Long Term Dredged Material Management Plan
Within the Context of
Maumee River Watershed Sediment Management Strategy

Executive Committee Phase 4 Report with Environmental Assessment

Toledo Harbor, Ohio

April 2001

Toledo Harbor Long Term Management Strategy

Executive Committee

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Toledo Harbor Planning Group
Long Term Management Strategy

U.S. Army Corps of Engineers

U.S. Fish and Wildlife Service

U.S. Environmental Protection Agency

U.S. Natural Resources Conservation Service

Ohio Environmental Protection Agency

Ohio Department of Natural Resources

Toledo-Lucas County Port Authority

Michigan Dept. of Natural Resources

The City of Toledo

Maumee River Remedial Action Plan Committee

ORGANIZATION OF PHASE 4 REPORT

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(Technical Report and Attachments under Separate Cover)

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EXECUTIVE SUMMARY

I. INTRODUCTION

The Port of Toledo is one of the most dynamic ports on the Great Lakes. It serves the domestic bulk markets, as well as the international general cargo markets, and the ship repair and construction industry. Cargo movements through the Port of Toledo have exceeded 40 million tons in the past. However, changes in environmental rules and the Midwest economy have diminished the total tonnage but not the significance of the Port to the local economy.

Over the past 10 years port tonnage has averaged 13 million tons. The primary cargoes include coal, iron ore, grain, liquid and dry bulk as well as general commodities. Toledo is also a full service port with shipyard repair and construction capabilities. The economic impact of the port to the local economy is over $500 million a year with over 5,000 jobs dependent on port activities. Access to efficient waterborne transportation continues to be a primary selling point in the area's development and marketing efforts.

In addition to the Port's significance to the local economy, the environmental quality of Lake Erie plays an important role in the overall health of the region. In addition to the region's transportation needs, Lake Erie provides the drinking water to the area, is a source of water for industrial users, and is a major source of recreational activities including swimming, boating and fishing.

The unique nature of the western basin of Lake Erie, which supports the transportation and recreational activities, requires special stewardship. The western basin is a shallow water habitat, which supports a productive fishery but also requires extensive dredging to maintain a viable navigation channel. Heightened environmental safeguards have helped protect the delicate ecosystem. The passage of the Clean Water Act in the early 1970's provided for better waste water treatment, controlled pollutants from point sources and led to the construction of confined disposal facilities (CDFs) for the placement of sediment removed from Federal navigation channels. All these steps have contributed to the tremendous water quality improvements experienced by Lake Erie over the past 25 years. It was also accomplished in a manner sensitive to the needs of the maritime community.

After years of water quality improvements, various concerns were raised regarding existing dredge material management practices including the need for confined disposal of sediment and the impact of CDFs on the fisheries. As confined disposal capacity diminished, increased scrutiny was focused on the best long-term option for the management of sediment removed from the Federal navigation channel. Some Federal, state and local agencies wanted to maintain the practice of confining all Dredge material. However, the U.S. Army Corps of Engineers, concerned about providing continued maintenance of the federal navigation channels in a cost-effective and environmentally acceptable manner, favored extending the life of existing and future facilities by relying on open lake disposal of suitable dredge material. Additionally, the U.S. Fish and Wildlife Service and the Ohio Department of Natural Resources, concerned about the loss of bottom land and the impact on the fish habitat, expressed reservation regarding the construction of any new or expansion of existing CDFs.

As a result of these concerns, a thorough reevaluation of the existing dredge disposal practices was initiated in 1985. This reevaluation was prompted due to a change in policy by the U.S. Army Corps of Engineers which, in order to extend the life of the existing CDF, implemented a practice of open lake disposal. At that time approximately 60% of the sediment removed from the Federal navigation channel was placed in the open lake with 40% of the material confined. At the same time the U.S. Army Corps of Engineers initiated its planning effort for an expansion of the confined disposal facility referred to now as Cell 1.

The reevaluation of the disposal practices involved a number of different stakeholders. The city of Toledo expressed alarm regarding the impact of open lake disposal on its water intake and treatment needs. Ohio Environmental Protection Agency (OEPA) expressed concerns regarding its ability to meet its phosphorous reduction program as required in the Water Quality Agreement between the U.S. and Canada. U.S. Fish and Wildlife and the Ohio Department of Natural Resources raised the issue of habitat preservation as it relates to the construction of any new CDF.

The U.S. Army Corps of Engineers expressed concern about the cost effectiveness of the disposal of sediment considering the environmental quality of the material. The Port Authority's concerns involved the need to maintain the Federal Navigation Channel and the operation of the Port of Toledo. These issues were discussed in light of the need for a 401 Water Quality Certification provided by the OEPA regarding open lake disposal practices and the Army Corps of Engineers need to annually dredge Toledo Harbor Channels. After several years of sometimes contentious debate, the Assistant Secretary of the Army for Civil Works, in 1992, required the establishment of a long term sediment management strategy working group to develop a mutually acceptable long term plan for the management of harbor sediments.

II. STATUS OF LONG TERM SEDIMENT MANAGEMENT STRATEGY (LTMS)

In 1992, the LTMS working group agreed to perform this study effort in a 5-phase approach. To date, the group has completed three reports, which summarize the first three phases. The Phase I study report provided an overview of the history of the dredging situation in Toledo and the debate which had taken place regarding open lake disposal and other sediment management strategies. The Phase II report, as required by the National Environmental Policy Act process, listed all the options available for sediment management. Many of these options were eliminated from further consideration due to cost, engineering feasibility or public acceptance criteria.

The Phase III report focused on those management strategies, which met the committee's criteria and were carried through for further investigation. The Phase III report accomplished a number of objectives. First it established an interim period in which to study and implement various management strategies. It modified the Army Corps of Engineers disposal practice by minimizing the amount of dredge material disposed of in the open lake. It also set out a three-part strategy for managing the sediment in the Port of Toledo. The strategy included 1) soil erosion control; 2) recycling and reuse; and 3) capacity expansion. The Phase IV report documents the progress in implementing some of these management strategies, and provides recommendations for future actions and study.

SOIL EROSION CONTROL

As the Maumee River is the largest tributary emptying into the Great Lakes it is also the largest contributor of sediment to the system. It drains a basin of over 3.2 million acres stretching from Fort Wayne, Indiana to Toledo, Ohio. Over 3 million acres is cultivated cropland. According to the U.S. Geological Survey, farm runoff annually contributes 2.4 million cubic yards (CY) of sediment to the Maumee River, of which 33% (790,000 CY) is deposited in the Federal navigation channel. This corresponds well to 800,000 CY the Corps annually dredges to keep the port of Toledo open. In order to minimize the flow of sediment into the Maumee River and subsequently into the Federal navigation channel, enhanced erosion control efforts were implemented.

The Natural Resources Conservation Service (NRCS) initiated these efforts with $750,000 in financial assistance from the U.S. Army Corps of Engineers to implement and expand a Conservation Tillage Program. This effort allowed the NRCS to demonstrate to farmers in the Maumee River drainage basin the techniques and the benefits of such conservation tillage practices. The results have shown that with a concerted effort and financial support of this Conservation Tillage program, the NRCS can successfully bring more acreage into the program.

In addition to the Conservation Tillage program, the NRCS has expanded its effort to include a Buffer Zone Program initiative throughout Northwest Ohio. This effort uses financial incentives to encourage farmers to create a buffer zone between farm fields and ditches, creeks and rivers. These buffer zones, consisting of grassy or wooded areas, help trap sediment which would otherwise be deposited in the waterway and eventually into the Maumee River. In 1999 the State of Ohio included $4 million in the Biennium Budget for the Conservation Reserve Enhancement Program which will leverage $20 million in Federal money to expand the Buffer Zone Program.

To continue with the successful effort initiated by the NRCS, additional financial support will be needed. To fully implement the Conservation Tillage Program $1.6 million is needed annually for the Maumee River basin effort to supplement the existing Department of Agriculture Budget. In addition, the State of Ohio and the Federal government need to continue funding the Conservation Reserve Enhancement Program to allow for the full impact of these conservation efforts.

RECYCLING AND REUSE

In 1986, The Toledo-Lucas County Port Authority entered into an agreement with S & L Fertilizer to initiate the recycling program. This effort started on an 11- acre parcel located at the Port's general cargo facility. The effort tested the use of treated city sewage sludge, lime sludge and dredge material to make commercially viable topsoil. The sewage and lime sludge are both products that municipalities pay to dispose of. S & L Fertilizer was able through this effort to develop a formula of the appropriate combination of the three waste products and produce high quality topsoil. However due to the nature of the sewage sludge in the topsoil product, known as Nu Soil, the use of the material is restricted. According to the Ohio EPA the material can only be placed in areas with restricted public access unless it is stored for up to 1 year when the freeze-thaw cycle will eliminate any possible pathogens resulting from the use of processed city sewage sludge. The Army Corps of Engineers built on the experience developed between the Port Authority and a local company, and initiated an effort to produce a non-restricted use material. The Army Corps of Engineers effort combined yard waste, N-VIRO soil amendment and dredge material to produce a "Class A", non-restricted use topsoil.

In order to further the recycling/reuse initiative, the Toledo-Lucas County Port Authority has initiated a demonstration program of the different technologies and uses of the material. Three companies responded to a request for proposal from the Port Authority and each has been provided 33 acres of land at the Port's confined disposal facility to demonstrate the commercial feasibility of their product. The producer of Nu Soil will expand on its existing program of using sewage sludge and lime sludge mixed with dredge material. The second company's effort will involve mixing fly ash with dredge material to produce a construction grade material. Finally the third company will be using yard waste mixed with dredge material to produce high quality topsoil. The demonstrations are anticipated to last through June 2001 and, depending upon the success of the effort, the companies may be granted a long-term lease or license to develop their business.

The only funds being sought at this time are from the U.S. EPA. The funds would be used to help develop the infrastructure necessary to move material into and out of the confined disposal facility. It is anticipated that approximately $500,000 would allow for the constructions of a second access bridge to the facility and upgrade the access roads.

CAPACITY EXPANSION

Several efforts were undertaken by the U.S. Army Corps of Engineers to investigate the prospect of expanding the capacity of existing CDFs. The first effort was to look at better management techniques of dredge material. The U.S. Army Corps of Engineers implemented a process of trenching Cell 1 of the existing confined disposal facility to enhance the runoff of moisture from the dredge material. This enhanced drainage system allowed for accelerated consolidation of material and provided some 1.5 million cubic yards of restored capacity at the confined disposal facility. This has improved the efficiency and use of the confined disposal facility. However, It is not a long-term solution to the capacity issues facing the Toledo Harbor project.

In addition to taking steps to de-water the existing facility, steps would be taken to maximize the use of the design capacity of the disposal area. As part of the trenching process, dredge material would be piled inside the dike wall, slightly above the existing dike height. When material is then pumped into the dike facility in the future it will allow for the total capacity of the facility to be utilized instead of filling the dike facility to a level two feet below the existing dike height.

The U.S. Army Corps of Engineers also investigated the prospect of raising the dikes at the existing confined disposal facilities. This investigation was intended to determine the technical feasibility of raising the dikes with on site material, as well as the cost of such an effort. Experiments were completed in both 1998-99 and demonstrated the practical feasibility of raising the dikes. It was determined that this is a very cost-effective way of adding additional capacity at the existing confined disposal facilities. These are short- term remedies, which can be implemented while a long-term strategy is being developed. On the other hand, raising of the dikes does pose a problem for the potential future use of facility #3. The higher the dikes are raised the less accessible the property is for marine, park or other uses.

In order to look at a longer- term solution while being sensitive to the concerns of the U.S. Fish & Wildlife Service and Ohio DNR, the Port Authority has investigated numerous means of utilizing the Woodtick Peninsula as a disposal site. The Woodtick Peninsula is located in the Southeasternmost corner of the State of Michigan. Over the last 100 years the Peninsula has been subject to a tremendous amount of erosion and is in danger of being lost forever. The wave and periodic high water levels which threaten this peninsula also threaten 1,400 acres of wildlife area located inland of the Peninsula.

Consequently the Port Authority undertook several investigations into means of rebuilding the Woodtick Peninsula. The first effort investigated the construction of a reinforced spine down the middle of the peninsula which would then have dredge material pumped onto the spine, thus rebuilding the peninsula. It was understood that this would act as a sacrificial measure with the wave action, in time, eroding away the material after it was placed on the Peninsula.

However, the Woodtick Peninsula is a popular habitat for bird populations feeding off sandy beaches. Consequently, the Michigan Department of Natural Resources requested that the Port Authority investigate an offshore facility, which could act as a protective barrier for the Woodtick Peninsula as well as a confined disposal facility. A preliminary environmental analysis has been completed demonstrating the capability of building such a facility and addressing many of the issues surrounding such a facility. The Michigan Department of Natural Resources and Department of Environmental Quality has requested additional information regarding the potential impacts of this facility on the surrounding shallow water habitat. As part of the Woodtick Peninsula project, consideration will be given to innovative CDF design, which will not only provide additional capacity but also enhance wildlife habitat and other environmental benefits.

While the Woodtick Peninsula has been investigated it is still uncertain whether it will be deemed politically and environmentally acceptable as a long-term disposal area for material removed from the Toledo Federal navigation channel. Consequently the Army Corps of Engineers has investigated the potential for expanding the two existing confined disposal facilities, Island 18 and facility # 3. Both areas would offer a cost-effective means of providing disposal space compared with existing capacity cost. However the acceptability of such expansions are still in question with the U.S. Fish and Wildlife Service and the Ohio Department of Natural Resources as well as local interest. The City of Oregon, Ohio has expressed grave concern regarding any attempt to expand Facility #3. Consequently, efforts to move forward with any horizontal expansion of facility #3 have been eliminated.

The cost of the options being investigated, Woodtick Peninsula and Island 18, range from $17- $60 million, depending upon the capacity to be established. The relative value of the disposal space versus the construction cost is within the economically feasible realm necessary to move forward. However each project needs to demonstrate its acceptability as not only a confined disposal facility but also provide environmental benefits to the region. In the near term however additional funding will be needed to respond to the request made by the Michigan Department of Natural Resources and Department of Environmental quality.

`III. RECOMMENDATIONS OF THE EXECUTIVE COMMITTEE

Acting on directives from the Secretary of the Army and the Water Resources Development Act of 1992 to develop a Long Term Management Strategy (LTMS) for Toledo Harbor, the Executive Committee concludes:

> **IT IS THE GOAL OF THE LTMS TO DEVELOP A PLAN AND MANAGEMENT STRATEGY THAT WILL PROVIDE FOR THE BENEFICIAL REUSE OR DISPOSAL NECESSARY OF DREDGED MATERIAL IN AN ENVIRONMENTALLY ACCEPTABLE AND COST EFFECTIVE MANNER.**

To that end, the Executive Committee recommends:

A. Immediately implement a LTMP that will involve:

1. Dredging and Material Disposal
2. Confined Disposal Facility Management
    a. Trenching to de-water the CDFs and extend their capacity.
    b. Maximize existing CDF capacity by filling to the existing dike height
3. Sediment Recycling and Beneficial Reuse
4. Sediment Load Reduction by Agricultural Practices
5. Modification of Island 18 site by 2007
6. Monitoring and Evaluation of LTMP components and provisions for modifications

B. While management practices are being performed that maximize use and utilize full capacity of existing CDFs, fully evaluate and select by 2003 long-term options from a list including:

1. Creation of protective barrier CDF at Woodtick Peninsula
2. Development of a long-term use plan for facility # 3, not including horizontal expansion
3. Horizontal and vertical expansion of Island 18
4. Evaluation of other confined/partially confined disposal/new landform options

C. In order to judge the adequacy of the overall strategy, it is essential to develop and maintain an evaluation program of various management practices to determine benefits that each practice is providing to the LTMS goals. This evaluation program *(Item A.6 above)* will also assure that the practices are being developed in accordance with the LTMS shedule so that the dredged material management practices are available as needed.

IV. RESPONSIBILITIES FOR IMPLEMENTATION

The Executive Committee recognizes that it cannot compel authorizing legislatures, counsels and boards to commit resources towards the LTMS. However, various agencies need to take a lead role to ensure the successful implementation of the Phase IV Report recommendations. The Executive Committee recommends that following actions be taken and agencies be responsible for their implementation:

- During the near term, the U.S. Army Corps of Engineers would maintain its ongoing practice of open lake disposal of only those materials removed lakeward of Lake Mile 5, and confining all materials from Lake Mile 5 inward including the entire river navigation channel.

- During the near term, OEPA would agree to issue a Section 401 Water Quality Certification to allow open lake disposal of sediments dredged lakeward of Lake Mile 5.

- The Natural Resource Conservation Service would continue its efforts to expand the soil erosion control and Buffer Zone program.

- Toledo-Lucas County Port Authority would continue its demonstration and implementation of the Dredge Material Recycling Program.

- The U.S. Army Corps of Engineers would implement those steps necessary to maximize the capacity utilization of the existing confined disposal facilities.

- The U.S. Army Corps of Engineers in cooperation with the Toledo-Lucas County Port Authority would initiate an evaluation of the horizontal and vertical expansion of Island 18.

- The Port Authority and the U.S. Army Corps of Engineers would investigate the design and feasibility of construction of a protective barrier/CDF off Woodtick Peninsula.

- The Toledo-Lucas County Port Authority and the city of Oregon would undertake a long-term use/development plan for facility #3.

PHASE 4 REPORT

PART I

MAIN REPORT

SECTION I

LONG TERM SEDIMENT MANAGEMENT STRATEGY
TOLEDO HARBOR PROJECT

SECTION I
LONG-TERM MANAGEMENT STRATEGY FOR TOLEDO HARBOR

A. OVERVIEW OF LONG TERM MANAGEMENT STRATEGY

The Maumee River Watershed, Maumee River, Maumee Bay and Lake Erie provide a wide variety of fish and wildlife habitats. These habitat areas, as well as the harbor area, have been substantially impacted by human developments. Maintenance of the Toledo Harbor navigation channels require the annual dredging of approximately 1,000,000 cubic yards of sediments from seven miles of river channel and 19 miles of Lake Erie channel. Historically this material has been disposed of either in Confined Disposal Facilities (CDF) or at unconfined open-lake disposal sites.

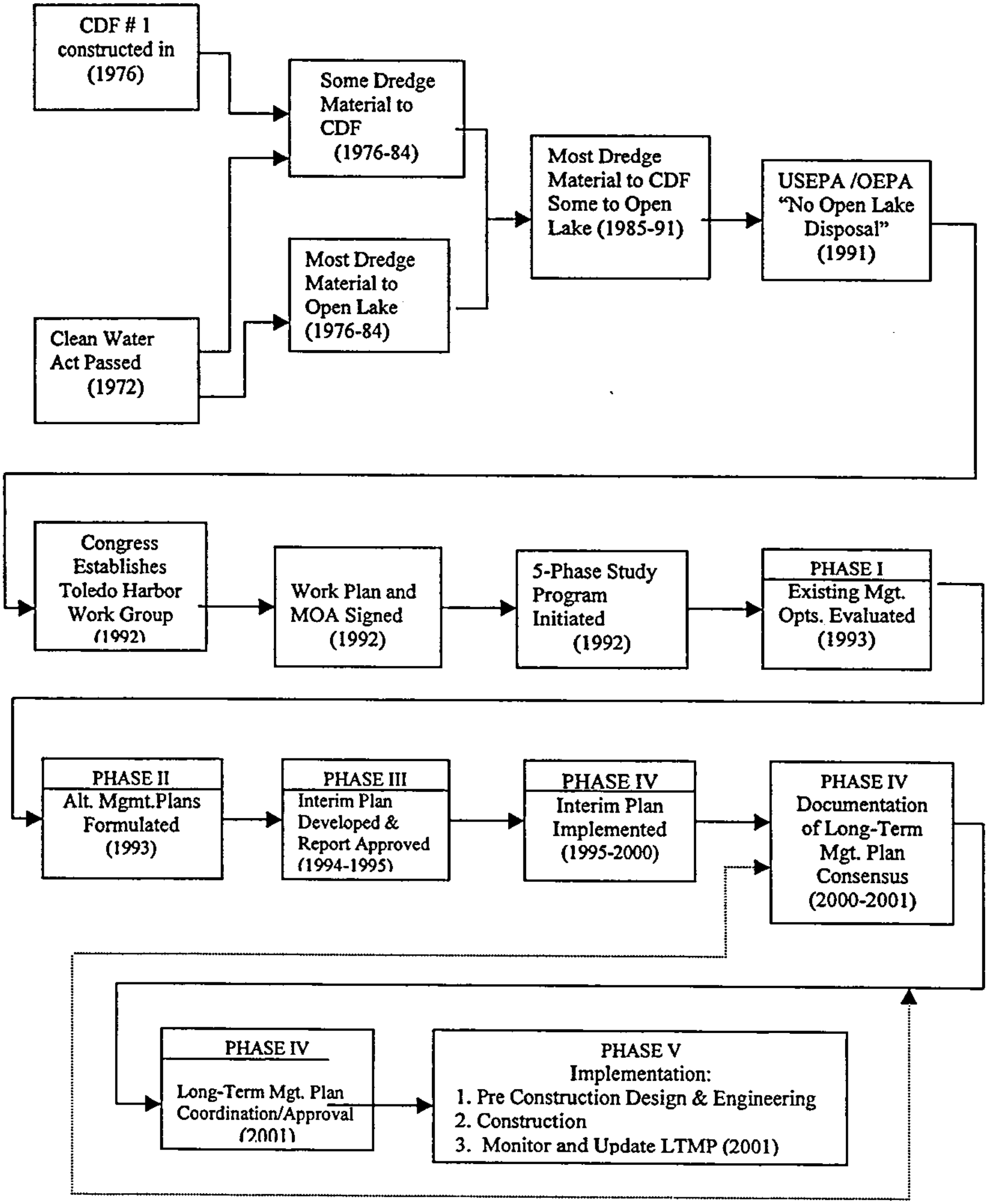
The purpose of the Toledo Harbor Long Term Management Strategy (LTMS) is to develop and evaluate long-term plan(s) for the management of sediment throughout the Maumee River watershed. The intent is to evaluate options to develop economically and environmentally sustainable alternatives. Concern over the effects of unconfined disposal of sediment prompted the study and the evaluation of various impacts of this practice (e.g., relative impact of open-lake disposal on sensitive near-shore areas) and the development of potential alternative methods and strategies for managing the dredged materials. An actual watershed management process flow diagram is shown in (***Figure I-01***).

The Executive Committee of the Toledo Harbor Planning Group (THPG) had formulated a Long-Term Management Strategy for Toledo Harbor. The strategy includes the development of remedial actions that, when integrated, provide a solution to the disposal of sediments dredged from the Maumee River and Lake Erie navigational channels. The strategy provided for the evaluation and implementation of management alternatives and preparation of a Long-Term Dredged Materials Management Plan (LTMP). The LTMP components were derived from the findings of the many pilot studies and demonstration projects that have been performed during the 5-year interim period of the investigation.

This Long-Term Management Strategy Phase IV Report is comprised of three parts. Part 1, the main body of the report, provides a synthesis of the studies and/or projects/experiments conducted during the interim period. Part II, a companion report, is the Environmental Assessments of the components of the LTMP that were investigated during the 5-year investigative period.

The main report is divided into five sections. Section I provides an overview of the watershed management study approach that led to the derivation of the LTMP. Section 2 provides historical background information. Section 3 recapitulates the development and implementation of the interim plan during the 5-year investigative period. This section highlights the results of the experiments performed, draws conclusions and makes recommendations on their viability for future use. Section IV describes the LTMP and identifies the agencies that will take the lead in its implementation and the respective roles they will play to implement their respective parts of the plan. Section V contains the Recommendations.

Figure I-01. MAUMEE RIVER WATERSHED MANAGEMENT IMPLEMENTATION APPROACH



B. Component of the Long Term Management Plan

The six primary components of the LTMP are identified in this section and described in details in Section IV.

1. Maintenance Dredging and Dredged Material Disposal

The U.S. Army Corps of Engineers will continue to dredge the Maumee River and Lake Erie navigation channels on an annual basis. Up to 1,000,000 cubic yards of sediment will be disposed of as indicated in ***Table I-01***.

2. Management of Existing Confined Disposal Facility (CDF)

The following CDF management options were selected for inclusion in the LTMP:

- Dewatering and consolidation through trenching.
- Construction of perimeter berms to maximize dredge material storage in existing dikes.
- Vertical expansion of existing dikes.
- Construction of cross berms to compartmentalize the CDFs and to facilitate the implementation of these management options.

3. Recycling and Beneficial Use of Sediment

This component consists of recycling of dredged material from CDFs and using the sediment to manufacture soils or fill material that could be used in a wide range of applications from soil products to road construction sub-bases.

4. Sediment Load Reduction (Soil Erosion Control)

Use of Best Management Practices to reduce source material erosion from agricultural activities in the Maumee River watershed, and to reduce the level of contaminants in the sediment.

5. Capacity Expansion of CDFs (horizontal)

This component provides for the horizontal expansion of Island 18 to accommodate future confined disposal facility needs.

6. Monitoring, Evaluation and Updating

Also included in the plan are provisions for monitoring and evaluating the findings from implementing the proposed measures. The results of these evaluations would be used to identify necessary improvements in, and updating of the program. The primary programmatic goal is to ensure that natural resources in the area are protected, while maintaining the navigational capabilities of Toledo Harbor. Therefore the monitoring and evaluation program is critical to this integrated program to ensure stated goals are achieved. As the program progresses, modifications may be required to refocus activities to meet the stated goal. Monitoring, evaluation and proactive program corrections are important to overall program success.

All these above-described components, acting together over time, constitute the Long Term Management Plan for Toledo Harbor. Some components are longer term than others, but all will contribute to the overall effort. The work efforts in the early years succeeding approval of the plan are to maximize use, and utilize the full capacity, of the existing CDFs. These work efforts are action items that need to be executed up front to insure continued maintenance of the Federal navigation channels until such time when a new CDF is in place and ready for use at the Island 18 site or elsewhere.

Table I-01. Source And Disposal Location Of Maumee River Dredged Sediments

Sediment Source	Disposal Locations
RM-7 to RM-0; LM-0 to LM-5	Confined Disposal Facility
LM-5 to LM-19	Open Lake Disposal Site

RM = River Mile
LM = Lake Mile

SECTION II

BACKGROUND

SECTION II
BACKGROUND

A. HISTORY

The shipping port of Toledo is a major transportation center located in northwest Ohio on the Maumee River in the City of Toledo Ohio (***Figure II-01***). The Port handles an average of 15 million tons of cargo a year including iron ore, coal, grain, and various other bulk commodities.

