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EPA Clean Lakes Demonstration Program

1990-91 Report To Congress

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CLEAN LAKES DEMONSTRATION PROGRAM

1990-91 REPORT TO CONGRESS

OFFICE OF WETLANDS, OCEANS & WATERSHEDS

OFFICE OF WATER

U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC

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EXECUTIVE SUMMARY

In 1972, Congress created the Clean Lakes Program to restore and protect the Nation's lakes. The 1987 amendments to the Clean Water Act (section 314) reauthorized the nationally competitive Clean Lakes Program and established the Demonstration Program. The objectives of the demonstration program are to develop pollution control techniques for lakes, particularly for nonpoint sources of pollution, and evaluate regional pollution control strategies; demonstrate environmentally preferred techniques for removing lake sediments and other impediments; construct and evaluate devices to prevent the deposit of sediment in lakes; and demonstrate the costs and benefits of using dredged material from lakes in the reclamation of spoiled land. The Program provides financial and technical assistance to states to conduct three types of lake specific projects: Phase I Diagnostic/Feasibility Studies that require one-year monitoring studies to determine baseline limnological data and an analysis of the most technologically feasible and cost-effective pollution control strategies; Phase II Restoration/Protection Implementation Projects that are actual in-lake restoration efforts based on Phase I recommendations; and Phase III Post-Restoration Monitoring Studies conducted three to five years after the completion of Phase II to assess the long-term effectiveness of the pollution control and restoration techniques.

The Act requires that the Administrator of the U.S. Environmental Protection Agency give priority consideration to the following ten lakes for inclusion in the demonstration program: Lake Houston, Texas; Beaver Lake, Arkansas; Greenwood Lake, New Jersey; Alcyon Lake, New Jersey; Deal Lake, New Jersey; Gorton's Pond, Rhode Island; Lake Washington, Rhode Island; Lake Bomoseen, Vermont; Sauk Lake, Minnesota; and Lake Worth, Texas. In FY 1989, Congress appropriated $5.0 million for the Demonstration Program. States submitted applications and received funding under this program for seven of the ten lakes named in the Act. In FY 1989, $1.7 million was awarded and the remaining $3.3 million was recertified for use in FY 1990. Of the recertified $3.3 million, approximately $2.3 million was awarded in FY 1990 and Congress redirected approximately $1.0 million to other lake projects. No additional funds were appropriated for the Demonstration Program in FY 1990. In FY 1991, Congress did appropriate $83,000 for the Lake Alcyon Demonstration Project.

The ten lakes have water quality problems that are common to many lakes throughout the United States and therefore may serve as models for similar restoration projects on other lakes. Most of the water quality problems fall into one of two categories: excessive siltation and sediment influx, and high levels of nutrient loading. For example, at Deal Lake in New Jersey, excessive siltation has gradually reduced the number of deep water areas in the lake and restricted recreational activities such as boating and swimming. High nutrient levels can lead to the rampant growth of aquatic weeds. This vegetation can also impede recreational activities, cause hypoxia and fishkills, and lead to a decline in the aesthetic quality of the lake. This situation has occurred at Lake Bomoseen in Vermont, where the nuisance growth of the aquatic plant, Eurasian water milfoil, has curtailed full use of the lake.

There are many sources of these water quality problems but most can be linked to the development of the lakes' watersheds. Urbanization can increase runoff from lawns, highways, stormwater outfalls, and other surfaces. Shoreline development can also result in increased nutrient loading from the use of fertilizers on lawns and the presence of septic systems in areas that have not been sewered. Rural development can lead to water quality problems as well. Farms and animal production facilities on or near lakes use and generate large quantities of nitrogen and phosphorus from animal feed, fertilizers, pesticides, and animal wastes. Runoff from these facilities or fields can significantly increase the nutrient load of the lake. Soil erosion that occurs during construction or from poorly maintained commercial, residential, or agricultural lands can cause a significant influx of silt and sediment to a lake.

Other lakes in the Demonstration Program are adversely impacted by industrial discharges. For example, Alcyon Lake in New Jersey has toxic contaminants in its water. The source of these contaminants is the toxic leachate the lake receives from an abandoned chemical waste dump upstream. This landfill is a designated Superfund site.

Community interest in restoring these lakes has been a major factor both in designating the lakes for the Demonstration Program, and in implementing measures to improve water quality and protect aquatic resources. For some of the lakes, lake associations consisting of property owners around the lakes have been instrumental in determining sources of pollution, initiating prevention and control efforts, and developing funding sources to match federal grants. Volunteer activities, particularly monitoring water quality in the lakes, have also been important. At Lake Washington, the University of Rhode Island coordinates these volunteer groups to gather useful baseline data. States in which diagnostic/feasibility studies are ongoing or have been completed agree that the Demonstration Program has been a valuable resource for initiating protection and restoration activities. Where such activities have been implemented, they have been successful in improving the water quality of the lake and encouraging further efforts. States agree that the Demonstration Program provides useful models for identifying water quality impairments in lakes, assessing protection and restoration techniques, and encouraging public involvement in maintaining and improving the Nation's lakes.

INTRODUCTION

In 1972, Congress created the Clean Lakes Program in response to public demand for the preservation and protection of the Nation's lakes. The Clean Lakes Program has as its primary goals the definition of the causes and extent of pollution problems in publicly owned lakes of each state, and the development and implementation of effective techniques to restore and protect lake resources. Promulgation of the Clean Lakes Regulations in 1980 defined the program structure and outlined the financial assistance mechanisms available to the states for carrying out the provisions and objectives of the Act.

The Clean Lakes Program provides financial and technical assistance to states to conduct three types of projects: Phase I Diagnostic/Feasibility Studies, Phase II Restoration/Protection Imple-mentation Projects, and Phase III Post-Restoration Monitoring Studies.

Phase I studies are used to determine the causes and extent of the pollution in a specific lake, identify potential control mechanisms, and recommend the most feasible and cost-effective methods for restoring and maintaining lake water quality. Phase I studies include a one-year monitoring program to obtain current limnological data on the trophic conditions of the lake including physical, chemical, and biological water quality data. The diagnostic portion of the Phase I study further requires gathering information on the limnological, morphological, demographic, socioeconomic, and other relevant aspects of the lake and its watershed. The feasibility portion of the study is to assess the diagnostic data to determine the causes and extent of the pollution to the lake, identify potential pollution control mechanisms, and recommend the most feasible and cost-effective methods for restoring and maintaining the aquatic resource for maximum public and environmental benefit.

Phase II funds are used to implement the lake restoration and protection recommendations identified in Phase I and may include actual in-lake techniques as well as watershed management practices. Phase II cooperative agreements require comprehensive lake water quality monitoring during restoration as well as for a minimum of one year after the implementation of restoration and protection measures to determine the initial effectiveness of the project.

Phase III monitoring studies are used as a long-term follow-up to Phase II activities. For restoration/protection projects that have been completed for at least five years, Phase III funds may be used to determine the longevity and effectivenesss of implemented techniques. Phase III monitoring studies must meet several criteria: 1) quantitative data must be available on pre-treatment and post-treatment water quality; 2) the treatment used in the lake should be applicable to other lakes with similar pollution problems; 3) the treatment and its implementation must be documented in detail; and 4) the measure of a successful treatment must be related to improved water quality or uses.

Since the mid 1970s, the Clean Lakes Program has provided more than $120 million in financial assistance to states to help fund hundreds of lake studies and implementation projects.

