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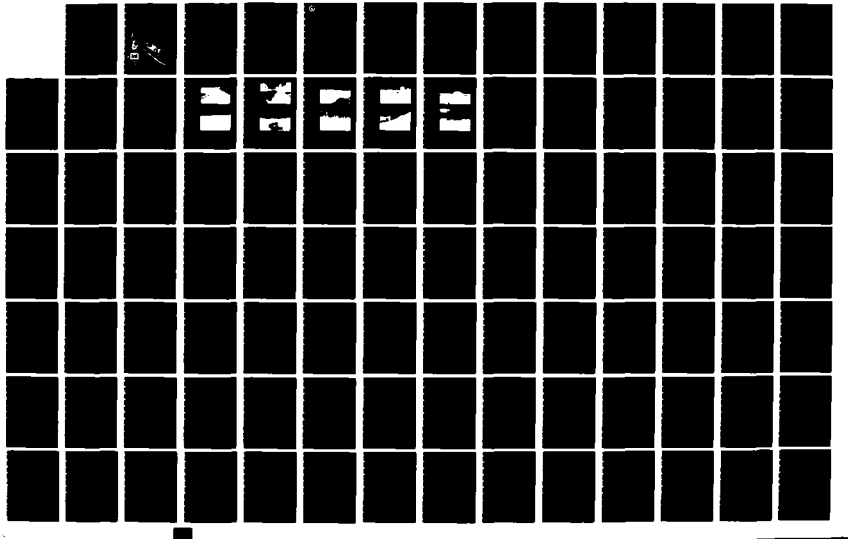

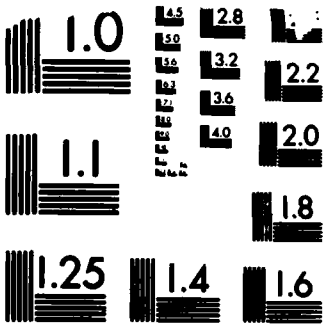

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MAUMEE BAY STATE PARK, OHIO

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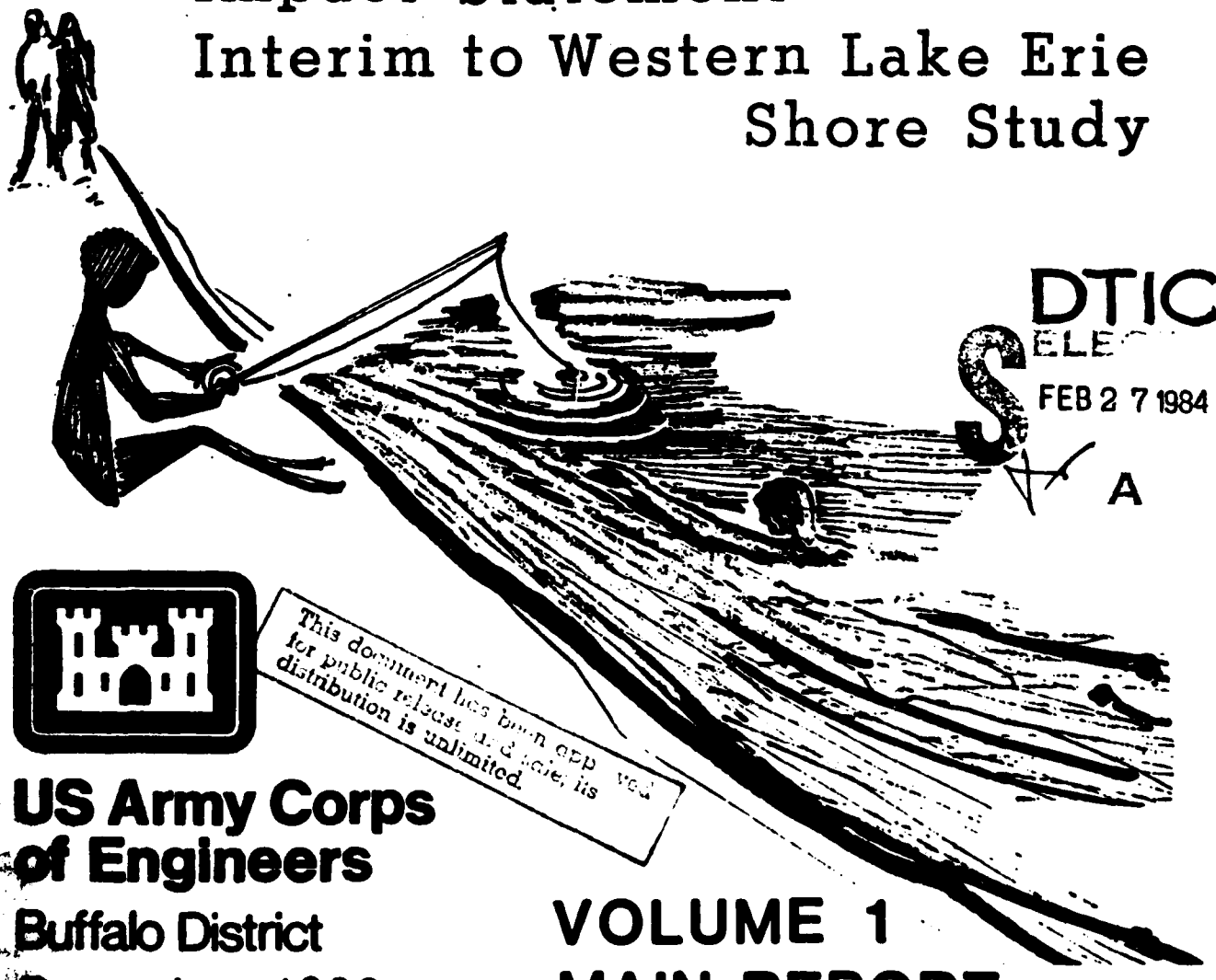
SHORELINE EROSION BEACH RESTORATION STUDY

