Farmers and producers.
*Estimated load reductions:* The PCS workgroup was unable to assign specific load reductions to the manures sheds or poultry mortality composters.

Thus, although these BMPs reduce nutrients, we will not specifically assign a nutrient load reduction to them. In the alternative, they will act as a "margin of safety" for achieving the TMDL.
*Estimated cost*: Cost-share programs provide partial funding for the construction of these structures. The total annual cost for these structures is $263,195, including funds expended through cost-share programs.

***Action:*** **Increase the annual quantity of manure relocated or put into an alternative use from 20,347 to 20,909 tons.**

*Implementation mechanism:* DNMC's cost-share program for manure relocation will provide outreach in order to gain more participants in the relocation program. The Perdue Agri-recycle facilities will continue to take excess manure for their plant as well.
*Schedule:* This relocation goal would be achieved on an annual basis. More intensive outreach has already begun.
*Monitoring:* The DNMC tracks the manure that is relocated and reports that data such that progress towards the goal may be tracked.
*Funding:* Funds for the relocation program come from the General Assembly as well as the 319 Nonpoint Source Program, if it is relocated off-peninsula.
*Responsible organizations:* Farmers, producers, DNMC
*Estimated load reductions:* The PCS workgroup assigned nutrient reductions from relocation (See Appendix E). Consequently, TN will be reduced by 321 lbs/day and TP by 34.1 lbs/day.
*Estimated cost:* The cost-share program is designed such that the producer will not have to bare any costs. Annually, this goal would cost $271,822 or $2.32/lb TN reduced.

***Action:*** **Continue the use of feed amendments, such as phytase, and to minimize calcium di-phosphate in poultry feed in order to reduce nutrients in poultry manure.**

*Implementation mechanism:* Poultry integrators must continue to attempt to balance feed additives with the nutritional needs of the birds. A Memorandum of Understanding between the integrators and the DNMC requires the use of feed additives. "Each Poultry Company shall research and incorporate, when appropriate, into their feed formulations the use of feed additives, feed ingredients or other nutritional strategies. These strategies shall be used in an effort to modify the ratio of phosphorus and nitrogen, or reduce or otherwise modify the nutrient levels within the feed without detrimental effects on bird health or growth. Progress on these initiatives and goals shall be part of the Company's annual report to the Nutrient Management Commission."
*Schedule:* Optimum utilization of this additive will occur as soon as possible, although, all integrators use phytase in their feeds now.
*Monitoring:* Manure nutrient contents from a University of Delaware fact sheet were used to calculate nutrient reductions. Poultry integrators report annually to the DNMC on the use of amendments.
*Funding:* The integrators pay for the process of adding phytase to the feed.

*Responsible organizations:* Poultry integrators.
*Estimated load reductions:* The PCS workgroup was able to estimate nutrient load reductions from the use of phytase. It was estimated that 8.24 lbs/day of TP are removed through the use of phytase.
*Estimated cost*: Not available.

***Action:*** **Implement additional Water Control Structures to treat 450 acres of cropland and maintain the 1,530 acres currently treated by these structures.**

*Implementation mechanism:* The Sussex Conservation District will approach farmers in the areas where these additional structures will be most appropriate.
*Schedule:* 25% should be installed by 2007, and additional 25% by 2008 and 100% by 2011. The Conservation District has already begun to market this Best Management Practice.
*Monitoring:* The Conservation District tracks BMPs that they cost-share.
*Funding:* Cost-share funds are available through the District.
*Responsible organizations:* Farmers and land owners.
*Estimated load reductions:* The PCS workgroup devised a method to estimate nutrient reductions from this practice. When the goal is achieved, these BMPs will be responsible for approximately 37.6 lbs/day reduction of TN.
*Estimated cost*: The Sussex Conservation District provides cost-share for this practice. Total annual costs will be $23,212 or $1.69/lb TN reduced.

## Urban Land Use

***General Action:*** **Decrease nutrient loading from urban nonpoint sources.** Urban or residential land usage is increasing in the watershed. From 1992 to 2002, the acreage considered urban increased 35 percent. It is expected that this trend will continue. In fact, 2000 census figures show that coastal Sussex County is the fastest growing area in Delaware. Urban areas with high percentages of impervious surface contribute significant pollution loads in waterways.

Numerous urban sources of nutrients are transported to the Inland Bays through erosion, stormwater runoff and leaching from soils to the ground water. The sources include discharges from individual and community on-site septic systems as well as fertilizers applied to private and commercial landscapes, nutrient rich sediments from construction activities, exhaust emissions, and open burning. For these reasons, urban land usage must be regulated in order to reduce nutrient loading from it—so that we may achieve the TMDL.

*Results*: This section of the Pollution Control Strategy will work to reduce nutrient loading by impacting how land is developed. Although most of the reductions are going to come from the agriculture sector, the watershed is developing quickly. Thus, as these agricultural lands convert to urban/residential/commercial use, the development must be accomplished such that nutrient loadings continue to be reduced through implementing all available Best Management Practices.

***Action:*** **Designation of the Inland Bays Watershed as a 'Critical Environmental Area.' The entire Inland Bays Watershed should be managed for nutrient reductions consistent with TMDL load reductions, or to the maximum extent possible.**

*Implementation mechanism:* All relevant programs should incorporate provisions that require permitted technologies and resource management needed to control nutrients. Nutrient reduction levels may be defined through the use of standards, performance measures and other techniques to ensure optimal nutrient removal.
*Schedule:* Programs will make changes upon the promulgation of this Strategy.
*Monitoring:* The Inland Bays Tributary Action Team in partnership with the Department will monitor progress toward the implementation of this action.
*Funding:* No funding is required to implement this action item.
*Responsible organizations*: Department, the County, Municipalities, other State agencies
*Estimated load reductions:* Depend upon the practice implemented.
*Estimated cost:* NA

***Action:*** The Preliminary land Use Service (PLUS) has improved coordination between federal, State and local government, yet measures must be taken to ensure that local zoning codes and ordinances provide adequate protection to the Inland Bays. The Strategies for State Policies and Spending (SSPS) is an important incentive tool in

encouraging resource-based land use planning. **It is suggested that the SSPS and other incentive/disincentive tools shall be specifically tied to natural resource protection goals in the Inland Bays Watershed.**

*Implementation mechanism:* The Preliminary Land Use Service (PLUS) provides for early review of various projects, including County and municipal plans. This provides ample opportunities for developers to become aware of environmental requirements. In addition, the recent update of the SSPS incorporated natural resource layers in an attempt to direct growth away from sensitive resources.
*Schedule:* County Comprehensive Plans must be updated every 5 years while municipal comprehensive plans are reviewed every 5 years and updated every 10.
*Monitoring:* The Office of State Planning ensures that Comprehensive Plans are consistent with the SSPS.
*Funding:* NA
*Responsible organizations:* Office of State Planning Coordination, County, municipalities
*Estimated load reductions:* Although this action will lead to nutrient reductions, they are not quantifiable at this point.
*Estimated cost:* NA

***Action:*** **Establish buffers of 100 feet landward from State-regulated wetlands, or landward from the mean high water line of all tidal waters, whichever extends farther upland, and landward from the ordinary high water mark of all other primary water features. Establish buffers of 60 feet landward from the ordinary high water mark of all secondary water features.** These buffers shall be clearly demarcated, designated, and recorded on final site plans or final major subdivision plats and demarcated on the ground with signs or other kinds of markers. More details regarding buffer requirements can be found in the Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds. See Appendix G for a discussion of the water quality benefits of riparian buffers. Procedures to Challenge the Map of Water Features to be Buffered in the Inland Bays Watershed can be found in Appendix H.

*Implementation mechanism:* Promulgation of the Regulations of the Pollution Control Strategy for the Inland Bays Watershed.
*Schedule:* Implementation will begin according to effective dates outlined in the Regulations of this PCS.
*Monitoring:* Compliance will be monitored through issuance of related permits.
*Funding:* None required.
*Responsible organizations:* State, county, municipalities, property owners
*Estimate load reductions:* Reductions from the implementation of buffers in the urban setting would result from the conversion of land in the buffer and by assuming that each acre of buffer reduces nutrients from two upland acres of urban land.
*Estimated costs*: NA.

***Action:*** **Buffer widths may be reduced when combined with stormwater provisions and with the creation of a development-wide nutrient management plan created by**

**a certified nutrient consultant and implemented by a certified nutrient handler.** More details regarding buffer and sediment and stormwater requirements can be found in the Regulations Governing the Pollution Control Strategy for the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds. See Appendix G for a discussion of the water quality benefits of riparian buffers. Procedures to Challenge the Map of Water Features to be Buffered in the Inland Bays Watershed can be found in Appendix H. See Appendix M for guidance on achieving stormwater pollution control strategy reductions for water quality.

*Implementation mechanism:* Promulgation of the Regulations of the Pollution Control Strategy for the Inland Bays watershed.
*Schedule:* Implementation will begin according to effective dates outlined in the Regulations of this PCS.
*Monitoring:* Compliance will be monitored through issuance of related permits.
*Funding:* The costs will be born by the developer.
*Responsible organizations:* Sediment and Stormwater Program, Division of Soil and Water Conservation, DNREC, Nutrient Management Program, Department of Agriculture, State, county, municipalities, property owners
*Estimate load reductions:* Reductions from the implementation of buffers in the urban setting would result from the conversion of land in the buffer and by assuming that each acre of buffer reduces nutrients from a portion of the upland urban land. In addition, nutrient reductions will occur as a result of any stormwater BMPs installed and the implementation of a nutrient management plan.
*Estimated costs*: NA.

