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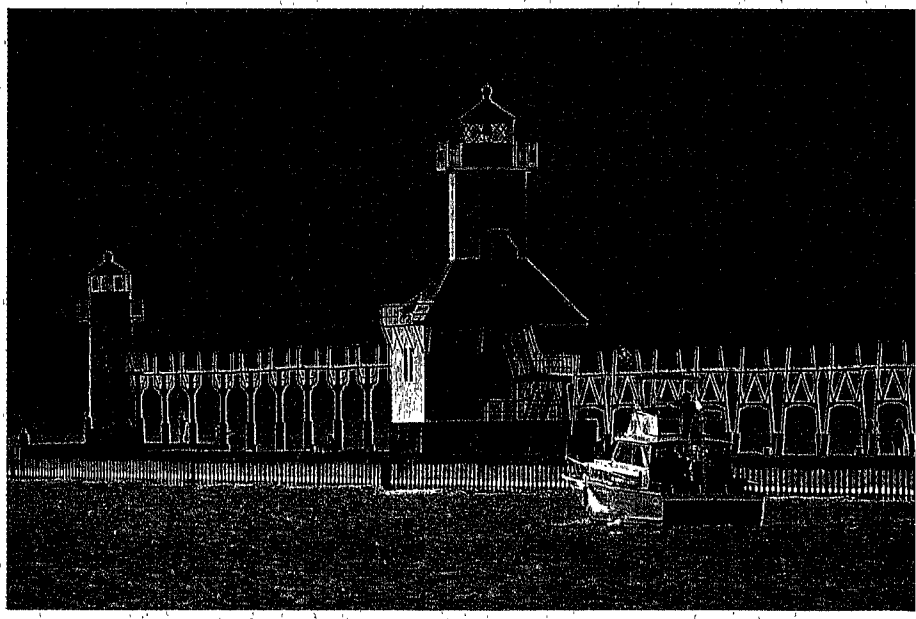
Great Lakes Demonstration Program Section 108a



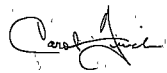
Foreword

The U.S. Environmental Protection Agency was created because of increasing public and governmental concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment.

An important part of the Agency's effort involves the search for information about environmental problems, management techniques, and new technologies through which optimum use of the nation's land and water resources can be assured and the threat pollution poses to the welfare of the American people can be minimized.

The Great Lakes National Program Office (GLNPO) of the United States Environmental Protection Agency was established in Region V, Chicago, to provide a specific focus on the water quality concerns of the Great Lakes. GLNPO provides funding for Great Lakes demonstration grants under Section 108(a) as well as provides personnel support to the International Joint Commission activities under the U.S.-Canada Great Lakes Water Quality Agreement. The Section 108(a) program was implemented by GLNPO in cooperation with other Federal, State, and local agencies and organizations.

The experience and lessons learned from the Section 108(a) program have had important implications with regard to point and nonpoint source remedial program development and implementation. The Section 108(a) program helped prepare the foundation for the Nation's effort in controlling nonpoint source pollution.



Carol Finch, Director

Great Lakes
National Program Office

Cover photo by David Kenyon,
Michigan Department of Natural Resources

Background

What is section 108a of the 1972 amendment to the Clean Water Act?

This section directs the US Environmental Protection Agency Administrator, in cooperation with other Federal departments and agencies, to enter into agreements with state or local agencies to undertake projects which demonstrate new and innovative technologies for reducing, preventing, or eliminating the movement of any pollutant material into the Great Lakes Basin. Projects funded by this section are required to demonstrate the engineering and economic feasibilities as well as the practicality of the technology with regard to pollutant removal and prevention.

What are the specific objectives of Section 108a?

The 108a demonstration projects primarily sought to reduce phosphorus pollution from point and nonpoint sources in both rural and urban settings within the Great Lakes Basin. Technologies were introduced to prevent overflows from sewers, improve malfunctioning septic systems, and improve phosphorus removal in wastewater treatment facilities. In addition, several agricultural best management practices (BMPs) primarily consisting of conservation tillage methods were evaluated. In some instances, the demonstration projects have sought to stimulate public interest in water pollution abatement by way of experimental education programs.

