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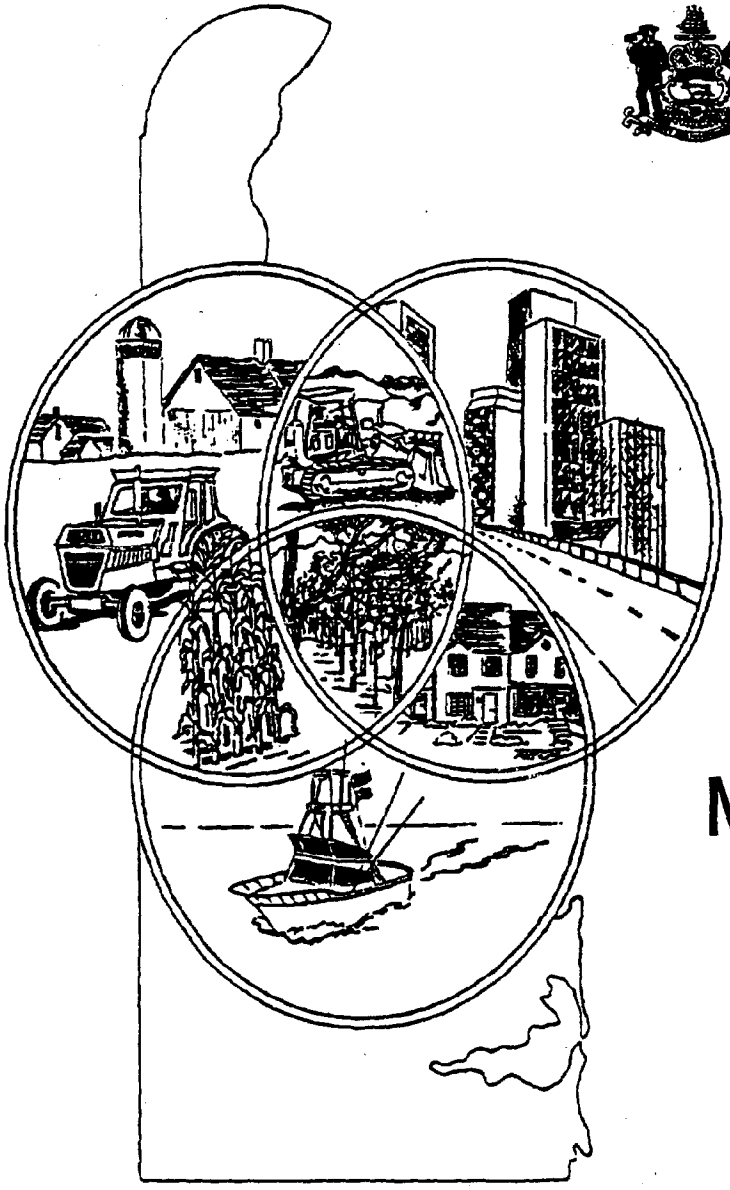
STATE OF DELAWARE



NONPOINT SOURCE POLLUTION MANAGEMENT PROGRAM

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DEPARTMENT OF NATURAL RESOURCES
AND
ENVIRONMENTAL CONTROL

AUGUST 4, 1988

AUTHENTICATED
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PREFACE

Nonpoint source pollution is caused by diffuse sources varying from homeowners fertilizing lawns to toxic spills to hazardous wastes leaching into ground water. There is not a single act or individual causing the pollution but a series of activities occurring, sometimes over decades which cumulatively creates a serious problem. Most nonpoint source pollution can be addressed through the following: Education, Research, Technical Assistance, Financial Incentives and Regulation. Delaware supports a balanced approach first before nonpoint source pollution controls enter a maze of regulations.

The implementors of a nonpoint source pollution management program number in the thousands, from the teacher giving a conservation lesson, farmers talking with one another, to industries providing safe transportation for hazardous chemicals. There is no way for a management program to keep track of all of these activities, but the program can help provide resources to facilitate the job. In addition, the management program is designed as open ended and requires a yearly update. These updates will reflect new nonpoint source pollution management initiatives.

Nonpoint source pollution is serious in Delaware. Our surface and ground waters are being polluted and the problem must be addressed. Delaware's Nonpoint Source Pollution Management Program provides a coordinated approach to undertake this difficult task.

Acknowledgements

The Department of Natural Resources and Environmental Control especially thanks the more than 40 members of the Advisory and Review Committee for their time and interest in developing Delaware's Nonpoint Source Pollution Management Program (NPSP).

A special thank you is given to Marianne Hardesty and Dorothy Abbott-Donnelly of the USDA, Soil Conservation Service for assisting with this plan. Since the NPSP management plan relies strongly on Delaware's Clean Water Strategy and the Environmental Legacy Report a thank you is also given to Carol Webb and Robert MacPherson the primary editors of these documents. Without everyone's assistance the task could not have been done.

DELAWARE

NONPOINT SOURCE POLLUTION

MANAGEMENT PROGRAM

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DELAWARE

NONPOINT SOURCE POLLUTION MANAGEMENT PROGRAM

ABBREVIATIONS

ASCS	-	Agricultural Stabilization and Conservation Service
BMP	-	Best Management Practice
CD	-	Conservation Districts
CES	-	Cooperative Extension System
CZM	-	Coastal Zone Management Program
DACD	-	Delaware Association of Conservation Districts
DAS	-	Development Advisory Service
DEL DOT	-	Delaware Department of Transportation
DGS	-	Delaware Geological Survey
DOA	-	Department of Agriculture (Delaware)
DNS	-	Delaware Nature Society
DNREC	-	Department of Natural Resources and Environmental Control (Delaware)
DSWC	-	DNREC Division of Soil and Water Conservation
DSWA	-	Delaware Solid Waste Authority
DWR	-	DNREC Division of Water Resources
EPA	-	Environmental Protection Agency
FAC	-	Food and Agricultural Council
FmHA	-	Farmers Home Administration
GIS	-	Geographic Information System
NPSP	-	Nonpoint Source Pollution
NWQA	-	National Water Quality Assessment
RMS	-	Resource Management System
SCS	-	Soil Conservation Service
TEAM	-	Total Environmental Application Management
U of D	-	University of Delaware
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey
WRA-NCC	-	Water Resources Agency of New Castle County

INTRODUCTION

The Water Quality Act of 1987 (Section 319) requires each state to develop programs to control nonpoint sources of pollution of both surface and ground waters. Nonpoint source pollution (NPSP) has been defined as "pollution caused by diffuse sources" and as such:

> "is associated with agricultural, silvicultural, urban runoff, runoff from construction activities, etc. Such pollution results in the human induced alteration of the chemical, physical, biological and radiological integrity of water. In practical terms, nonpoint source pollution does not result from a discharge at a specific, single location (such as a pipe) but generally results from land runoff, precipitation, atmospheric deposition, or percolation. Pollution from nonpoint sources occurs when the rate at which pollutant materials entering water bodies or ground water exceeds natural levels (U. S. Environmental Protection Agency, 1987)."

The nonpoint source pollution management program is a dynamic program which will be revised as new information, needs and implementation methods are identified. The following goals were developed to guide this open ended working program.

GOALS: NONPOINT SOURCE POLLUTION MANAGEMENT PROGRAM

1. The NPSP Management Program will continue to identify and quantify those problems that are caused specifically by nonpoint source pollution through annual assessment updates.
2. The NPSP Management Program will be implemented and updated to realistically reduce nonpoint source pollution in a cost-effective manner.

3. The NPSP Management Program will address nonpoint source pollution through a program that balances education, technical assistance, financial incentives, research and regulations.
4. The NPSP Management Program will follow a non-degradation policy in areas where surface and ground water meet state water quality standards and a policy to realistically improve water quality in areas that do not meet these standards.
5. The NPSP Management Program will continue to use the coordinated approach for implementation and maintain an open-ended framework to incorporate new initiatives.

Many initiatives have been started in Delaware to address nonpoint source pollution. Initiatives were started under the EPA's 208 program, Delaware Conservation Districts, the Delaware Coastal Zone Management Program, the USDA, Soil Conservation Service's Watershed Program, specific legislation and hundreds of other efforts which can be used to build a comprehensive nonpoint source management program. Recent accomplishments include Delaware's Environmental Legacy Report, the Inland Bays Program, revisions to the comprehensive land use plans in all three counties and expansion of many on-going programs. Where appropriate, these existing programs will be incorporated into the NPSP management plan.

Delaware's nonpoint source management program is based on five components:

1. Education
2. Research
3. Technical Assistance
4. Financial Incentives
5. Regulation

Though Delaware has been addressing nonpoint source pollution for many years, until now no formal identification of the overall nonpoint source pollution problem has been documented nor has a comprehensive management program been developed. Under the Clean Water Act of 1987, states are required to submit to the Environmental Protection Agency (EPA) their Nonpoint Source Pollution Assessment report and Management Program by August 4, 1988. The complexity of this task is evidenced in the 1988 State of Delaware Clean Water Strategy, which includes Delaware's Environmental Legacy Report, and are part of the NPSP Assessment Report.

In Delaware, the lead agency for developing a nonpoint source pollution control program is the Department of Natural Resources and Environmental Control (DNREC). The Division of Soil and Water Conservation and the Division of Water Resources worked closely with other resource agencies in developing a Comprehensive Management Program. The Division of Soil and Water and the local conservation districts were designated to carry out the program for agricultural activities, woodland areas, urbanized areas and construction sites and would compliment the implementation of the Clean Water Strategy by the Division of Water Resources utilizing a balanced approach of implementing procedures.

The "Delaware Nonpoint Source Pollution - Assessment Report" quantifies the effects of nonpoint source pollution on the State's surface and ground water resources. The assessment is further expanded by the April 1988 - 305b report - 1988 Delaware Water Quality Inventory published by the DNREC. The Assessment Report highlights existing programs which already address nonpoint source pollution. Details of these existing programs are given in the April 1988 Clean Water Strategy for the State of Delaware and are expanded in this management program document. In addition, the Assessment Report examines the process to be used for the identification of best management practices (BMP's) to reduce nonpoint source pollution.

The Assessment Report utilized a landuse/loading-based model to evaluate surface water impacts and a source/risk assessment-based model to predict ground water effects. Individual drainage basins were ranked to provide priorities for remediation actions.

The Assessment Report concluded that ground water (the drinking water source for 60% of Delaware's population) quality is affected by nitrates from septic systems, farm and lawn fertilizers, and animal wastes, by toxics from landfills and waste lagoons, pesticides, and saltwater intrusion as well as many other factors. Surface waters are affected mainly by pathogens, nutrients and toxics generated by land disposal activities, agricultural and urban runoff. To a lesser degree, surface waters are affected by sediment, pesticides, oxygen demanding materials and physical habitat alteration due to construction, agriculture, land disposal of wastes and/or urban runoff.

NPS pollution is easily transported between surface and ground waters. Delaware's surface and ground water are very much interconnected because of the large areas of sandy soils. Because of this interconnection, groundwater is a concern in the use of any non-point source pollution management strategy.

The "Delaware Nonpoint Source Pollution - Management Program" builds upon the Assessment Report and gives a management framework to accomplish certain goals over the next four years. The Management Program was developed through the use of two committees, the Working Committee and the Advisory and Review Committee. The Working Committee consists of representatives from the Department of Natural Resources and Environmental Control, the State Department of Agriculture; the USDA Soil Conservation Service; and the Delaware Association of Conservation Districts (DACD). This committee met about bi-weekly to develop the strategy for the program. The Advisory and Review committee consists of over 40 local agencies and organizations involved in water quality concerns. The Advisory and Review Committee met as needed to review drafts and

provide broad based guidance. The committee's are listed in the beginning of the document.

Three major watersheds of Delaware include the Chesapeake Bay, Coastal Sussex (Inland Bays) and the Delaware Bay. All three of these watersheds have major programs in the planning or implementation stages and are involved with the National Estuary Program. Delaware is also active in EPA's Near Coastal Waters Initiative and Clean Lakes Program and intends to coordinate its nonpoint source management program with these existing programs.

Delaware has subdivided the three major watersheds into 30 smaller watersheds. Because of Delaware's small size recordkeeping and NPSP tracking will be kept on a statewide basis and for specific demonstration areas. Several of the 30 watersheds have interested groups focusing attention on their problems and several are part of special projects such as EPA's Rural Clean Water Project, USDA's P.L. 566 projects, CZM Murderkill River Corridor Project, the Stream Watch Program, Clean Lakes studies and others. These special programs will be tied closely to this management program.

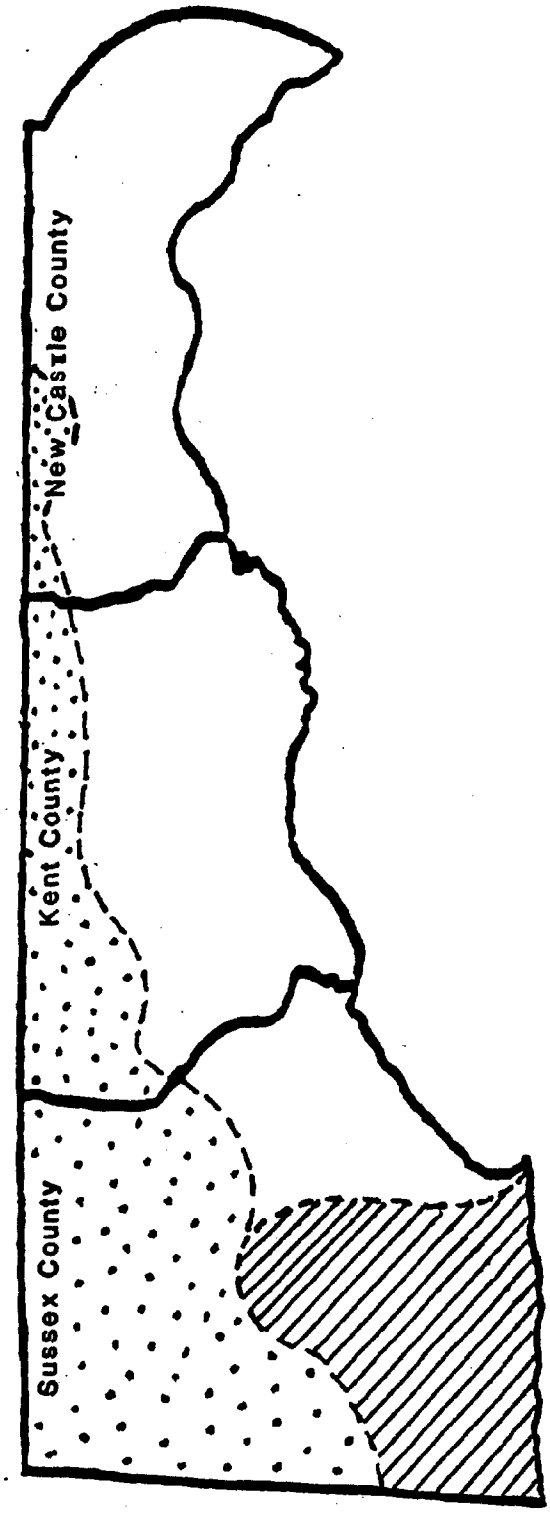
As the Advisory and Review Committee shows, Delaware is fortunate in being able to involve most statewide interest groups and affected parties. Through the interchange with these groups, a strong implementation mechanism exists. The NPSP Management Program takes advantage of existing structures and programs.

The Management Program has to be careful that it remains an implementing tool and a positive facilitator. Therefore, a balanced approach will be taken to involve the five program components; education, research, technical assistance, financial incentives and regulation.

Tremendous expertise and resources are already available to address many nonpoint source pollution problems in Delaware. Each current effort should be encouraged and managed in the NPSP Management Plan only to the extent that the effort can be helped through a comprehensive team approach. Regulations should

MAP #1

The State Of DELAWARE



MAJOR WATERSHEDS

Approximate Acres

= Delaware Bay (680,100 ac.)

= Coastal Sussex (186,450 ac.)

= Chesapeake Bay (399,370 ac.)

TOTAL STATE ACREAGE = 1,265,920

USDA - Soil Conservation Service (County Soil Survey), 1988

only be used to handle difficult or recalcitrant situations after other efforts have failed.

The Delaware NPS Management Program uses a Resource Management Systems approach to implement Best Management Practices. The statewide problems identified in the Assessment Report were divided into two broad categories labeled rural and urban. Rural NPS pollutants were identified as a resulting from on-site septic systems, land disposal of wastes, agricultural and forestry activities. Urban NPS pollutants were identified as resulting from the complex urban environment of roads, construction, residences, industrial lands and others. The urban landscape may contribute a wide variety of pollutants including sediments, fertilizers, pesticides, toxics and organics.

The Management Program was developed using the information from the Assessment Report, along with background information on rural and urban nonpoint source pollution. This document identifies targeted high priority watersheds, NPSP demonstration projects, proposes an implementation framework and gives a schedule containing annual milestones to initiate a comprehensive NPSP management program for the State of Delaware.

RESOURCE MANAGEMENT SYSTEMS

To address nonpoint source pollution in Delaware, practices which will best address a water quality problem can be identified. Thus the term a "Best Management Practice" or BMP was coined. But, often one BMP does not address the entire problem and a combination of BMPs is needed. For this reason, "Resource Management Systems" (RMS) which are combinations of conservation practices that meet the resource needs and the land user's objectives are used. The RMS are "designed to protect, restore or improve the total resource base including soil, water, air, plant and animal resources and are identified by the primary use of land or water (USDA, SCS, 1987)." RMS have already been developed for many rural and urbanizing land uses and are documented by the USDA, Soil Conservation Service. Listed below are definitions of Delaware land uses that have been identified as possible sources of nonpoint source pollutants.

CROPLAND - Land that is primarily used for the production of adapted, cultivated and close growing crops for harvest alone or in rotation with sod crops.

FARMSTEADS - Land that is primarily used for dwellings, barns, pens, corrals, gardens, and other uses in connection with operating farms. This includes greenhouses, mushroom houses, feed lots and agricultural waste storage systems.

FOREST LAND - Land that is primarily in tree cover that may be used to produce wood crops, provide tree cover for watershed protection, beautification, wildlife cover, etc.

PASTURELAND - Land that is primarily used for the production of adapted domestic forage plants for livestock grazing.

URBAN LAND - Land that is in the process of being converted to or is used for commercial, industrial, community services, residential and/or transportation purposes.

MINED LAND - Areas used for the mining of minerals. This designation is to be applied to abandoned lands that have been disturbed for mining as well as those that are active. Examples are quarries and borrow pits.

Appendix A describes the common Resource Management Systems used in Delaware. The relationship between major nonpoint source pollution categories, resource management systems, conservation practices and best management practices is partially shown below in Figure 1.

Major Nonpoint Source Pollution Categories	Resource Management System	Conservation Practice(s)	Samples of Best Management Practice(s)	
AGRICULTURE	CROPLAND	Fertilizer Management 1/	- soil test for nutrient needs - calibrate equipment - fertilize for yield goals	- time application - split application
		Pesticide Management 1/	- use pest specific chemicals - apply chemical at proper time - apply chemical at label rates - integrated pest management	- watch weather conditions - dispose of container properly - calibrate spray equipment - manage spills and wastewater
		Conservation Cropping Sequence 1/	- crop rotation	- cover and green manure crop
		Conservation Tillage System 1/	- reduced tillage - no-tillage	- minimum tillage - crop residue use
		Irrigation Water Management 1/		
		Structure for Water Control 1/		
		Terrace 1/		
		Grassed Waterway 1/		
		Water & Sediment Control Basin 1/		
	FARMSTEAD/HEADQUARTERS	Waste Management System 1/	- waste storage structure - waste utilization - waste storage pond - waste treatment lagoon	- roof runoff management - filterstrips - effluent spray irrigation
	PASTURELAND	(Pasture/Hayland Planting)	- fertilize management - soil test for nutrient needs	- pesticide management
		(Pasture/Hayland Management)	- intensive grazing - pesticide management	- manure management - livestock exclusion
SILVICULTURE	FOREST LAND	Woodland Improved Harvesting	- preharvest assessment & planning - proper harvesting practices - buffer strip	- regeneration cutting - residual tree protection
		Forest Land Erosion Control System	- proper harvesting practices - outsloping haul roads - woods/haul road maintenance	- environmental exclusion, i.e., harvesting during dry season only - skid trail and haul road closure
		Tree Planting	- site preparation	- species selection
		Wooded Corridor Management	- timber stand improvement - interplanting	- selective cutting

Figure 1

Major Nonpoint Source Pollution Categories	Resource Management System	Conservation Practice(s)	Samples of Best Management Practice(s)	
CONSTRUCTION (Highway/Road/Bridges)	TRANSPORTATION SERVICES LAND		- proper storage facility of deicing salts - vegetative erosion and sediment control measures - alternate snow removal techniques - water quality inlets - creation of traffic-free zones - public education - heavy-use area protection	- density restrictions in residential developments - reduction of number of vehicle trips in sensitive areas - incorporation of open spaces - regional and multi-use management measures - land-use planning
CONSTRUCTION	URBAN LAND	Runoff Management System 1/	- infiltration structures - vegetated swales - grassed waterways - filterstrips - artificial wetlands - porous pavement	- streambank/shoreline protection - slope stabilization - silt fence - stabilized construction entrance - sediment traps - critical area planting
RESOURCE EXTRACTION/ EXPLORATION/DEVELOPMENT	MINED LAND	(Land Reconstruction)	- land reclamation - sediment basins - guides to include water quality requirements	- diversion dike - critical area planting - well-head protection
URBAN RUNOFF			- artificial wetlands - flood prevention measures - catch basin cleaning - pet litter control	- critical area planting - urban forestry - fertilizer management - pesticide management
LAND DISPOSAL	COMMUNITY SERVICES LAND		- public information and education - state-of-the-art landfill operations - resource reclamation plant - energy generating facilities - erosion and sediment control	- composting operations - density of on-site systems - rural wastewater policy - reduction of land application rates
HYDROLOGIC/HABITAT MODIFICATION			- erosion and sediment control	- public education and information
OTHER (Atmospheric Deposition)			- restriction of certain pollutant containing building materials - reduction of smoking in public facilities - emission control on heating devices - public information and education - regional pollution reduction programs	- gasoline vapor capture devices on automobiles - restriction on certain paints, adhesives and solvents - restriction on water & wastewater treatment & disposal facilities - building code uniformity as to ventilation and circulation

1/ Indicator Practices

Conservation practices for both rural and urban management systems have been developed by the USDA, Soil Conservation Service in conjunction with the USDA, Cooperative Extension System, the USDA - Agricultural Stabilization and Conservation Service and local conservation districts. These rural and urbanizing practices have been developed over many years and are being continually revised as part of the USDA - Soil Conservation Service Technical Guides for Delaware.

Other urban Best Management Practices (BMPs) noted in the NPS Management Program for Delaware are a product of personal communications with various local, state and federal agencies; such as Delaware Department of Transportation, Delaware Department of Agriculture, local Soil Conservation Districts, County Government Offices, Delaware Department of Natural Resources and Environmental Control, University of Delaware Specialists, Delaware Geological Survey, Dover Air Force Base and Delaware Solid Waste Authority. State, local and federal programs were utilized for consistency throughout this program and included:

- 1980 Delaware Erosion and Sediment Control Handbook
- 1987 Delaware Septage Management Plan
- 1987 New Castle County Water Resource Protection Area Progress Report
- Delaware's 1988 Environmental Legacy
- Delaware's 1987 Plan of Action for Assuring Hazardous Waste Disposal Capacity
- Delaware's 1986 Report on Reasonable Further Progress Toward the Attainment of the National Ambient Air Quality Standard for Ozone
- New Castle County's 1977 Stormwater Management Plan
- 1987 Septic System Regulations: New Castle County
- 1973 New Castle County Drainage Code
- 1988 Delaware Water Quality Inventory
- 1988 Delaware's Clean Water Strategy
- 1987 Delaware's Groundwater Management Plan

Along with these references other out-of-state publications were used in the development of the management program.

It is expected that urban BMPs and Resource Management Systems will be developed and refined as a result of the state's NPSP management program. By using the SCS technical guides and resource management systems approach, the state's NPSP program stays compatible with the traditional nationwide documentation of conservation practices. This will also be very important in coordinating our NPSP management program with other statewide conservation efforts.

RURAL NONPOINT SOURCE POLLUTION

As stated earlier, the rural nonpoint source pollutants result from agricultural activities and on-site septic systems. Rural land uses comprise 1,075,600 acres or 89% of Delaware's land area (USDA, SCS, 1982). The breakdown of rural land acreage is shown in Table 1.

TABLE 1

Rural Land Uses in Delaware

Acres	%	Land Use	Reference
521,104	48.5	Cropland	US Dept. of Commerce, 1982
376,387	35.0	Forest Land	USDA, Forest Service & Del. Dept. of Ag, 1987
88,617	8.2	Tidal Marsh	USDA, 1970, 1971, 1974
35,200	3.3	Pastureland	USDA, SCS, 1982
25,900	2.4	Rural Transportation	USDA, SCS, 1982
28,392	2.6	Minor Land Uses*	

* Includes farmsteads, housing <10 Ac, etc.

AGRICULTURE

The potential pollutants from agricultural activities are sediment, pesticides, fertilizers, agricultural wastes and land treatment of municipal wastes.

1. SEDIMENT

The rural land uses of cropland, forest land and pastureland may contribute sediments. Sediment when delivered to a waterway affects the water quality of surface waters in Delaware. Fine particles such as clays stay in suspension reducing the ability of light to penetrate water bodies and adversely impact the aquatic ecosystem. Biological systems are destroyed when heavy sediment loads physically bury the many living aquatic organisms. Reservoirs and stream channels filled with sediments cause flooding and degrade water quality and

drinking water supplies. Wetlands are often the site of sediment deposition when adjacent to crop fields.

A. CROPLAND - SEDIMENT

Table 2 lists the major crops and acreages planted in Delaware.

TABLE 2

Crops Grown in Delaware

Crop	Acreage Planted	Reference
Soybeans	245,000	DE Dept. of Ag., Stat. Service, 1986
Corn	180,000	DE Dept. of Ag., Stat. Service, 1986
Small Grain	125,000	DE Dept. of Ag., Stat. Service, 1986
Vegetables*	56,345	DE Dept. of Ag., Stat. Service, 1986
Hay	23,000	DE Dept. of Ag., Stat. Service, 1986
Orchards	1,218	DE OMBP, 1980
Nursery	1,092	US Census, 1982

*Includes melons and strawberries

Estimates of sheet and rill erosion and wind erosion which may occur on cropland were taken from the USDA - SCS National Resource Inventory. Streambank, gully and other types of erosion were estimated for the State of Delaware by a 1977 SCS Land Inventory. Erosion figures estimate amounts of sediments that move but do not indicate the amount delivered to the water bodies. Some sediments are deposited before reaching the stream, ditch or pond. It is estimated that 5% of the water borne sediments originating in the Delaware Coastal Plain are delivered to watercourses. In the Piedmont Region (the extreme north, about 48,000 acres of Delaware), 20% of cropland sediments are delivered.

Table 3 shows the cropland erosion figures for Delaware based on "T". "T" is the maximum annual soil loss before threatening the long term productivity of a soil. "T" values in Delaware range from 2 to 5 tons per acre, per year, per soil.

TABLE 3

Cropland Erosion Rates**

	<T	T>2T	>2T	Total
Wind erosion				
tons	238,500	469,300	232,700	940,500
acres	427,800	72,500	18,800	519,100*
tons/ac	.6	6.5	12.4	
Sheet erosion				
tons	642,000	186,100	213,900	1,042,000
acres	466,100	36,100	16,900	519,100*
tons/ac	1.4	5.2	12.7	

* Cropland acres total is 519,000 Acres in 1982 NRI

**USDA, SCS, 1982

These erosion rates can be greatly reduced by tillage practices, setting aside critical areas and other farm management practices.

Ephemeral gullies (gullies that reappear each year in the same area but are re-tilled) have been inventoried by SCS but no estimates are available at this time. However, they are common and contribute significant sediments because they act as direct stream tributaries and thus have a high delivery ratio.

Resource management systems that address erosion must be designed specifically to handle either wind or water related erosion. Cropland is eroded by water through sheet and rill, ephemeral gully, gully and streambank erosion. Sheet and rill erosion is barely detectable because only small amounts of the soil surface are removed. Ephemeral gullies are small gullies that are usually filled in by cultivation each year but then reappear in about the same location each year. Gullies are large and not crossable with farm equipment. Streambank erosion occurs on stream channels and ditches in response to flows, soil type, traffic and weathering.

Sheet and rill erosion can usually be controlled by using practices that add organic matter to the soil, such as crop residue management, conservation tillage, use of winter cover crops and/or crop rotations that leave large amounts of residue following harvest.

Delaware's soils are well adapted to the use of no-till and minimum tillage methods. Farmers have readily converted to these conservation tillage methods and in the process conserved many tons of soil from erosion. Delaware ranked first in the nation in 1987 for the percent of land under conservation tillage (74%) and first in the percentage under no-till (42%) (Conservation Tillage Information Center, 1987).

Ephemeral gullies may be controlled using the same methods as with sheet and rill erosion. Supplemental structural practices may also be required. Gullies may require the sheet and rill practices plus a construction practice such as a grassed waterway, diversion or a grade stabilization structure. Streambank erosion control may require structural measures or simply shaping, fencing or revegetation. Sometimes converting the cropland to a permanent vegetative cover is the solution for erosion.

Kent and Sussex Counties have reported wind erosion problems. Wind erosion occurs when erodible soil is exposed to strong winds. The amount of erosion depends on the unsheltered distance crossed by prevailing winds. Wind erosion's most evident damage is to the plants, especially young seedlings. However, the sediments are often deposited in streams and drainage systems that occur in the open parts of the field. Practices to reduce wind erosion include those that maintain crop residues on the surface plus conservation tillage and winter cover crops. Other practices include barriers that reduce unsheltered distances across fields such as wind barriers, windbreaks and hedgerows.

Irrigation of cropland is increasing especially on the southern sandy soils. An inventory done by SCS in 1984 for Delaware, identified about 57,800

acres being irrigated or approximately 11% of the cropland. Table 4 shows the breakdown by county.

TABLE 4

Irrigated Acres in Delaware - 1984

New Castle	1,597 Acres	3%
Kent	21,331 Acres	37%
Sussex	34,918 Acres	60%
Total	57,846 Acres	100%

In 1987, SCS estimated 50,000 acres are under irrigation in Sussex County. This is an increase of 43% from 1984. New Castle and Kent counties have had about a 15% increase. The majority of New Castle's (63%) and Sussex's (70%) irrigated acres are in grain where Kent's is in vegetables (75%).

Irrigation in Delaware is typically by sprinkler systems which may if poorly managed result in erosion. The National Resource Inventory of 1982 showed that 18% of the irrigated cropland was in need of erosion control. To protect water quality on irrigated cropland, proper timing and rates of water application are important. Improved systems which reduce the size and velocity of the water droplets are available.

Resource Management Systems that are commonly used to address cropland erosion and sediment problems are listed in Appendix A.

B. FOREST LAND - SEDIMENT

Forest land in Delaware accounts for about 376,400 acres or 35% of the rural land acres (USDA, Forest Service and Del. Dept. of Agriculture, 1987). According to preliminary survey results, there are approximately 13,400 acres are in state ownership, 29,000 acres are in forest industry ownership, with the remaining 334,000 acres in private, corporate and other ownership. There are 36,514 acres of forest land in non-industrial private and forest industry ownership which are certified under the American Tree Farm System. These forested areas or Tree Farms are privately owned lands which are recognized for

achievement and maintenance of excellence in forest management. To date, there are 111 Tree Farmers in Delaware. The Delaware Department of Agriculture, Forestry Section, manages 6700 acres of forest land statewide for wood production and other multiple uses (DE Dept. of Ag., Forestry Section, 1988).

Approximately 7,000 - 9,000 acres of forest land are harvested each year in Delaware. There exists potential for soil erosion and sedimenttion from forest land during timber harvesting, road building (for access, maintenance, fire control, recreational use, etc.) and other land-disturbing activities. The erosion potential is based on the site characteristics of the forest land, including soils, topography and slope, proximity to a water course, management/silviculture/harvesting techniques, and forest stand characteristics. Methods for prevention include design and location of skid trails, haul roads, and log landing; buffer or filter stirps along streams; seeding of skid trails, roadways and firebreaks; and stream crossings.

RMS that are commonly used to address forest land erosion and sediment problems are listed in Appendix A.

Naturally existing wooded stream corridors act as an erosion and sediment control practice. Management of these "buffer" areas should be stressed throughout conservation management plans. Restoration of these areas is another management tool to control nonpoint source pollution.

C. PASTURELAND - SEDIMENT

Delaware has 35,200 acres or 3% of its rural acres used as pastureland. In the National Resource Inventory of 1982, 2,700 acres are defined as needing erosion control. Erosion occurs on pastures due to poor management such as overstocking, not rotating animals to allow the pasture to regrow, allowing livestock to enter streams, poor nutrient or species management, poor establishment techniques, or highly erodible lands.

Methods to control erosion may involve improvement of the vegetative stand, limiting access of cattle to streams and/or pasture reestablishment. Rotational grazing has been shown to allow a larger number of animals per acre, while improving the quality of the vegetation. Streambanks can be fenced to restrict the watering of cattle to appropriate areas. With the development of better no-till planters pastures can be reestablished without plowing the field.

See Appendix A for Resource Management Systems that are frequently used to control sediments on pastureland.

II. PESTICIDES

Pesticides from agricultural uses affect both surface and ground waters in Delaware. They are transported both attached to eroded sediments and in solution. Pesticides may be derived from cropland, forest land, pastureland or farmsteads. The "State of Delaware Ground Water Management Plan" indicates that there is little evidence of pesticides in Delaware's ground water, but pesticide contamination has been documented as a problem in other states with similar hydrogeological conditions and agricultural practices. W. F. Ritter's research through the University of Delaware has detected some levels of atrazine and aldicarb in monitoring wells in the Appoquinimink Watershed (RCWP) during a three year study. The number of acres in Delaware having pesticides applied are shown below in Table 5.

TABLE 5

Pesticide Application Acreage**

	1982		1978		1974		1969	
USED FOR	FARMS	ACRES	FARMS	ACRES	FARMS	ACRES	FARMS	ACRES
Insects	896	170,101	1102	186,476	*	120,914	*	50,040
Nematodes	188	23,010	118	16,925	18	1,778	17	1,013
Disease	214	16,975	123	15,769	51	9,173	72	7,678
Weeds	1768	381,813	1956	359,005	*	261,184	*	188,155

* Information not available
** Agricultural Census, 1982, 1978, 1974, 1969

Through the Delaware Department of Agriculture and Delaware Cooperative Extension System pesticide applicators are trained on the proper use of pesticides. In 1987, there were 1,722 private applicators and 869 commercial applicators certified in Delaware by the Department of Agriculture.

A. CROPLAND - PESTICIDES

With the increase of conservation tillage (74% of the cropland acres in 1987), it is assumed there is an increase in the amounts of pesticides being

applied. Chemicals have tended to replace cultural practices on cropland under conservation tillage. Because some chemicals attach readily to soil particles, efforts to decrease soil erosion or trap sediments should improve water quality. For chemicals transported in solution, efforts are needed to reduce the amount of pesticides applied and to use chemicals which are less toxic. Pesticides in solution may move into the water either through direct application on water, aerial drift during application, runoff in solution, and/or percolation.

Some reduction in pesticides should be expected because of federal programs that are reducing acreages planted. Such programs include the USDA, Agricultural Stabilization and Conservation Service's Payment-In-Kind (PIK) program in 1983, the annual Acreage Crop Reduction Program (ACR) and the Conservation Reserve Program (CRP).

Delaware has been agressively addressing pesticide use through the Cooperative Extension System. Measures to reduce pesticide water quality problems include the use of Integrated Pest Management (IPM),which involves cultural, mechanical, biological and chemical controls. IPM benefits include reduced pesticide costs, while improving yields on fields that have been scouted for pests. For the years 1985-1987, IPM use was increased from 700 to 1,700 acres on alfalfa and from 1,000 to 5,500 acres on field corn (University of Delaware, 1988). Improvement in application techniques and selection of specific chemicals also permits lower application rates and results in less misapplication of pesticides.

All these measures are included under the practice "Pesticide Management". See Appendix A for commonly used cropland Resource Management Systems that address pesticides on cropland.

B. PASTURE - PESTICIDES

Pesticides used on pastures usually are limited to herbicides. Practices to prevent NPS pollution from pesticides on pastures will be the same as for cropland.

Resource Management Systems that are commonly used to address pastureland pesticide use are listed in Appendix A.

C. FOREST LAND - PESTICIDES

Herbicides may be used during site preparation and timber stand improvement activities to control competing vegetation. These activities are most often performed by certified applicators under the direction of professional foresters (in accordance to Federal and State Regulations). Use of proper herbicide application techniques, outlined in a pesticide management plan, reduces the effect on water quality.

Pesticides used in forestry are mainly used during the establishment period. Some insecticides are used but on a limited basis.

Delaware, like many eastern coast states, is experiencing an outbreak of Gypsy Moth which is devastating many large timber tracts. A gypsy moth suppression program has been implemented since 1983 and includes both Demilin as well as Bacillus thurengensis (BT). Sprayed acreage varied from 1,100 acres in 1983 to 67,000 acres in 1985. In 1988 the acreage was reduced to 43,000 acres (Source: Linda Bradley, DDA, Plant Industry Section).

See Appendix A for Resource Management Systems that are commonly used on forest land.

D. FARMSTEADS - PESTICIDES

Pesticides are stored, mixed and used on the farmstead area. The "1986 Delaware Agricultural Statistics Summary" indicates there are 3,200 farms in Delaware. The proper storage and disposal of containers,both unused and used, is a major concern because of toxic, corrosive and combustible attributes of these chemicals.

Mushroom production is clustered in the very northern part of the state. In 1983, there were 17 mushroom growers with 118 houses and 6 who did their own composting (Tatman & Lee, Inc., 1983). When cleaning out a mushroom house,

compost piles containing some pesticides are sometimes piled outside of the building and leachate from rain or snow may contain organics and pesticide residues. Such water quality problems have been documented on the Red Clay Creek by DNREC.

Practices to prevent NPS pesticide pollution on farmsteads are included in the practice "Pesticide Management" and "Waste Management System". Resource Management Systems that are commonly used to address farmstead pesticides are listed in Appendix A.

III. FERTILIZERS

Fertilizers used in agriculture may effect both surface and groundwater. Eutrophication of water bodies is accelerated by excessive nitrogen and phosphorous loadings. Algal blooms, fish kills, and foul odors result from this eutrophication. High nitrogen levels (as nitrite), when found in drinking water, may be harmful to humans especially infants. Fertilizers are transported both attached to eroded sediments and in solution. They may be derived from cropland or pastureland. Table 6 shows the tons of commercial fertilizer consumption in Delaware.