***Action:*** **When development-wide nutrient management plans are required, the homeowners association must retain the plan on file, maintain records of nutrient applications, and submit a summary of nutrient application records to the Department of Agriculture, Nutrient Management Program on an annual basis.**

*Implementation mechanism:* Promulgation of the Regulations of the Pollution Control Strategy for the Inland Bays watershed.
*Schedule:* Implementation will begin according to effective dates outlined in the Regulations of this PCS.
*Monitoring:* Compliance will be monitored through issuance of related permits and annual submittal of nutrient application summary reports to the Nutrient Management Program.
*Funding:* The costs will be born by the homeowner's association.
*Responsible organizations:* homeowner's association, Nutrient Management Program, Department of Agriculture
*Estimate load reductions:* NA, nutrient management plans are very effective at reducing the over-application of nutrients in the agriculture sector and likely have similar impacts in the urban sector.
*Estimated costs*: NA.

***Action:*** **No landowner or their representative shall extend lot lines into buffers.**

*Implementation mechanism:* Promulgation of the Regulations of the Pollution Control Strategy for the Inland Bays watershed.
*Schedule:* Implementation will begin according to effective dates outlined in the Regulations of this PCS.
*Monitoring:* Through the Preliminary Land Use Service and other governmental permitting practices.
*Funding:* NA.
*Responsible organizations:* Department and local governments
*Estimate load reductions:* NA.
*Estimated costs*: NA.

***Action:*** **Encourage the planting of trees and other plants adjacent to all waters and wetlands.**

*Implementation mechanism:* Land owners are encouraged to plant buffers in trees, shrubs and grasses in order to maximize nutrient removal efficiencies of the buffers. In addition, turf grass abutting a water or wetland should not be fertilized. The developer is encouraged to work with the tax ditch managers to develop an agreement which would allow some strategic planting of trees within the right-of-way. This may involve added maintenance responsibilities for the property owners which would be performed to the satisfaction of the tax ditch organization. This recommendation applies to both new and existing buffers. See Appendix G for the water quality benefits of planting trees, shrubs, and other vegetation in buffers. See Appendix I for a buffer evaluation form which can be used to evaluate existing buffers on water resources. See Appendix J for a list of recommended plant species for the establishment, expansion, and enhancement of buffers. See Appendix K for a list of invasive species, which are non-native to Delaware and should not be planted under any circumstances and should be removed from buffers as feasible. See Appendix L for guidance regarding the establishment of forested buffers.

*Schedule:* Implement as soon as possible.
*Monitoring:* Through working with State agencies, we should be able to track the acreage of planted buffers.
*Funding:* The Delaware Forest Service, Delaware Coastal Program, Delaware Fish and Wildlife and Delaware Nonpoint Source Program have grants which may be available for planting of buffers.
*Responsible organizations:* State, municipalities, property owners
*Estimate load reductions:* NA, depends on acreage planted
*Estimated costs*: NA, depends on acreage planted and species and plant sizes used.

***Action:*** **Upon the improvement of a parcel, the Department will produce a nutrient budget. The nutrient budget will illustrate how the future land use will reduce or increase nutrient loading.** This budget, based on the best available data, will illustrate the current nutrient loading of that parcel to ground and surface water and the proposed nutrient loading from the new use. The Department will use a protocol for producing this

budget. Copies of the protocol are available for use from the Watershed Assessment Section.

*Implementation mechanism:* The Watershed Assessment Section has already begun this process. Projects subject to the Preliminary Land Use Service (PLUS) are being reviewed.
*Schedule:* This provision is being implemented.
*Monitoring:* The Department will use the protocol results to help estimate changes in nutrient loading to waters in the Inland Bays Watershed.
*Funding:* The protocol tool will be available free of charge.
*Responsible organizations:* Watershed Assessment Section
*Estimated load reductions:* Difference in the land use loading rate for the previous land use and the developed land use with BMPs.
*Estimated cost:* NA

***Action:*** The Delaware Nutrient Management Commission (DNMC) is the controlling authority for fertilizer application on parcels of land 10 acres in size or greater within the Inland Bays Watershed. Recognizing the significant contributions of nitrogen and phosphorus from land parcels less than 10 acres in size, **develop a program which addresses practices that may result in nutrient reductions. These should include, but are not limited to: establishing nutrient budgets for homeowners, technical support for small landowners, and education.**

*Implementation mechanism:* The DNMC has produced a brochure on proper lawn maintenance. These brochures have been placed in most retail outlets that sell fertilizer in the watershed. In addition, the Inland Bays Tributary Action Team has run an advertisement on a local television station reminding people about proper lawn nutrient application and urging people to get a soil test done prior to applying fertilizer.
*Schedule*: Efforts are already underway.
*Monitoring:* It is impossible to monitor the fertilizer usage on everyone's lawn. However, it is hoped that through education, people can learn the proper techniques and share their knowledge with their friends, family, and neighbors.
*Funding:* Funds for the brochure and the ad has come from multiple sources including the Department, EPA, and the Center for the Inland Bays.
*Responsible organizations:* Property owners, Nutrient Management Commission, the Department
*Estimated load reductions:* Although we know that there will be some reduction from this action, we are currently unable to assign a nutrient load reduction to this activity.
*Estimated cost:* NA

***Action:*** **Land maintained as open space under County or municipal ordinances or codes should be managed to minimize nutrient loading.** If the land is fertilized in order to achieve its intended use, nutrients should be applied by a licensed nutrient applicator according to a nutrient management plan.

*Implementation mechanism:* Implementation will occur at various levels of government—State, county and municipal. Open space will be designed

at the site plan stage. The developments will then deed the open space to the community for their management.
*Schedule:* This recommendation is already being made.
*Monitoring:* The Watershed Assessment Section will assist associations in finding the appropriate agency or program to advise communities about their nutrient management needs.
*Funding:* This recommendation should save land owners money since it calls for limiting the use of fertilizers on the lands.
*Responsible organizations:* Homeowner associations, NMC, Department, Sussex County, Delaware Department of Agriculture, Coastal Management Program's Community Open Space Management Program
*Estimated load reductions:* Nutrient load reduction may occur as the land converts from its previous use to a grassed or forested area.
*Estimated cost:* NA

## Onsite Wastewater Treatment and Disposal Systems

***General Action:*** **Improve operation and maintenance of onsite wastewater disposal systems such that nutrient loadings from them are reduced. This will require the use of innovative and alternative removal systems as well as the conversion of some onsite systems to central sewer.**

Onsite wastewater treatment and disposal systems are widely used within the watershed and contribute nutrients to the ground and surface waters. Approximately 18,212 septic systems are permitted in the Inland Bays Watershed, discharging as much as 523 pounds of nitrogen and 44.5 pounds of phosphorus to the groundwater, daily assuming that the systems are functioning properly. Malfunctioning systems would discharge even more pollutants into the ground. Most of the nitrogen from septic tanks is converted to nitrate-nitrogen, which easily enters the ground water and ultimately, the bays or their tributaries. Many older homes near the bays are on small lots with sandy soils, and some still have substandard onsite wastewater disposal systems like cesspools or seepage pits. Approximately 50 percent of the septic systems in the Inland Bays Watershed may not meet current regulations for onsite wastewater disposal systems for a variety of reasons including inadequate lot sizes and system capacities. Thus, these sources will be regulated in order to protect water quality. However, once in the groundwater, the phosphorus may not necessarily make it to the surface waters given the multiple manners in which phosphorus acts in that environment. The recommended actions work toward reducing the load from these sources.

*Results*: Combined, these recommendations will lead to a reduction of 377 lbs/day of TN and 7.79 lb/day of TP. The annual costs of these recommendations will be $13,437,696.

***Action:*** **Permanent holding tanks shall not be permitted within the watershed. A permanent holding tank is a tank that will be in use for 4 years or more.**

*Implementation mechanism:* Section 5.13015 of the Regulations Governing the Design, Installation and Operation of On-site Wastewater Treatment and Disposal Systems implement this action.
*Schedule:* This prohibition is in effect.
*Monitoring:* The Ground Water Discharges Section, Division of Water Resources, DNREC oversees the permitting of these systems.
*Funding:* No additional funding will be needed.
*Responsible organizations:* Ground Water Discharges Section, Division of Water Resources, DNREC.
*Estimated Load Reductions:* This action will prohibit any future additional loading of nutrients into the system.
*Estimated cost:* NA

***Action:*** **Maintain the existing Holding Tank inspection program.**

*Implementation mechanism:* The Ground Water Discharges Section, Division of Water Resources, DNREC currently implements a State-wide holding tank inspection program. This Strategy relies on the continuation of this program.

*Schedule:* The program is currently underway.
*Funding:* The program is funded with EPA monies. It is hoped that this program will eventually be funded by the General Assembly and through fees.
*Monitoring:* Ground Water Discharges Section, Division of Water Resources, DNREC
*Responsible organizations:* Ground Water Discharges Section, Division of Water Resources, DNREC
*Estimated load reductions:* 22.5 lbs/day TN; 8.45 lbs/day TP
*Estimated cost:* Annually, the action will cost $771,120 or $94.10/lb of TN reduced.