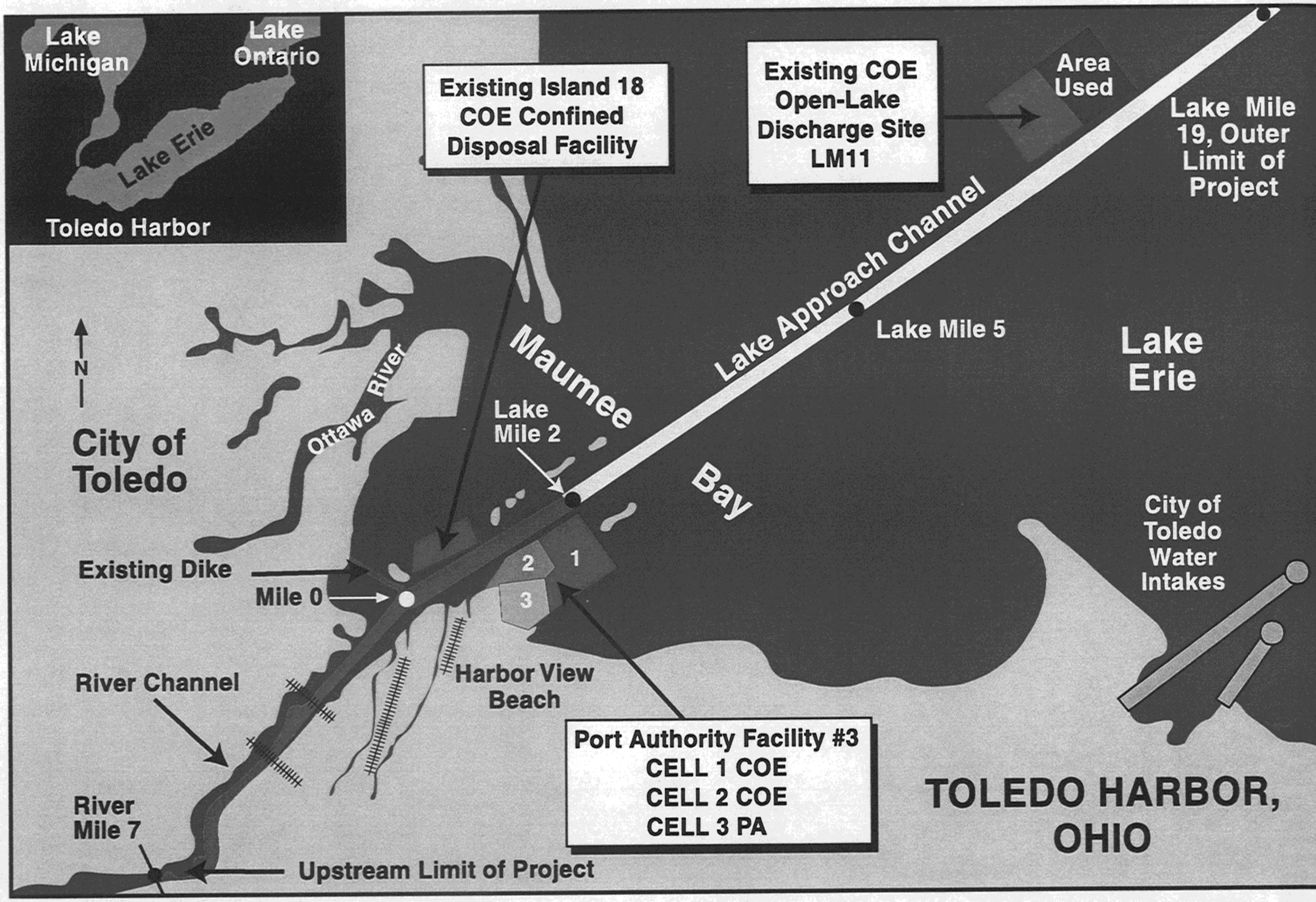
The U.S. Army Corps of Engineers (USACE) is authorized to perform maintenance dredging of the navigation channels (seven miles of the Maumee River and 19 miles of entrance channels starting at the mouth of the Maumee River and extending into Lake Erie) necessary to keep the port of Toledo open. These dredging operations have been a recurring process since the late 1800s. By the River and Harbor Act of June 13, 1866, Congress made the first appropriations for the improvement of the Harbor by the United States Government. Overall, this effort requires the removal and disposal of up to 1,000,000 cubic yards of sediment annually.

The determination to dispose the sediments in the open lake, or place it in a confined disposal facility, is based on sediment quality. USACE samples the sediment for contaminants and disposes the dredged material in accordance with appropriate guidelines and in coordination with USEPA and Ohio EPA. Initial guidelines included the Federal Water Pollution Control Act of 1948 and particularly amendments of 1972. Subsequent guidelines included the Clean Water Act of 1977, and USEPA 1997 Guidelines for the Pollution Classification of Great Lakes Harbor Sediments. Currently, guidelines include the Clean Water Act and USEPA/USACE Great Lakes Dredged Material Testing and Evaluation Manual.

In the mid 1970s, while dredged material was open lake disposed, a number of environmental concerns were expressed. The concerns included: (1) potential adverse impact on Lake Erie water quality, (2) resuspension and movement of dredged materials placed at the disposal site and its affect at the Toledo water treatment plant water intake, (3) phosphorus input to Lake Erie, (4) eutrophication due to open lake disposal, and (5) impacts on lake sediment chemistry and biota. In addition to the impacts related to open lake disposal, issues were also raised concerning the potential use of near-shore areas for the construction of dredged material Confined Disposal Facilities.

In 1986 a five-year Memorandum of Agreement (MOA) was signed by the Toledo-Lucas County Port Authority, City of Toledo, Toledo Metropolitan Area Council of Governments, Ohio Environmental Protection Agency (OEPA), and U.S. Army Corps of Engineers. In the MOA the participants agreed *"to explore a mechanism for the maintenance of Toledo Harbor and the protection of the quality of the water in Lake Erie"*. The MOA was designed to build a framework for cooperative investigation of alternatives to open lake disposal. This was necessary since open lake disposal was scheduled to be phased out in 1990. Unfortunately the MOA did not reach a consensus due to differences over cost sharing and environmental standards.

Figure II-01 - Project Location



In 1991, the U.S. EPA concurred with Ohio EPA's determination that the current practice of open lake disposal was environmentally unacceptable. In order to resolve this impasse, and to provide for the continued operation and maintenance of Toledo Harbor, the Congress of the United States through the Assistant Secretary of the Army for Civil Works, directed the Corps of Engineers to form an intergovernmental agency group. This group worked toward the development of a long-term management plan, consistent with the Water Resources Development Act of 1992. This Act requires a five and twenty-year management strategy for sediment disposal. The development of these management strategies is a mechanism that would allow Federal, State and local agencies to work together toward a sediment management program.

A Toledo Harbor Planning Group, structured with an Executive Committee and a Study Management Team, was established in August 1992 to develop a jointly supportable action plan [or Long Term Management Strategy (LTMS)] for the management of dredged material. The overall program consists of developing and evaluating long-term sediment management actions that would be applicable to Toledo Harbor. The following sections briefly describe more specific activities performed under this program.

B. PROGRAM DESCRIPTION

1. Problem Definition and Need

The problem to be addressed is the management of the sedimentation of the Maumee River and Lake Erie navigation channels. These sediment loads require the U.S. Army Corps of Engineers to annually dredge and dispose of approximately 1,000,000 cubic yards of sediment. The need for a long-term management plan results from the growing concern over environmental impacts resulting from (1) disposal of dredge material at open lake sites, (2) the lack of adequate storage capacity in existing Confined Disposal Facilities to accommodate future disposal needs, (3) the scarcity of nearshore land to build new CDFs, (4) the proliferation of diked Confined Disposal Facilities in the littoral zone in the Maumee Bay.

2. Purpose of LTMS

The purpose of the LTMS was to develop and evaluate long-term plans for the management of sediment in the navigation channels and also throughout the Maumee River watershed. The LTMS provided a consistent, logical procedure by which alternatives were identified, evaluated, screened, recommended, and selected for the management of dredged material in a timely, environmentally sound and cost-effective manner. This Phase IV Report documents the results of alternative sediment management studies/projects and experiments that were carried out during the 5-year interim period. It recommends the implementation of a jointly supportable set of integrated actions or long-term management plan to meet the long-term needs of Toledo Harbor.

3. Authority

The LTMS was conducted under Section 356 of the Water Resources Development Act of 1992 (WRDA 1992). This act directs the development of a comprehensive sediment management strategy for the Maumee River, Toledo, Ohio to include a combination of several sediment disposal alternatives and shall emphasize innovative, environmentally benign alternatives, including reuse and recycling. The Planning Group also worked under the following additional authorities from other Federal, state and local agencies:

- Public Law 83-566 which authorizes the Secretary of Agriculture to cooperate with States and local agencies in the planning and carrying out of works of improvement for soil conservation and other purposes.

- Public Law No. 46 of the Soil Conservation Act of 1935 that authorizes the Soil Conservation Service to conserve basic soil and water resources by extending sound land use practices to all land vulnerable to soil erosion, develop demonstrations that illustrate the practical effectiveness of soil-conserving land use practices and to prove the techniques of erosion control through actual application of the land.

- Section 1135 of the Water Resources Development Act of 1986, as amended, which allows for the environmental restoration of existing Corps projects.

- Section 204 of the Water Resources Development Act of 1992, which allows for the protection and restoration of environmental resources in connection with new or maintenance dredging of federal navigation projects.

The study also complies with such environmental protection legislation as the National Environmental Policy Act (NEPA), the Clean Water Act, the Fish and Wildlife Coordination Act, the Coastal Zone Management Act, and others.

4. Study Phases Description

All potentially viable alternative actions were analyzed and assessed through a 5-phase study approach. Phases 1-3 identified and recommended for implementation alternative actions that addressed the problem of managing dredged material at Toledo Harbor within the context of the Maumee River watershed sediment management strategy. Phase 4 implemented a 5-year intermediate plan and developed a consensus on a Long Term Management Plan (LTMP). Phase 5 will implement, monitor and update the LTMP. The detailed designs and plans and specifications for the construction of recommended projects will be carried out in Phase 5. The five phases of this approach are presented in ***Table II-01***.

The reports for Phases 1, 2 and 3 were completed in March 1993, July 1993 and November 1995 respectively. ***Table II-02*** is a summary of the screening of alternatives that took place in the first three phases. Also, these phases are briefly discussed in the next paragraphs.

a. Phase 1

The Phase 1 study defined the problem and established geographical limits and time frames. It also reviewed historical dredging quantities, dredged material management actions, sediment characteristics and quality. Further it presented environmental concerns relating to dredging and disposal, listed management options identified to-date, proposed several preliminary concept plans, and presented some preliminary screening of management options.

Phase 1 also identified alternative actions that could contribute to managing sediment from the Maumee River Watershed and dredged material from Toledo Harbor. These alternative actions were grouped into the following categories: Sediment Load Reduction, Contaminant Level Reduction, Beneficial Uses, Confined Disposal Facilities, Open Water disposal and No Action. These actions are briefly discussed below.

- Sediment Load Reduction: consisted of Crop Residue Management, Conservation Cropping Sequence, Alternative Crops, Grassed Waterways, Wetland Sediment Ponds, Agricultural Runoff Retention Reservoirs, Filter Strips, Stream bank Erosion Control and Developing a Market for Canola Crop.

- Contaminant Level Reduction: consisted of Nutrient Management, Animal Waste Management, and Pest Management.

- Beneficial Uses: included Manufactured Soils, Environmental Restoration and or Protection (Woodtick Peninsula), Shallow Water Habitat, Grassy Island, Recreational Hill and Strip Mine Reclamation.

- Confined Disposal Facilities: included Expansion of Existing CDFs, CDF Reuse Management (Dewatering), Recycling CDFs, Construction of New Nearshore CDFs and Construction of New Upland CDFs or Offshore CDFs.

- Open-Water Disposal: evaluated sediment and water quality for the continued use of existing open water disposal site and finding a new site.

- "No Action" was also evaluated.

Phase 1 eliminated the following management options: the use of filter strips, stream-bank erosion control and pest management. Although filter strips were eliminated in Phase 1 as a management option, NRCS used them later as one of their agricultural strategies to decrease farmland erosion. During implementation of Phase 4 of the LTMS, the State of Ohio and the Department of Agriculture's NRCS funded a Buffer Initiative" program in the interest of reducing farmland erosion in Ohio, particularly in the Maumee River Basin. NRCS reiterated interest in filter strips, which became part of the Crop Residue Management test project.

b. Phase 2

Phase 2 was a continuation of the screening process. Based on engineering judgment, environmental, economic and/or time constraints, the following management options were eliminated early in Phase 2 from further consideration: Conservation Cropping Sequence, Alternative Crops; Developing A Market for Canola; Nutrient Management; Animal Waste Management; Construction of Shallow Water Habitat; and Construction of a Recreational Hill.

The following management options were retained for further screening in Phase 3:

- Crop Residue Management
- Grassed Waterways
- Wetland Sediment Ponds
- Agricultural Runoff Retention Reservoirs
- Manufactured Soils
- Environmental Restoration/Protection Of Shoreline
- Grassy Island, also referred to as Island 18
- Expansion of CDFs
- CDF Reuse Management (Dewatering, Consolidation)
- Recycling CDFs
- Construction of New Nearshore CDFs
- Upland and Offshore CDFs
- Open Lake Disposal
- Strip Mine Reclamation
- No-Action Plan

c. Phase 3

Management options eliminated in the Phase 3 evaluation were the Grassed Waterways, and Strip Mine Reclamation (upland CDF). Construction of new nearshore CDFs option was avoided unless other environmental benefits could be achieved.

Phase 3 developed four potential alternative "Intermediate Plans". The specific components of these alternative intermediate plans are presented in ***Table II-03***.

The alternative intermediate plans were subsequently screened by evaluating the characteristics of their respective environmental impacts, engineering feasibility, cost effectiveness and overall performance towards meeting the Planning Group objectives. Intermediate Plan 2a (hereafter Plan 2a) was selected as the preferred alternative for implementation during the 5-year interim period from 1995 to 2000. See Phase 3 Report for details. This intermediate plan was implemented during Phase 4.

Plan 2a was formulated to provide an integrated approach to manage sediment by reusing it as a raw material; reducing required disposal quantities; and restoring storage capacity through dewatering and consolidation; while maintaining the operation of the Port in a cost-effective and environmentally acceptable manner.

In addition to the above, expansion of Facility 3 (Cell 1, Cell 2), Island 18; recycling materials in existing CDFs; and new CDFs associated with the protection and or restoration of the Woodtick Peninsula, were also investigated.

TABLE II-01. BRIEF DESCRIPTION OF THE PHASES

Phase 1. Evaluate Existing Management Options
Phase 2. Formulate Alternatives
Phase 3. Preliminary Analysis of Alternatives Recommend for Approval and Implementation an Action Plan: a component of which is an interim management plan
Phase 4. Implement the LTMS which includes execution of the Interim Plan and recommend a LTMP
Phase 5. Implementation, Periodic Review and Update of the LTMP.

TABLE II-02. SUMMARY OF SCREENING- (Phases 1, 2 and 3)

Options	PHASES			RATIONALE FOR ELIMINATION			
	PH-1	PH-2	PH-3	Enginring	Envirnmntl	Economic	Time
A. SEDIMENT LOAD REDUCTION							
1. Crop Residue Management	C	C	C				
2. Conservation Cropping Sequence	C	E	-			X	X
3. Alternative Crops	C	E	-			X	
4. Grassed Waterway	C	C	E	X		X	
5. Wetland Sediment Ponds	C	C	C				
6. AgriRunoff Retention Reservoir	C	C	C				
7. Filter Strip	E	-	-	X	X		
8. Streambank Erosion Control	E	-	-			X	
9. Market For Canola Crop	C	E	-	X		X	
B. CONTAMINANT LEVEL REDUCTION							
1. Nutrient Reduction	C	E	-	X			X
2. Animal Waste Management	C	E	-	X			X
3. Pest Management	E	-	-		X		
C. BENEFICIAL USES							
1. Manufactured Soils	C	C	C				
2. Environmental Restoration/Protection (Woodtick Peninsula)	C	C	C				
3. Shallow Water Habitat	C	E	-	X	X	X	
4. Grassy Island	C	C	C				
5. Recreational Hill	C	E	-			X	X
6. Strip-Mine Reclamation	NC	NC	E			X	
D. CONFINED DISPOSAL FACILITIES							
1. Expansion of CDFs	C	C	C				
2. CDF Reuse/ Management (Dewatering)	C	C	C				
3. Recycling CDFs	C	C	C				
4. Construction of Nearshore CDFs	C	C	C				
5. Offshore CDFs	C	C	C				
6. Upland CDFs (see Strip MineReclamation)			E				
E. OPEN-WATER DISPOSAL							
1. Existing Site	C	C	C				
2. New Site	C	C	C				
F. NO-ACTION	C	C	C				

C: Retained

E: Eliminated. This option was considered in this phase, but eliminated

NC: Not Considered

TABLE II-03. PHASE 3 CONSIDERED INTERMEDIATE PLANS

Alternative Intermediate Plan 1a:
- All Material Dredged From the Federal Channels would be placed in a CDF Starting in 1995

Alternative Intermediate Plan 1b:
- All Dredged Material Would Be Placed Into A CDF, starting in 1995
- Crop Residue Management
- Manufactured Soils (Beneficial Reuse)
- CDF Management
- Evaluation of Above Component

Alternative Intermediate Plan 2a:
- Place Sediment From Lake Mile 5 to River Mile 7 into CDF
- Place Sediment From Lake Mile 5 to Lake Mile 19 in the Open Lake
- Crop Residue Management
- Manufactured Soils (Beneficial Reuse)
- CDF Management
- Evaluation of Above Component

Alternative Intermediate Plan 2b:
- Place Sediment From Lake Mile 2 to River Mile 7 into CDF
- Place Sediment From Lake Mile 2 to Lake Mile 19 in the Open Lake
- Crop Residue Management
- Manufactured Soils (Beneficial Reuse)
- CDF Management
- Evaluation of Above Components

No-Action
- Place Sediment From Lake Mile 2 to River Mile 7 into a CDF
- Place Sediment From Lake Mile 2 to Lake Mile 19 into CDF (OEPA) and in Open Lake (USACE).

d. Phase 4

The intermediate plan that was recommended and approved in Phase 3 was implemented during Phase 4. This effort resulted in the consensus reached by the Executive Committee to recommend for implementation a Long Term Dredged Material Management Plan (LTMP). The components of the 5-year intermediate Plan and the studies performed are discussed in detailin Section III.

C. ECONOMIC VIABILITY OF TOLEDO HARBOR

Concerns about the economic viability and benefits of investing in future maintenance dredging of the Federal navigation channels, and associated confined disposal facilities (their size, location and timing) were identified during the development of the Toledo Harbor Long Term Management Strategy. This section addresses the benefits for continued maintenance of the Toledo Harbor commercial navigation channels. These benefits would apply to any long-term dredged material management plan that provides for the continued maintenance of existing Toledo Harbor channel depths.

1. Benefits Definition

Project benefits associated with any plan evaluated can be defined as commercial navigation transportation cost increases avoided. In the context of Toledo Harbor, failure to maintain adequate channel configurations would result in natural shoaling thus reducing water depth that is usable for shipping. As channel water depths decrease, commercial shippers that use the Harbor to move bulk commodities (iron ore, coal, and grain) would have to reduce ship drafts. This would most likely be accomplished by decreasing the tonnage of the bulk commodities carried per trip. Consequently, more vessel trips would be needed to deliver the same amount of bulk materials to the Port. Additional trips result in increased transportation costs. This would continue as the channels become shallower due to the lack of dredging. At some point in time use of Toledo Harbor could become uneconomical for the receipt or shipment of commodities. As a result shippers would begin to explore less expensive ways to move their raw materials. Eventually, the movement of bulk commodities may shift to alternate ports and then be trucked to their final destination.

These physical changes in the navigation channel and subsequent increases in transportation costs would not be realized if the proposed Long Term Management Plan were implemented at Toledo Harbor. Transportation cost increases avoided can be taken as one of the main benefit category associated with implementing the LTMP for Toledo Harbor.

2. Methodology

An economic analysis was completed and the U.S. Army Corps of Engineers under "Without Project" conditions and "With Project" conditions evaluated average annual commercial navigation transportation costs. In general, the "Without Project" condition evaluation identifies what would likely occur to Toledo Harbor channel depths if the USACE ceased channel maintenance operations, and the response to these changes by the bulk commodity handlers. Under "With Project" conditions, it is assumed current harbor channel depths are retained throughout the duration of the project evaluation period.

3. Evaluation

Toledo Harbor is a major Trans-shipment point for bulk commodities. Examples, such as iron ore received at the Harbor from Lake Superior ports is loaded onto railroad cars in Toledo and transported to inland steel mills in Ohio and Kentucky. Coal railed from West Virginia is loaded onto Great Lakes vessels and shipped to electrical generating stations and other consumers in the United States and Canada. Toledo is also a major exporter of grain to Canada.

This section presents estimates of the likely change in commercial navigation transportation costs for these major harbor users if the U.S. Army Corps of Engineers no longer maintains the Toledo Harbor commercial navigation channels. The analysis is based on tonnage that moved during the 1996 commercial navigation season. Commodities shipped and their relative tonnage, and the vessel origin/destination patterns used in 1996 are assumed to be representative of the traffic patterns occurring over the project evaluation period under "Without Project" and "With Project" conditions. The evaluation period was 20 years (from 2002 to the year 2021) and a Federal Discount rate of 7.125% was used to determine costs/benefits. All project benefits reflect September 1998 price levels. A general description of the methodology used to develop average annual benefits follows.

a. "Without Project" Condition, Average Annual Transportation Costs

For valuation purposes the following assumptions were made to reflect the "Without Project" condition:

- No new constructed Confined Disposal Facilities (CDF) will be built over the 20 year evaluation period.
- The existing CDF #3 would reach capacity by 2003. Thereafter, CDF Management techniques would be implemented that would allow material to be confined until the year 2007. Therefore, after 2007, Toledo Harbor channels would begin to fill up and bulk commodity shippers would begin to incur increased water transportation costs.
- No navigation channel maintenance dredging would take place at Toledo Harbor from the year 2008 to 2021 (no disposal facilities in place).
- Harbor channels would be allowed to fill naturally from the year 2007 to the end of the evaluation period (2021) eventually reaching the natural river bottom depth of approximately 17 feet.
- Response of shippers under the "Without Project" condition would range from continued usage of the Harbor over the 20-year evaluation period to shifting their commodity movements to alternative ports once Toledo Harbor navigation channel depths limit specific shipping activities.

Transportation costs associated with the "Without Project" conditions were developed for each origin/destination pair for iron ore, coal and grain. A time stream of transportation costs was developed for each year of the 20-year evaluation period for the origin/destination pairs. The analysis evaluated five origin/destination pairs for iron ore, twenty-nine origin/destination pairs for coal movements and one origin/destination pair for grain movements.

"Without Project" water and rail transportation costs were calculated for each year in the 20-year evaluation period in order to capture all relevant changes in transportation costs. These transportation costs vary from year to year as the channels fill and commodity movements are shifted to alternate ports. Harbor users will continue to use Toledo Harbor as long as it is economically advantageous, that is, combined water and rail costs associated with using Toledo Harbor are less than the combined water and rail costs associated with using an alternate port.

Water transportation costs associated with a range of Toledo Harbor channel depths were calculated using a computer model. The model took into account the commodities affected, their origin/destination routes, the tons moved by route, the vessels used by route, vessel operating and carrying characteristics, vessel operating costs, origin/destination harbor loading/unloading rates, origin/destination harbor channel depths and lake/channel levels throughout the origin/destination route.

The Tennessee Valley Authority calculated rail costs associated with using Toledo Harbor. The costs considered many factors including (1) the commodities affected (iron ore, coal, grain), (2) the location of the final users of the commodity received at Toledo Harbor, (3) location of the commodity source or collection point of origin, (4) the railroads and routes used in moving the commodities, and (5) number of tons of each commodity affected. A rail cost per ton was generated for each source/destination location. These rail cost per ton were then multiplied by the number of tons that moved on that route to arrive at total rail costs by commodity. The total rail costs by commodity were then allocated to the various origin/destination points based on the percentage of total tonnage handled by each origin/destination pair. The rail costs were then added to the water transportation costs to arrive at a total transportation cost for Toledo Harbor, by channel depth, by commodity for each of the origin/destination pairs under "Without Project" conditions.

These Toledo Harbor total transportation costs (water and rail) by channel depth were then compared to alternative harbor water and rail transportation costs. If Toledo Harbor total transportation costs for a given Toledo Harbor channel depth were lower than total transportation costs at an alternative harbor, the shipper was assumed to continue to use Toledo Harbor. If the alternate port total transportation costs were less than Toledo Harbor total transportation costs, the shipper was assumed to shift to the alternate port and stay there for the remainder of the project evaluation period. Yearly channel shoaling rates were used to develop channel depths for each year of the project evaluation period. Total transportation costs under "Without Project" conditions were developed for each year of the 20-year evaluation period for all origin/destination pairs using these channel depths by project year and for comparison, the total transportation costs for alternative ports.

The resulting time streams of "Without Project" condition transportation costs for the origin/destination pairs were then converted to average annual dollar values. These calculations used a 7.125 percent annual interest rate and a 20-year evaluation period. A summary of "Without Project" condition average annual transportation costs by commodity and origin/destination pairs is presented in ***Table II-04***. Total average annual transportation costs for the "Without Project" were estimated to be $205,298,100.

b. "With Project" Condition Average Annual Transportation Costs

Transportation costs for the "With Project" were developed based on the following:

- Under the currently proposed Long-Term Dredged Material Management Plan the currently maintained channel depths in the Toledo Harbor would be maintained for each year in the 20 year evaluation period (2002 to 2021).
- The new CDF recently built at Toledo (1994) would hold all of the material dredged at the Harbor for the period between 1998 and 2007.
- Current shippers would continue to use Toledo Harbor throughout the duration of the evaluation period.

Total "With Project" transportation costs include those associated with both the water and the rail portion of the commodity movement in each of the origin/destination pairs. Therefore, total transportation costs associated with "With Project" conditions were developed for each origin/destination pair for iron ore, coal and grain. A time stream of transportation costs (water and rail) was also developed for each year of the 20-year evaluation period. As in the "Without Project" calculations, this analysis evaluated five origin/destination pairs for iron ore movements, twenty-nine origin destination pairs for coal movements and one origin destination pair for grain movements.

The time streams of "With Project" condition transportation costs were then converted to average annual dollar values. Calculations were made using a 7.125 % annual interest rate over the 20 - year evaluation period. A summary of average annual transportation costs by commodity by origin/destination pair is presented in ***Table II-04***. Total "With Project" average annual transportation costs were estimated to be $196,980,800.

c. Transportation Cost Benefits.

The economic benefits associated with any dredge material management plan are the difference in average annual transportation costs between the "Without Project" and "With Project" scenarios. These benefits would be applicable to any of the management plans considered since all would provide current Toledo Harbor channel depths over the full project evaluation period. The average annual benefit for the proposed action, in October 2000 prices and a 6.375% annual interest rate, is $8,497,000 (***Table II-04***). Given a 20-year evaluation period and a 6.375% annual interest rate these average annual benefits would support a program with a current value of $94,561,000. A more complete description of the derivation of transportation cost benefits can be found in ***Appendix A***.

TABLE II-04 - TOTAL AVERAGE ANNUAL TRANSPORTATION BENEFITS ASSOCIATED WITH MAINTAINING TOLEDO HARBOR 20 YEAR EVALUATION PERIOD.