Three Types of Water Pollution Control Projects

The 108a demonstration projects are conducted to follow one of three approaches:

- Projects that are designed to demonstrate the effectiveness of a given control technology with the purpose of encouraging its adoption;
- Experimental projects that are intended to determine the practicality and the economic and engineering feasibility of a given control technology; and
- Remedial projects which are designed to use available technologies to restore or protect a water resource.

Ideally, pertinent technical and institutional information is acquired from experimental projects, and demonstration projects lead to enhanced acceptance of a particular technology. Ultimately, these efforts should culminate in widespread remedial projects and programs which address point and nonpoint source water resource problems in an efficient manner.

The Section 108a Program

From 1972 through 1985, funding was provided for thirty one 108a demonstration projects in the Great Lakes Basin. Based on the similarity of the technologies which they demonstrated, the projects can be categorized as multi-dimensional, accelerated conservation tillage, combined sewer overflow (CSO) abatement, land application of sewage and Anaerobic/Oxic (A/O) treatment plant digesters, and septic tank alternatives.

Multi-Dimensional Projects

Three large multi-dimensional nonpoint source projects were conducted in Allen County (Black Creek), Indiana; Washington County, Wisconsin; and Red Clay, located on the south shore of Lake Superior in Minnesota and Wisconsin.

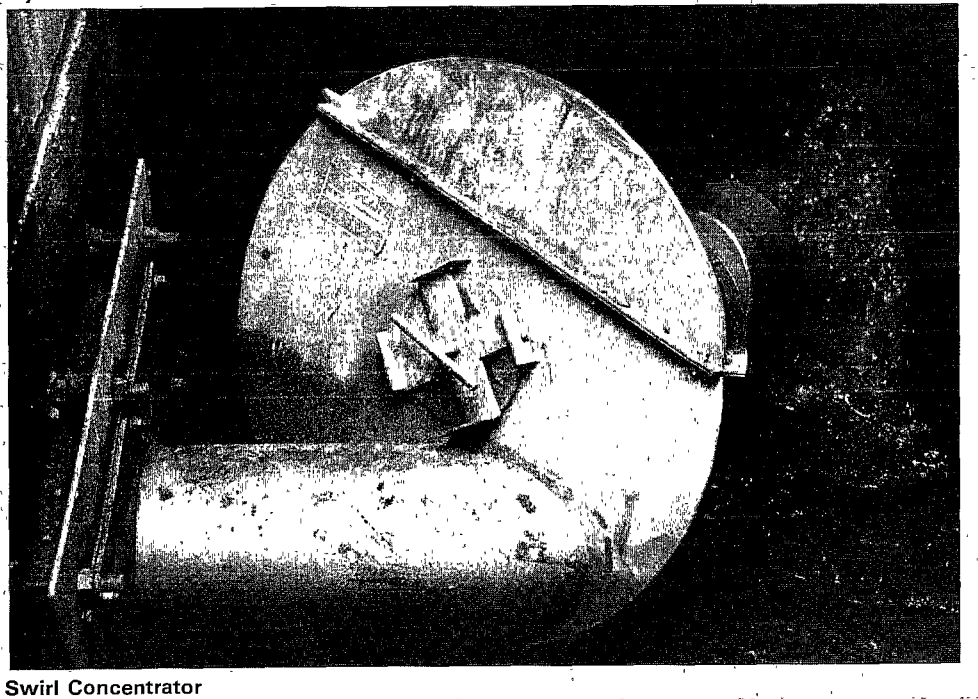
Whereas most 108a projects addressed a single goal or demonstrated a specific technology or practice, the major objective of the multi-dimensional projects was to demonstrate agricultural pollution control through implementation of a variety of best management practices, public information/education on water quality issues, and monitoring to assess changes in water quality relative to changes in management practices.