***Action*: No new drainfields on parcels recorded 30 calendar days or more after the publication of these final Regulations in the Delaware Register of Regulations may be present within 100 feet landward from State-regulated wetlands, or the mean high water line of all tidal waters, whichever extends farther upland, and from the ordinary high water mark of all other primary water features.**

*Implementation mechanism:* Promulgation of the Regulations of the Pollution Control Strategy for the Inland Bays watershed.
*Schedule:* This requirement becomes effective 30 days from the date of publication of the final Regulations.
*Monitoring:* The Ground Water Discharges Section, Division of Water Resources, DNREC oversees the permitting of these systems.
*Funding:* The developers or homebuilders will absorb the costs of these systems.
*Responsible organizations:* Ground Water Discharges Section, Division of Water Resources, DNREC.
*Estimated load reductions:* This requirement will reduce the additional nutrient loading from these new developments over what it would be if drainfield placement is allowed closer to the protected water features.

***Action:* All properties utilizing an OWTDS that are sold or otherwise transferred to other ownership shall have their systems pumped out and inspected prior to the completion of the sale. If an inspection has occurred within the previous 36 months and the property owner can provide documentation of such pump out and inspection, then that paperwork will fulfill the requirements of this section.**

*Implementation Mechanism:* The Regulations for this Pollution Control Strategy implement this recommendation. Inspectors shall be licensed by the Department. The Ground Water Discharges Section, Division of Water Resources, DNREC will maintain a list of all permitted septage haulers and licensed inspectors, which will be available for review on the Department's website.
*Schedule:* This requirement becomes effective 180 days from the date of publication of the final Regulations.
*Monitoring:* This program will be self-monitoring since the paperwork will be required to be shared at settlement before title transfer occurs.
*Funding:* The costs of the inspection will be covered through an agreement between the buyer and the seller.

*Responsible organization:* Real estate agents, attorneys, Ground Water Discharges Section, Division of Water Resources, DNREC.
*Estimated Nutrient Reductions:* Although this recommendation will lead to improved system performance and reduced nutrient loading, these reductions cannot be quantified at this time.

***Action:*** **All new and replacement onsite wastewater disposal systems must be designed to achieve performance standards as specified in the PCS regulation. These standards vary based on system size.**

*Implementation mechanism:* This requirement is made through the promulgation of this Strategy. The Ground Water Discharges Section and the Watershed Assessment Section, Division of Water Resources, DNREC contracted with an expert in North Carolina to develop and recommend performance standards all sizes of onsite systems. The Ground Water Discharges Section will maintain a list of approved technologies for small systems from which permit applicants choose. The Groundwater Discharges Section will maintain the updated requirements.
*Schedule:* This requirement becomes effective on different dates for different systems. See the Regulations of the Pollution Control Strategy for the Indian Rover, Indian River Bay, Rehoboth Bay and Little Assawoman Bay Watersheds for the specific requirements.
*Monitoring:* The technologies listed will be tested technologies.
*Funding:* The costs of these systems will be paid by the land owner. Cost-share funds may be found to assist those of middle-income and below. Currently, SRF funds may be used to provide low interest loans to property owners replacing a failed system.
*Responsible organizations:* Ground Water Discharges Section, Watershed Assessment Section, and the Financial Assistance Branch, Division of Water Resources, DNREC.
*Estimated load reductions:* 273 lbs/day TN for the retrofitting of existing small (<2,500 gpd) systems, 16.0 lbs/day TN for 2,500-20,000 gpd systems, 15.3 lbs/day TN for >20,000 gpd systems. All new systems that are required to use enhanced-nutrient removing technologies will actually add nutrients to the system.
*Estimated cost*: Annually, this recommendation will cost $11,230,899 on average for the 15,853 small systems owners who are not currently scheduled to connect to sewer. For the individual system owner, this will cost $708/system/year. Per pound of TN reduced, the recommendation will cost an average of $112.67. Costs are not currently available for the retrofit of larger systems.

***Action*****: Sussex County converts an additional 2,359 individual onsite systems to central sewer.**

*Implementation mechanism:* The County is in the process of providing central sewer to 2,359 residences that currently utilize individual onsite wastewater treatment and disposal systems.
*Schedule*: These changes will be made within 5 years.

*Funding*: Funds for sewer expansion come from the County and State and Federal grants and loans, however, property owners will also have to pay for the connection.
*Monitoring*: The County will report on their progress.
*Responsible organizations:* County and property owners
*Estimated load reductions*: 67.7 lbs/day TN and 5.76 lb/day TP
*Estimated cost:* Annually, these will cost $2,028,032 or $82.04/lb of TN reduced.

***Action:*** **Economic assistance for those in need will be available through the Financial Assistance Branch, Division of Water Resources.**

*Implementation mechanism:* The Financial Assistance Branch, Division of Water Resources, DNREC administers low interest loans for on-site wastewater systems for persons of low to moderately low incomes from the State Revolving Fund. In addition, the Department is working with the Environmental Finance Center from the University of Maryland to identify various potential sources of additional funding.
*Schedule:* The program is currently underway.
*Funding:* The funds come from the State Revolving Fund.
*Monitoring:* Financial Assistance Branch, Division of Water Resources, DNREC
*Responsible organizations:* Financial Assistance Branch, Division of Water esources, DNREC
*Estimated load reductions:* NA
*Estimated cost:* NA

**Stormwater**

***General Action:*** **Stormwater runoff shall be managed for nutrient reduction when practicable.**

Stormwater is a major factor in loading of nutrients in the Inland Bays Watershed, specifically caused by the rapid urbanization and development of the area. As stormwater moves overland, it picks up and carries natural and human-made pollutants from lawns, streets, parking lots and industrial and commercial facilities, eventually depositing them into the waters of the Inland Bays. Reducing stormwater impacts within the Inland Bays will require action by all stakeholders and innovative management techniques.

Stormwater management is the primary way to control nonpoint source pollution from developed areas. A variety of methods can be used to control and treat runoff from lawns, homes, parking lots, roads, and commercial and industrial facilities. Some of these methods reduce nutrient loading from stormwater more than others. When possible, these methods should be preferred. However, there may be instances where the pollutant of most concern on the site would not be reduced sufficiently by the most effective nutrient removal technique. In these cases, the method used should be the best at treating the removal of the pollutant of most concern.

*Results*: The implementation of recommendations requiring the retrofitting of commercial and residential areas with stormwater management where none previously existed will result in 131 lbs/day reduction in TN and 5.48 lbs/day reduction in TP. The remainder of the actions in this section will ensure that properties developed in the future will include stormwater management techniques that will help to achieve water quality standards and the TMDLs.

***Action:*** **Where practicable, all permanent sediment and stormwater management plans shall be designed and implemented to include criteria to reduce nutrient contributions by the percentage required by the TMDL to the ground and surface waters or to the maximum extent practicable.** For the upper Indian River subwatershed, the required nutrient reductions are 65% for total phosphorus and 85% for total nitrogen. For the Little Assawoman Bay, Indian River Bay and Rehoboth Bay subwatersheds, the required reductions are 40% for total phosphorus and 40% for total nitrogen. Maps of these areas are available at the Watershed Assessment Section. The percent reductions shall be based on a comparison between the post-developed condition with and without stormwater quality management best management practices. See Appendix M for guidance on achieving stormwater pollution control strategy reductions for water quality. This guidance includes several methods for achieving this requirement and includes options that allow for the preservation or establishment of natural features like forest stands or use of mathematical computations of pollutant reductions using other types of BMPs. When the option of preserving or establishing forest stands is chosen to achieve compliance with this requirement, Appendix L should be consulted. Innovative designs such as rain gardens, natural landscaping, and constructed wetlands are encouraged where appropriate.

*Implementation mechanism:* The Regulations for this Pollution Control Strategy.

*Schedule:* For projects within the County, the effective date for this action shall be the date of adoption of the regulation. For projects on lands located within municipalities as of the date of adoption of the regulation, the effective date of this action shall be one year from the date of adoption of the regulation.

*Monitoring:* 305b monitoring of the tributaries to the Inland Bays should be able to track general water quality trends.
*Funding:* The costs will be born by the developer.
*Responsible organizations:* Sediment and Stormwater Program, Division of Soil and Water Conservation, DNREC.
*Estimated load reductions:* Stormwater management implemented to date results in reductions of 17.5 lbs/day TN and 1.29 lbs/day TP.
*Estimated cost*: Annually, these existing systems cost $688,580. Or, these systems reduce TN at a rate of $89.52 to $276.83/lb (depending on the structure used).