Final Feasibility Report and Final Environmental Impact Statement Interim to Western Lake Erie Shore Study

AD A138419



US Army Corps of Engineers
Buffalo District
December 1983

VOLUME 1
MAIN REPORT

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The Ohio Department of Natural Resources (ODNR) is developing a multiuse facility on the shore of Lake Erie near Toledo, OH, called Maumee Bay State Park They have requested Coprs assistance in designing and cost-sharing structures to halt the severe shoreline erosion which is occurring, so that the park can be developed to its full potential.

A plan for accomplishing the stated purpose has been developed. It would provide a protective sand beach, 250 feet wide by 5,500 feet long over the

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western half of the park, stabilized by eight 300-foot offshore rubblemound breakwaters. The eastern half of the park would be protected by a rubblemound revetment placed along existing shoreline, while the drainage ditches would be protected by rubblemound jetties.

The plan recommended for construction is environmentally acceptable, engineeringly and economically feasible, and has an estimated first cost of $11.8 million. In addition, ODNR plans an expenditure of $3.3 million for associate development which will include a bathhouse, parking, and lands. Average annual benefits for the Federal Project and associated ODNR development are $5.7 million. With total annual charges of $1.7 miilion, the benefit-to-cost ratio is 3.41 to 1.0.

ODNR is fully supportive of the Coprs ahoreline protection plan. There is no known opposition to this plan or to the planned park development of the State.

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207

MAUMEE BAY STATE PARK

SHORELINE EROSION - BEACH RESTORATION STUDY

FINAL FEASIBILITY REPORT

AND

ENVIRONMENTAL IMPACT STATEMENT

INTERIM TO WESTERN LAKE ERIE SHORE STUDY

A-1

December 1983

SYLLABUS

MAUMEE BAY STATE PARK, OH

The Ohio Department of Natural Resources (ODNR) is developing a multiuse facility on the shore of Lake Erie near Toledo, OH, called Maumee Bay State Park. They have requested Corps assistance in designing and cost-sharing structures to halt the severe shoreline erosion which is occurring, so that the park can be developed to its full potential.

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The plan recommended for construction is environmentally acceptable, engineeringly and economically feasible, and has an estimated first cost of $11.8 million. In addition, ODNR plans an expenditure of $3.3 million for their associated development which will include a bathhouse, parking, and lands. Average annual benefits for the Federal project and associated ODNR development are $5.7 million. With total annual charges of $1.7 million, the benefit-to-cost ratio is 3.41 to 1.0.

ODNR is fully supportive of the Corps shoreline protection plan. There is no known opposition to this plan or to the planned park development of the State.

ACKNOWLEDGEMENTS

This Final Feasibility Report for Maumee Bay State Park, OH, is the result of input and effort of many individuals from the Buffalo District, other Federal agencies and the State of Ohio. The following are the Corps personnel who were most instrumental in conducting the investigation and preparing the text presented herein.