The pollution abatement goals of the Black Creek Project were focused primarily on agricultural problems, and investigated sociologic factors which affected farmer participation in the program. The Washington County Project addressed pollution problems arising from construction activities associated with urbanization, and investigated the need for erosion control ordinances in both urban and rural settings. The Red Clay Project addressed stream bank erosion problems and initiated research projects to develop and assess management practices for this widespread problem.

Accelerated Conservation Tillage Projects

Conservation tillage projects to demonstrate nonpoint source pollutant control strategies were conducted in 22 counties in Ohio, six counties in Indiana, four counties in Michigan, and two counties in New York. Project funds were used primarily to purchase no-till and conservation tillage equipment for use by area farmers without charge to them or for nominal rental rates to cover maintenance costs. Technical assistance was also provided to farmers who participated in the program to ensure proper application of the new tillage methods.

Hydrobrake

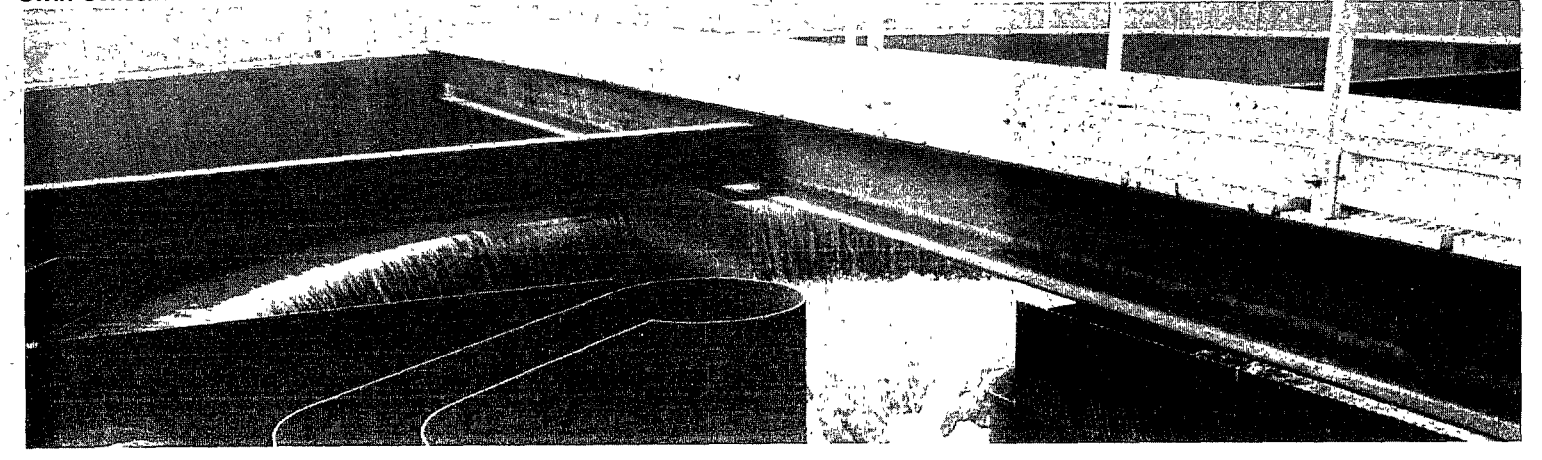


Combined Sewer Overflow Abatement Projects

In cities where domestic sewage, industrial wastes, and urban runoff are all routed through a combined sewer system, untreated overflow water may be discharged directly into adjacent waterbodies when the capacity of the systems is exceeded. The objectives of the CSO abatement projects were to increase the in-system storage capacity of sewer systems or to divert runoff or sewage in order to eliminate or decrease the frequency of overflow to adjacent surface waters.

Existing CSOs were evaluated in Rochester, New York; Cleveland, Ohio; and Saginaw, Michigan for alternative renovations. Vortex control valves with associated storage were utilized to control flows in most of the studies. In addition, the projects demonstrated technological changes in sewage treatment and land treatment BMPs to control runoff volumes.