TABLE 6

Commercial Fertilizer Consumption in Delaware**

YEAR	1982		1983		1984		1985		1986
SEASON	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
TONNAGE	19792	75668	55208	62307	25156	89946	18292	94774	16014
N TONS	2942	11713	10490	14603	4353	14826	16772		
P_2O_5	1830	5746	3407	6784	1897	6812	6757		
K_2O	3474	13226	7457	13950	4009	13701	13811		
FARM TONNAGE*						98%	88%	98%	92%
NON-FARM TONNAGE*						2%	12%	2%	8%

* Source: Bruce West, Maryland and Delaware Agricultural Statistics Service
**Delaware Agricultural Statistics 1983-1986 Summaries

A. CROPLAND - FERTILIZER

Efforts to reduce the amount of commercial fertilizers rely on reducing the total amounts used, splitting the applications, reducing runoff and reducing the soil erosion. Soil testing is the biggest factor in reducing amounts of applied fertilizers (North Carolina State University, 1982). Applying recommended amounts at the proper time and using slow release formulations will reduce

losses. Practices that reduce runoff, such as terraces, can reduce the nutrients in surface waters but may increase quantities in the groundwater, depending on soil types.

In areas where drainage systems are present, structures to control water levels in the channels are effective. Water control structures promote denitrification in the soil profile. This method of controlling drainage also reduces the rate that the water table falls in the soil profile through the droughty summer months. In doing so drought related crop damage is reduced and thus the plant is more fully capable of utilizing applied fertilizers. By improving soil moisture, water control structures reduce the demand for supplemental irrigation and reduce damage to nearby wetlands. Delaware is conducting a demonstration project utilizing these structures in the Inland Bays area. A properly designed drainage channel can reduce out of bank flows and reduce the amount of pollutants such as nitrates from entering surface waters.

Efforts to control erosion using conservation tillage and stripcropping, will also reduce offsite transport of fertilizers attached to soil particles. Monitoring in the Appoquinimink Watershed (RCWP) showed that erosion control measures, predominantly conservation tillage, decreased total phosphorus in streams by 60% (WRA, NCC, 1986). Winter cover crops will use most nutrients remaining after a summer crop and reduces the amount of nutrients leaching through the soil profile.

Measures to improve fertilizer application are included under the practice "Fertilizer Management". See Appendix A for commonly used Resource Management Systems that address cropland fertilizers.

B. PASTURELAND - FERTILIZER

Fertilizers used on pastures would contribute NPS pollution in the same methods as cropland. See Appendix A for a list of Resource Management Systems that are commonly used for pastureland.

IV. AGRICULTURAL AND MUNICIPAL WASTES

Agricultural wastes in Delaware includes manures from beef cattle, dairy cattle, swine, poultry; dead bird disposal; wash water from dairy facilities; wash water from egg, fruit or vegetable processing; and compost from mushroom houses. Table 7 shows the numbers of animals raised on farms and manure produced.

TABLE 7**

ANIMAL	# OF ANIMALS	# OF FARMS	ANNUAL TONS MANURE*
Dairy	13,000	230	174,798
Beef	14,000	730	84,420
Hogs	60,000	360	128,520
Layers	938,000	253**	36,207
Broilers	196,783,000	788**	250,453

* See Appendix C for calculations
** These numbers are low. They are based on Census of Agr. 1982
*** Delaware Agricultural Statistics Summary, 1986

Municipal wastes, in the form of sludge, are also disposed of on cropland. These organic materials are a potential threat to water quality because they are oxygen demanding, a source of plant nutrients and may carry infectious agents or toxic substances. Bodies of water are affected by wastes through turbidity, taste, odor, increased algae and macrophyte plant growth and fish kills. The contaminants may also be leached to the ground water, as well as carried to surface waters in runoff.

These wastes can also be very useful if properly managed and utilized. It provides organics when incorporated into the soil, increases the water absorption ability of that soil and decreases the erodibility. Some wastes can be substituted on a unit for unit basis for N based fertilizers. Because nutrients in wastes are predominantly organic in form they release nutrients over a long period of time.

To establish standards for land treatment and application of municipal wastes, DNREC currently has a moratorium on new permit applications. Since Delaware has farmland available near larger out of state metropolitan areas, the demand is high to use municipal sludges on cropland. DNREC has drafted separate Environmental Guidelines and Procedures for Dairy, Poultry, Swine, Cattle, other Animal Operations as part of the new Land Treatment Rules. The drafted guidelines were given to TEAM this spring for review and for comment this fall.

A. CROPLAND - AGRICULTURAL & MUNICIPAL WASTES

Animal wastes contain phosphorus, nitrogen, potassium, oxygen demanding material, and bacteria which are of concern to water quality. The phosphorus contained in wastes readily reacts within the soil to become insoluble. Studies have shown that a large percentage of phosphorus is lost with soil erosion. Thus, adequate erosion control measures will reduce phosphorus loads in runoff water.

In the Appoquinimink River watershed, a Rural Clean Water Project in Delaware, total phosphorus delivered to streams was reduced over 60% by erosion control measures (WRA, NCC, 1986).

Manures contain nitrogen in the organic and ammonium forms. The Ammonia is tightly held by soil particles and organics and can be transported by erosion. As organics are broken down by microbes, ammonia is formed. In well-aerated soils the ammonium is oxidized to nitrite and then nitrate. Nitrate is water soluble and rapidly leaches to the groundwater if not utilized by plants.

Oxygen demanding substances can cause an imbalance in the oxygen levels in bodies of water. These substances act as a substrate for aerobic bacteria in the receiving stream and are usually measured in terms of Biological Oxygen Demand (North Carolina State University, 1982).

Proper application of wastes to cropland allows the farmer the nutrient and organic content benefits while safely disposing of the wastes. This application

requires soil testing of the fields, testing of the waste for nutrients, calibrating the spreading equipment and applying wastes at recommended rates. Where municipal wastes are to be used, testing of both the waste and the fields for heavy metals and pH is critical.

Location and timing of the waste application is also important. The spreading of wastes on frozen ground or near water courses with inadequate filterstrips should be avoided. Application of wastes should coincide with the ability of plants to utilize the nutrients. Wastes should be worked into or injected into the soils to reduce runoff contamination.

Conservation practices such as "Filterstrips" and "Waste Utilization", along with practices that reduce runoff and erosion will have a positive effect on NPS water quality due to waste application on cropland. See Appendix A for commonly used Resource Management Systems on cropland.

B. PASTURELAND - AGRICULTURAL & MUNICIPAL WASTES

Pastureland may also be used for land application of manure or sludges. Wastes to be spread on pastures should be handled the same as for cropland and the amount should be balanced with the contribution of pasture livestock.

Manure concentrations by pastured livestock depends on the stocking density and length of grazing. Overgrazing pastures can lead to increased erosion and runoff with associated loss of sediments and bound nutrients. Overgrazing will also increase runoff. Animals should be fenced out of water bodies except where necessary to allow watering.

See Appendix A for Resource Management Systems that are commonly used on pastureland.

C. FARMSTEADS - AGRICULTURAL & MUNICIPAL WASTES

To reduce the effects of agricultural wastes on water quality proper storage and application is needed. Manures, mushroom compost, and wash waters are presently stored in above and below ground storage tanks, under house pits, roofed over structures, open waste ponds and lagoons, covered by tarps and also

stockpiled without any protection. Some farms, without any storage facility, haul their wastes periodically. Wash water is sometimes treated by the use of filterstrips instead of storage. A proper manure management plan includes timing, storage, application rates, crop uptake or other management techniques.

Proper waste management methods are site specific and may require any of the following: covering to prevent leaching, diverting clean runoff water, storage of wastes for a specific time period, reducing quantity by use of filterstrips for wash water, spray irrigating waste water, recycling wash water, or minimizing water use.

See Appendix A for Resource Management Systems commonly used on farmsteads.

V. EXISTING PROGRAMS - RURAL/AGRICULTURE

Conservation Districts

A Conservation District has been established in each county. Under the Delaware Conservation Districts Law, the conservation districts are governmental subdivisions of Delaware with the authority "to develop comprehensive plans for, and carry out, preventive and control measures and works of improvement for the prevention of erosion, floodwater and sediment damages, and the conservation development and utilization of land and water resources. Some of their programs include education, cost sharing, no-till drill rental, erosion and sediment control, and tax ditches" (Vanderwende, William, 1987). The State Conservation Incentive Program has proven very effective, see Appendix D for a summary. Education programs involve newsletters, displays at fairs, programs to schools and groups, mini-grants to fund education projects, a library of pamphlets and audio-visuals and support of the NACD/Deutz-Allis Conservation Education Awards Program. The conservation districts are strong implementors of many portions of the State's NPS management program and were designated the management agencies along with the DNREC Division of Soil and Water Conservation.

USDA, Soil Conservation Service (SCS)

The Soil Conservation Service is a technical agency within the USDA. Agency staff provide detailed on-site evaluation, planning, design, installation, operations and maintenance assistance for resource management systems in rural areas and in urbanizing areas. SCS technical assistance is provided through Conservation Districts. SCS can provide financial assistance for installing conservation practices through long-term contracting with land users. This financial assistance is available only within certain designated project areas where water quality degradation or other natural resource concern requires special emphasis. Assistance is provided through the watershed protection provisions of Public Law 83-566. SCS also provides leadership for the National Cooperative Soil Survey. A soil survey is an inventory of soil and

other landscape features. It is a valuable tool for assessing land potentials and problems. National Resource Inventories are also done periodically.

USDA, Agriculture Stabilization and Conservation Service (ASCS)

ASCS provides financial incentives to establish conservation practices for erosion control, water quality benefits and wildlife benefits through the Agriculture Conservation Program (ACP). The Forestry Incentive Program (FIP) provides cost shares, to promote forest land conservation practices and encourages use of land for forest production. The Emergency Conservation Measures Program (ECMP) allows for cost-sharing to rehabilitate farmlands damaged by natural disasters.

The Conservation Reserve Program (CRP) of the 1985 Food Security Act (FSA) offers both commodity reduction, erosion control and water quality benefits for critically eroding areas by taking land out of production for 10 years; providing cost sharing for permanent cover and making yearly rental payments. The Act also has the Sodbuster provision that requires new land brought into the production of annually tilled crops be done under a conservation plan or risk the loss of USDA program benefits, under swampbuster provisions, eligibility for USDA farm programs is endangered if drainage of wetlands occurs in order to grow annually tilled crops.

Also in the Food Security Act of 1985 is the provision for Conservation Compliance. Under conservation compliance, highly erodible fields planted to annual crops will be activity following a conservation plan (developed by 1990, and fully implemented by 1995).

The Rural Clean Water Program (RCWP) has provided cost-shares, in the Appoquinimink Watershed since 1980 to demonstrate water quality improvements due to the adoption of conservation practices by farmers.

USDA, Farms Home Administration (FmHA)

Loans that will benefit water quality are available to farmers through several programs of FmHA. Soil and Water Farm Program loans are available to eligible borrowers for irrigation, farmstead water, drainage, soil and water conservation, forestry, fish farming, land development and certain pollution abatement or control measures. Resource Conservation and Development (RC&D) loans are available for communities having projects of community benefit which conserve and develop natural resources. FmHA is also authorized to provide financial assistance for water and waste disposal facilities in rural areas.

Water Resources Agency for New Castle County (WRA-NCC)

Since 1980, WRA-NCC has been monitoring the Appoquinimink Watershed RCWP using funding from the EPA and USDA and documenting the results with annual reports.

A study of New Castle County's mushroom industry was also funded to determine its potential impact on water quality. From this a "grower's guide" was developed and distributed.

A program has been drafted to protect the public drinking water resources of New Castle County from pollution. The program identifies areas of concern and lists possible land use controls to increase protection of both ground and surface waters.

Delaware, Department of Agriculture (DOA)

The Forestry Section of DOA provides forest management assistance to all forest landowners of Delaware through county forestry and watershed forestry programs. The Forestry Section also manages state forests in each county for multiple use purposes. There is also a tree seedling program, rural-urban interface fire prevention and suppression program, utilization program and an urban forestry program. The Forestry Section provides technical assistance to ASCS in the Forestry Incentives Program, Agricultural Conservation Program and Conservation Reserve Program. The Forestry Section and Department of

Agriculture also sponsor the Delaware Tree Farm Program (a recognition program for excellence in forest management by non-industrial private landowners).

The Department of Agriculture is the primary sponsor of Delaware's Project Learning Tree program. Project Learning Tree is an education program which teaches students (kindergarten through grade 12) about the environment using the forest as a window to the natural world. Through Project Learning Tree students develop skills in natural resource decision making.

The Department of Agriculture is mandated to regulate septage used as soil conditioners, fertilizers and pesticides. Both pesticide applicators and retailers are required to be licensed. The State also maintains a list of approved chemicals for use in Delaware.

The Plant Industry Section manages the Gypsy Moth Suppression Program.

Delaware Cooperative Extension System (CES)

The Delaware Cooperative Extension System involves both Delaware State College and the University of Delaware. This is an educational system which extends research results and advances in technology to the people in both rural and urban communities. NPS concerns appear in their plan of work and are included in the sections "Competitiveness and Profitability in Agriculture," "Water Quality/Conservation" and "Other Programs."

Within these sections are programs that improve crop, poultry, and livestock production by fine tuning inputs and reducing excesses that become NPS pollutants. New crops are introduced that will improve both the economic picture for the farmers and water quality. An example is milo (grain sorghum). It fulfills the poultry demand for grain, yet does well on Delaware's droughty soils milo reduces irrigation needs, resists the soybean cyst nematode allowing rotation of crops, provides residues for soil erosion protection, and requires little nitrogen.

The Integrated Pest Management Program (IPM) has been very successful. A three to four-year program for alfalfa and field corn has been completed and proven effective in reducing costs to the farmer. The program may be picked up by a Crop Management or Improvement Association in the future. Programs now exist to help farmers calibrate their sprayers and fertilizer and manure spreaders. The "MANURE" program was developed to educate the broiler industry on the benefits of proper waste management. Research is being done in dead bird composting disposal systems.

Education will be provided on water quality and quantity through management of ground water, household hazardous wastes, agricultural nutrients, water conservation and septage and sludge disposal on agricultural land. Information is dispersed through local meetings, newsletters, radio spots, newspaper articles, publications and one-on-one. Other programs include safety programs done in conjunction with the Delaware State Fire School, pesticide impact assessment and pesticide applicator training.

Delaware Department of Natural Resources and Environmental Control (DNREC)

Statewide regulation of waste application has existed since 1974. DNREC is presently in the process of developing new "Land Treatment of Wastes Guidance and Rules of Practice." Included is the land treatment of wastewater, sludge and sludge products and agricultural residuals in such a way that assures long-term land productivity, protection of water quality and safe-guards public health. Presently, permits are required for the construction of agricultural waste storage structures and hauling of wastes on roads.

The Delaware Erosion and Sediment Control Law for agricultural and urban lands is administered by DNREC through the local Conservation Districts. Agricultural lands for the most part are affected only if they equal more than one acre, are on a greater than 6 percent slope or they are not in conformance with a conservation plan. If there is no 50% or greater cost-share funding available for practices or if the owner or operator is unable to pay the private

shares of the cost-sharing, exceptions may be made. Through the erosion and sediment control program, a District no-till farming project has been initiated in two counties.

DNREC has drafted a Well Head Protection Program for the State. "Wellhead protection requirements will be controversial and will take time to implement." (DNREC, 1988 Clean Water Strategy). One level of protection is for the wellhead only, while another level of protection is for groundwater preserves or protection areas. At this time any efforts are tied closely to the local land use decisions and no formal protection areas have been established.

DNREC, through the Division of Soil and Water, administers the local conservation districts and coordinates state-wide conservation programs. A primary tool for the NPS management plan is the State Conservation Incentive Program. In FY 1988, each District received $115,000 for conservation practices which were cost shared at a 50 - 75% range. DNREC also helps direct federal, state, and private funding sources to the local districts for conservation implementation and special NPS studies.

DNREC, through the Division of Water Resources is responsible for development and implementation of the state's Estuary Program, Clean Lakes Program, Wetlands Legislation, Animal Waste Management, the implementation of the Clean Water Act, Water Quality Standards and other related programs. All of these programs will reinforce the states NPSP management program.

Total Environmental Application Management (TEAM)

TEAM was developed in July, 1986 by the Delaware Association of Conservation Districts, the Secretaries of Delaware Department of Agriculture and Delaware Department of Natural Resources and Environmental Control, and the State Conservationist of the USDA, Soil Conservation Service.

The objective of TEAM is to clarify the roles of the agencies and to strengthen the existing programs while eliminating overlap. In addition to the

original goals, TEAM works to recognize trends in the environment and coordinate activities within the State.

The TEAM now includes representatives from the USDA, Agricultural Stabilization and Conservation Service, Delaware Cooperative Extension, Delaware Department of Transportation, Delmarva Poultry Institute (DPI) and will soon include the Corps of Engineers, the US Environmental Protection Agency, US Fish and Wildlife Service and the National Oceanic and Atmospheric Administration (NOAA).

Food and Agriculture Council (FAC)

FAC exists on both the county and state level with representatives from the USDA agencies - ASCS, FmHA, Cooperative Extension System, SCS, as well as the Conservation Districts. The council is involved in developing and coordinating programs. The "Friends of Agriculture" is a monthly community breakfast with speakers of interest to the agricultural community.

Other Agricultural Production Groups

Many groups exist in Delaware and provide a system for disseminating information. The CES, DOA and the Conservation Districts are involved with many of them and can assist in information dissemination and program development. Appendix F lists many of these groups.

VI. Needed Programs: Rural/Agricultural

Rural nonpoint source pollution problems related to agriculture can be chiefly handled through existing resource agencies, commodity groups, coordination efforts and cost sharing methods. There is a need to increase coordination efforts, education, research, technical assistance and financial incentives. New legislation should be introduced only when necessary. To assist, Delaware's Resource Conservation Plan (1980-1985) and the local Districts' long range plans should be revised. The State and local FACS should increase their involvement with solving NPS problems and implementing NPS programs. All rural resource agencies should continue their coordination efforts through TEAM and other outreach programs. Both the state's Clean Water Strategy and Delaware Environmental Legacy should be implemented in a holistic environmental approach.

Agencies need to realign their approaches on an individual basis to encompass the five key elements which range from education to regulation. Areas of traditional focus should be maintained, while other elements are enhanced. For example, the Division of Water Resources should integrate education and interagency coordination (e.g. technology transfer) into its traditional research and regulatory framework. On the other hand, the conservation districts should strengthen NPSP concerns associated with cost sharing.

As an adjunct to the new land treatment rules, consideration should be given to additional provisions for animal waste management. The augmentation would be accomplished in conjunction with enhanced and/or targeted education technical assistance and financial incentives in priority watersheds. A dialog among producers, users and agencies concerned with animal wastes needs to be established. Symposia, technology transfer, site visits, alternatives and long range plans need to be undertaken.

The nonpoint source pollution management program schedule of implementation identifies further program areas which need development or emphasis.

Rural: On-Site Wastewater Systems

"Because of the rural nature of much of the state, some 35 percent of Delaware households are not linked, and may never be, to municipal sewage systems. Instead on-site septic systems are used for the treatment and disposal of domestic wastewater." Loma 1982. "Unfortunately, many of these systems have been constructed in soils which are not suitable for their use or systems have been improperly installed or maintained. Resulting septic system problems can become a health risk, contaminate shallow ground water and surface waters, and cause odor problems for the entire community. Septic systems frequently pose actual or potential threats to ground water quality due to the high ground water table and poor soils found in much of Delaware. Septic systems in permeable soils with shallow water tables add nitrates to the underlying ground water. New Delaware on-site wastewater treatment and disposal regulations that reflect the latest in technology have recently been implemented. Septic systems are a potential source of nitrates, pathogens, and toxics and are more prevalent in Kent and Sussex Counties. DNREC, 1987."

The New Castle County Septic System Regulation, (delegated to the County by DNREC) administered through the Department of Public Works, addresses on-site wastewater disposal in New Castle County. In August 1974, New Castle County established a septic system permit and enforcement program and took over DNREC's administration. This program was updated in June 1987, and addresses permit issuance for all on-site waste disposal system, except experimental systems. The DNREC is responsible for state-wide licensing of all percolation testers, system designers, site evaluators, liquid waste haulers and system contractors. Residents of Kent and Sussex Counties receive permits for septic systems through the DNREC, On-Site Wastewater Branch. The Delaware Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems, in 1985, are designed to prevent groundwater contamination. Design standards provide for alternate disposal systems, require professional site

evaluation prior to permit application, require a pre-subdivision review, may require hydrogeological studies and set minimum densities.

The National Estuary Proposal for the Inland Bays summarizes some of the concerns and needed work regarding on-site wastewater systems.

"Problem Statement: The Inland Bays watershed retains much of its rural heritage. Most unincorporated areas and some towns utilize septic systems for sewage disposal. Under previous regulations, lot size and system spacing was not a major consideration, resulting in areas with closely spaced trailers on individual systems. As much of the watershed overlies soils unsuitable for conventional septic systems, problems (e.g. overflows, partial or total bypass to surface waters, excessive drainage, direct discharge to groundwater) have occurred.

Past Research and Control Efforts: Groundwater studies undertaken in 1977 and 1982 (Ritter and Chirnside) showed significant percentages of wells with excessive levels of nitrate. This contamination is linked to septic systems in areas with high density development and sandy soils. State regulations governing the installation and operation of septic systems have existed since 1968. As rural areas became urbanized and public health threats surfaced, deficiencies in these regulations became apparent. New regulations, which seek to require the use of on-site systems that will function as designed and protect groundwater so as to prevent violations of Federal drinking water standards, were adopted in 1985. Site evaluation, and system selection, design, installation and maintenance are addressed by the new regulations. DNREC staff has been expanded to facilitate implementation. Systems installed under these or previous regulations, if malfunctioning, must be repaired, replaced or abandoned.

Current Research and Control Efforts: The on-site regulations undergo regular revision as new designs and methods are accepted for use. Research is

underway to evaluate shallow groundwater impacts from an assortment of conventional and innovative on-site systems. This research includes both field and laboratory work.

Remaining Needs: On-site wastewater disposal regulation, monitoring and enforcement programs are, for many reasons, less effective than their point source equivalents. Additional personnel are needed to conduct inspections of new and existing systems, particularly large community systems, process paperwork and handle inquiries. Public education programs need to be expanded and tailored to various target groups. Demonstration projects for various on-site, septage and sludge management techniques should be undertaken. For the long-term, plans need to be devised to convert densely populated areas. This will involve updating the existing Water Quality Management Plan (208 and/or 303(e)) for the watershed, and influencing land use planning efforts at the County level."

On-site wastewater systems by all definitions cause nonpoint source pollution. The controlling factor for their use, though, is the amount of area which is needed to safely absorb the pollution. The Cooperative Extension System, Extension Bulletin 126 on Home Septic Systems clearly describes the problem.

"Good soil drainage for effluent disposal requires a medium flow rate, neither to fast nor too slow (Figure 3). A coarse soil texture, such as pure sand, allows effluent to move too quickly, so there is no opportunity for the soil to filter out pollutants and disease-causing viruses and bacteria. A medium soil texture, such as sandy loam, provides the best drainage because natural soil processes can filter and treat the effluent. A fine soil texture, such as silt or clay, restricts effluent flow. If wastewater cannot soak into the soil as fast as, or faster than it is passed through the system, the trench fills with effluent which will eventually overflow onto the ground surface or back up into the house.

When high water tables exist, as they do in much of Delaware, drainage is hampered. If the groundwater rises into the drainfield, the effluent can be forced up toward the ground surface before pollutants and organisms are removed, or it can travel large distances from the drainfield area. For effective filtration and treatment, a sufficient depth of soil should exist between the bottom of the trench and the seasonal high water table. This depth depends on soil type.

Soil must further stabilize effluent before it enters groundwater that supplies drinking water. In the soil, small particles carried along by the wastewater, including most disease-causing organisms, are filtered out. Tiny bacteria and animal life that live in the soil remove some of the dissolved pollutants. Other pollutants, such as phosphate, adhere to soil particles. But nitrate, another byproduct of the septic system's digestive process, is not usually removed by soil. Therefore, it passes through and can accumulate in groundwater. High concentrations of nitrate in drinking water can cause health problems.

Because a septic system produces nitrate, one way to prevent an excessive buildup in groundwater is to limit the number of septic systems in an area. Ideally in new subdivisions, there should be one septic system per 1.5 acres where drinking water is supplied by individual wells; with some soils, even larger lots are desirable. Some older subdivisions with three or more septic systems per acre have groundwater so polluted with nitrate that shallow wells can no longer be used for drinking water. The present solution is to drill a well deep enough to reach an unpolluted aquifer.

Septic systems are needed in areas not served by municipal or regional sewer systems which transport wastewater from many houses for treatment and disposal. Wastewater reaching a sewage treatment plant goes through processes similar to those occurring in your septic system. Solids are removed and

digested by bacteria. Sludge is separated from wastewater and sent to a landfill. Cloudy water goes through more filtering and is disinfected before the effluent is discharged. Treatment plants require maintenance, as do septic systems. Although your septic system is simpler to operate, it can't run forever without care."

The 1988 Delaware Clean Water Strategy discusses the problems in developing an effective on-site sewage treatment and disposal program and gives suggestions for further consideration.

On-site sewage systems have generally been used in suburban and rural areas of Delaware where distance and low housing density make public sewer systems too expensive to install. Systems installed in suburban areas, however, present potentially greater groundwater pollution and health risks than those located in rural areas because housing density is greater, reducing the capacity of the soils to treat effluent. The result is more people are exposed to health hazardous and groundwater quality is deteriorated.

Beginning in 1980, the DNREC conducted a series of rural wastewater management and groundwater contamination studies which identified deficiencies in the way septic systems were regulated. New on-site wastewater treatment and disposal regulations were written and adopted in 1985. The new regulations provide for improved design standards, alternative disposal systems, professional site evaluation, subdivision review, hydrogeological studies, and larger lot sizes. By implementing professional site evaluation and subdivision review, the department has started to reduce some potential sources of groundwater contamination, especially in soils having insufficient capacity to treat effluent.

The important future issues the state may face in protecting groundwater from septic system contamination are system density in particular and rural wastewater management policy in general. The land market in many areas of the state is such that it would be uneconomical to develop land at very low

densities, nor would it be prudent land use and fiscal policy to encourage large scale, low density development. The questions which then need to be addressed are:

a. Should the state require all new or expanded subdivisions to have central wastewater treatment facilities?

b. If so, how should they be managed and who should be responsible?

c. Should the state designate certain areas where development pressure is significant and require the installation of public wastewater treatment systems as a condition to future development approval?

A major source of controversy concerning limits on septic system density is related to the distribution of costs and benefits and how they are perceived by those affected. The most obvious cost will be the loss in a landowner's property value when the amount of developable land or the allowable density of development on septic systems is reduced. On the other hand, the benefits of fewer septic system will be in the form of better protection of groundwater quality, increased open space, and reduced costs for providing growth related services such as roads, utilities, schools and other public facilities. Equally important is the effect of minimizing the public costs of supplying problem areas with sewers and water.

Under the new regulations the state must identify the circumstances under which septic systems pollute groundwater to an unacceptable level. It must decide at what development densities the environmental effects of septic systems would be tolerable, either on a permanent basis as in a rural area, or on a temporary basis until sewer service can be provided.

While septic systems for a suburban area might be less costly in the short run, they will almost inevitably be more expensive in the long term because of the high probability that public sewers or public water will eventually be

needed. Thus, capital costs for waste treatment systems may have to be paid twice -- once for the septic system and again for the public sewer.

RECOMMENDATION A GUIDING PRINCIPLE WHICH SHOULD GOVERN THE MANAGEMENT OF ON-SITE SEWAGE TREATMENT AND DISPOSAL SHOULD BE THE PROTECTION OF GROUNDWATER FOR DRINKING AS WELL AS PROTECTION AGAINST SURFACE WATER POLLUTION FROM CONTAMINATED GROUNDWATER DISCHARGE.

Actions that should be considered in furthering this principle include the following.

a. Require that all new or expanded subdivisions, above a certain number of lots, and of a certain density have central wastewater treatment systems. Studies should be conducted under present zoning regulations to determine the impact they have had on water conditions.

b. Develop policy and regulations that require subdivisions recorded before April 1984, but where no substantial construction has yet occurred, to come under the auspices of the principles under (a) above. It is estimated that as many as 15,000 lots in Coastal Sussex County may be affected by this action.

c. Require local governments to accept responsibility for management of privately owned on-site sewage treatment facilities in the event that the private owners default on meeting the terms of this operating permit. Require suit of the responsible owner in event of default.

d. Require the installation of public wastewater treatment systems in critical growth areas such as the inland bays as a condition to future development approval.

Best Management Practices for On-Site Wastewater Systems are determined through the DNREC regulations governing these activities as well as the Cooperative Extension System, Extension Bulletin 126.

Rural: Land Treatment of Waste: Sludge/Septage

The Delaware Septage Management Plan was published in 1987 and recorded that 3,805,000 gallons of septage was disposed on land per year. Seventeen approved disposed sites are located in Sussex County. The Septage Management Plan described these sites and the associated concerns. "The sites are evaluated by the Department of Natural Resources and Environmental Control (DNREC) through the "Lands Disposal Authorization" process. A state permit is required for land application of sludge from water or wastewater treatment plants. The completed application should be submitted to the department for technical review. A site inspection and preliminary concurrence by the department is part of the evaluation process. A copy of the toxicity test analysis of the sludge must verify that the sludge does not qualify as a hazardous waste. If the sludge is deemed hazardous, it must be managed following hazardous waste regulations implemented by the department. The department also regulates landfilling and land treatment of nonhazardous industrial sludges."

The 17 approved sites are located in Sussex County and are concentrated within the inland bays area. All except five of the sites are owned by individuals other than hauler. Three of the sites are used by the owner for disposal of septage generated from a specific source such as a single mobile home park or campground. None of the sites are used by more than one hauler.

There are no indications that illegal septage disposal sites exist in Delaware. Since farmland is readily available for land disposal, the need to use illegal sites does not appear to exist.

All except a few sites were found to have isolation distances of 300 feet of more from the nearest dwelling and 100 feet or more from the nearest waterway. Sites range in size from 1.5 acres to over 100 acres. Most sites are between 10 and 50 acres. Larger sites tend to restrict septage disposal to a limited portion of the tract where crops are not planted.

The most common crops grown on the septage disposal sites are corn and soybeans. A surprising number of site owners (seven) do not grow a crop on the site and maintain it by frequent cultivation. Where crops are grown, the portion of the field used for septage disposal is moved each year to another portion of the field. Crops are then planted on the portion used for septage in the previous year.

All except three of the sites contain soils which are either excessively drained or somewhat excessively drained. These soils are usually very deep and have a slope of less than five percent with few streams being present. The seasonal high water table is greater than five feet below the surface and the soil permeability is greater than six inches per hour. These soils also tend to be very acidic and have a low available moisture capacity. Septage addition to these soils tend to improve their moisture retention capacity and adds some buffering capacity for the soil pH. Farmers utilizing the septage sites have noted the improved agricultural characteristics of the portions of the fields receiving septage.

The primary disadvantage of these soils for septage disposal is their rapid drainage. Sandy soils are prone to nitrate (NO_3-N) and bacterial contamination of the groundwater. This potential contamination is not only influenced by the rapid drainage but also by the limited cationic exchange capacity of the soil, the lack of crops on many of the sites, and the loading rates used at a few of the sites.

Nitrogen, as it is contained in septage, consists of a limited amount of nitrite and nitrate nitrogen (0.7 mg/l NO_2 and 3.2 mg/l NO_3). Most of the nitrogen is contained in the form of ammonia and organic nitrogen (TKN) which only becomes a problem after it is converted to nitrates (NO_3-N). Much of the ammonia nitrogen is volatilized when the septage is applied to land. As much as 50 percent of the ammonia may be volatilized during the application process.

The ammonia not volatilized is converted to nitrates by soil bacteria. Excessively drained soils allow for the rapid conversion of ammonia to nitrates with little opportunity for denitrification by soil microbes under anaerobic conditions. The lack of crops on the disposal sites during the growing season and the "back-up and dump" method used by some haulers also contributes to the potential build-up of nitrates in the groundwater.

The amount of septage applied to a site each year is determined by DNREC using nitrogen as the limiting factor. A total of about 84,000 gallons per acre per year is used as the limit. Most of the sites use a significantly lower application rate, apparently because of the large amount of land available. Almost half of the sites use application rates greater than 30,000 gallons per acre per year. Some states rely upon the 30,000 gallons per acre per year limit as a safety factor since limited management of septage sites usually occurs.

Most of the septage disposal sites are used heavily during the summer with limited use in the winter. In discussions with three of the land owners, winter operation of the sites often consists of discharging at a point on the site where access is the best. Septage at about half the sites appears to be dumped rather than spread from a moving truck. Sites visited where complaints have been lodged against the haulers were found to be nearer residential development although the sites appeared to be managed similarly or better than other more remote sites.

The loading rate, soils, crops, waste constituents, and other factors determine the potential for contamination of the groundwater. Pollutants travel quickly through the sand soils present at most of the disposal sites and are transported into the water table aquifer. The pollutants may or could eventually leak into the confined aquifer unless they are discharged to nearby waterways. Groundwater contamination was considered most critical where the

movement is slow (less than one foot per day) or there is major groundwater development within one mile of the site.

Three sites exhibit the potential for contaminating surface waters if pollutants enter the groundwater. Two sites are also of particular concern because of nearby wells within the direction of groundwater movement. The groundwater movement from another site is toward a village which would also be a concern if pollutants entered the groundwater in significant quantities.

The Septage Management Plan makes the following recommendations:

The continued use of land disposal for septage on excessively drained soils requires additional precautions be taken to protect the groundwater from contamination by nitrogen or pathogenic bacteria. To achieve an acceptable level of environmental and public health protection, two major changes to current land disposal practices have been identified.

First, reduced application rates are recommended to limit the amount of nitrogen reaching the groundwater. The recommended yearly rate has been established at 7,100 gallons per acre. This rate assumed no uptake of the nitrogen by crops and generally poor management practices. The use of higher application rates would be allowed if supported by a management plan for the disposal site.

Secondly, pretreatment to significantly reduce the level of pathogens in the septage is recommended. This allows for the continued use of excessively drained soils where the natural mechanisms to eliminate pathogens are limited. The most cost-effective method of pretreatment was determined to be lime stabilization with direct land application. Other treatment techniques may be more adaptable to a particular haulers operation and would be acceptable if they also significantly reduced the level of pathogens in the septage.

Delaware Environmental Legacy further outlines specific objectives and recommendations on land treatment of wastes.

Land treatment of partially treated wastewaters, sludges and other residual wastes is a proven and cost-effective alternative to traditional technology over a wide range of circumstances where the necessary land is available at reasonable cost. For effluents and sludges, it is particularly attractive at locations where the design flow of receiving waters is low, waste treatment requirements are high and suitability of landfills is low. The full advantages of land treatment will not be realized, however, unless there is a concerted effort to focus the designs on essential features. Groundwater quality and public health must be protected, but treatment hardware and operational criteria should be based on firm evidence of need. Lined earthern lagoons should be used whenever possible and concrete, steel, and firm-set structures limited except where fully justified.

Specific objectives in using land treatment technology are:

1. To apply wastes to the plant-soil system at such rates or over such limited time periods that no land is irreversibly removed from some other potential uses such as agriculture, development, forestry, etc.
2. To mix or disperse wastes into the upper zone of the plant-soil system with the objective of microbial stabilization, immobilization, selective dispersion, or crop recovery leading to an environmentally acceptable assimilation of the waste.
3. To promote effective regulation, public understanding, and implementation of current and evolving land treatment technologies by governmental units and industries in the state.
4. To establish reasonable measures of protection for the environment and public health, safety, and welfare through proper design, operation, and management of land treatment systems; and the proper treatment, transport, handling, and beneficial use of wastes.

5. To dispose of non-hazardous sludges in landfills as an inefficient use of resources. Pretreatment programs and sludge management programs should be directed to provide adequate treatment for land application.

RECOMMENDATION: GIVEN LATEST TECHNOLOGY, LAND TREATMENT OF WASTEWATER AND WASTEWATER RESIDUALS SHOULD BE ACCEPTED AS AN ENVIRONMENTALLY AND COST EFFECTIVE MEANS OF DISPOSAL IN THE FUTURE PROVIDED PUBLIC HEALTH STANDARDS ARE MET.

DNREC should proceed to adopt guidance and regulations for land treatment of wastes which would contain standards and guidelines for the best available technical and administrative approaches and which will ensure public health and environmental quality.

Public education efforts including interpretation of the guidance and rules should be made so that waste generators and those receiving the wastes on their lands will be fully knowledgeable of all factors related to this form of waste disposal.

Best Management Practices for Land Treatment of Waste are given in the Delaware 1987 Septage Management Plan, the new Land Treatment Rules and the draft Environmental Guidelines and Procedures for Dairy, Poultry, Swine, Cattle and other animal operations.

Rural: Land Treatment of Wastes: Wastewater

Land application of wastewater include processes such as spray irrigation, infiltration and percolation basins. Sources of these wastes include municipal wastewater treatment plants, animal waste stockpiles, food processing operations and textile dyeing operations. These activities, if not properly controlled, can result in ground water becoming contaminated by nitrates, pathogens, toxics, salt, metals, and organic compounds. Although a few instances of contamination of domestic water wells from land application of wastes have been discovered in Delaware, most land application occurs away from inhabited areas.

The land treatment of waste: wastewater basically follows the same procedures and BMPs as sludge/septage applications. Permit requirements would be the same. The following recommendation is part of Delaware 1988 Clean Water Strategy.

> FOR WASTEWATER RESIDUALS (NON-HAZARDOUS SLUDGES AND SEPTAGE) AND ANIMAL WASTES, LAND TREATMENT SHOULD BE PRACTICED TO THE MAXIMUM EXTENT TO MAKE USE OF THE NUTRIENT CONTENT OF THE MATERIALS WHILE REDUCING IMPACTS ON LANDFILLS SPACE AND THE ENVIRONMENT.

URBAN NONPOINT SOURCE POLLUTION

Urban nonpoint source pollution controls are complex. One sample resource management system addressing urban runoff management is given in Figure 1. The following discussion of urban nonpoint source pollution problems varies from the rural section since urban programs and BMPs are not well developed in all cases. Many urban sources of NPSP are addressed by performance standards or programs in developing stages. Urban NPSP management is also complicated by overlapping jurisdictions of municipal, county and state governments. This is especially evident when water quality, usually a state jurisdiction, is affected by land use decisions, usually a county jurisdiction. Appendix A gives a resource management systems guide sheet for urban lands and Appendix II gives a conservation practice matrix involving urban conservation practices. In addition to the Urban BMPs, many rural practices can be used and are available for certain situations.

CONSTRUCTION

Nonpoint source pollution from construction activities can be partially addressed by land use decisions, subdivision approvals, project planning, permit requirements and environmental laws.

LAND USE DECISIONS can be very effective nonpoint source pollution management tools. Construction in floodplains, on steep slopes and in certain critical areas is prohibited or limited. During the decision making process environmental issues, such as NPSP, can be considered. The planning boards in all three counties and most of the major municipalities base their land use decisions on the planning staff recommendation and public or professional testimonies.