	Average Annual Without Project Transportation Costs	Average Annual With Project Transportation Costs	Average Annual Benefits
Average Annual Iron Ore Transportation Costs			
Duluth Minnesota	$22,375,700	$20,831,000	$1,544,700
Presque Isle, Mn.	$ 4,258,700	$ 3,964,700	$ 294,000
Silver Bay	$40,250,900	$37,326,100	$2,924,800
Two Harbors	$ 1,905,300	$ 1,772,300	$ 133,000
Sept Isles	$ 9,676,700	$ 9,283,200	$ 393,500
Total	$78,467,300	$73,177,300	$5,290,000
Average Annual Coal Transportation Costs			
Coal Benefits			
Canadian			
Hamilton, Ont.	$16,793,800	$16,227,300	$566,500
Montreal, Ontario	$ 807,200	$ 765,100	$ 42,100
Nanticoke, Ont.	$ 4,045,400	$ 3,972,500	$ 72,900
St. Catherines, Ont.	$ 645,300	$ 625,200	$ 20,100
Sault St. Marie, Ont.	$21,913,300	$21,734,000	$179,300
ThunderBay, Ont.	$ 379,000	$ 361,400	$ 17,600
	$44,584,000	$43,685,500	$898,500
United States			
Alpena Mi.	$ 1,206,800	$ 1,186,500	$ 20,300
Cleveland, Oh	$ 193,300	$ 192,600	$ 700
Dearborne, Mi	$ 6,493,600	$ 6,487,600	$ 6,000
Detroit, Mi	$ 8,912,700	$ 8,903,700	$ 9,000
Duluth, Mn	$ 1,179,300	$ 1,161,000	$ 18,300
Escanaba, Mi	$ 5,689,300	$ 5,478,000	$211,300
Gladstone, Mi	$ 415,700	$ 411,100	$ 4,600
Green Bay, Wi.	$ 7,199,200	$ 7,060,400	$138,800
Holland Mi	$ 3,526,600	$ 3,496,600	$ 30,000
Harbor Beach, Mi	$ 367,200	$ 365,300	$ 1,900
Manistee, Mi	$ 3,827,100	$ 3,794,300	$ 32,800
Manitowoc, Wi.	$ 409,600	$ 405,600	$ 4,000
Marinette	$ 348,100	$ 343,800	$ 4,300
Milwaukee, Wi	$ 1,289,700	$ 1,277,000	$ 12,700
Marysville, Mi	$ 1,037,200	$ 1,031,500	$ 5,700
Munising, Mi	$ 997,000	$ 990,800	$ 6,200
Muskegon, Mi	$ 579,900	$ 569,500	$ 10,400
Ontonagon, Mi	$3 ,726,000	$ 3,694,700	$ 31,300
Presque Isle, Mi.	$ 217,300	$ 214,500	$ 2,800
Saginaw, Mi	$ 397,200	$ 393,300	$ 3,900
St. Clair, Mi	$ 830,300	$ 827,100	$ 3,200
Wyandotte, Mi.	$ 711,700	$ 710,200	$ 1,500
	$50,343,500	$49,777,600	$565,900
Total Average Annual Coal Transportation Costs	$94,927,500	$93,463,100	$1,464,400
Average Annual Grain Transportation Costs			
Chicago	$31,903,300	$30,340,400	$1,562,900
Total Average Annual Transportation Costs	**$205,298,100**	**$196,980,800**	$8,317,300
Update factor from September 1998 to October 2000			1.02161
Benefits in October 2000 Prices			$8,497,000
Present Worth 1$/Period For 20 Years for a 6.375% annual interest rate			11.12876
First Costs That Can Be Covered By Benefits			$94,561,000

Note: All benefits are expressed in October 2000 price levels. Multiply by 1.0216 to go from September 1998 prices and a 7.125% annual interest rate to October 2000 prices and a 6.375% annual interest rate, respectively.

SECTION III

FIVE YEAR INTERMEDIATE EVALUATION

SECTION III
FIVE-YEAR INTERIM EVALUATION (1995-2000)

A. PROACTIVE ACTIVITIES

The recommended five-year Interim Plan implemented in Phase IV, consisted of the following:

1. Continued dredging of the Toledo Harbor channels (Lake Mile 5 to River Mile 7 in CDF).
2. Open lake disposal evaluation (Lake Mile 5 to Lake Mile 19 in open lake).
3. Management of confined disposal facilities.
4. Recycling and beneficial uses.
5. Agricultural strategies to decrease erosion and sediment loading.
6. Expansion of and possible new, confined disposal facilities, which can achieve environmental benefits.
7. Monitoring and Evaluation of LTMP components and provisions for modification.

The pilot studies, laboratory experiments and field demonstration projects accomplished during the interim period are discussed below.

1. Continued Dredging of Toledo Harbor Channels

Under the 5-year intermediate plan, dredged material was placed in Cell 1 or Cell 2 or both cells of facility #3, and at the existing open lake disposal site as well. Sediment dredged from River Mile 7 to Lake Mile 5 was placed in Cell 1 or Cell 2 or both. Sediment dredged from Lake Mile 5 lake-ward to Lake Mile 19 was placed at the existing open-lake disposal site. The average annual cost of dredging was estimated at $3.3 million to keep the River and Lake channels open for commercial navigation.

The sediment volumes dredged from 1994 to 2000 are presented in ***Table III-01*** below.

TABLE III-01. VOLUME OF SEDIMENT DREDGED FROM 1994 TO 2000

YEAR	CUBIC YARDS REMOVED FROM RIVER CHANNELS	CUBIC YARDS REMOVED FROM LAKE CHANNELS	TOTAL CUBIC YARDS REMOVED	CUBIC YARDS DISPOSED OF IN CDF
1994	385,992	434,287	820,279	585,992
1995	512,043	405,979	918,022	712,043
1996	392,500	421,500	814,000	592,500
1997	cancelled	146,575	146,575	cancelled
1998	804,529	356,000	1,160,529	1,004,529
1999	811,630	513,838	1,325,468	1,011,630
2000	394,273	324,133	722,406	598,273

Note: No dredging occurred in 1997. The increase in cubic yards of material dredged in 1998 and 1999 corresponded to a two-year sedimentation period rather than the typical one-year sedimentation in the channels.

2. Open Lake Disposal Evaluation

As discussed previously in Section II of this report, in the mid 1970s a number of environmental concerns were expressed regarding open lake disposal. These concerns included:

- Potential adverse impact on Lake Erie water quality
- Impact to water quality from resuspension and movement of dredged materials placed at the open lake disposal site to the Toledo water treatment plant intake
- Phosphorus loading and subsequent eutrophication in Lake Erie
- Impacts on lake sediment chemistry and biota
- Potential use of near-shore areas for the construction of Confined Disposal Facilities

Open lake disposal of sediment was eliminated in 1991. However, in 1992, after the establishment by Congress of the Executive Committee, a Sub-Committee on Open Lake Disposal was formed to study all data generated on materials dredged from Lake Mile 2 to Lake Mile 19. The Sub-Committee, composed of OEPA, USEPA, USACE and the City of Toledo began deliberating in February 1996. The regulatory agencies made clear that they were willing to participate on this subcommittee to gather data that they could use in making decisions but that they retained full responsibility for the regulatory decision and were not delegating any authority to the subcommittee. A five- step process was developed to evaluate the future of open lake disposal with respect to the above stated concerns. These steps were as follows:

- Assemble all existing data on current sediment conditions and effects of open lake disposal
- Evaluate the need for any additional data, specifically data that would add to the understanding of the disposed sediment from Toledo Harbor and its fate following open lake disposal
- Design a sampling and analysis plan for the collection of new data
- Conduct the sampling and evaluate the new data relative to the original conclusion concerning open lake disposal
- Track the movement of the resuspended sediment from the open-lake disposal site

Two contracts were awarded to conduct these studies in an effort to scientifically resolve these issues. One contract was awarded to Greeley-Polhemus, an Architect/Engineer firm, to conduct a review of all previous documents produced on the issue of sediment and water quality. The second contract was awarded to Ohio State University to address the concern and/or impact on water quality from resuspension and movement of dredged material placed at the open lake disposal site to the Toledo water treatment plant intake.

a. Document Review

Early in the process, the Sub-Committee on Open Lake Disposal determined that a significant amount of scientific data on sediment and water chemistry of Toledo Harbor existed. In order to summarize this data and determine if there were critical data gaps, a contract was awarded to The Greeley-Polhemus Group. The primary purpose of the contract was to determine if there were sufficient existing scientific data to identify and quantify any chemical contamination of the sediments and if the water quality requirements would be met during and after dredging and disposal of the dredged material. The objective of the work was to perform the following tasks:

- Screen all documents that were provided to the contractor into two categories: applicable and non-applicable. Non applicable documents would be all documents that did not appear to address Sections 404 and 401 of the Federal Clean Water Act, and Ohio's Water Quality Standards;

- Conduct a comprehensive review of all applicable documents and compare the data associated to the narrative and numeric water quality criteria listed in Ohio Water Quality Standards (OWQS) and the Federal Clean Water Act Sections 404 and 401 regulations. The contractor was also required to scan the applicable documents for their relationship to the requirements specified in the Ohio new anti-degradation provisions. As a result of the review, the contractor was to identify data gaps or deficiencies and determine any criteria specified in the OWQS that were not addressed in the documents;

- Develop a list of parameters to be used in the future to assess the sediments at Toledo Harbor with respect to their suitability for open lake disposal.

(i) Results of the Document Review: The contractor determined that an abundance of data on dredging and open lake disposal of the dredged material had been collected. However, relatively little could be used to evaluate past or potential future open lake disposal with respect to the OWQS and requirements under the Federal Clean Water Act. Numerical and narrative criteria presented in the OWQS were applicable only to concentrations of toxic pollutants and other water quality parameters in the water column.

(ii) Data Evaluation and Gap Analysis: Both the OWQS and requirements for the Clean Water Act Section 401 Water Quality Certification, identify parameters that should be considered in evaluating compliance with the state standards. Since data were not available for all of the pollutants identified in the regulatory documents, the contractor concluded that the absence of data for all the listed parameters was considered a data gap. To resolve this problem, future sampling should include analysis for all parameters listed in ***Table III-02***.

In addition, the contractor indicated that future sampling work should focus on parameters that:

- Past sampling had indicated exceeded current criteria;
- Nutrients that can cause eutrophication and problems with public water uses (i.e., total phosphorus);
- Parameters indicative of potential pollution from the prevailing land uses in the western basin of Lake Erie (e.g. pesticides); and
- Other parameters of concern to the State and Federal regulatory agencies.

TABLE III-02. RECOMMENDED PARAMETERS FOR FUTURE SAMPLING EVENTS

Group	Description	Parameters	Rationale
I	Inorganic Parameters	Antimony Arsenic Beryllium Cadmium Chromium Copper Cyanide Lead Mercury Nickel Selenium Silver Thallium Zinc	• Accumulate in sediments • Impacts to aquatic life (flora and fauna) • Cadmium, lead and mercury may accumulate in tissue • Introduced by variety of industrial sources • May be widespread and persistent in Lake Erie
II	Nutrients	Ammonia Nitrate + Nitrite Total Phosphorus	• Cause fouling of water • Cause eutrophication
III	Pesticides and Fertilizers	Acenapthene Aldrin Dieldrin Endrin Heptachlor Hexachlorobenzene Toxaphene	• Characteristic of agricultural land use • Persistent in the environment
IV	Other Parameters of Concern	%Total Volatile Residue % Total Residue Total Kjeldahl Nitrogen Chemical O_2 demand PCBs PAHs	• Recommended by Ohio EPA
V	Water Quality During Open Lake Disposal	Dissolved O_2 PH	• Potentially limiting to aquatic life • Good indicators of impacts during open lake disposal

Note:
PCB = Polychlorinated Biphenyl
PAH = Polyaromatic Hydrocarbons

(iii) Recommendations: Five categories of parameters were recommended for analysis in future sampling events as shown in *Table III-02*. The fifth category was conditionally recommended to be sampled during the actual disposal of the dredged sediments. The fact that criteria were only available for the water column dictates that analysis for the recommended parameters be done for water samples and elutriates [even though there may be inherent problems in comparing available water criteria (field) with elutriate water samples (laboratory)].

To supplement the water quality analyses (because there had been no applicable State or Federal criteria for sediments toxicity) it was recommended that the analysis of biological indicators be used to assess the suitability of the sediments for aquatic life. Bioassay tests were recommended because these tests provide complementary physiochemical information to chemical analytical results. Specifically, the test organisms integrate factors such as bioavailability and toxicity and indirectly address the potential for adverse water and sediment quality impacts due to dredged material disposal.

The bioassay testing that was recommended included (1) testing of local Lake Erie reference sediments as well as sediments in the areas to be dredged, (2) implementation of a comprehensive suite of toxicity tests including both elutriate (to evaluate potential impacts of water quality during material disposal) and whole sediment (to evaluate impacts associated with sediment quality). The suite should also include 7-day survival and reproduction tests using *Ceriodaphnia dubia* (cladoceran) and/or the 7-day survival and growth test with the fathead minnow, *Pimephales promelas*.

Also recommended were whole sediment tests that included the 14-day survival and growth tests utilizing *Hyalella azteca* (amphipod) and *Chironomus riparius* midge). Similar to the elutriate tests, the recommended whole sediment tests are widely accepted and provide a measurement of potential effects due to bulk sediments. For more details on the Greeley Polhemus data evaluation and gap analysis see *Appendix B1*.

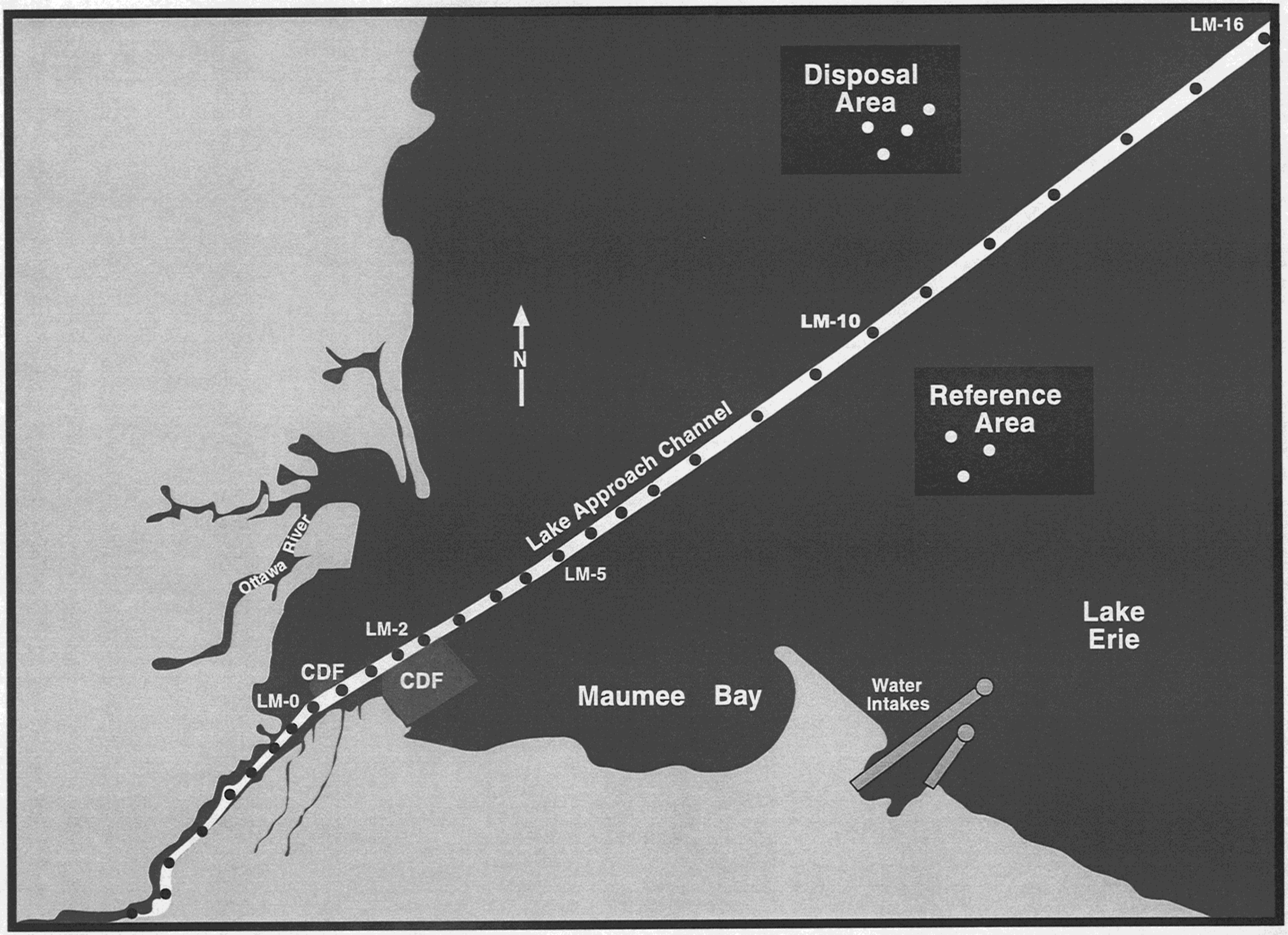
b. Sampling and Analysis Plan

Acting on the recommendations of the Greeley-Polhemus Group, the Committee amended the contract and tasked Greeley-Polhemus to develop a sampling plan. Subsequently, new Ohio water quality standards passed Ohio legislature. As a result, building on the Polhemus Plan, the Committee developed its own sampling and analysis plan ***(Appendix B2)*** based on the State of Ohio's new standards, and the Great Lakes Testing Manual. Samples were collected from River Mile 7 to Lake Mile 16 (***Figure III-01***).

Padia Environment Inc. (See ***Appendix B3*** Sediment Sampling and Laboratory Results) executed the sampling and analysis plan for sediment and water, developed by the Committee. Extensive sediment sampling and testing were conducted for Toledo Harbor in accordance with the Study Plan of 1999 (LTMS Executive Committee, 1999).

During the interpretation of the partial results of this work, it became apparent that there was a need for further work for the subcommittee to reach agreement on the interpretation of the results. The subcommittee determined that a review of all the data according to the four tiered approach contained in the Great Lakes Testing Manual was needed and that complete results of

Figure III-01 - Sediment Chemistry and Biological Sampling Locations



this approach, as well as the macro-invertebrate testing, must be thoroughly reviewed and discussed, prior to the committee considering a set of recommendations. This four tiered analysis is currently underway.

c. Transport of Resuspended Sediment to Sensitive Areas

Concerns were expressed that dredged sediment from unconfined disposal sites could be re-suspended back into the water column where they could be subjected to physical transport and movement to sensitive near-shore areas such as beaches or water supply intakes causing degradation of water quality. As a result of these concerns, researchers at Ohio State University, under contract to the Corps of Engineers, analyzed the movement of sediment from the Toledo Harbor open lake disposal site using computer modeling.

The computer simulation project had three primary objectives: (1) to determine if material discharged at the disposal site is actually transported to sensitive areas, (2) if transport takes place, determine the frequency, duration and magnitude of the transport events from the disposal site to the sensitive sites, and (3) determine the relative contribution of the disposal site sediments with other sediments transported to the sensitive locations.

The study was conducted in three stages. The objective of Stage 1 was to collect and analyze data at the disposal site in an effort to determine the resuspension and sediment flux characteristics at the site. Flow velocities and pressure, water temperature and suspended sediment concentrations were obtained from the field in 1996. These data were compared to model results conducted with flow velocities, pressure and water temperature from the Great Lakes Forecasting System (GLFS). The results of the Stage 1 analysis led to several conclusions about the sediment resuspension at the disposal site. For instance, the analysis found that there is no persistent correlation between the wind direction and bottom current direction; and that bottom current directions during resuspension events were found to be either from the North of from the Southwest. More conclusions of this analysis are summarized in ***Appendix B4.***

The objectives of Stage 2 were to examine the possibility of dredged sediments being transported from the disposal site to the Toledo water intake pipes by a single large storm/transport event and to determine the conditions under which this transport would take place. Both issues were addressed using a probability analysis. Hourly velocity data obtained from the Great Lakes Forecasting System 20 year data base (1972-1992) were analyzed for (1) magnitude and direction to determine if water flow in Lake Erie commonly moved in a direction from the disposal site to the sensitive area, and (2) magnitude, duration and frequency of particle transport during single storm events.

This stage 2 study led to the conclusions that in a 20-year period of record, no single flow event was of sufficient magnitude or duration to result in bottom currents carrying material to the intake site. The same result occurred for the integrated velocity field. The Stage 2 study also concluded that the heavier sand sized particles at the placement site remain near the bottom during transport and do not reach the intake pipe zone, as the bottom currents are insufficient during any single event.

The objective of Stage 3 was to evaluate the relative impact of different sediment sources on sensitive near-shore areas in a multigrain, multi-source sediment transport formulation. Four sediment sources were selected to represent the sediment inputs to Lake Erie, namely:
(1) sediments originating from the disposal site, (2) resuspension of lake bottom sediments,
(3) suspended sediment inputs from the Maumee River and, (4) suspended sediment inputs from the Detroit River.

The model results included:

- A full 3-D velocity field
- A 2-D vertically averaged velocity field
- A 3-D temperature field
- A 3-D sediment concentration field
- Bottom sediment fraction distributions and,
- Changes of the bottom elevation.

The summary plots included time traces of the total suspended sediment mass (TSSM) of each grain size and for all three-grain sizes combined from each source. Also included are time traces of the relative intensities at the water intake site (defined as the ratio of the TSSM of all grain sizes of each source to the TSSM of all grain sizes from all sources).

Several conclusions were drawn from this stage 3 analysis. Of particular interest are the conclusions that the sediments found at the water intake are mainly fine size sediments (silt and clay) and that clay size sediments found at the water intake site originate from all the assigned sources with major contributions coming from the lake bottom sediment. The riverine contributions are not trivial. The contribution from the disposal site is low. However some member agencies had expressed reservations about the completeness of the study. As mentioned above, all 3 stages are summarized in ***Appendix B4***.

(i) **Conclusions of the Sediment Transport Study:** The overall impact at the water intake from sediment originating at the disposal site is relatively small during storm events and insignificant between storm events. Combining these results with those of Stage 2 indicates that sediment transport from the disposal site to the water intake is insignificant in comparison with other sources of sediments. The disposal site contribution to the suspended sediment at the water intake is insignificant in comparison to sediment loads originating from the lake bottom or the Detroit and Maumee Rivers. On the average, the sources of sediment at the intake, by percent contribution are lake-bottom sediment-90%; Maumee River-7.5%; Detroit River- 2.0%; and CDF disposal site- 0.5% (***Figure III-02***).

3. Management of Confined Disposal Facilities

One method of conserving space within a CDF is to effectively manage the dredged material that is placed into the CDF. ***Appendix D*** provides detailed information on the dewatering, consolidation, and settlement of dredged material, to restore storage capacity. A number of management demonstrations took place on Cell 1 from 1995 to 1999. ***Figure III-03*** illustrates the locations of these demonstration projects. The specific management demonstrations were trenching to dewater the material, examining dredged material consolidation and settlement; and building berms with consolidated dredged material to determine soil strength potentials. These projects are discussed below.

a. Demonstration of Berm Building

In June of 1995, a demonstration berm was built in Cell 1 using material from the Cell contents itself. The purpose of the project was to show that berms could be built from existing dredged material and that they would be sufficiently stable to hold dredged material. The berm was built in the shape of a square, with each side 500 feet long. It was approximately 5-8 feet high, had a five-foot long crest and a 1:2 vertical to horizontal side slope (***Figure III-04***). The demonstration area was then used to hold dredged sediment. An outlet channel was cut into the berm and dredged material was pumped into the confined area through a 16-inch diameter pipeline. The bermed area received from 20,000 to 50,000 cubic yards of dredged material. The test berm (***Figure III-05***) constructed with dredged material performed successfully during filling, retaining the full height of hydraulic loading without failure over the duration of the demonstration.

b. Application of Berm

Based upon the successful results obtained from the test berm built with material confined in Cell 1, one option was considered that would that would beneficially used the material to restore capacity in Cell 1. That option concentrated on building a cross dike using the dredged material confined within the Cell thus dividing it into two separate compartments. Dividing the Cell separate compartments provides the advantage of having recycling and manufacturing of soil occurring on one compartment while the other compartment is available to receive newly dredged material.

Berms can also be built on the perimeter of the Cell causing a temporary increase in the dike height, which would facilitate maximum use of the storage space available in the Cell.

Berm building is a cost-effective measure that can yield and provide additional storage capacity as part of the innovative management of confined disposal facilities. Berm building can occur on any of the existing confined disposal facilities.

c. Dewatering-Consolidation-Desiccation Technique

During dredged material disposal operations, the sediment is routinely pumped from a barge into a CDF through a pipe in slurry composed of approximately 85% water. The water facilitates transport of the sediments. However, once in the CDF the water becomes a problem since it occupies valuable storage space. Therefore removal of as much of this water as possible from the CDF would result in greater storage capacity. To assess the potential for water removal, and settlement of the dredged material, the innovative technique of de-watering, consolidation and desiccation was also investigated.

A study of the potential for consolidation of material in Cell 1 was undertaken in April 1994 by conducting field tests and installing monitoring instrumentation. Soil samples were taken from three different sites in Cell 1 (***Figure III-06***). Field vane shear strength tests and measurement of excess pore water pressure were taken at six locations (2 locations per site) throughout Cell 1. Pneumatic piezometers (to measure water levels) were installed into each of six holes at sites 1 and 2 after the vane shear tests were completed and soil samples collected. Additional soil samples were taken at all three sites from test pits dug with a backhoe (See ***Appendix D***).

Laboratory tests were performed on the soil samples at the Corps Waterways Experiment Station for natural moisture content, Atterberg limits and grain size. Four odometer tests were performed on block soil samples to provide consolidation test information. Three alternatives were evaluated for consolidation in Cell 1: strip drains, electro-osmosis and trenching. Strip drains were judged to be cost ineffective due to the relatively small size of the site and the unfavorable geology. Removal of water by electro-osmosis was also found to be cost ineffective due to the tremendous electrical energy costs required and the minimal amount of water that would be removed.