The 1987 amendments to the Clean Water Act (section 314) reauthorized the nationally competitive Clean Lakes Program and established the Demonstration Program. The objectives of the Demonstration Program are to develop techniques to prevent and control pollution to lakes, particularly nonpoint sources of pollution, and evaluate the feasibility of implementing regional pollution control strategies; demonstrate environmentally preferred techniques for the removal and disposal of contaminated lake sediments, silt, aquatic growth, and other obstructions; construct and evaluate silt traps and other devices to prevent the deposit of sediment in lakes; and demonstrate the costs and benefits of utilizing dredged material from lakes in the reclamation of despoiled land. The Act requires that the Administrator of the U.S. Environmental Protection Agency (EPA) give priority consideration to the following ten lakes for inclusion in the Demonstration Program: Lake Houston,

Texas; Beaver Lake, Arkansas; Greenwood Lake, New Jersey; Deal Lake, New Jersey; Alcyon Lake, New Jersey; Gorton's Pond, Rhode Island; Lake Washington, Rhode Island; Lake Bomoseen, Vermont; Sauk Lake, Minnesota; and Lake Worth, Texas.

The EPA policy is to carry out the newly established Demonstration Program under existing program guidance and regulations. In FY 1988, the Clean Lakes Program did not receive an appropriation. However, in FY 1989, Congress appropriated $5.0 million for the Demonstration Program and $7.5 million for the nationally competitive program. States applied for and received funding for seven of the ten lakes named in the Act. In FY 1989 and 1990, approximately $1.7 million and $2.3 million were awarded, respectively. In FY 1990, Congress reprogrammed the remaining approximately $1.0 million to other lake projects. In FY 1991, Congress appropriated an additional $83,000 for the Alcyon Lake project. The distribution of the Demonstration Program funds, as well as competitive Clean Lakes funds, for each project is shown below. The 1987 amendments to the Clean Water Act further instructed the Administrator of EPA to report to the Congress on work undertaken by the Demonstration Program. This report summarizes the current status of each demonstration project and describes the work undertaken by the EPA Clean Lakes Program as well as by others involved in these projects.

The Agency will continue to closely monitor the progress of these projects and intends to make available to interested parties the results of these demonstration projects. This information transfer will occur through a variety of sources. For example, much of the pertinent water quality data collected under these projects will be entered into the Agency's STORET water quality data base, as well as reported in each State's Biennial Section 305(b) National Water Quality Report to Congress. In addition, the progress and results of each demonstration project will be entered into the Clean Lakes Program Management System (CLPMS). The data in this tracking system is available to both the States and the public for information transfer purposes.

Funding of Clean Lakes Demonstration Projects

Lake, State	Phase	DEMO Funds ($)	Competitive Clean Lakes Funds ($)	State/Local Matching Funds ($)
Houston, TX	I	-0-	100,000	42,857
Beaver, AR	I	100,000	-0-	42,857
Greenwood, NJ	I	-0-	98,233	42,100
	II	452,400	-0-	452,400
Greenwood, NY	II	369,600	-0-	369,600
Deal, NJ	II	604,881	-0-	604,881
Alcyon, NJ*	II	83,000	17,123	100,123
Gorton's Pond, RI	I	-0-	74,200	31,800
	II	-0-	143,353	143,353
Washington, RI	I	98,413	-0-	42,176
Bomoseen, VT	II	-0-	74,640	74,640
	II	588,000	-0-	384,700
Sauk, MN	I	100,000	-0-	42,857
Worth, TX	I	-0-	100,000	42,857
	II	1,723,706	-0-	1,723,706
	TOTAL	$4,120,000	$607,549	$4,140,907

* Has received several million dollars from the EPA Superfund Program

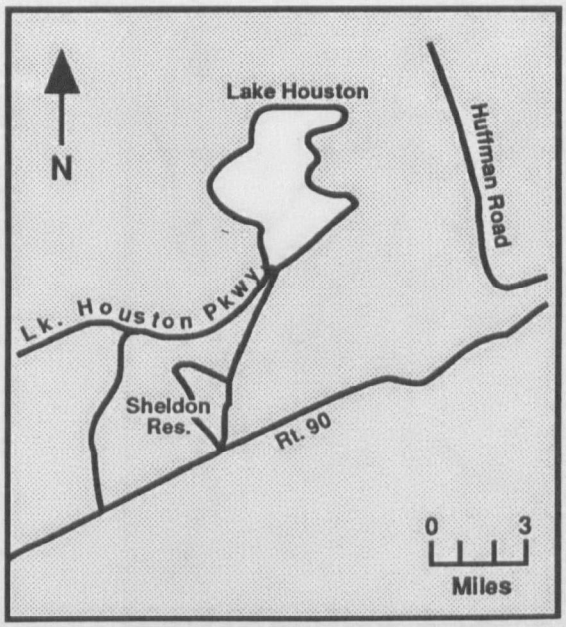
LAKE HOUSTON

The construction of the Lake Houston Dam on the San Jacinto River in 1954 resulted in the formation of Lake Houston. This impoundment, which has a surface area of 12,350 acres, serves as a water supply and recreational lake for the City of Houston, Texas. Originally the lake had a storage capacity of over 160,000 acre-feet, but during the intervening 35 years the capacity of the lake has decreased by more than 27,000 acre-feet (18%).

Studies conducted in 1980 by Rice University indicated that the diminished capacity resulted from constant sedimentation and aquatic plants. These plants, primarily water hyacinths and alligator weed, are found in inlets around the periphery of the lake. In addition to decreasing the storage capacity of the lake, the plants have restricted recreational uses such as boating and fishing.

Aquatic resources also have been affected by high turbidity and high nutrient levels in Lake Houston. Although at one time fecal coliform concentrations were a significant problem as a result of point source permit violations, stringent permitting and enforcement have eliminated this particular problem. There are several hundred NPDES and state discharge permits issued for Lake Houston, and the compliance rate is very good.

The current water quality problems are caused by runoff, primarily from urbanized areas around the lake; a significant source may be fertilizers applied to property adjacent to the lake. The City of Houston has long been active in monitoring the water quality of the lake and has initiated a number of measures designed to maintain or improve lake quality. These have included inspection and licensing of septic systems, inspecting and approving oil well drilling locations near the periphery of the lake, monitoring sewage treatment plants, collecting water samples within the watershed, and issuing citations for code violations. Recent federal regulations pertaining to stormwater permitting for communities of over 100,000 people



may also have an eventual impact on the water quality of the lake.

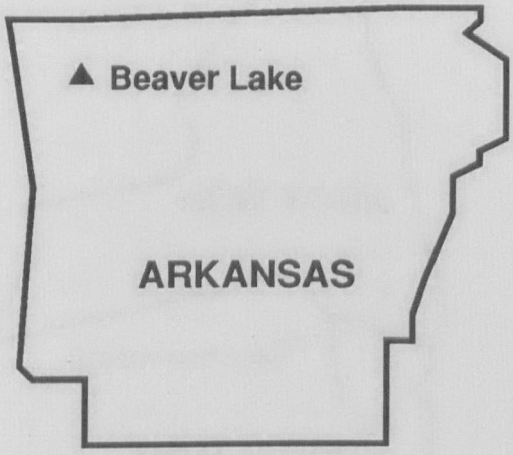
A number of restoration and pollution prevention methods were considered for Lake Houston. These methods include shoreline stabilization, dredging, nutrient inactivation and precipitation, nutrient outflow acceleration, and fertilizer management plan. In 1987, the Texas Water Commission received $100,000 from the Clean Lakes Program for which matching state and local funds of $42,857 were committed. These funds were used in the Phase I Diagnostic/Feasibility Study for Lake Houston, which resulted in a better understanding of the factors affecting the water quality.