The subdivision process can consider NPSP more directly. Technical advisory committees participate in the subdivision review process in all three counties. The names are, TAC: Technical Advisory Committee in Sussex County, DAC: Development Advisory Committee in Kent County and SAC: Subdivision

Advisory Committee in New Castle County. In addition DNREC has a DAS committee: Development Advisory Service. DNREC and the local conservation districts are members on all the county level committees. Their recommendations which often involve NPSP can become part of the formal requirements for subdivision and permit requirements.

Project planning is another area where NPSP concerns can be addressed. On government projects such as highways, roads and bridges, DNREC is often directly involved in the planning process. On private projects informal involvement often takes place.

The permit process is the most direct way to require NPSP concerns. Delaware's Erosion and Sediment Control Law sets up an enforcement process that can greatly reduce NPSP.

In 1980, Delaware passed legislation which led to statewide regulations for Erosion & Sediment Control. The law provided for an acceleration and extension of the existing program for control of soil erosion and sediment damages resulting from land disturbing activities occurring within the state (Title 7, Chapter 40). This law provided for the adoption of a statewide comprehensive program and local conservation district programs.

The 1980 Erosion & Sediment Control Law states that no persons are to engage in land-disturbing activities until an erosion and sediment control plan has been approved by the local conservation district or by the DNREC (on state owned lands). The permitting authority has the authority to conduct periodic inspections and determine plan compliance. On activities where no permits are issued, the District and DNREC may also inspect and pursue plan compliance. The Attorney General has the power to issue a cease and desist order to violators. Following the adoption of the State program, each county developed and implemented a District Erosion and Sediment Control Program to fit their particular needs.

The Best Management Practices for erosion and sediment control are well developed and are given in Delaware's Erosion and Sediment Control Handbook and the SCS technical guides. Appendix A and B outlines some of these BMPs.

The Delaware Erosion and Sediment Control Program relies strongly on a cooperative approach between the local conservation districts and local governments as well as other state agencies with DNREC. For example, the Delaware Department of Transportation has incorporated DNREC's standards and specifications for erosion and sediment control into their own highway specifications. On the local level conservation district personnel work within New Castle County's Department of Public Works on plan review and inspections. Erosion and Sediment Control Programs outlining these types of arrangements have been approved by DNREC for all three conservation districts. In Delaware a distinction would not be made between highway/road/bridge work and land development for E & S requirements, but the approving agency would vary on a case by case basis.

Stormwater management is another direct way to address NPSP concerns on construction sites.

Delaware does not presently have a State-Wide Stormwater Management program. Although there are numerous state and local government agencies managing aspects of stormwater management, there is not a single control program for comprehensive coverage.

New Castle County (NCC) and several municipalities require stormwater management plans on all urbanized developments where past development runoff is increased. An amendment in 1977 to the April 1969 New Castle County Surface & Groundwater Drainage Code, Chapter 6 Drainage, permitted the Department of Public Works to enforce the 1977 NCC Standards for Stormwater Management and Sediment & Erosion Control.

Currently Kent County requires that all site plans and subdivision plans be reviewed for storm water management compliance by both the County Engineer's Office and the Kent Conservation District. These plans must meet county standards and acceptable practices prior to approval for recordation. A new "Development Code," part of Kent County's Comprehensive Plan process, will have a storm water management program component which will require all development undertaken in Kent County to comply with minimum code requirements. This new part of the code could be in place by the end of 1988.

A Stormwater Management Plan is proposed for incorporation in the Coastal Sussex Land Use Plan. Although Sussex County lacks a stormwater management ordinance, the local Conservation District incorporates stormwater considerations in the erosion & sediment control plans submitted for District review. Infiltration devices are encouraged, along with other types of control methods. Sussex and New Castle County engineers work with stormwater runoff, based on a 10-year storm frequency, in developing management practices. Sussex County is also looking at the vast network of existing community drainage ditch

systems for stormwater outlets. The existing stormwater and drainage infrastructure may provide opportunities for retrofitting NPSP measures.

DNREC Division of Water Resources has, on a case-by-case basis, looked at proposed development plans and required "wet ponds" and/or artificial wetland creations as a means of stormwater management. The Department inspects proposed development sites for the Army Corps of Engineers 404-Permit requirements and through a Joint Processing Review Committee involves EPA and the National Fish and Wildlife Service as well.

Dover Air Force Base monitors stormwater runoff from their property on a scheduled quarterly basis. They visually inspect outlets for sediment loads and maintain these accordingly. Every effort to help and give local consistency when new construction occurs.

At this time, a state level stormwater management committee has been formed to consider a statewide stormwater management program. In late 1987 the State entered into a contract to have a quantitative stormwater management plan prepared by early fall 1988. Water quality, although it is not the focus of this proposed plan, would be a consideration of any program. In implementing county level programs more emphasis is being given to water quality considerations, but again this is being done on a case by case basis.

Highway/road/bridge construction under Delaware's Department of Transportation (DOT) will consider stormwater if a problem is brought to their attention, but stormwater designs mainly provide for adequate outlets. DOT has expressed a willingness to consider stormwater quantity and quality and is currently supporting a demonstration retention basin and a wetlands, creation project.

Other permits could include a subaqueous lands permit and water quality certification if construction involves streams or water bodies. These permits are issued by DNREC through the wetland section. Federal permits could involve a 404 permit through the U.S. Corps of Engineers.

Needs:

To implement a NPSP management program for construction sites most of the mechanisms are in place. The next step is to fully exercise the opportunities in the construction approval process to integrate NPSP concerns. This can be done by increasing technical assistance and education. DNREC is revising the erosion and sediment control handbook, regulations and local programs in cooperation with the local conservation districts. These steps should be completed in FY 89. The project review at all levels of government is continually being strengthened and becoming more comprehensive. A more comprehensive approach would consider NPSP in the review and permit process.

URBAN RUNOFF

Runoff from urban areas contains heavy metals, microorganisms, sediment, nutrients and other inorganic and organic material. The major pollutant is sediment. The National Urban Runoff Program (NURP), an EPA study, categorized sources of urban pollution, surface runoff and air contamination from: vehicles, sedimentation, fertilizer and pesticide application, inorganic & organic litter and the lower atmosphere. Uncontrolled urban runoff can result in nuisance flooding, major flooding, erosion and sedimentation and impairment of the quality of receiving waters. Sediments and nutrients may adversely impact stream aquatic life, disrupts water habitat, accelerate eutrophication problems and damage aesthetics. Domestic water supply systems may become contaminated by metals and toxic organics present in urban runoff that infiltrate into the ground water. Bacterial contamination may also limit recreational usage of surface waters.

Urban runoff may cause the water temperature in nearby streams to rise. Runoff water temperature is increased due to flow over surfaces exposed directly to sunlight. Trace metals, such as those found in runoff from flashing & roofing materials, downspouts, galvanized pipes, metal plating, paints, wood

preservatives, catalytic converters, brake lining, tires etc. that wash onto impervious surfaces during a storm event, may serve as a source of pollution. Some trace metals have a toxic effect on aquatic life and are potential contaminates of drinking water. Use of unleaded gasoline has reduced the level of trace metals in stormwater runoff and the atmosphere.

While the construction phases of urbanization pose the greatest potential sediment load, sediments normally occur in an urban setting. High concentrations of suspended sediment in streams severely decrease the available oxygen, reduces light needed for photosynthesis, bury benthic organisms, and alters stream channels by reducing flow hydro-dynamics. Organic sediments in streams with low water depths, poor flushing and slow moving waters, may reduce oxygen levels to harmful levels for aquatic life. Nutrients attached to eroding soils also pose a severe threat to aquatic life and create on algal bloom. Once in water bodies, they are readily taken-up by algae. Undesirable algal blooms enhance eutrophication, cause large pH variations and increase the build-up of excessive organics on the lake bed.

Flooding and streambank erosion occur when unaltered streams are forced to widen their channels following upstream land disturbances and increased runoff. The removal of large areas of vegetation, without temporary or permanent stabilization of the exposed soil, will increase runoff velocity, there by increasing the potential for flooding and concentrations of nonpoint source pollutants.

The application of chemicals in urbanized areas is a source of nonpoint source pollutant. Significant amounts of these concentrated chemicals are washed into storm sewer systems. Ammonia, nitrate and ortho-phosphate, found in lawn fertilizers, are soluble pollutants readily transported by surface runoff.

Stormsewers (source controls)

Much of the nonpoint source pollution delivered to storm sewers in the urban setting results from incidental or minor activities which can

culmulatively cause a problem. Although someone dumping oil down a storm sewer can be fined, most pollution sources would have to be addressed indirectly. For example, pollutants from building materials would best be addressed with the manufacturers, education would be the best approach for the over use of lawn chemicals and urban public works and parks departments could develop or preserve vegetation as filtering areas.

The Cooperative Extension System is setting up a education program for homeowners involving pollution control and conservation. They are also very active with landscapers and lawn care companies to educate them on the proper use of lawn chemicals. The local conservation districts are developing urban conservation programs.

Under the 1971 Delaware Commercial Fertilizer & Soil Conditioner Law, the State of Delaware, Department of Agricultural (DOA), is mandated to regulate fertilizer. Under Title 3, Chapter 12 (Pesticide Law) of the Delaware Code, DOA is authorized to inspect applicators of home and agricultural land pesticides.

An indepth monitoring and tracking of these applicators has not been done due to budget constraints. Inspectors have found, overall, that applicators are following label directions carefully and that tank mixes (i.e. lawn application companies) are applied at the minimal recommended rate. Lawn applicator companies generally apply weed killer, fertilizer, insecticide and fungicide in a series of applications, as opposed to all at one time.

Needs:

Education and technical assistance are the key to these incidental or indirect causes of NPSP. The leaders for this effort could be the Cooperative Extension System, the local conservation districts and the public schools. Technical assistance to local governments could help establish urban NPSP management strategies.

Stormwater sewers from industrial sites are now treated as point discharges through NPDES. Municipalities and other land use sites may have to meet NPDES requirements in the future.

BMPs for urban runoff to stormsewers involve structural practices such as filter strips and nonstructural practices such as the proper use of fertilizers. Figure 1 and Appendix A give sample Urban BMPs.

Combined Sewers (Source Control)

The City of Wilmington has some combined sewers which handle both stormwater and sewage. Other areas of the State may have sections of combined sewers either through undocumented hookups or accidentally. When major rains occur some of these systems overflow or overload treatment facilities. Since sewage treatment costs money, efforts are ongoing to reduce combined sewers.

Need:

All sewer systems need to be monitored by the operating agencies to reduce combined sewers. Construction grant funds should be made available to correct known problems.

Surface Runoff

As previously discussed stormwater management can be a useful tool for the NPSP program. Although specific quantity controls can be required on new construction sites, surface runoff from both existing urban lands and new construction may continue to affect water quality. Again a system of education and technical assistance to land owners, local governments and commercial chemical applicators may be beneficial.

The NPSP management program takes a watershed approach. On a watershed basis, water quality may be addressed by utilizing buffer areas, water control systems, greentree reservoirs, wetlands and ponds. The committee which is considering a statewide stormwater management program is looking at a watershed approach to both the quantity and quality issues of stormwater.

Need:

An education and technical assistance effort on nonpoint source pollution needs to be made with landowners. Watershed strategies for water quality practices need to be demonstrated and evaluated.

BMP's for surface runoff are given in Appendix A and can involve both rural and urban practices.

RESOURCE EXTRACTION/EXPLORATION/DEVELOPMENT

Mining activities in Delaware are limited to sand and gravel operations using surface or dredge mining. Subsurface or placer mining, petroleum extraction and mill tailings are not currently active within the State.

Extractive Use: Existing Programs

Although there are no specific state requirements on extractive use, several state authorities would apply including the Erosion and Sediment Control Law, wetlands permits, water quality permits, transportation requirements and any health requirements. In addition the Department of Natural Resources and Environmental Control is part of advisory and review committees in all three counties for these activities.

In order to mine soil material from lands in Kent County, the land must first be granted a Conditional Use Area by the Regional Planning Commission. Applications are accepted at the Planning & Zoning Office where the formal site plan review procedure is initiated. A full engineering site plan is required, along with a fee to cover the review. The Kent County Development Advisory Committee is given the opportunity to review and suggest plan changes and to adhere with laws governing erosion and sediment control, transportation regulations, county building codes, etc. The County Planning office receives the technical comments and makes a formal report and presents recommendations to the Regional Planning Commission, who in turn submits the final plan to the Kent County Levy Court for approval. Prior to Levy Court presentation, a public hearing is set and all adjacent landowners are notified. This entire process is

subject to a 30 day procedure. Once the plan has been approved, the landowner has one full year to submit proper changes and register the plan with the Recorder of Deeds. The Kent County Building Inspection Office issues certification of occupancy and building/grading permits as well as provide enforcement during operations.

In December 1983, New Castle County (NCC) adopted a substitute ordinance to the New Castle County Code that entitles license requirements for extractive use operations. The ordinance covers the extraction of clay, sand, silt, gravel and rock for commercial purposes, along with the protection of groundwater and land reclamation. Each borrow pit owner and/or operator is required to obtain a license and renew it every two calendar years. The NCC Department of Public Works accepts all license applications and turns them over to the NCC Department of Planning for review. The Department of Public Works either approves or disapproves applications and issues licenses based on the review findings.

NCC applicants, through public meetings and a Technical Advisory Committee review, are guided to compliance standards set forth in the regulations. Permits are issued upon compliance of an approved license application, excavation plan, operating report, restoration plan, drainage plan and an erosion and sediment control plan. The inspection and enforcement of projects are conducted by the Department of Planning and the Department of Public Works. An operation may be halted temporarily by the Department of Public Works due to market conditions or other "reasonable causes." Rezoning of land must be completed to designate a Planned Extractive Use District (PEUD) prior to land disturbing activities.

Extractive Use in Sussex County is only permitted after a conditional land use change has been made for that particular land area. The process involves two public hearings prior to the submission of a site and reclamation plan. Plans are approved by the Sussex County Council upon recommendation by the

Planning Office. The Planning and Zoning Office has jurisdiction over enforcement of extraction use and reclamation plans. Currently the Planning Office is conducting a county-wide inspection of existing active and inactive borrowed areas and developing a list of each classification. This inspection will note the date of observation, condition of pit, vegetation established and if the pit is being utilized as a trash/rubbish disposal area. A photograph is taken for the file. Sussex County is working with landowners, on a voluntary basis, for reclamation procedures. County laws have not been established for the reclamation of prior existing borrow pits, but only for those which have come into being under the recent County Ordinance.

Surface Mining

Surface mining operations, such as gravel pit operations would have to follow all extraction use requirements as outlined for each county.

Dredge Mining

A dredge mining operation would have to follow all the same procedure as outlined for extractive use plus if applicable secure a subaqueous lands permit and water quality certificate from DNREC. The federal government could require other permits such as 404 permits if fill was involved.

LAND DISPOSAL (RUNOFF/LEACHATE FROM PERMITTED AREAS

Waste material is generated by every person and from every aspect of their daily activities. Urban non-point source pollutants are generated by, on-site wastewater systems, waste treatment plants, landfills, industrial waste generators and hazardous and/or toxic substances and from their disposal on land.

Sludge

The land application of sludge was discussed on pages 48-52 as a rural land use practice.

Wastewater

The land application of wastewater was discussed on page 53 as a rural land use practice.

Landfills

Delaware has three major municipal landfills, one in each county, that are owned and operated by the Delaware Solid Waste Authority (DSWA). Estimated state-wide capacity for disposal is 20 years. New Castle County has a 1000 ton/day Resource Recovery Facility owned by the Authority. Most older landfills which are no longer used are unlined. Leachates from these sites are a concern because of potential well contamination with metals, toxic, organics, odors and colors. The DNREC has the responsibility to investigate and order remedial action at these older landfills and enforce the proper design of new sites.

State-generated infectious wastes are being incinerated at 22 approved sites or are disposed of out-of-state. Infectious wastes include pathogens (isolated wastes of contagious humans, cultures and stock organs, biologics, blood and blood products, needles, glass and surgical wastes), solid wastes, tissue, organs, bodyparts and animal research tissue after human exposure. Currently, there are wastes from medical offices being mixed with municipal trash. Efforts are being initiated by DNREC and DSWA to eliminate this problem.

Pursuant to the Delaware Environmental Protection Act (7 Del. C., 60), DNREC has adopted the Delaware Solid Waste Disposal Regulation and under this regulation, the Solid Waste Branch manages a permit program to regulate sanitary and industrial land disposal facilities. The regulation includes both hydrogeological and engineering requirements for landfills to protect the natural resources of the State. The Solid Waste Branch also monitors and evaluates disposal sites to ensure that they do not contaminate surface and groundwaters. The branch is authorized to take enforcement actions against those facility operators who violate permit conditions or cause a state of pollution.

Landfills are permitted through DNREC. Integration of NPSP concern including possible runoff and leachate pollutants would be addressed during the permit process. Landfills under the Delaware Solid Waste Authority are state-of-the-art landfills and incorporate NPSP concerns in all their operations.

The Environmental Legacy Report outlines several waste management strategies which would help reduce NPSP.

> REDUCE TO THE GREATEST EXTENT PRACTICABLE, THE PRODUCTION OF WASTES.
>
> FOR WASTES THAT CANNOT BE REDUCED AT THE SOURCE, RECLAIM OR REUSE TO THE MAXIMUM EXTENT PRACTICABLE INCLUDING RECLAMATION OF EXISTING LANDFILLS. PROVIDE FOR THE PROCESSING OF 100% OF MUNICIPAL SOLID WASTES THROUGH RECLAMATION FACILITIES BY THE YEAR 2000.
>
> FOR WASTES THAT CANNOT BE RECLAIMED OR REUSED AND FOR THE RESIDUALS OF THE RECLAMATION PROCESS ITSELF, PROVIDE ENVIRONMENTALLY SAFE DISPOSAL FACILITIES WITH INCINERATION AS THE PREFERRED MEANS OF DISPOSAL.

Source Reduction of Wastes

The traditional approach to dealing with wastes has been to control the waste after it has been generated with little emphasis placed on processes to reduce the quantity produced. Part of the problem is that federal and state policy has not directly promoted waste reduction as a practical method of environmental protection (although it can be argued that higher disposal costs have encouraged waste reduction to some degree). By promoting indirect incentives only, federal and state governments presume that industries are motivated to implement waste reduction methods and that economic and technical resources are available to do so. However, waste reduction efforts have been a secondary consideration to complying with pollution control regulations. As a result, waste reduction is often viewed as a long term ideal rather than an immediate alternative to pursue.

Waste reduction is a practical approach to waste management for today and will be needed much more in the future. Waste reduction makes good economic sense since it precludes wasting raw materials and reduces the ultimate costs of controlling pollutants. Moreover, many practical waste reduction measures are often possible without significant capital investment.

While larger industries have access to technical information necessary to make process changes to reduce wastes, many smaller industries lack the research and development capabilities to make waste reduction possible. A policy to effectively promote and encourage waste reduction to the fullest extent practicable is needed. To implement that policy, the following recommendation is made.

RECOMMENDATION THE STATE SHOULD COORDINATE DEVELOPMENT OF A STATE AND INDUSTRY SUPPORTED AWARENESS AND TECHNICAL ASSISTANCE PROGRAM AIMED AT REDUCING THE GENERATION OF HAZARDOUS AND NON-HAZARDOUS WASTES.

Increased Solid Waste Reclamation Capability

Although public attention has largely focused on hazardous waste disposal in the last decade, solid waste disposal continues to be important. Improper disposal of solid waste can have a significant impact on public health and the environment. The more immediate impacts of improper disposal include the potential for disease and odors from decaying organic wastes. Long term impacts may include the contamination of public drinking water from leachate entering underground aquifers. The long term impacts are more serious since they can remain undetected until long after the contamination has occurred.

There is sufficient capacity at Delaware's three solid waste authority landfills for only about twenty more years. This situation is of particular concern in Kent and Sussex Counties where central reclamation facilities are not available.

Despite the current twenty year capacity of Delaware's landfills, it is likely that the landfilling of waste will become a much less viable disposal option in the future. The development of a downstate reclamation facility by the late 1990's would extend the life of existing landfills in Kent and Sussex Counties and would reduce the state's dependence on landfilling as the only downstate solid waste disposal option.

RECOMMENDATIONS

RECOMMENDATION 1. DEVELOP A SECOND RECLAMATION FACILITY TO HANDLE THE SOLID WASTE GENERATED IN KENT AND SUSSEX COUNTIES. This project should be managed by the Delaware Solid Waste Authority. The planning process should be initiated in the near future since a plan may take as long as five years to complete. Special efforts should be made to include participation by industry and neighboring Maryland counties since economics of scale will play an important part in determining cost effectiveness.

RECOMMENDATION 2. RECLAIM AND REUSE EXISTING LANDFILLS TO THE MAXIMUM EXTENT PRACTICABLE.

Industrial Land Treatment

The land treatment of industrial wastes would be permitted in the same manner as sludges. A state permit is required for the construction and operation of these facilities. The completed application package must be submitted to DNREC for technical review. NPSP concerns for runoff and leachates would be incorporated into this review. In addition, an industrial land complex is often monitored for surface and ground water pollution and would be regulated by water quality programs (i.e. LUST program). New industrial land projects may go through several reviews for zoning, subdivision, site plan reviews (erosion and sediment control, stormwater), permits and operation plans.

On-Site Wastewater Systems (Septic tanks)

Although some urban areas of Delaware rely on on-site wastewater systems, it is primarily a rural land use as discussed in Section VI.

Hazardous Waste

Hazardous materials are defined as finished products or wastes that are ignitable, corrosive, reactive or toxic. These materials can be in the form of valuable commodities such as gasoline and pesticides or as waste products like dye, chemical containers, solvent wastes, oils, paint wastes and metal scraps. They can be found in landfills, surface impoundments, land treatment areas and storage tanks and may find their way into groundwater through accidents, corrosion of containers, and improper use. They can pollute groundwater with heavy metals, oils and volatile organic compounds.

A major problem in dealing with hazardous materials' releases is the high cost of cleanup. Although the General Assembly has appropriated a modest sum for hazardous waste site and spill cleanup, the potential costs to the state far exceed the money appropriated to date. In 1987, the General Assembly enacted a Leaking Underground Tank Trust Fund, but no money has been authorized to deal with this near epidemic environmental problem (Delaware, Clean Water Strategy).

In December 1987 the DNREC, published Delaware's Plan of Action for assuring hazardous waste disposal capacity. The Environmental Protection Agency (EPA) has mandated every state to have a plan of action by October 1989 to assure establishment of waste disposal capacity sufficient to handle its projected volume of hazardous waste for the next twenty years. This mandate is contained in the 1986 Superfund Amendments & Reauthorization Act (SARA).

"Superfund" monies provide for the immediate and the long-term clean-up of sites where responsible parties are non-existent or where litigation would cause lengthy time constraints and delays. There are 152 known potentially contaminated disposal sites in Delaware, 18 of which are on EPA's national Priority List for Superfunds and 10 of the 18 are currently under remedial investigation. The State does not have State Superfund supplementation for federal expenditures on site clean-up (refer to Figures C & D). In July 1987, Governor Michael N. Castle signed into law the Leaking Underground Tank Response Fund (LUST) to financially assist underground petroleum storage tank owners and operators in clean-up activities. Since 1984, about 4900 underground storage tanks have been located and 170 of them were determined leaking.

There are no commercial hazardous waste disposal sites in the State. Delaware has the option of joining an interstate contract for possible out-of-state disposal, as well as providing or attracting intrastate facilities. Hazardous wastes disposed within the state are generated only from in-state companies, (refer to Figure E). There are currently no hazardous wastes disposed of in Delaware from other states. Delaware transports approximately 66% of its hazardous wastes to out-of-state disposal sites. Transportation from point of origin to the disposal area is mainly through specially designed trucks, although some modified railway transportation is used.

Delaware has 15 treatment, storage and/or disposal facilities (TSD's). A Resource Conservation & Recovery Act (RCRA) permit is required to operate these TSD's sites and only wastes generated by that specific company is disposed of at

the TSD. In addition to these RCRA permitted sites, there are roughly 40 large quantity generators (producers of at least one ton waste per month) and 200 small quantity generators (220 pounds to one ton waste per month) located in Delaware. DNREC has the authority to regulate the siting, design, construction and operation of hazardous waste disposal facilities and is in the process of developing a document that expands the existing regulatory criteria of the hazardous waste facility.

The Delaware Department of Transportation (DELDOT) and the Department of Public Safety jointly enforce federal laws on hazardous waste transportation by the use of truck inspections at selected transportation sites. Delaware law allows the state to regulate the transportation of these wastes but there is no legislation to control the routing network throughout the state.

Current state authority includes a Waste End Assessment Law that charges a fee based on the hazardous wastes generated. This aids in industry awareness of effective waste minimization as an incentive tool. DNREC, Waste Management Section, has a data base for TSD's statewide, but the system needs to be upgraded and implemented. E.I. duPont currently has a waste minimization program. Formosa Plastics has instituted waste reduction efforts since 1983. DNREC is not aware of any known liquid waste being disposed in open waters.

Dover Air Force Base works jointly with DNREC to monitor underground storage tanks on Base property. The DAFB has been permitted to store hazardous waste material on-site and non-military contractors haul it to certified disposal sites.

The Delaware Toxicity Control Strategy was revised in February 1987 to monitor and control toxic pollutants in the state's surface waters and will be periodically updated to reflect new information. Efforts are concentrated on point source discharges in priority basins. Besides the Toxicity Control Strategy, other special projects which are concentrated in the area of toxic

pollution include examination of the presence of toxic substances, the effects of chlorinated discharges a "toxics atlas" of the Delaware estuary and a Draft Planned Toxics Control Initiatives/Action Plan. Delaware and New Jersey are developing a joint Delaware River and Bay Oil Spill Contingency Plan to prioritize the limited available protection and clean-up equipment and to supply manpower and supplies in initial critical areas.

The Delaware Hazardous Waste Management (HWM) Program regulates all generators and transporters of hazardous waste, as well as all hazardous waste treatment, storage and disposal (TSD) facilities. The scope of the Regulation includes all federal facilities located in the State.

Delaware has Regulations for the purpose of establishing requirements for the proper management of Hazardous Waste. These regulatory requirements also establish the basis for State regulatory activities within the Hazardous Waste Management Program. The foremost regulatory activities within the HWM Program are as follows:

a) Permit determination of TSD facilities upon review of appropriate application materials which indicate that proper treatment, storage and disposal will be performed.

b) Monitoring compliance with technical and administrative requirements by on-site inspection of facilities and a review of facility records.

c) Enforcing the provisions of the regulations and law to remedy TSD facility non-compliance.

d) Verification of compliance with requirements placed upon generators and transporters of hazardous waste.

e) Enforcing requirements for reporting of hazardous waste management activities by regulated units.

f) Providing for appellate review of administrative actions.

g) Providing adequate opportunity for public participation in actions.

h) Monitoring and enforcing compliance with interim status requirements.

Delaware's Hazardous Waste Management Program provides for regulation of hazardous waste management activities within the State in a manner that reflects the policies established under RCRA Subtitle C. Delaware has selected to require standards of performance on administrative methods which are "more stringent" than federal requirements. The scope of the Delaware HWMP activities is as broad as that of the federal program.

HYDROLOGIC/HABITAT MODIFICATION

Channelization

As a coastal plain state with high water table soils, drainage/channelization has become a part of the state's infrastructure for both the rural and urban landscape. Proper drainage systems often provide a basis to implement and maintain other BMPs. Most of these activities are carried out by Tax Ditch Organizations which are formed under state law and assisted through DNREC, Division of Soil and Water Conservation. To date, 200 Tax Ditches have been formed. They manage over 2000 miles of drainage ways and provide both direct and indirect benefits to about 100,000 people and about 1/2 of the state maintained roads.

Projects proposed through tax ditch organizations enter construction, operations and maintenance agreements with the local conservation districts and DNREC. These agreements assure that certain standards are met. Over the past few years NPSP concerns have been more fully integrated into these agreements.

Since Kent and Sussex Counties do not have large public works departments almost all projects are completed through the ditch organizations and/or conservation districts. This again assures conservation standards and specifications. In New Castle County, the Department of Public Works cooperates

on drainage/channelization projects with the local conservation district. All tax ditch work would meet state wetlands and subaqueous lands requirements, require a state water quality certificate and meet any Federal regulations such as 404 permits. The USDA Soil Conservation Service standards and specifications are used for most projects.

Private channelization projects would be regulated by the same state and federal requirements. On large projects an erosion and sediment control plan would be required. The required plan would be based on the Delaware Erosion and Sediment Control Handbook and/or the USDA Soil Conservation Service Technical Guides.

Dredging

In Delaware, dredging operations are regulated and permitted through the DNREC. DNREC has developed a policy on dredging publicly accessible ponds. The policy sets guidelines for improved and/or maintained water quality and warm-water fisheries habitat and to improve and/or maintain safe boating access.

Policy objectives of pond dredging projects are outlined in DNREC's Delaware Pond Dredging Program, effective July 1984. Anyone wishing to conduct pond dredging must submit an application to DNREC, Division of Water Resources. An environmental assessment must accompany the application for any "privately owned pond using state or private equipment. Public hearings on the project are scheduled prior to permit approval. When all requirements are met a State Subaqueous Lands Permit is issued by DNREC. A U.S. Army Corps of Engineers permit must also be issued if filling activities will occur within a wetland or floodplain.

Periodic field inspections are conducted by DNREC to assure compliance. If the project violates the State of Delaware's Water Quality Standards, it will be stopped until the conditions improve. All upland disposal sites must be reviewed by the U.S. Army Corps of Engineers.

DNREC owns and operates 2 dredges, a small 10" pipe dredge used for minimum spoil disposal of 5 acres and a large 14" pipe dredge used for disposal sites of 6-7 acres. New Castle Conservation District owns a 10" dredge used for pond restoration. All dredging projects in the State are now studied in detail and documented. Dredge material is being used for wetland and island creation in several areas. Some of these demonstration projects will be studied in detail for environmental effects and long term stability.

Other Hydrologic/Habitat Modification

Dam construction, flow regulation/modification, bridge construction, removal of riparian vegetation and streambank modification/destabilization all would require the same review processes and many of the same permits. Listed below is a summary of these reviews and permits.

1. Federal Funds for any project would then initiate a NEPA review.
2. Work in water courses would require a State Subaqueous Lands Permit which involves a Water Quality Certificate.
3. These activities would require an approval erosion and sediment control plan.
4. Any fill activities would require a U.S. Corps of Engineers 404 Permit.

Best Management Practices would be incorporated as part of these permit reviews and could involve BMPs given to Appendix A.

Other Nonpoint Source Pollution

ATMOSPHERIC DEPOSITION

Non-point source pollutants to surface water from the atmosphere include metals, organics, nutrients, particulates and acids. The 1968 State air pollution control regulations have improved air quality through emission reduction from heavy industries and utilities. Pollutants, including sulfur dioxide and suspended particles, have been reduced and controlled at or

considerably below levels meeting national public health and environmental standards.

Lower atmospheric ozone is a major component of smog produced by chemical and industrial plants, refineries, dry cleaners, gas stations and automobile emissions. High levels of this pollutant can produce health and environmental problems in a widespread area. Control is difficult because the sources are varied and dispersed and because it takes time for the volatile organic compounds and other precursors to react with sunlight to produce ozone.

Toxic air pollutants such as metals and organics include a vast number of chemicals emitted from a variety of sources such as; industrial and manufacturing processes, sewage treatment plants, hazardous waste treatment-storage and/or disposal facilities (TDSF) and fuel combustion. Presently, there is a lack of health standards for ambient air toxics due to an absence of information. Figure 2 lists a few air toxics for which emission standards have been set.

Figure 2

HAZARDOUS (TOXIC) POLLUTANTS WITH ESTABLISHED EMISSION STANDARDS

Pollutant	Source
Asbestos	Asbestos mills, road surfacing with asbestos tailings, manufacturers of asbestos-containing products (fire-proofing, etc.) demolition of old buildings, spray insulation.
Beryllium	extraction plants, ceramic manufacturers, foundries, incinerators, rocket motor manufacturing operations.
Mercury	ore processing, chlor-alkali manufacturing, sludge dryers and incinerators.

Vinyl Chloride	Ethylene dichloride manufacturers, vinyl chloride manufacturers, polyvinyl chloride manufacturers.

Source: 1987 Delaware Environmental LEGACY

Input of particulates and nutrients from rain washout and dry fallout to surface waters can be significant. In "closed" systems (e.g. lakes with limited surface or groundwater inflows), this type of input will govern the quality of the waters. Studies have shown large seasonal and spatial variations in concentrations. For example, ammonia concentrations in agricultural areas are much higher in the spring than other times," particulate lead levels drop off rapidly in air and soil in the first few hundred feet downwind of major highways.

To date, acid rain has not shown serious visible effects in Delaware. Precipitation is naturally acidic. Atmospheric pollutants return to the soil and water through wet precipitation in the form of acid rain. This lowers the pH in water to levels unsuitable for plant and animals. It also interacts with sediment in lake bottoms to release toxic metals. Lower pH rainwater in conjunction with other pollutants such as ozone can damage agricultural crops and trees. Most of the acid rain which falls in Delaware is generated out-of-state. Acid rain is a problem on a national scale.

Existing Programs

In 1982, Delaware developed a State Implementation Plan to reduce emissions and in order to attain the National Ambient Air Quality Standard (NAAQS) for ozone. Since then, significant volatile organic compound (VOC) reductions have been made. Double seals were added to all gasoline storage tanks and some crude oil storage tanks. Vapor recovery systems were added to bulk gasoline terminals and at all gasoline dispensing facilities in New Castle County.

From 1980 to 1986, Delaware experienced a 35.5% decrease in highway mobile source VOC emission. Overall, mobile source emission reductions occurred due to

a combination of the implementation of the 1983 (mandatory) Delaware Motor Vehicle Inspection and Maintenance Program and vehicle attrition since newer model vehicles have improved emission control technology. Air quality is being monitored at 14 sites statewide: 9 in New Castle County, 1 in Kent County, 2 in Sussex County, and 2 are on stand-by. These sites monitor five air pollutants; sulfur dioxide, total suspended particulates, carbon monoxide, ozone and acid rain. Two sites in New Castle have been monitored since 1979.

Due to commitments of the 1982 program, VOC's have been reduced from 103,400 kg/day in 1980 to 63,318 kg/day in 1986 (1986 Report on Reasonable Further Progress (RFP) Toward the Attainment of the National Ambient Air Quality Standard for Ozone). A proposal is in motion for additional monitoring stations to measure low level ozone transports from the Baltimore-Washington D.C. Area. A downwind station in Clarksboro, NJ monitors air pollutants from northern Delaware. The 1977 Clean Air Act required all States to achieve national standards by December 31, 1987. To date Delaware has not met these standards. Monitoring data from Kent County now indicates that the county will probably be required to be controlled for VOC's in the near future. Data from Sussex County shows marginal attainment of national standards. New Castle County has placed controls on major industrial hydrocarbon emission sources. Annually, Delaware will be looking for a 3% hydrocarbon reduction from emission sources. A "Post 1987 Ozone Attainment Strategy," proposed by EPA, is currently up for public comment. Monthly air quality is monitored and a report published. DNREC is currently developing toxic air regulations for permit issuance of controlled toxic air emissions. Existing permits are being evaluated for effective toxic emission controls.

Since 1977, the University of Delaware College of Marine Studies, has been conducting atmospheric chemistry research at a site in Cape Henlopen State Park, near Lewes. Through funding from various federal agencies (Dept. of Energy,

NOAA, USGS), the chemistry of individual precipitation events has been analyzed on a continuous basis for a ten year period. The long-term pH of precipitation at Lewes is 4.32, which is comparable to other sites in the northeastern U.S. Values as low as 3.0 have been recorded, with maximum acidities during the summer months. The Lewes data suggest an enrichment of the nitric acid component (relative to sulfuric acid) compared to other northeastern U.S. sites, which may reflect local or regional (Washington-Baltimore-Philadelphia corridor) inputs from automobile emissions. Recent research has focused on measuring the concentration of trace metals in precipitation, in conjunction with air mass trajectory analysis, in an attempt to identify specific sources of acid rain in Delaware.

Waste Storage/Storage Tank Leaks

Leaks from surface storage tanks are detectable by visual inspection. Underground storage tanks are not so easily detected and are being addressed by the Federal LUST program (Leaking Underground Storage Tanks). Delaware's 1987 Ground Water Management Plan describes the problem.

"Underground Storage Tanks: Leaking underground storage tanks and pipelines have been recently recognized as a widespread source of ground water contamination. Tanks for fuel storage that were buried in the 1940's or 1950's were generally made of steel and subject to corrosion in most soils. Over 140 of these tanks and/or connecting pipelines are now leaking and contaminating the ground water with hydrocarbons and other toxic substances through the State.

The vast number of and proximity of underground storage tanks to shallow wells make leaking underground storage tanks a major concern in Delaware. A new state law was passed in 1985 and regulations were adopted in 1986 to deal with this issue."

Highway Maintenance and Runoff

Non-point source pollutants can occur from transportation facilities and networks, individual vehicles and commuter services both on the land and in the air. Pollutants, such as trace metals and toxic organics originate from the friction and passage of traffic over highways and from exhausts. Acid rains enhance metallic decay increasing the time and amount of concentration from these pollutant sources. Usage of unleaded gasoline has resulted in a reduction of trace metals found in stormwater runoff levels and the atmosphere. Other pollutants include hydrocarbon compounds that are found in oil and grease on road surfaces, parking lots and service stations. (Refer to Figure 3).

Deicing salts have the highest pollution potential during the winter months when they are used for snow and ice removal on roadways and walkways. Chloride content in nearby streams is drastically increased from surface and subsurface runoff. Although impact on aquatic life is rare this can effect drinking water.

Deicing salt additives that prevent pavement cracking and surface corrosion could be toxic to humans and animals. Storage facilities for these road salts must protect them from precipitation and runoff to reduce the formation of brines.

Figure 3

SOURCES OF COMMON STREET POLLUTANTS

Sources	Pollutants
Local soil erosion	Particulates (inert)
Local plants & soils (transported by wind & traffic)	Nitrogen & Phosphorus
Wear of asphalt street surfaces	Phenolic compounds
Spills from vehicles (oil additives)	Grease, petroleum, lead and n-paraffin
Combustion of leaded fuels	Lead
Tire wear	Lead, zinc and asbestos
Clutch & brake lining wear	Asbestos, lead, nickel, chromium and copper
Vehicle & metal parts wear	Copper, nickel and chromium
Deicing compounds (traffic dependent), road abrasives & soils.	Chlorides

Source: Northern Virginia Planning District Commission, BMP Handbook for Occoquan Watershed, Annandale, Virginia, August 1987.

Another type of roadway pollutant is thermal pollutant. Impermeable surfaces heat-up and runoff can cause temperatures of nearby stream water to increase by $10^{\circ}F$ to $15^{\circ}F$. This may lead to oxygen deficiencies and aquatic life decline.