Figure III-02 Sources of Sediment at the Toledo Water Intake Site

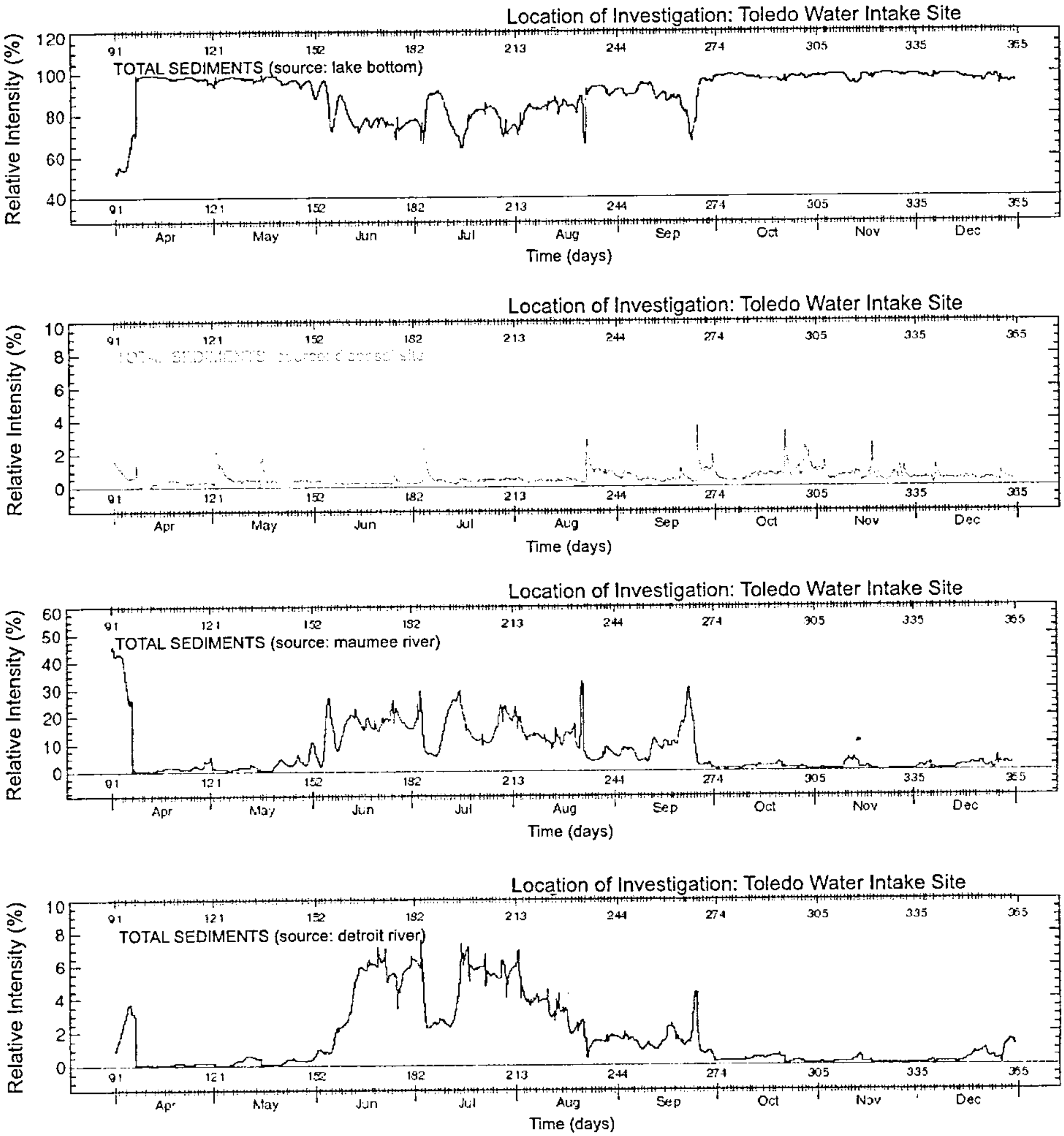


Figure III-03 - Schematic of Cell 1 and Locations
of Various Demonstrarion Projects

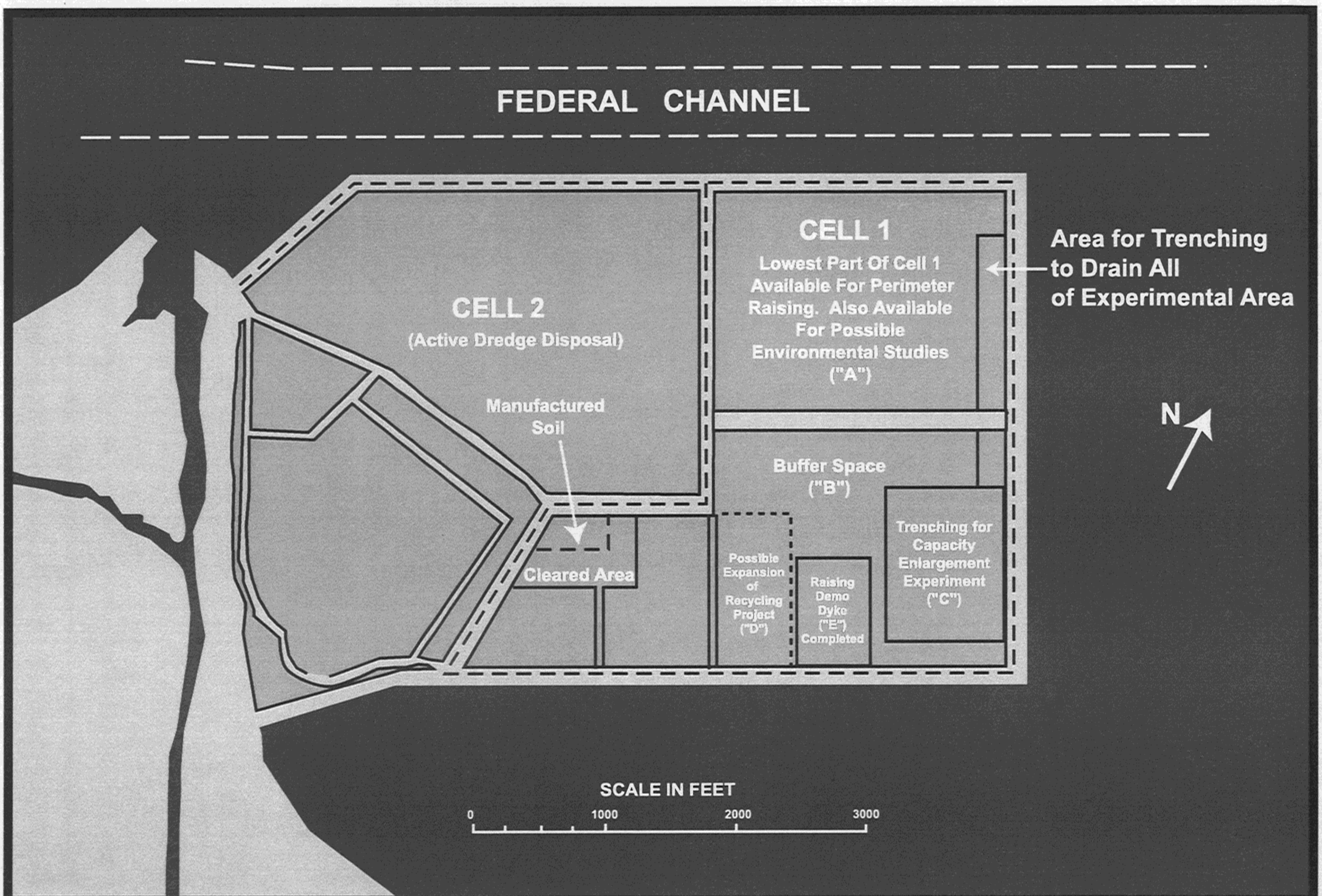
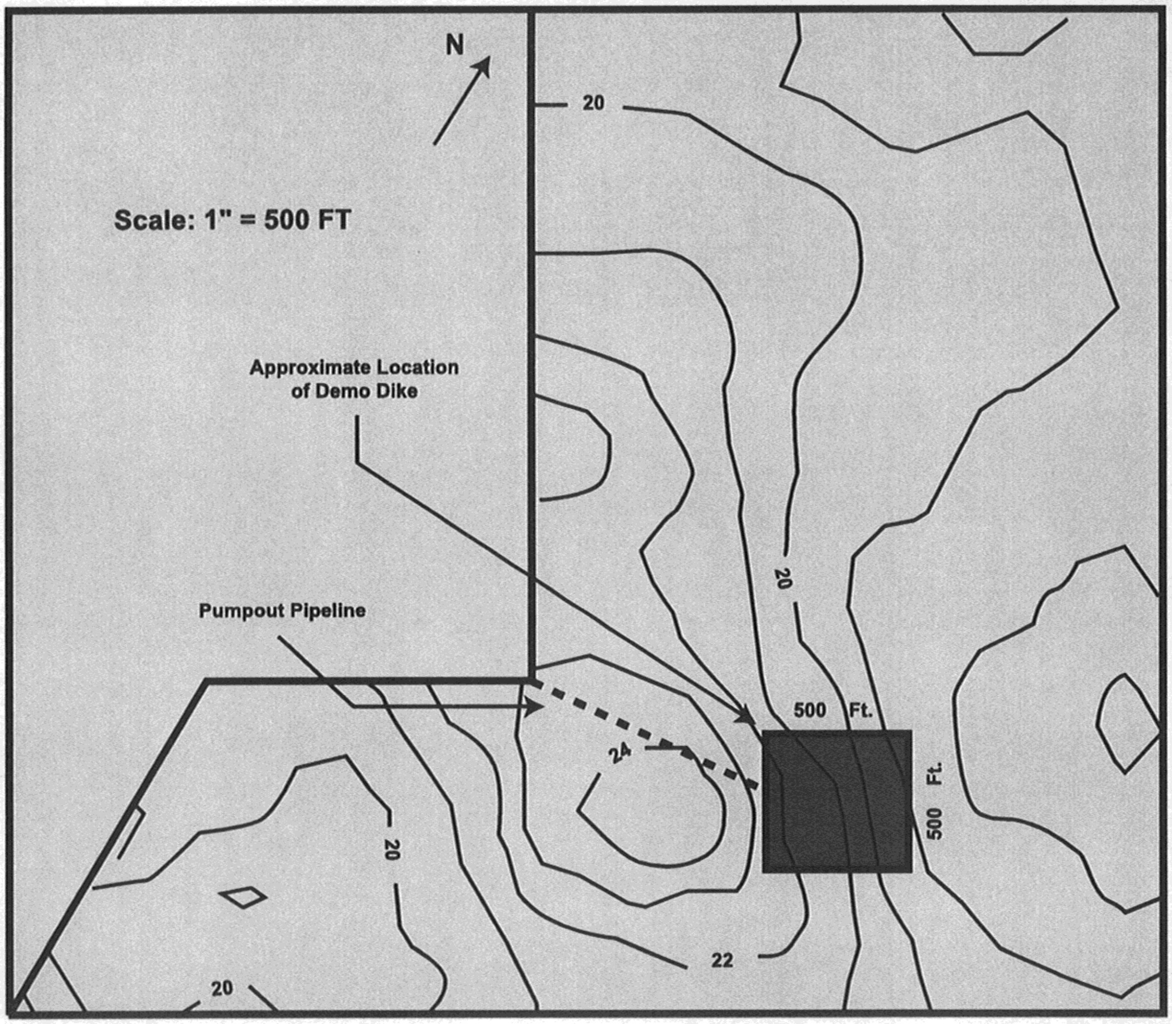


Figure III-04 - Test Berm Location and Typical Cross Section



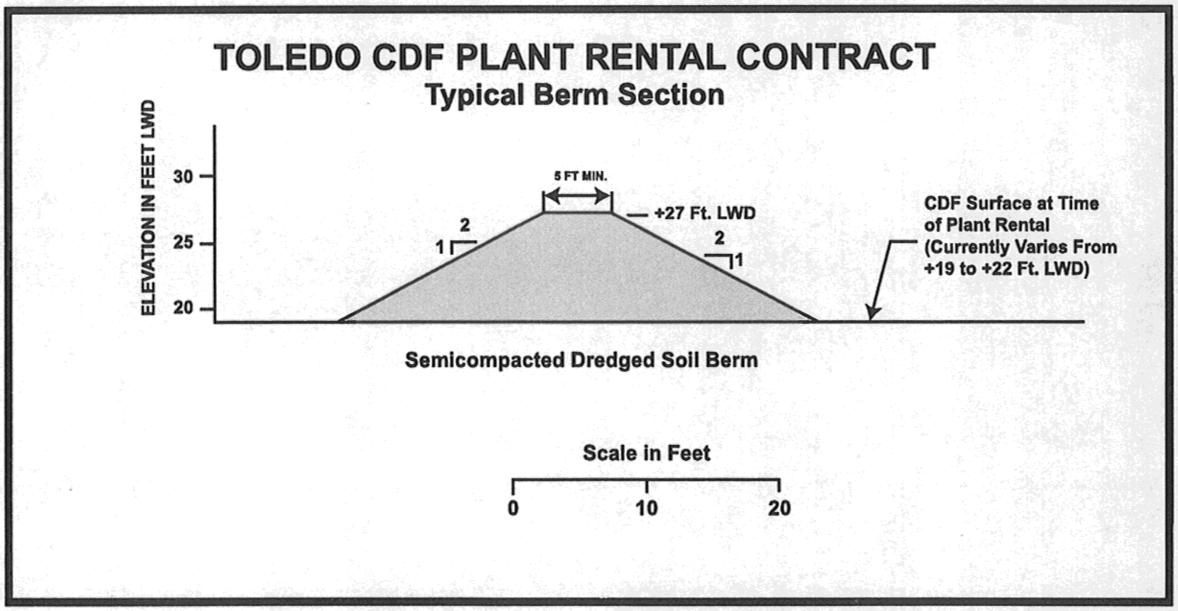
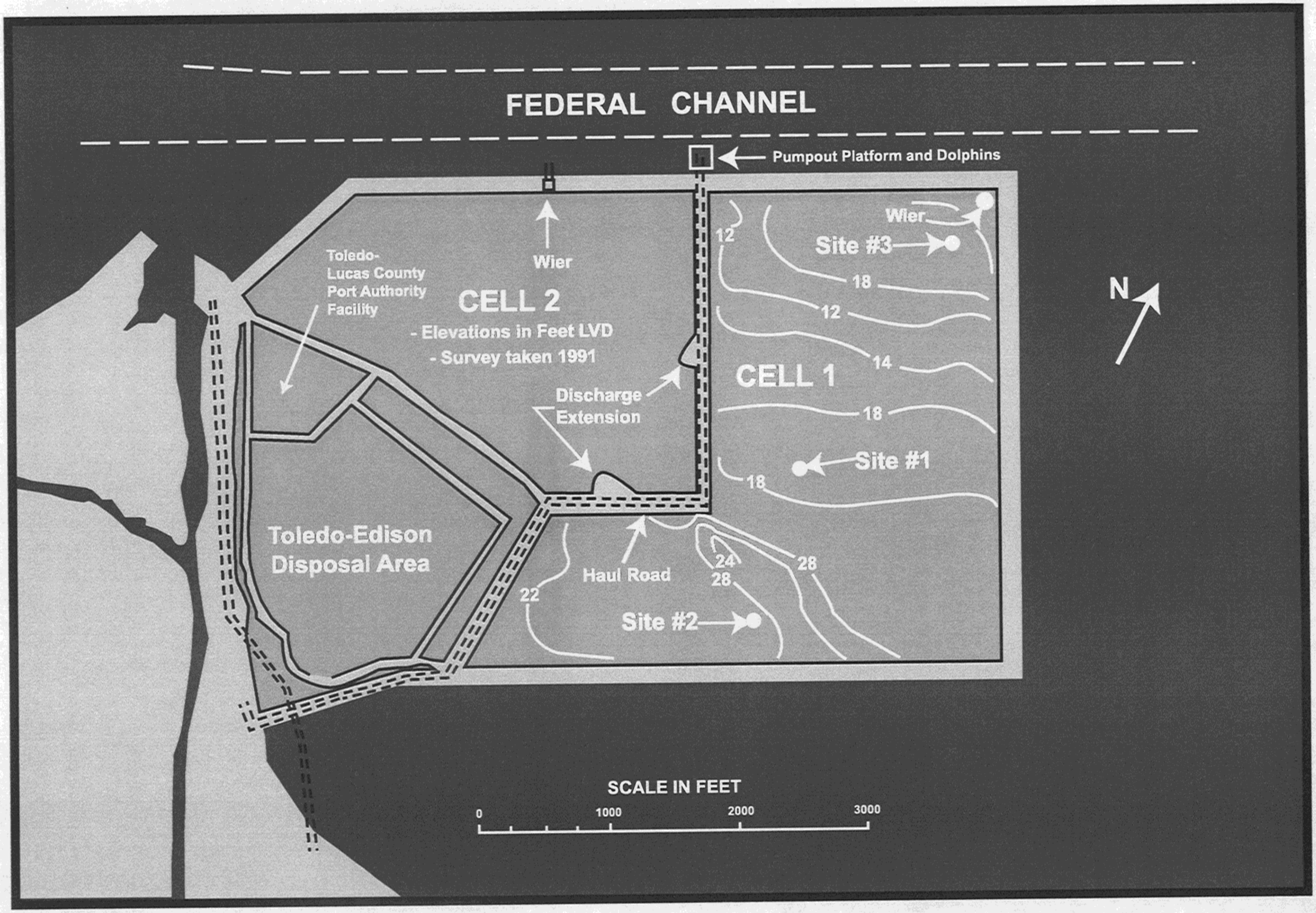


Figure III-05 - Test Berm Constructed of Dredged Material

Figure III-06 - Location of Cell 1 Soil Sample
Sites For Consolidation Evaluation



d. Trenching Demonstration

The effectiveness of excavating a series of deep trenches to remove water and increase CDF capacity by inducing consolidation through material settling was evaluated at Cell 1 in 1996. The trenching demonstration project consisted of constructing 10-foot deep, L shaped trenches at two locations and digging seven 15-foot deep test pits at various locations in Cell 1 (See *Figure III-07*).

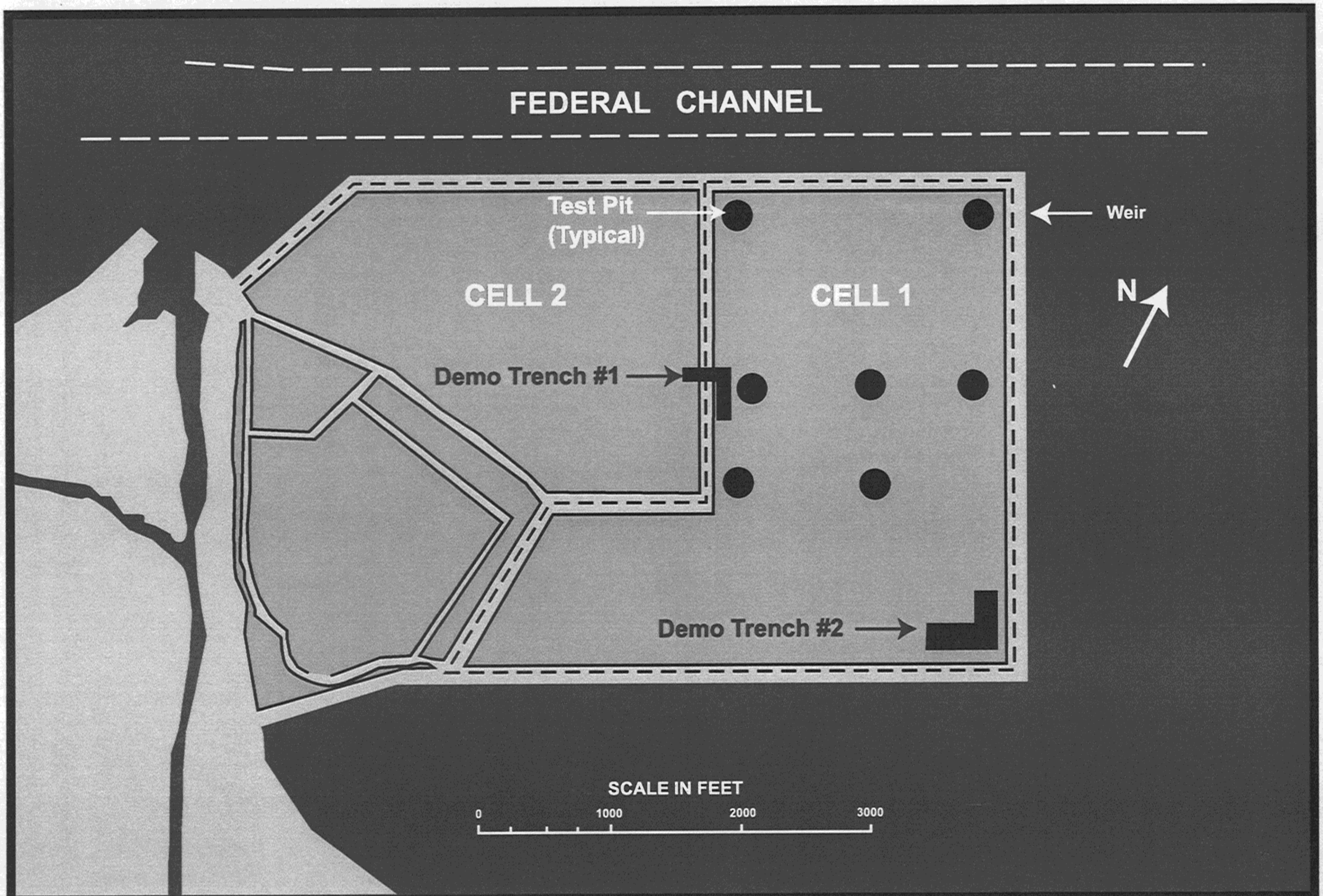
The deep L shaped trenches had reduced hydrostatic pressure and facilitated water movement by gravity to locations where it could be collected and removed through existing weirs. The excavated soil was placed on the edge of the trench. This assisted dewatering by increasing surface load in the area and squeezing out water into the trenches. The newly exposed material was also being subject to desiccation and evaporation from the air and wind. Demonstration trench number 1 remained virtually dry for several months. It was concluded that very little free water existed in the soil in that location. However, the L shaped trench at site 2 filled up with water shortly after the trenches were dug and remained full for the duration of the experiment. This is a strong indication that trenching could facilitate dewatering in the CDFs.

Digging the seven test pits at random locations allowed data to be collected, throughout the fall of 1996, on the amount of groundwater that still existed in Cell 1. Information on water levels within the test pits indicated what areas within Cell 1 would be good candidates for trenching to drain water and enhance consolidation settlement.

Water levels in the test pits indicated groundwater contours in Cell 1 varied significantly from one location to another. Also, the maturity of the dredged material varied over Cell 1. The results of the trenching and test pit monitoring was that trenching, if fully applied with optimal trench spacing and depth, could result in consolidation settlement, and possibly result in an additional year of capacity. In fact, the cumulative effect of demonstration trenching, implemented over a 3-year period (1996-1999) on cell 1, was a restoration of 1.5 million cubic yards of storage capacity at total yearly cost estimated at approximately $100,000. This is not an annual event. The test trenches indicated that if shallow trenching were practiced in conjunction with filling operations taking place at a new CDF, this management measure would improve short term drainage off the dike surface, enhance crust formation and improve dredging efficiency in the dike, subject to effluent quality criteria.

Based upon the findings of the demonstration trenches, the amount of additional space that could be gained by including trenching as a CDF management tool if applied to Cell 2 was analyzed.

Figure III-07 - Location Of Demonstration Trenches And Test Pits In Cell 1



A desiccation/consolidation computer model (PCDDF89) was used to make these calculations. The computer model simulates the consolidation and desiccation processes in fine-grained soils using the finite strain theory of consolidation and an empirical desiccation model. Settlement was calculated for each compressible layer within the disposal area, and a cumulative settlement for each subsequent dredge fill layer and compressible foundation layer was determined. Additional layers of dredged material could be added at any time. A total of 25 types of dredged fill and 25 foundation layer types could be analyzed in one simulation.

The model used the following input data: (1) foundation material properties (compression properties, specific gravity, permeability); (2) dredged material properties (compression properties, specific gravity, permeability, desiccation properties); (3) incompressible foundation reference elevation, compressible foundation thickness and initial dredged fill thickness; (4) simulation times; (5) additional fill heights; (6) initial void ratio of dredged material at time of disposal; and (7) climatological data (for desiccation settlement).

The model was first used to estimate dredged fill surface elevations for Cell 1. Model input parameters were based upon the actual historical filling pattern of Cell 1 with respect to amount of cubic yards placed on a yearly basis, the composition of the sediment, physical dimensions and characteristics of the cell itself, and local climatological data. The computer model generated dredged fill surface elevations for Cell 1. Dredged fill in place volumes were then compared to actual dredged fill surface elevations and volumes at Cell 1. The computer model dredge fill volume projections came within approximately 4 percent of the actual volume in Cell 1. Consequently, fairly accurate estimates of the impacts of using various management techniques on Cell 2 could be generated using the computer model. However, the de-watering experiment and demonstration effort was conducted on a portion of the 240-acre Cell where the material was fully characterized. It was thus difficult to estimate with accuracy how much additional capacity would be annually restored in the Cell through the application of the demonstrated CDF management techniques because of the variations in the characteristics of the bottom sediment throughout the Cell.

Based on the actual filling rates, which have exceeded 600,000 cubic yards of material per year, Cell 2 would become filled in the year 2003 without CDF management. For this study, three annual filling rates were evaluated for the time period after year 2000: 400,000; 600,000; and 850,000 cubic yards/year. All 3 filling rates assumed 600,000 cubic yards would be placed in Cell 2 from 1996 - 2000. All computer runs also assumed that the disposal facility would be managed through trenching to achieve de-watering, consolidation and settlement of the material.

e. Conclusions on Dewatering and Consolidation

These studies/projects indicate that there is significant potential to restore and provide additional capacity for the disposal of dredged sediments through the application of the berm building; and the dewatering-consolidation-settlement technique. The use of berms and trenches to dewater and consolidate materials, are effective techniques that can be included in the composition of the long-term management plan being sought. Several millions of cubic yards of storage capacity can be restored in these facilities at relatively low costs ranging from $50,000-$100,000 per year, including supervision and administration.

f. Plans for Cell 1 Southernmost Compartment

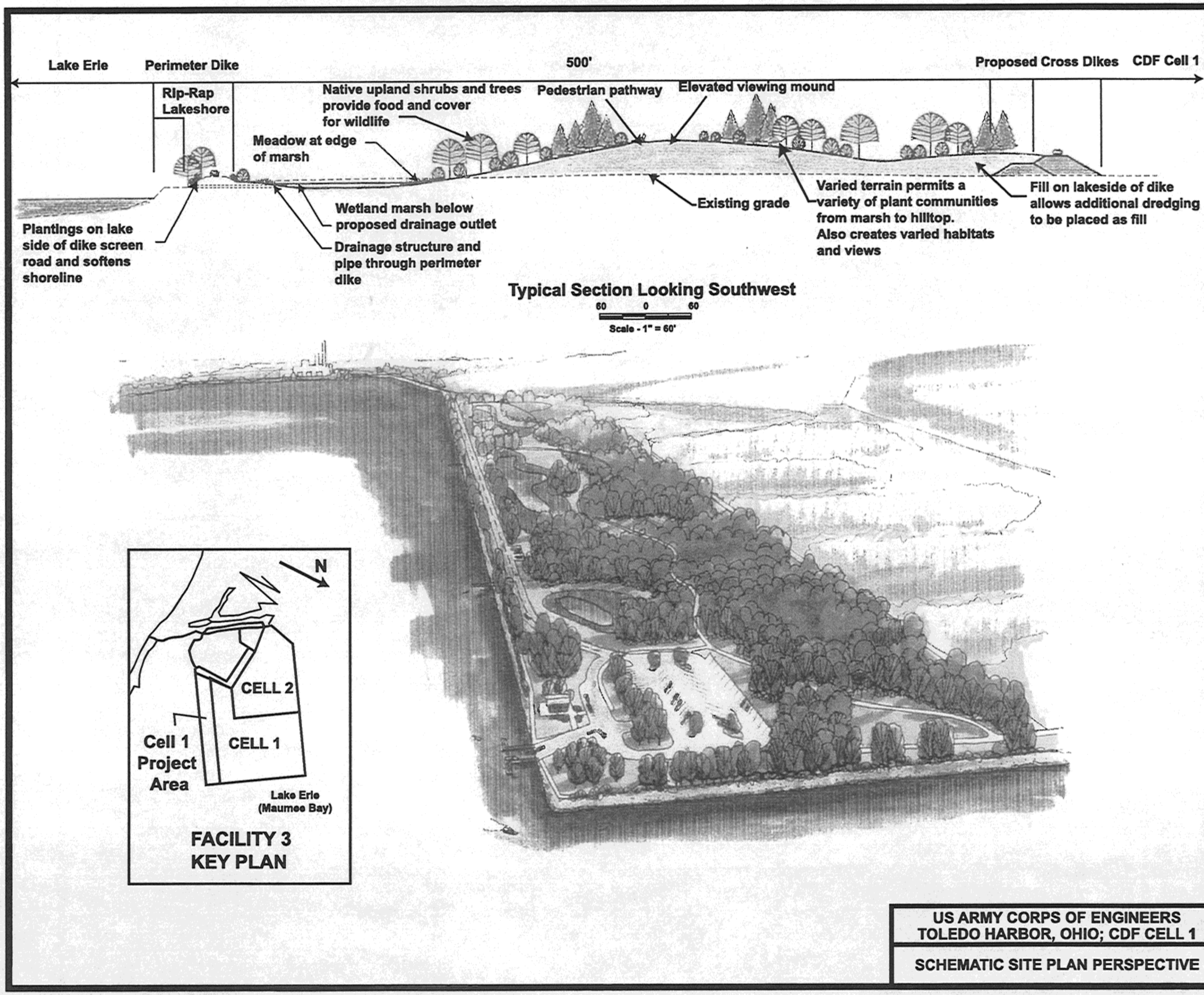
Dredge material currently in Cell 1 would be used to build a 15-foot-high cross-dike in the southernmost area of the Cell 1. This area of Cell 1 would be landscaped to provide a more environmentally pleasing view of the Cell elevation view, and would serve as a buffer zone between the raised dikes and adjacent communities, particularly the neighboring City of Oregon. The area would be landscaped with shrubs and trees etc. to create a visual buffer for the "Harbor View Beach" area, while benefiting wildlife with additional cover and food.