David MacPherson - Study Manager
Richard Mammoser - Past Study Manager
Thomas Bender - Coastal Engineer
Joan Pope - Coastal Geologist
Sharon Cooper - Economist
William Butler - Geographer
Philip Berkeley - Biologist
Jonathan Brown - Economist
David Heicher - Biologist
Brian Greene - Geologist
John Kolber - Geotechnical Engineer
John Zorich - Assistant Chief, Planning Division

Other agencies contributed to this report through their coordination activities and participation at public meetings. The individuals involved are numerous and not easily identified. Recognition is provided by the names of their employing agencies, as follows:

U.S. Fish and Wildlife Service, Columbus Ohio Field Office
The Ohio Department of Natural Resources, Columbus, OH
ODNR, Division of Geological Survey, Lake Erie Section

The report itself was produced through the efforts of many other Corps personnel who contributed significantly to its preparation:

Roman Bartz - Chief, Drafting Section
Irving Stone - Lead Draftsman
Donna Davis - Illustrator
Paul Ehrensberger - Draftsman
Mary Ann Schultz - Chief, Word Processing Center
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James Szpakowski - Reprographics Branch
Ronald Guido - Chief, Economics Branch
Sandra Reisman - Economics Trainee
Rodger Repp - Estimator
Timothy Daly - Sociologist

The Buffalo District Commander during preparation of this report was Colonel George P. Johnson, while Colonel Robert R. Hardiman was District Commander at the time of final submittal. The Chief of Engineering Division was Donald M. Liddell, and the Chief of Planning Division was Charles E. Gilbert. Kenneth R. Hallock was the Chief of Planning Division at the time of final submittal.

Finally, efforts of other individuals who participated in the study and report preparation but whose names have not been mentioned above, are gratefully acknowledged.

MAUMEE BAY STATE PARK, OH

FINAL FEASIBILITY REPORT

MAIN REPORT

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SECTION 1 - INTRODUCTION

GENERAL

During the late 1960's and into the 1970's, Lake Erie was a largely polluted body of water. Beaches that had once been crowded with swimmers were closed. Fisheries that were significant sources of food were depleted and in some cases disappeared. These problems were exacerbated by a long period of abnormally high lake levels which accelerated the erosion of shoreline.

The water is now cleaner and the fisheries are building again with the result that people are returning to Lake Erie for recreation. The documented demand for beach swimming in northwestern Ohio now outweighs the available beach area, let alone the intuitive observation expressed by many resource managers and planners that the demand documentation has not kept pace with the changing perceptions of the Lake and the recreation opportunities it offers.

On the other hand, erosion of the available shoreline continues unabated. Much of the shoreline of Lake Erie in northwestern Ohio is in private ownership, protected by an eclectic collection of shore protection and erosion prevention measures. The area designated as the future Maumee Bay State Park is one of the last shoreline areas where public access to significant areas of beach is possible.

GEOGRAPHICAL SETTING

Maumee Bay State Park is in Lucas County, Ohio, approximately 5 miles east of Toledo. Plate 1 shows the vicinity and location of the park development. The 1,855-acre park has 11,000 feet of shoreline along the south shoreline of Maumee Bay. It is bordered on the west by the residential community of South Shore Park and on the east by the Cedar Point Unit of the Ottawa National Wildlife Refuge.

The Ohio Department of Natural Resources is developing a multiuse recreation complex at Maumee Bay State Park. Erosion of the shore fronting the partially developed park and lack of desirable beaches are the major water resources problems at this site. Resolution of these problems is considered imperative by ODNR for full development of the park facilities to take place. As a result, ODNR has requested Corps of Engineers assistance in planning, design, and construction of shore protection works for the park.

Plate 2 is a master plan showing the proposed recreational development at Maumee Bay State Park by the Ohio Department of Natural Resources. When completed, the park will encompass 1,855 acres and will provide opportunities for camping, swimming, picnicking, hiking, fishing, and golfing, as well as lodge and cabin facilities. The development began in 1979 and to date, (Fall 1983) the campgrounds, associated roadways, and check-in station have been completed. Two hundred fifty-six sites have been constructed in the campground which was opened to the public in July 1981.

Photos 1 through 10 provide a review of the existing conditions at Maumee Bay State Park.