***Action:*** **Develop a program to assist homeowners' associations in the creation of a stormwater maintenance plan as well as to assist in the establishment of a funding mechanism to meet financial obligations for related stormwater facility maintenance.**

*Implementation mechanism:* DNREC's Sediment and Stormwater program produced a handbook for homeowners associations that can be used to learn how to maintain their plan. DNREC as well as the Sussex Conservation District will work with homeowners in forwarding this concept.
*Schedule:* The handbook was completed September 2004. Workshops on maintenance were held throughout the watershed in October 2004 and more are scheduled in 2007.
*Monitoring:* DNREC's Sediment and Stormwater program and its designated agencies have the authority to inspect sites. The Sussex Conservation District has hired an inspector. Thus, through inspection, these agencies can monitor the maintenance of these facilities.
*Funding:* The program will be funded as the budget permits. Currently, a 319 Nonpoint Source Program grant is being used to develop the handbook for homeowners association on stormwater management maintenance. EPA funds were used to support maintenance workshops geared towards homeowners throughout the watershed in October 2004.
*Responsible organizations:* Homeowner associations, the Sediment and Stormwater Program, Division of Soil and Water Conservation, DNREC and its delegated agencies. Failure by homeowners to properly maintain stormwater facilities will make it difficult to achieve the TMDL nutrient reductions established for the Inland Bays.
*Estimated load reductions:* This action will help to ensure that the reductions associated with the specific stormwater management techniques are achieved through proper maintenance.
*Estimated cost:* NA

***Action:*** **Encourage Sussex County to create a stormwater utility for the Inland Bays Watershed. This utility will collect fees for the construction of stormwater management structures where needed.**

*Implementation mechanism:* The Sediment and Stormwater regulations serve as an enabling structure for the local ordinances needed in order to set up the utility. The Sediment and Stormwater program has held workshops to generate interest in the formation of a utility. The County is in the best position to start the most effective utility.
*Schedule:* The Department will begin talks with the County regarding creating a utility. Two workshops were held in 2004 promoting the concept.
*Monitoring:* The utility would have a monitoring component.
*Funding:* Stormwater utilities are designed to become a funding mechanism for stormwater retrofits, maintenance, and source reduction strategies.
*Responsible organizations:* Sussex Conservation District; Sussex County; DNREC; Delaware Department of Transportation; Municipalities
*Estimated load reductions:* Stormwater retrofit projects would increase the amount of nutrient load reduction in various quantities associated with the practices used.
*Estimated cost:* Costs will depend on the goals of the program instituted. In some areas of the country, the household cost is equivalent to a fast food hamburger per month.

***Action:*** **Create stormwater management facilities and source reduction strategies for 4,500 acres of urban and residential lands developed pre-1990.**

*Implementation mechanism:* DNREC will work with the DELDOT, the Sussex Conservation District, and Sussex County to identify priority areas for stormwater retrofits and to find funds to pay for these upgrades.
*Schedule:* Work on this task will begin upon promulgation of the Strategy.
*Monitoring:* When possible, water quality samples will be taken to evaluate the effectiveness of the action taken.
*Funding:* The responsible organizations will work together to locate funds.
*Responsible organizations:* DNREC, DELDOT, Sussex County, Sussex Conservation District
*Estimated load reductions:* The specific reduction will depend upon the stormwater management techniques used. Assuming that the majority of the area will be treated by filtration devices with some ponds, the nutrient reductions achieved by this action will be: 130 lbs/day TN; 5.48 lbs/day TP.
*Estimated cost*: Annually, this recommendation will cost about $7,115,572 or $106.14-$151.56/lb of TN reduced.

***Action:*** **Institute tax incentives that encourage an increase in open space (green areas) in commercial developments, thus, reducing the percentage of impervious surface and reduce nutrient contributions.**

*Implementation mechanisms:* This program could be instituted at the State or County level.
*Schedule:* This recommendation could be implemented once guidelines were

established and tax law is changed.
*Monitoring:* This program could be monitored and administered by the County or the entity administering the Sediment and Stormwater law.
*Funding:* Funds lost due to the incentive would need to be generated.
*Responsible organizations:* County or State
*Estimated load reductions:* This recommendation will help to reduce the nutrient loading from the parcel in question.
*Estimated cost:* NA

## CONCURRENCE

***General Action:*** **A higher level of government accountability is necessary if nutrient reductions are to be affected. There exist numerous instances of government inconsistencies and lapses in application and enforcement of policies, laws, and regulations. A mechanism should be established to ensure concurrence of policies, laws, and regulations within, between, and among government and other agencies.**

*Results*: Although no nutrient load reduction will be quantified, loading should be reduced. An additional benefit will be the improved coordination between agencies and governments.

***Action:*** **A task force will be formed to examine laws, regulations and ordinances that are in effect within the Inland Bays Watersheds. This group will then identify areas where adjustments are needed in order to have concurrence.**

*Implementation mechanism*: The Watershed Assessment Section, Division of Water Resources, DNREC will take the lead in coordinating this effort.
*Schedule:* This group will meet soon after the promulgation of the Strategy.
*Monitoring:* This group will report to DNREC and the Inland Bays Tributary Action Team.
*Funding:* All relevant organizations will donate staff time to this endeavor.
*Responsible organizations:* All governmental entities within the Inland Bays Watershed.
*Estimated load reductions:* Although we cannot quantify nutrient reductions, we believe that this effort will lead to lowered loadings.

***Action:*** **All water quality impacting permits shall be consistent with the Surface Water Quality Standards (SWQS). The Department will begin creating a process to ensure that all wastewater and stormwater permits meet these standards.**

*Implementation mechanism:* The Department will explore convening a group to coordinate the issuance of some permits in the Inland Bays. This group will ensure that permits comply with the Strategy and the SWQS.
*Schedule:* The Department has already begun considering this action.
*Monitoring:* The group will monitor the activities of the various programs and sections issuing permit that impact water quality.
*Funding:* The costs will be staff time.
*Responsible organizations:* DNREC
*Estimated load reductions:* Compliance with the SWQS will ensure that nutrient loads will not be increased such that the water quality standards cannot be achieved.

*Action:* **The use of advanced nutrient reduction technology on parcels subdivided after promulgation of the Regulation for this Pollution Control Strategy shall not be**

**used as justification for reductions in isolation, set-back, and/or separation distances.**

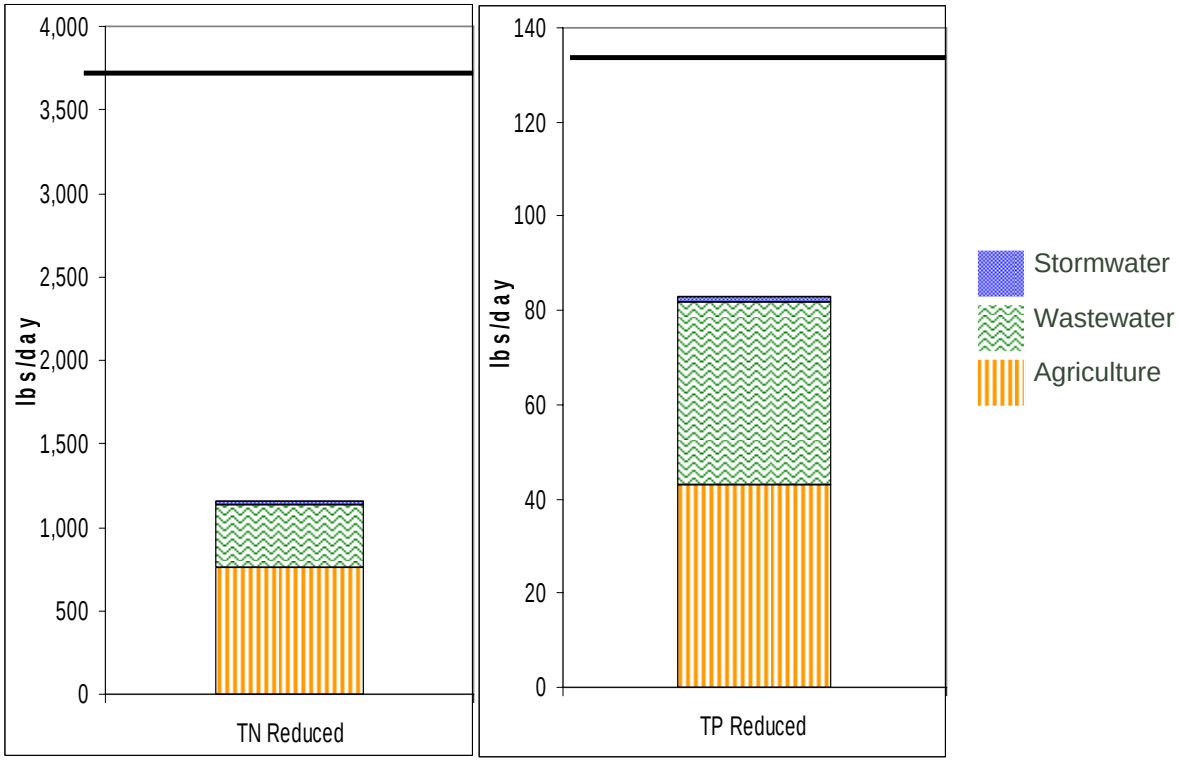
*Implementation mechanism:* The Department will not permit reductions in these distances in the appropriate permits.
*Schedule:* Implement upon promulgation of the Regulations for this Pollution Control Strategy.
*Monitoring:* Through the permit process.
*Funding:* There are no associated costs.
*Responsible organizations:* DNREC
*Estimated load reductions:* Compliance with the isolation, set-back, and/or separation distances will ensure that nutrient load reductions associated with the use of advanced nutrient reduction technology will not be used as a means to discharge the effluent closer to a waterbody.