The area north of the berm would be used to create additional dredged material storage space in Cell 1 by raising its perimeter dikes. Also, the dredged material within the Cell would be used to build a cross-dike resulting in two rectangular compartments. The restored storage capacity resulting from the use of the dredged material to build the cross-dike would be a function of the geometric dimensions of the cross-dike, and the amount of dredged material used to landscape the southernmost area of the Cell.

Four park-like plans were conceived as part of potential future development of Cell 1. They represented a range from the lowest to the highest development cost. Although each plan had a number of elements in common, the extent to which each element was developed varied between plans. Also, the amount of dredged material needed for each plan varied and is based upon the amount of reconfiguration of existing compartment grades. A discussion of the components of the four plans is presented in ***Appendix H.***

Figure III-08 provides a diagram depicting the potential development of a park-like area on Cell 1. This is the most comprehensive plan and includes a two-lane access road that parallels the southern shore of the project area. Dredge material fill would be placed in the area between the existing perimeter dike and the proposed cross dike to create irregular mounds and simulate natural landforms. Some areas would have existing dredged material scraped away to create grassy meadows and wetland marshes. Grading within the site would result in a number of different environmental ecosystems ranging from wetlands, to grassy knolls to small hills. The terrain variation would create a variety of habitats and views. A number of tree plantings would be provided along the entire south side of the raised dike area to enhance facility aesthetics. These trees would soften the otherwise unvaried appearance of the berm when viewed from the City of Oregon. Three general parking areas, with access to fishing platforms, would be placed along the 4,200 feet of access roadway. A two-lane boat launch ramp and a parking area would be located in the southeast corner of Cell 1. A restroom/concession building with an overlook patio would be provided to the west of the launch ramp area. A network of recreational pathway would be constructed throughout the recreational compartment. Access to this recreational pathway would be provided at each of the general parking areas as well as at the boat launch area. Implementation of this park-like area is uncertain as the Port Authority and the City of Oregon differ on the future use of facility #3. At the December 13, 2000 meeting of the Executive Committee, the Toledo-Lucas County Port Authority and the City of Oregon were assigned the task of undertaking a long-term use/development plan for facility #3. Therefore, none of these plans for park-like development is recommended at this time.

Figure III-08 - Artist's Interpretation of Site Plan for Southeast Portion of Cell 1



4. Recycling and Beneficial Uses

Another method of conserving space in a CDF is to recycle the confined material and manufacture quality topsoil. Appendix E provides detailed information on the recycling and reuse of dredged material to restore storage capacity. The concept of recycling and beneficial use of dredged material was evaluated as a means of extending the useful life of existing CDFs. One method was to remove the sediment that has been placed in CDFs, and use this dredged sediment as a raw material, such as fill in road construction. In another method, organic wastes and bio-solids were brought to the CDF site at Cell 1 and mixed with the dredged material to manufacture a soil. This manufactured soil can be used for topsoil, landfill final cover and wetlands.

In 1986, the Toledo-Lucas County Port Authority entered into an agreement with a fertilizer company to manufacture high quality topsoil. The effort started on an 11-acre parcel located at the Port's general cargo facility. The effort tested the use of treated city sewage sludge, lime sludge and dredge material to make commercially viable topsoil. The test effort resulted in the development of a formula that identified the appropriate combination of the three waste products needed to produce high quality topsoil. However, due to the nature of the sewage sludge in the topsoil product, known as Nu-soil, the use of the material was restricted. Nu-soil consisted of 90% dewatered dredged material, 8% wastewater biosolids, and 2% water treatment lime sludge. Nu-soil had a pH around 8 from the addition of lime, and could be used as a topsoil product. It contained a large fraction of silt and clay from the dredged material, and an increased organic matter and nutrient level from the addition of wastewater biosolids.

According to Ohio EPA, the material can only be placed in areas with restricted public access unless it is stored for up to one year when the freeze-thaw cycle will eliminate any possible pathogens resulting from the use of processed city sewage sludge. 25,000 to 50,000 cubic yards of Nu-soil are being produced annually for landfill cover throughout the City of Toledo. Nu-soil is less expensive than conventional topsoil, and should be sustainable through the sale of the product as topsoil. The market for Nu-soil is not large enough to help remove substantial volumes of material from the CDF at this time. However, this product has been developing and has shown much success as landfill cover.

In 1994, the Buffalo District conducted sampling and laboratory analysis of material from Cell1 of Facility #3 to determine the quality of the confined material. The results of soil testing data indicated that the tested area soil quality level would meet OEPA's regulations pertaining to any contaminants. As a result, the district awarded a contract to remove 50,000 cubic yards of dredged material over a two-year period down to maximum cut of about 3 to 4 feet below existing contour. During this 2-year period about 300 cubic yards of material was removed. Upon request by the contractor in 1996, the district renewed and extended the contract for one more year. The contractor removed no additional material during that one-year period. This was an indication that beneficial reuse of the dredged material without amending it would not help restore any significant storage capacity in the existing CDF.

In 1996, the U. S. Army Corps of Engineers developed another form of manufactured soil with dredged material from Cell 1 using its congressionally authorized Cooperative Research and

Development Agreements (CRDA). Screening tests on the suitability of using sediment from Toledo Harbor CDF Cell 1, in conjunction with sawdust (cellulose) and bio-solids (N-Viro), were conducted by Scott and Sons at their research facility in Marysville, Ohio. Four blends of the three components were used to grow test plants. One objective of the test was to determine what combination of dredged material, sawdust and N-Viro was the best growth medium. Once this combination was determined, a field demonstration using this mixture was made. Dredge material was sampled from three locations at Toledo Dike No.1, and from three different depths: 0-4 feet, 4-8 feet and 8-12 feet. This material was used to make four blends of growth medium (See *Appendix E*). Four annual plant species (tomato, vinca, marigold, and ryegrass) were grown from seed in the various blends to evaluate seed germination and plant growth. These plant species were selected because they are sensitive to salt, metals, nutrient imbalances and represented a wide range of upland plants. Seed germination tests lasted 14 and 21 days. The best seed germination was found for blend 2 while blends containing a higher percentage of dredged material showed significantly lower seed germination. In addition to the germination tests, biomass growth tests were run for seven weeks. At the end of the tests, total above ground biomass was measured. Blend 4 produced the highest biomass of any of the blends with results comparable to the fertile reference control growth medium (***Figure III-09***).

According to the U.S. EPA Part 503-regulation guidance (Application of sludge material), total metal concentrations in blend 4 would be a fraction of the concentrations allowed for unrestricted land use for land receiving bio-solids from reconditioned sewage sludge (See ***Table III-06***). Additional tests were also conducted using fertility analysis and physical characteristics of the manufactured soil, pre- and post-demonstration, on plant growth (***Table III-07***). Based upon these test results, a demonstration project was conducted in September 1996.

The demonstration project used 660 cubic yards of manufactured soil prepared at Toledo CDF Cell 1. A test area 400 by 400 foot was cleared of all vegetation (***Figure III-10***). The top foot of dredged material was removed by bulldozer and used to construct a 100 by 200-foot processing pad. The second foot of material was used to create the manufactured soil. Approximately 1,800 cubic yards of dredged material was collected from Cell 1 with a bulldozer. Yard waste (140 cubic yards) was trucked in from a compost processing plant at Greenleaf, Ohio. N-Viro bio-solids were obtained from the Toledo Wastewater Treatment Facility/N-Viro Facility. Manufactured soil was produced in batches by combining the blending equipment with a front-end loader (***Figure III-11***). Individual batches were blended with a rotary screen and then stockpiled in a 100 by 100-foot staging area (***Figure III-12***). During the production of manufactured soil, stormwater was collected from around the processing pad.

The manufactured soil was loaded into trucks, sealed and covered prior to transport to the two field demonstration sites. These field demonstration sites were located at the University of Toledo and the Toledo Botanical Gardens. The University of Toledo site used 500 cubic yards of manufactured soil to landscape two entrance sites at the University. The sites consisted of a grassed lawn, evergreen trees toward the back of the area, and a small shrub landscaped area around the entrance signs to the University. The Toledo Botanical Gardens used 160 cubic yards of the manufactured soil to increase the elevation of soil beds behind a hedge at the entrance to the Botanical Garden. The remaining material was used to either rework other soil beds or satisfy landscaping needs throughout the Botanical Garden.

The demonstration sites were monitored by observation and photographed periodically to document their progress. Grass lawn areas and areas with shrubs and trees were maintained with standard procedures used for the remainder of the Garden. The plants and grasses grown in the manufactured soil showed that soil manufactured using dredged material from Cell 1 of the Toledo CDF, was a very good medium for plant growth at both the City University and the botanical garden sites. See ***Figures III-13 and 14.***

The engineering feasibility of the recycling and beneficial reuse of the soils manufactured from the dredged material has been established and successfully demonstrated (***Appendix E***). There remains yet the task of establishing its economic feasibility and which product will expand the current market and what share of the expanded market it will capture. In order to achieve this goal and move forward, the Toledo-Lucas County Port Authority has initiated a demonstration program of the different technologies and uses of the material. Three companies responded to a request for a proposal from the Port Authority and each has been provided 33 acres of land at the Port's confined disposal facility to demonstrate the commercial feasibility of their product. The producer of NU soil will expand on its existing program of using sewage sludge and lime sludge mixed with dredge material. The second company's effort will involve mixing fly ash with dredge material to produce a construction grade material. Finally the third company will be using yard waste mixed with dredge material to produce high quality topsoil. The demonstrations are anticipated to last through June 2001 and depending upon the success of the effort, the companies may be granted a long-term lease or license to develop their business. The only funds being sought at this time are from the USEPA. The funds would be used to help develop the infrastructure necessary to move material into and out of the confined disposal facility. It is anticipated that approximately $500,000 would allow for the construction of a second access bridge and to the facility and upgrade the access roads.

5. Agricultural Strategies to Decrease Erosion and Sediment Loading

Sediment reduction strategies had three major components in common, namely; incentive programs for landowners, demonstration projects, and information and education activities. The largest activity within the county strategies was the development of incentive programs to encourage individual landowners to implement sediment-reducing practices. These incentives included vegetative cover programs, structural practice programs (wetlands, sediment ponds), conservation tillage farmer incentives and new and innovative ideas.

The Maumee River watershed encompasses more than 4.2 million acres in three states: Ohio, Indiana and Michigan. Approximately 78 % of this land (3,300,000 acres) is used for agriculture. Forestland, farmland and pasture account for another 300,000 acres, 100,000 acres and 50,000 acres respectively. The remaining 450,000 acres consists of urban development and transportation systems.

Land use significantly affects the rate of runoff and erosion. The sediment load in the Maumee River is extremely high by national standards due to the large size of the watershed and the high percentage of the watershed that is used as cultivated cropland. Sediment loads eventually settle out in the Maumee River as flow rates decrease and the river flow enters Lake Erie. This is evidenced by high sedimentation rates in the navigation channels located in the lower River and western basin of Lake Erie. Approximately 1,268,000 tons of sediment passes the USGS gauge at Waterville Ohio, annually. Waterville, Ohio is located approximately 15 miles south of Toledo, upstream of Toledo on the Maumee River. This sediment load is primarily the result of erosion and over 90 % of the erosion occurring in the basin is the result of crop production.

Figure III-09 - Overall View of the Toledo Harbor
Dredged Material Plant Growth After Seven Weeks

TABLE III-06
PREDICTED METAL CONCENTRATIONS IN BLEND 4 USINF 0-3 FOT SURFACE LAYER OF DREDGED MATERIAL FROM TOLEDO HARBOR CELL (ppm)

	Dredged Material from Cell 1	Blend 4	EPA 503 Regulations
Arsenic	8.20	5.00	41.00
Cadmium	1.40	0.84	39.00
Chromium	33.20	19.90	
Copper	35.70	21.40	1500.00
Lead	41.20	24.70	300.00
Mercury	1.78	1.07	17.00
Nickel	35.90	21.50	420.00
Zinc	171.00	102.60	2800.00

TABLE III-07. SOIL FERTILITY ANALYSIS AND PHYSICAL CHARACTERIZATION OF BLEND 4 CONSISTING OF DREDGED MATERIAL FROM CELL 1

Parameters	Units	Blend 4 Dredged material + cellulose + biosolids *	Blend 4 Dredged material + cellulose + biosolids **
Total Kjeldahl Nitrogen	mg/kg	319.0	157.0
Total Phosphorus	mg/kg	140.86	278.61
Ortho-Phosphate	mg/kg	15.80	4.56
Sulfur	mg/kg	619.50	462.74
Magnesium	mg/kg	210.30	195.15
Sodium	mg/kg	79.84	35.84
Calcium	mg/kg	2867.73	5782.46
Zinc	mg/kg	16.19	10.15
Potassium	mg/kg	260.94	229.84
Organic Matter		21.83	20.00
CEC	Me/100g	57.7	56.8
PH		7.22	8.42
Base Saturation	%		
(Ca-MG-K-Acid)		84-10-4-2	93-5-2-0
Particle Size			
Sand	% wt	18.9	
Silt	% wt	58.98	
Clay	% wt	22.12	

* prior to plant growth test
** after the plant growth test

Figure III-10 - Removal of Surface Dredged Material for
Construction of a Processing Psd

Figure III-11 - Placing Mixture Into a Hopper of a Rotating 1" Screen Blender

Figure III-12 - Blender Discharging Manufactured Soil Out of a Conveyor Belt to the Right Into a Pile

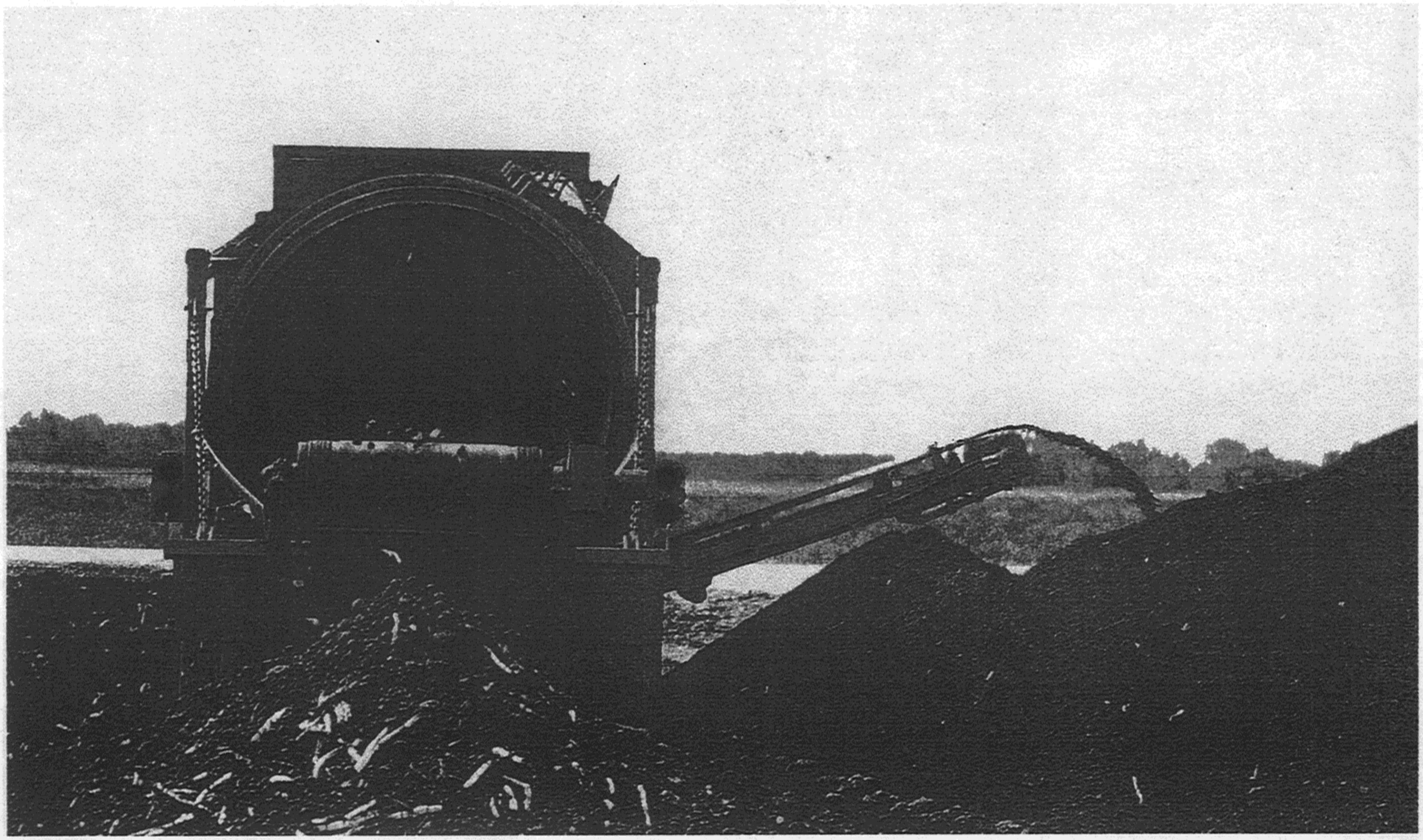


Figure III-13 - Lanscaped Entrance to the University of Toledo

Figure III-14 - Landscaped Bed at the Entrance to the Toledo Botanical Garden

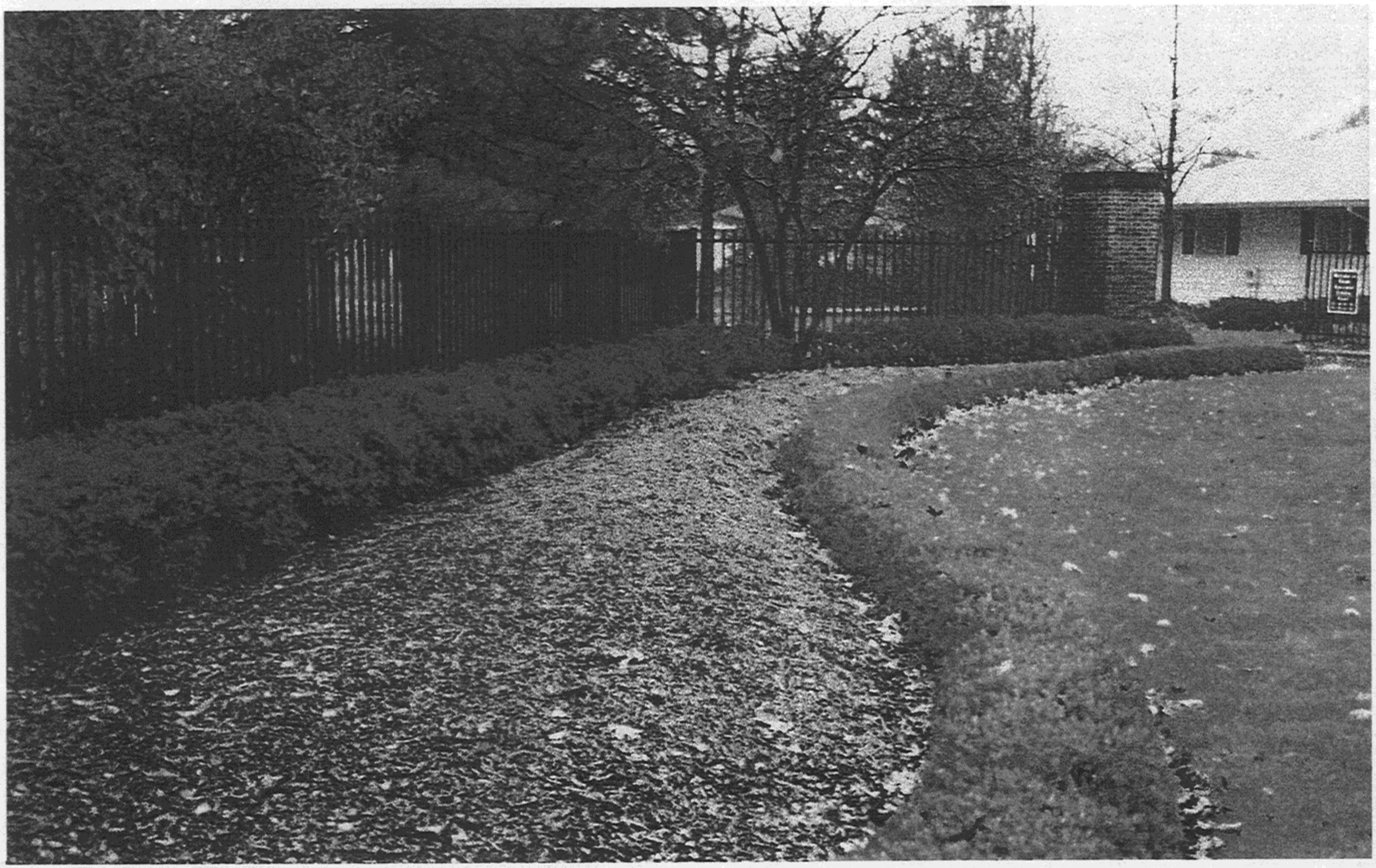
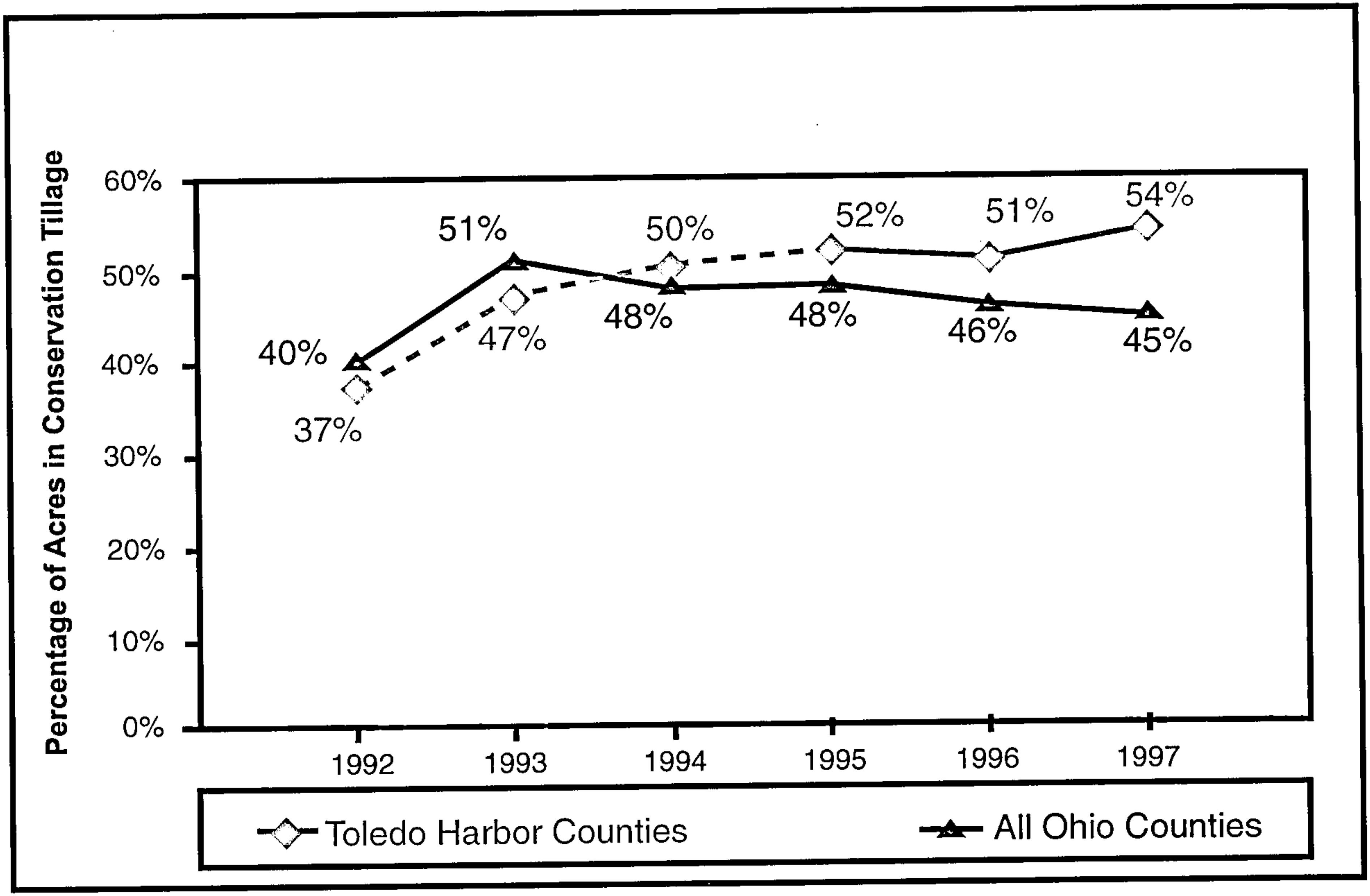


Figure III-15 - Conservation Tillage Trends in Northwest Ohio



An additional 3 to 5% comes from gully and large rill erosion. The remaining erosion comes from all other sources. Seventy-five percent of the cropland acreage is planted in corn and soybeans each year (2.5 million acres), and 90 % of the watershed erosion comes from cultivated cropland. Consequently, it is logical to assume that a reduction of sediment entering the watershed from corn and soybean farmland erosion could have an impact on the cubic yards dredged annually at Toledo Harbor.

Based upon historical information, the Corps of Engineers dredges, on the average, 850,000 cubic yards of material per year from the Toledo Harbor navigational complex. Approximately 400,000 cubic yards is removed from the River channel and the remaining 450,000 is dredged from the Lake channel. The sediment removed from the River channel represents almost half of the sediment removed annually. The primary source of this river sediment is from cropland erosion. Therefore the LTMS addressed agricultural sediment loading and set a target of reducing sediment load by 130,000 cubic yards annually. The primary method to achieve this reduction in sediment loading was identified as having the agriculture community in the watershed engage in conservation tillage practices that have proven successful in reducing cropland erosion.