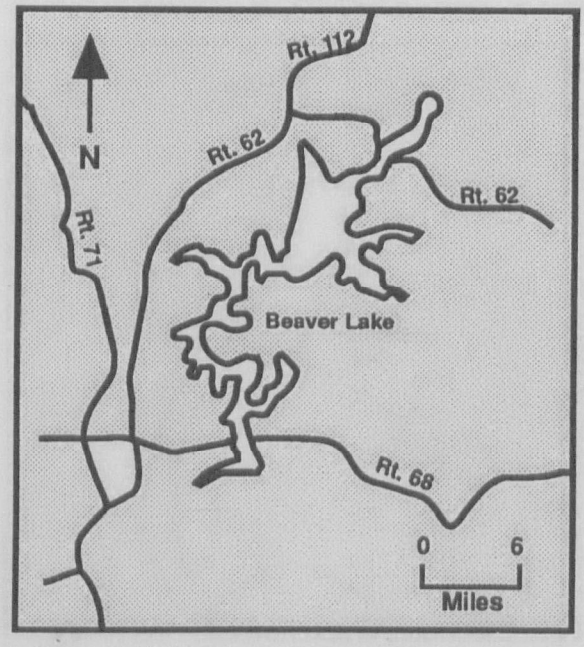
The first draft of the Diagnostic/Feasibility Study final report has been completed and reviewed. The results indicate that it is not economically feasible to restore the lake. Although better land use practices and extensive treatment of sewage discharges to the lake's tributaries may improve lake water quality, the extent of the controls and treatment necessary to actually restore the lake are prohibitively expensive.

BEAVER LAKE

Located near Fayetteville, Arkansas, an area experiencing rapid growth, Beaver Lake is a 28,190-acre reservoir which provides excellent recreation facilities as well as drinking water for the surrounding population of over 200,000 people. Although Beaver Lake has escaped any significant impairment to date, the Arkansas Department of Pollution Control and Ecology is concerned that rapid commercial, agricultural, and residential development increases the potential for water quality degradation in the lake.

The Beaver Lake watershed has been extensively studied through the cooperative efforts of several federal agencies, including the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the Tennessee Valley Authority, and the U.S. Department of Agriculture's Soil Conservation Service. The Soil Conservation Service, recognizing that runoff from the growing number of chicken and swine farms in the watershed could eventually affect the quality of the drinking water supply, was instrumental in designating Beaver Lake for the Clean Lakes Demonstration Program. Between 1980 and 1986, studies conducted by the U.S. Army Corps of Engineers and the U.S. Geological Survey focused on erosion, animal wastes, nutrient transport, water quality, aquatic species and habitats, and water quality management. The studies indicated that water clarity in the upper reservoir has been decreasing as a result of siltation and algal blooms. The source of the siltation and algae is believed to be the increased number of confined animal production facilities and the spreading of the wastes from the facilities on nearby pastures. Federal permits have not been required for the many chicken and swine farms located around the lake. However, the State of Arkansas does regulate swine farms and some state permits have been issued. The EPA and the State of Arkansas are encouraging farmers to use best management practices on a voluntary basis to reduce the potential for nutrient loading to the lake, although





if necessary the EPA can require permits for any feedlot significantly polluting U.S. waters, under the National Pollution Discharge Elimination System (NPDES).

The Corps of Engineers has spent more than $400,000 to characterize the water quality of the lake and to determine the impacts of the surrounding watershed by monitoring critical watershed areas where there are cooperative farmers. To assess the potential impacts from increased development within the watershed and outline the best approach to protecting the water quality of the lake, the state has undertaken a $142,857 Phase I Diagnostic/Feasibility Study ($100,000 Federal Clean Lakes funds and $42,857 state funds) to characterize the limnological aspects of the lake proper, which will not be included in the Corps' study. Public meetings have been held to allow all parties interested in the lake and its future to participate in the development of the lake protection plan.

In 1990, the first milestone of the project was completed, which involved data assimilation and analysis. This included a review of existing and historical data, implementation of a quality control/ quality assurance plan, and the design of a lake and watershed monitoring program. The monitoring program has been coordinated with the Corps of Engineers and the Soil Conservation Service to maximize efficiency of data collection.

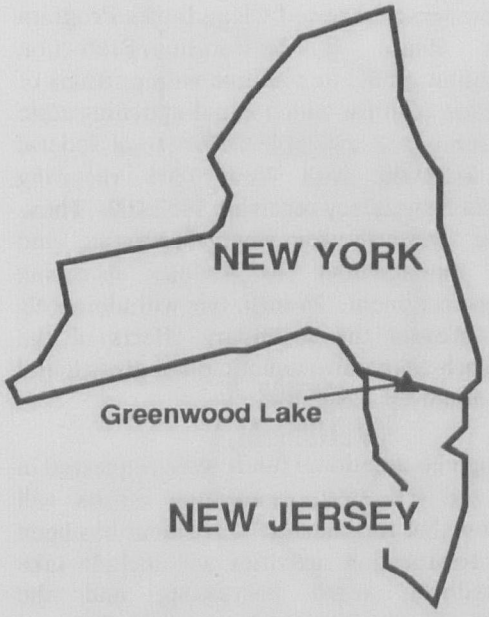
In 1991, the monitoring program was completed, and the state is currently preparing a Diagnostic/Feasibility Study final report to be completed in August 1992. Lake restoration alternatives are likely to focus on installation of Best Management Practices (BMPs) to address the significant animal waste contribution within the watershed.

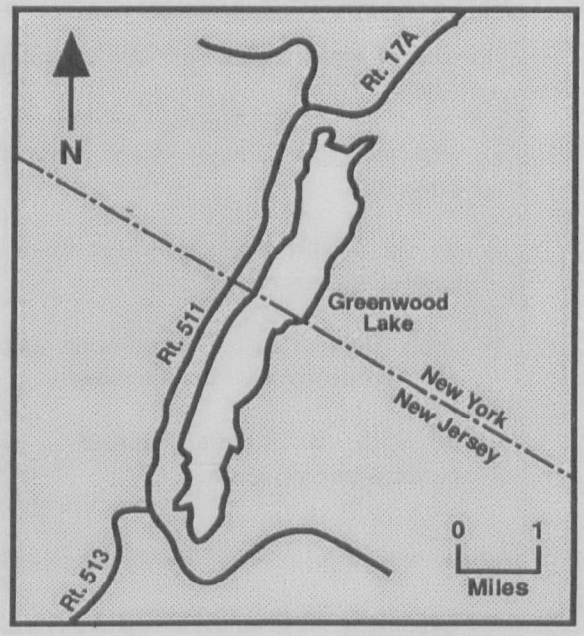
GREENWOOD LAKE

Historic Greenwood Lake is unique among the Clean Lakes Demonstration Program lakes because it is located in two states, New Jersey and New York. Its use extends back to pre-Colonial days and it remains a popular recreational area. Numerous marinas, restaurants, homes, and other facilities are located along the shoreline. In addition, the lake is part of the headwaters for the Wanaque Reservoir, which is a major water source for northern New Jersey. The lake, which has a surface area of 1,920 acres, is divided almost in half by the New York/New Jersey state line with the northern New York portion being deeper and having a steeper shoreline.