Swirl Concentrator



Land Application of Sewage and the Anaerobic/Oxic (A/O) Treatment Plant Digester Projects

Demonstration projects for land application of sewage included the ponds at Michigan State University, an overland flow project in the Village of Paw Paw, Michigan, a crop irrigation project in Muskegon County, Michigan, and a sludge application project on forest land in Montmorency County, Michigan. For most of these systems, wastewater pretreatment was accomplished by biological methods or in holding ponds. The holding ponds were also evaluated for alternative sewage treatment. Another demonstration project was devoted specifically to the A/O process, a secondary treatment technique employed for phosphorus removal.

For each project, water quality changes were measured throughout the treatment process, and the effect of sludge application on vegetation and animals was monitored.

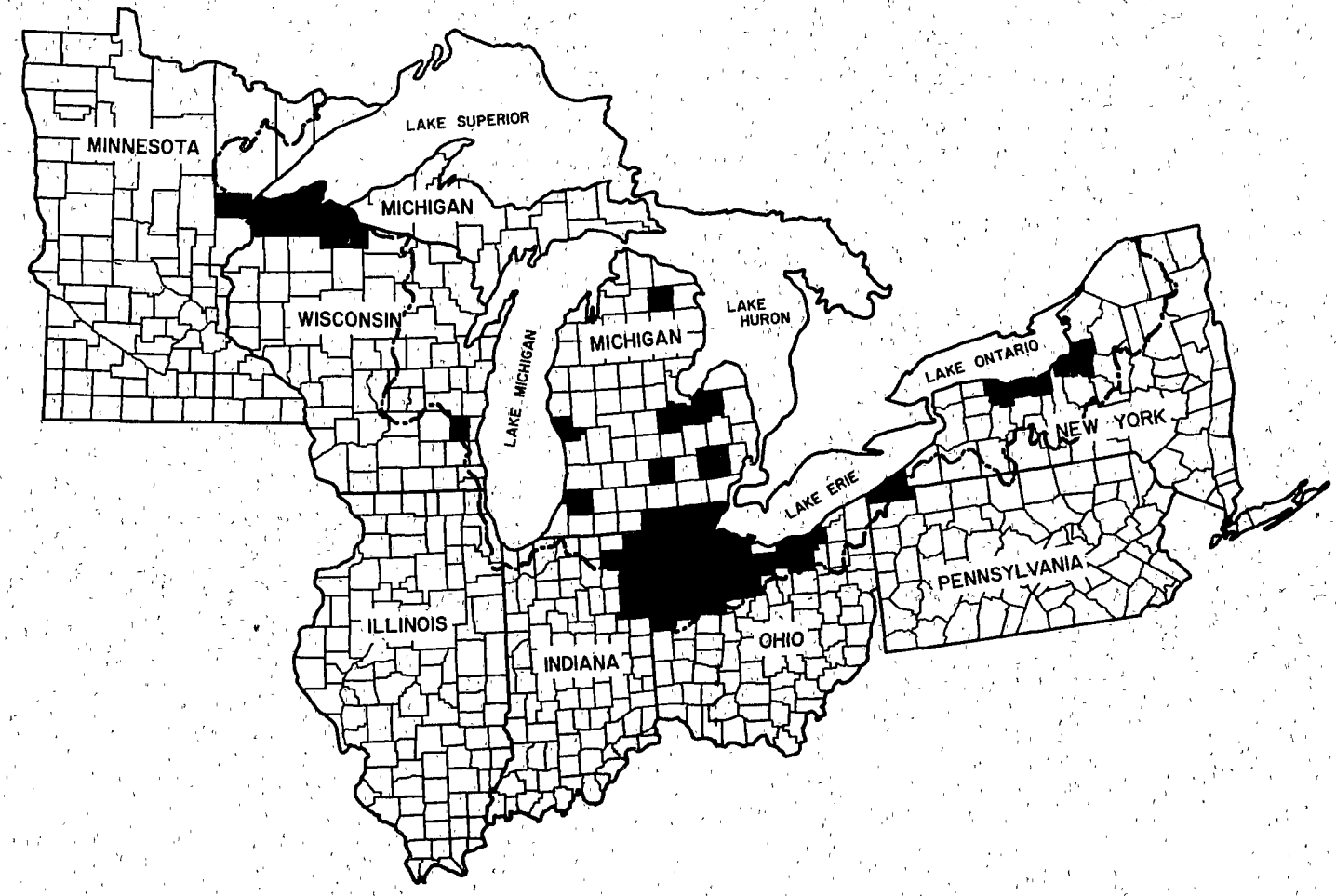
Sludge Application

Septic Tank Alternatives

These projects evaluated alternatives to conventional septic systems that function inadequately in areas of poor soil drainage. Septic system improvements were made and water usage monitoring was conducted in Steuben County, Indiana and Allen County, Ohio.