In 1995, the Natural Resources Conservation Service (NRCS) and the U.S. Army Corps of Engineers formed a partnership to implement a 2-year pilot project that would assess the effectiveness of using conservation tillage and other innovative technologies to reduce sediment transported to Toledo Harbor channels. Details of the pilot study are provided in *Appendix C.*

The project provided $700,000 that was used by individual counties in the watershed to develop and implement locally led sediment reduction strategies and activities. Twenty-two of the twenty-five counties in the watershed participated in the pilot project. The three counties that did not participate were located at the edge of the watershed and only had a few acres contributing to the Maumee River watershed.

The participating counties were asked to form a sediment reduction committee and develop a county sediment reduction strategy. The process was locally managed and involved more than just local conservation partners in developing the county strategies. The average sediment reduction committee consisted of 16 individuals. Over 44 different organizations participated as partners on the collective committees.

Once each county developed their sediment reduction strategy, they competed for grants to implement their respective programs. Approximately 76 % of the funds ($532,000) needed to implement the programs were provided in the grant program. Grants were awarded based on merit, innovation, potential for success, and likelihood of contributing to sediment reduction.

The Counties' sediment reduction strategies briefly discussed below are:

a. Conservation Tillage
b. Vegetative Cover (Filter strips)
c. Wetland Sediment Ponds (Structural Practice)

a. Conservation Tillage

Conservation Tillage incentives were part of every county sediment reduction strategy. This practice requires the farmer to till the soil after harvest in such a way that at least 30 % of the soil surface is covered with the previous crop residue after planting. This usually requires specialized equipment. To address the need for the specialized equipment the incentives were of two major types: equipment incentives and tillage demonstrations. The incentives allowed the farmer to buy, lease or rent a piece of conservation tillage equipment or equipment attachment that would allow the farmer to do new conservation tillage or get more consistent results with an existing tillage system.

b. Vegetative Cover

Vegetative Cover programs encourage landowners to develop conservation buffers (filter strips), convert cropland to grassland, utilize fall seeded cover crops, etc. Eleven counties included vegetative cover programs in their strategies. The benefits of these programs included filtering runoff, and reducing erosion rates by changing intensive row crop cultivation to grass cover.

c. Wetland Sediment Ponds

Three counties included structural practice programs in their county sediment reduction strategies. Structural conservation practices included building erosion control structures, sod waterways, and water sediment control basins or wetland sediment ponds, which NRCS did not consider cost-effective practices with respect to the other strategies and their relative contributions to the total sediment load reduction effort.

Since the demonstration project period was only two years in length, it was not expected that reductions in sediment loading resulting from project activities would be reflected in gauge data or in short term dredge quantities. Therefore, the effect of the pilot project activities on sediment reduction in the Harbor were evaluated using the following three measures: measurements of conservation tillage trends within the Maumee Basin, long term sediment concentrations based on long term water monitoring data, and estimates of gross erosion within the watershed.

The conservation tillage trend for corn and soybeans was evaluated for all counties in the project area and all counties in the state. The evaluation indicated the percent of corn and soybean acreage in conservation tillage continued to increase from 52 to 54 % during the pilot study for the counties within the project area (***Figure III-15***). This is in contrast to a decline in the percent of corn and soybean acreage in conservation tillage acres for all counties in the state during this same period (from 48 to 45 %).

In 1995, the U.S. Department of Agriculture funded an investigation on the effectiveness of agricultural pollution abatement programs over a period of 20 years (1975 to 1995) in the Maumee and Sandusky watersheds (Lake Erie Agricultural Systems for Environmental Quality (LEASEQ) Project). The availability of water quality data for these two watersheds over the study period allowed the interrelationship between agricultural land use and water quality to be evaluated. See ***Appendix C1*** for details on this program.

The study concluded that during this time frame sediment concentrations decreased by approximately 20 %. It was determined that this reduction in sediment concentrations was predominately due to improved agricultural stewardship of the land and water resources of the two watersheds. This study demonstrated that increasing conservation tillage practices in the Maumee River Basin has a high potential for decreasing sediment concentrations in the River and subsequently sediment deposition in the commercial navigation channels.

The third measure examined yearly changes in gross erosion in the Maumee River watershed. Gross erosion is affected by: (1) the number of acres under conservation tillage; (2) the yearly mix of row crops, small grains and meadow crops; (3) the number of acres enrolled in the Conservation Reserve Programs and (4) the acres of land in conservation buffers.

A preliminary estimate of the change in gross erosion occurring in the Maumee River watershed was calculated for the period of 1992 to 1997. This estimate was based solely on the increased conservation tillage and conservation buffer data for the Ohio counties in the watershed. The data indicated that sediment loading in the system had been reduced by 68,900 cubic yards, or 53 % of the annual goal of 130,000 cubic yards. This was achieved by constructing conservation buffers in approximately 5% of the possible areas available, 43% of available corn acreage and 60% of the soybean acreage utilizing conservation tillage.

One of the findings of the study was that it would be extremely difficult to meet the goal of reducing agricultural related sediment by 130,000 cubic yards per year by only increasing the percentage of corn and soybean acres using conservation tillage practices. However, available agricultural information also indicated that conservation buffers are effective at trapping sediments, nutrients, pesticides and pathogens. Consequently, the NRCS included this management practice in the two-year pilot project and evaluated their effectiveness in reducing sediment loading to the receiving waterbody.

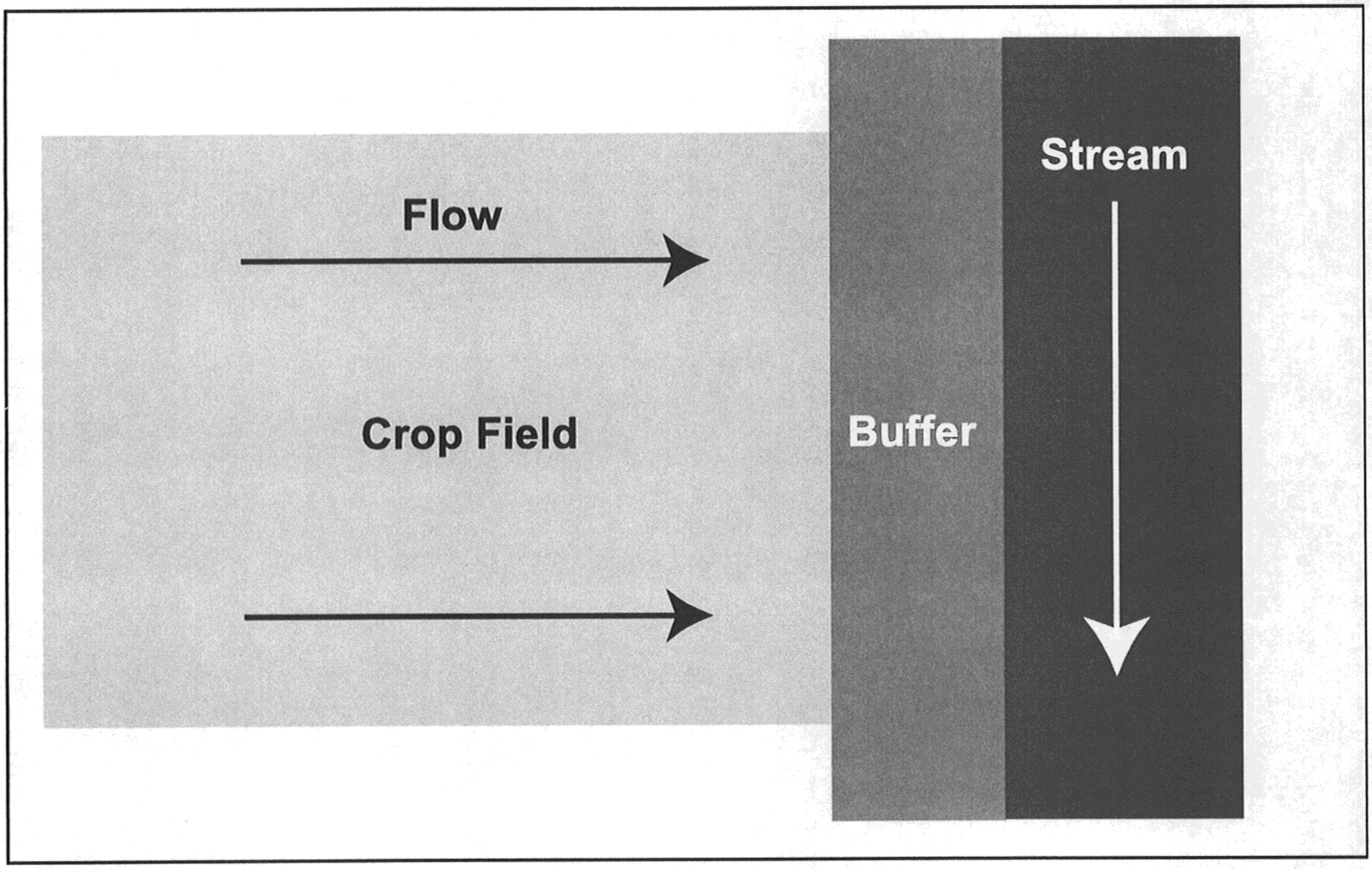
It was determined that the types of buffers that would be most appropriate for the Maumee River watershed included: grass filter strips, grassed waterways, riparian forest buffers, wetland restoration and field windbreaks. The effectiveness of these types of buffers is site specific, and depends on buffer width, site topography, vegetation, buffer size, buffer configuration and climate.

An analytical model was developed that calculated pre (1992) and post (1997) erosion and sediment delivery rates as new conservation buffers were applied at varying rates to the watershed. The model accommodated simultaneously varying the rate of conservation tillage and assigned credits for reduced erosion rates from land taken out of production and devoted to buffers.

For model evaluation purposes, the buffers were assumed to be of two types: filter strips and filter basins. The filter strips were designed to be grass or tree strips located adjacent to streams and watercourses in the flatter sections of the basin. The average buffer width was between 35 and 45 feet. Filter basins or constructed wetlands were circular or rectangular filter areas located at the outlets of drainage areas in the more rolling areas of the basin. The maximum area effectively protected by each one acre of buffer was assumed to be 15 acres. The buffers were assumed to trap 25 % of the sediment that passes through each acre of buffer. It was also assumed that fields draining into the buffers would practice conservation tillage at the same percentage as the watershed as a whole (***Figures III-16 & 17***).

Figure III-16 - Conceptual View of a Filter Strip Conservation Buffer for Flat Land

Top View



Profile view

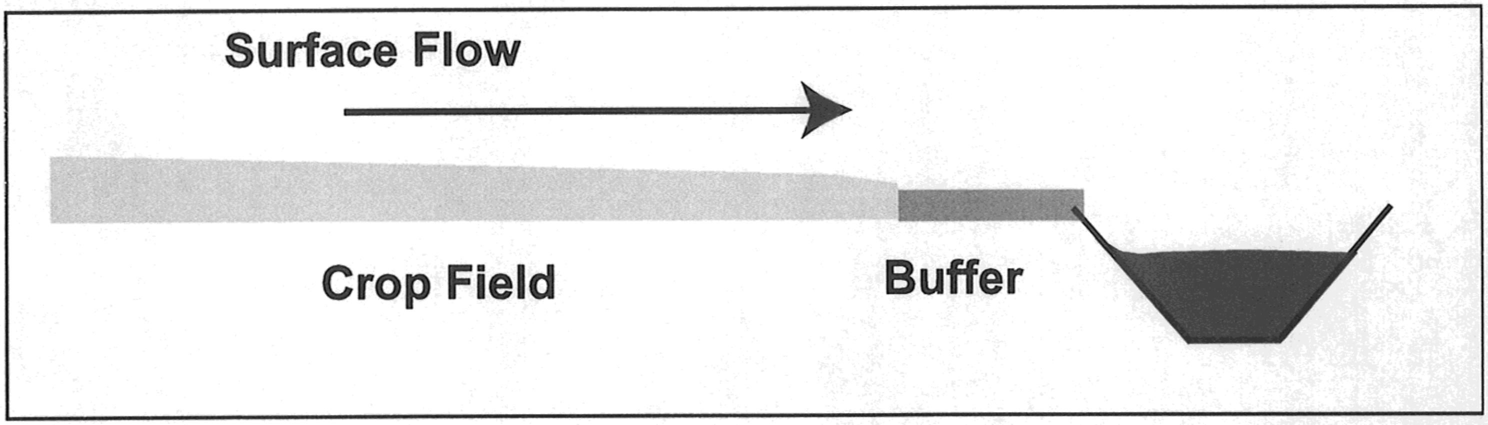
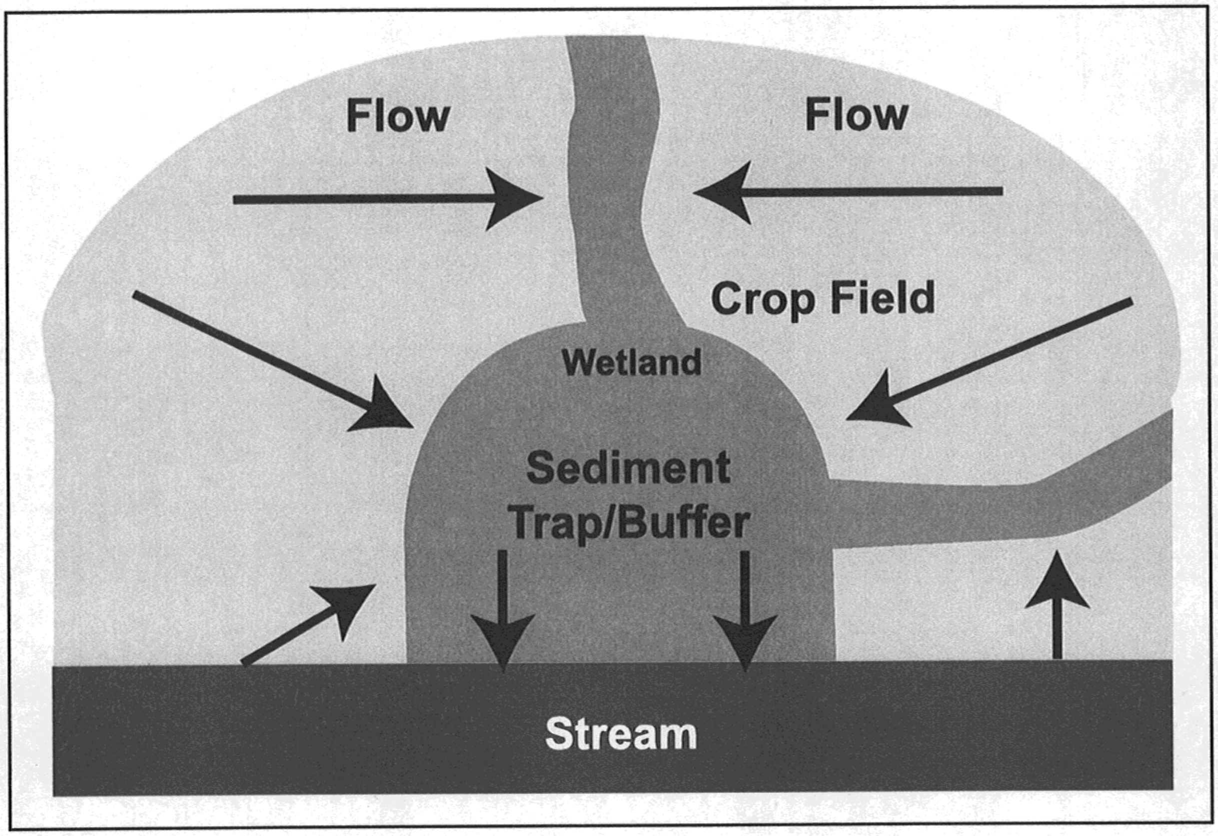
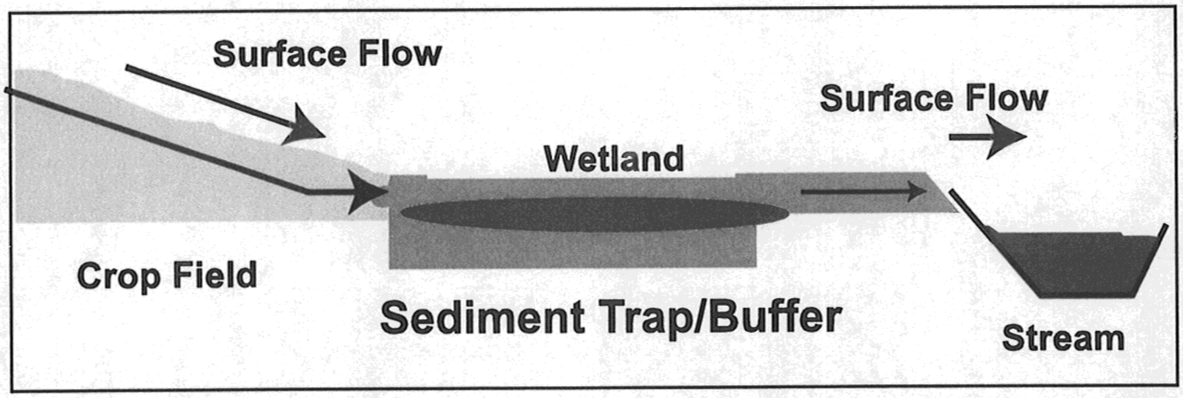


Figure III-17 - Conceptual View of a Sediment Basin Buffer for Sloping Lands

Top View



Profile View



Based on 1992 crop patterns, the model determined that 131,163 cubic yards of sediment loading potential could be removed from agricultural sources by applying buffers to 30 % of active cropland and having corn and soybean conservation tillage achieve a 55% and 66 % levels respectively. This integrated approach would allow the goal of reducing yearly sediment loading from agricultural sources by 130,000 cubic yards in the Maumee River to be met even if the original goal of 75 % of available acreage under conservation tillage was not achieved. At the end of the 1997 crop year, conservation buffers had been applied to 5 % of cropland. The percent of corn acreage practicing conservation tillage was at 43 % and the percent of soybean acreage practicing conservation tillage was at 60%. Raising the acres of corn and soybeans that have conservation buffers by 25 % would call for an additional 58,330 acres of new conservation buffers to be created.

One of the findings of the study was that recent changes in USDA commodity programs and crop market prices have resulted in an increase in acres planted in corn and soybeans and a decrease in small grain acres in the watershed. This will result in more gross erosion and subsequent increase in the sedimentation of the navigation channels. This in turn translates to an increased rate of erosion and thus increased need for conservation buffers and conservation tillage. This shift in crop patterns will increase the percent of acres that will need to be managed with conservation tillage in order to meet the goal of reducing the annual sediment load in the River by 130,000 cubic yards. Consequently, the model needs to be updated to account for this shift in crop patterns and to determine the percentage of conservation tillage needed to meet the agricultural goal.

Additionally, given the size of the watershed (over 4 million acres) it is difficult to determine the actual sources of the majority of the sediment. The basin has a number of sub-watersheds that have a high level of agriculture activity and extensively developed manmade drainage systems. Additionally, soils in the watershed have high concentrations of fine clay particles that stay in suspension for long periods of time and thus can be transported long distances. Better sediment data on each of the major tributaries could help isolate the major sources of sediment. Because of the watershed complexity, there is a need to continue long term monitoring at the stations that exist throughout the basin and to establish similar monitoring stations on the major tributaries that currently do not have monitoring stations.

To fully implement the Conservation Tillage Program, $1.6 million is needed annually over a period of five years for the Maumee River Basin effort to supplement the existing Department of Agriculture budget. The Ohio State University, Department of Agriculture, Environmental economics, completed research in 1998 on the costs and benefits of controlling soil erosion in the Maumee River basin. It was found that a 15% reduction in total gross soil erosion in the basin could reduce dredging and confining costs by $1.3 million per year. (Reference Ohio State University Department of Agricultural, Environmental and Development Economics: *"Natural Resources and Environmental Economics Research News, published November 1998).*

In addition, the State of Ohio and the Federal Government need to continue funding the Conservation Reserve Enhancement Program to allow for the full impact of these conservation efforts.

6. Capacity Expansion of Confined Disposal Facilities

Phase 4 evaluated the impacts associated with construction of new CDFs as part of the sediment management strategy. Construction of new facilities would be needed once capacity in existing CDFs had been reached. However, due to the scarcity of nearshore land and the loss of wetland and aquatic habitat associated with the construction of new CDFs, the construction of new CDFs was considered a last resort unless environmental benefits can be achieved.

A capacity analysis of Cells 1 and 2 was performed and documented in detail in ***Appendix D2.*** The conclusions drawn from that analysis were that the two cells would become filled somewhere between 2003 and 2009 even if CDF management was practiced. This analysis was based on a number of scenarios including annual cell fill rates, and consideration of whether open lake disposal was available. As a result of the analysis, construction of a new CDF would need to be completed sometime during the 2003-2007 period to assure the continued maintenance of Toledo Harbor navigational channels.

Three potential sites for new CDFs: were considered: (1) Facility #3 site for possible expansion of Cell 1, (2) Island 18 site for possible expansion of Island 18 itself and (3) Woodtick Peninsula site for possible construction of a new CDF located north of Woodtick Peninsula (***Figure III-18***). These sites are discussed later in this report.

a. Expansion of Cell 1

Construction of a new CDF adjacent to the east side of Cell 1 was evaluated. Three different sizes were considered based on assumed results of the open-lake evaluation effort. The new CDF was designed to hold 20 years of dredged material. Therefore in order to accommodate a 20-year life expectancy the width of the new cell varied from 3,500 feet to 2,500 feet to 1,500 feet based upon annual dredging volumes of 850,000, 600,000, and 350,000 cubic yards respectively. Total volume of material placed in the CDF over the 20 year period equaled annual dredging volumes that needed to be confined times 20 years of dredging times a representative consolidation factor. Total needed CDF cubic yard capacity ranged from 12,920,000 for annual placement of 850,000 cubic yards (Cell-1, Size A) to 5,320,000 for annual placement of 350,000 cubic yards (Cell-1, Size C). The actual perimeter of the CDF site was then calculated for each alternative, given the total cubic yards needed to hold 20 years of dredging for each alternative (***Table III-08***).

Relative costs were developed from the footprint for each of the structures. Costs included construction costs, contingencies, engineering and design costs, and supervision and administration costs. Interest during construction was calculated for each of the plans assuming a two-year construction period and no construction during January, February and March. This interest was then added to construction and management costs to obtain total project costs.

The total project costs resulted in investment costs that were converted to average annual costs using the partial payment factor for a 6.375 % interest rate and a 20-year project life. Average annual maintenance costs were added to arrive at total average annual costs. Total project costs ranged from $10,371,400 for Cell 1-Size C to $21,287,300 for Cell 1-Size A. (see ***Table III-09***).

As shown in *Table III-09*, total average annual costs ranged from $750,600 for Cell 1-Size C to $1,540,700 for Cell 1-Size A.

Expanding Cell 1 received considerable opposition from the local community because of its potential to degrade Maumee Bay water quality by cutting water circulation in that area of the Bay. Further, the Ohio Department of Natural Resources and U.S. Fish and Wildlife historically opposed the construction of CDFs in the near shore because they believe these structures have destructive and adverse impacts on underwater fish habitats. In addition to the above oppositions, a "*Save the Bay*" committee was formed in the city of Oregon. Their goal was to stop the expansion of Cell 1. On June 26, 2000, the City Council, supporting the views of its citizens, passed a resolution stating its opposition to any horizontal expansion of the confined disposal facility #3 based on their concern for the public health, safety and welfare of its citizens.

At several other meetings with citizens groups in both Toledo and Oregon, the Port Authority and the Corps have recorded their numerous complaints and reasons for opposing so vehemently the horizontal and vertical expansion of facility #3.

Figure III-18 - Possible Location of New CDFs

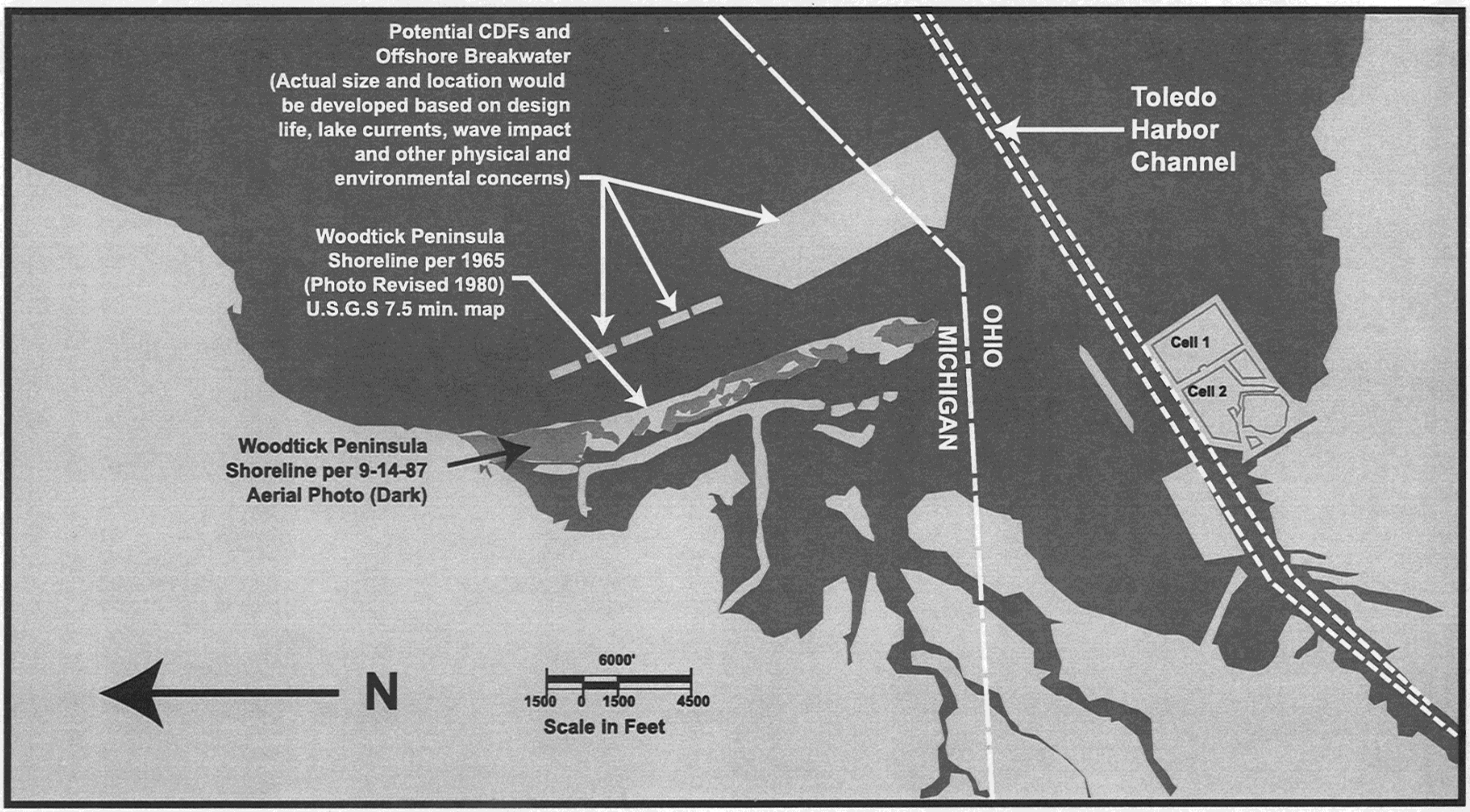


TABLE III-08. REQUIRED CAPACITY AND DIKE LENGTHS FOR NEW CDFs ADJACENT TO CELL 1 AND ISLAND 18.