Although Greenwood Lake is still a thriving water resource, in recent years it has begun to show signs of water quality degradation. Fishing has changed from a game/sport fishery to pan fish. Excessive growth of aquatic plants along the shoreline, particularly in the shallower areas, has seriously affected navigation, and has also resulted in unpleasant odors and taste. The aquatic plant growth is caused by increased nutrient loading and the influx of sediments, which are the result of development in the watershed, storm runoff, septic discharges, and point source discharges into tributaries of the lake. Of the six NPDES permits issued for the New Jersey shoreline of the lake, all were found to be out of compliance at some time; of these, the three sewage treatment plants are in the process of upgrading their facilities to comply with their permits; of the other three permits, two are under administrative orders to achieve compliance and one was a single incidence of exceeding permit discharge levels.

In 1983, a Phase I Diagnostic/Feasibility Study was undertaken by the State of New Jersey with $98,233 in federal funds. The study was to identify sources of lake pollution and determine the best possible restoration methods. It was determined that the hypolimnion was anoxic during the summer; that annual total particulate and sediment loadings were over 5,000 kilograms (11,000 lbs) and 3 million kilograms (6.6 million lbs), respectively; aquatic plants had reached nuisance proportions in the





southern end of the lake and in some northern areas, and floating stumps posed safety hazards. The poor water quality, inaccessibility to the lake, and safety hazards have resulted in a decline in recreational activities such as fishing. A restoration/management plan was developed to provide for long-term improvements to the lake as well as to address the immediate need for maintaining recreational opportunities. The plan had 10 parts:

1) upgrade the sewage treatment plant and prohibit future sewage treatment plant discharges to the lake;

2) develop a septic management district to monitor existing on-site wastewater disposal systems and improve new ones;

3) develop a comprehensive stormwater quality management plan to treat first runoff;

4) stabilize the tributaries to decrease erosion and sediment transport;

5) establish a site plan review committee to oversee all proposed development in the lake's watershed;

6) control aquatic plant growth by periodic lake drawdown;

7) implement an aquatic plant harvesting program;

8) dredge specific locations where there are navigation hazards;

9) apply alum or install an aeration unit to control phosphorus recycling; and

10) establish a public education and participation program.

The total costs for the plan were estimated at $10 million. Restoration activities were to be conducted as funds became available. Some portions of the plan were implemented as early as 1985, specifically the lake drawdown and aquatic plant harvesting in the northern part of the lake. In addition, engineering drawings for a detention basin have been prepared, sewage treatment facilities in the area have been upgraded, stormwater control measures have been implemented for new developments, and runoff conveyances have been maintained. At present the U.S. Army Corps of Engineers is developing a dredging plan for the lake which includes an archaeological survey. It was anticipated that this work by the Corps would allow the Greenwood Lake Watershed Management District (GLWMDI) to use funds from Phase II on other aspects of the restoration project. However, implementation was delayed because it was determined that the GLWMDI, a nonprofit organization, was not eligible to receive state funding. As a result, the Borough of West Milford has joined the project as an official agent, while maintaining a close working relationship with the GLWMDI. Grant agreements reflecting this relationship have been finalized and implementation efforts will resume.

In FY 1989, the State of New York and the State of New Jersey received Clean Lakes Program funds for Phase II Restoration/Protection Implementation grants to continue with portions of the restoration plan for which equal matching state and local funds are available. The total federal award is $822,000, with New York receiving $369,600 and New Jersey receiving $452,400. These monies are primarily for weed harvesting and watershed management to reduce incoming nutrients and sediment. In turn, this will ultimately reduce or prevent the secondary effects of the pollutants such as massive aquatic plant growth and decreased dissolved oxygen.

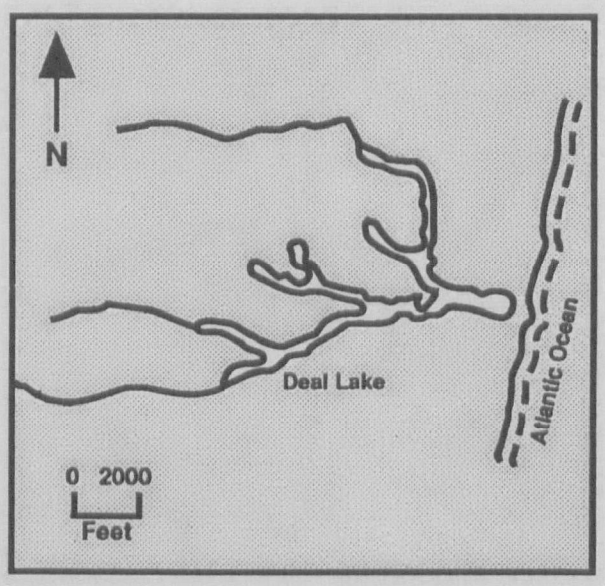
Although no additional funds were requested in FY 1990 and FY 1991, restoration efforts will continue now that the substate agreement has been finalized. Restoration activities will include lake level drawdown, weed harvesting, and the construction of a stormwater detention basin.

DEAL LAKE

As the largest freshwater body in Monmouth County, New Jersey, Deal Lake has provided neighboring communities with water recreation opportunities since 1890. The lake was formed by the damming of a tidal creek and consists of a series of shallow finger-like sloughs branching from a main basin. Community involvement with the lake is evidenced by the planting of ornamental plants along the lake periphery and the active promotion of water activities such as fishing, swimming, and boating.

The Deal Lake watershed has been subjected to continuous development with a subsequent degradation in lake water quality resulting from increased nutrient and sediment inflow. By 1950, aquatic plant growth, algal blooms, and bacteria concentrations had become excessive and the use of the lake for boating and swimming was impeded or prohibited.

State and local interest in restoring Deal Lake to its former standard of water quality culminated in 1983 in a state-sponsored comprehensive diagnostic/feasibility study. This study determined the status of the lake and identified the sources of the influx of nutrients and sediment. The primary source of sediment was determined to be an old landfill located upstream of the lake. This, in turn, led to a remediation plan which consisted of three steps: 1) the development of a cooperative agreement between the Deal Lake Commission and neighboring local governments to develop new ordinances and zoning requirements or upgrade existing ones to control stormwater runoff and soil erosion, and to maintain proper watershed/land use management, particularly to stabilize the landfill responsible for most of the sediment influx; 2) identify the current or potential sources of soil erosion, and determine sensitive habitats and implement ordinances to correct or avoid development of these areas; and 3) construct sediment catch basins, detention basins and/or vegetated retention basins (wetlands). The restoration project was initiated by the Deal Lake



Commission in 1988, using $1 million of State of New Jersey funds. A heavily sedimented portion of the lake, the Harvey Brook arm, was restored by dredging, the construction of a sediment trap, the development of a 2-acre wetland, and the reclamation of 4 acres of surface water habitat. Other restoration activities completed to date include the retrofitting of the lake's flume to permit adjustments in lake water levels for flood control and to allow for increased drawdown for aquatic plant control, fishery management, and sediment removal. Of three known industrial dischargers to the lake, one company has gone out of business, one water treatment plant is being penalized for noncompliance with its state discharge permit, and the third industry is no longer discharging into the lake.