Existing Programs

The Delaware State Department of Transportation (DELDOT) currently has a road-salt storage program incorporating covers for deicing salts. Existing wooden structures are being replaced. Since 1985, budgeted monies have been appropriated for one or two storage facilities per year. To date, there is a minimum of one building in each of the county highway yards. DELDOT is also monitoring application of road deicing salts to insure that only the needed amount is applied. Experimental ground sensing units have been installed on six salt spreading trucks which releases salt according to vehicle speed. DELDOT plans to purchase six more trucks with this sensing unit.

DELDOT has a full time horticulturist who is responsible for seeding determinations and erosion control measures on newly constructed road shoulders. The vegetative right-of-way width not only provides motorists with a safe recovery area, but it acts as a filter strip for pollutant runoff from roadway surfaces. Recovery areas on state highways are ideally 30 feet wide but vary from very little (2') to several hundred feet). Secondary roads do not have standard recovery widths, but do include a vegetative swale for drainage easement. A proposed Stormwater Management Plan for state roadway work is based on the present E&S Law.

DELDOT is working with the New Castle County Government for information on known aquifer recharge areas in order that proposed roadways can be adequately separated from these areas. Knowledge of these sensitive areas will also help in conducting reclamation projects from roadway spills without damaging the recharge area. Through a DRAFT Memorandum of Understanding with DNREC transportation of hazardous waste material on the state road network is addressed and monitored. DELDOT is working with DNREC on underground storage tanks (LUST Program).

DELDOT is evaluating various methods of establishing marsh vegetation on exposed tidal marsh sites such as the St. Jones Rt. #113 Site (smooth cordgrass

establishment by seeding and planting in conjunction with phragmites control) at Barker's Landing. The establishment of wetland vegetation is generally considered on a project specific basis where wetland acreage is affected. In addition, the Department has begun the development of a wetland site on the Mispillion River at Route 1. Through excavation only, no dredging is expected, we hope to create additional acres of wetlands to off-set acreage lost where it can not be replaced on-site. In conjunction with the U.S. Route 13 Relief Route Project, the Department is also considering the conversion of Borrow Pits to wetland areas.

Throughout the State, DELDOT utilizes the existing Delaware Erosion and Sediment Control Handbook on roadway projects. The roadway design engineer within the Department either develops E&S control practices on each plan or refers it to a consultant. DELDOT personnel conduct monitoring reviews of each project.

SPILLS

Delaware is vulnerable to polluting spills during both on land and water transport. The State Office of Emergency Management has developed a Oil & Hazardous Substance Incident Contingency Plan, June 1, 1984. Delaware's Clean Water Strategy addresses both of these issues.

The transportation of hazardous waste and hazardous materials is recognized as an issue because of the potential health and environmental effects resulting from a transportation-related accident or emergency. This is a particularly relevant concern in light of the volume of hazardous waste and materials that are moved by rail and highway.

Improvements in technology have significantly reduced a transportation vehicle's vulnerability to accidents. Railroad tank car design and construction improvements have reduced the number of major environmental/public health emergencies associated with train derailments.

The transportation of hazardous materials is regulated by the United States Department of Transportation. The Delaware Department of Transportation and the Delaware Department of Public Safety help enforce numerous aspects of the federal law by conducting truck inspections at selected sites in Delaware.

The transportation of hazardous wastes is also regulated by the United States Environmental Protection Agency under the provisions of the Resource Conservation and Recovery Act amendments of 1980. Delaware also has the authority to regulate the transportation of hazardous waste under state law (7 Del. Code C. 63).

Existing regulations appear to be sound but implementation of the regulations, particularly those governing the transport of hazardous materials, appear to be weak. Regulations do not exist to control the routing of hazardous materials/waste transporters through the state.

The establishment of safe transportation corridors for hazardous materials/waste shipments while desirable from the public's viewpoint might be legally impossible due to Interstate Commerce Act provisions which allow for the uninterrupted movement of cargoes throughout the United States.

There may be resistance by the trucking and railroad industry to increased regulation over the transportation of hazardous materials. Moreover, the establishment of safe transportation corridors within Delaware could be challenged in the courts as interfering with the free commerce provisions of the Interstate Commerce Act.

Delaware has no clearly defined policy which deals with the safe transportation of hazardous materials/hazardous wastes, although preliminary recommendations were developed by the Hazardous Materials Commission in early 1984. The emphasis appears to be placed on responding to a transportation related emergency as opposed to preventing the emergency from occurring.

RECOMMENDATION THE STATE SHOULD ESTABLISH A POLICY GOVERNING THE TRANSPORTATION OF HAZARDOUS WASTES AND HAZARDOUS MATERIALS TO MINIMIZE POTENTIAL ADVERSE IMPACTS TO THE PUBLIC HEALTH AND THE ENVIRONMENT.

Steps to implement this recommendation include:

1. Determine the effectiveness of DOT, EPA and state (DPS-DNREC) policies/procedures/requirements concerning the transportation of hazardous wastes/materials in Delaware.
2. Examine the feasibility of establishing transportation corridors for hazardous wastes/materials shipments.
3. Strengthen inspection program for vehicles transporting hazardous wastes and materials.

Oil Spill Contingency Plan: State environmental agencies of Delaware and New Jersey are actively engaged in developing a Delaware River and Bay Oil Spill contingency Plan with various Federal Agencies (USCG, NOAA, US Fish and Wildlife, etc.). The purpose of this effort supplies and manpower in the initial critical hours of a major oil spill event upon the River or Bay.

The plan is to be developed in four phases as described below:

Phase I - Identify environmental receptors by season

(a) Shoreline Types - wetlands, sand beaches, mudbars, etc.

(b) Environmental Resources

1. Fish Resources - spawning, nursery and staging areas.
2. Shellfish areas
3. Wildlife

(c) Socio-Economic Resources

1. Public drinking water intakes
2. Public recreational beaches

Phase II - Prioritize environmental receptors for protection and recovery

Phase III - Establish:

1. Protection Strategies
2. Equipment Inventories
3. Protection and Clean-up techniques and methodologies.

In Place Contaminants

Historic NPSP sources may exist as in place contaminants. These sources could include old landfill sites, abandoned farmsteads or industrial lands, old building materials, etc. These types of NPSP sources will be handled on a case by case basis due to the severity of the NPSP problem on surface and ground water.

NATURAL

Natural areas such as wetlands and forestlands can be net exporters of nutrients. Although this would be called the natural background NPSP, sometimes BMPs can be used to reduce the level of nutrients. BMPs listed in Appendix A can often help reduce the natural delivery of nutrients to surface and ground water.

SPECIAL DISCUSSIONS

WATER SUPPLY MANAGEMENT

Rainfall must be able to infiltrate the ground continuously during precipitation to replenish groundwater aquifers. In Delaware, groundwater recharge averages about 14 inches per year or over a half million gallons per square mile per day (LEGACY, 1987). This amount is subject to variations in seasonal precipitation, as well as topographic conditions and soil structure. The primary loss of recharge is through reduction of pervious open space in urbanizing areas. Artificial recharge techniques (i.e. retention basins) can offset some of the effects of impervious surfaces and should be utilized whenever practical. Developed areas impact available water supply through

increased runoff and introduction of contamination sources and increased use of aquifers for domestic water supply.

Saltwater intrusion into water supplies continues to be a concern and could be considered a non-point source pollution problem. This is a factor along the Atlantic coast, Delaware Bay and its estuaries the C & D Canal and the Inland Bays of Sussex County. Some public water supply wells have already been abandoned due to saltwater intrusion and replaced by either deeper wells or wells installed farther inland.

Existing Programs

The State of Delaware does not have legislation to protect aquifer recharge and wellhead areas from urbanization. Historically, water supplies have been abundant with very few cases of supply contamination. A Groundwater Management Plan for the protection of quantity and quality was completed in November of 1987 and will be finalized soon.

New Castle County has developed measures to protect wellhead areas from hazardous wastes. The 1986 amendments to the National Safe Drinking Water Act require that all states formulate a program for well-head protection. One is presently being developed for the State. State mandated requirements for wellhead protection areas may be viewed as very controversial, because land use decisions have traditionally been a local level responsibility. Protection programs must incorporate present and future supplies of the aquifer recharge areas. Protection areas will either restrict or modify development to assure protection of the resource.

In New Castle County, north of the Chesapeake & Delaware Canal, there are five municipal or investor-owned water utilities which provide more than 80% of the water to that area. Both state and local water resource agencies encourage regionalization and supply optimization. WATER 2000, New Castle County's water resource program, is a comprehensive water plan with a long term

strategy for conservation, management, protection and development of water resources in the county.

In March 1987, DNREC adopted water allocations regulations as recommended by the 1983 Comprehensive Water Resources Management Plan, promoting regionalization. These allocation regulations will assist in the state's response during droughts and to effectively utilize, conserve and protect water resources of the State. DNREC also adopted a Departmental policy for the creation of water service franchise areas that grant exclusive rights to provide public water service within a given area. Developments outside these franchise areas are still burdened with obtaining utility service.

Almost all municipalities in the state have a central water supply system, but most of them are very old and need extensive maintenance or replacement. DNREC has no jurisdiction over municipally-owned water systems in lower Delaware. At this time, DNREC only issues waterwell permits and enforces certain health regulations. DNREC does have some jurisdiction in other areas of the state.

The existing well permit program tracks well installation and allocation. DNREC issues the permits and uses them as a tracking system for the number of existing and replacement wells. In 1988, EPA, under the National Pesticide Survey, will test domestic and public wells in Sussex County (one of 9 nationwide pilot projects). Under the National Water Quality Assessment Program (NAWQUA), a U.S.G.S. team will sample wells on the Delmarva Peninsula in 1988 for nitrates, metals, agricultural fertilizers, and pesticides and will assess present water quality conditions of shallow aquifers. There are seven areas nationwide which will undergo the sampling.

The Delaware Geological Survey (DGS) has almost completed a hydrologic mapping program of Delaware. New Castle County utilizes this information system to indicate areas that are potentially vulnerable to groundwater contamination.

New Castle County is beginning implementation of a Resource Protection Area program as outlined in the New Comprehensive Development Plan which addresses performance oriented preservation and mitigation techniques to protect flood plains, wetlands, surface waters, and aquifer recharge areas.

The New Castle WRA proposes to redefine and expand the existing Resource Protection Areas (RPA) to include: the Cockeysville formation RPA, the Well-head RPA, the Surface Water RPA and the Recharge RPA. The Water Resource Agency works through a cooperative program with the cities of Newark, Wilmington and the New Castle County Government.

Other Programs: Urban Forestry

The Department of Agriculture, Forestry Section conducts a request-basis urban forestry program. This assistance entails site specific management recommendations to ensure proper silvicultural practices and perpetration of the forest. To be most effective, pre-development or pre-land clearing planning is needed. This program can supplement and possibly reduce sediment and erosion control needs.

The watershed and county forestry programs of the Delaware Department of Agriculture, Forestry Section are designed to provide owners of woodland with forest management assistance. This assistance entails site-specific management recommendations to ensure perpetuation of the forest. Where water quality protection is the primary need or objective, for instance along streams, these management plans can provide for long-term health of these woodlands.

Water Bodies

Delaware is strongly influenced by large waterbodies including the Delaware River and Bay, Inland Bay and the Atlantic Ocean. In developing resource management systems to address different land uses, Delaware's open water resources were identified as a unique nonpoint source pollution management issue. Although water bodies are affected by pollution generated from the land, they are also affected by non-point source pollution generated on the water

bodies. Non-point source pollution on a water body may be generated by a variety of activities including recreational and commercial boating, dredging and shoreline erosion.

In developing the management plan it was difficult to identify a lead agency on open water bodies issues. As a result a major implementation component of Delaware's non-point source pollution management program will be to work closely with the nation estuary programs targeted for the Inland Bays and Delaware River and Bay. In addition, the local conservation districts have proposal to extend their long range resource management plans to include these water bodies where practical. Over the next few years comprehensive management plan should be developed for both the Inland Bays and the Delaware River and Bay through the National Estuary Program and the local conservation districts will develop compatible new long range management plans.

In addition to the large water bodies, Delaware has many smaller mill ponds. These ponds could also be benefited by on-water management strategies.

The following practices may become part of the management strategies that can address non-point source pollution on open water bodies in addition to the land generated sources of pollution.

1. Provide pump out and portable toilet dumping facilities.
2. Develop state regulations on overboard disposal.
3. Use approved marine sanitation devices.
4. Develop criteria for Marine location.
5. Develop dredging policies.
6. Develop a shoreline stabilization program.
7. Limit the use of salt-treated or creosote timbers or bulkheads, docks and piers.
8. Limit tin-based paints for boats.
9. Identify areas of limited boat access.

10. Identify areas where boat makes should be limited to NPSP.
11. Develop remediation plans for poorly designed canals and lagoons (i.e. aeration, mixing, slow stabilization).
12. Develop BMP's for bridge repainting.
13. Develop BMP's for boat oil and fuel spill prevention.
14. Develop BMP's for plant and fish management.

IMPLEMENTING A NON-POINT SOURCE POLLUTION MANAGEMENT PROGRAM

EPA outlines six categories required to implement a non-point source pollution plan.

A. **"Best management practices and management measures which will be used to reduce pollutant loadings resulting from each category, subcategory or particular non-point source designated to the State's Assessment Report, taking into account the impact of the practice on ground water quality."**

As discussed, Delaware is taking a Resource Management Systems approach to both rural and urban non-point source pollution problems. Under this Systems Approach, Best Management Practices are considered as a small component of an overall plan to address a complex problem such as fertilizer pollution on cropland. Appendix A and B give detailed breakdown of best management practices available under the resource management system approach.

The resource management system approach is compatible with the USDA conservation coding system. This compatibility will assist in tracking NPS accomplishments and developing future needs.

While the rural NPS problems have a long history of BMP development within USDA agencies, urban NPS problems do not. Through work with urban erosion and sediment control and stormwater management, the framework for coding of BMPs for urban resource management systems is in place but not fully developed. Appendix A identifies BMP's that the management program will utilize the current USDA recording system and help develop it further to address urban NPS problems.

The conservation practices developed in the SCS technical guides consider both surface and ground water. As new technical information is received, the practices are changed. For example many practices which were used to control surface water contamination were recently discovered to increase ground water contamination in certain soil types. Therefore, some of these practices have

been revised. Delaware will continue to utilize the state of the art conservation practices as outlined in the SCS technical guides.

The following Table correlates EPA's category sheet with Delaware's Non-Point Source Pollution Management Plan.

Table 8

Major Non-Point Source (NPS) Pollution

Categories and Subcategories

EPA Category	Delaware NPS Program
10. Agriculture	In Chapter on Rural RMS
11. Non irrigated crop production 12. Irrigated crop production 13. Specialty crop production	Cropland Resource Management System including sediments, pesticides, fertilizers, agricultural and municipal waste application
14. Pasture Land	Pastureland Resource Management System including sediments, pesticides, fertilizers and agricultural and municipal waste application
15. Range Land	Not applicable in Delaware
16. Feed Lots - all types	Farmstead Resource Management System including all components of animal wastes
17. Aquaculture	At this time only a minor industry in Delaware
18. Animal holding/management areas	Farmstead Resource Management System including all components of animal waste management (ie manures, dead animals etc)
20. Silviculture	In Chapter on Rural NPS
21. Harvesting, reforestation, residue management	Forestland Resource Management System including sediments and pesticides
22. Forest Management	
23. Road Construction/Maintenance	

30.	Construction	In Chapter on Urban NPS
	31. Highway/Road/Bridge	Transportation Section including erosion & sediment control
	32. Land Development	Urban Runoff Section including erosion & sediment control and stormwater management
40.	Urban Runoff	
	41. Storm sewers (source control)	Urban Runoff Section including stormwater management, surface runoff, erosion and sediment control, floodplain management and pesticide and fertilizer application on lawns.
	42. Combined Sewers	
	43. Surface Runoff	
50.	Resource Extracting/Exploration/ Development	In Chapter on Urban NPS
	51. Surface Mining	Resource Extraction/Exploration/ Development includes Soils Mining
	52. Subsurface Mining	Not applicable in Delaware
	53. Placer Mining	Not applicable in Delaware
	54. Dredge Mining	Resource Extraction/Exploration/ Development includes dredge mining
	55. Petroleum Activities	Not now applicable in Delaware
	56. Mill Tailings	Not applicable in Delaware
	57. Mine Tailings	Not applicable in Delaware
60.	Land Disposal (Runoff/Leachate from Permitted Areas)	In Chapter on Urban NPS
	61. Sludge	In Rural: Land Treatment of Waste: Sludge/Septage
	62. Wastewater	In Rural: Land Treatment of Waste: Wastewater
	63. Landfills	In Land Disposal Section
	64. Industrial Land Treatment	In Land Disposal Section

65.	On-Site Wastewater Systems	In Rural: On-Site Wastewater Systems
66.	Hazardous Waste	In Land Disposal Section
70.	Hydrologic/Habitat Modification	
71.	Channelization	Separate discussion channelization
72.	Dredging	Separate discussion dredging
73.	Dam Construction	
74.	Flow regulation/modification	
75.	Bridge Construction	Combined discussion 73-77 includes construction requirements and applicable permits
76.	Removal of riparian vegetation	
77.	Streambank Modification/ destabilization	
80.	Other	
81.	Atmospheric Deposition	Atmospheric Deposition Section includes Program Description
82.	Waste Storage/Storage Tank	Separate discussion
83.	Highway maintenance and runoff	Transportation Section includes fertilizers, salts and other pollutants
84.	Spills	Separate discussion
85.	In Place Contaminants	Separate discussion
86.	Natural	Separate discussion

B. Programs (including as appropriate, non-regulatory or regulatory program for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects) to achieve implementation of the best management practices designated under subparagraph (A).

The NPSP assessment, Appendix III of the assessment ("Delaware's Clean Water Strategy" March 30, 1988 including "Delaware's Environmental Legacy) and the discussion in the NPS management plan all point out existing programs underway or needed to address NPSP in Delaware. To begin a coordination framework the management plan includes a Schedule of Implementation. The schedule identifies the NPS Pollution Category, the Specific NPSP Problem, the Responsible Agency or Agencies and Milestones. The overall responsibility to monitor and facilitate this schedule will be DNREC through assigned leadership in the Division of Soil and Water Conservation and Water Resources as time and funding permit and using existing structures such as TEAM and on-going programs such as the Inland Bays.

The Non-point Source Pollution Management Program is not an isolated program, but an integration of existing programs. As mentioned throughout the report, several key programs are underway which will strongly enhance the NPSP management program. Other programs include Delaware Environmental Legacy Program, Delaware's Clean Water Strategy, as well as the Estuary Programs on the Inland Bays and Delaware River and Bay. Highlights of these programs are summarized below.

DELAWARE'S ENVIRONMENTAL LEGACY

"Governor Castle announced the creation of the Delaware Environmental Legacy Program in April 1986 as a long ranged plan, one that will assure that Delaware's environmental legacy will be undiminished as we begin the 21st Century." Over 150 people participated in developing the Legacy Program which was published in January 1988. The Legacy Program Report contains 122

recommendations. Almost all of the recommendations address nonpoint source pollution in some way and will be integrated into Delaware's Nonpoint Source Pollution Management Program where feasible. Below is a summary of key recommendations from the Environmental Legacy Report.

SUMMARY OF KEY RECOMMENDATIONS

1. Ways to sustain our present air quality
   * Delaware needs to seek a regional solution to the state's ozone problem which is aggravated by emissions from upwind states.
   * The state must develop an air toxics control strategy to include substantial participation and assistance from the private scientific community.
   * The state should develop a statewide indoor air pollution control program.
   * Delaware must continue to maintain vigilance over the potential effects of acid precipitation.
2. Ways to protect the state's water resources
   * Groundwater aquifer recharge areas should be protected through land use restrictions and other controls by state and local governments.
   * Require water saving plumbing devices in new buildings and in those being rehabilitated.
   * Improve programs to monitor and control toxic chemicals.
   * Implement a program to clean Delaware's lakes and ponds and keep them clean.
   * Provide increased resources and other means to protect groundwater.
   * Establish stormwater management programs on a statewide basis with state and local government coordinating activities.

* Help to assure availability of water through regionalization and, where feasible, the interconnection of facilities.
* Adopt a water systems financing policy to assist local governments in rehabilitating and expanding water systems.

3. Ways to help manage and curtail, the increasing wastes that will be generated by the state's expected population and economic growth in the next generation
   * Construct a second waste reclamation project to serve Kent and Sussex Counties.
   * Develop a program to reduce the generation of hazardous and non hazardous wastes.
   * Increase citizen awareness of household hazardous wastes and their proper disposal and support a program to collect and dispose of such wastes.
   * Adopt a policy of "recycling" land fills rather than developing new ones.
   * Establish a fund for the cleanup of Delaware's hazardous waste sites and other hazardous material spills.
   * Oppose use of the Delaware River and Bay as a transportation corridor for ocean bound hazardous wastes incineration vessels.
4. Ways to help sustain and/or restore key ecologic habitats and other important environmental resources
   * Protect freshwater wetlands through legislation and other means.
   * Implement sufficient pollution controls so that waters in the Delaware River can restore and sustain populations of anadromous fish and other species that have seriously declined over the years.

* Conduct a comprehensive study of the Delaware Estuary and Inland Bays.
* Provide adequate funds, legislation and other means, including closer cooperation by local governments, to protect Delaware's critical natural and cultural areas.
* Consider all activities carried out within a watershed in a "holistic" manner, where emphasis is placed on the functional relationship between each activity.
* Develop a comprehensive land acquisition program to ensure adequate open space is preserved for the protection of important natural resources and for outdoor recreation.
* Develop a strategic management plan to assure continued protection of Delaware's beaches.
* Increase environmental protection and conservation measures on agricultural lands principally by expanding the role of local conservation districts and by encouraging ways to improve the farmer's financial well-being.

5. Ways to make better environmentally sensitive land use decisions, particularly the placement of roads, sewers and other major "infrastructure" that can pose serious environmental consequences
   * Require all local government land use regulations and infrastructure placement decisions be consistent with comprehensive development plans and allowing plans to be amended only where the benefits of amending the plan are for the good of the community at large; and by requiring that state environmental protection policies and standards be incorporated into local plans.
   * Improve coordination between state and local governments regarding land use matters through legislation and other means.

* Encourage development and growth within existing communities as opposed to scattered growth and supporting that concept through taxing policies, impact fees and other means of directing growth.
* Encourage and fund public transportation where practicable.

6. Ways to help inculcate an environmental ethic in our citizenry
   * Integrate environmental education into the public schools from kindergarten to grade 12 in a more formal manner.
   * Improve and expand adult education opportunities.
   * Create a Delaware environmental institute.

DELAWARE'S CLEAN WATER STRATEGY, 1988

Delaware's Clean Water Strategy was developed to show the Department of Natural Resources and Environmental Control's plans for satisfying the requirements of the Water Quality Act of 1987. The strategy also relies on other programs, such as the nonpoint source pollution management plan and the Environmental Legacy Program as well as development of goals for the Division of Water Resources.

The Division of Water Resources goals all relate to water quality improvements and either address nonpoint source pollution directly or indirectly. The following goals would have a direct effect on nonpoint source pollution.

BROAD GOAL

To protect and maintain the quality of life in Delaware through the wise management of the state's load and water resources.

GOALS DIRECTLY RELATED TO NONPOINT SOURCE POLLUTION

To improve the conduct of land use planning as it relates to the management of environmental resources.

To provide water quality planning support to Division of Water Resources water programs including coordination of nonpoint source pollution abatement program and Inland Bays Environmental Management Program.

To develop a household hazardous waste cleanup program.

To review and update water pollution control statutes and regulations.

To improve water quality monitoring and data analysis programs.

To improve public participation/education efforts to increase the public's involvement in water pollution control activities.

To improve water quality and quantity planning and research activities for the State.

DELAWARE'S INLAND BAYS PROPOSAL: ESTUARINE CONSERVATION AND MANAGEMENT PLAN

A proposal was submitted to the U.S. Environmental Protection Agency to develop an estuarine conservation and management plan for Delaware's Inland Bays. The following needs will be addressed as part of the program. Again many of the needs will be incorporated into the statewide nonpoint source pollution management program.

Non-Point (Land-Based)

a. Agriculture

* Enhancement of Agricultural Education Services Staff
* Technology transfer of BMP advantages to farmers
* Enhancement of BMP cost share monies
* Requirements governing the use of BMPs
* Feasibility study on the reuse of poultry manure
* Inventory of agricultural operations
* Literature search of agricultural controls required by other states
* Examination of the use of buffer areas
* Evaluation of "no-till"

b. Residential Stormwater

* Development of a plan to retrofit stormwater management practices in critical subwatersheds
* Determination on how to regulate stormwater management
* Demonstration of the efficacy of stormwater management techniques
* Technology transfer to local land use planners

c. On-Site Waste Disposal

* Enhancement of On-Site Inspection staff
* Technology transfer to homeowners, builders, realtors, and local planners
* Demonstration projects on innovative systems
* Development of central sewage systems for small communities
* Update the Water Quality Management Plan

Non-Point (Water-Based)

1. Marina/Boat

* Examination of the impacts of marinas and open-water boating on water quality and aquatic life

2. Dredge Effects

* Examination of the effects of dredging
* Evaluation of the Dredging Policy
* Adoption of Dredging Regulations

DELAWARE RIVER AND BAY ESTUARY PROPOSAL: ESTUARINE CONSERVATION AND MANAGEMENT PLAN

A proposal has been submitted to EPA to develop an estuarine conservation and management plan. Nonpoint source pollution problems will be identified in the plan and solutions will be coordinated closely with the local conservation districts and the NPSP management program.

C. "A schedule containing milestones for (i) utilization of the program implementation methods identified in subparagraph (B), and (ii) implementation of the best management practices identified in subparagraph (A) by the categories, subcategories, or particular nonpoint sources designated in the State's Assessment Report. Such schedule shall provide for utilization of the best management practices at the earliest practicable date."

The following Schedule of Implementation identifies milestones for the various nonpoint source pollution problems found in Delaware. Table 9 gives the conservation workload of Statewide Indicators.

To track NPSP program progress in Delaware, 12 indicator practices were chosen. These practices are part of the Resource Management System Approach, the expected conservation practice workload and the USDA recordkeeping system. The Indicator Practice Definitions are given below.

INDICATOR PRACTICE DEFINITIONS

Conservation Cropping Sequence (Ac.) - An updated sequence of crops designed to provide adequate organic residue for maintenance or improvement of soil tilth. Improved soil tilth promotes water infiltration and reduces runoff and provides related benefits and hazards to water quality (See Conservation Tillage).

Conservation Cropping Sequence can recduce soil erosion if sod forming crops are part of the sequence. Close growing crops will reduce soil detachment from raindrop and runoff water and filter suspended sediment and organics. Use of cover and green manure crops in the cropping sequence can reduce erosion rates

by 40 to 95 percent while these crops scavenge for excess nitrogen in the soil profile.

Conservation Tillage (Ac.) - Any tillage and planting system in which at least 30 percent of the soil surface is covered by plant residue after planting to reduce soil erosion by water. Where soil erosion by wind is the primary concern, at least 1,000 pounds per acre of flat small grain residue-equivalent are on the surface during the critical erosion period.

Conservation Tillage can reduce soil losses by 60 to 99 percent compared to conventional tillage techniques. A corresponding reduction is sedimentation and soil attached pollutants can be expected. Because runoff from conservation tillage averages 25 percent less than convetnional tillage, indicating increased water percolation, potentially higher rates of water soluable pollutant leaching exists. Use of resource management systems that combine practices like conservation cropping sequence, conservation tillage, and fertilizer and pesticide management reduce this hazard.

Fertilizer Management (Ac.) - Managing the amount, placement, and timing of applications of plant nutrients such as nitrogen, phosphorous, potassium, and other elements needed for plant growth and crop production.

Fertilizer rates should be determined by realistic crop yield goals. After the goal is established and the fertilizer is applied, other limiting factors to plant growth must be managed to achieve the yield goal or excess fertilizer will be available for leaching and runoff.

Pesticide Management (Ac.) - Managing the timing, placement, and amount of application of pesticides.

Integrated pest management uses the most appropriate mixture of pest control techniques including cultural, mechanical, biological, and chemical methods to minimize pesticide movement to surface water or ground water.

Irrigation Water Management (Ac.) - Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.

Irrigation Water Management requires careful water monitoring to achieve identified yields goals, thereby reducing the availability of excess nutrients in the soil profile for runoff and leaching at the end of the growing season. This practice also requires avoiding excessive rates of water application that may cause flushing of agricultural chemicals from the profile or excessive runoff.

Grassed Waterway (Ac.) - A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the stable conveyance of runoff.

Grassed Waterways improve water quality mainly by reducing soil erosion. This practice may increase runoff volume and decrease soil infiltration. Waterways reduce the formation of gullies and decrease the sediment and attached chemical loading of adjacent waters. They have demonstrated the ability to reduce sediments, phosphorous, and pesticides in discharge waters by five to 40 percent.

Runoff Management System (No. and Ac.) - A system for controlling excess runoff caused by construction operations at development sites, changing land use, or other land disturbances.

The amount of land devoid of vegetation from construction activities at any time is relatively small compared to the acreage of cropland in Delaware. However, erosion rates from construction sites tend to be five to 10 times higher than rates from cropland on similar landscapes. Also, sediment delivery may be three to four times higher on construction sites. A well planned and installed runoff management system can reduce excessive rates of soil erosion and sedimentation to reasonable levels on construction sites.

Structure for Water Control (No.) - A structure in an irrigation, drainage, or other water management systems that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

This practice is used in Delaware to regulate water outflow from drainage systems. It increased crop yield reliability by reducing drought damage to more fully utilize applied fertilizers. The practice of regulating water outflow from drainage systems also promotes denitrification in the soil profile. This biochemical process has been shown to reduce nitrates concentrations in drainage discharge waters by one-third.

Terrace (Ft.) - An earth embankment, a channel, or a combination ridge and channel constructed across the slope.

Terraces reduce slope length to improve surface water quality by reducing soil erosion, sediment, and associated pollutants. Terraces can reduce soil erosion by 50 to 90 percent. Terraces may have a detrimental impact on water quality if they concentrate and accelerate delivery of dissolved or suspended nutrient, salt, or pesticide pollutants to surface waters or ground water.

Waste Management System (No.) - A planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas, in a manner that does not degrade air, soil, or water resources.

Waste Management Systems combine waste utilization, that defines manure nutrient content, crop nutrient needs, application machinery calibration, and timing of applications, with storage or treatemnt needs and runoff management.

Water and Sediment Control Basin (No.) - An earth embankment or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and a water detention basin.

Water and Sediment Control Basins provide similar benefits and potential hazards as terraces. Their area of impact is generally more limited than the impact area of terraces.

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Agriculture	* 10	(L)-Lead Agency				
(Sediment)	Education & Technical Assistance to landowners/operators	USDA - SCS DOA CES Conservation Districts (L)	Identify new NPSP needs Continue to provide existing cooperative programs	Upgrade & Continue existing program(s)	Upgrade & continue existing program(s)	Evaluate program(s)
	10 Financial Assistance (Federal & State)	USDA - ASCS (L) Conservation Districts	Assess Needs for ACP, FIP, RCWP, CRP, PL566	Continue Assessment	Continue Assessment	Continue Assessment
		DNREC - DSWC (L) Conservation Districts	Evaluate new NPSP needs & con't state c/s	Increase if necessary	Continue	Evaluate program(s)
		USDA - FmHA (L)	Increase involvement & public education	Upgrade & continue existing program	Continue	Evaluate program(s)
		EPA (L)	Provide construction grants	Provide continuing support	Continue	Evaluate program
(Pesticides)	10 Current and concise data on pesticides in groundwater	EPA (L)	Continue research in Sussex County through National Pesticides Survey			
		USGS DGS	Continue research through NWQA on Delmarva & cooperative program existing	Continue study on pesticides	Complete study	Publicize study finding(s)

EPA NPSP Categories

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S) (L)-Lead Agency	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Agriculture	40, 10					
(Pesticides) (cont'd)	Educate Private and Commertial pesticide applicators on proper use, calibration transportation, disposal & storage of material	DOA (L) CES	Provide user workshops, educate 100 private & 200 commercial new applicators & recertify 1,700 private & 1,200 commercial applicators by 1992	Increase education to targeted groups & retrain	Upgrade competency studies for applicators	Implement new studies & develop special training programs to address them
	10 Enhance pesticide applicator's licensing program	DOA (L) CES	Identify expanded NPSP needs & provide training programs	Incorporate identified needs into licensing procedure	Reduce the number of unlicensed applicators & businesses	Continue
	10 Improve management of sale & use of pesticides, provide technical assistance	DOA (L)	Identify expanded NPSP needs	Incorporate identified needs into existing program	Add environmental specialist to staff	Inc. monitoring activities at dealer user level
	10 Delaware Pesticide Management Plan (for groundwater)	CES DOA (L) DNREC	Draft action program survey 100 users/year for kinds amounts & locations of usage	Finalize draft continue survey	Implement plan & continue survey	Continue program survey
(Fertilizers)	11, 12, 13 Test fertilizers for label quality	DOA (L)	Identify expanded NPSP needs	Incorporate identified needs into existing program	Continue program	Continue program

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
		(L)-Lead Agency	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Agriculture						
(Fertilizers) (cont'd)	10 Education & Technical assistance to commercial fertilizer applicators	CES (L) DOA USDA-SCS Conservation Districts	Identify expand NPSP needs	Provide program on efficient use of fertilizer and agronomic practices Provide demonstration and research	Continue	Continue
	10 Data on water quality conditions & benefits of water management	DNREC DGS USGS USDA-SCS	Research through NWQA & develop action plan	Through USGS-DGS Cooperative Program publicize findings on irrigation and fertilizer movement into ground water.		Continue
(Agricultural Wastes)	11, 12, 13, 14 Guidelines for agricultural land waste disposal	CES DOA DNREC-SWM Sect., Water pollution branch (L)	Complete guidelines	Implement new guidelines (sludge & spray irrigation)	Continue	Evaluate program
	10 Educate users on proper manure management	DNREC CES SCS DOA Conservation Districts	Expand current programs; add staffing positions continue to reach 250 farmers, yearly	Implement waste utilization program	Continue	Continue
	10 Financial assistance for manure testing	CES Conservation Districts (L)	Develop coordinator program plan & facilitate through private state & federal agencies	Implement program	Continue	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
		(L)-Lead Agency	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Agriculture						
(Agricultural Waste) (cont'd)	Financial assistance on waste storage structures 16, 18	DNREC-DSWC USDA-ASCS Conservation Districts (L) USDA-FmHA	Continue existing programs (ACR, RCWP)	Continue	Continue	Continue
	(Poultry) dead bird disposal methods 18	DOA DNREC-DWR/DSWC CES & U of D USDA-SCS Conservation Districts	Conduct demonstration projects, education, & research	Continue	Recommend BMP's and consider cost-sharing	Continue
	Technical assistance 10	CES & U of D DOA USDA-SCS DNREC Conservation Districts	Identify new NPSP needs & continue existing programs	Increase technical assistance for NSPS, if needed Contact 100 farmers yearly	Continue	Continue
	New methods of agricultural waste storage 18	Conservation Districts DNREC-DWR/SWM/WPC CES & U of D DOA USDA-SCS USDA-ASCS	Identify extent of problem, review research literature	Implement plan to address problems	Propose new specifications	Continue
	Research & assistance on poultry manure spreading & reuse 18	CES DNREC DOA DPI Individual growers Conservation Districts	Organize symposium through districts plan & program	Implement spreader rental Plan manure regional brokerage	Implement area-wide manure	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Silviculture	20	(L)-Lead Agency				
	Statewide Forest Conservation Plans	DOA-FS (L) USDA-SCS Consultant Foresters	Expand conservation planning use for forestry practices	Expand to incorporate private foresters	Develop tracking system for private foresters	Evaluate
	21 Delaware State Timber Harvesting Techniques & Management Practices	DOA-FS (L) CES Conservation Districts	Develop harvesting guide book	Publish & distribute	Continue	Continue
	20 Address sediments & pesticides from forestry practices	DOA-FS (L) CES USDA-SCS USDA-ASCS	Continue technical assistance & education and financial assistance program(s)	Evaluate needs to address NPSP	Continue	Continue
	22,43 Pre-development Urban Forestry Program	County Governments CES DOA-FS (L) USDA-SCS Conservation Districts	Identify NPSP needs	Develop program	Implement Program	Evaluate & upgrade program
	20 Technical Assistance	DOA-FS (L) USDA-SCS	Continue existing programs	Continue	Continue	Continue
	21 Financial Assistance	DOA-FS USDA-ASCS (L)	Continue existing program	Continue	Continue	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S) (L)-Lead Agency	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Silviculture (cont'd)	20 Education of landowners/users of sound forest management practices	CES Conservation Districts DOA-FS (L) SCS	Develop action plan and information and education materials	Implement action plan	Evaluate & continue program	Continue program

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Land Disposal		(L)-Lead Agency				
(Community Services Land Managment)	60 Interstate & Regional Cooperative Agreement for Out-of-State Waste Disposal (liquid, solid, toxic)	DNREC-DAWM/WM (L)	Develop working group	Draft Document		
	63,66 State Superfund Program	DNREC-DAWM/WM (L)	Develop Program			
	62 Commercial On-Site Treatment Facility for Waste Detoxification, Neutralization & Stabilization	DSWA-(NON-HAZ,ONEY) DNREC-DAWM/WM (L)	Conduct Research			
	60 Solid & Liquid Waste Minimization Program (Information Clearinghouse	DNREC-DAWM/WM (L)	Collect data			
	66 Public Information = Hazardous Waste	DNREC-DAWM/WM (L) CES Conservation Districts	Develop publication and prepare a education program for 60,000 homeowners & youth	Print & distribute publication	Continue distribution	Continue distribution
	66 Toxic Waste Disposal Site for Local Homeowners (re-zoning?)	DNREC-DAWM/WM (L) CES County Governments	Develop working group	Provide educational programs & BMP's for homeowners and youths		