STUDY AUTHORITY

In a letter dated 21 March 1975, the Ohio Department of Natural Resources requested the Corps of Engineers to initiate a study of an erosion problem along State-owned property located at Maumee Bay State Park, Oregon, Ohio. A copy of the letter is reproduced in Appendix E, Exhibit 1.

Under Section 103 (a) of the River and Harbor Act of 1962, as amended, a reconnaissance report on shore erosion was prepared and issued by the Detroit District of the Corps in November 1976. The plan considered in that report was a 3,500-foot sand beach protected by steel sheet pile groins along the westerly half of the park (see Plate 3). The estimated total first cost, was $2.7 million (Aug 1976) with a non-Federal share of about $1.7 million, because of the $1 million Federal share limitation under Section 103. The report recommended that a detailed project report be authorized to further study the erosion problem at Maumee Bay State Park. Because the proposed project would be considerably larger than projects normally constructed under Section 103 authority and Federal cost-sharing under Section 103 is limited to $1 million, the Ohio Department of Natural Resources subsequently requested that further studies be performed under existing Congressional study resolutions.

The House Committee on Public Works of the House of Representatives on 11 April 1974 authorized the Western Lake Erie Shore Study with the following resolution (Exhibit 6, Appendix E):

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report, Lake Erie Shore Line from the Michigan-Ohio State Line to Marblehead, Ohio, published as House Document Number 63, 87th Congress, 1st Session, and other pertinent reports, with a view to determining the advisability of providing for beach erosion control, flood protection, and related purposes in the study area, with particular reference to the advisability of protection works against storm waves and wind-generated high lake levels."

Initial funding for the Western Lake Erie Shore Study was appropriated in Fiscal Year 1979. The present study was conducted under this authority as an interim report in partial response to this resolution.

SCOPE OF THE STUDY

Shore erosion along the portion of Lake Erie presently owned by the State of Ohio located at Maumee Bay State Park, Oregon, Ohio, precludes desired full development of the park for recreation. This Feasibility Report identifies the problems and needs relating to shoreline erosion and flooding at the park. Natural forces, such as winds, waves, and storm surge, and their influence on the shoreline are also assessed. The beach problems are discussed in terms of erosion as they relate to recreation within the park. Finally, various alternatives are presented for solving shore erosion and

PHOTO 1: May 1980 - Westward View of Shoreline from midreach between western boundary of the Park and Berger Ditch. Lake Erie elevation 572.5± IGLD.

PHOTO 2: October 1981 - Eastward View of shoreline with Niles Beach Area in background. Lake Erie elevation 571.0± IGLD.

PHOTO 3: December 1980 - Southward View of Berger Ditch and existing jetty. Lake Erie elevation 571.0± IGLD.

PHOTO 4: October 1981 - Eastward View of St. John Ditch.

PHOTO 5: October 1981 - Wetlands at East end of Park.

PHOTO 6: October 1981 - Bottomland forested Area at East end of Park.

PHOTO 7: October 1981 - East end of park showing Cedar Point Revetment. Lake Erie elevation 571.0± IGLD.

PHOTO 8: December 1980 - Revetment along Cedar Point Wildlife Refuge.

PHOTO 9: Campground Check-in-Station off Norden Road.

PHOTO 10: Newly developed Campground.

protecting the beach. In addition, the flood potential is evaluated, and nonstructural methods for minimizing flood damage to proposed facilities are presented. As previously noted, this study is being prepared as an interim report to the overall study known as the "Western Lake Erie Shore Study," (WLES) which addresses beach erosion and flooding along the shoreline of Lake Erie from Toledo to Marblehead, Ohio. A Reconnaissance Report, was recently completed for the entire 60-mile reach of Lake Erie shoreline from the Ohio-Michigan border to Marblehead, OH, covered by the WLES resolution. This report concluded that there were no locations which could economically justify a flood protection project. It did recommend that further study of shoreline erosion be conducted for Maumee Bay and East Harbor State Parks. The study for Maumee Bay State Park is currently ahead of the overall WLES Study, which will include East Harbor State Park.