In 1989, the Deal Lake Commission received financial assistance ($604,881) from the Clean Lakes Program, matched equally by the state, to complete four other restoration and protection elements for the lake. These elements are 1) construction of a wet basin and biofilter to prevent property damage from flooding, improve stormwater quality, and provide new wetlands; 2) the conversion of a pool, which currently has an accumulation of sediment and unstable sideslopes, to a functional retention basin to decrease sediment and nutrient influx to the main body of the lake; 3) the creation of a biofilter and wetland on the present site of stagnant backwater pool; and 4) watershed and land use management. This last project will require the development of new ordinances, the identification of areas under or proposed for development, and the determination of site-specific impacts.

In 1990 and 1991, significant progress was made on the watershed management portions of the project including the completion of engineering designs. Wetlands and coastal zone permits will soon be acquired for the construction of a detention basin. The Deal Lake Commission was successful in acquiring funding to develop this site as a public recreation area.

A public education presentation was prepared for local groups and schools, and additional dates were scheduled for various user groups of the lake.

The ability of the Deal Lake Commission to function as the lead organization for restoration activities has been a significant accomplishment. The lake watershed consists of several municipalities whose efforts have been coordinated by the Deal Lake Commission. This increased visibility has fostered better working relationships with other regulatory agencies and has improved the likelihood of eventual project success.

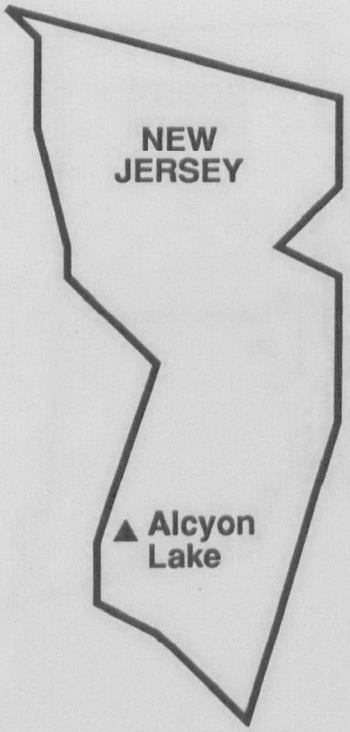
ALCYON LAKE

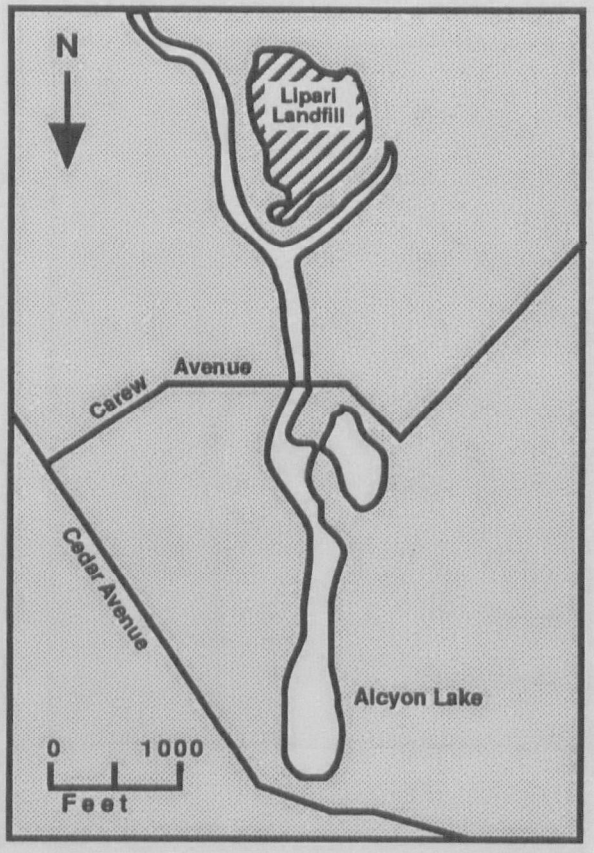
Alcyon Lake is a small manmade lake occupying approximately 18.5 acres. Located in Pitman, New Jersey, in the county of Gloucester, the lake has been a center of community activity since the 1890s when Alcyon Park was built on the lakeshore. At the turn of the century, a beach and an amusement center were established at the Park. In 1951, Alcyon Park was sold and essentially abandoned, although the beach was maintained during the 1950s.

By 1980, three sources of pollution had been identified for Alcyon Lake: 1) the LiPari Landfill, an abandoned chemical waste dump, 2) urban stormwater runoff, and 3) agricultural runoff. This pollution had been ongoing for over 20 years. In 1980, it was determined that the major problem at the lake was the discharge of 130 to 150 thousand gallons of chemical wastes from the LiPari Landfill. Forty-four of the 126 priority toxic pollutants (listed as such by the EPA pursuant to section 307(a) of the Clean Water Act), were found in the leachate stream.

In 1980, the State of New Jersey Department of Environmental Protection applied for financial assistance under the Clean Lakes Program to begin the study and restoration of Alcyon Lake for recreational purposes. However, because of the ongoing contamination of the lake from the LiPari Landfill -- the number one Superfund site in the country -- Alcyon Lake was declared ineligible for Clean Lakes funds until the landfill cleanup was completed.

In the same year, the LiPari Landfill project applied for and received several million dollars in Superfund monies to begin site remediation





efforts. Since then, the first stage of Superfund activities -- on-site construction of a slurry wall and membrane cap -- has been completed. The second stage of the remediation plan consists of on-site and off-site remedial investigation/feasibility studies to address cleanup of the contained landfill area as well as contaminant migration from the site. In July 1988, EPA committed $21 million from the Superfund Program for the third and final stage of the remediation plan. This stage includes 1) dredge and removal of contaminated sediments from Alcyon Lake and its associated streams and wetlands, 2) treatment of these sediments to remove contaminants, 3) placement of the treated sediments over a nearby abandoned racetrack, and 4) flushing of contaminants from the landfill. The cleanup of Alcyon Lake has been delayed due to difficulties in design of the sediment decontamination process.

The State of New Jersey did not submit an application for financial assistance under the Clean Lakes Program in FY 1989. However, throughout 1990, the State worked with Gloucester County to implement watershed work to prevent and control other sources of pollution to the lake. A feasibility study addressing watershed management activities was prepared by the county in conjunction with the Soil Conservation Service.

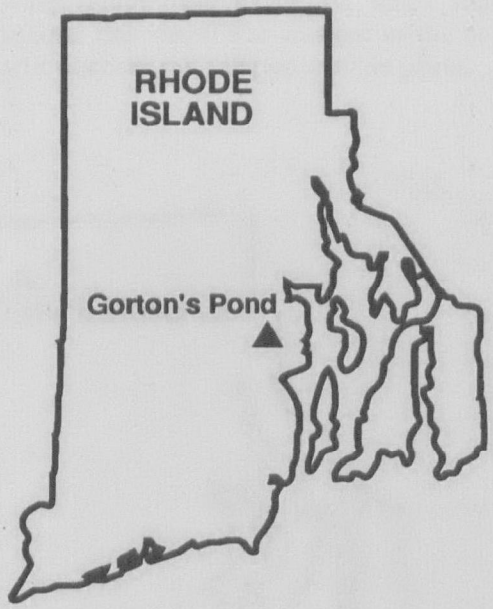
In FY 1991, Congress appropriated $83,000 for the New Jersey Lake Alcyon Demonstration Program. In addition, the state received $17,123 in competitive Clean Lakes funds. These combined funds will be matched equally by the State ($100,123) and used to implement watershed erosion control measures and construct erosion control devices in the lake watershed. The Soil Conservation Service and a local community college are providing assistance to the county for controlling soil erosion.