CDF SITE	Cubic Yards Placed Annually	Cubic Yards Placed Over 20 Years	Consolidation Factor	Cubic Yard Capacity Needed In New CDF
Cell 1- Size A.	850,000	17,000,000	0.76	12,920,000
Cell-1- Size B	600,000	12,000,000	0.76	9,120,000
Cell-1- Size C	350,000	7,000,000	0.76	5,320,000
Island18-Size A	850,000	17,000,000	0.76	12,920,000
Island 18-Size B	600,000	12,000,000	0.76	9,120,000
Island 18-Size C	350,000	7,000,000	0.76	5,320,000

In an August 2000 meeting, about 200 residents of the cities of Toledo and Oregon expressed their opposition to further expansion of facility #3 and vowed to get their state senators and U.S. representatives involved to stop the project.

As a result, the city of Oregon held a follow-up meeting in city hall in September 2000 to convey to USACE the wishes of the people of Oregon. During the meeting, the mayor provided USACE's representative a copy of Resolution No 199-2000 passed by the City Council and endorsed by the mayor opposing the placement of dredged material beyond Facility 3 within the city of Oregon.

Section 2 of the resolution reads: "this Council urges the U.S. Army Corps of Engineers, the Ohio Environmental Protection Agency, the Ohio Department of Natural Resources and each and every other public agency or office with any authority over the dredging project to deny and reject any dredging plan which includes disposing of dredged material in the City of Oregon". The Resolution was further declared to be an emergency measure and shall take effect and be in force from and after its passage and signature by the Mayor. It further stated that the reason for this emergency lies in the immediate need to protect the public health, safety and Welfare.

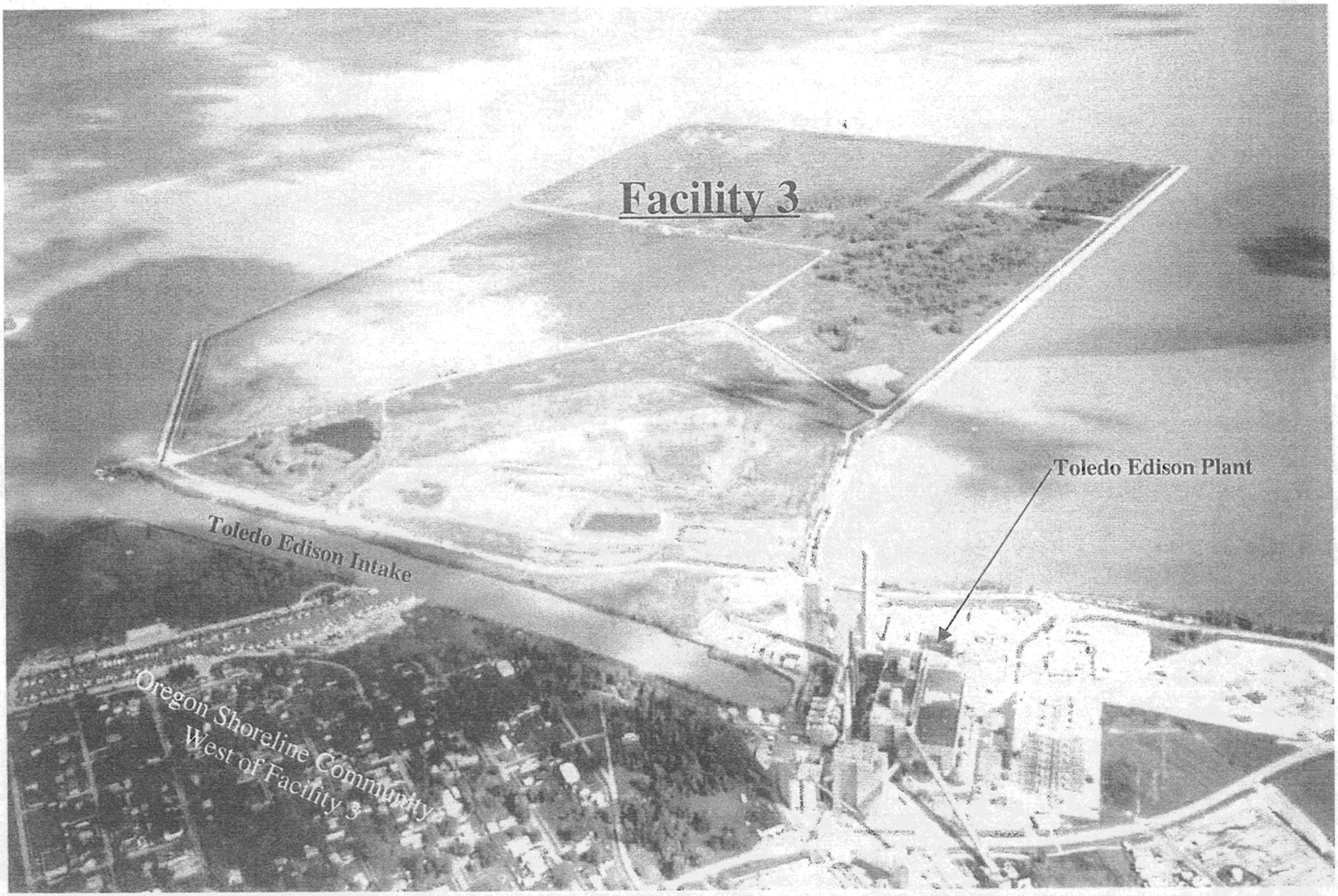
In October 2000, the City of Oregon held another meeting to discuss the City of Oregon Position Paper on facility #3. The purpose of the Position Paper was to protect Maumee Bay and the Oregon shorelines. The Position Paper contends that the existing 242-acre facility #3 (***Figure III-19***) cuts off Maumee Bay from the natural currents of the Maumee River and western Lake Erie. It states that "the proposed expansion would truly isolate the remainder of the Bay from Lake Erie. The "Toledo Blade,"in an article entitled "Bacteria no simple foe at Maumee Bay State Park" published on July 30, 2000, reported that the Ohio Department of Health has concluded that stagnant water in the Bay is a major cause of the problem allowing *E-coli* bacteria problems to build up. Any proposed extensions into the Bay would magnify these problems by further cutting off circulation.

TABLE III-09 Preliminary Costs Associated With New CDFs Located Adjacent To Cell 1 And Island 18

Dike Disposal Sites	Construction Costs	Total Cost Plus Contingencies	Engineering And Design Costs	Supervision & Administration costs (Includes S&I)	Total Project Costs	Investment Costs Plus Interest During Construction	Present Worth Of Annual Mainten Costs(1)	Total Implntation Costs	Present Worth Factor Yr7 to Yr 1	Total Present Worth Of Implntation Costs (2)	Total Average Annual Costs (3)	Average Annual Bnfts (4)	Benefit To Cost Ratio(5)
Cell 1-Size A	$15,423,900	$19,279,400	$1,388,000	$619,900	$21,287,300	$22,425,000	$2,417,300	$24,842,300	0.690180304	$17,145,700	$1,540,700	$4,758,300	3.08
Cell 1-Size B	$11,469,000	$14,336,200	$1,032,500	$460,600	$15,829,300	$16,675,300	$1,797,300	$18,472,600	0.690180304	$12,749,400	$1,145,600	$4,758,300	4.15
Cell I-Size C	$7,514,200	$9,393,000	$676,100	$302,300	$10,371,400	$10,925,700	$1,177,900	$12,103,600	0.690180304	$8,353,700	$750,600	$4,758,300	6.39
Island 18-Size A	$25,607,500	$32,009,000	$2,305,100	$1,029,500	$35,343,600	$37,232,500	$4,013,300	$41,245,800	0.690180304	$28,467,000	$2,558,000	$4,758,300	1.86
Island 18-Size B	$21,356,100	$26,695,100	$1,922,100	$858,900	$29,476,100	$31,051,500	$3,346,900	$34,398,400	0.690180304	$23,741,100	$2,133,300	$4,758,300	2.23
Island 18-Size C	$15,423,900	$19,279,400	$1,388,000	$619,900	$21,287,300	$22,425,000	$2,417,300	$24,842,300	0.690180304	$17,145,700	$1,540,700	$4,758,300	3.08

(1) Annual Maintenance Based on 2% of Construction Costs Plus Contingencies being incurred from 2008 to 2021.
(2) Assumes All costs represent costs in 2007 and costs are brought back to the base year of 2002 using a 6.375% annual interest rate.
(3) Assumes a 20-year project life and a 6.375% annual interest rate.
(4) Average annual benefits associated with the CDF component of the plan are approximations. The benefits associated with the CDFs were derived by multiplying total project average annual benefits ($8,497,000) times the percent of total dredged material that the CDF would accommodate over the 20-year evaluation period. This percentage for all sites is approximately 56%. Therefore the CDF's related average annual benefits are $4,758,300.
(5) All benefits and costs reflect October 2000 prices, a 20-year project life and a 6.375 percent annual interest rate.

Figure III-19 - Facility #3



These same concerns were aired at a public meeting held by the Executive Committee in Toledo on 1 March 2001. Several participants stated their opposition for the record. The Mayor of the City of Oregon read a portion of the 28 February 2001 City Council resolution opposing any expansion of Facility #3. However, the Mayor expressed full support for the Executive Committee's recommended Long-Term Management Plan, as stated in this same resolution.

Based on the potential adverse impact of this expansion on the quality of the water in Maumee Bay; and considering the expressed concerns of the adjacent Communities, the Ohio Environmental Protection Agency, the Ohio Department of Natural Resources and the U.S. Fish and Wildlife Service, the Executive Committee decided not to give any further consideration to this alternative at this time.

b. Expansion of Island 18

Construction of a new CDF adjacent to Island 18 was evaluated. A number of elongated configurations located to the east and north of the Island were considered in order to minimize the impact on spawning and feeding areas located near Island 18. Preliminary capacity computations revealed that the resulting CDF would need to be (0.9 to 2.3 miles long) in order to accommodate 20 years of dredging. Consequently, a more economically efficient CDF was evaluated that would utilize the east side of Island 18 and be square in shape. Again, three different sizes were evaluated in order to reflect a range in the amount of dredged material that could potentially be disposed of at an open lake site. The width of the new cell varied from 3,650 to 2,350 feet based on annual CDF fills of 850,000, 600,000, and 350,000 yds^3 respectively. Total project costs (see *Appendix I*) ranged from $21,287,300 for Island 18-Size C to $35,343,600 for Island 18-Size A as previously shown on *Table III-9*. Total average annual costs ranged from $1,540,700 for Island 18-Size C to $2,558,000 for Island 18-Size A as previously shown in *Table III-9.*

c. Woodtick Peninsula CDF

Woodtick Peninsula, previously shown on Figure III-18, is located in the State of Michigan and thus there are numerous institutional issues that must be addressed and resolved before an in-depth engineering and environmental assessment can be conducted. The construction of a new CDF north of Woodtick Peninsula is currently under investigation and the Ohio and Michigan Departments of Natural Resources and the Toledo Port Authority are addressing the institutional issues.

In general, a new CDF adjacent to the Peninsula would be located east of the peninsula itself and designed in an elongated configuration oriented north to south. This design will allow a multi-use function for the CDF (i.e., disposal of Toledo Harbor navigation channel sediments and also as a shoreline preservation facility to minimize erosion of the Woodtick Peninsula).

Shoreline protection/restoration projects that would involve the use of dredged material were identified as part of the overall strategy to be investigated. One application of this approach would be the construction of a CDF as a barrier to decrease erosion of an area currently experiencing high erosion rates. Woodtick Peninsula is one such area in close proximity to the

Toledo navigation channels. The Peninsula is located north of the Toledo Harbor channel, on the western shore of Lake Erie, Monroe County, Michigan. It is approximately 1.5 miles west of the navigation channel at Lake Mile 3. A rectangular sized CDF, sited east of the Woodtick Peninsula could serve as a physical barrier to hydrologic erosive forces that have been affecting the Peninsula for decades. The CDF could be designed to promote the development of high quality environmental habitat in the protected area of the CDF and/ or enhance such habitat that already exists in the area. An environmental assessment was completed for the Toledo-Lucas County Port Authority in February 1999 on the Woodtick Peninsula and general area to determine the impact of construction of such a CDF.

A private engineering firm ahs assessed the construction of a 3.5 mile-long, one half-mile wide CDF, located approximately one-half to three-quarters of a mile east of the Woodtick Peninsula. The CDF would be constructed in 6 to 10 feet of water and have a capacity of approximately 24,000,000 yds^3. At a disposal rate of 800,000 yds^3 per year, this facility would provide 30 years of storage capacity. The assessment looked at the potential impacts on the natural resources of the area for both the construction and operation of the CDF.

The assessment results indicated that a variety of upland, wetland and shallow-water habitats currently existed in the Woodtick Peninsula area and that they would potentially benefit from the construction of the CDF facility. The protection resulting from the CDF would occur from the significant reduction of direct wave impacts and bank overwash along Woodticks' eastern shore. Wave propagation into the North Maumee Bay area would also be minimized. This would provide additional protection to non-diked wetlands in the bay and along the mainland, as well as upland dike structures that surround significant Bay area wetland resources. Protection of these habitats would greatly benefit the resident and migratory wildlife and aquatic communities that populate these areas.

In addition to protecting and preserving existing upland and deep-water habitats, construction of a CDF near Woodtick may also promote the development of new and valuable wetland, shallow-water, and/or upland habitats in the area. New fish habitat unique to the area could also develop at the periphery of the CDF. New wetland, shallow water, and/or upland habitats could also develop in the area between the CDF and Woodtick and within the boundaries of the Peninsula itself. The extent of development of these new resources will depend on hydrologic and sedimentation conditions that occur due to the construction of the new CDF.

The construction of the CDF would also have positive socioeconomic impacts. A number of recognized historical/cultural sites occur on peninsula uplands, as well as islands in the southern portion of the Bay area. These sites would also be protected from erosion by construction of the CDF. Finally, the construction of the CDF at this location would offer a facility convenient for the disposal of sediments dredged from Toledo Harbor benefiting the Toledo Port Authority and meeting the needs of regional shipping interests (See ***Appendix G***).

While Woodtick Peninsula has been investigated it is still uncertain whether it will be deemed politically acceptable as a long-term disposal area for material removed from the Toledo Federal navigation channel. The Michigan Department of Natural Resources and Department of Environmental Quality, by letter dated October 2000 to the Toledo-Lucas County Port Authority outlined their rationale for why they do not support the potential Woodtick CDF project. The letter stated that although the CDF might possibly modulate wave-induced erosion of the Peninsula during storm events, the feasibility and effectiveness of using an offshore structure to protect the peninsula have not been established. It further stated that the structure would permanently occupy over 700 acres of bottomland in Michigan that would result in loss of habitat for fish and other organisms and ecological productivity of lower trophic levels that the open bottomlands currently provides.

The cost of the CDF option being investigated at the Woodtick Peninsula would range from $40-$60 million, depending upon the capacity to be established. Considering the economic benefits provided by Toledo Harbor and the evaluation and analysis presented in this report, any reasonable environmental restoration project at Woodtick Peninsula that would involve the construction of innovative CDFs whose cost would fall within the stated range would be economically feasible. Nevertheless, each project needs to demonstrate its acceptability as not only a confined disposal facility but also provide environmental benefits to the region. To this end, it is reasonable to continue to pursue the Woodtick investigation in the first 2-years of the LTMP and reach of consensus with Michigan. Therefore, additional funding would be needed to respond to the issues discussed above and other issues that have been raised by the Michigan Department of Natural Resources and Department of Environmental Quality.

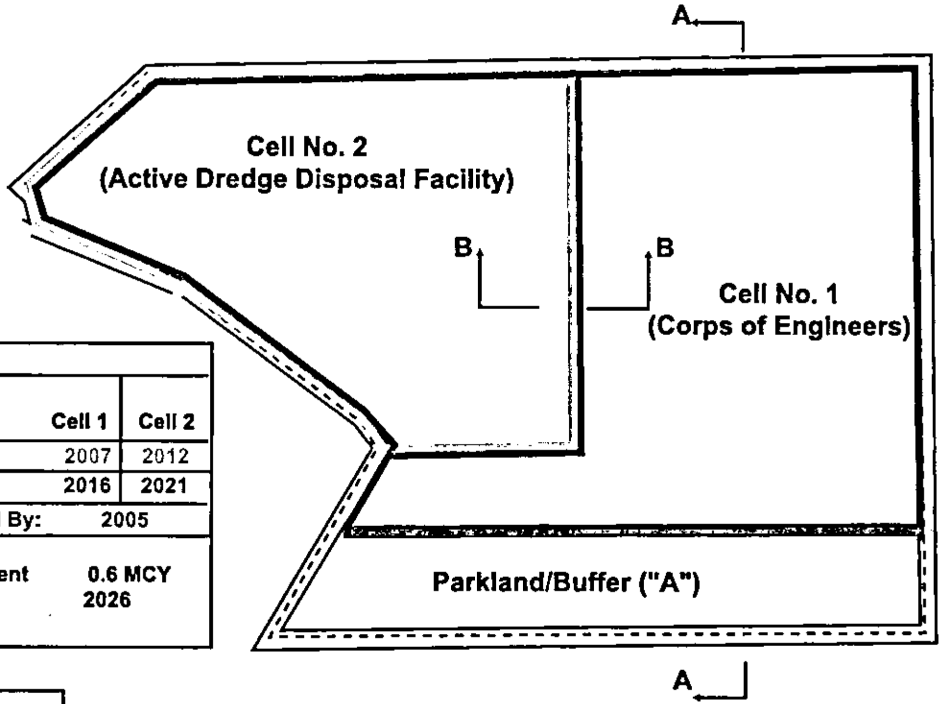
d. Dike Raising

Considering the objectives set forth by the Executive Committee for raising facility 3, as discussed in Section III, Application of Cross Berm, several dredged material disposal capacity scenarios were developed that portray potential future dredged material management in Toledo Harbor. These scenarios were based on the 3 different dredged material disposal rates and 2 different CDF configurations ***(Figure III- 20).*** Six scenarios or cases A1, A2, A3, B1, B2, B3 were considered and analyzed in the Geotechnical ***Appendix F2.*** These scenarios are summarized and displayed in a dredging scenario matrix referred to as ***(Table III-10)*** below.

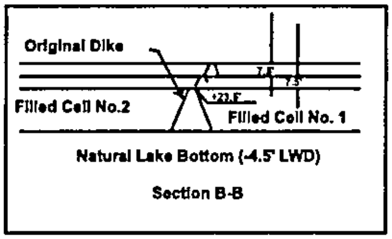
TABLE III–10 DREDGING SCENARIOS MATRIX

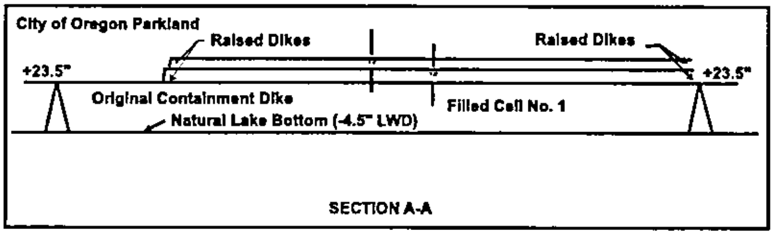
ANNUAL DREDGING RATE (CY)	A SET ASIDE 20% OF CELL 1 AREA FOR PARKLAND BUFFER	B SET ASIDE 45% OF CELL 1 AREA FOR RECYCLING
850,000	CASE A1 Cell 2 Full in 2005; Raise Cell 1 by 2004	CASE B1 Cell 2 Full in 2005; Raise Cell 1 by 2004
600,000	CASE A2 Cell2 Full in 2008; Raise Cell 1 by 2007	CASE B2 Cell 2 Full in 2008; Raise Cell 1 by 2007
350,000	CASE A3 Cell 2 Full by 2016; Raise Cell 2 by 2015	CASE B3 Cell 2 Full by 2016; Raise Cell 1 by 2015

Figure III-20 - Toledo Dike Raising



Case A2		
Legend	Cell 1	Cell 2
—— First Raising	2007	2012
—— Second Raising	2016	2021
—— Cross Dike Constructed By:	2005	
Annual Rate of Confinement	0.6 MCY	
Year Capacity Reached	2026	





The previously discussed dike raising demonstration project completed in 1995 revealed that the combined dredged material was most likely well above optimum moisture content, but proved to be workable. However, facility 3 may not have sufficient material, which is dry enough to be excavated, hauled and placed to satisfy raising all the dikes at one time. The raised berm performed well without stability or seepage problems. It was concluded that "dike raising" could be implemented in 7.5-foot increments, based on previous experience. Specialized construction techniques and materials may be required to construct such features as access roads and weirs.

Raising facility 3 would be a cost-effective measure in that it could provide storage capacity for up to 20 years at minimal cost by using the material currently confined in the facility (See ***Table III-11***). This material would need to be reinforced with drier off site material to achieve the consistency needed to avoid seepage and stability problems.

B. Summary of Dike Raising

There are problems associated with the possibility of raising either facility 3 or Island 18. During the 5-Year interim period, landscape architectural plans (See ***Appendix H***) were formulated to act as buffers for potential dike raising at facility 3. These plans were presented to the City of Oregon in 1998. The City expressed interest in these schemes, but made it known that they do not have the financial resources to support the construction of any of the 3 plans that were presented. Coordination meetings with the City of Oregon in October, November, December 2000, and March 2001 revealed that the City is still opposed to any expansion of facility #3 for environmental reasons. A total of 150,000 gallons per day of contaminated water from the river through the Toledo Edison Electric Company's water intake was being discharged into the Bay at temperatures higher than that of the Bay. This contaminated water discharge is stagnant due to the blockage of water circulation by facility #3. In October 2000, the City published a *"Position Paper"* opposing any expansion of facility #3. In that paper, the mayor wrote: "The City of Oregon urges that the State of Ohio begin to develop disposal facility #3 into a recreational land. It also urges that Army Corps of Engineers, the Port Authority, the Ohio Department of Natural Resources and other agencies financially assist in this effort." However, opposition to raising Island 18 has not been as strong as that for raising facility #3. There are environmental and engineering problems and issues associated with raising Island 18. Its structural and geotechnical stability as well as its environmental characteristics are not well established. This would need to be determined before any consensus can be reached as to its future use and/or development. Island 18 is now a wildlife habitat for several species such as deer, foxes, and birds. Further, a wide variety of trees grow on the Island that are separated or isolated by wetlands, ponds and shallow and narrow channels. Finally, ownership of the property would need to be investigated, resolved and properly documented. If implementable, "Dike Raising" can occur on any of the existing CDFs. Its engineering and economic feasibility has been established as shown in the example given in Table III-11.

Table III-11. Facility 3 Dike Raising Project Costs

1. Dike Raising Costs

Case A2*** 600,000 Cubic Yards Per Year	Year in Which Construction Takes Place	Total First Costs	E&D And S&A	Total Project Costs	Interest During Cnstrtn *	Total Investment Costs
First Raising						
Cell 1	2007	$267,600	$40,800	$308,400	$ 4,000	$312,400
Cell 2	2012	$141,000	$20,400	$161,400	$ 2,100	$163,500
Second Raising						
Cell 1	2016	$270,700	$40,800	$311,500	$ 4,000	$315,500
Cell 2	2021	$137,900	$20,400	$158,300	$ 2,100	$160,400
Total Dike Raising Costs		$817,200	$122,400	$939,600	$12,200	$951,800
2. Environmental Buffer Costs **		$5,256,500	$788,500	$6,045,000	$125,900	$6,170,900
3. Total Cost		$6,073,700	$910,900	$6,984,600	$138,100	$7,122,700

* Dike Raising IDC assumes three months of construction and the Environmental Buffer assumes nine months of construction.

** E&D + S&A=15 Percent

*** Case A2 was the most practical middle ground Case scenario. It was therefore the preferred example used for estimating the cost that could be incurred in raising the dikes at facility #3. Case A2 involves the confinement in facility #3 of 600, 000 cubic yards of material per year. The other two cases (A1 and A3) would involve the annual confinement of 350,000 and 850,000 cubic yards or more of the dredged material, respectively.

C. Summary of 5-Year Interim Plan Activities

The information developed and discussed throughout this section of the report was used to formulate and derive the Long Term Management Plan (LTMP) to provide continued maintenance of the Toledo Harbor navigational capabilities. The information from each and every potential component was considered and integrated in a complementary manner to achieve the goals of the Executive Committee and insure maintenance of the Harbor while minimizing any impacts to natural resources in the area. These components, as previously outlined, were studied, tested in laboratories, and demonstrated in the field to ascertain their worth and contribution to the long-term viability of the harbor. The resulting LTMP identifies those individual management activities that, when integrated together, form the basis for achieving success in managing sediment loads in the Maumee River watershed. This LTMP is a comprehensive step in the right direction in the quest of the Federal, State and local governments to successfully address the overall water resource problems and opportunities in the Maumee River Basin.

SECTION IV

LONG TERM MANAGEMENT PLAN

SECTION IV
LONG TERM MANAGEMENT PLAN

The following description of the Long Term Management Plan identifies the activities required for achieving long term maintenance dredging and management of the material dredged from the Federal navigation channels at Toledo Harbor, Ohio. Twenty to twenty-five years of confined disposal facility space for sediments dredged from the Toledo Harbor would be provided. In addition, the section provides an estimate of the anticipated contribution of each component to the LTMP. The 20 to 25 year time frame is based on various sediment management strategies and the construction of a new CDF. The new CDF would provide 20 years of sediment storage and would be available in 2007. Other activities such as de-watering and recycling are planned for the period between 2003 (when current CDFs reach capacity) and 2007 (when the new CDF comes on line) are called for to provide the capacity needed in the interim period. The components of the LTMP are discussed below.

A. COMPONENTS OF THE PLAN

The formulation of the LTMP considers the results of all the scientific studies and tests and pilot and demonstration studies/projects performed during the five-year interim period. The Plan includes the following 6 components:

1. Dredging and Material Disposal.
2. Confined Disposal Facility Management.
3. Sediment Recycling and Beneficial Use.
4. Sediment Load Reduction (Agricultural Best Management Practices).
5. CDF Capacity Expansion.
6. Monitoring and Evaluation of LTMP components; and provisions for modification.

It is anticipated that at the confinement rate of 600,000 cubic yards per year, existing CDF Cell 2 will reach capacity by year 2003. Therefore specific actions are necessary to ensure that sufficient additional disposal capacity is available through 2007, at which time a new CDF is anticipated to be available to accept materials. The required actions are: management of Facility #3 as appropriate, sediment recycling & beneficial reuse, potential berm building on and management of Island 18, and pre-construction engineering and design and plans and specifications to construct a new CDF. The program for constructing a new CDF will require approximately 7 years to complete beginning with a site recommendation in year 2001, evaluation in 2002, and completion of construction by 2007. ***Figure IV-01*** shows the spatial and temporal relationship of activities that need to be performed to increase disposal capacity at existing CDFs during the interim period 2003 to 2007. ***Figure IV-02*** illustrates the type of activities that need to be performed to assure the development and construction of the new CDF. Specific components of the plan are briefly discussed below.