	Location	Dates
Multi-Dimensional Projects	Black Creek, IN	1972-1977
	Black Creek, IN	1977-1980
	Washington Co, WI	1974-1978
	Washington Co, WI	1979-1981
	Red Clay Project, WI, MN	1974-1978
Accelerated Conversion Tillage Projects	Allen Co, OH	1980-1985
	Defiance Co, OH	1980-1985
	Lake Erie Basin, OH	1981-1985
	Six Counties in IN	1981-1985
	Bean Creek, MI	1981-1985
	Otter Creek, MI	1982-1986
	Tuscola Co, MI	1980-1983
	Oswego Co, NY	1982-1985
	Wayne Co, NY	1982-1985
Combined Sewer Overflow Projects	Rochester, NY	1974-1977
	Rochester, NY, BMPs	1977-1982
	Cleveland, OH	1979-1983
	N.E. Cleveland, OH	1980-1985
	Saginaw, MI	1979-1984
Land Application of Sewage Projects	East Lansing, MI	1972-1975
	Muskegon, MI	1972-1975
	Muskegon, MI	1980-1981
	Montmorency Co, MI	1980-1985
	Paw Paw, MI	1980-1986
Septic System Alternatives Projects	Great Lakes Basin, IN	1980-1984
	Allen Co, OH	1980-1985
A/O Treatment Plant Digester Project	Pontiac, MI	1983-1985
Background Water Quality Assessment Project	Cleveland, OH	1971-1974
Project Data Incorporated into Basin Water Quality Management Plans	S.E. Michigan	1971-1973
	Erie, PA	1971-1973
	Muskegon, MI	1976-1978
	Cleveland, OH	1980-1983