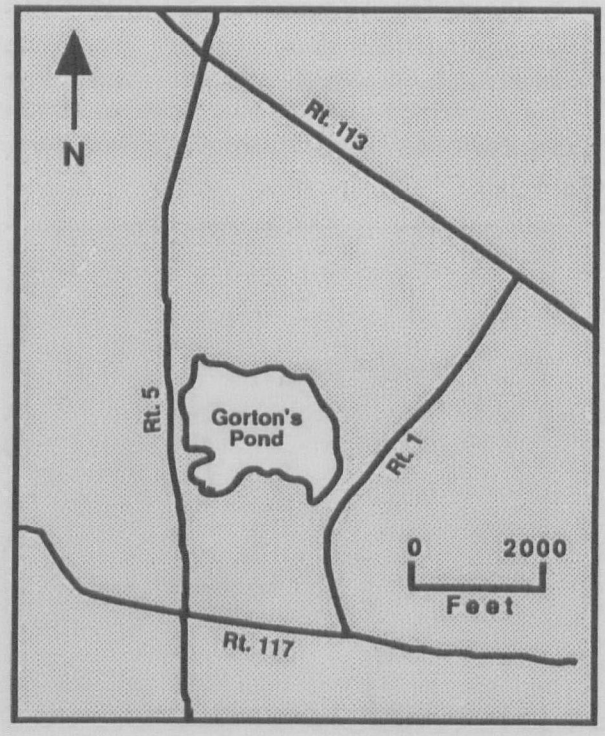
GORTON'S POND

Located near Warwick, Rhode Island, Gorton's Pond has been a commercial water resource for settlers for over 250 years, when a filling mill was first established on its shore. Since that time, Gorton's Pond has been the site of a cotton mill (now a warehouse), extensive residential development, and a major source of freshwater fishing, swimming, boating, and hiking. The pond, essentially a lake, covers 57 acres and has a small dam at its outlet which is used to control its depth.

Gorton's Pond is in a heavily urbanized area of Rhode Island, and as such has many of the pollution problems associated with residential and commercial development. These include surface runoff that contains oil, grease, bacteria, and fertilizers, as well as other wastes that enter the water from storm drains or surface runoff. This influx of nutrients has resulted in green and blue-green algal blooms. Watershed development has also caused severe soil erosion with a subsequent increase in sediment inputs to the lake. This deposit of sediment has resulted in shallow areas along the periphery of the lake and encouraged the growth of aquatic macrophytes. Nutrient loading in the lake has also increased because of septic system discharges, although these discharges are the result of hydraulic continuity with subsurface waters rather than outdated or inefficient systems. These manifestations of declining water quality have reduced the population of sport fisheries.

In 1980, the State of Rhode Island received $74,200 in Clean Lakes Program funds matched by $31,800 in state/local funds to conduct a Phase I Diagnostic/Feasibility Study of Gorton's Pond. A year-long monitoring study indicated that the eutrophication of the lake was caused primarily by land use practices in the watershed. The feasibility study stressed that any restoration plan must deal with the causes of the water pollution, not just the artificial aeration and nutrient inactivation





effects; that is, in addition to actual lake restoration activities, the plan must include land use management practices to control further nutrient and sediment loading. Land use management recommendations included erosion and sediment control, particularly during construction and at stormwater outfalls; stormwater treatment and/or diversion; and elimination of point and nonpoint source discharges such as on-site sewage disposal systems. Although some areas around the lake have been sewered, some septic systems are still used. Methods proposed for lake restoration included dredging, drawdown, aquatic plant harvesting, dilution/flushing, and bottom sealing. It was emphasized that more than one method would be necessary for preventing and controlling runoff and sedimentation.

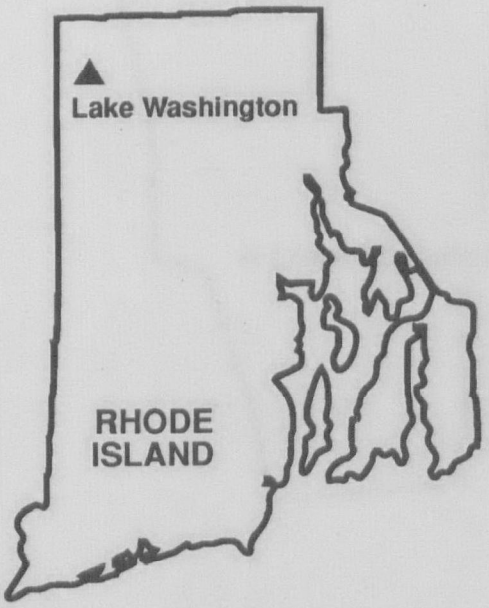
In 1986, Rhode Island received $143,353 in Clean Lakes Program funds, matched equally by state/local funds, to implement the stormwater treatment component of the restoration project. Due to a significant increase in the initial estimated cost of implementing the proposed plan (over $1 million) and a loss of $100,000 in state-matching funds due to state budgetary problems, only the design phase for a stormwater infiltration basin could be completed. However, the Rhode Island Department of Transportation has initiated a resurfacing project on the roads from the pond. The department has agreed to move the road draining pipe from an area discharging directly to the public beach and to construct a riprap and grassy swale adjacent to the pond to provide stormwater treatment. Design costs for the stormwater treatment basin have been paid, but the remainder of the federal funds ($117,226) will be returned because of the state's budgetary problems noted above.

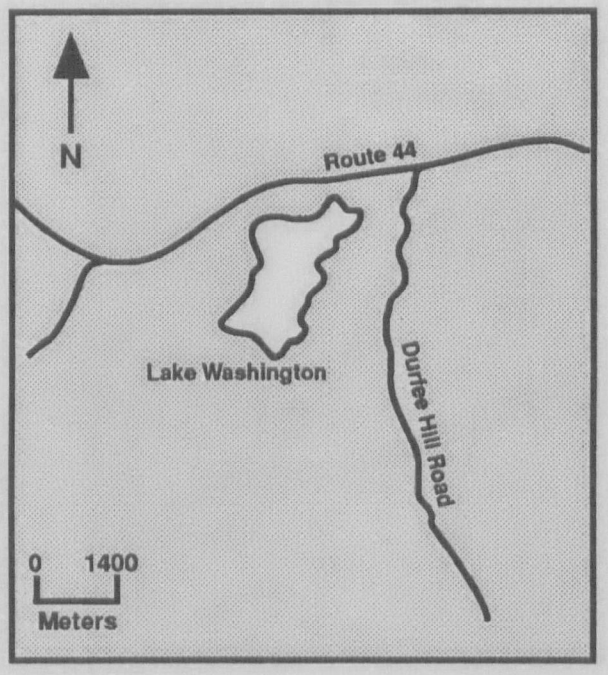
LAKE WASHINGTON

Located in upper northwestern Rhode Island, near the Connecticut border, Lake Washington is a shallow basin covering 41 acres that was formed by the excavation of a cranberry bog and construction of an earthen dam over 80 years ago. The shoreline is densely populated by homeowners who enjoy the lake for warm water fishing and boating.