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S) (L)-Lead Agency	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Land Disposal (Community Services Land Management) (cont'd)	61,62 Centralized Public Sewer Systems (Liquid waste)	DNREC-DWR/SWM/CGF (L) County Governments NCC-Public Works	Develop working group	Participate on sewer district basis		
	60 Pretreatment of Land Disposal, Waste (solid and liquid)	DNREC-DWR/SWM/WPCB (L)	Develop Guidelines			Locate Site(s) & Inform Public
	63 Locate Inert & Solid Waste Disposal Site Close to Urban Growth Areas	DNREC-DAWM/WM (L) DSWA-(Solids only)	Conduct Research	Locate Site(s) & Inform Public	Locate Site(s) & Inform Public	
	61,62,63 Additional (New) Solid & Liquid Waste Disposal Sites & Wastewater Treatment Facilities	DNREC-DAWM/WM (L) DSWA-(Solid only)	Conduct Research	Locate Site(s) & Inform Public		
	62 Septage Acceptance Wastewater Treatment Facilities	DNREC-DWR/SWM Municipalities (L) NCC-Public Works	Conduct Research	Locate Site(s) & Inform Public		
	84,85 Contaminated Soils Management Program	DNREC-DAWM/WM (L) USDA-SCS Conservation Districts DEL-DOT	Develop working group	Develop Program	Implement Program	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S) (L)-Lead Agency	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Land Disposal (Community Services Land Management) (cont'd)	66 Infectious Waste Disposal Sites	DNREC-DAWM/WM (L)	Conduct Research	Locate Site(s) & Inform Public		
	63 1974 Solid Waste Regulations Updated/Revised	DNREC-DAWM/WM (L)	Complete Revision	Implement	Continue	Continue
	63 Rubber Tire Disposal Sites	DNREC-DAWM/WM (L) OSWA	Conduct Research	Locate Site(s) & Inform Public		
	60 Special Waste Disposal Sites (radiological, PCB's, animal)	DOA DNREC-DAWM/WM (L)	Conduct Research	Locate Site(s) & Inform Public		
	63 Solid Waste Transfer Stations	DNREC-DAWM/WM (L) DSWA County Governments	Conduct Research	Locate Site(s) & Inform Public		
	63 Resource Recovery Facilities and Fuel/Steam Incinerators	DNREC-DAWM/WM (L)	Conduct Research	Locate Site(s) & Inform Public		
	63,64 Industrial/Municipal Waste Disposal Sites	DSWA DNREC-DAWM/WM (L) County Governments	Conduct Research	Locate Site(s) & Inform Public		

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
		(L)-Lead Agency	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
(Community Services Land Management) (cont'd)	30 Statewide Erosion & Sediment Control Program	USDA-SCS DNREC-DS & WC (L) CES County Governments DEL-DOT NCC-Public Works Conservation Districts	Publish New Handbook Training Program	Training Program	Training Program	Training Program
	General Public Information	DNREC/	Develop NPSP	Continue I&E	Continue I&E	Continue I&E
Atmospheric Deposition	81 Resource Recovery Facility & Toxic Emissions Control for Refuse Incineration	DNREC-DAWM/A (L)	Conduct Research			
	81 Public Information - Air Pollution	DNREC-DAWM/A Conservation Districts Dept. of Health (L)	Develop Publication	Print & distribute publication	Continue distribution	Continue distribution
	81 National & Regional Air Pollution Monitoring, Protection, & Control (ozone pollutants, etc.)	Industry DNREC-DAWM/A (L)	Develop working group			
	81 Air Toxics Emission Inventory (Chemical Industries Facilities, etc.)	DNREC-DAWM/A (L)	Conduct on-going program	Assemble data		Continue collection & update
	81 Statewide Control Standards for Air Pollution & Monitoring	DNREC-DAWM/A (L)	Conduct on-going program	Assemble data		

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Atmospheric Deposition (cont'd)	81 Emmision Control Equipment Protocals for Known Carcinogen Producers	(L)-Lead Agency DNREC-DAWM/A (L)	Conduct on-going program	Assemble Data		
	81 Leak Detection Requirement for Business & Industried Using Toxic Substances	DNREC-DAWM/A (L)	Conduct on-going program	Assemble Data		
	81 Statewide Comprehensive Indoor Air Quality Program	DOA Dept. of Health & Social Services Dept. of Labor	Develop Publication	Print & distribute publications	Continue Publications	Continue distribution
	81 Statewide Acid Rain Monitoring Stations	DNREC-DAWM U of D U.S. Dept of Energy	Continue inplace research			
	81 Incineration of Toxic Emissions	DNREC-DAWM (L)	Conduct Research			

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)		PARTICIPATING AGENCY(S)	Milestone			
				Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Urban Runoff			(L)-Lead Agency				
	Comprehensive State Stormwater Management Plan	40	Conservation Districts Local Governments DEL-DOT DNREC-DSWC &DWR	Develop a state-wide program	Strengthen state & county staffing	Evaluate program	Adjust program
	Groundwater sampling & analysis Prior real estate sales	32	State Board of Realtors DNREC-WR	Develop strategy	Establish needed program	Implement program	Continue
	Urban Development Regional Plan	32	County Governments DEL-DOT	Develop working group	Develop Strategy	Draft plan	Implement plan
	Public Information - Urban Housekeeping	40	DACD CES	Develop Publication	Print & distribute publication	Update & reprint if necessary	Continue distribution
	Public Information - Fertilizer & Pesticide Application	40	DOA CES (L) USDA-SCS	Develop publication	Print & distribute publication, (i.e. through realtors)	Update & reprint if necessary	Continue distribution

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Resource Extraction		(L)-Lead Agency				
	51 Pre-1950 Abandon Pit Reclamation	DNREC DEL-DOT County Government WRA-NCC NCC-Public Works	Develop working group	Develop State Plan	Obtain Funding	Implement

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Construction		(L)-Lead Agency				
(Transportation Services Land Management)	31 Urban stormwater collection treatment areas and along rural roadways	DEL-DOT (L) DNREC-DSWC County Governments	Develop working group			
	50 Statewide borrow pit program	County Governments DNREC-DS WC (L) NCC-Public Works	Develop working group			
	83 De-Icing Salt Storage Program	DEL-DOT (L)	Finalize Program	Install Facility	Install Facility	Install Facility
	84 Emergency Response Team	DNREC (L) Local Fire Departments Division of Public Safety	Continue existing program	Continue	Continue	Continue
	New erosion and sediment control standards	DEL-DOT DNREC-DSWC	Incorporate new E&S standards to Highway specs.	Training programs and technical assistance	Training programs and technical assistance	Training programs and technical assistance

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Construction	32	(L)-Lead Agency				
(Water Supply Management)	State Aquifer Recharge Area Delineation, Protection, & Optimization	DGS County Governments WRA-NCC DNREC-DWR/GWM	Develop working group & continue DGS geologic mapping			
	32 Promotion, creation & expansion of centralized, utility oriented public water systems	Local Governments DNREC-DWR/GWM WRA-NCC	Develop working group			
	70 Secure Potential Future Reservior Site in New Castle County	NCC Planning Office WRA-NCC	Conduct Research (EIS)			
	32 Municipality Sinking Fund Program for Water Supply Systems	County Governments	Develop working committee			
	32 Prohibition of Well Installation in Saltwater Intrusion Areas	DNREC-DWR-GWM-WSB County Governments	Conduct Research	Identify areas	Develop strategy	
	56,32 Statewide Data Management Program for Well Information and Accessible to State, County, & Local Agencies	DNREC-DWR (L) DGS	Develop working group to incorporate existing data & intergrate with state GIS	Make data readily available & continue input	Continue input	Continue input
	Statewide Data Management Program for Septic Tank Information	DNREC-DWR-GWM-DSB (L)	Develop working group	Collect Research	Continue input	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S) (L)-Lead Agency	Milestone			
			Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Construction (Water Supply Management) (cont'd)	70,50 Complete hydrologic mapping of Delaware	DGS (L)	Continue existing mapping program	Map Middletown/ Odessa Area	Continue mapping	Map Central Sussex Co.
	70 Groundwater quality data on Delmarva	USGS DGS	Continue monitoring & research through NWQA & USGS/DGS Cooperative programs	Publicize effects of irrigation on water quality	continue monitoring	NWQA results available
	32 State Well-Head Protection Program	DNREC-DWR-WSB (L) DGS County Governments	Develop plan Hold conference September 1988	DGS mapping in New Castle County		
	Well Permits 50	DNREC-DWR-WSB (L) GWM	Continue program	Intergrate to GIS Information syste		
	70 Ground Water Management Plan	DNREC-DWR-WSB (L) GWM	Begin program implementation			
	70 Water Allocation Program	DNREC-DWR-WSB (L) GWM	Continue program			
	70,50 Increased awareness of groundwater pollution	CES (L)	Educate 15,000 individuals	Continue	Continue	Continue

Schedule of Implementation

DELAWARE

Non-Point Source Pollution Management Program

NPSP CATEGORY	NPS NEED(S)	PARTICIPATING AGENCY(S)	Milestone			
		(L)-Lead Agency	Fiscal Year 1989	Fiscal Year 1990	Fiscal Year 1991	Fiscal Year 1992
Hydrologic (Water Supply Management) (cont'd)	71 Incorporate NPSP in Tax Ditch Program	DNREC-DS&WC USDA-SCS Conservation Districts (L)	Installation of water control structures in demonstration areas	Monitor Sites	Evaluate & report	
	70 Water Quality Standards	DNREC	Revise standards to address NPSP	Implement standards	Continue	Continue Revision
	70 Clean Lakes Study	DNREC	Develop Silver Lake/Dover plan	Implement Silver Lake/Dover plan	Assess other lakes	Develop plans on those lakes
	70 Monitor ground water & surface water NPSP	DNREC Dept. of Public Health	Revise programs	Implement revision	Continue	Continue
	65 Improve management of Rural (on-site) Septic Systems	CES DNREC-WR	Educate 600-650 households	Continue	Continue	Continue
	70 Increase public understanding of water testing needs	CES	Educate 100 households	Continue	Continue	Continue

Potential FY'89 NPSP Grant Activities

The following lists of grant activities are a result of asking the working committee and others, "if funds were available, what activities would your agency propose?"

Grant ideas were received from the various local Conservation Districts, DNREC Divisions, Cooperative Extension System, and Delaware Department of Agriculture. Most of the proposal ideas would cross agency lines and involve others including the USDA Soil Conservation Service and Delaware Department of Transportation.

The listing of potential activities is not considered all inclusive or given any priority ranking at this time. Priorities would be established as detailed proposals are developed for specific funding sources. In addition, we would expect additional grant ideas continually as activities under the schedule of implementation are carried out. Below is a flow chart to guide grant activity.

1. General problems are stated in the NPSP Assessment Report and Management Program.

2. The Schedule of Implementation outlines approximately 90 items to be worked on and considered.

3. The listing of potential funded NPSP activities would help address the Schedule of Implementation and can be expanded at any time.

4. Specific grant proposals would be developed to target NPSP problems.

At this time several of the suggested grant activities address similar issues. When specific grant proposals are developed, an attempt will be made to combine similar proposals.

Sussex Conservation District
P.O. Box 8 · Georgetown, Delaware 19947 · Phone (302) 856-2105 or 7219

RECEIVED
AUG 1 1988
Div. of Soil & Water Conservation

July 27, 1988

Frederick Mott
Division of Soil and Water Conservation
DNREC
P.O. Box 1401
Dover, DE 19903

Dear Fred:

The Board of Supervisors of the Sussex Conservation District have reviewed your request for projects under the nonpoint source pollution program.

These projects would be funded with EPA funds. The projects for Sussex that we request funding for are a mobile manure analysis unit and a demonstration of water control structures in a watershed. It is our understanding that you have cost estimates and descriptions on these projects.

Sincerely,

Cashar W. Evans
Chairman

CWE/edj

pc: Cashar Evans

Suggested NPSP Grant Activities
Local Conservation Districts

New Castle Conservation District

Middle Run and Upper Pike Creek Demonstration Watershed
An urban conservationist is needed to take a proactive approach for NPSP concerns through landowner education and technical assistance, county subdivision reviews, planning and permit processes, and to plan needed conservation practices (such as streambank erosion control) in the watershed to reduce NPSP.

Urban Conservationist	- $ 25,000/yr.		
Program Costs	- 10,000/yr.		
	$ 35,000/yr.	X 2 yrs. =	$ 70,000
Conservation Practices			
Engineering & Design	- $ 50,000		
Conservation Practices	- 200,000		
	$250,000	=	250,000
		TOTAL =	$320,000

Kent Conservation District

Murderkill River Demonstration Watershed
A subwatershed demonstration project to show total resource management systems for erosion and sediment control and other water quality measures is needed in the Murderkill River Watershed. Activities would include conservation planning, engineering and design, and installation of practices such as grassed waterways, filter strips, water control structures, manure management facilities and others.

Technical Assistance Requirements	-	$100,000
Conservation Practices	-	200,000
TOTAL	=	$300,000

Sussex Conservation District

A. Inland Bays Demonstration Watershed

1. Iron Branch (Subwatershed) - A demonstration is needed to show water quality practices incorporated as part of total water management in this agricultural subwatershed. Conservation practices could include irrigation management, water control structures for denitrification as well as fertilizer and manure management planning.

Technical Assistance Requirements	-	$ 60,000
Conservation Practices	-	70,000
TOTAL	=	$130,000

2. Beaver Dam (Subwatershed) - As above a demonstration is needed to show water quality practices incorporated as part of total water management in this agricultural subwatershed. Conservation practices could include irrigation management, water control structures for denitrification as well as fertilizer and manure management planning.

Technical Assistance Requirements	-	$ 60,000
Conservation Practices	-	70,000
TOTAL	=	$130,000

3. Wolf Glade (Subwatershed) - The Inland Bays area is rapidly becoming urbanized in the coastal area. As a result, an assessment is needed of the urban runoff in terms of quantity and quality. Therefore, a need exists to evaluate stormwater outfalls and to demonstrate conservation practices to address urban stormwater.

Technical Assistance	-	$ 25,000
Conservation Practices	-	50,000
TOTAL	=	$ 75,000

B. <u>Nanticoke River Demonstration Watershed</u>

1. Broad Creek (Subwatershed) - Within this subwatershed three sites have been selected to address water quality practices within a comprehensive water management system. Practices would include water control structures, sediment control, filter strips, fish and wildlife, freshwater wetlands, etc. The three sites include Tussocky Branch, Meadow Branch, and Mt. Zion Branch.

Technical Assistance Requirements (Each site $100,000 X 3)	=	$300,000
Conservation Practices ($150,000 X 3)	=	450,000
TOTAL	=	$750,000

2. Clear Brook (Subwatershed) - A demonstration of total resource management is needed in this subwatershed. Activities would be coordinated across agency lines to include water quality, fish and wildlife, soil and water conservation practices, freshwater

wetlands, and others.

Technical Assistance Requirements	-	$ 70,000
Conservation Practices	-	100,000
TOTAL	=	$170,000

3. Tyndall Branch (Subwatershed) - As above a demonstration of total resource management is needed in this subwatershed. Activities would be coordinated across agency lines to include water quality, fish and wildlife, soil and water practices, freshwater wetlands and others.

Technical Assistance Requirements	-	$100,000
Conservation Practices	-	200,000
TOTAL	=	$300,000

DNREC, Division of Soil and Water Conservation
Proposal NPSP Grant Activities

1. District Coordination
The Schedule of Implementation requires strong coordination with the local conservation districts. Since the Districts do not receive operation funds, funding is needed to assure their participation.

Estimated Cost $25,000/district = $75,000/yr.

2. Statewide Erosion and Sediment Control Program
At this time the state implements the state's erosion and sediment control program as a pass through grant to the local conservation districts. A need exists to strengthen the state level E&S expertise by adding an environmental engineer in the Division of Soil and Water Conservation.

Estimated Cost $50,000/yr.

3. Develop a Statewide Stormwater Management Program
Although several municipalities require stormwater management as part of the construction process, many do not. A need exists to develop a statewide comprehensive stormwater management program to supplement the erosion and sediment control program. The program would be carried out by one engineer on the state level and a technician in each local conservation district.

Estimated Cost $155,000/yr.

4. Strengthen the Highway Erosion and Sediment Control Program
The Delaware Department of Transportation is the largest construction organization in the state. A need exists to incorporate erosion and sediment control expertise into the highway construction process by cost sharing one position.

Estimated Total Cost $30,000/yr.

5. NACD/NPSP Conference 1989
The NACD/NPSP Conference in 1989 will most likely be a landmark effort to coordinate NPSP management at a national level. To coordinate Delaware's NPSP management program on a national level approximately 20 people from Delaware should try to attend.

Estimated Cost $17,000

6. Broaden the USDA-SCS PL 566 Program for NPSP
Delaware has been very active with the USDA-SCS PL 566 Program from a project construction standpoint. Delaware is now involved on a national committee to help broaden the PL 566 program to address other concerns such as NPSP. Three people would be appropriate to involve in this activity.

Estimated Cost $6,000

7. Revise the State Long Range Resource Conservation Plan
The conservation activities of DNREC are directed by their long range resource conservation plan. This plan has not been fully updated since 1985 and needs to incorporate NPSP concerns.

Estimated Cost $20,000

8. Revise the Conservation Districts Long Range Resource Conservation Plans.
Each local conservation district needs to revise their countywide resource conservation plans. These revisions are necessary to help implement the NPSP management plan as well as the National Estuary Program in the Chesapeake Bay, Inland Bays and Delaware River and Bay.

Estimated Cost $45,000

9. Participation in the National Estuary Program, Chesapeake Bay.
Delaware needs funding to participate in the National Estuary Program on the Chesapeake Bay. At this time Delaware is a limited participant as time permits.

Estimated Cost $25,000

NPS POLLUTION PROGRAM
IMPLEMENTATION PROPOSALS
DNREC DIVISION OF WATER RESOURCES

The Division of Water Resources has developed the following list of titles and brief descriptions for implementation projects under the Delaware NPS Management Program. We believe that these projects meet the requirements as outlined in "Nonpoint Source Guidance", U.S. Environmental Protection Agency, December, 1987, and that they are in concert with the objectives of the Management Program. The projects are ordered according to estimated cost; no priority is implied.

(1) Evaluation of sludges and organic wastes applied to agricultural lands. This multi-year project will examine the effects of these materials on the productivity of soils and quality of ground waters. Cost = $300,000.

(2) Interstate management conferences for several watersheds in New Castle County. This multi-year project will result in the establishment of coordinated work teams and plans for improved management of NPS-impacted water supply and recreation streams. Cost = $250,000 including monitoring over five years.

(3) Develop and demonstrate rainfall simulator for BMP evaluation. This project is designed to construct and utilize for three BMP tests a rainfall simulator modeled after the one used by Virginia Tech. This approach allows better control and minimizes problems associated with uncooperative weather and vandalism. Cost = $200,000.

(4) Statewide lakes assessment plan. Delaware has 28 public lakes, all of which are eutrophic (overly enriched) because of excessive nutrient inputs and unfavorable nutrient removal mechanisms. A detailed basic data gathering program will be used as a lead-in for lake restoration and management programs which are a priority under the NPS program. Cost = $200,000.

(5) Enhance and implement ERES high value surface water use. ERES waters have high ecological and recreational values, and are accorded extra protection in the state's water quality standards. An implementation strategy has been drafted but significant data and analysis needs exist. Over three years, cost = $150,000.

(6) Environmental impact of animal confinement facilities. Animal holding facilities are common in Delaware. The environmental impacts of these facilities vary according to animals raised, location, site conditions (soils, slopes), construction, management, etc. This project would develop site-specific management practices. Cost = $150,000.

(7) Evaluate wetland systems: nutrient reductions. Both saltwater and freshwater wetland systems have value for removal of nutrients and protection of surface and ground waters. Natural and artificial wetlands will be evaluated for their removal efficiencies and the impacts of nutrients on their ecosystems. Cost = $150,000.

(8) Effects of large community septic systems on ground water quality in Delaware. Large community systems, with tile fields handling thousands of gallons of wastewater per day, can have significant local impacts on shallow ground water quality. The extent and severity of impacts, as well as development of alternative distribution and treatment approaches, are needed. Cost= $150,000.

(9) Waste containment evaluation. DNREC is developing new guidance and rules on agricultural wastes. As part of the development process, a need exists to evaluate the different containment practices such as ponds, lagoons, and above-ground storage. Cost = $100,000

(10) Training, education and participation of land-appliers of sludge and septage. A public interest group comprised of all entities which land-apply waste materials (initially sludges and septage, but eventually including agricultural wastes) should be established. The group would handle newsletters, educational materials, field tours and demoes, agency interactions, and so on. Cost over five years = $100,000.

(11) Inland Bays or Delaware Bay demonstrations. All or part of these watersheds are high priority waters and have been included for funding under the National Estuary Program. Various innovative nutrient, sediment, and toxics reducing systems should be tested in these areas prior to mandated use of controls. Cost = $100,000.

(12) Mapping of critical aquifer recharge areas. The key to protection of the quality of subsurface supplies is preventing pollution at the source. Recharge areas represent those locations where contaminants can most damage a ground water supply source. Cost for statewide map preparation = $100,000.

(13) Irrigation water management demonstration project. Innovative water delivery systems have been developed for use in areas where water supplies are tight and climates are dry or otherwise harsh. Delaware, relatively water-rich, has not used such systems to any extent, but should start introducing (demonstrating) them to farmers because of the growth in populations and irrigated agriculture coupled with apparent reductions in climatic wetness. Cost = $100,000.

(14) Organic waste testing laboratory. Organic (animal) waste management requires testing facilities which can give quick accurate results. At this time the University of Delaware lacks this capability and services must be contracted through the University of Maryland. Delaware needs to develop this in-state capability. Cost = $95,000.

(15) Stormwater watershed management plan demonstration. Innovative approaches on a watershed basis for urbanizing areas have been developed for several Virginia basins. A detailed hydrologic review, land use assessment and projection, funds evaluation, public participation, etc. would be done. Cost = $75,000.

(16) Public education program. Effective control of NPSP depends to a large extent on attitudes and motivations. The public, both adults and teen-agers, need to be made aware of how their actions contribute to water quality problems. The program could fund an information officer and provide audio, video and written materials for dissemination. Cost = $75,000 over two years.

(17) Enhance lake management public participation. Delaware does not have a statewide lake management society even though most Delaware lakes have water quality problems. The goal would be to establish a self-sustaining group which provides information, training, technical assistance and support for lake management and restoration. Cost = $60,000 over three years.

(18) Water control structure evaluation for Vines Branch watershed. Water control structures are being installed by SCS in this watershed as part of comprehensive water management systems. Although research in other areas of the country has shown that these structures provide water quality as well as quantity benefits, demonstration work needs to be carried out in Delaware in the form of monitoring. Cost = $50,000.

(19) Implement dredge plan/demonstrate spoil uses. Dredge plans exist for Delaware tidal waters and for lakes. One objective of the work is to make positive environmental use of the spoils. Alternatives include island and wetland/shallows creation and deep hole filling. Two demonstration projects with design, technical assistance and reporting are requested; cost = $50,000.

(20) Develop and implement environmental guidelines for agricultural wastes. The Department is about to implement new land treatment regulations. These regulations contain a section of guidance for agricultural wastes. This section needs significant enhancement with respect to Delaware's situation. Cost = $50,000.

(21) Ground water contribution to nutrient loadings to surface waters. In many basins, surface water quality may be governed by the quality of ground water outflows. Ground water quality, especially in areas with permeable soils, is highly dependent upon land use and attendant waste/chemical handling practices. In priority basins, analysis of quality and estimation of flows through simple modeling techniques can be accomplished. Cost = $50,000.

(22) Monitor effectiveness of existing stormwater BMPs. Although not required in most instances, stormwater controls have been installed in some areas. Monitoring of the effectiveness of such controls is useful in proving their benefit. Monitoring costs = $30,000.

(23) Assessment of the effect of BMPs on nitrate concentrations in ground water (analysis of domestic well samples). Cost = $30,000.

(24) Educational programs for agriculture. A need exists to inform the public of ground water (in addition to surface water) impacts and benefits of various resource management systems/BMPs and general agricultural practices. Development of informative pamphlets and videos and delivery of information to the community is intended. Cost - $20,000.

Delaware Cooperative Extension
University of Delaware — Delaware State College

Richard E. Fowler, Director
Townsend Hall
Newark, DE 19717-1303
302-451-2504

RECEIVED
JUL 26 1988
Div. of Soil & Water Conservation

July 22, 1988

Mr. Frederick T. Mott
Manager, District Programs
Div. of Soil & Water Conservation
DNREC
P. O. Box 1401
Dover, DE 19903

Dear Fred:

Throughout the State of Delaware Nonpoint Source Pollution (NPSP) Management Program, emphasis on education is stated as preferable to the alternative of regulations. In the proposed NPSP schedule of implementation, Delaware Cooperative Extension is frequently designated as a participating agency to conduct this educational work.

We want to contribute in an effective way. However, Delaware Cooperative Extension is stretched very thin on personnel and operating capital, and we are faced with a certain reduction in our federal formula funds for 1988-89. Additional funding would certainly be needed if we are to strengthen educational programs to solve this important problem of nonpoint source pollution.

Expansion of Extension education would be necessary on integrated pest management; fertilizer, manure, sludge, and septage management; disposal of dead chickens (broilers); agricultural waste storage; runoff, erosion, and sediment control; hazardous and toxic waste management; forestry practices; rural on-site septic systems; and possibly other subjects that bear on nonpoint source pollution.

In our letter of July 6 to John Hughes, Dean Crossan and I indicated that to assist in the overall Nonpoint Source Pollution Management Program will require an addition of $220,000 per year to the Delaware Cooperative Extension budget for the next four years. This money would enable us to employ a water quality agent for each of the three counties for the four-year period and also would provide the fringe benefits, equipment, materials, secretarial, travel, and other operating expenses essential to support the work of these professionals.

A manure testing program and field research is needed to support an educational program. Best management practices (BMPs) need a strong research base to determine the efficacy and impacts of BMPs.

Cooperative Extension Education in Agriculture and Home Economics, University of Delaware, Delaware State College and the United States Department of Agriculture cooperating. It is the policy of the Delaware Cooperative Extension System that no person shall be subjected to discrimination on the grounds of race, color, sex, handicap, age or national origin.

The three county water quality agents would work under the program guidance of a statewide Extension water quality specialist, whom we are seeking to employ using funds we have reallocated in our budget. The Extension water quality team of a state specialist augmented by three county agents would reach many more farmers and other landowners with education on Best Management Practices than the specialist could hope to if working alone. Creating such a team is the way Extension can most effectively respond to the educational goals set forth in the NPSP Management Program.

Therefore we request EPA funding of $880,000 over the next four years.

Very Sincerely,

Richard E. Fowler

Richard E. Fowler
Director

REF/mea

cc: Dean D. F. Crossan
Mr. John Hughes
Mr. David Woodward

B U D G E T

3 water quality positions @$52,500 = $157,500 x 4 yrs. =	$630,000
(Includes salary, fringes, secretarial support, travel, and supplies.)	
Manure testing, BMP field monitoring equipment and research project funds.	250,000
Total:	880,000

LYNN

RECEIVED
JUL 29 1988
Div. of Soil & Water Conservation

STATE OF DELAWARE
DEPARTMENT OF AGRICULTURE
2320 SOUTH DUPONT HIGHWAY
DOVER, DELAWARE 19901

OFFICE OF THE
SECRETARY

TELEPHONE: (302) 736 - 4811

July 28, 1988

To: Fred Mott

Fr: Kevin Donnelly Kevin Donnelly

Re: EPA Grant Money

Enclosed is an abbreviated list of projects that should be accomplished under the umbrella of our NPS Pollution Management Program. This information can be expanded as EPA decides where they would like to use their grant funds.

Thanks for the invite and I'll call you sometime during the week of August the 8th.

cc: Mike McGrath
Grier Stayton
Theresa Crenshaw
Nancy Milliken Willis

Delaware Agriculture

DELAWARE DEPARTMENT OF AGRICULTURE

PESTICIDE MANAGEMENT

Survey Pesticide Dealers/Users to Determine Level of Pesticide Use in Delaware
- 3 years of Survey at 3-5 year intervals.
- $ 20,000/year
- Contract w/ USDA Ag Statistic Service

Total cost: $60,000

Upgrade State-wide Commercial Pesticide Applicators Training Program
- 1 year development/implementation period
- $ 5,000 for research and I&E Materials
- $ 3,500 for salaries

Total cost: $ 8,500

Develop NPS Data Base to Assist in the Management of NPS Pollution generated by agribusinesses:
- 6 month development/training/implementation period
- $10,000 software/hardware costs
- $ 2,500 development and training costs

Total cost: $12,500

FOREST MANAGEMENT

Landowner Cost-share Program to Re-establish wooded buffers along selected stream corridors.
- 6 month identification/development phase
- 3 year implementation phase
- $15,000 cost-share funds
- $20,000 salary costs

Total cost: $35,000

Pre-development Urban Forestry Program to reduce urban/suburban NPS pollution.
- 3 year development/implementation phase
- $15,000 seed money for program
- $25,000 salary costs

Total cost: $40,000

Implement/Refine Statewide Forest GIS system to track NPS inputs from Delaware's 376,000 acres of forestland.
- 2 year data collection/input phase
- 1 year implementation phase
- $18,500 computer hardware expense
- $35,000 salary costs

Total costs: $53,500

Fertilizer Management

Increase/expand fertilizer sampling and sludge testing statewide.
- 1 year training and implementation phase
- $25,000 equipment upgrade
- $30,000 salary costs
  Total costs: $55,000

Develop/implement statewide verification of fertilizer use
- 6 month training/implementation phase
- Contracted data base development
- $ 5,000 hardware/software costs
- $17,500 salary costs
- $ 2,500 I&E costs
  Total costs: $25,000

Table 9

Conservation Workload

Delaware
Nonpoint Source Pollution Management Program

Estimated Statewide Indicator Status

RESOURCE MANAGEMENT SYSTEM	POTENTIAL	AMT. APPLIED AS OF 10/87	AMOUNT TO BE PLANNED	4-YEAR GOAL
Cropland (Ac	521,100	260,000	261,100	88,000
Pastureland/Hayland (Ac)	35,200	22,600	12,600	1,200
Forest Land (Ac)	376,400	81,000	294,400	5,000
Farmstead/Headquarters (Ac)	3,600	450	3,150	150
Urbanizing Land (Ac)	-	-	-	-
INDICATOR PRACTICES				
(328) Conservation Cropping Sequence (Ac)	521,100	260,000	261,100	88,000
(329) Conservation Tillage System (Ac)	463,000	384,000	10,000	3,000
(INT) Fertilizer Management (Ac)	591,0001/	197,000	394,000	40,000
(INT) Pesticide Management (Ac)	470,0002/	223,000	247,000	25,000
(449) Irrigation Water Management (Ac)	58,000	16,000	42,000	14,000
(412) Grassed Waterway (Ac)	100	14	86	20
(570) Runoff Management System (No)	-	-	-	-
(587) Structure for Water Control (No)	4,000	30	3,950	200
(600) Terrace (Mi)	200	4	195	6
(312) Waste Management System (No)	1,200	150	1,050	50
(633) Water and Sediment Control Basin (No)	300	2	290	20

1/ Includes Agricultural Sources 521,100 ac.; Urban Runoff 70,000 ac.
2/ Includes Agricultural Sources 400,000; Urban Runoff 70,000 ac.

(D) A certification by the Attorney General of the state or states (or the chief attorney of any state water pollution control agency which has independent legal counsel) that the laws of the states or states, as the case may be, provide adequate authority to implement such management program or, if there is not adequate authority, a list of such additional authorities as will be necessary to implement such management program and a schedule and commitment by the state or states to seek such additional authorities as expeditiously as practicable.

A certification from the Delaware State Attorney General is attached.

STATE OF DELAWARE
DEPARTMENT OF JUSTICE
STATE OFFICE BUILDING
820 N. FRENCH STREET, 8TH FLOOR
WILMINGTON, DELAWARE 19801

CHARLES M. OBERLY, III
ATTORNEY GENERAL

DIRECT DIAL:

**ATTORNEY GENERAL'S CERTIFICATION
OF LEGAL AUTHORITY FOR
NONPOINT SOURCE POLLUTION MANAGEMENT PROGRAM**

I hereby certify, pursuant to my authority as Attorney General of the State of Delaware, and in accordance with §319(b)(2)(D) of the Water Quality Act of 1987 (33 USC §1329(b)(2)(D) that in my opinion the laws of the State of Delaware provide adequate authority to carry out the program set forth in the "Nonpoint Source Pollution Management Program" submitted by the Department of Natural Resources and Environmental Control (DNREC). The authority of DNREC to regulate nonpoint source pollution is contained in 7 Del. C. §6003(a)(2), which provides that "No person shall, without first having obtained a permit from the Secretary, undertake any activity . . . in a way which may cause or contribute to discharge of a pollutant into any surface or ground water." This lawfully enacted statute is the legal authority for the State's delegated programs under the Clean Water Act.

The Nonpoint Source Pollution Management Program contains five basic components: education, research, technical assistance, financial incentives, and regulations. There are no new regulatory programs proposed by this program. All regulatory

efforts will be within existing regulatory programs by the amendment and coordination thereof. The State of Delaware has the necessary existing regulatory programs presently in place, or has statutory authority to put them in place, to carry out the purposes of the Nonpoint Source Pollution Management Program.

Charles M. Oberly III

Date: 8/3/88

Charles M. Oberly, III
Attorney General

JLL:vmg:22-35

(E) Sources of federal and other assistance and funding [other than assistance provided under subsections (h) and (i)] which will be available in each of such fiscal years for supporting implementation of such practices and measures and the purposes for which such assistance will be used in each of such fiscal years.

State Funded NPSP Activities

Erosion and Sediment Control Program: The state has funded erosion and sediment control activities at the conservation district level since 1981. The FY 89 budget is $159,600. Budget requests for FY 90 = $200,000, FY 91 = $250,000, FY 92 = $312,500.

Conservation Cost share Program: Delaware initiated a state leve construction cost share program. Appendix D gives a three year status of the program funding and accomplishments. FY 89 budget is $315,000 and has been leveraged at 2:1 with additional matching funds generated by USDA - ASCS, private land owners

and local governments. Budget requests for FY 90 = $450,000, FY 91 = $550,000, FY 92 = $650,000.

Delaware's Inland Bays Program: Delaware's General Assembly budgeted $200,000 in FY 89 to work on the Inland Bays. Many of the program activities addressed NPSP. Specific activities were contracted through the USDA Soil Conservation Service and the Sussex Conservation District. These funds will continue for FY 90.

Delaware Cooperative Extension System: The state through the University of Delaware, has regularly funded the statewide educational program of the Delaware Cooperative Extension System in the College of Agricultural Sciences. The expansion of integrated pest management, reduced pesticide usage, nitrate management, and biological pest control programs to assist in the overall Nonpoint Source Pollution Program will require an addition of $220,000 to the state budget line "U. Del - Cooperative Extension".

Special Funds: NPSP projects were initiated by the Division of Water Resources through permit fees and fines. A nutrient management program contracted through the USDA Soil Conservation Service on the Nanticoke River is one of these technical assistance projects.

Water Control Structure: The Division of Soil and Water is cost sharing water control structures with USDA and landowners on watershed drainage systems. The water control structures will help water management including water quality. Over 90 water control structures are scheduled to be cost shared on the next two years.

Personnel, Related Programs and Ongoing NPSP Efforts: NPSP activities are continually a part of DNREC activities. Types of activities might include personnel time for TEAM, environmental activities, education activities, subdivision reviews, permit reviews, in-house coordination and others. Construction activities might include pond restoration, shoreline stabilization and erosion control. Other agencies such as Delaware DOT, the Delaware Solid

Waste Authority, Delaware Office of Emergency Management or Delaware Department of Public Health and Social Services would all be part of different NPSP activities. The NPSP management program will help coordinate these activities and specifically identify them as NPSP efforts. The Division of Soil and Water Conservation has budgeted a conservation position to assist with the NPSP program in FY 90.

Erosion and Sediment Control Program: Local governments also have responsibilities for erosion and sediment control and provide assistance from various public works departments. The assistance of engineers and inspectors at the local level is a significant resource contribution to the overall program.

Local Conservation Districts: The local conservation districts implement the state's conservation cost share program. In addition they coordinate the matching funds from private landowners, local governments and the federal agencies. This ability to combine resources plays an important part in the NPSP management program.

Personnel, Related Programs and Ongoing Efforts: Again NPSP activities are becoming increasingly important at the local level. Local contributors involve personnel time, such as local planning officials, or day to day activities such as construction of various public works or parks projects. The monetary value of these indirect activities would probably far outweigh the budgeted dollars for NPSP.

Federal Funded NPSP Activities: The DNREC Division of Water Resources applies for and manages many of the EPA NPSP grants. Funds could include construction grant funds 201(g)(1)(B), 205(j)(5) Nonpoint Source Reserve, Section 201(g)(1)(B) the Governor 20% Discretionary Fund and Section 603(c)(2) - State Revolving Loan Funds. At this time the use of construction grant funds and state revolving loan funds for NPSP are being investigated, 205(J)(5) funds are being directed to the program and the Governor's Discretionary Fund is being

used for other projects. Coordination has started between the Divisions of Water Resources and Soil and Water to integrate these funds into NPSP activities.

USDA funding is available through ASCS and SCS. Both agencies coordinate their programs through the local conservation districts and individual conservation plans. This coordination mechanism will be used to focus other federal, state and local funds to NPSP activities.

Personnel, Related Programs and Ongoing Efforts: The education and technical assistance efforts by the USDA Soil Conservation Service and Cooperative Extension System are major contributors to the NPSP management effort. This "internal" effort will continue to be part of the backbone of the NPSP management program.

(F) **The federal financial assistance programs and federal development projects for which the state will review individual assistance applications or development projects for their effect on water quality pursuant to the procedures set forth in Executive Order 12372 as in effect on September 17, 1983, to determine whether such assistance applications or development projects would be consistent with the program prepared under this subsection; for the purposes of this subparagraph, identification shall not be limited to the assistance programs or development projects subject to Executive Order 12372 but may include any programs listed in the most recent Catalog of Federal Domestic Assistance which may have an effect on the purposes and objectives of the State's nonpoint source pollution management program.**

The following letter certifies that Delaware's NPSP Management Program meets CZMA Federal Consistency approval. CZMA Federal Consistency shows consistency with Executive Order 12372.

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
89 KINGS HIGHWAY P.O. BOX 1401
DOVER DELAWARE 19903

PLANNING AND SUPPORT
SECTION

TELEPHONE (302) 736 5409

MEMORANUM

TO: David Hugg

DATE: July 15, 1988

THROUGH: Robert H. MacPherson
Mary McKenzie, MMcK

FROM: Dennis Brown DB

SUBJECT: CZMA Federal Consistency for the NPS Pollution Management Program

---

The Divisions of Soil and Water Conservation and Water Resources are about to publish the state's first document on the abatement of NPS pollution, entitled "Nonpoint Source Pollution Management Program." It is my understanding, based on EPA's Guidelines, that such a plan requires CZMA Federal Consistency approval.

I have attached a copy of the program for you and/or Lee Emmons to review. Lee has participated with our committee in developing this document and is extremely familiar with it.

The document must be finalized and ready for submission to EPA by August 1, 1988. We need a CMP consistency statement from you by July 26, 1988 in order to incorporate it in with the plan. If you have any questions, please call Fred Mott, the lead coordinator of this project.

Thank you for your cooperation.

Attachment

cc: Fred Mott

OFFICE OF THE SECRETARY

MEMORANDUM

RECEIVED

JUL 20 1988

PLANNING

TO: Dennis Brown

FROM: Lee Emmons

SUBJECT: Delaware NPS Pollution Management Program CMP Consistency Determination

DATE: July 19, 1988

Thank you for your letter to Dave Hugg dated July 15, 1988, concerning Delaware's submission to EPA for approval of the "Nonpoint Source Pollution Management Program".

The proposed Management Program is consistent with the Delaware Coastal Management Program.