## ANALYSIS FOR TMDL ACHIEVEMENT AND COST

Promulgation of this Pollution Control Strategy and full implementation of its elements should lead to the achievement of the TMDLs for Total Nitrogen (TN) and Total Phosphorus (TP). Because of the lag time between seeing improvements in ground and surface water quality, estimated to be up to 30 years, improved water quality conditions will not be realized immediately. The Department will continue to monitor water quality as will many citizen volunteers. The Department is committed to revisit this Pollution Control Strategy in 10 years to ensure that water quality is improving with implementation of the regulations and voluntary practices called for within this document.

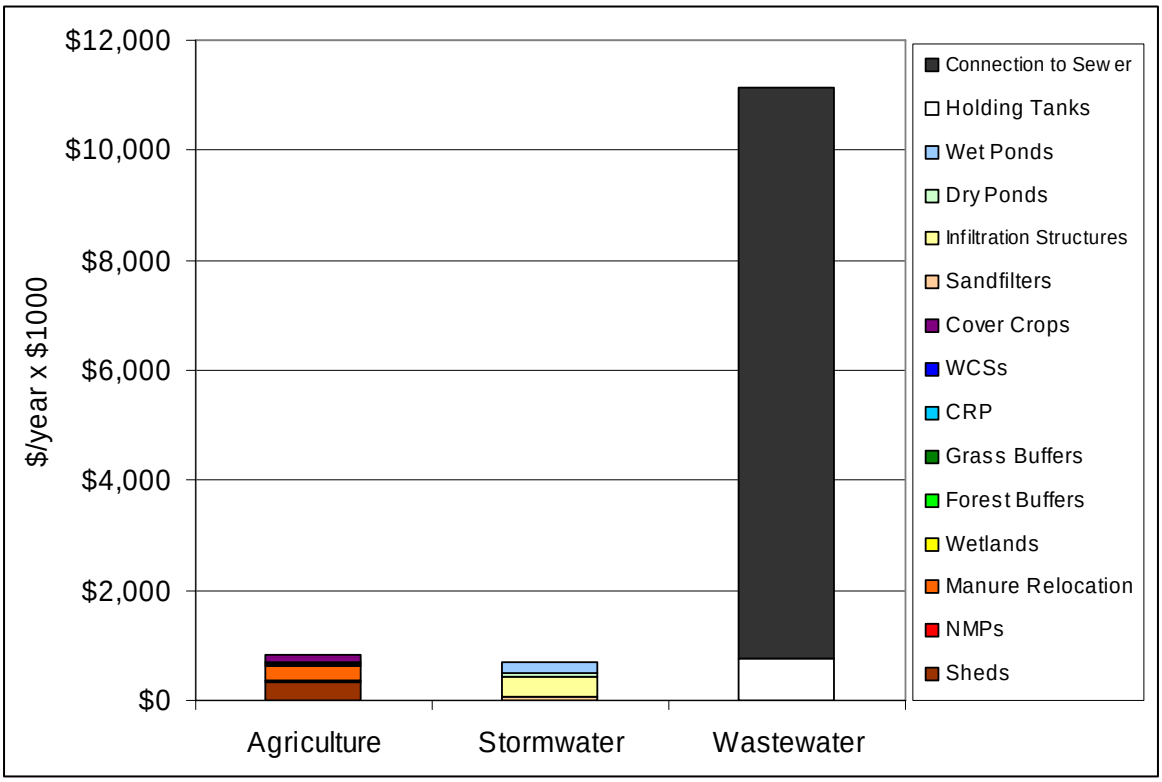
Analysis using a basic land use loading rate model shows that, to date, nonpoint sources of TN and TP have been reduced by 31 percent and 62 percent, respectively (Figure 5). Thus, voluntary programs for installation of agricultural best management practices have been successful as well as the County's effort to expand central sewer and reduce the number of onsite wastewater treatment and disposal systems in use. Implementation of the Sediment and Stormwater law has also led to decreases in nutrient loading, however, the full impact is not shown here because many sediment and stormwater practices, known to be in place, are not yet captured in a database and therefore, not considered in these calculations.

**Figure 5: TMDL Progress to Date**



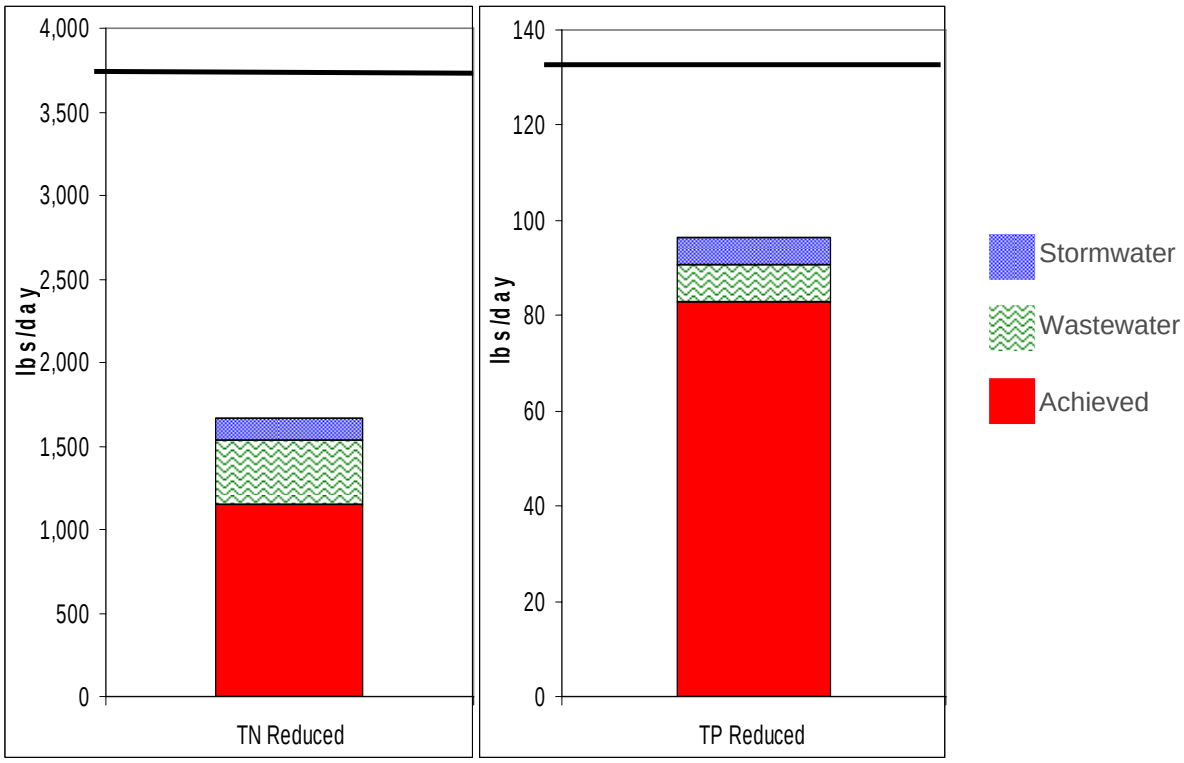
Although agriculture and wastewater actions have made equivalent reductions in TP, the costs of achieving those reductions were vastly different. Figure 6 shows that the annualized cost of the wastewater actions are about 10 times greater than the costs of the agricultural best management practices. Thus, agricultural actions are far less expensive than those actions related to wastewater.

**Figure 6: Annualized Costs of Best Management Practices Implemented to Date**




When the additional Pollution Control Strategy prescribed wastewater and stormwater actions are entered into the model, the model estimates that the TMDL will not be achieved (Figure 7).

**Figure 7: Progress Toward TMDL—Without Agricultural BMP Goals**




Given the cost-effectiveness of agricultural BMPs and the additional available areas for BMP implementation, it became obvious that the Pollution Control Strategy needed additional goals for BMP implementation. Dollar per pound, agricultural BMPs were much less expensive than requiring additional wastewater or stormwater actions (Figures 8 and 9). But, care needed to be taken such that only a small amount of agricultural lands would be taken out of production and placed in BMPs such as buffers or wetlands. The agriculture industry would be impacted by losing to great a percentage of cropland, so the Strategy only calls for a 14% reduction in lands used for production. A model was used to calculate the specific agricultural Best Management Practice implementation goals.