In recent years, there has been excessive growth of aquatic vegetation, algal blooms, and increased sedimentation. The degradation of the aquatic plants and algae has resulted in an increased dissolved oxygen demand that threatens survival of the fish population. Part of the water quality problems stem from the fact that the lake has a naturally low inflow of water, primarily groundwater, compared to the size of the lake basin and, consequently, has poor flushing. In addition, lakeshore residents are not on sewer lines and their septic systems were installed prior to state standards. Many of these sewage systems are at, or have exceeded, their useful life. The septic systems are problematic because of the high water table in the watershed. A further source of pollutants is highway runoff from Route 44, which abuts the lakeshore; this runoff has resulted in the nuisance growth of some salt-tolerant aquatic plants.

To study these problems and eventually restore the lake to its full range of recreational uses, the Rhode Island Department of Environmental Management (D.E.M.) applied to EPA's Clean Lakes Program for FY 1989 financial assistance to conduct a Diagnostic/Feasibility Study of Lake Washington. Although the restoration of Lake Washington is the ultimate goal of the project, the D.E.M. also hopes to use the lake as a prototype for restoration programs at other lakes in the state. A further consideration is the existence downstream of a large public park lake system, the George Washington Management Area, that includes Bowdish Reservoir. Rhode Island is anticipating that the restoration of Lake Washington will have a positive effect on the water quality of the reservoir and promote the funding of other water quality projects in the Management Area. A public education program will also be initiated to assist other lake associations in developing their own lake management programs. At present, there is a volunteer water quality monitoring program on the lake, coordinated by the University of Rhode Island. The diagnostic/feasibility study will determine the current status of the lake, identify causes of water quality degradation, omit sources of pollution, and evaluate control alternatives and implementation





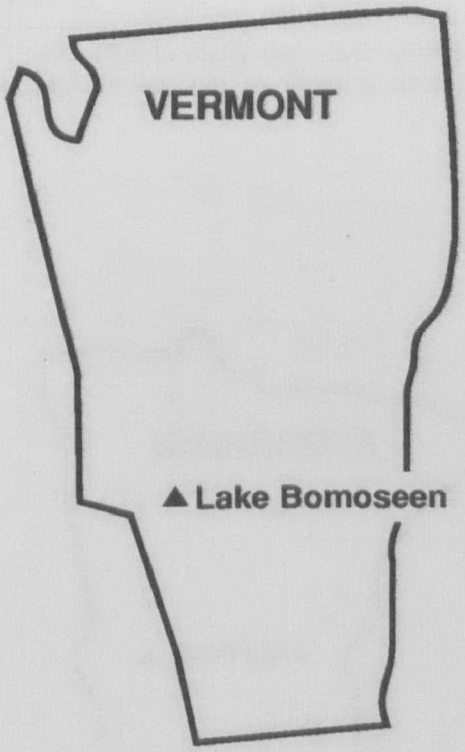
plans, including pressurized dosing septic systems. The D.E.M. received federal financial assistance in the amount of $98,413 from the Clean Lakes Program to be matched by $42,176 in state and local funds for the Phase I study. Although temporarily delayed due to problems in obtaining state funds, the diagnostic/feasibility study has been completed and a final report was submitted in FY 1991.

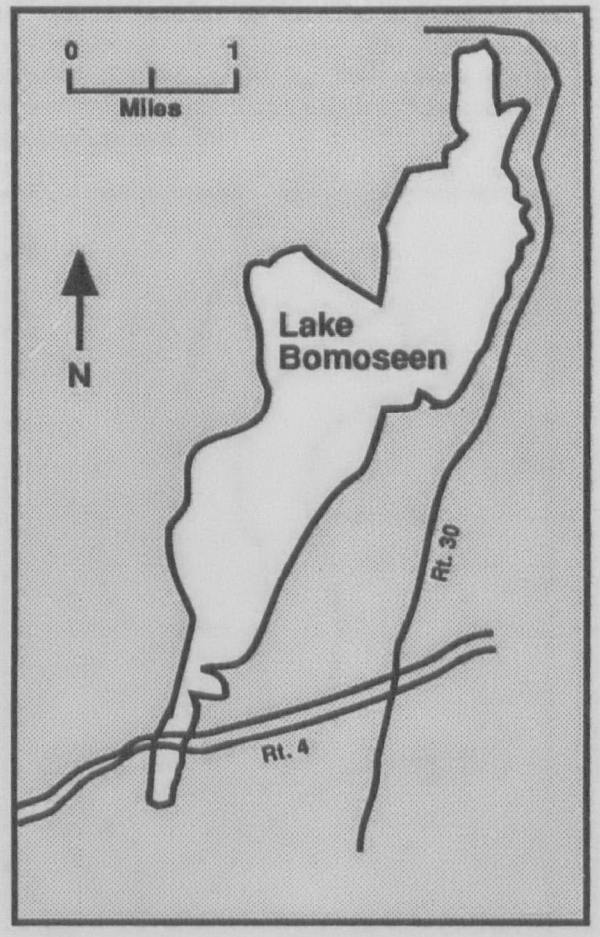
The final report identifies failing septic systems as the primary source of nutrients to the lake and recommends the construction of a centralized wastewater treatment system. The report also recommends in-lake work such as drawdown, harvesting, and algicides as needed; and watershed management activities such as revision of local land ordinances, rip rap and vegetative swells, land acquisition, and better maintenance of storm water drainage systems.

LAKE BOMOSEEN

Lake Bomoseen is the largest lake located entirely within Vermont. It covers 2,364 acres and has an average depth of 27 feet. As a result, the lake is a major recreational resource and contributes to the economy of the region. The lakeshore is densely developed with approximately 1,000 seasonal and year-round residences. One shore of the lake is sewered, and there are no known violations of NPDES permits. There are two public boat access areas, a state park, and a town beach area, as well as marinas and other businesses that directly or indirectly depend on the lake for revenue.

Prior to 1982, the lake had a nuisance population of the aquatic plant *Potamogeton crispus*, which was controlled by mechanical harvesting. Since then, however, another aquatic plant, the Eurasian milfoil, has spread rapidly in some areas of the lake. It is estimated that the plant now occupies over 600 acres of the lake out to a depth of 20 feet. The Eurasian milfoil coverage is very dense and has severely restricted recreational activities in and on the lake. Swimming has declined because plant congestion along the shoreline has made access to clearwater difficult; boat use and fishing have been impaired because the aquatic plants become entangled in propellers and fishing lines; other water activities such as water skiing, canoeing, and SCUBA diving in shallow areas have been curtailed; decaying plants cause an odor problem; and dead fish, algae, and debris are caught in the plant mats. The culmination of these effects has been less tourism and fewer recreational and economic opportunities.





Since the identification of the Eurasian milfoil, the Town of Castleton has been using mechanical harvesters to remove the plants from the lake's surface. However, this method has proven to be both ineffective and uneconomical in controlling the plant growth. The Vermont Department of Environmental Conservation (DEC) applied for funds from the U.S. Environmental Protection Agency Clean Lakes Program to implement a Lake Bomoseen Demonstration Program to evaluate a variety of milfoil control methods. The state hopes to apply the most effective method to the other 25 lakes in Vermont which also have a milfoil growth problem. Several control technologies have been proposed along with mechanical harvesting: drawdown, shallow dredging, sediment manipulation (fill), rotavating, hydro-raking, and diver-operated dredging. In 1977, Vermont received $74,640 under the Clean Lakes Program for the harvesting of aquatic plants and the permanent removal of nutrients. Vermont also requested $500,000 in federal funds for FY 1989; however, the state was unable to accept the grant offer because of the unavailability of required matching funds.