LEE:jad

153-B

PUBLIC PARTICIPATION

To initiate the NPS assessment and management program a NPS Working Committee (listed with Preface) was organized. This committee met approximately every other week during the past year. The NPS Working Committee utilized documented literature pertaining to the pollutants found in and around Delaware and effective management methods and programs. They also extended their efforts by personal contacts with local, state and federal agencies involved in individual aspects of existing Delaware NPSP programs.

The NPS Working Committee organized an Advisory and Review Committee to assist them. This committee (listed with Preface) is made up of over forty urban and rural agencies, groups and organizations that are involved with water quality concerns. The NPS Advisory & Review Committee met four times with the NPS Working Committee. In addition, they have spent hundreds of hours contributing to the total effort.

During this period Delaware's Environmental Legacy was being developed. This report concluded with 122 recommendations most of which address NPS pollution. Over 150 people were involved in this process which is now coordinated with this management program.

The NPS Working Committee and the NPS Advisory & Review Committee comments and those received through many personal contacts were incorporated in this management program. After they had been compiled and reintroduced to each agency for final review.

Draft copies of the NPS Pollution Management Program were advertised for public review on June 23, 1988 for a period ending July 25, 1988.

In addition to Delaware's Environmental Legacy the NPS Pollution Management Program incorporates many other program documents such as Delaware's Clean Water Strategy, Delaware's Ground Water Management Plan, Delaware's Resource Conservation Plan and the long range plans of the Conservation Districts.

A partial list of various activities directed towards NPS pollution assessment and management is included.

PARTIAL LISTING OF ACTIVITIES DIRECTED TOWARDS NPS POLLUTION ASSESSMENT AND MANAGEMENT JUNE 1, 1987 THROUGH AUGUST 10, 1988

Approximately Bi-weekly - NPS Working Committee, DNREC, DOA, SCS, DACD
36 meetings - New Castle, Kent, and Sussex Conservation District Board meetings.
Eight meetings - Resource Conservation and Delevelopment Council
Two or more meeting - Inland Bays Monitoring Committee - Williams
Four - Erosion and Sediment Control Workshops - Four for over 319 people. New Castle, Kent, Sussex, and Highway Dept.
Continuous - Delaware Forestry Association - Willis
Continuous - Delaware Tree Farm Association - Willis
Continuous - Water Quality Federation - Sprague
Two - Radio coverage (Wilmington-Sussex)

6/25-26/87 - NACD Water Resources Committee meeting and tour in Delaware.
7/27/87 - Chesapeake Bay Subcommittees - NPS and Implementation
9/10/87
11/16/87
1/7/88
3/31/88
7/22/88
8/5/87 - Presentation at TEAM meeting - Mott
8/10-12/87 - NACD Northeast Regional meeting
8/25/87 - NPS Symposium - SCSA - Pocomoke Chapter
9/9/87 - SCS staff meeting - Mott
9/29/87 - Stream Watch Advisory Group
10/20/87 - DACD Fall Workshop
11/20/87 - NPS Advisory and Review Committee Meeting
12/21/87 - Public Hearing - Waste Disposal, Sludge, etc.
1/6/88 - NPS Workshop, New Castle Conservation District
1/12/88 - No-till Conference, Felton - Hughes
1/20/88 - Delaware Council of Soil & Water Conservation
1/25/88 - Friends of Agriculture Breakfast meeting - Hugg
1/27/88 - Presentation at Delaware Association of Conservation Districts (DACD) Annual Convention
2/1-4/88 - National Association of Conservation Districts Annual Convention, Little Rock, Arkansas
2/24/88 - Coastal Sussex Cooperative River Basin Study Meeting at SCS
3/2/88 - Presentation at TEAM Meeting - Mott
3/2/88 - Stormwater Management Working Committee - Williams
4/20/88
5/11/88
7/8/88
4/8/88 - NPS Advisory and Review Commmittee Meeting
4/19/88 - DACD Spring Workshop
4/28-29/88 - Chesapeake Bay Commission - Mott and Hughes
5/16/88 - NPS Advisory and Review Committee Meeting
5/19/88 - 6/9/88 - Public Review Period - Assessment
6/9/88 - DNREC/University of Delaware Water Resources Conference
6/20/88 - Delaware Farm Bureau Special NPS Committee

6/23/88 - News release - Management plan
6/23/88 - 7/25/88 - Public Review Period - Assessment & Management Program
7/7/88 - TV-2
7/12/88 - NPS Advisory and Review Committee Meeting
7/13/88 - Delaware Council of Soil & Water Conservation
7/21/88 - NACD Water Resource Committee Watershed Conference Planning Committee, Phoenix, Arizona
7/15/88 - Dead Bird Disposal Demonstration
7/15/88 - Delaware Manure Management Coordinating Committee
7/25/88 - Chesapeake Bay Commission - Sprague
7/28/88 - TV-12
7/28/88 - Public Hearing - Waste Disposal, Sludge, etc.
7/29/88 - Friends of Agriculture Breakfast Meeting - Zimmerman
8/10/88 - NACD Northeast Regional Meeting - NPS Workshop Presentation

TARGETED BASINS AND DEMONSTRATION PROJECTS

With the approval of the Nonpoint Source Pollution Management Program, demonstration projects can be developed for possible federal funding and implementation under Section 319 of the Construction Grants Program.

Since program resources are limited, priority nonpoint source pollution problem areas within the state have been targeted so as to provide the greatest opportunity for achieving water quality improvement in the short run (U. S. Environmental Protection Agency, 1987). The target basins were chosen based on the Assessment Reports ranking and by the judgement of the Conservation Districts with the approval of the Working Committee.

In choosing the targeted basins, the following factors were considered.

1. Which basins support valuable designated uses?
2. In which basins do nonpoint sources pose the greatest threat (or potential threat) to public health or the environment?
3. Where will NPS controls offer the greatest benefits relative to the value of designated uses?
4. Where are capable and cooperative groups that are willing to proceed with an implementation program?

The targeted basins that were chosen are Middle Run and Upper Pike Creek in New Castle County, the Murderkill River in Kent County, and the Nanticoke River and the Inland Bays area in Sussex County. See Map #1 for their locations.

MIDDLE RUN AND UPPER PIKE CREEK

The Middle Run and Upper Pike Creek are both tributaries of the White Clay Creek and are located adjacent to each other in New Castle County. The White Clay Creek supplies public water through the Wilmington Suburban Water Corporation at points both above and below these tributaries.

The combined drainage area of these two basins in approximately 4,800 acres. Soils in the basins are loams on rolling to steep slopes. 50% of the area is used as cropland, 33% as forest land, and 17% as residential. Residential and commercial development pressures are extreme.

In both basins the stream channels cross the Pleasant Hill outcrop of the Cockeysville Formation which is valuable because of high potential yields for public water supply purposes. This formation contains limestone rock that is susceptible to sinkhole development. Observed decreases in stream base flows in the area indicate direct hydrological connection with the underlying Cockeysville formation.

Beside agriculture's potential for pollution, the increasing urban development pressures require monitoring. Construction increases soil erosion and sediment transport to the streams. The residential use will contribute pollutants by way of lawn fertilizers and pesticides. Increases in urban land uses reduces the quality and quantity of ground water recharge and stream baseflow.

The basins provide an ideal opportunity to demonstrate the effectiveness of existing programs in minimizing adverse impacts on both surface and ground water.

MURDERKILL RIVER BASIN

The Murderkill River, located in southern Kent County, is a tributary of the Delaware Bay and is one of the major drainage basins in central Delaware. It has a drainage area of 68,400 acres.

Soils in this basin are mainly the well drained sandy loams, moderately well drained sandy loams and poorly to very poorly drained loams. The poorly drained soils are mainly in the upstream areas and are interspersed with the well drained soils.

Land use predominantly agricultural with approximately 270 farms. The breakdown of land use is given below.

Cropland	57%
Forest Land	26%
Rural Residential	7%
Tidal Wetlands	6%
Lakes and Ponds	1%
Miscellaneous	3%

The most severe sheet, rill and wind erosion occurs on approximately 11,000 acres of sandy loam and loamy sand cropland in the central portion of the basin. Approximately 1,300 acres of the basin's cropland are interspersed with ephemeral gully erosion. There are 38 livestock operations, most of which are poultry and the number of poultry operations are increasing.

On-site disposal of sludges and animal wastes is a major concern in this basin which contains the county's residual sewage treatment plant. Landfills cover 124 acres.

Although the natural resources of the Murderkill River basin and its river corridor are relatively undisturbed at this time, impending pressures from development and recreation will begin placing greater stress on these resources.

Total resource management systems using multiple conservation practices have begun to protect the ground and surface water resources in this basin.

NANTICOKE RIVER BASIN

The Nanticoke River, located in northwestern Sussex County, is a tributary of the Chesapeake Bay and one of the major drainage basins in southern Delaware. The Delaware portion of the basin has a drainage area of 179,000 acres.

The majority of the soils are relatively light with a high sand content. These soils have a rapid permeability. Other soils in the basin include loams and sandy loams that are well drained to poorly drained. Although much of the basin has gentle slopes, there is a sizable area of steep slopes especially along the river near Seaford, Delaware.

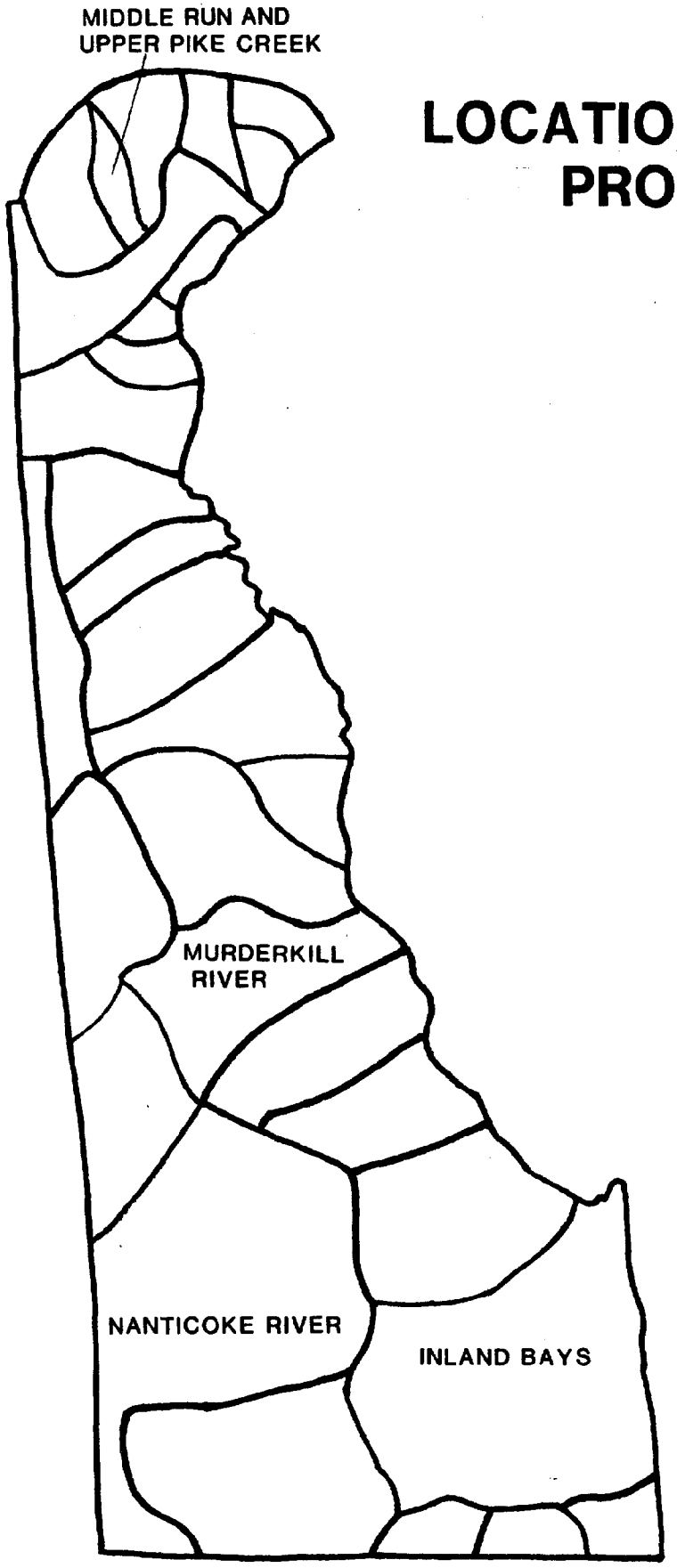
Forty-three percent of the basin is in agricultural uses. On this land there are approximately 670 animal production farms; the majority are poultry operations, the largest basin total in the state. Woodlands, small towns and some freshwater wetlands (in the headwater areas and bordering the stream) occupy the remaining land.

The erosive sandy soils, the management of animal waste and the on-site disposal of urban wastes are the primary NPS concerns within this watershed. Total resource management systems using multiple conservation practices are needed to protect the ground and surface water resources in this basin. The NPS Assessment Report states "The Nanticoke Basin should receive priority attention in statewide planning for nonpoint source management."

INLAND BAYS

Delaware's Inland Bays remains Delaware's number 1 priority to address nonpoint source pollution and other environmental problems. Both the state and federal governments have focused extensive resources in this area through the Delaware's Inland Bays Program. Further work will be done as part of the National Estuary Program. With this attention, the work done in the Inland Bays under the National Estuary Program will be documented as an important part of Delaware's Nonpoint Source Pollution Program.

MAP #2



LOCATION OF DEMO PROJECTS

DEMONSTRATION PROJECT ACTIVITY

Within the targeted basins, demonstration projects that will inform and educate individuals and communities about the use of resource management systems to protect water quality are planned. These will demonstrate the use and the ability of combinations of practices to protect water quality for particular land uses. Research projects may also be established to determine the cost effectiveness of systems. Funds for implementing these projects may be available under Section 319(h)(7).

Demonstration projects within the targeted basins will be chosen by the local conservation districts in conjunction with the Department of Natural Resources and Environmental Control. The projects will be based on their feasibility of on-the-ground implementation showing nonpoint source pollution improvements within a four year period.

Literature Cited

Baker, Watson 1988. Personal communication, January 19, 1988. Department of Transportation, Division of Highways. Dover, Delaware.

Barczewski, Richard A. 1988. Personal communication. University of Delaware, Cooperative Extension Service. Kent County Office, Delaware.

Blendy, Nickolas 1988. Personal communication. February 3, 1988. Department of Transportation, Division of Highways. Dover, Delaware.

Cherry, Phillip 1987. Personal communication. December 30, 1987. Department of Natural Resources & Environmental Control, Water Supply Branch. Dover, Delaware.

Conservation Tillage Information Center. 1986 National Survey of Conservation Tillage Practices. National Association of Conservation Districts/Conservation Tillage Information Center. Pages 43 and 45.

Cugnini, Joseph 1988. Personal communication. January 29, 1988. Department of Natural Resources & Environmental Control, Division of Air & Waste Management. Dover, Delaware.

Delaware Department of Agriculture and Delaware Agricultural Statistics Service. 1986 Delaware Agricultural Statistics Summary. Dover, Delaware.

Delaware Office of Management, Budget and Planning. Dimensions on Delaware - A Statistical Abstract for 1979. Dover, Delaware. Page 681.

Folmsbee, Richard 1988. Personal communication, January 25, 1988. Department of Natural Resources & Environmental Control, Division of Air & Water Management. Dover, Delaware.

Gauch, Richard M. 1988. Personal communication. February 29, 1988. Kent County Planning Office. Dover, Delaware.

Gilliam, J.W. and R. W. Skaggs 1985. Use of Drainage Control to Minimize Potential Detrimental Effects of Improved Drainage Systems. Biological & Agricultural Engineering Departments, North Carolina State University. Raleigh, North Carolina.

Henshaw, Frank 1988. Personal communication, January 19, 1988. Department of Natural Resources & Environmental Control, Division of Water Resources. Dover, Delaware.

Horsey, Beth 1988. Personal communication, January 19, 1988. Sussex Conservation District. Georgetown, Delaware.

Izzo, Mike 1988. Personal communication, January 19, 1988. Sussex County Government. Georgetown, Delaware.

Jones, Paul 1988. Personal communication, January 22, 1988. Department of Natural Resources & Environmental Control, Water Management Section. Dover, Delaware.

Lank, Lawrence 1988. Personal communication. March 4, 1988. Sussex County Planning Office. Georgetown, Delaware.

Malenfant, Raymond H., P.E. 1988. Personal communication. January 29, 1988. Department of Natural Resources & Environmental Control, Division of Air & Waste Management. Dover, Delaware.

McNalley, Charles 1988. Personal communication. February 25, 1988. Department of Natural Resources & Environmental Control, Wetlands Section. Dover, Delaware.

Milliken Willis, Nancy 1988. Descriptive Report on Forest Water Quality Enhancement Issues, Opportunities and Land Treatment Activities. Delaware Department of Agriculture, Forestry Section. Dover, Delaware.

Milliken Willis, Nancy 1988. Personal Communication. Delaware Department of Agriculture, Forestry Section. Dover, Delaware.

New Castle County 1973. New Castle County Drainage Code. Ordinance No. 73-32. March 16, 1973. New Castle, Delaware.

New Castle County 1977. New Castle County Stormwater Management. Resolution No. 77-144. June 1977. New Castle, Delaware.

New Castle County 1987. New Castle County Septic System Regulations. March 1987. New Castle, Delaware.

New Castle County 1987. Water Resource Protection Area Program (Revised). Water Resource Administration. Newark, Delaware.

North Carolina Extension Service 1982. Best Management Practices for Agricultural Nonpoint Source Control 1. Animal Waste. Biological & Engineering Departments, North Carolina State University. Raleigh, North Carolina.

North Carolina Extension Service 1982. Best Management Practices for Agricultural Nonpoint Source Control 2. Commercial Fertilizer. Biological & Engineering Departments, North Carolina State University. Raleigh, North Carolina.

Northern Virginia Planning District Commission 1987. BMP Handbook for the Occoquan Watershed, Annandale, Virginia.

Palmer, David H. 1988. Personal communication. University of Delaware, Cooperative Extension Service. Sussex County Office, Delaware.

Parker, Matthew 1988. Personal communication. February 16, 1988. Dover Air Force Base. Dover, Delaware.

Pase, James L. 1988. Personal communication. March 4, 1988. Delaware Solid Waste Authority. Dover, Delaware.

Petit deMange, Michael 1988. Personal communication. March 2, 1988. Kent County Planning Office. Dover, Delaware.

Ritter, W.F. 1984. Nonpoint Source Pollution and the Inland Bays. University of Delaware. Newark, Delaware.

Ritter, W.F., J.R. Harris and C.E. Palo 1981. Nitrogen and Water Quality Relationships in Delaware Lakes. ASAE paper #81-2003. University of Delaware. Newark, Delaware.

Russell, Tom 1987. Personal communication. December 16, 1987. New Castle County Government, Water Resources Administration. Newark, Delaware.

Schueler, Thomas R. 1987. Controlling Urban Runoff: A Practical Manual for Planning & Designing Urban BMPs. Water Resource Planning Board, Metropolitian Washington Council of Governments, Department of the Environmental Programs. Washington, D.C.

Scudlark, Joe 1988. Personal communication. February 1, 1988. University of Delaware, College of Marine Studies, Lewis, Delaware.

State of Delaware 1980. Delaware Erosion & Sediment Control Handbook. Department of Natural Resources & Environmental Control, Division of Soil & Water Conservation. Dover, Delaware.

State of Delaware 1987. Delaware's 1986 Report on Reasonable Further Progress (RFP) Toward the Attainment of the National Ambient Air Quality Standard for Ozone. Department of Natural Resources & Environmental Control, Division of Air & Water Waste Management, Air Resources Section, Dover, Delaware.

State of Delaware 1987. Delaware's Environmental Legacy.

State of Delaware 1987. Delaware's Plan of Action for Assuring Hazardous Waste Disposal Capacity. Department of Natural Resources & Environmental Control, Division of Air & Waste Management. Dover, Delaware.

State of Delaware 1987. Septage Management Plan. Department of Natural Resources & Environmental Control, Dover, Delaware.

Stayton, Greer 1988. Personal communication, January 20, 1988. Department of Agriculture, Pest Compliance. Dover, Delaware.

Tatman & Lee Associates, Inc. 1983. Mushroom Industry Assessment for New Castle County Water Resources Agency. Wilmington, Delaware.

Tourbier, J. Toby and Richard Westmacott 1980. Water Resources Protection Measures in Land Development - A Handbook - Revised Edition. Technical Report, University of Delaware, Newark, Delaware.

Tramontano, Jack 1988. Personal communication. February 1, 1988. University of Delaware, College of Marine Studies, Newark, Delaware.

U.S.D.A. Forest Service and Delaware Department of Agriculture - Forestry Section. 1986 National Forest Inventory.

U.S.D.A. Science and Education Administration 1979. Animal Waste Utilization on Cropland and Pastureland - A Manual for Evaluating Agronomic and Environmental Effects. USDA Utilization Report No. 6. Page 17.

U.S.D.A. Soil Conservation Service and Delaware Agricultural Experiment Station. 1970, 1971 & 1974 County Soil Surveys (New Castle County, Kent County and Sussex County), Delaware.

U.S.D.A. Soil Conservation Service 1982. Basic Statistics 1982 National Resource Inventory. page 24.

U.S.D.A. Soil Conservation Service 1987. Technical Guide Section III-A.

U.S.D.A. Soil Conservation Service and New Castle Conservation District 1984. Floodplain Management Study, Mill Creek, New Castle County, Delaware. Newark, Delaware.

U.S. Department of Commerce, Bureau of the Census 1982. 1982 Census of Agriculture.

U.S. Environmental Protection Agency 1983. Results of the Nationwide Urban Runoff Program (NURP), Vol. I - Final Report. WH-554. Water Planning Division. Washington D.C.

U.S. Environmental Protection Agency 1987. Nonpoint Source Guidance. Office of Water Regulations and Standards. Washington, D.C.

Vanderwende, William 1987. DACD Correspondence.

Water Resources Agency for New Castle County. 1986 Appoquinimink River Basin Project, Rural Clean Water Program, Final Report. New Castle County, Delaware. Page 47.

Whalen, Joanne 1988. Personal communication. University of Delaware, Cooperative Extension Service. Newark, Delaware.

Williams, Charles 1988. Personal communication. February 4, 1988. Department of Natural Resources & Environmental Control, Division of Soil & Water. Dover, Delaware.

Willrich, T.L. and G.E. Smith 1970. "Livestock Operations and Field Spread Manure as Sources of Pollutants", Agricultural Practices and Water Quality. Iowa State University Press. Ames, Iowa. Pages 231-238.

Woodruff, Ken 1987. Personal communication. December 17, 1987. University of Delaware, Delaware Geological Survey. Newark, Delaware.

Wutka, Joe 1988. Personal communication. February 4, 1988. Department of Transportation, Division of Highways. Dover, Delaware.

Appendices

Appendix A-1	Delaware Resource Management Systems
Appendix A-11	Resource Management Systems: Silviculture
Appendix B	Conservation Matrix
Appendix C	Calculations Animal Manure Production
Appendix D	Delaware State Cost Share Program
Appendix E	Definitions
Appendix F	Delaware Agricultural Directory
Appendix G	Public Response Summary

Appendix A-I

SECTION III-A(1): RESOURCE MANAGEMENT SYSTEMS

A resource management system is a combination of conservation practices and management measures, identified by primary use of land or water, that will, as a minimum, protect the resource base by meeting acceptable soil loss rates, maintain acceptable water quality, maintain acceptable ecological and management levels for the selected resource use, and meet the economic and social needs of the decisionmaker. In addition, resource management systems may include conservation practices that restore or improve the resource base by exceeding the minimum to enhance water quality, land productivity, wildlife habitat, and improve health, safety and environmental conditions.

The objective of conservation planning and application of resource management systems is to protect, restore, or improve the resource base including soil, water, air, plant, and animal resources. The kind of soil and the intended use of the resources must be considered in developing the resource management system. Soils suitable for each land use are found in Section II of the Technical Guide.

A resource management system is identified by primary land use, and is designed to meet resource needs and the landuser's objectives. When a secondary land use is designated, minimum acceptable levels of essential treatment for both resource management systems is required.

PERFORMANCE STANDARDS

A. ESSENTIAL TREATMENT:

The minimum levels of essential treatment for a resource management system apply to all land uses. They may not always apply equally to every land use or to every resource management system. However, when a resource problem is identified in the planning process, the treatment used for that resource problem must meet the minimum standard in order to establish a resource management system.

The essential treatment and minimum standards to protect the resource base in a resource management system include:

1. Erosion control - Sheet, rill, wind, gully (both ephemeral and permanent), streambank, and irrigation-induced soil erosion are controlled within acceptable limits as defined in Section I of the Technical Guide.

2. Water disposal - Excess surface and subsurface water is disposed through acceptable outlets. This includes removal and safe disposal of surface runoff and subsurface drainage.

3. Animal wastes and agri-chemical management - Animal wastes, other organic material, pesticides, and fertilizers are managed to achieve desired levels of production while protecting the resource base and minimizing off-site effects.

4. Resource management - Natural resources are managed to sustain plant and/or animal production, promote acceptable ecological and vegetative conditions, provide acceptable wildlife habitat quality, improve soil tilth, and minimize soil compaction in the most economical manner. Resources of concern may be soil, water, plant, animal and attributes such as scenic resources.

5. Water management - Water from all sources is managed to provide acceptable quantity and quality for the intended use (such as plant production, animal management, or domestic, municipal, and recreational uses).

6. Off-site effects - Negative off-site effects are minimized to an acceptable level. Criteria are found in federal, state, and/or local legislation, environmental ordinances, or in technical literature.

Resource management systems can be developed for each of the sixteen land use categories recognized by SCS. Examples of resource management systems commonly planned in the Field Office area are included on the following pages of this section. Other treatment combinations can be formulated using Appendix III-A.

B. ADDITIONAL TREATMENT

Additional treatment, beyond essential treatment, may be applied to enhance natural resources or to serve secondary or tertiary land uses. This treatment may include practices or management measures that contribute to improved water quality, environmental enhancement, improved production, improved drainage or irrigation, improved wildlife habitat, improved aesthetics, and health and safety.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1							
Conservation Cropping Sequence	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Alternative 2							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Alternative 3							
Conservation Cropping Sequence	X		X	X	X	X	
Cover and Green Manure Crop	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Alternative 4							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Field Border	X			X		X	
Alternative 5							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Irrigation Water Management	X		X	X	X	X	

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Surface Drainage		X		X			
Subsurface Drain		X		X	X		
Other Practices							
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Grade Stabilization Structure	X	X				X	
Critical Area Planting	X			X		X	
Pond				X	X	X	
Alternative __							
Alternative __							
Alternative __							

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIIe, IVe, VIe, VIs, VIIe, 1/

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Stripcropping	X		X	X	X	X	
Alternative 2							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Other Practices							
Terrace	X	X		X	X	X	
Water and Sediment Control Basin	X	X		X		X	
Underground Outlet	X	X				X	
Diversion	X	X	X	X	X	X	
Grassed Waterway	X	X		X		X	
Critical Area Planting	X			X		X	
Grade Stabilization Structure	X	X				X	
Alternative __							
Alternative __							

1/Consider conversion of VIe, VIs, and VIIe soils to noncropland use.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Alternative 2						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Other Practices						
Waste Storage Pond			X			X
Waste Storage Structure			X			X
Waste Treatment Lagoon			X			X
Roof Runoff Management	X	X	X	X		X
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Woodland Site Preparation				X		
Tree Planting	X			X		X
Firebreak	X			X		X
Alternative 2						
Woodland Improvement				X		
Livestock Exclusion	X		X	X	X	X
Alternative 3						
Woodland Pruning				X		
Alternative 4						
Woodland Improved Harvesting				X	X	X
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, Vw, VIw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1							
Woodland Site Preparation				X			
Surface Drainage		X		X			
Tree Planting	X			X		X	
Firebreak	X			X		X	
Alternative 2							
Woodland Improvement				X			
Surface Drainage		X		X			
Livestock Exclusion	X		X	X	X	X	
Alternative 3							
Woodland Pruning				X			
Alternative 4							
Woodland Improved Harvesting				X	X	X	
Alternative __							

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIIe, IVe, VIe, VIs, VIIe

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Woodland Site Preparation				X		
Tree Planting	X			X		X
Firebreak	X			X		X
Alternative 2						
Woodland Improvement				X		
Livestock Exclusion	X		X	X	X	X
Alternative 3						
Woodland Pruning				X		
Alternative 4						
Woodland Improved Harvesting				X	X	X
Forest Land Erosion Control System	X	X		X		X
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe, VIe, VIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Hayland

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Subsurface Drain		X		X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Mined land

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe, VIe, VIs, VIIe, VIIIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Land Reconstruction	X	X		X	X	X
Sediment Basin		X	X	X		X
Diversion	X	X	X	X	X	X
Critical Area Planting	X			X		X
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Pastureland

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe, VIe, VIs, VIIe

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Pastureland

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, Vw, VIw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Surface Drainage		X		X		
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Recreation Land

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe, VIe, VIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Recreation Trail and Walkway	X	X		X		X
Heavy Use Area Protection	X			X		X
Recreation Land Grading and Shaping		X				
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Recreation Land

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, Vw, VIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Recreation Trail and Walkway	X	X		X		X
Heavy Use Area Protection	X			X		X
Pond				X	X	X
Fishpond Management				X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Urbanizing Land1/

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIs, IIIe, IVe

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
land grading3/	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative 2						
Runoff Management System	X	X		X		X
Diversion	X	X	X	X	X	X
Sediment Basin		X	X	X		X
Underground Outlet	X	X				X
sediment trap3/				X		X
perimeter dike3/				X	X	X
land grading3/	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative 3						
Streambank and Shoreline Protection	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative __						
Alternative __						

1/Includes Commercial/Industrial Land, Community Services Land, Residential Land, and Transportation Services Land.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
3/Management measures.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Surface Drainage		X		X		
Subsurface Drain		X		X	X	
Critical Area Planting	X			X		X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Includes Commercial/Industrial Land, Community Services Land, Residential Land, and Transportation Services Land.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Wildlife Land

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IVe, VIe, VIs, VIIe, VIIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Upland Habitat Management				X		
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, Vw, VIw, VIIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Upland Habitat Management				X		
Pond				X	X	X
Fishpond Management				X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, Vw, VIw, VIIIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Wetland Habitat Management				X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

Conservation Practice Matrix

Following is a listing of all conservation practices contained in Section IV of the Field Office Technical Guide.

An "X" in the column labeled "Commonly Used" indicates that the practice is locally applicable and has been approved for use in the development of Land Management Systems.

		PURPOSE					
Commonly Used	Conservation Practice	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
X	Access Road (560)	X	X				X
	Bedding (310)		X		X		
	Brush Mgt. (314)	X			X		X
X	Channel Vegetation (322)	X			X		X
X	Chiseling and Subsoiling (324)		X		X		
X	Clearing and Snagging (326)	X	X		X		X
X	Conservation Cropping Sequence (328)	X		X	X	X	X
X	Conservation Tillage (329)	X		X	X	X	X
	Contour Farming (330)	X				X	X
	Contour Orchard and Other Fruit Area (331)	X				X	X
X	Cover and Green Manure Crop (340)	X		X	X	X	X
X	Critical Area Planting (342)	X			X		X
	Crop Residue Use Management (344)	X			X	X	X
	Dam, Floodwater Retarding (402)	X	X				X

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Dike (356)	X	X	X	X	X	X
X	Diversion (362)	X	X	X	X	X	X
	Farmstead and Feedlot Windbreak (380)				X		
X	Fencing (382)	X			X		X
X	Fertilizer Management, Interim			X	X		X
X	Field Border (386)	X			X		X
	Field Windbreak (392)	X			X	X	X
X	Filter Strip (393)			X			X
	Firebreak (394)	X			X		X
X	Fishpond Management (399)				X	X	
	Floodway (404)		X		X		X
X	Forest Land Erosion Control System (408)	X	X		X		X
X	Grade Stabilization Structure (410)	X	X				X
	Grasses and Legumes in Rotation (411)	X			X	X	X
X	Grassed Waterway or Outlet (412)	X	X		X		X
X	Heavy Use Area Protection (561)	X			X		X
X	Hedgerow Planting (422)				X		
X	Irrigation Pit (552-A)				X	X	
	Irrigation System, Trickle (441)	X		X	X	X	X

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Irrigation System, Sprinkler (442)				X	X	
X	Irrigation Water Management (449)	X		X	X	X	X
X	Land Clearing (460)				X		
X	Land Reconstruction, Abandoned Mined Land (543)	X	X		X	X	X
	Land Reconstruction, Currently Mined Land (544)	X	X		X	X	X
X	Land Smoothing (466)		X		X	X	
X	Lined Waterway or Outlet (468)	X	X				X
X	Livestock Exclusion (472)	X		X	X	X	X
X	Mulching (484)	X			X	X	X
X	Obstruction Removal (500)				X		
X	Open Channel (582)		X		X		
X	Pasture and Hayland Management (510)	X		X	X	X	X
X	Pasture and Hayland Planting (512)	X			X		X
	Pesticide Management, Interim			X	X		X
	Pipeline (516)				X	X	
X	Pond (378)				X	X	X
X	Pond Sealing or Lining (521)				X	X	

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Precision Land Forming (462)	X	X		X	X	X
	Pumping Plant for Water Control (533)		X		X	X	
	Recreation Land Grading and Shaping (556)		X				
X	Recreation Trail and Walkway (568)	X	X		X		X
X	Regulating Water in Drainage Systems (554)			X	X	X	X
X	Roof Runoff Management (558)	X	X	X	X		X
	Runoff Management System (570)	X	X		X		X
X	Sediment Basin (350)		X	X	X		X
X	Spoilbank Spreading (572)		X		X		
	Spring Development (574)					X	
X	Streambank and Shoreline Protection (580)	X	X		X	X	X
X	Stream Channel Stabilization (584)	X	X				X
X	Stripcropping, Contour (585)	X		X	X	X	X
X	Stripcropping, Field (586)	X		X	X	X	X
	Stripcropping, Wind (589)	X			X		X
X	Structure for Water Control (587)			X	X	X	X
X	Subsurface Drain (606)		X		X	X	

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Surface Drainage						
X	Field Ditch (607)		X		X		
	Surface Drainage						
X	Main or Lateral (608)		X		X		
X	Terrace (600)	X	X		X	X	X
	Toxic Salt Reduction (610)				X		
X	Tree Planting (612)	X			X		X
	Trough or Tank (614)	X		X	X	X	X
X	Underground Outlet (620)	X	X				X
	Waste Management System						
X	(312)			X			X
X	Waste Storage Pond (425)			X			X
	Waste Storage Structure						
X	(313)			X			X
	Waste Treatment Lagoon						
X	(359)			X			X
X	Waste Utilization (633)	X		X	X		X
	Water & Sediment Control						
X	Basin (638)	X	X		X		X
	Well (642)					X	
	Wildlife Upland Habitat						
X	Mgt. (645)				X		
	Wildlife Wetland Habitat						
X	Mgt. (644)				X	X	

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Wind Barrier, Interim	X			X		X
X	Woodland Improved Harvesting (654)				X	X	X
X	Woodland Improvement (666)				X		
X	Woodland Pruning (660)				X		
X	Woodland Site Preparation (490)				X		

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe, IVs, VIe, VIIs1/

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1 Cash Grain Crops3/						
Conservation Cropping Sequence	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 2 Cash Grain Crops3/						
Conservation Cropping Sequence	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 3 Cash Grain Crops3/						
Conservation Cropping Sequence	X		X	X	X	X
Conservation Tillage	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 4 Cash Grain Crops3/						
Conservation Cropping Sequence	X		X	X	X	X
Conservation Tillage	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Other Practices						
Terrace	X	X		X	X	X
Diversion	X	X	X	X	X	X
Grassed Waterway	X	X		X		X
Grade Stabilization Structure	X	X				X
Underground Outlet	X	X				X
Contour Farming	X				X	X
Irrigation Water Management	X		X	X	X	X
Field Border	X			X		X
Hedgerow Planting				X		

1/Consider conversion of VIe and VIIs soils to noncropland use.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
3/Corn, Wheat, Barley, Soybeans.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe, IVs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1 Vegetable Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 2 Vegetable Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 3 Vegetable Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Other Practices						
Contour Farming	X				X	X
Field Border	X			X		X
Irrigation Water Management	X		X	X	X	X
Wind Barrier	X			X		X
Alternative 4 Vegetable Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Other Practices						
Terrace	X	X		X	X	X
Diversion	X	X	X	X	X	X
Grassed Waterway	X	X		X		X
Grade Stabilization Structure	X	X				X
Underground Outlet	X	X				X
Contour Farming	X				X	X

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Peas, Lima beans, Potatoes, Sweet corn, Cucumbers.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1 Cash Grain Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Surface Drainage		X		X			
Subsurface Drain		X		X	X		
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Grade Stabilization Structure	X	X				X	
Field Border	X			X		X	
Alternative 2 Cash Grain Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Surface Drainage		X		X			
Subsurface Drain		X		X	X		
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Grassed Waterway	X	X		X		X	
Grade Stabilization Structure	X	X				X	
Irrigation Water Management	X		X	X	X	X	
Field Border	X			X		X	
Alternative __							

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Corn, Wheat, Barley, Soybeans.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1 Vegetable Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Cover and Green Manure Crop	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Surface Drainage		X		X			
Subsurface Drain		X		X	X		
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Grade Stabilization Structure	X	X				X	
Field Border	X			X		X	
Alternative 2 Vegetable Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Cover and Green Manure Crop	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Surface Drainage		X		X			
Subsurface Drain		X		X	X		
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Grassed Waterway	X	X		X		X	
Grade Stabilization Structure	X	X				X	
Irrigation Water Management	X		X	X	X	X	
Field Border	X			X		X	
Alternative __							

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Peas, Lima beans, Potatoes, Sweet corn, Cucumbers.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIw, IIIs, IVe, IVs, VIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Waste Management System			X			X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIw, IIIs, IVe, IVw, IVs, VIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Woodland Improvement				X		
Alternative 2						
Woodland Improvement				X		
Livestock Exclusion	X		X	X	X	X
Alternative 3						
Woodland Improved Harvesting				X	X	X
Alternative 4						
Woodland Improved Harvesting				X	X	X
Forest Land Erosion Control System	X	X		X		X
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Hayland/Pastureland

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIw, IIIs, IVe, IVw, IVs, VIIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Alternative 2						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Surface Drainage		X		X		
Subsurface Drain		X		X	X	
Alternative 3						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Spring Development and					X	
Trough and Tank or	X		X	X	X	X
Pond				X	X	X
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Urbanizing Land1/

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe, IVs

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
land grading3/	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative 2						
land grading3/	X	X		X	X	X
Critical Area Planting	X			X		X
Runoff Management System	X	X		X		X
Other Practices & Management Measures						
Sediment Basin		X	X	X		X
sediment trap3/				X		X
perimeter dike3/				X	X	X
Grassed Waterway	X	X		X		X
Grade Stabilization Structure	X	X				X
Dam, Floodwater Retarding	X	X				X
Alternative __						
Alternative __						

1/Includes Commercial/Industrial Land, Community Services Land, Residential Land, and Transportation Services Land.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
3/Management measures.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIw, IIIs, IVe, IVs, VIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Upland Habitat Management				X		
Alternative 2						
Wildlife Upland Habitat Management				X		
Pond				X	X	X
Fishpond Management				X	X	
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw, VIIw, VIIIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Wetland Habitat Management				X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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APPENDIX III-A

Conservation Practice
Matrix

Following is a listing of all conservation practices contained in Section IV of the Field Office Technical Guide.