**Figure 8: Dollar Per Pound of TN Reduction**

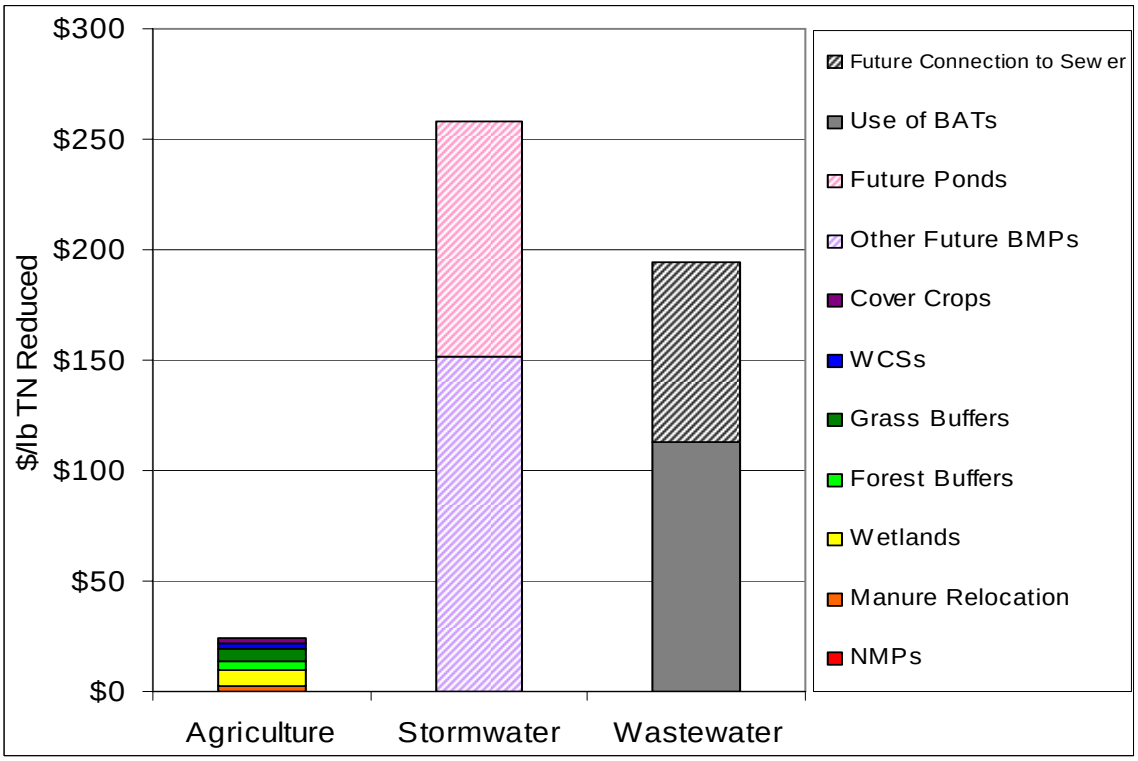
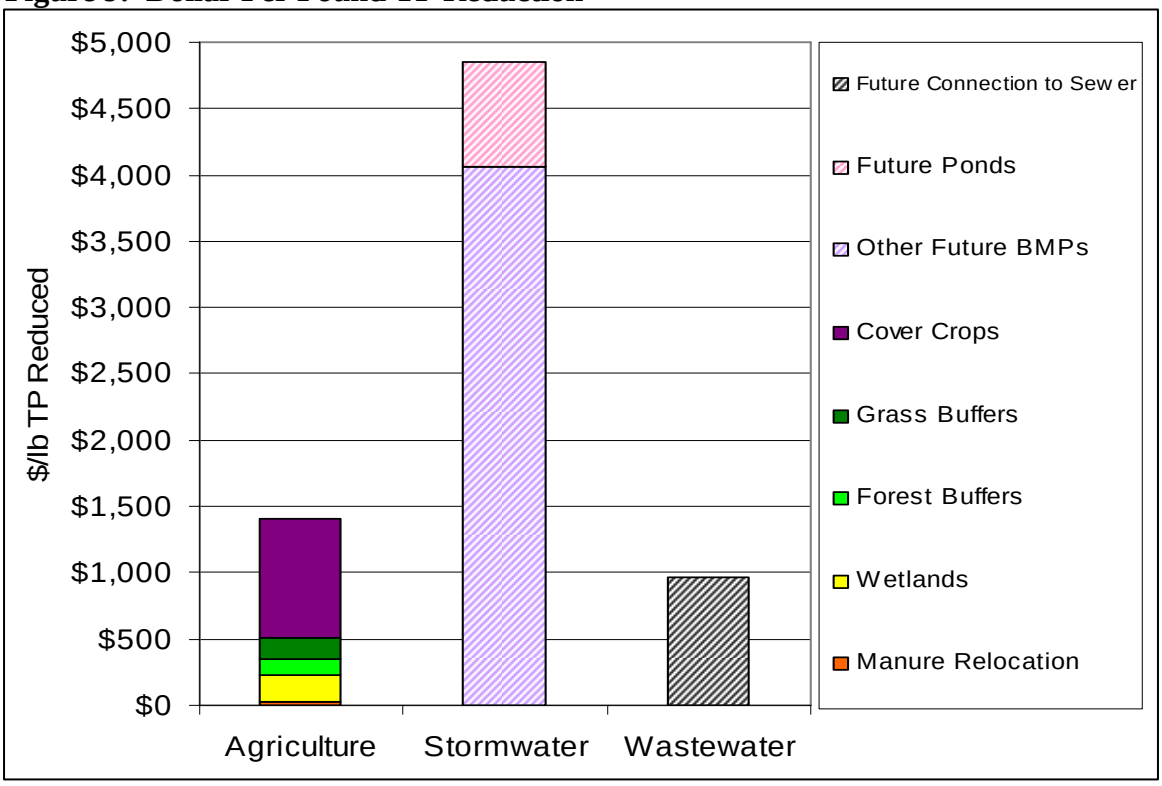


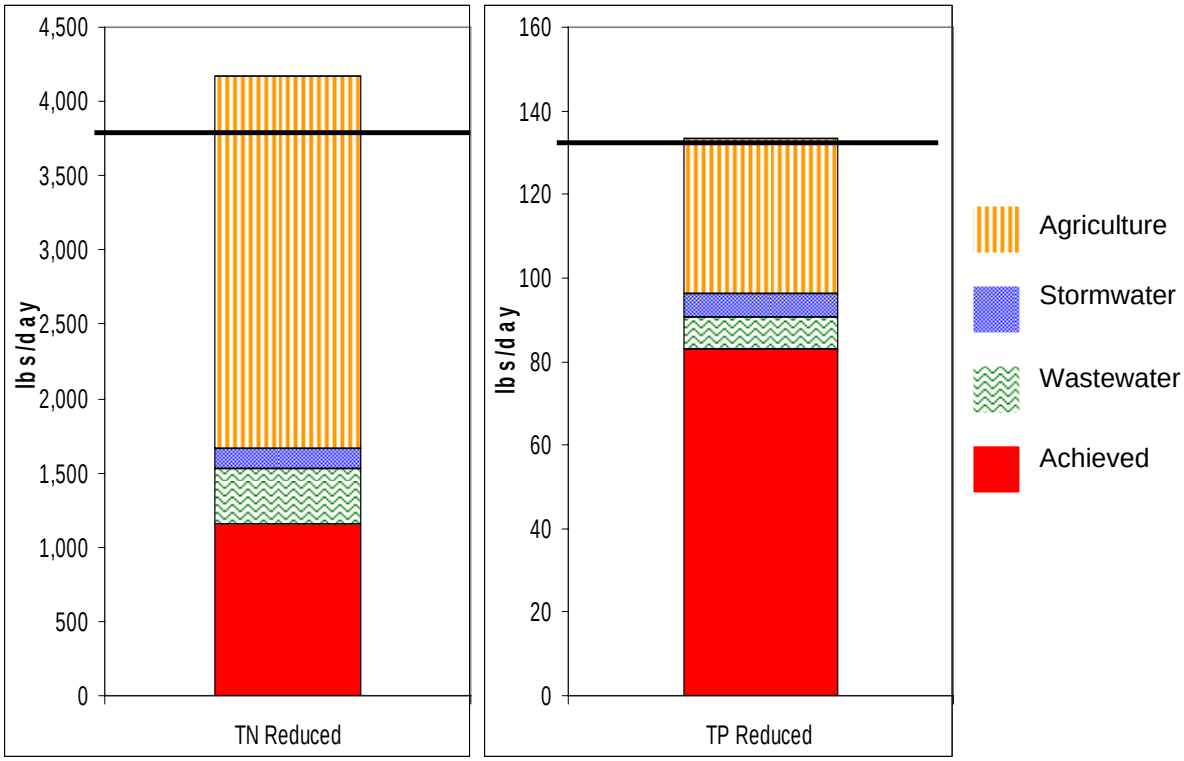

**Figure 9: Dollar Per Pound TP Reduction**



The Strategy could not only be comprised of the actions within these three sectors with which we had nutrient load reduction efficiencies. Land values in the Inland Bays Watershed continue to increase. Thus, the Strategy needed a component that addressed how these former agricultural, forest and barren lands would be developed. The section on Urban Land Use sets out actions that will ensure that as these lands with agricultural BMPs are converted to other uses, that BMPs are required to be implemented, and ensuring achievement of the TMDL and water quality standards.