In 1989, staff of the Vermont DEC discovered a dramatic decline in milfoil growth in Brownington Pond, a 136-acre lake in northeastern Vermont. The decline appeared to be associated with the presence of three types of herbivorous (plant-eating) aquatic insects. As a result, in 1990, the DEC applied for, and was awarded, $588,000 in Clean Lakes Demonstration funds to conduct a 5-year research project on the use of herbivorous insects as a biological control for milfoil. The project involves determining the extent to which aquatic insects may have contributed to the milfoil reduction in Brownington Pond and whether Lake Bomoseen would be suitable for herbivore introductions.

SAUK LAKE

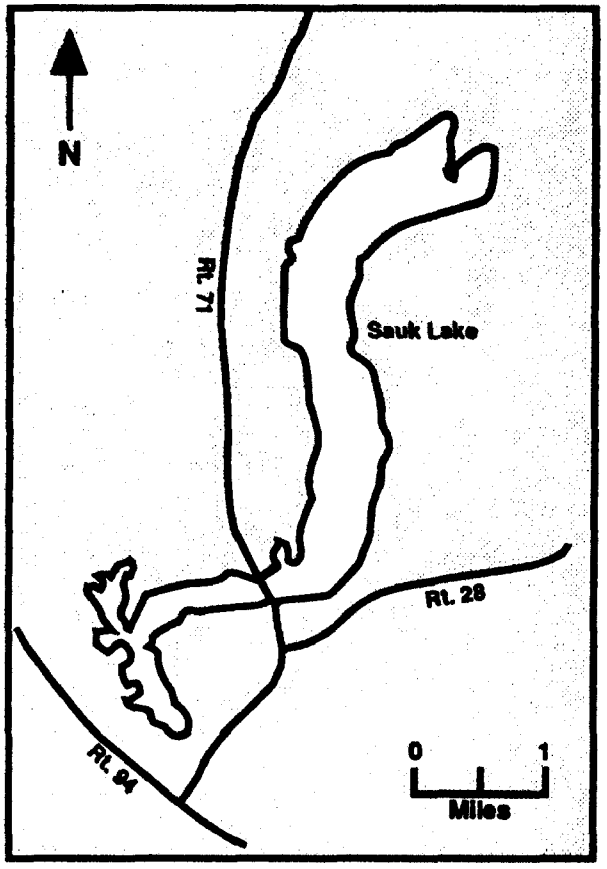
The Sauk River Headwaters Project includes Sauk Lake and its tributaries. The lake covers 2,111 acres in central Minnesota, with the watershed being a predominantly agricultural area encompassing 5 counties, 49 townships, and 28 cities.

In the recent past, Sauk Lake has been a major recreation area for water activities including water skiing, swimming, fishing, sailing, and log rolling contests. At present, such uses have been severely curtailed or entirely discontinued because of the excessive growth of aquatic plants.

The eutrophication and attendant growth of the aquatic plants, both algae and macrophytes, in Sauk Lake has resulted from heavy pollution, primarily phosphorus and sediments. The suspected sources of these pollutants are fields and feedlot runoff, effluents from wastewater treatment plants, septic systems, and food processing facilities. Although Minnesota has state programs that pertain to feedlots, the ongoing Diagnostic/Feasibility Study will examine how these programs apply to Sauk Lake.

In order to study the water quality problems in Sauk Lake and to develop restoration and protection options, the State of Minnesota received $100,000 from the Clean Lakes Program, to be matched with $42,857 in state and local funds, to conduct a Phase I Diagnostic/Feasibility Study. This study will determine the sources of pollution and select the best restoration and protection alternatives for Sauk Lake.

The U.S. Army Corps of Engineers (COE) is providing hydrological data, surveying lake vegetation, determining sediment chemistry, conducting water quality monitoring, assessing the need for and preparing a community education brochure, and conducting a nonpoint source pollution analysis through their Water Resources Study authorized under section 602 of the 1986 Water Resources Development Act. The Corps study was conducted during a period of relative drought and may not be representative of normal lake conditions. The Clean Lakes Project will complement the COE study through completion of an indepth assessment of land use activities and water quality monitoring in tributaries to assess nonpoint sources of pollution. The Sauk River Watershed District is in the final stages of the Diagnostic/Feasibility Study, which is expected to be completed by mid-1992.



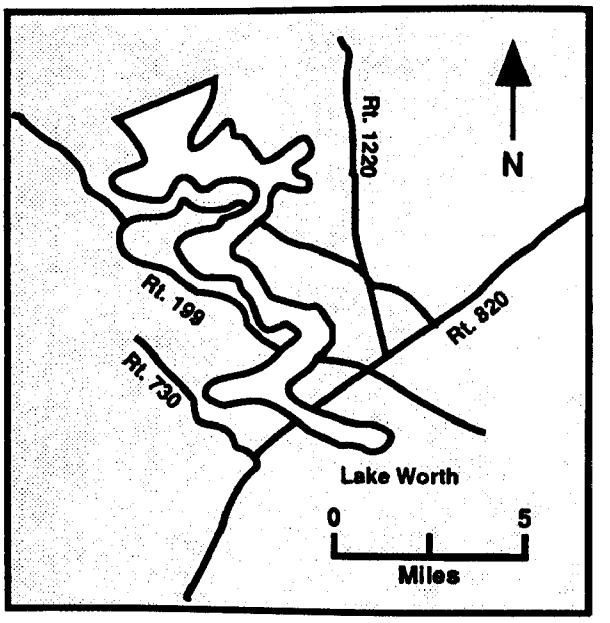
LAKE WORTH

Lake Worth is the primary source of drinking water for the City of Fort Worth, Texas. It is also a major recreational resource and is surrounded by almost 4,000 acres of public parks. Recreational uses of the lake include swimming, boating, water skiing, and fishing. Constructed in 1914, the lake has a surface area of approximately 3,550 acres.

In recent years, however, these activities have been impaired by siltation and the unchecked growth of aquatic plants in the shallow areas of the lake. Studies conducted over the last 30 years had recommended several methods for improving the lake. These include dredging; better wastewater management, particularly with regard to septic systems; improving nonpoint source controls in the parklands on the perimeter of the lake; and using effective watershed management practices. Three NPDES permits, including one for cooling-water blowdown, have been issued for facilities around the lake, and there has been good compliance for discharge levels.

In FY 1987, the Texas Water Commission applied to the Clean Lakes Program for financial assistance in the amount of $100,000 (state/local match of $42,857) to conduct a Phase I Diagnostic/Feasibility Study to determine the present condition of the lake and watershed, and to evaluate restoration and protection alternatives. The Diagnostic/Feasibility Study includes an one-year water quality monitoring program and a public participation program. The study has been completed with the cooperation of the U.S. Army Corps of Engineers.

Following completion of the Phase I study, the City of Fort Worth and the Texas Water Commission was awarded $1.7 million in Clean Lakes Program Phase II funds to help finance the implementation of the restoration alternatives selected. This will be equally matched by city funds, indicating the high level of community commitment to restoring the lake. The Corps of Engineers will



also assist the City of Fort Worth with Phase II of the project.

A draft workplan for the restoration project has been submitted, engineering designs are being prepared, and necessary permits are being obtained. The project is expected to include stump removal, wetland enhancement for nutrient uptake, and dam adjustment to raise the lake level and expand existing wetlands. The restoration efforts are being coordinated through an interagency planning committee composed of federal, state, and local entities.