Distribution of 108a Projects Among Great Lakes States



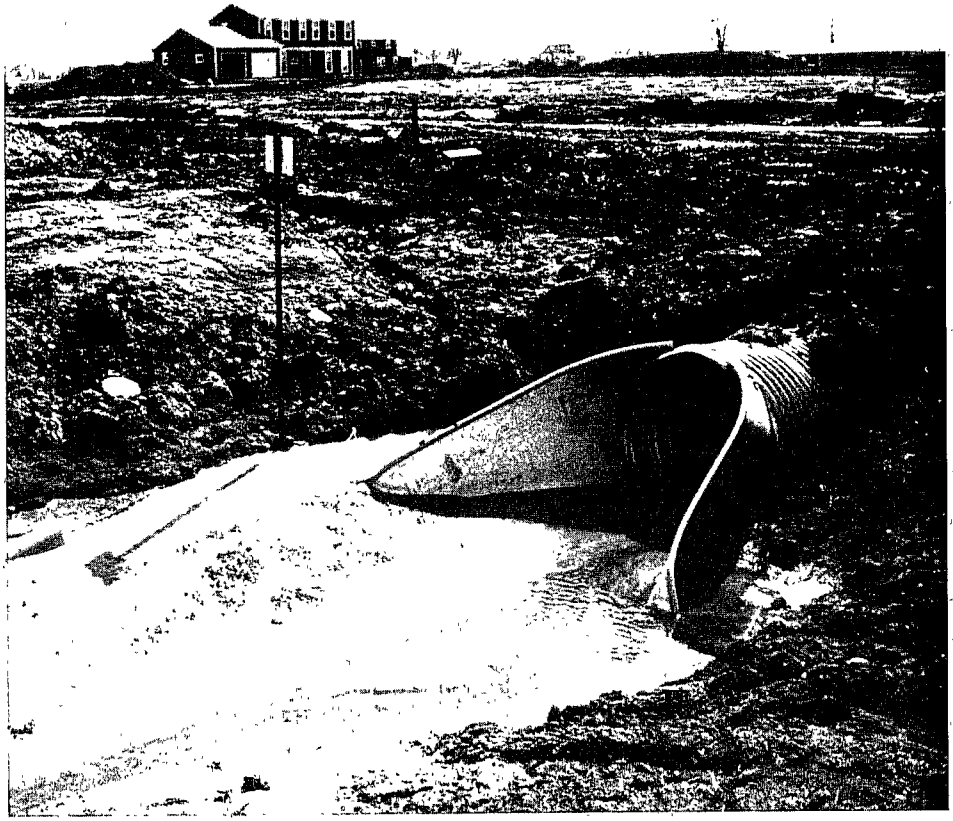
108a Demonstration Project Results

Multi-Dimensional Projects

Black Creek, Indiana

The Black Creek Project was a landmark pioneering effort for future watershed-level agricultural nonpoint source control efforts. This demonstration project provided important information regarding streambank erosion, sediment basin effectiveness, and water quality monitoring requirements which would be beneficial to subsequent programs. In addition, it achieved an almost unparalleled degree of public support and landowner participation, including high participation from the historically more isolated Amish community. The success of this project came, in large part, from putting as high a priority on public participation and input as on technical solutions.

Additionally, a computer model, Areal Nonpoint Source Watershed Environment Response Simulation (ANSWERS), was developed to provide a method for estimating BMP effectiveness. Based on the results of the project, it was speculated that if the conservation practices utilized in the demonstration were implemented across the entire Maumee River Basin, the sediment and phosphorus loadings to Lake Erie would decrease by 50% and 25% respectively.



Washington County, Wisconsin

Washington County had the most extensive education program, which included the development of grade school and secondary school curricula dealing with water quality and water pollution issues. In addition, an extensive county-wide education program targeted for a variety of audiences demonstrably increased public awareness of soil conservation and water quality.

Two model sediment control ordinances, one to control agricultural sources of pollution and the other to control urban sources of sediment, were researched extensively and drafted. The county passed the subdivision ordinance aimed at construction site erosion control. Although the agricultural erosion measures were not adopted by the county as an ordinance, the Soil and Water Conservation Districts passed the standards and objectives as a resolution, thus indicating a changed attitude and a greater commitment to soil conservation goals.

Water quality monitoring two years after adoption of several agricultural BMPs showed that total phosphorus, nitrogen, and sediment yield had decreased.

Red Clay, Minnesota and Wisconsin

Despite the problems associated with the differences in state and county jurisdictions, five Soil and Water Conservation Districts (SWCD) from Minnesota and Wisconsin jointly managed a basin-wide research and demonstration project.

A low cost system was developed for continuous monitoring of precipitation, wind, air, and soil parameters at remote, unmanned sites. In addition, shoreline stabilization structures were constructed which accomplished short-term erosion control. It was concluded from the extensive surveys that the major cause of streambank erosion was natural, accelerated because of forestation changes since the turn of the century, and that the red clay sediment, although aesthetically unpleasing, caused little impairment to aquatic biota.

As a result of the Red Clay Demonstration Project, the Wisconsin Department of Transportation was able to save millions of dollars in maintenance costs by modifying the design of highway roadbeds that were being reconstructed along the southern shore of Lake Superior.