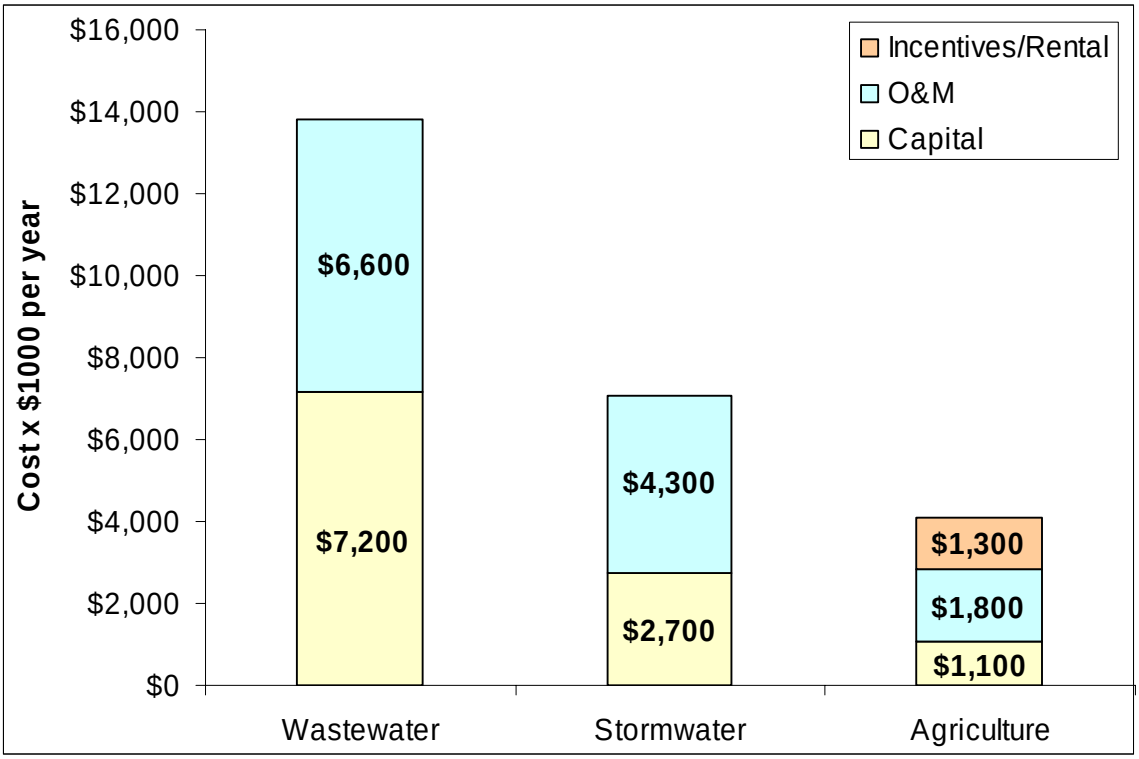
Overall, the Strategy will likely achieve the TMDL, as depicted in Figure 10. Additionally, many of the actions in this Strategy do not have nutrient loading reduction estimates associated with these actions (reduced home fertilizer usage, increases in open space). This provides an adequate margin of safety.

**Figure 10: Pollution Control Strategy's Progress Towards TMDL Implementation**




Implementing this Pollution Control Strategy will cost at least twenty-five million dollars per year. This figure includes annualizing the over $169 million needed in capital expenditures plus annual operation and maintenance costs of various Best Management Practices. Figure 11 shows the annualized capital, annual operation and maintenance, and annual rental and incentives fees for each sector. Costs associated with wastewater strategies are the greatest in both the capital and operation and maintenance areas.

**Figure 11. Annual Costs By Sector**




Every effort has been made to make the Strategy fair and equitable. It impacts everyone in the watershed given that all activities contribute to nutrient loading. And, it attempts to take cost into consideration through promoting the least expensive actions and cost-share for those actions that are more expensive. The Department intends to review the Strategy in 10 years and update it if further actions are needed to improve water quality.

## IMPLEMENTATION PROGRAMS

Pollution of the Indian River, Indian River Bay, Rehoboth Bay and Little Assawoman Bay did not happen over a short period of time, nor did it only happen due to the actions of a few people. Thus, implementing the Pollution Control Strategy will necessitate participation from a broad variety of programs, agencies, non-profit and community organizations. These programs will provide technical, financial and administrative assistance in the effort to clean up these waters.

### *Center for Inland Bays CCMP*

The Delaware Center for the Inland Bays was established as a nonprofit organization in 1994 under the auspices of the Inland Bays Watershed Enhancement Act (Title 7, Chapter 76). The Center's mission is "to oversee the implementation of the Inland Bays Comprehensive Conservation and Management Plan (CCMP) and to facilitate a long-term approach for the wise use and enhancement of the Inland Bays Watersheds by conducting public outreach and education, developing and implementing conservation projects, and establishing a long-term process for the preservation of the Inland Bays Watersheds." The Center receives federal funds for coordinating implementation of the federal CCMP, and raises private grant money to support educational activities, research, restoration and land acquisition efforts. The CCMP addresses action plans in five targeted areas including (1) Education and outreach; (2) Agricultural sources; (3) Industrial, municipal and septic system use; (4) Land use; and (5) Habitat protection.

### *Coastal Nonpoint Program-6217*

The Coastal Nonpoint Program was established by Congress in 1990 under section 6217 of the Coastal Zone Act Reauthorization Amendments (CZARA) to ensure that coastal States have the tools needed to address polluted run-off. A consistent set of management measures was established for States to use in controlling polluted runoff. Management measures are designed to prevent polluted runoff resulting from a variety of sources. The program includes enforceable policies and mechanisms to ensure implementation of the measures. The Delaware Coastal Nonpoint Program is administered in the State of Delaware by the Delaware Coastal Programs in the Division of Soil and Water Conservation of the Department of Natural Resources and Environmental Control. Delaware's Coastal Nonpoint Program is a networked program with implementation responsibilities distributed throughout the State. The Delaware Coastal Programs receives an annual award used to aid in the implementation of management measures, program initiatives and the funding of grants for projects designed to preserve and protect Delaware's waterways from the degradation of nonpoint source pollution. Through cooperative efforts with both government agencies and local organizations, numerous projects have been designed and funded to help address issues concerning nonpoint source pollution in Delaware. Examples of these projects/programs include:

- Tracking & Monitoring System - Developing an integrated information system to monitor and assess progress on nonpoint source pollution control in Delaware.
- Onsite Inspection Pilot Program - Supporting proper inspection and maintenance of on-site wastewater disposal systems.

- Delaware Riparian Buffer Initiative - Developing tools to help conservation planners prevent erosion and water pollution with riparian buffers.
- Working to develop a Delaware Clean Marina Program - A voluntary program that will challenge marinas to identify opportunities and implement practices to reduce and control pollution associated with boat operations and facilities management.
- Monitoring of innovative stormwater practices - Water quality monitoring of multi-cell vegetated systems designed to capture sediment and other pollutants from stormwater that would otherwise enter neighboring waterways.
- System-Wide Monitoring Program - Designed to support nonpoint source pollution control programs by establishing local networks of continuous water quality monitoring stations in the St. Jones and Blackbird Creek Watersheds.

***The Delaware Forest Service***

The Delaware Forest Service is a section of the Delaware Department of Agriculture and is charged to improve and enhance the state rural and urban forest resources. Listed below is a brief summary of each of the major programs that directly impact the implementation of the TMDL strategy for the Inland Bays Watershed.

*Forest Conservation*

Urban and Community Forestry

Delaware's Forest Service staff, through the Urban and Community Forestry (U&CF) program, provides technical, educational and financial assistance to cities, towns, communities, developers and local governments to develop a community forestry management plans and resource evaluation studies. Foresters also review new planned subdivisions in order to conserve forest resources. Additionally, the U&CF Program provides annual grant assistance to a variety of partners to provide both tree planting and tree care activities.

Watershed & Landowner Assistance

Our professional foresters help private and public landowners to improve their forest resources through a variety of services. This technical assistance encompasses a wide range of forest management activities including reforestation, timber stand improvements, timber harvesting and forest management plan development.

Wild-land Fire

Forest Service staff work to provide technical assistance to communities and civic associations to better manage invasive plant species which are prone to wild-land fire. Staff work to develop management plans to reduce these dangers. In addition, the forest service provides financial assistance in the form of cost share grants to remove and reduce these hazard fuels within the community.

***Ground Water Discharges Section***

Located within the Division of Water Resources, the Ground Water Discharges Section is responsible for overseeing all aspects of the siting, design and installation of on-site

wastewater treatment and disposal systems (septics). This is a three step process which includes the site evaluation, the design/permit application and the construction/installation of the system. The Small Systems Permitting Branch reviews and approves site evaluations, permit applications and conducts inspections of system installations. Experimental/Alternative Technologies and Advanced Treatment Units are approved and permitted for use by the Large Systems Permitting Branch. The Section is also responsible for the permitting of underground injection wells, large spray irrigation wastewater systems, and other means associated with land application wastewater treatment. The Section also issues waste transporter permits and licenses to designers, percolation testers, site evaluators and system installers.

***Ground Water Protection Program***

This program is responsible for providing technical review of permit applications for non-hazardous waste sites (i.e. large septic, wastewater spray irrigation, sludge application) and for water well permit applications where wells are located near problem sites. Staff hydrologists conduct investigations based on public complaints of ground-water quality, often associated with domestic water wells. In addition, this program oversees the Coastal Sussex Saltwater Monitoring Network and the Potomac Aquifer Saltwater Monitoring Network which monitor sensitive coastal aquifers for saltwater intrusion.

***Inland Bays Tributary Action Team***

During the autumn of 1998, the Center for the Inland Bays initiated a Tributary Strategy Program. Local stakeholders (industry, agriculture, municipalities, golf courses, citizens, etc.) from each of the Inland Bays Watersheds (Rehoboth Bay, Indian River Bay, and Little Assawoman Bay) were organized into three "Tributary Action Teams." The Teams created a body responsible for providing guidance and direction to the Center for the Inland Bays in its mission to reduce nutrient contributions and restore habitat in Delaware's Inland Bays. Since January 1999, the Tributary Action Teams have been involved in a coordinated effort with the Department of Natural Resources and Environmental Control (Department) to develop Pollution Control Strategies to meet the required Total Maximum Daily Loads (TMDLs) for nitrogen and phosphorus in the Inland Bays. In order to accomplish this, Public Talk – Real Choices, was developed and is being applied to this program by the University of Delaware's Cooperative Extension Agency, which is co-facilitating the process with the University's Sea Grant Marine Advisory Service. The purpose of Public Talk – Real Choices is to move formulation and creation of a major public policy decision from a public agency (the Department) to the public for deliberation and dialogue. Using deliberative dialogue as the core, Public Talk goes further by engaging the public in learning about the issue, framing it for deliberation, deliberation, weighing the costs and consequences of choices, coming to public judgment, and making decisions. It is not a model which engages a small group to simply make recommendations to a public agency that subsequently "sells" the policies to the public via public workshops and public hearings. The Inland Bays Tributary Action Teams have offered two sets of Pollution Control Strategy recommendations to the Department for review and consideration.