Figure IV-01 - CDF Sediment Management Schedule For Storage Space Restoration

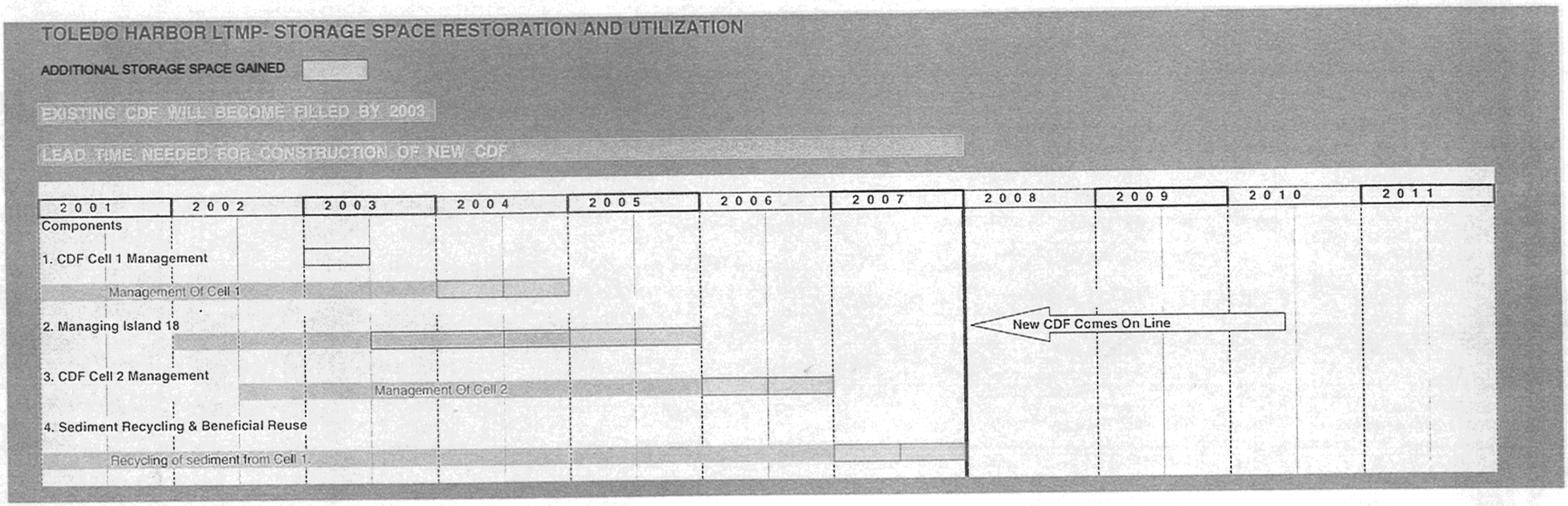
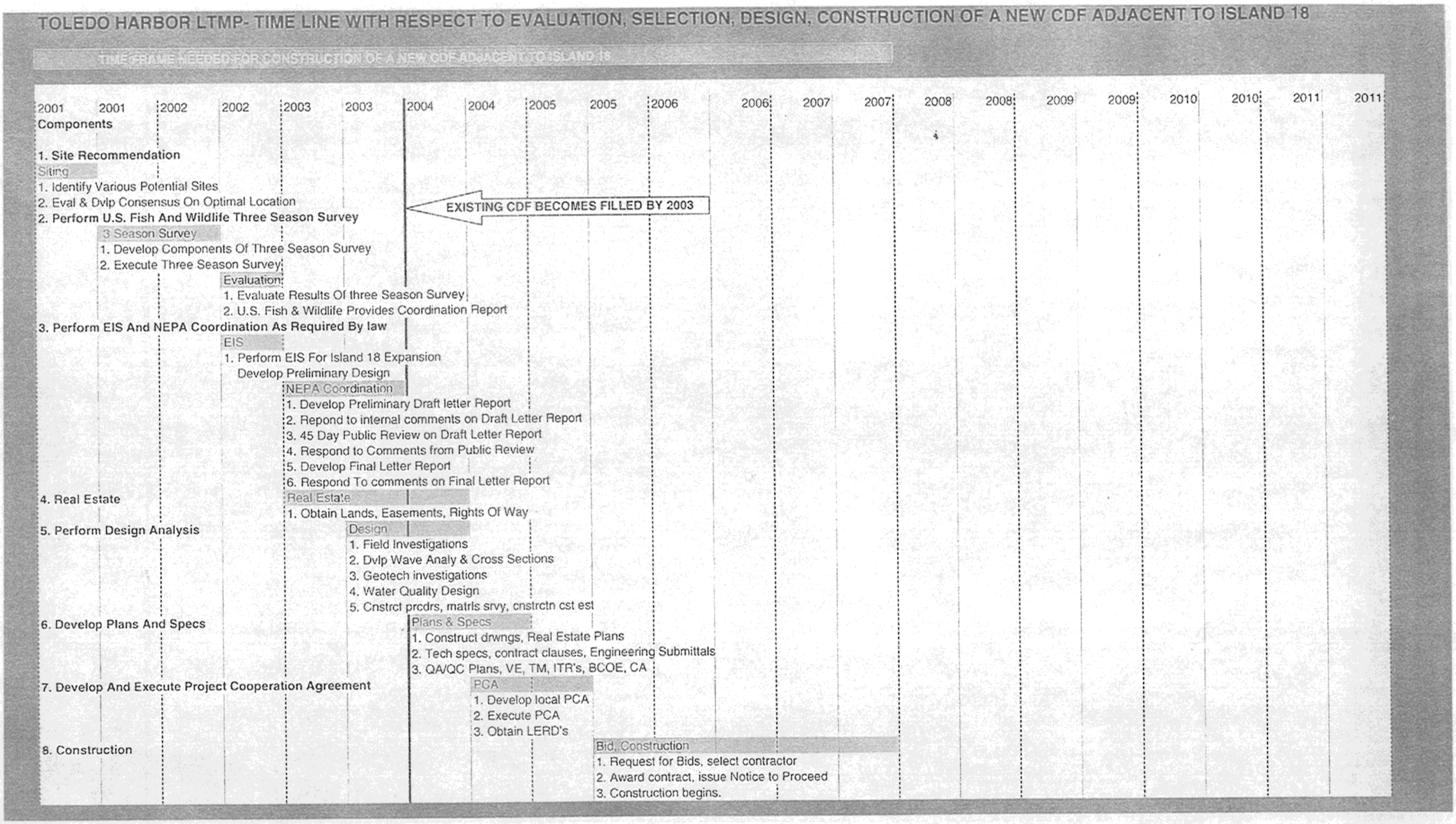


Figure IV-02 - Toledo Harbor LTMP - Time Line with Respect to Evaluation, Selection, Design, Construction of a New CDF to Island 18



1. Dredging and Material Disposal

- The Corps of Engineers would continue to dredge the navigation channels at Toledo Harbor. Approximately 1,000,000; or an average of 850,000 cubic yards, of material would be dredged from the Maumee River and Lake Erie navigation channels on an annual basis

- All sediments dredged from the Maumee River will be placed in a Confined Disposal Facility (CDF)

- Sediments removed from Lake Mile 0 to Lake Mile 5 would also be placed in a CDF

- All sediments removed from Lake Mile 5 to Lake Mile 19 would be disposed of at the current open lake disposal site

- Sediment sampling, testing and laboratory analysis will be conducted periodically from River Mile 7 through to Lake Mile 19 or within specific river or lake reaches as necessary

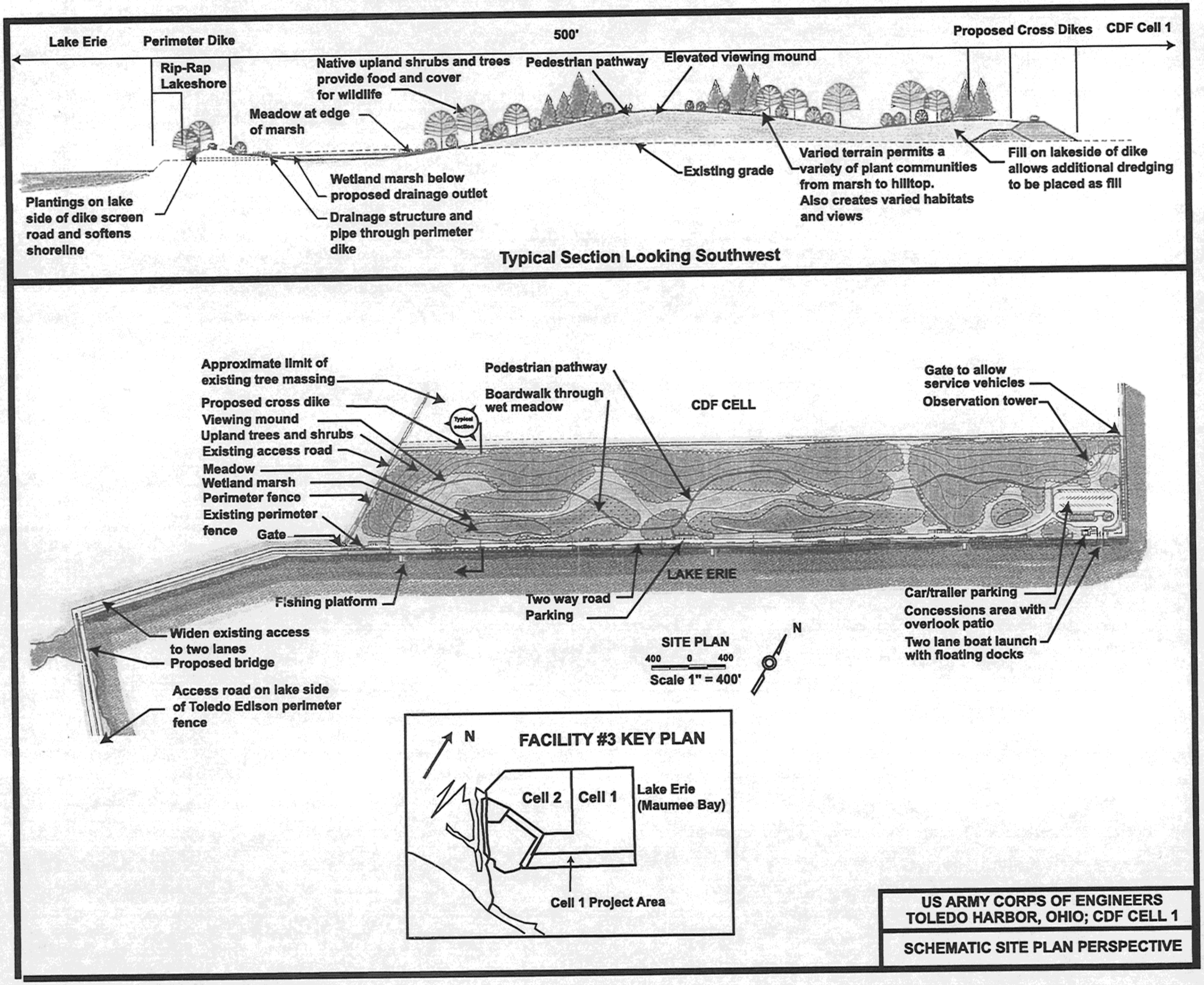
2. Management of Confined Disposal Facility (CDF)

The useful life of facility #3 (***Figure IV-03***) would be extended by maximizing its use and utilizing its full capacity. Also, through application of the dewatering-consolidation-settlement technique, and beneficial use of the confined sediment, its storage capacity can be significantly restored, thereby expanding its useful life.

A cross berm, approximately 8 feet in height, would be built in Cell 1, essentially dividing the cell into two compartments. The cross berm would parallel the entire south side of Cell 1, a distance of about 4,200 feet. The resulting southern rectangle would have a width of approximately 500 feet. The topography of the southern compartment of Cell 1 would subsequently be modified using dredged material from the northern compartment, landscaped and allowed to revert to its natural ecological habitat. Surface drainage structures would be installed to allow excess water to drain off and prevent ponding. Existing trees would be preserved and no additional fill would be placed near these trees. New tree and shrub plantings would be placed in groves to create a natural appearance. Minor amounts of fill (1 to 2 feet) would then be placed where new groves are proposed to help dry out these areas and the groves would provide a more natural setting and allow the use of a wider variety of tree and shrub species. Plantings would also be made on the lakeshore side of Cell 1 to soften the stark appearance of the dike, and on the lower south side of the cross berm, which would further screen the new northern compartment. An emphasis would be placed on selecting native plants and species beneficial to wildlife. Once the plantings become established, there would be minimal maintenance required (***Figure IV-03***).

A number of management strategies would be conducted in the northern section of Cell 1 ranging from intensive shallow trenching to building new berms equal in height to the cross berm. The primary technique that would be utilized to implement the dewatering would be the technique of surface trenching and installation of strip drains to dewater, desiccate, and

Figure IV-03 - Schematic Plan for Cell 1 Cross Dike



consolidate the dredged material. These management strategies would provide additional storage capacity in this part of facility #3, thereby prolonging this part of the CDFs useful life. Construction of a cross berm would allow a more complete management of the northern compartment of Cell 1 and maximize its holding capacity. The berms would be constructed with dredged material currently located in this northern compartment. Use of the dredged material to build new berms will range from building a new berm around the total perimeter to building a series of sub-compartments, which would accommodate recycling strategies and or allow maximum desiccation of any new dredged material placed in the subcompartments. Building compartments within cells would help maximize the removal of water from the dredged material and thus optimize the amount of dredge material that can be placed there. For example, the existence of three compartments that hold a year's amount of dredging, one located in Cell 1 and two compartments in Cell 2, will allow a filling rotation to be established. This strategy would allow each compartment to be managed for two years before additional dredging spoils are placed in that compartment.

These procedures/processes would be applied to Cell 1 and Cell 2 until all available space was completely utilized. The procedures could include building temporary berms around the perimeter of Cells 1 and 2 in order to fully utilize the storage capacity available in these two cells. Once Cells 1 and 2 have been optimally filled, the perimeter berms that have been built to accomplish this would be removed.

Finally, as existing capacity utilization is being optimized, in Cells 1 and 2, all discharge effluents will be managed (facility weir discharge, settling basins/ditches) to satisfy Federal and State water quality discharge requirements.

3. Sediment Recycling and Beneficial Use

The beneficial uses of the dredged material would be expected to come from the removal and recycling of several hundred thousands or more cubic yards of material annually. Currently contractors are manufacturing up to 50,000 cubic yards or soil per year by amending dredged materials in Cell 1. Compartmentalization of Cells 1 and 2 would allow for the recycling between placement of new, and removal of confined, material for beneficial use. This recycling of dredged material, and its removal for beneficial use would allow for the continuous use of the CDFs for disposal of the contaminated dredged material. The various needs and management strategies that would be needed in order to use Cells 1 and 2 for dredge disposal as well as recycling would be periodically reevaluated with respect to the changes in demand for dredge material.

- Several beneficial uses of dredged material appear feasible and could be performed at any time during implementation of the long-term plan. Several possible uses are listed below

- Use in road construction (fill for roadbed construction purposes, fill for approach ramps, raising roadbeds, filling in behind abutments, etc)

- Fill for raising site elevations

- Landfill cover material (daily coverage as well as final landfill capping material)

- Recreational uses (building sledding hills, artificial relief on golf courses, in parks, etc.).

- Also, greenhouse bench-scale testing and field demonstration projects in 1996 established that dredged material, when combined with other waste additives in various combinations, could be used to manufacture a soil product that could be used for landscaping and other purposes such as making a soil for home use (for landscaping and elevating flower beds, as a garden additive).

The use of the dredged material to manufacture soils or fill could take place at the CDF, or at an off-site location. The Port Authority, or its designated representative, is responsible for final compliance with any and all applicable Federal, State and local regulations and permits that address access, transport, processing, land use applications and development for the usage of dredged material as a fill or as part of a manufactured product.

4. Sediment Load Reduction (Soil Erosion Control)

The pilot project promoted by the Department of Agriculture and Natural Resources Conservation Service (NRCS) had demonstrated the effectiveness of agricultural Best Management Practices (BMPs) for reducing Maumee River sediment loads. Best Management Practices in the Maumee watershed included use of no-till farming, optimum use of pesticides, buffer areas, and use of sediment collection ponds to reduce sediments and pesticides migration into the River tributaries and eventually the navigation channels. It was shown that this program had been moderately successful. It had displayed the potential for reaching the Executive Committee's goal of reducing dredging attributable to agricultural sources by 130,000 cubic yards annually. Of this annual goal, 53% has been met as a result of 43 % of corn acreage and 60 % of soybean acreage are currently practicing conservation tillage farming.

In the long run, it is expected that optimum implementation of these agricultural BMPs would result in meeting the LTMP goal of reducing sediment load by 130,000 cubic yards per year. The program would consist of a combination of increasing the number of farmed acres in the watershed practicing conservation tillage and development of filter strip and sediment basin buffers *Figures III-16 and III-17* in Section III of this report display the geometric characteristics of filter strips and basins.

In order to continue with the successful effort initiated by the NRCS, and to fully implement the Conservation Tillage Program, $1.6 million is needed annually over a five-year period for the Maumee River Basin effort to supplement the existing Department of Agriculture budget. As previously discussed, this effort would help reduce the cost of dredging and confining the river and lake channel sediments by $1.3 million per year. In addition, the Federal government and the State of Ohio need to continue funding the Conservation Reserve Enhancement Program to realize the full impact of these conservation efforts.

5. Capacity Expansion of CDFs

A major component of the LTMP would be the horizontal expansion of Island 18 to provide storage capacity for 20 years of placement of dredged material. Based on the current decision of Ohio EPA to allow for the application of both the confined and unconfined methods of disposal of dredged material, an L shape expansion of Island 18 would be built to confine 17 million cubic yards of dredged material at a placement rate of 600,000 cubic yards per year. Preliminary estimates of project construction costs range from $21 to $35million, depending on annual placement rates. The facility would contain innovative features to yield environmental benefits to the region. Additional funding would be needed soon to respond to the request made by the U.S. Fish and Wildlife and Ohio Department of Natural Resources that the expanded facility be used as a recreational area and enhance habitat for fish and wildlife.

Expansion of Cell 1 was eliminated from further consideration as the new CDF site. The Port Authority will pursue consideration of a new CDF at Woodtick Peninsula. Discussion between the Toledo-Lucas County Port Authority and the State of Michigan on Woodtick would continue during the first two years of implementation of the LTMP, prior to eliminating Woodtick from further consideration.

6. Monitoring and Evaluation of the LTMP Components and Provisions for Modification

Periodic monitoring and evaluation of the various LTMP components will take place over the 30-year evaluation period from 2001 until completion of the new CDF and through its expected lifespan of 20 years. Particularly, discharge effluents for any facility developments will continue to be managed (facility weir discharge, settling basins/ditches) to satisfy Federal and State water quality discharge requirements. Sediment sampling and analyses will continue to be conducted by the U.S. Army Corps of Engineers in accordance with current regulations and guidelines (Great Lakes Testing Manual) to determine suitability of dredged material for unrestricted open-lake disposal at the designated disposal site. Where results of the monitoring suggest modifications in the Plan, these will be made in an expeditious manner.

B. IMPLEMENTATION OF THE LTMP

1. Sediment Management Strategies and New CDF Design and Construction

a. It has been determined that current disposal capacity at existing CDFs would be reached by the year 2003. Assuming an intensive and accelerated schedule of CDF pre-construction planning and design beginning in 2002, a new CDF could be on line ready to accept dredge material by 2007. What this means is that additional disposal capacity will be needed beginning in the year 2004. Sufficient capacity for an additional 6 months of dredging quantity is available from previous CDF Cell 1 management for the first half of 2004 and an additional 24 months by maximizing use, and utilizing the full capacity of, existing CDFs. It is anticipated that recycling and beneficial use of sediments from Cell 1 will provide up to 6 months of storage capacity to reach year 2007 when the new CDF would be ready for accepting dredge materials. The Committee is confident that the CDF management techniques experimented with during the interim period will yield at least 4 years of storage capacity when applied on facility #3, and even more if Island 18 is reactivated. Also, additional capacity at the existing confined disposal facilities is possible should real estate, environmental and future use plan issues are resolved: Cell 1 was turned over to the Port Authority, the official non-federal sponsor, by letter dated 26 April 1999. As a result, "Real Estates Office" raised questions about whether the Corps has authority to return to manage the Cell even if the Port Authority provides the Corps with easements and the rights of ways. This issue must be resolved. Also, the sponsor's interest in future development of the Cell as a commercial area conflicts with the city of Oregon's and the Corps' plan to build a park-like area and to raise the dikes. This park-like area would serve as buffer zone between the Oregon shoreline community and the raised dikes. "Dike Raising" is a cost-effective way to gain additional CDF capacity.

Therefore to successfully implement the LTMP, the Executive Committee will jointly act, during the first 8-year interval following approval of the LTMP, to perform best management practices that maximize use, and utilize full capacity, of existing CDFs. The LTMP will thus involve:

- Trenching to de-water the CDFs and extend capacity.
- Utilizing full capacity by filling to the existing dike height
- Continue open lake disposal of material removed from Lake Mile 5 outward
- Continue to confine material removed from Lake Mile 5 inward including the entire Maumee River
- Continue to expand soil erosion control including Conservation Tillage and Buffer Zones
- Continue to expand the dredged material recycling program
- Develop a Long Term Use Plan for facility #3 and Island 18 and determine any remaining capacity
- Conduct additional studies of environmental impact/benefits of options.

b. Initiate, and complete by 2003, the implementation of a program to fully evaluate the following:

- Horizontal and/or vertical expansion of Island 18
- Creation of protective barrier CDF at Woodtick Peninsula
- Evaluation of other confined/partially confined disposal/new landform options
- Dredged material recycling program.

Update the Long Term Management Plan based on the result of the evaluation.

c. The basic principles for Toledo Harbor management practice options remain as stated in the Phase 3 Report.

- Eliminate the practice of open lake disposal
- Avoid new near shore CDF expansion unless other environmental/wildlife benefits associated with the construction of new CDFs or expansion of expansion of existing CDFs can be achieved.

However these principles are supplemented by the additional principles of:

- Reducing materials at their source
- . Supporting beneficial reuse
- Exploring additional authorities and funding sources for implementing the LTMP upon approval of this Phase IV Report, including the Executive Summary.

The success of the implementation of Long Term Management Plan is dependent on the parties giving continued support to consensus recommended in this report. The integrated components proposed and described in the plan are designed to achieve the goal of maintaining the shipping capabilities and economic viability of the Toledo Harbor complex. Of equal importance is to design a dredging program that is inherently environmentally sensitive resulting in minimal impacts to the ecological resources of the area. To that end the following characteristics are incorporated into the LTMP and are important to the success of the program:

- The Executive Committee reached consensus, on December 13, 2000, to build a new CDF at the Island 18 site such that environmental and/or wildlife benefits associated with the new work are achieved. However, standard environmental, engineering, and economic studies must be conducted for meeting NEPA and other requirements before start of construction.
- The performance of the plan components must be monitored and continually evaluated during implementation. As implementation progresses evaluations will allow for adjustment to designs, locations, dredging quantities etc. as they relate to relative contributions to the overall program. This is crucial to ensure continued progress and to verify that the program remains on target to achieving the stated goal.
- The staging and sequential implementation of activities should be evaluated with scheduling approaches such as Critical Path Analysis to ensure that a correct logic exists for initiation and completion of activities. This will provide a proactive capability and allow required modifications to the program to be implemented in the most efficient manner.

2. LTMP Agency Responsibilities

The Executive Committee recognizes that it cannot compel authorizing legislators, counsels and boards to commit resources towards the LTMS and implementation of the LTMP. However, various agencies need to take responsible steps to ensure the successful implementation of the Phase IV report recommendations the Long-Term Management Plan.

The Executive Committee recommends the following actions be taken and agencies be responsible for their implementation:

- During the near term the U.S. Army Corps of Engineers will maintain its ongoing practice of open lake disposal of only those materials removed from Lake Mile 5 out to Lake Mile 19, and confining all materials from Lake Mile 5 inward including the entire Maumee River channel
- During the near term Ohio EPA will agree to issue a 401 water quality certification to allow open lake disposal of sediments dredged lakeward of Lake Mile 5
- The Natural Resources Conservation Service will continue its effort to expand the Soil Erosion Control and Buffer Zone Program
- Toledo-Lucas County Port Authority will continue its demonstration and implementation of the Dredged Material Recycling Program
- The Army Corps of Engineers will implement those steps necessary to maximize the capacity utilization of the existing CDFs
- The U.S. Army Corps of Engineers in cooperation with the Toledo-Lucas County Port Authority will evaluate the horizontal expansion of Island 18
- The Port Authority and the U.S. Army Corps of Engineers will investigate the design and feasibility of constructing a protective barrier CDF off Woodtick Peninsula upon the State of Michigan's consensus on the use of the site
- The Toledo-Lucas County Port Authority and the City of Oregon will undertake a long-term use/development plan for facility #3.

A table outlining the major components of the LTMP, major agencies responsible for their implementation are presented in ***Table IV-01***.

Table IV-01 Major Components of The LTMP Responsibilities

LTMP Component	Lead Agency
1. Dredging and Material Disposal	U.S. Army Corps of Engineers
2. Confined Disposal Facility (CDF) Management	U.S. Army Corps of Engineers
3. Sediment Recycling and Beneficial Use	Toledo Lucas County Port Authority
4. Sediment Load Reduction	Natural Res. Conservation Service
5. New CDF Capacity Expansion	U.S. Army Corps of Engineer, and Toledo Lucas County Port Authority
6. Monitoring, Evaluation, Provision for Modifications	All

SECTION V

RECOMMENDATION

SECTION V
RECOMMENDATION

Based on the results of the technical studies and demonstration projects undertaken during the interim period, the Executive Committee concludes that it is the goal of the LTMS to develop a long term plan and management strategy that will provide for the beneficial reuse or disposal necessary, of dredged material in an engineeringly feasible, environmentally acceptable and cost-effective manner.

To that end the Executive Committee recommends:

A. Immediately implement a LTMP that involves:

1. Dredging and Material Disposal
2. Confined Disposal Facility Management
    a. Trenching to dewater the CDFs and extend their capacity
    b. Maximize existing CDF capacity by filling to the existing dike height
3. Sediment recycling and beneficial reuse
4. Sediment load reduction by agricultural practices
5. Modification of the Island 18 site by 2007
6. Monitoring and Evaluation of LTMP components and provisions for modification

B. While management practices are being performed that maximize use and utilize the full capacity of existing CDFs, fully evaluate and select by 2003 long-term options from a list including:

1. Creation of a protective barrier CDF at Woodtick Peninsula
2. Development of a long-term use plan for facility #3, not including horizontal expansion
3. Horizontal and vertical expansion of Island 18
4. Evaluation of other confined/partially confined disposal/new landform options

C. In order to judge the adequacy of the overall strategy, it is essential to develop and maintain an evaluation program of various management practices to determine the benefits that each practice is providing to the LTMS goals. This evaluation program (*Item A.6 above*) will also assure that the practices are being developed in accordance with the LTMS schedule so that the dredged material management practices are available as needed.