Accelerated Conservation Tillage Projects

From 1979 to 1986, conservation tillage demonstration projects were funded in 34 counties in the Lake Erie Basin, Michigan, Indiana, Ohio, and New York. The use of conservation tillage practices increased significantly in those counties. The results of the studies demonstrated that whereas crop yields from no-till are comparable to those from conservation tillage practices, the time saving and dollar returns with no-till are attractive. Erosion reduction was estimated to range between 2 to 17 tons/acre-year. The ridge-till practice was shown to be an effective alternative in situations where no-till was proven to be less than optimal or impractical. Although phosphorus loadings were shown to decrease with conservation tillage practices, careful fertilizer management was also recommended to ensure minimal phosphorus and nitrogen runoff.

Combined Sewer Overflow Projects

Five 108a projects to demonstrate overflow abatement were performed in Rochester, New York; Saginaw, Michigan; and Cleveland, Ohio between 1974 and 1986. The major strategies demonstrated in all three cities were controlled sewer flow and increased sewer storage capacity, but changes in sewage treatment were also demonstrated in Rochester and Saginaw.

Of the several sewage treatment alternatives examined in Rochester, New York for high rate primary treatment of increased sewage volumes, swirl concentrators and flocculation/sedimentation devices were considered equally cost-effective. Computer models were shown to be useful for evaluating a variety of expensive alternatives without actually implementing them. The projects conducted in Rochester, New York also demonstrated that although such labor-intensive activities as street cleaning and field inspections of sewer systems could yield short term results, they were expensive for long term use. Controlling sewer flows and adapting sewage treatment plants to handle storm flows, on the other hand, were done effectively at relatively low cost.

Installation of hydrobrakes (vortex valves) and swirl concentrators in the Saginaw, Michigan CSO increased the in-line storage capacity and consequently decreased the overflow of untreated sewage into the Saginaw River. The flow change resulted in decreased loads of biochemical oxygen demand (BOD), suspended solids, and total phosphorus as well.

Installation of a hydrobrake in the Cleveland, Ohio CSO resulted in an increase in flow control and in-line storage space and a decrease in the frequency of basement flooding in area homes.

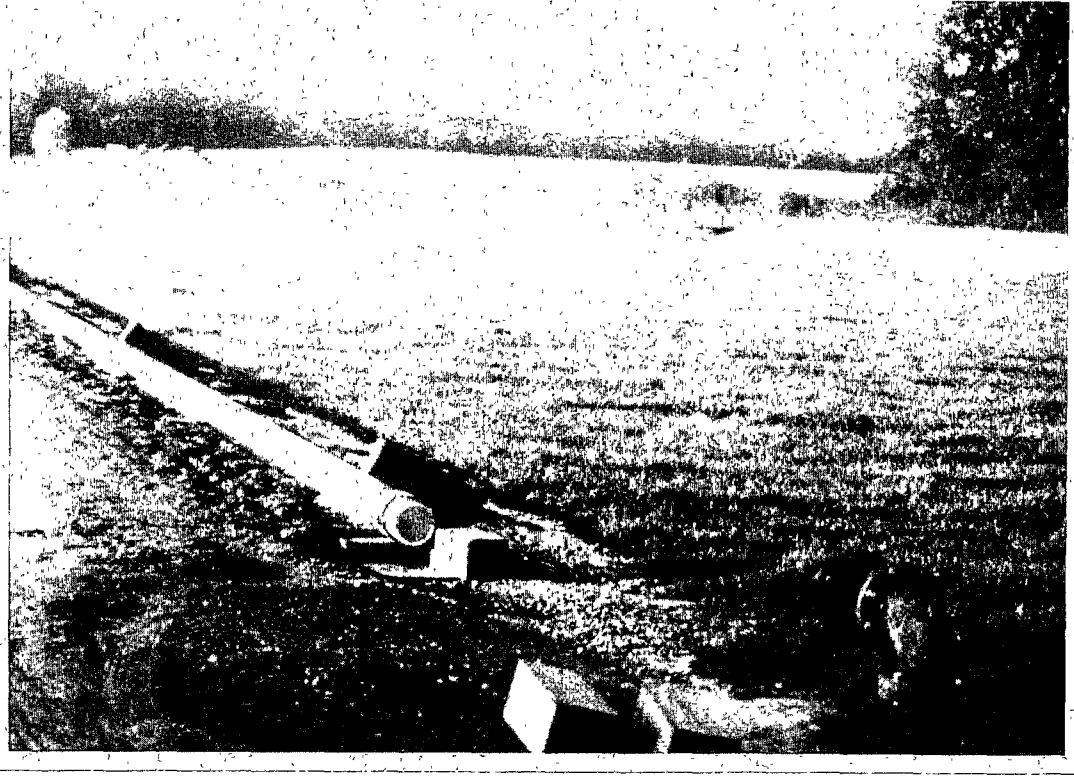
Land Applications of Sewage and the Anaerobic/Oxic (A/O) Treatment Plant Digester Projects