***Inland Bays/Atlantic Ocean Whole Basin Management***
The Delaware Department of Natural Resources and Environmental Control has been implementing a different type of approach to assess, manage and protect Delaware's natural resources. This approach, known as Whole Basin Management, encourages the various programs from throughout the Department to work in an integrated manner to assess different geographic areas of the State defined on the basis of drainage patterns.

***Local Governments***
County and municipal governments have the authority to enact ordinances to further the goals of this Pollution Control Strategy. They are all required to complete Comprehensive Plans and address how they intend on assisting in the implementation of the TMDLs. Many of these entities have ordinances that require buffers, open space and maximum impervious coverage – ordinances that work towards achieving water quality standards. Municipalities within the TMDL watershed include: Bethany Beach, Dagsboro, Dewey Beach, Fenwick Island, Frankford, Henlopen Acres, Lewes, Millsboro, Millville, Ocean View, and Rehoboth Beach. Sussex County has also been responsible for the growth of central sewer in the watershed.

***Nonpoint Source Program- 319***
The Delaware Nonpoint Source Program (NPS) administers a competitive grant made possible through Section 319 of the Clean Water Act. It is housed under the Division of Soil and Water Conservation within the Department of Natural Resources and Environmental Control. The grant provides funding for projects designed to reduce nonpoint source pollution in Delaware. NPS pollution may be defined as any pollution that originates from a diffuse source (such as an open field or a road) and is transported to surface or ground waters through leaching or runoff. Reduction of NPS pollution may often be achieved through incorporation of specific best management practices (BMPs) into operation plans. Projects may target any source of NPS pollution, but most frequently involve agriculture, silviculture, construction, marinas and septic systems. Proposals are reviewed and evaluated, and those which are determined to meet specific requirements are eligible for funding. All projects must include matching funding from a non-Federal source totaling at least 40 percent of the overall project cost. In addition to funding projects that achieve reductions in NPS pollution, the Delaware NPS Program is committed to addressing the issue through educational programs, publications and partnerships with other organizations working to reduce NPS pollution in Delaware.

***Nutrient Management Commission***
The Delaware Nutrient Management Program was established as a result of the Delaware Nutrient Management Law. The Delaware Nutrient Management Commission (DNMC) was established to direct the program and develop regulations pertaining to nutrient management, waste management for Animal Feeding Operations (AFOs) and National Pollutant Discharge Elimination System (NPDES) permits for concentrated animal feeding operations (CAFOs). The DNMC manages activities involving the generation and application of nutrients in order to help maintain and improve the quality of Delaware’s ground and surface waters and to help meet or exceed federally mandated

water quality standards, in the interest of the overall public welfare. All persons who operate an animal feeding operation in excess of 8 animal units (1 AU = 1,000 pounds) and/or control/manage property in excess of 10 acres where nutrients are applied must develop and implement a nutrient management or animal waste plan. The DNMC provides cost assistance programs, education programs, certifications and investigation of complaints.

***Office of State Planning Coordination***

The mission of the Office of State Planning Coordination (OSPC) is "the continuous improvement of the coordination and effectiveness of land use decisions made by state, county and municipal governments while building and maintaining a high quality of life in the State of Delaware." Under the new PLUS (preliminary Land Use Service) process, the OSPC will bring together State agencies and developers early in the development process in order to try to identify and mitigate potential impacts. The OSPC also supports the Governor's "Livable Delaware" initiative and has published *Better Models for Development in Delaware* that includes many Best Management Practices which will be needed in order to achieve the TMDL.

***Sediment and Stormwater Program***

The Sediment and Stormwater Program is managed by the Division of Soil and Water Conservation in the Department of Natural Resources and Environmental Control. Delaware's stormwater management program requires sediment control during construction and post-construction, stormwater quantity and water quality control. This program functions from the time construction begins through a project's lifespan. It requires construction and development projects to obtain sediment control and stormwater management plan approval, be inspected during construction, and a post-construction inspection of permanent stormwater facilities and education and training. The program's initial emphasis is to prevent existing flooding or water quality from worsening and limit further degradation until more comprehensive, watershed approaches (as detailed in State legislation and regulations) are adopted. Current regulations require stormwater management practices to achieve an 80 percent reduction in total suspended solids load after a site has been developed. This is achievable with present technology. Long-term removal rates over 80 percent may require other measures, such as water re-use, which may be required locally. In Delaware, day-to-day inspection responsibilities are handled by the delegated local agency, but projects where site compliance is not possible are handled by the State with progressive and aggressive enforcement, including civil and criminal penalty provisions.

***Soil and Water Conservation Districts***

County Conservation Districts were created by State law and are administered through Delaware Natural Resources and Environmental Control. They operate the State Conservation Cost Share Program which provides funds for installation of agricultural management practices, promote the State Revolving Loan Fund Program for poultry producers (low-interest loans to implement best management practices or BMPs) and are the delegated agencies for the Sediment and Stormwater Management Program carrying out plan review and field inspections in their respective counties. Watersheds prioritized

by Delaware's Nonpoint Source (Section 319) Pollution Program can be targeted by these activities.

***Source Water Protection Program***

The Source Water Protection Program (SWPP) has been delegated to the DNREC and is managed by the Water Supply Section of the Division of Water Resources. This program was created from the 1996 Amendments from the Safe Drinking Water Act. The SWPP is responsible for determining the locations of water supplies used for ***public*** drinking water. In the Inland Bays Watershed these drinking water sources are comprised totally of wells (242 in total). The program is also responsible for mapping the wellhead protection areas (those areas around a well or group of wells from which a source obtains its water), locating the existing and potential sources of contamination to drinking water within those delineated areas, and determining the susceptibility of the drinking water source to contamination. The SWPP is required to make this information available to the public and does so through the program's website: http://www.wr.udel.edu/swaphome/index.html.

Because approximately 60-percent of all Delawareans state-wide (and 100-percent within the basin) use ground water as their source of drinking water, the Department of Natural Resources and Environmental Control and the Delaware Geological Survey undertook the task to map those areas which contribute recharge to the aquifers which supply water to wells. The mapping of these areas began in 1988 in New Castle County and was completed in 2001 for the counties of Kent and Sussex. Recharge areas have been mapped as *excellent* in all three counties and as *good, fair, and poor* in both Kent and Sussex counties. Excellent ground-water recharge areas are those areas where ground water is most easily transmitted vertically through the first twenty feet of soils and sedimentary deposits to the water table aquifer. These soils tend to have greatest ratio of sands to clays in them and most readily allow for the introduction of contaminants to the water table aquifer in the event of a spill or release. The Inland Bays Watershed contains approximately 6% of areas considered excellent ground-water recharge areas.

Through the Source Water Protection Law of 2001, the SWPP has been charged with the development of a guidance manual for the protection of source water areas (which include both wellhead protection areas and areas of excellent ground-water recharge). This manual was developed to give (the counties and those municipalities containing 2000 or more persons) ideas on methods that could be used to protect those areas by the year 2007.

***Surface Water Discharges Program***

The Surface Water Discharges Program is delegated to the Division of Water Resources in the Department of Natural Resources and Environmental Control. Program administrators are responsible for eliminating pollutant discharges into State surface waters by issuing regulatory permits under the National Pollutant Discharge Elimination System (NDPES). An NPDES permit legally sanctions the discharge of substances that may become pollutants. However, the NPDES permit is designed to limit the discharge of those substances so that there will be no adverse effect on the quality of the receiving

waters or interference with the designated uses of those waters. The health of a water body is measured by its attainment of designated uses. If potential pollutants in a NPDES discharge are reduced to levels that allow receiving waters to meet applicable designated uses, then, in effect, the pollutant discharge has been eliminated. For example, a freshwater stream could have designated uses of "protection of aquatic life" and (human) "drinking water." A chloride discharge to that stream is a pollutant since it could adversely affect freshwater organisms and drinking water quality. The same chloride discharge is likely not a pollutant when discharged into a saltwater body. Saltwater species are accustomed to chlorides, and the water body is not used for human drinking water.

Municipal sewage treatment or industrial plants that discharge wastewater to surface waters of Delaware are issued permits specifying discharge limitations, monitoring requirements and other terms and conditions that must be met to be allowed to discharge. In addition to wastewater, wastewater facilities often generate a waste sludge solid that is also an NPDES discharge under federal and State regulations. The NPDES General Permit for "stormwater discharges associated with industrial activities," a single permitting regulation with requirements that apply to a group of similar dischargers, e.g., truck maintenance operations, is also issued to industrial sites that discharge only stormwater.

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