An "X" in the column labeled "Commonly Used" indicates that the practice is locally applicable and has been approved for use in the development of Land Management Systems.

		PURPOSE					
Commonly Used	Conservation Practice	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Access Road (560)	X	X				X
	Bedding (310)		X		X		
	Brush Mgt. (314)	X			X		X
X	Channel Vegetation (322)	X			X		X
	Chiseling and Subsoiling (324)		X		X		
	Clearing and Snagging (326)	X	X		X		X
X	Conservation Cropping Sequence (328)	X		X	X	X	X
X	Conservation Tillage (329)	X		X	X	X	X
	Contour Farming (330)	X				X	X
	Contour Orchard and Other Fruit Area (331)	X				X	X
X	Cover and Green Manure Crop (340)	X		X	X	X	X
X	Critical Area Planting (342)	X			X		X
X	Crop Residue Use Management (344)	X			X	X	X
	Dam, Floodwater Retarding (402)	X	X				X

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Dike (356)	X	X	X	X	X	X
X	Diversion (362)	X	X	X	X	X	X
	Farmstead and Feedlot Windbreak (380)				X		
X	Fencing (382)	X			X		X
X	Fertilizer Management, Interim			X	X		X
X	Field Border (386)	X			X		X
X	Field Windbreak (392)	X			X	X	X
X	Filter Strip (393)			X			X
	Firebreak (394)	X			X		X
X	Fishpond Management (399)				X	X	
	Floodway (404)		X		X		X
X	Forest Land Erosion Control System (408)	X	X		X		X
X	Grade Stabilization Structure (410)	X	X				X
	Grasses and Legumes in Rotation (411)	X			X	X	X
X	Grassed Waterway or Outlet (412)	X	X		X		X
	Heavy Use Area Protection (561)	X			X		X
X	Hedgerow Planting (422)				X		
	Irrigation Pit (552-A)				X	X	
X	Irrigation System, Trickle (441)	X		X	X	X	X

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
X	Irrigation System, Sprinkler (442)				X	X	
X	Irrigation Water Mgt. (449)	X		X	X	X	X
	Land Clearing (460)				X		
	Land Reconstruction, Abandoned Mined Land (543)	X	X		X	X	X
	Land Reconstruction, Currently Mined Land (544)	X	X		X	X	X
X	Land Smoothing (466)		X		X	X	
X	Lined Waterway or Outlet (468)	X	X				X
X	Livestock Exclusion (472)	X		X	X	X	X
	Mulching (484)	X			X	X	X
	Obstruction Removal (500)				X		
X	Open Channel (582)		X		X		
X	Pasture and Hayland Mgt. (510)	X		X	X	X	X
X	Pasture and Hayland Planting (512)	X			X		X
	Pesticide Management, Interim			X	X		X
	Pipeline (516)				X	X	
X	Pond (378)				X	X	X
	Pond Sealing or Lining (521)				X	X	

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Precision Land Forming (462)	X	X		X	X	X
	Pumping Plant for Water Control (533)		X		X	X	
	Recreation Land Grading and Shaping (556)		X				
	Recreation Trail and Walkway (568)	X	X		X		X
X	Regulating Water in Drainage Systems (554)			X	X	X	X
X	Roof Runoff Management (558)	X	X	X	X		X
X	Runoff Mgt. System (570)	X	X		X		X
	Sediment Basin (350)		X	X	X		X
	Spoilbank Spreading (572)		X		X		
	Spring Development (574)					X	
	Streambank and Shoreline Protection (580)	X	X		X	X	X
X	Stream Channel Stabilization (584)	X	X				X
	Stripcropping, Contour (585)	X		X	X	X	X
	Stripcropping, Field (586)	X		X	X	X	X
	Stripcropping, Wind (589)	X			X		X
X	Structure for Water Control (587)			X	X	X	X
X	Subsurface Drain (606)		X		X	X	

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Surface Drainage						
X	Field Ditch (607)		X		X		
	Surface Drainage						
X	Main or Lateral (608)		X		X		
X	Terrace (600)	X	X		X	X	X
	Toxic Salt Reduction (610)				X		
X	Tree Planting (612)	X			X		X
	Trough or Tank (614)	X		X	X	X	X
X	Underground Outlet (620)	X	X				X
	Waste Management System						
X	(312)			X			X
X	Waste Storage Pond (425)			X			X
	Waste Storage Structure						
X	(313)			X			X
	Waste Treatment Lagoon						
X	(359)			X			X
X	Waste Utilization (633)	X		X	X		X
	Water & Sediment Control						
	Basin (638)	X	X		X		X
	Well (642)					X	
	Wildlife Upland Habitat						
X	Mgt. (645)				X		
	Wildlife Wetland Habitat						
X	Mgt. (644)				X	X	

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Wind Barrier, Interim	X			X		X
X	Woodland Improved Harvesting (654)				X	X	X
X	Woodland Improvement (666)				X		
	Woodland Pruning (660)				X		
	Woodland Site Preparation (490)				X		

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1 Cash Grain Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Alternative 2 Cash Grain Crops2/							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Managment			X	X		X	
Pesticide Management			X	X		X	
Alternative 3 Vegetable Crops3/							
Conservation Cropping Sequence	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Field Border	X			X		X	
Terrace	X	X		X	X	X	
Grade Stabilization Structure	X	X				X	
Alternative 4 Vegetable Crops3/							
Conservation Cropping Sequence	X		X	X	X	X	
Cover and Green Manure Crop	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Field Border	X			X		X	
Terrace	X	X		X	X	X	
Grade Stabilization Structure	X	X				X	

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Corn, Wheat, Barley, Soybeans.
3/Lima beans, Snap beans, Peas, Carrots, Cantaloupe, Watermelon.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1 Cash Grain Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Conservation Tillage	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Alternative 2 Cash Grain Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Surface Drainage		X		X		
Subsurface Drain		X		X	X	
Regulating Water in Drainage Systems			X	X	X	X
Structure for Water Control			X	X	X	X
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Corn, Wheat, Barley, Soybeans.

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Applicable Soils: Land Use Capability (LUC) IIIe, IVe, VIIs, 1/

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1 Cash Grain Crops3/							
Conservation Cropping Sequence	X		X	X	X	X	
Conservation Tillage	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Alternative 2 Vegetable Crops4/							
Conservation Cropping Sequence	X		X	X	X	X	
Fertilizer Management			X	X		X	
Pesticide Management			X	X		X	
Terrace	X	X		X	X	X	
Grade Stabilization Structure	X	X				X	
Field Border	X			X		X	
Alternative __							
Alternative __							
Alternative __							

1/ Consider conversion of VIIs soils to noncropland use.
2/ Additional practices identified in Appendix III-A can be substituted to form various other other combinations of treatment.
3/ Corn, Wheat, Barley, Soybeans.
4/ Lima beans, Snap beans, Peas, Carrots, Cantaloupe, Watermelon.

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Applicable Soils: Land Use Capability (LUC) IIIs

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1 Cash Grain Crops2/						
Conservation Cropping Sequence	X		X	X	X	X
Conservation Tillage	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Irrigation Water Management	X		X	X	X	X
Alternative 2 Vegetable Crops3/						
Conservation Cropping Sequence	X		X	X	X	X
Cover and Green Manure Crop	X		X	X	X	X
Fertilizer Management			X	X		X
Pesticide Management			X	X		X
Field Border	X			X		X
Terrace	X	X		X	X	X
Grade Stabilization Structure	X	X				X
Field Windbreak	X			X	X	X
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
2/Corn, Wheat, Barley, Soybeans.
3/Lima beans, Snap beans, Peas, Carrots, Cantaloupe, Watermelon.

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Farmstead or Headquarters

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIw, IIIs, IVe

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Alternative 2						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Farmstead or Feedlot Windbreak				X		
Alternative 3						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Waste Storage Structure			X			X
Alternative 4						
Waste Management System			X			X
Waste Utilization	X		X	X		X
Waste Storage Structure			X			X
Waste Storage Pond			X			X
Filter Strip			X			X
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe, VIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Woodland Site Preparation				X		
Tree Planting	X			X		X
Alternative 2						
Woodland Improvement				X		
Alternative 3						
Woodland Pruning				X		
Alternative 4						
Woodland Improved Harvesting				X	X	X
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw

Examples of Minimum Treatment Alternatives1/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects	
Alternative 1							
Woodland Site Preparation				X			
Tree Planting	X			X		X	
Surface Drainage		X		X			
Regulating Water in Drainage Systems			X	X	X	X	
Structure for Water Control			X	X	X	X	
Alternative 2							
Woodland Improvement				X			
Alternative 3							
Woodland Pruning				X			
Alternative 4							
Woodland Improved Harvesting				X	X	X	
Alternative __							

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Hayland/Pastureland

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Pasture and Hayland Planting	X			X		X
Pasture and Hayland Management	X		X	X	X	X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Mined Land

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe, VIIs, VIIIs

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Land Reconstruction	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative 2						
Land Reconstruction	X	X		X	X	X
Sediment Basin		X	X	X		X
Diversion	X	X	X	X	X	X
Critical Area Planting	X			X		X
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Urbanizing Land1/

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Applicable Soils: Land Use Capability (LUC) I, IIe, IIw, IIs, IIIe, IIIs, IVe

Examples of Minimum Treatment Alternatives2/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
land grading3/	X	X		X	X	X
Critical Area Planting	X			X		X
Alternative 2						
Runoff Management System	X	X		X		X
Dam, Floodwater Retarding	X	X				X
Sediment Basin		X	X	X		X
Grade Stabilization Structure	X	X				X
sediment trap3/				X		X
perimeter dike3/				X	X	X
land grading3/	X	X		X	X	X
riprap3/	X			X		
Critical Area Planting	X			X		X
Alternative __						
Alternative __						
Alternative __						

1/Includes Commercial/Industrial Land, Community Service Land, Residential Land, and Transportation Services Land.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.
3/Management measures.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw

Examples of Minimum Treatment Alternatives2/

	Purpose						
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Open Channel or Surface Drainage, Main or Lateral		X		X		
Critical Area Planting	X			X		X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Includes Commercal/Industrial Land, Community Services Land, Residential Land, and Transportation Services Land.
2/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Wildlife Land

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Applicable Soils: Land Use Capability (LUC) I, IIw, IIe, IIs, IIIw, IVw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Upland Habitat Managment				X		
Pond				X	X	X
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

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Applicable Soils: Land Use Capability (LUC) IIw, IIIw, IVw, VIIw, VIIIw

Examples of Minimum Treatment Alternatives1/

	Purpose					
	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
Alternative 1						
Wildlife Wetland Habitat Management				X	X	
Alternative __						
Alternative __						
Alternative __						
Alternative __						

1/Additional practices identified in Appendix III-A can be substituted to form various other combinations of treatment.

APPENDIX III-A

Conservation Practice
Matrix

Following is a listing of all conservation practices contained in Section IV of the Field Office Technical Guide.

An "X" in the column labeled "Commonly Used" indicates that the practice is locally applicable and has been approved for use in the development of Land Management Systems.

		PURPOSE					
Commonly Used	Conservation Practice	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Access Road (560)	X	X				X
	Bedding (310)		X		X		
X	Brush Mgt. (314)	X			X		X
X	Channel Vegetation (322)	X			X		X
	Chiseling and Subsoiling (324)		X		X		
X	Clearing and Snagging (326)	X	X		X		X
X	Conservation Cropping Sequence (328)	X		X	X	X	X
X	Conservation Tillage (329)	X		X	X	X	X
	Contour Farming (330)	X				X	X
	Contour Orchard and Other Fruit Area (331)	X				X	X
X	Cover and Green Manure Crop (340)	X		X	X	X	X
X	Critical Area Planting (342)	X			X		X
X	Crop Residue Use Management (344)	X			X	X	X
	Dam, Floodwater Retarding (402)	X	X				X

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
X	Dike (356)	X	X	X	X	X	X
X	Diversion (362)	X	X	X	X	X	X
X	Farmstead and Feedlot Windbreak (380)				X		
X	Fencing (382)	X			X		X
X	Fertilizer Management, Interim			X	X		X
X	Field Border (386)	X			X		X
X	Field Windbreak (392)	X			X	X	X
X	Filter Strip (393)			X			X
X	Firebreak (394)	X			X		X
X	Fishpond Mgt. (399)				X	X	
	Floodway (404)		X		X		X
	Forest Land Erosion Control System (408)	X	X		X		X
X	Grade Stabilization Structure (410)	X	X				X
X	Grasses and Legumes in Rotation (411)	X			X	X	X
	Grassed Waterway or Outlet (412)	X	X		X		X
X	Heavy Use Area Protection (561)	X			X		X
X	Hedgerow Planting (422)				X		
	Irrigation Pit (552-A)				X	X	
	Irrigation System, Trickle (441)	X		X	X	X	X

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Irrigation System, Sprinkler (442)				X	X	
X	Irrigation Water Mgt. (449)	X		X	X	X	X
	Land Clearing (460)				X		
	Land Reconstruction, Abandoned Mined Land (543)	X	X		X	X	X
	Land Reconstruction, Currently Mined Land (544)	X	X		X	X	X
	Land Smoothing (466)		X		X	X	
	Lined Waterway or Outlet (468)	X	X				X
X	Livestock Exclusion (472)	X		X	X	X	X
	Mulching (484)	X			X	X	X
	Obstruction Removal (500)				X		
X	Open Channel (582)		X		X		
X	Pasture and Hayland Mgt. (510)	X		X	X	X	X
X	Pasture and Hayland Planting (512)	X			X		X
	Pesticide Management, Interim			X	X		X
X	Pipeline (516)				X	X	
X	Pond (378)				X	X	X
X	Pond Sealing or Lining (521)				X	X	

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Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Precision Land Forming (462)	X	X		X	X	X
	Pumping Plant for Water Control (533)		X		X	X	
	Recreation Land Grading and Shaping (556)		X				
	Recreation Trail and Walkway (568)	X	X		X		X
X	Regulating Water in Drainage Systems (554)			X	X	X	X
X	Roof Runoff Management (558)	X	X	X	X		X
X	Runoff Mgt. System (570)	X	X		X		X
X	Sediment Basin (350)		X	X	X		X
X	Spoilbank Spreading (572)		X		X		
X	Spring Development (574)					X	
	Streambank and Shoreline Protection (580)	X	X		X	X	X
X	Stream Channel Stabilization (584)	X	X				X
	Stripcropping, Contour (585)	X		X	X	X	X
	Stripcropping, Field (586)	X		X	X	X	X
	Stripcropping, Wind (589)	X			X		X
X	Structure for Water Control (587)			X	X	X	X
X	Subsurface Drain (606)		X		X	X	

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Surface Drainage						
X	Field Ditch (607)		X		X		
	Surface Drainage						
X	Main or Lateral (608)		X		X		
X	Terrace (600)	X	X		X	X	X
	Toxic Salt Reduction (610)				X		
X	Tree Planting (612)	X			X		X
X	Trough or Tank (614)	X		X	X	X	X
X	Underground Outlet (620)	X	X				X
	Waste Management System						
X	(312)			X			X
X	Waste Storage Pond (425)			X			X
	Waste Storage Structure						
X	(313)			X			X
	Waste Treatment Lagoon						
X	(359)			X			X
X	Waste Utilization (633)	X		X	X		X
	Water & Sediment Control						
X	Basin (638)	X	X		X		X
	Well (642)					X	
	Wildlife Upland Habitat						
X	Mgt. (645)				X		
	Wildlife Wetland Habitat						
X	Mgt. (644)				X	X	

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Commonly Used	Conservation Practice	PURPOSE					
		Erosion Control	Water Disposal	Animal Waste & Agr-chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Wind Barrier, Interim	X			X		X
X	Woodland Improved Harvesting (654)				X	X	X
X	Woodland Improvement (666)				X		
X	Woodland Pruning (660)				X		
X	Woodland Site Preparation (490)				X		

DEFINITIONS

Conservation practices are measures commonly used to meet a specific need in planning and carry out soil and water conservation programs for which standards and specifications have been developed.

Management measures are methods of managing soil, water, and related resources used in planning and carrying out soil and water conservation programs for which standards and specifications have not been developed.

Resource base consists of the air, soil, water and related plant and animal resources.

Performance standards are the minimum criteria acceptable in meeting the protection or improvement of the resource base.

Land Uses:

(1) Commercial/industrial land. Land that is primarily occupied by facilities for buying, selling, and processing goods and services, including sites for stores, factories, shopping centers, and industrial parks, together with necessary adjacent facilities.

(2) Community services land. Land that is primarily used for schools, hospitals, churches, libraries, sewage and water treatment plants, sanitary landfills, public parking areas, and other community service facilities, together with adjacent facilities.

(3) Cropland. Land that is primarily used for the production of adapted cultivated and close-growing crops for harvest, alone or in association with sod crops.

(4) Farmstead or headquarters. Land that is primarily used for dwellings, barns, pens, corrals, gardens, and other uses in connection with operating farms or ranches.

(5) Forest land. Land that is primarily used to produce adapted wood crops and to provide tree cover for watershed protection, beautification, etc. Does not include farmstead or field windbreaks.

(6) Hayland. Land that is primarily used for the production of hay from long-term stands of adapted forage plants.

(7) Native pasture. Land on which the primary use is for grazing of native plants, but the climax (natural potential) plant community is forest. Includes land originally cleared from forest and managed for native forage plants.

(8) Natural areas. Land and water that is maintained insofar as possible in natural conditions with a minimum of human disturbance.

(9) Pastureland. Land that is primarily used for the production of adapted domesticated forage plants for livestock.

(10) Rangeland. Land on which the climax (natural potential) plant community is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing use.

(11) Recreation land. Land or water that is primarily used for recreation.

(12) Residential land. Land that is primarily used for permanent dwelling such as houses, apartments, and housing developments, including adjacent facilities.

(13) Mined land. Areas in which the primary interim use is for the mining of minerals. This designation is to be applied to abandoned lands that have been disturbed by mining, as well as areas being mined.

(14) Transportation services land. Land that is primarily used for highways, roads, mass transit, railroads, utility rights-of-way, airports, and other transportation facilities.

(15) Wildlife land. Areas in which the primary use of land and/or water is for fish and wildlife.

(16) Other land. Land in which the primary use is for purposes not described above. Identify the actual use with a brief descriptive name.

APPENDIX A - II

RESOURCE MANAGEMENT SYSTEMS*

SILVICULTURE

Sample Decision-making Guidelines

* Resource Management Systems on forest land are synonymous with forest management planning. Preparation of forest management plans is performed by professional foresters on a site specific basis.

The follow sample decision-making guidelines are intended as an example of some of the techniques utilized by professionals foresters in preparation of long-term forest management plans. Long-term forest management plans typically include all the management activities recommended over the life of the existing woodland (i.e. a 40 year old hardwood stand over 80-100 year time span). Short forest management plans may also be prepared and do include best management practice(s) recommendations. However, short plans are typically prepared when no immediate land treatment activities are recommended (i.e. no action for 5-20 years) and future re-assessment is desirable prior to preparation of a long-term forest management plan.

Recommended Activity	Options/BMPs	Purpose/NPS Benefits
No action at this time	Leave timber to grow	Stand development/no man-induced NPS.
Selection harvest	Skid Trail & road design & location Environmental exclusion Residual tree protection Skid trail & road seeding Long-term maintenance of seeded areas & crossings Fire protection Log landing location &	natural regeneration/ erosion control, water quality benefits, min. off-site effects.

	post-harvest stabilization, etc.	
Seed tree cut & Timber Stand Improvement if needed	Proper harvesting practices Timing of harvest for best seed crop Seed tree protection Regeneration establishment assessment & protection Elimination of competing vegetation	regeneration/erosion control, water quality benefits & reductions in off-site effects.
Clearcut & Artificial reforestation	Proper harvesting practices Site Preparation methods - chop & burn or shear & pile or rootrake or others. Site protection methods - debris treatment & alignment, road locations, firebreaks, others. Environmental exclusion Tree planting, etc. Mechanical/chemical control of competing vegetation	regeneration/erosion control, water quality enhancement, off-site effects reductions.
Clearcut & Natural regeneration Selection harvest & Patch clearcut Patch clearcut Timber Stand Improvement		combinations of needed BMPs

Access road building, includes recreational

Firebreaks

Boundary line maintenance

Pruning - seldom done in Delaware, except for Christmas trees

Wooded Corridor Management

Urban Forestry i.e. pre-development planning & urban plantings

Wildlife - Forestry planning - combinations of harvesting and planting techniques for increases in diversity and edge effect.

Tree planting for windbreaks, buffer strips along streams and for erosion control within cropland.

Others.

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Appendix B

Conservation Practice Matrix

Following is a listing of all conservation practices contained in Section IV of the Field Office Technical Guide.

An "X" in the column labeled "Commonly Used" indicates that the practice is locally applicable and has been approved for use in the development of Land Management Systems.

		PURPOSE						
Commonly Used	Conservation Practice	Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
X	Access Road (560)	X	X				X
	Bedding (310)		X		X		
	Brush Mgt. (314)	X			X		X
X	Channel Vegetation (322)	X			X		X
X	Chiseling and Subsoiling (324)		X		X		
X	Clearing and Snagging (326)	X	X		X		X
X	Conservation Cropping Sequence (328)	X		X	X	X	X
X	Conservation Tillage (329)	X		X	X	X	X
	Contour Farming (330)	X				X	X
	Contour Orchard and Other Fruit Area (331)	X				X	X
X	Cover and Green Manure Crop (340)	X		X	X	X	X
X	Critical Area Planting (342)	X			X		X
	Crop Residue Use Management (344)	X			X	X	X
	Dam, Floodwater Retarding (402)	X	X				X

U.S. Department of Agriculture
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Technical Guide
Section III-A

Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Dike (356)	X	X	X	X	X	X
X	Diversion (362)	X	X	X	X	X	X
	Farmstead and Feedlot Windbreak (380)				X		
X	Fencing (382)	X			X		X
X	Fertilizer Management, Interim			X	X		X
X	Field Border (386)	X			X		X
	Field Windbreak (392)	X			X	X	X
X	Filter Strip (393)			X			X
	Firebreak (394)	X			X		X
X	Fishpond Management (399)				X	X	
	Floodway (404)		X		X		X
X	Forest Land Erosion Control System (408)	X	X		X		X
X	Grade Stabilization Structure (410)	X	X				X
	Grasses and Legumes in Rotation (411)	X			X	X	X
X	Grassed Waterway or Outlet (412)	X	X		X		X
X	Heavy Use Area Protection (561)	X			X		X
X	Hedge[illegible] Planting (422)				X		
X	Irri[illegible] Pit (552-A)				X	X	
	Irrigation System, Trickle (441)	X		X	X	X	X

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Technical Guide
Section III-A

Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Irrigation System, Sprinkler (442)				X	X	
X	Irrigation Water Management (449)	X		X	X	X	X
X	Land Clearing (460)				X		
X	Land Reconstruction, Abandoned Mined Land (543)	X	X		X	X	X
	Land Reconstruction, Currently Mined Land (544)	X	X		X	X	X
X	Land Smoothing (466)		X		X	X	
X	Lined Waterway or Outlet (468)	X	X				X
X	Livestock Exclusion (472)	X		X	X	X	X
X	Mulching (484)	X			X	X	X
X	Obstruction Removal (500)				X		
X	Open Channel (582)		X		X		
X	Pasture and Hayland Management (510)	X		X	X	X	X
X	Pasture and Hayland Planting (512)	X			X		X
	Pesticide Management, Interim			X	X		X
	Pipeline (516)				X	X	
X	Pond (521)				X	X	X
X	Pond Sealing or Lining (521)				X	X	

U.S. Department of Agriculture
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Technical Guide
Section III-A

Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Precision Land Forming (462)	X	X		X	X	X
	Pumping Plant for Water Control (533)		X		X	X	
	Recreation Land Grading and Shaping (556)		X				
X	Recreation Trail and Walkway (568)	X	X		X		X
X	Roof Runoff Management (558)	X	X	X	X		X
	Runoff Management System (570)	X	X		X		X
X	Sediment Basin (350)		X	X	X		X
X	Spoilbank Spreading (572)		X		X		
	Spring Development (574)					X	
X	Streambank and Shoreline Protection (580)	X	X		X	X	X
X	Stream Channel Stabilization (584)	X	X				X
X	Stripcropping, Contour (585)	X		X	X	X	X
X	Stripcropping, Field (586)	X		X	X	X	X
	Stripcropping, Wind (589)	X			X		X
X	Structure for Water Control (587)			X	X	X	X
X	Subsurface Drain (606)		X		X	X	

Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-Chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
X	Surface Drainage Field Ditch (607)		X		X		
X	Surface Drainage Main or Lateral (608)		X		X		
X	Terrace (600)	X	X		X	X	X
	Toxic Salt Reduction (610)				X		
X	Tree Planting (612)	X			X		X
	Trough or Tank (614)	X		X	X	X	X
X	Underground Outlet (620)	X	X				X
X	Waste Management System (312)			X			X
X	Waste Storage Pond (425)			X			X
X	Waste Storage Structure (313)			X			X
X	Waste Treatment Lagoon (359)			X			X
X	Waste Utilization (633)	X		X	X		X
X	Water & Sediment Control Basin (638)	X	X		X		X
	Well (642)					X	
X	Wildlife Upland Habitat Mgt. (645)				X		
X	Wildlife Wetland Habitat Mgt. (644)				X	X	

Commonly Used	Conservation Practice	PURPOSE: Erosion Control	Water Disposal	Animal Waste & Agr-chem Mgt.	Resource Mgt.	Water Mgt.	Offsite Effects
	Wind Barrier, Interim	X			X		X
X	Woodland Improved Harvesting (654)				X	X	X
X	Woodland Improvement (666)				X		
X	Woodland Pruning (660)				X		
X	Woodland Site Preparation (490)				X		

APPENDIX C

ANNUAL MANURE PRODUCTION

Animal	Animal #1	Av. Wt.	AU**	Tons Manure/AU[2]	Total Tons
Dairy	13,000	900#[3]	11,700	14.94	174,798
Beef	14,000	900#[3]	12,600	6.7	84,420
Hogs	60,000	180#[3]	10,800	11.9	128,520
Layers	938,000	4#[4]	3,752	9.6[5]	36,207
Broilers	35,779,000*	2#[4]	71,558	3.5[5]	250,453

*number of total broilers produced = 196,783,000

5.5 flocks per year[4]

**AU = Animal Units = a 1000 lbs of animal weight

1 - Delaware Agricultural Statistics Summary, 1986.

2 - USDA, Science and Education Administration, 1979.

3 - Richard A. Barczewski, Delaware Cooperative Extension, 1988.

4 - David H. Palmer, Delaware Cooperative Extension, 1988.

5 - Proper Manure Management - A Key to Tomorrow's Success, Delaware Cooperative Extension, 1987.

20,000 boilers/house = 140 Tons of manure/year

X 2 pounds/broiler

40,000 pounds broilers/house = 140 Tons of manure/year

- 1,000 pounds/AU

40 AU/house = 140 Tons of manure/year

1 AU = 3.5 Tons of manure/year

Appendix D

CONSERVATION INCENTIVE PROGRAM
THREE YEAR REPORT
FY1985 thru FY1987
Prepared By
Division of Soil and Water Conservation

The State's Conservation Incentive Program provides State funds for cost sharing with landowners who apply soil and water conservation practices.

This program began in fiscal year 1985. The program is managed by the Division of Soil and Water Conservation and implemented by the three (New Castle, Kent and Sussex) Conservation Districts.

Each Conservation District has developed a written Conservation Incentive Program tailored to the conservation needs in their District. These programs are updated each year and approved by the Division of Soil and Water Conservation. Cost sharing is generally provided at 50% but does increase depending on the degree of incentive needed and the critical need for protecting a particular resource.

Landowners applying for and using State Cost Share Funds must become cooperators of their respective Conservation District, develop an approved resource management plan, apply the conservation practice according to established standards and specifications as certified by technicians provided by each District and sign an agreement to maintain the conservation practice, as applied, for ten years. This obligation is passed on to any new owner of the lands involved.

Report A Shows the funds spent for the major resource needs over the past three fiscal years (85, 86 & 87). A total of $510,000 of State Cost Share funds were used to apply over one million dollars worth of conservation practices on the land. The technical assistance of the U.S. Soil Conservation Service provided through conservation districts and the volunteer time of conservation district supervisors are major factors in keeping the technical and administration costs to a minimum.

Report B Shows what conservation practices were applied and where. (NCCD = New Castle Conservation District, KCD = Kent Conservation District and SCD = Sussex Conservation District) Unfinished requests, as of February 1988, are shown. Funds are committed by each Conservation District on a controlled basis in an attempt to maintain a balanced program. All FY1988 funds ($315,000) will be committed during the program year.

If you have any questions, please refer them to Fred Mott, Conservation District Program Manager, Division of Soil and Water Conservation, phone 736-4411.

A

CONSERVATION INCENTIVE PROGRAM
FY85 THRU FY87
USE OF FUNDS APPROPRIATED

Resource Need	FY85	FY86	FY87	Total	%	No. Of Jobs
Water Quality	$ 32,337	$ 51,482	$ 59,830	$143,649	28	32
Erosion Control	57,994	43,552	30,541	132,087	26	52
Water Management	33,700	44,977	41,242	119,919	23	142
Wildlife Habitat	8,500	10,415	15,459	34,374	7	29
Technical Assistance	7,469	11,574	15,321	34,364	7	
Administrative	10,000	18,000	17,607	45,607	9	
TOTAL	**$150,000**	**$180,000**	**$180,000**	**$510,000**	**100%**	255
Total Each District	**50,000**	**60,000**	**60,000**	**170,000**		

A. No. of Jobs Using additional USDA ACP Cost Share = 87

B. Total Cost of Conservation Practices Applied -

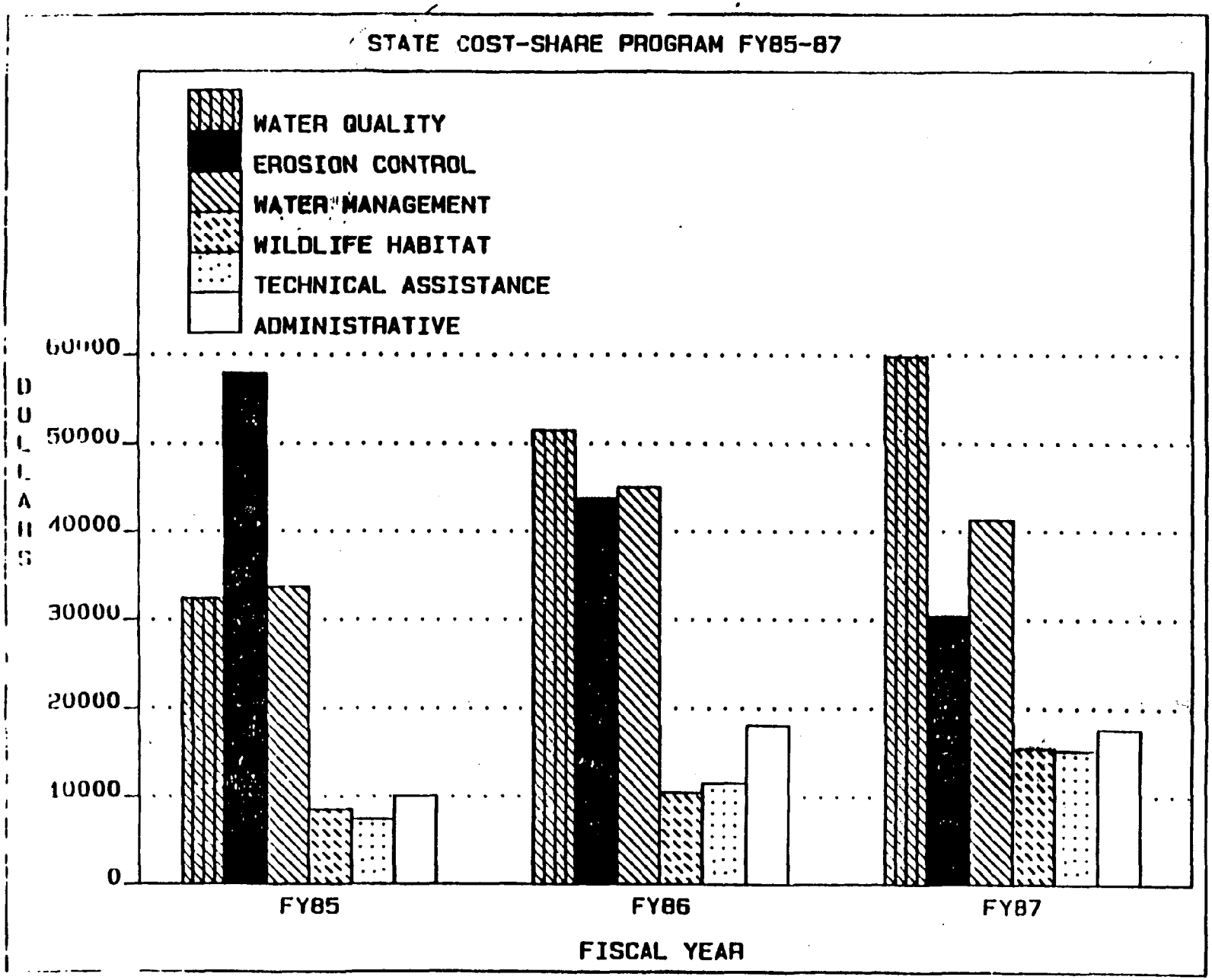
1985	$358,807
1986	$353,288
1987	$386,713
TOTAL	**$1,098,808**

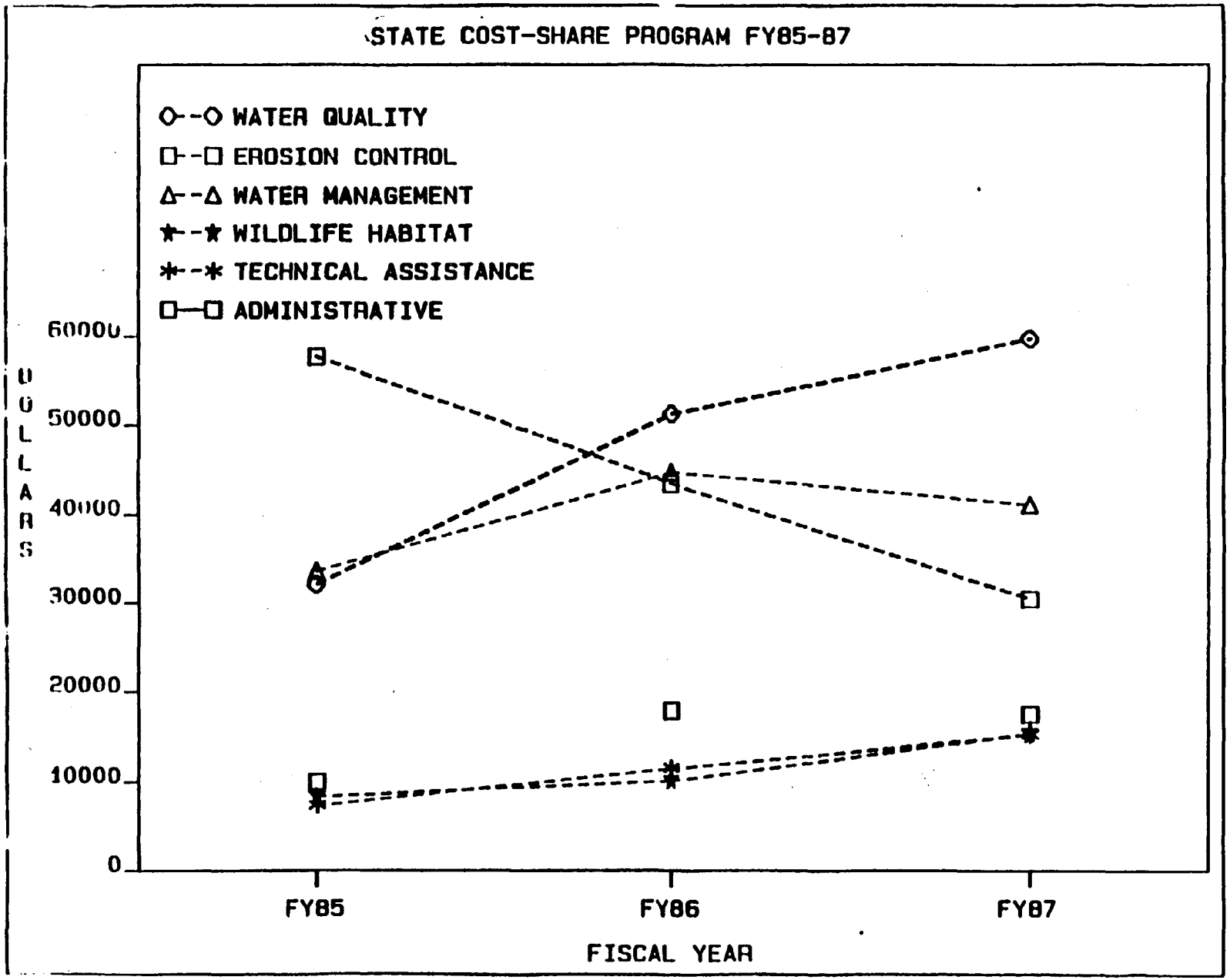
C. Total Cost / Total Cost Share = $1,098,808 / $ 510,000 = $2.15 Applied for each one dollar of cost share

CONSERVATION INCENTIVE PROGRAM
NUMBER OF CONSERVATION PRACTICES APPLIED
USING STATE COST SHARE FUNDS
FY85 thru FY87

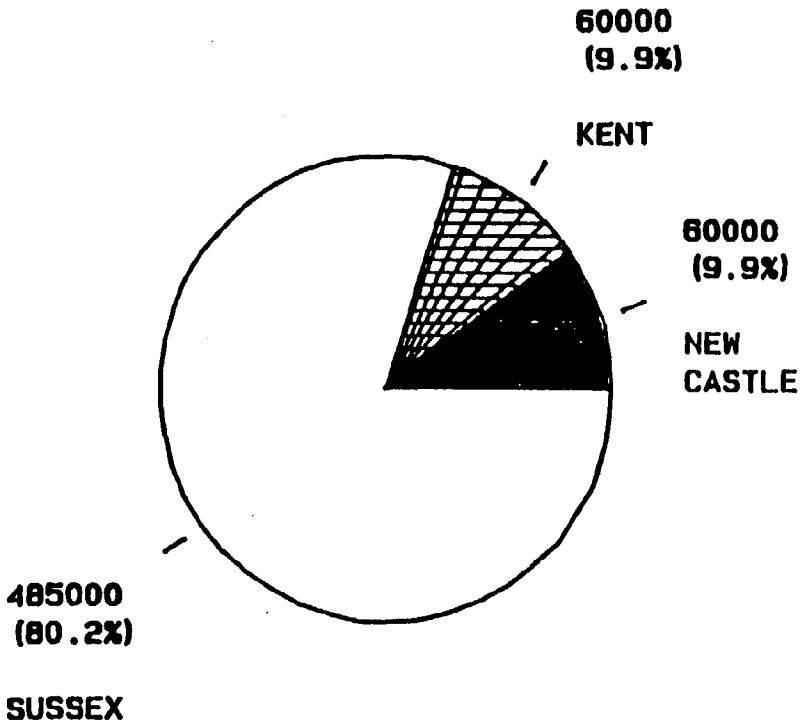
Conservation Practice	NCCD	KCD	SCD	Total
Poultry Manure Structures		3	25	28
Animal Waste Structures	3	5	5	13
Cropland Terraces	2	3	7	12
Wildlife Wetland Development	5	13	10	28
Critical Area Plantings	3		2	5
Diversion Terraces			2	2
Filter Channel			2	2
Water & Sediment Control Basins	2	2	2	6
Filter Strips			2	2
Wastewater Storage Pond			1	1
Water Control Structures	2		7	9
Surface Drainage	3	41		44
Subsurface Drainage	28	49		77
Grassed Waterways	2	3		5
Erosion Control Structures	3	3		6
Upland Wildlife Habitat	8			8
Tide gate	1			1
Stream Bank Protection	26			26
Land Leveling		4		4

Unfinished requests as of Feb., 1988	SCD:	97 Poultry Manure Strs.	=	$485,000
	NCD:	Stream Protection 4-6 sites	=	60,000
	KCD:	Wildlife/water quality impoundments	=	60,000


STATE COST-SHARE PROGRAM FY85-87
WATER QUALITY
EROSION CONTROL
WATER MANAGEMENT
WILDLIFE HABITAT
TECHNICAL ASSISTANCE
ADMINISTRATIVE
60000
50000
40000
30000
20000
10000
0
DOLLARS
FY85
FY86
FY87
FISCAL YEAR


STATE COST-SHARE PROGRAM FY85-87
WATER QUALITY
EROSION CONTROL
WATER MANAGEMENT
WILDLIFE HABITAT
TECHNICAL ASSISTANCE
ADMINISTRATIVE
60000
50000
40000
30000
20000
10000
0
DOLLARS
FY85
FY86
FY87
FISCAL YEAR

UNFUNDED COST-SHARE REQUESTS ($)



Total : 605000

Appendix E

DEFINITIONS

Conservation practices are measures commonly used to meet a specific need in planning and carry out soil and water conservation programs for which standards and specifications have been developed.