Results of the land application demonstration projects suggest that treatment of sewage by land application is more cost-effective than other common treatment methods. Water quality monitoring showed that diverting sewage effluent to land application areas improved the quality of receiving lakes by reducing phosphorus and nitrogen loadings.

These projects have demonstrated feasible approaches to reducing wastewater pollutant loadings to surface waters. These practices also appear to be more economical than conventional treatment methods, particularly when recovery of some of the costs of treatment through the sale of forage crops is considered.

As a result of the A/O treatment plant digester demonstration, which involved a sequential anaerobic and aerobic secondary treatment, increased phosphorous removal and ammonium nitrification were realized.

Overland Flow Distribution Pipe



Impact of the 108a Projects

Phosphorous loadings have been identified as a key factor in the degradation of freshwater lakes including the lower Great Lakes. Specifically, phosphorus has been identified as a problem in Lake Erie, Lake Ontario, and Saginaw Bay in Lake Huron. A 1983 supplement to Annex 3 of the 1978 Great Lakes Water Quality Agreement confirmed target loads for reduction of phosphorus in the lower lakes needed to restore water quality. The phosphorus load reduction plans developed and implemented by the States of Indiana, Michigan, Ohio, Pennsylvania, and New York relied heavily on the lessons learned from 108a demonstration projects concerned with controlling phosphorous.

- State-implemented Remedial Action Plans that clearly address the need to reduce phosphorus in the Great Lakes have also borrowed from the wealth of information generated by the 108a demonstration projects.

- The 108a multi-dimensional projects pioneered many methods used in subsequent nonpoint source control programs (RCWP, Special ACP, and MIP) and demonstrated the importance of one-on-one technical assistance to sustained landowner participation for creating a successful nonpoint source (NPS) program.

- During the Black Creek demonstration project, the development of a computer simulation model to identify critical areas and to predict treatment effectiveness preceeded an increased critical area emphasis in subsequent land treatment and water quality programs. This is becoming a standard component of new NPS projects.

- Of all available agricultural best management practices (BMP) for phosphorus control, conservation tillage and fertilizer management were found to be the most cost-effective alternatives.

- Land application of sewage was shown to be highly effective for reducing municipal phosphorus loadings.

- State NPS programs have been altered or established as a result of lessons learned such as the Wisconsin Nonpoint Source Abatement Fund.

- The national NPS program has profited from the 108a projects in establishing guidelines for the implementation of NPS controls.

The experience and lessons learned from the 108a program have important implications with regard to protecting lakes and rivers from the effects of point and nonpoint source pollution. Specifically, we have come to recognize the importance of public awareness and participation in clean water goals, the practical necessity of targeting NPS control efforts to the most critical areas, and matching the specific water quality impairment to the most effective land treatment.

The 108a program has also provided valuable insights into obtaining landowner participation and designing NPS water quality monitoring programs. Finally, the program has lent some much-needed optimism that the effects of nonpoint source pollution can be moderated substantially using specific low-cost runoff management systems.