Management measures are methods of managing soil, water, and related resources used in planning and carryout out soil and water conservation programs for which standards and specifications have not been developed.

Resource base consists of the air, soil, water and related plant and animal resources.

Performance standards are the minimum criteria acceptable in meeting the protection or improvement of the resource base.

Land Uses:

(1) Commercial/industrial land. Land that is primarily occupied by facilities for buying, selling, and processing goods and services, including sites for stores, factories, shopping centers, and industrial parks, together with necessary adjacent facilities.

(2) Community services land. Land that is primarily used for schools, hospitals, churches, libraries, sewage and water treatment plants, sanitary landfills, public parking areas, and other community service facilities, together with adajcent facilities.

(3) Cropland. Land that is primarily used for the production of adapted cultivated and close-growing crops for harvest, alone or in association with sod crops.

(4) Farmstead or headquarters. Land that is primarily used for dwellings, barns, pens, corrals, gardens, and other uses in connection with operating farms or ranches. This includes greenhouses, mushroom houses, feed lots and agricultural waste storage systems.

(5) Forest land. Land that is primarily in tree cover that may be used to produce wood crops, provide tree cover for watershed protection, beautification, wildlife cover, etc.

(6) Hayland. Land that is primarily used for the production of hay from long-terms stands of adapted forage plants.

(7) Native pasture. Land on which the primary use is for grazing of native plants, but the climax (natural potential) plant community is forest. Includes land originally cleared from forest and managed for native forage plants.

(8) Natural areas. Land and water that is maintained insofar as possible in natural conditions with a minimum of human disturbance.

(9) Pastureland. Land that is primarily used for the production of adapted domesticated forage plants for livestock.

(10) Rangeland. Land on which the climax (natural potential) plant community is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing use.

(11) Recreation land. Land or water that is primarily used for recreation.

(12) Residential land. Land that is primarily used for permanent dwelling such as houses, apartments, and housing developments, including adjacent facilities.

(13) Mined land. Areas in which the primary interim use is for the mining of minerals. This designation is to be applied to abandoned lands that have been disturbed by mining, as well as areas being mined.

(14) Transportation services land. Land that is primarily used for highways, roads, mass transit, railroads, utility rights-of-way, airports, and other transportation facilities.

(15) Wildlife land. Areas in which the primary use of land and/or water is for fish and wildlife.

(16) Other land. Land in which the primary use is for purposes not described above. Identify the actual use with a brief descriptive name.

APPENDIX F

DELAWARE AGRICULTURAL DIRECTORY

Department of Agriculture -- 2320 S. DuPont Highway,
Dover 19901

Secretary -- William B. Chandler, Jr. 736-4811

Director -- Roland L. Derrickson 1-800-282-8685

Governor's Council on Agriculture

Chairman -- Earle Isaacs, R.D. 1, Box 417, 684-4526
Ellendale 19941

Pesticide Advisory Committee

Chairman -- Robert C. Berry, 203 Old Oak Rd., 731-5113
Newark 19711

Advisory Council on Forestry

Chairman -- Dorothy Downs, 241 S. Delaware Ave., 653-7227
Smyrna 19977

Department of Natural Resources & Environmental Control

Secretary -- John E. Wilson, III, 89 Kings Highway, 736-4403
P.O. Box 1401, Dover 19903

State Farmland Evaluation Advisory Committee

Dr. Donald F. Crossan, 133 Townsend Hall, Univ. of 451-2501
Del., Newark 19717-1303

James Baxter, Jr., R.D. 5, Box 360, Georgetown 19947

Claude Hoffman, R.D. 4, Box 378, Dover 19901

State Department of Public Instruction, Vocational Division

Supervisor, Vocational Agriculture -- William Dannenhauer, 736-4681
John Townsend Bldg., Dover 19901

Division of Employment and Training

Northern New Castle County -- Robert Lucia, Manager, 571-2662
3301 Lancaster Ave., P.O. Box 2168, Wilm. 19899

Kent County -- Melvin J. Parquet, Manager 736-5473

P.O. Box 616, Dover 19903-0616

Sussex County -- Jim Tribbitt, Manager, DuPont Highway, 856-5230

P.O. Box 548, Georgetown 19947

State Farm Program Coordinator -- A.O. Glover, 736-5476

217 Carroll's Plaza, P.O. Box 616, Dover 19903-0616

Federal Crop Insurance

District Director -- Emil J. Ewing, 126 East High St., 301-398-6671

Suite 2, Elkton, MD 21921

Harrisburg Regional Office, Director -- John Gartside, 717-782-4803

3555 North Progress Ave., Harrisburg, PA 17110

Field Underwriting Office, Director -- Richard E. 717-782-4807

Moore, 3555 North Progress Ave.,

Harrisburg, PA 17110

County Government

Sussex County Council Administrator --

Sussex County Council President --

President, Kent County Levy Court -- William Paskey

New Castle County Executive -- Rita Justice

New Castle County President -- Karen E. Peterson

GENERAL FARM ORGANIZATIONS

Delaware Agriculture Museum Association --

866 N. DuPont Highway, Dover 19901 734-1618

Director - Curator -- Hope Z. Schladen

President -- Edward McIlvaine, R.D. 5, Box 182, 934-7676

Georgetown 19947

Delaware Federal Land Bank Association of Dover --

1410 S. State St., P.O. Box 418, Dover 19901 734-7534

Chairman -- Donnell Calhoun, Box 52, Milford 19963

Association President -- J. Wayne Cooper, Dover 19901

Delaware State Fair -- Fairgrounds, Box 28, Harrington 19952 — 398-3269

General Manager -- Gary Simpson, 123 Shawnee Rd., Milford 19963 — 422-3460

Delaware State Grange -- 911 S. Governors Ave., Dover 19901 — 734-4653

Master -- Mrs. Jane T. Mitchell, 1019 Kings Highway, Lewes 19958 — 645-6427

Secretary -- Mrs. Lula Carrow, 1002 E. Division St., Dover 19901 — 678-0376

Pomona Granges (County Unit)

New Castle County Master -- Ronald Martin, 424 Wharton Dr., Newark, DE 19711 — 368-5963

Kent County Master -- Virgil Crockett, R.D. 1, Box 36-Z, Centerville, MD 21617 — 301-758-0552

Sussex County Master -- Lowder W. Mitchell, Jr., 1019 Kings Highway, Lewes, DE 19958 — 645-6427

Delaware Farm Bureau -- 233 S. DuPont Highway, Camden 19934 — 697-3183

Executive Vice President -- Sherman G. Stevenson

President -- John F. Tarburton, R.D. 3, Box 341, Dover 19901 — 678-2912

County Presidents:

New Castle -- Robert Baker, R.D. 1, Box 93-A, Middletown 19709

Kent -- Daniel Palmer, R.D. 1, Box 164, Wyoming 19934 — 492-3030

Sussex - Joseph Calhoun, R.D. 2, Box 74, Dagsboro 19939 — 732-6326

Delaware Council of Farmer Cooperatives

President -- Robin Breeding, Eastern Milk Producers, R.D. 2, Box 53A, Greenwood 19950

Secretary -- Scott Wharton, Agway, Inc., Box 38, Hickory St., Frankford 19903

Treasurer -- Steve Hollenbeck, Delaware Farm Credit, P.O. Box 418, Dover 19903

Executive Secretary -- Carl German, 230 Townsend Hall, Univ. of Del., Newark 19717-1303 451-2511

4-H Leaders Association

New Castle President -- Nancy Schafer, 792 Sunnyside Lane, Bear 19702 834-7912

Kent President -- Delores Smoot, 5 Victoria Circle, Dover 19901 697-3963

Sussex President -- Evelyn Messick, R.D. 1, Box 236, Seaford 19973 629-7222

Delaware Council of Farm Organizations

President -- Henry R. Walls, Jr., Box 55, Hartly 19953 492-8338

Vice President -- Vacant

Secretary -- William Chandler, Jr., Dept. of Agriculture 2320 S. DuPont Highway, Dover 19901 736-4811

Treasurer -- Gerald B. Truitt, Jr., Delmarva Poultry Industry, Inc., R.D. 2, Box 47, Georgetown 19947 856-9037

Delaware Bankers Association, Agriculture Committee

Member -- Robert F. Rider, O.A. Newton & Son Co., Box 397, Bridgeville 19933 337-8211

Agricultural Alumni Association

President -- Ed Ralph, R.D. 3, Box 303, Laurel 19956 875-5566

1st Vice President -- Charles Postles, R.D. 2, Box 86, Milford 19963 335-3149

2nd Vice President -- Ed Baker, R.D. 2, Box 86 Middletown 19709 Office 378-4227

3rd Vice President -- Chet Stachecki, R.D. 1, Box 142-2, Harrington 19952 335-5892

Secretary-Treasurer -- Ed Kee, R.D. 2, Box 48, Georgetown 19947 Home 422-9010 Office 856-7303

Delaware Beekeepers Association

President -- John Landon, 727 Union St. Extension, Milton 19968 684-8998

County Vice Presidents:

New Castle -- George Reynolds, 14 Panorama Dr., Newark 19711 731-5471

Kent -- Richard Goerger, 123 Lakeview Ave., Dover 19901 678-2749

Sussex -- Ethel Landon, 727 Union St. Extension, Milton 19968 684-8998

Secretary-Treasurer -- Larry Francisco, 2016 Telegraph Rd., Wilmington 19808 994-1219

Delaware Pest Control Association

President -- Robert Sadusky, Jr., General Pest Control, 88 Lynnhaven Dr., Dover 19901 378-5757

Vice President -- Joe Reardon, Reardon Exterminating Assoc. Ltd., 2222 Silverside Rd., Wilmington 19010 475-7874

Secretary-Treasurer -- Phil Kreer, Ajax Termite & Pest Control, P.O. Box 10701, Wilmington 19850 658-9365

Executive Secretary -- Bobbie Earhart, Ajax Termite & 658-9365

Pest Control, P.O. Box 10701, Wilmington 19850

Technical Advisor -- Dr. Dale F. Bray, 18 South Parkway, Elkton, MD 21921 — 301-398-3784

COMMODITY GROUPS

DAIRY

Dairy Herd Improvement Association

President -- R. Wayne Collison, R.D. 2, Box 210C, Harrington 19952 — 398-8047

Vice President -- Dave Sheats, R.D. 2, Box 180, Middletown 19709 — 378-8421

Secretary -- Herman Cook, 3154 Frazer Rd., Newark 19702 — 836-1732

Atlantic Breeders Cooperative

General Manager -- Harry Roth, 1575 Apollo Drive, Lancaster, PA 17601 — 717-569-9413

Member & Public Relations Director -- N. Alan Bair, R.D. 2, Box 394, Columbia, PA 17512 — 717-569-0413

Area 1 Supervisor -- Willis Ritchey, 1829 Stevens St., East Petersburg, PA 17520 — 717-569-6990

Unit 1 Technician -- Edward g. Dougherty, R.D. 3, Box 703, Felton 19943 — 284-9148

Unit 2 Technician -- Perry D. Morrison, 12A Providence Dr., Parkview Townhouse, Smyrna 19977 — 653-2410

Unit 3 Technician -- James E. Gordon, 1901 Old Limestone Rd., Oxford, PA 19363 — 215-932-5564

Interstate Milk Producers Corp.

Field Representative -- William Baumgardt, 27 Dalwin Drive, Dover 19901 — 697-7297

District Director -- William Hopkins, Lewes 19958 654-8716

Field Representative -- Carlton Porter, Cedar Lane, Rt. 1, Box 158, Greensboro, MD 21639 301-482-6981

Eastern Milk Producers Coop., Inc.

Manager -- Gilbert Carrow, Dover Plant, P.O. Box 256, Dover, 19901 734-2681

Field Representative -- Robin Breeding, R.D. 2, Box 110-B, Greenwood 19950 349-5161

Delaware Holstein-Friesian Association

President -- Walter Hopkins, R.D. 1, Box 211-AA, Lewes 19958 645-2550

Vice President -- Richard Morris, 521 S. College Ave., Newark 19713 368-2448

Secretary-Treasurer -- Mrs. Charmayne Busker, R.D. 2, Box 216-A, Harrington 19952 398-4764

Regional Holstein Fieldman -- Judy Wolford, 1822A Abbey Lane, Hagerstown, MD 21740 301-733-1208

Director, Consumer Information -- Connie Parvis, DPI Office 856-9037

Executive Assistant -- John William Satterfield, DPI Office 856-9037

LIVESTOCK & HORSES

Delaware Pork Producers

President -- John Urban, R.D. 3, Box 590, Milford 19963 335-4221

Vice President -- Robin James, R.D. 1, Box 148, Laurel 19956 875-3217

Secretary -- Art Kauffman, R.D. 2, Box 22, Harrington 19952 398-3516

Treasurer -- Roger Swartzentruber, R.D. 1, 349-4629
Box 79-A, Greenwood 19950

National Director: Dale Ockels, R.D. 2, 856-7123
Box 103-A, Milton 19968 Office 856-6137

Delaware Beef Cattlemen's Association

President -- Dan Enterline, P.O. Box 695, Dover 19903 674-5544

Vice President -- Ned Dykes, Rt. 2, Box 191, 301-651-2089
Princess Anne, MD 21853

Secretary-Treasurer -- Henry R. Walls, P.O. Box 55, 492-8338
Hartly 19953

Executive Secretary -- Richard A. Barczewski, 697-4000
R.D. 1, Box 658, Dover 19901

Delaware Pond Breeders & Owners Association

Charles S. Moore, 1105 Bear Rd., New Castle 19720 834-1185

Delaware 4-H Horse Advisory Committee

President -- Ms. Betty Niblett, 564 Old Porter Road, 834-7143
Bear 19701

Secretary-Treasurer -- Mrs. Bette Phillips, R.D. 4, 645-9629
Box 261, Lewes 19958

Delaware Quarter Horse Association

President -- Jim Harrison, P.O. Box 77, Kenton 19955 653-6829

Secretary -- Connie McCormick, 4125 Kirkwood-St. Georges 834-3335
Rd., Bear 19701

Delaware Appaloosa Horse Association

President -- Ola Foskey, Salisbury, MD 21801 301-546-4472

Secretary -- Nikki Baden, Marydel, MD 21649

Delmarva Arabian Association

President -- Jan McPherson, Lot 854, Mobile Gardens, 629-5358
1020 Brickyard Road, Seaford 19973

Secretary -- Joan McDonald, Old McDonald's Farm, 301-546-3408
Rt. 1, Box 814, Hebron, MD 21830

AGRONOMY

Delaware Crop Improvement Association

President -- Clark Callaway, R.D. 1, Box 244, 629-7320
Bridgeville 19933

County Vice Presidents:

New Castle -- Larry Jester, P.O. Box 373,
Middletown 19709

Kent -- George Wilson, R.D. 1, Box 161,
Smyrna 19977

Sussex -- Jerry Hevner, Southern States,
200 Allen Drive, Seaford 19973

Treasurer -- George Baker, R.D. 2, Box 608,
Middletown 19709

Secretary -- Dr. Richard Taylor, Townsend Hall, 451-2532
Univ. of Del., Newark 19717-1303

Delaware-Maryland Plant Food & Crop Protection Association, Inc.

Immediate Past President -- Gerard T. Warwick, Jr., 301-479-2030
202 Sunset Dr., Denton, MD 21629

President -- Wayne Argo, 88 Jamore Dr., 629-3818
Seaford 19973

Vice President -- Robert Willard, P.O. Box 100, 301-778-1000
Lynch, MD 21646

Secretary -- Ray J. Filasky, Jr., 2 Evergreen Farms 834-1844
Middletown 19709

Treasurer -- William L. Calloway, P.O. Box 221, Delmar 19940 — 846-2674

Delaware Advisors:

Dr. Richard Taylor, Townsend Hall, University of Delaware, Newark 19717-1303 — 451-1383

Roland Derrickson, Del. Dept. of Agriculture, 2320 S. DuPont Highway, Dover 19901 — 736-4815

Dr. Richard E. Fowler, Townsend Hall, University of Delaware, Newark 19717-1303 — 451-2504

Dr. Donald Sparks, Dept. of Plant Science, Townsend Hall, Univ. of Del., Newark 19717-1303 — 451-2531

Mid-Atlantic Soybean Association, Inc.

President -- Henry Spies, Rt. 1, Box 227, Cordova, MD 21625 — 301-820-2117

Vice President -- Keith Carlisle, R.D. 1, Box 72A, Greenwood 19950 — 349-5692

Secretary -- Jerry Kennedy, P.O. Box 319, Salisbury, MD 21801

Treasurer -- William Bradley, Rt. 2, Box 337, Salisbury, MD 21801 — 301-896-9437

HORTICULTURE

Delaware Produce Grower's Inc.

President -- Joseph Jackewicz, Sr., R.D. 1, Box 144, Magnolia 19962 — 697-7681

Delaware Potato Growers Association

President -- Joseph Jackewicz, Jr., R.D. 1, Box 144, Magnolia 19962 — 697-7681

Delaware Vegetable Growers Association

President -- Martin Isaacs, U.S. 113, Georgetown 19947 856-7245

Vice President -- Joe Jackewicz, Jr., R.D. 1, Box 144 697-7681
Magnolia 19962

Secretary-Treasurer -- Ed Kee, R.D. 2, Box 48, 856-7303
Georgetown 19947

Directors:

Chris Wicks, Box 397, Middletown 19709 378-2864

Dwight S. Meyer, 24 Mifflin Rd., Dover 19901 734-1226

Joe Jackewicz, Jr., R.D. 1, Box 144, Magnolia 19962 697-7681

Martin Isaacs, U.S. 113, Georgetown 19947 856-7245

William A. O'Day, Route 3, Box 293, Seaford 19973 629-7854

John Gundry, Near Woodland, Seaford 19973 629-9877

Ed Baker, R.D. 1, Box 94, Middletown 19709 378-2084

Warren Lamborn, R.D. 1, Box 10, Frederica 19946 856-6395

Delaware Direct Marketing Association

President -- Tom Ryan, Ryan's Berry Farm & Orchard, 238-7776
R.D. 3, Box 244-B, Frankford 19945

Vice President -- Mary Fifer Fennemore, R.D. 1, 697-2141
Box 446, Wyoming 19934

Secretary -- Diane Lamborn, R.D. 1, Box 9, Wyoming 19934 697-6647

Treasurer -- Carl German, 230 Townsend Hall, Univ. 451-2511
of Del., Newark 19717-1303

Peninsula Horticultural Society

President -- Charles Adams, Jr., Trappe, MD 21673

Vice President -- James Hearn, Delmar 19940

Secretary -- Wayne V. Shaff, Quantico Rd.,
Salisbury, MD 21801

Asst. Secretary -- Jay Windsor, R.D. 2, Box 48, 856-7303
Georgetown 19947

Treasurer -- Samuel C. Graham, Riverside Drive,
Salisbury, MD 21801

County Vice Presidents:

New Castle -- Warren Baker, Middletown 19709

Kent -- Eric Tarburton, 195 S. Dual Highway, Camden 19934

Sussex -- Fred M. O'Neal, R.D. 2, Box 33, Seaford 19973

Delaware Association of Nurserymen

President -- Steven Wrede (All Seasons Nursery & Garden 734-2060
Center), 1325 S. Governors Ave., Dover 19901

Vice President -- Debra Mulholland (Greener Landscapes),
P.O. Box 223, Bear 19701

Secretary -- Susan Barton, Townsend Hall, Univ. of Del., 451-2531
Newark 19717-1303

Treasurer -- Eric Tarburton (Happy Hoe Garden Center), 697-3948
195 S. Dual Highway, Camden 19934

Mid-Atlantic Food Processors Association, Inc.

P.O. Box 2497, Salisbury, MD 21801 301-546-5854

Executive Vice President -- Franklin Schales

Delaware Directors:

Greg Cox, Draper-King Cole, Inc., Milton 19968 684-8555

Gerald Hudson, Draper-King Cole, Inc., 684-8555
Milton 19968

Jim Reed, Jr., Clifton Canning Co., Milton 19968

Paul G. Townsend, J.G. Townsend, Jr. & Co.,
Georgetown 19947

Delaware Fruit Growers Association

President -- Charles Smith, R.D. 2, Box 168, Bridgeville 19933 — 337-8271

Vice President -- Carlton Fifer, Rt. 1, Box 466, Wyoming 19934 — 697-2141

Delaware Turfgrass Association

President -- James L. Pyle, Greenville Tree Corp., Box 3651, Greenville 19807 — 656-0390

Appendix G

PUBLIC RESPONSE SUMMARY

Public Notice: June 23, 1988
Advertised in Wilimington Morning News and Delaware State News

Review Period: June 23, 1988 through July 25, 1988

Comments Received:

1. From: A. J. Farling on July 1, 1988
   RE: Groundwater Management Section Comments
   Response: A detailed list of responses is included with the attached letter.

2. From: Delaware Cooperative Extension on July 6, 1988
   RE: Funding
   Response: Statements were reflected in final draft.

3. From: Secretary William B. Chandler, Del. Dept. of Agriculture; Secretary John E. Wilsion, Dept. of Natural Resources and Environmental Control; and Douglas E. Hawkins, State Conservationist, Soil Conservation Service.
   RE: Comments to Farm Bureau
   Response: Farm Bureau is concerned about NPSP management and such a comprehensive document. Assurances were given that this is an openended working program. A meeting will be held this winter when the farmers are not so busy.

4. From: Lee Emmons on July 19, 1988
   RE: CMP Consistency Determination
   Response: Consistency between the NPSP Management Program and CMP were noted.

5. From: Walter Gabel on July 14, 1988
   RE: State Forestry Section Comments
   Response: Edits were made where appropriate. Responses are noted on letter.

6. From: Michael R. Kolman on July 21, 1988
   RE: Soil Conservation Service Comments
   Response: Edits were made where appropriate or possible. The coordination between building permits and waste management facilities can be a discussion item for a working group under the schedule of implementation. Editorial comments were incorporated where possible, but some comments were a matter of writing style.

7. From: Joseph T. Wutka on July 25, 1988
   RE: Dept. of Transportation, Division of Highways comments.

Response: Edits were made to transportation discussions as requested. The schedule of implementation will include E&S revisions to Highway Standards.

8. From: Amy White on July 26, 1988
RE: Delaware Nature Education Society Comments
Response: Responses are noted on contact sheet.

Special Comments:

1. From: Joseph Corrado on June 8, 1988
RE: Need for one agency response. Call for a centralized water and waterwater authority.
Response: The call for one coordinating agency will be a topic of all subgroups. The paper on a centralized water and wastewater authority will be addressed in the appropriate subgroup.

2. A notebook of responses including comments given before the public notice will be submitted to EPA for review.

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
GROUNDWATER MANAGEMENT SECTION

M E M O R A N D U M

RECEIVED
JUL 1 1988
Div. of Soil & Water Conservation

TO: Frederick T. Mott

FROM: A. J. Farling

COPY: Gerard L. Esposito
Philip J. Cherry

SUBJ: NPS Management Program Comments

DATE: July 1, 1988

I appreciate having the opportunity to review the NPS Management Program document. It appears that a considerable amount of work effort has been put into this document and I only wish that I or members of the Groundwater Management Section had been able to be involved in its early development.

We have reviewed the draft document and collective comments are marked on the enclosed copy.

Due to prior commitments, I am unable to attend the July 12th meeting. If you desire to discuss our comments, please get with me at your convince.

NPS MANAGEMENT PROGRAM COMMENTS
FROM A. J. FARLING, DIVISION OF WATER RESOURCES

Page 2 - Is this NPSP definition?
- Yes, as taken from EPA guidelines.

Page 4 - Did assessment report consider other management plans, i.e. groundwater?
- Yes, the assessment plan was mainly developed by DNREC's Water Resources Section.

Page 9 - Are on-site systems not major NPS?
- Yes, they are covered under the rural section.

Page 13 - Where are on-site regs, water well regs, and water allocation regs?
- These specific are covered in the Clean Water Strategy and Groundwater Management Plan.

Page 16 - What reservoirs are silted in?
- Smalleys Dam Reservoir is in the process of a major dredging project.

Page 27 - How come the assessment doesn't identify specific fertilizer use?
- The management plan document is an extension of the assessment and both are working documents.

Page 37 - The description of Well Head Protection is vague.
- This will be expanded.

Page 39 - There is confusion between legislation at a minimum or only when needed.
- This will be edited.

Page 40-47 - (Edits)
Since this section relied on quotes from several reports some edits cannot be made. Others will be incorporated.

(Various Edits)
Revised where appropriate. Some edits were writing style differences of many people.

Page 123 - Where did statewide data management system for septic tank data come from?
- The Water Resources Section through GIS.

In several places add Groundwater Management Branch. Edits done where possible.

Delaware Cooperative Extension
University of Delaware — Delaware State College

Richard E. Fowler, Director
Townsend Hall
Newark, DE 19717-1303
302-451-2504

RECEIVED
JUL 11 1988
Div. of Soil & Water Conservation

July 6, 1988

Mr. John A. Hughes, Director
Division of Soil & Water Conservation
DNREC
89 Kings Highway
P. O. Box 1401
Dover, DE 19903

Dear John:

We recently reviewed portions of the draft of the "Nonpoint Source Pollution Management Program". We wanted to congratulate you on a good job of putting together an understandable document on an important subject. We were pleased to note the need for education of the public was an important component of the program, and as in our current cooperation with the department, this college is ready to help through our extension network.

We write to ask that in a rewrite of the draft, you specifically mention the need for funding of educational programs to include Cooperative Extension. We are stretched very thin right now on both personnel and operating capital, and we are faced with a certain reduction in our federal formula funds for the next fiscal year. State funding would certainly be needed if we are to do a good job of education on this important topic.

It would be helpful if you would add a specific line under the section on State Funded NPSP Activities as follows:

> **Delaware Cooperative Extension System: The state, through the University of Delaware, has regularly funded the statewide educational program of the Delaware Cooperative Extension System in the College of Agricultural Sciences.**
>
> **Expansion of integrated pest management, reduced pesticide usage, nitrate management, and biological pest control programs to assist in the overall Nonpoint Source Pollution Program will require an addition of $220,000 to the state budget line "U.Del-Cooperative Extension".**

We ask that you include this in the final draft of the program document.

Sincerely,

Richard E. Fowler
Director, CES

Sincerely,

Donald F. Crossan
Dean and Director

/mea

Cooperative Extension Education in Agriculture and Home Economics, University of Delaware, Delaware State College and the United States Department of Agriculture cooperating. It is the policy of the Delaware Cooperative Extension System that no person shall be subjected to discrimination on the grounds of race, color, sex, handicap, age or national origin.

LYNN

STATE OF DELAWARE
DEPARTMENT OF AGRICULTURE
2320 SOUTH DUPONT HIGHWAY
DOVER, DELAWARE 19901

OFFICE OF THE
SECRETARY

TELEPHONE: (302) 736-4811

Date: July 12, 1988

To: Chris Wicks, Jr.
Daniel Palmer
R. Roland Hill, Jr.

Fr: William B. Chandler, Jr., Secretary of Agriculture
John E. Wilson, III, Secretary of Natural Resources and Environmental Control
Douglas E. Hawkins, State Conservationist, Soil Conservation Service

Re: 1988 NPS Assessment and Management Program

The Water Quality Act of 1987 required Delaware to develop a non-point source pollution assessment and management program. The Introduction to our 1988 Nonpoint Source Pollution Management Program describes these efforts as "a dynamic program which will be revised as new information, needs, and implementation methods are identified." Furthermore, the goals of the Management Program state very clearly the need to annually reassess the problems caused by nonpoint source pollution and call for updating the cost-effective programs that will be implemented to reduce NPS pollution.

We are committed to fulfilling the goals of this Management Program. There will be an annual reassessment of problems and an annual review of the management program. Communication with federal, state and local agencies interested in reducing nonpoint source pollution, and members of the private sector whose businesses may be affected will be critical for this program to succeed. Agriculture is one sector whose day-to-day operations will be affected by the NPS Program.

As they agreed to at the conclusion of the meeting of June 20, 1988, Fred Mott, Lynn Sprague and Kevin Donnelly will meet with you or any other Farm Bureau representatives in the fall of 1988. The purpose of this meeting will be to keep the Farm Bureau fully informed of any new information or proposed revisions to the 1988 NPS Assessment Report and 1988 NPS Management Program. We feel that the Farm Bureau should set the date, time and place of this

meeting and ask that you keep Fred and Kevin informed of your plans so that they can set their calenders.

Thank you for your help and let's continue to solve our problems by working together.

cc: John F. Tarburton, Jr., President, Delaware Farm Bureau
Kevin C. Donnelly, Department of Agriculture
Fred Mott, Division of Soil and Water, DNREC
Lynn Sprague, Division of Soil and Water, DNREC
Michael McGrath, Manager, AgLands Preservation

RECEIVED
JUL 20 1988
PLANNING

OFFICE OF THE SECRETARY
MEMORANDUM

TO: Dennis Brown

FROM: Lee Emmons

SUBJECT: Delaware NPS Pollution Management Program CMP Consistency Determination

DATE: July 19, 1988

Thank you for your letter to Dave Hugg dated July 15, 1988, concerning Delaware's submission to EPA for approval of the "Nonpoint Source Pollution Management Program".

The proposed Management Program is consistent with the Delaware Coastal Management Program.

LEE:jad

STATE OF DELAWARE
DEPARTMENT OF AGRICULTURE
DIVISION OF PRODUCTION AND PROMOTION
FORESTRY SECTION
2320 SOUTH DUPONT HWY.
DOVER, DELAWARE 19901

OFFICE OF THE
DIRECTOR

TELEPHONE: (302) 736-4811

RECEIVED
JUL 25 1988
Div. of Soil & Water Conservation

July 14, 1988

Frederick T. Mott
DNREC
Division of Soil and Water Conservation
89 Kings Highway
Dover, DE 19901

Dear Mr. Mott: Fred

Upon careful review of the Non-Point Source Pollution Management Program for Delaware (dated June 21, 1988), we would like to request the following changes be made, to ensure accuracy, and to make some generalized comments.

On page 16, Table I and page 20, item B. Forest Land - Sediment, there is an error in the reference citation it should read: (USDA, Forest Service and Delaware Department of Agriculture, 1987). Done

Also, the following sentence should begin: According to preliminary survey results, there are approximately 13,400 acres in state ownership,... Done

On page 21 in the first **full** paragraph please change the harvest range from 7,000 - 10,000 acres to 7,000 - 9,000, and correct the spelling and grammatical errors of the last sentence. Done

On page 91, Other Programs: Urban Forestry, second paragraph please modify the second sentence to read: This assistance entails site specific management recommendations to ensure proper silvicultural practices and perpetuation of the forest. Done

Please change the Literature Cited (currently page 139) for Nancy Milliken Willis to the alphabetically correct location, i.e., Willis, Nancy Milliken... Left as is now.

Lastly, on pages 8 and 180 of Definitions please change Forest land to read as follows: Land that is primarily in tree cover that may be used to produce wood crops, provide for watershed protection, beautification, wildlife cover etc.. Current def page 8 was noted out with SCS

On page 182, please remove the lines listing Divisions and have it read: Director - Roland L. Derrickson. Done

Overall, we appreciate the opportunity to work cooperatively on the development of this management program and believe it is a good framework for future activities. We are also pleased to see that the program identifies a key role for professional foresters in non-point source pollution management activities.

Sincerely yours,

W. F. Gabel
State Forester

WFG/d

cc: Wm. B. Chandler, Secretary
Roland Derrickson, Director
Nancy Milliken Willis, Watershed & Utilization Forester

United States
Department of
Agriculture

Soil
Conservation
Service

207 Treadway Towers
9 E. Loockerman Street
Dover, DE 19901-7377

July 21, 1988

RECEIVED
JUL 22 1988
Div. of Soil & Water Conservation

Lynn Sprague
Division of Soil and Water Conservation
DNREC, P.O. Box 1401
Dover, Delaware 19903

Dear Mr. Sprague:

We have completed our review of the NPS Management Program. We feel that it is an excellent plan, and we are committed to providing continued assistance to ensure a quality NPS program.

A couple of general comments:

(1) The State might consider a requirement that a waste management plan be made part of the building permit process.

(2) There were questions at the advisory committee review session on July 12 concerning the data on page 126. SCS will provide further explanations of this data as soon as possible after July 25.

(3) Attached are specific editorial comments. If you wish to discuss any of these, please contact the commenter directly.

Sincerely,

MICHAEL R. KOLMAN
Asst. State Conservationist (WR)

Attachment

cc: Mark Gates w/o attachment
Fred Mott w/o attachment — NONE RECEIVED

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
P.O. BOX 778
DOVER, DELAWARE 19903

OFFICE OF THE
DIRECTOR

TELEPHONE: 736-4643

RECEIVED
JUL 27 1988
Div. of Soil & Water Conservation

July 25, 1988

MEMORANDUM

TO: Mr. F. T. Mott, DNREC, Division of Soil and Water Conservation

FROM: Mr. J. T. Wutka, DelDOT, Location/Environmental Studies

REF: NPS Pollution Management Program - Public Review Draft

The following are comments on the above referenced document:

1) Page 84 - Paragraph 2; Recovery areas on state highways are ideally 30 feet wide. This figure varies with the roadway section and geometrics. For instance, on a curbed primary roadway, the required recovery area may be only 2 feet on a tangent portion of roadway. Alternatively, on an open section of inter-state type highway, several hundred feet could be required in a curvilinear section of roadway.

2) Page 84/85 - Paragraph 4; The establishment of wetland vegetation is generally considered on a project specific basis where wetland acreage is affected. In addition, the Department has begun the development of a wetland site on the Mispillion River at Route 1. Thru excavation only, no dredging is expected, we hope to create additional acres of wetlands to off-set acreage lost where it can not be replaced on-site. In conjunction with the U.S. Route 13 Relief Route Project, the Department is also considering the conversion of Borrow Pits to wetland areas.

3) General - As you are aware, a draft copy of the new E & S Handbook is currently under review by the Department. We would anticipate that our standards will have to be reworked in conjunction with the Division of Soil and Water Conservation and that our procedures for compliance would also receive a review and recommendations on improving that aspect of the program.

JTW/des
cc: Mr. R. M. Harbeson
Mr. R. D. Richter

PUBLIC RESPONSE

TO: Lynn Sprague, Division of Soil & Water Conservation

FROM: Amy White, Delaware Nature Education Society (By Telephone)

SUBJECT: NPS Management Program

DATE: July 26, 1988

1. Question: Why was DNES taken out of the schedule of implementation?

   Answer: The schedule of implementation is mainly focused on government agencies which can be directed by state and local elected or appointed officials. The state cannot direct DNES to assume responsibility. The Delaware Nature Education Society would be asked to help working groups to address specific problems.

2. Please add a reference to a September 1988 conference to discuss wellhead protection and water supply.

   Answer: This will be added.

3. DNREC Information and Education is working on a "How to" series of publications. Should this be referenced?

   Answer: This will be mentioned.

4. Various typos.

   Answer: These will be changed.

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14104 8522

CORRADO · AMERICAN

RECEIVED
JUN 14 1988
Div. of Soil & Water Conservation

June 8, 1988

Delaware Non-Point Source Pollution
Advisory and Review Committee
Dept. of Natural Resources & Environmental Control
Division of Soil & Water Conservation
89 Kings Highway
P.O. Box 1401
Dover, DE 19903

Attn: Frederick T. Mott, Manager
Conservation Districts

RE: NPS Pollution Management Program

Gentlemen:

The Delaware Contractors Association has reviewed the schedule of implementation for the Non-Point Source Pollution Management program and would like to offer the following comments. It seems to us that a major consideration in the overall management program should be that one agency oversee the NPS program. The current program calls for various agencies to be responsible for certain facets of the management program. While this may be acceptable in the agricultural sector, we feel that it is not appropriate for the other non-point sources of pollution.

Additionally, the Delaware Contractors Association recently has given the Secretary of the Department of Natural Resources and Environmental Control a White Paper with respect to water resource and wastewater treatment. We respectfully request that your committee review that White Paper in light of the promulgation of the management program. We feel that the recommendations put forth in the White Paper will have a direct impact on your Non-Point Source Pollution Management Plan.

Sincerely,

Joseph J. Corrado
President

JJC:cas

attachment

cc: John McMahon

200 Marsh Lane
New Castle, Delaware 19720
302/655-6501
302/652-5800