PRIOR STUDIES AND REPORTS

The following is a summary of the various previous reports pertinent to the Maumee Bay State Park study area:

a. Report on Beach Erosion Study of Ohio Shores of Lake Erie from Ohio-Michigan State Line to Marblehead, Ohio, dated 20 June 1944, prepared under the authority of Section 2 of the 1930 River and Harbor Act. Project was not justified at this time, although the report stated that a continuous sea wall sufficiently high to prevent overtopping would be necessary to arrest erosion of the shore.

b. Beach Erosion Contract Report, Shoreline of Lake Erie, Ohio-Michigan State Line to Marblehead, Ohio, dated 5 February 1960, prepared under the authority of Section 2 of the 1930 River and Harbor Act. At the time of this report, protective works had been constructed for almost the entire reach of Maumee Bay by individual property owners, although there was practically no beach along the reach. Nothing was recommended at Maumee Bay State Park.

c. Wave Analysis - Toledo Disposal Area, 1972, U. S. Army Engineer District, Detroit.

d. Maumee Bay - Erosion and Sedimentation Report, prepared by the Ohio Division of Geological Survey, 1975, for U. S. Army Engineer District, Detroit.

e. Reconnaissance Report on Shore Erosion, prepared under Section 103 of the River and Harbor Act of 1962, as amended. This report was prepared by the U. S. Army Corps of Engineers, Detroit District, and was issued in November 1976. This report favorably recommended the preparation of a detailed project report for a beach erosion and shore protection project at Maumee Bay State Park, Ohio. It concluded that the development proposed by the Ohio Department of Natural Resources would not be feasible until shore protection was provided which would allow for restoration of the swimming beach.

f. Waterways Experiment Station report on Lake Erie waves, January 1976, contains statistical information on wave height and frequency recurrence along Lake Erie.

g. Water Levels of the Great Lakes - Local Flood Protection Projects, dated 11 August 1953, by U.S. Army Corps of Engineers, North Central Division. No consideration given to Maumee Bay area.

h. Lake Erie Shore Erosion and Flooding, Lucas County, Ohio, by Ohio Department of Natural Resources, 1978. Provides information to shoreland owners and planners on how to deal effectively with the problems of shore erosion and flooding.

i. Access Road Study for Maumee Bay State Park - Study of effects of increased traffic on Maumee Bay State Park road system and access roads. Study was performed for the Ohio Department of Natural Resources by McDonnell Proudfoot Associates, Inc., January 1980.

THE REPORT

The overall organization of this Final Feasibility Report consists of a Main Report, a Final Environmental Impact Statement, and a series of appendices. The Main Report is written to give both the general and technical reader a clear understanding of the study, the study results, and the key decisions and conclusions.

The Technical Appendices to the report provide additional detailed information on the design, costs, and benefits of the alternatives studied.

STUDY PARTICIPANTS AND COORDINATION

This Feasibility Report is the result of a joint study effort involving Federal and State agencies. Principal study participants were representatives of U.S. Army Engineer District, Buffalo, U. S. Fish and Wildlife Service from the Columbus, Ohio, field office, and the Ohio Department of Natural Resources. The U. S. Fish and Wildlife Service prepared Interim and Draft Fish and Wildlife Coordination Act Reports for the Preliminary and Final Reports, respectively. Their Final Coordination Act Report is included in this report as Appendix G. The ODNR assisted through review of tentative plans and study efforts. They also assisted through an active coordination between the Federal agencies and their Contractors working on formulating the beach project and shoreline protection features, and ODNR's Contractors developing site plans for the State Park Development.

Moffatt and Nichol, Consulting Engineers, prepared preliminary designs, cost estimates, and economic evaluations under contract to the Buffalo District.

John Milner and Associates, Consulting Engineers, performed a Cultural Resource and Archaeological survey and evaluation for this Report. A copy of their report is included in this report as Appendix H.

Coordination and direction for the study has been achieved through a series of workshops. Technical workshops were held throughout the course of the study to discuss and review the various alternatives as they were developed. To date, a total of seven workshops have been held and copies of the minutes of the meetings are provided in this report in Appendix F.

In addition to the seven technical workshops conducted specifically for the Maumee Bay Study, orientation workshops for the overall Western Lake Erie Shore Study were held on 10 and 11 January 1979. Various officials and citizens were in attendance at these meetings, and numerous public and private organizations were represented. Maumee Bay State Park and ODNR's development of the park was discussed at the 10 January 1979 workshop.

On 4 June 1981, the Corps conducted a Public Meeting at Oak Harbor, OH, to discuss the results of the Reconnaissance Report for the Western Lake Erie Shore Study. Discussions included the current status and plans for this Maumee Bay State Park Shoreline protective beach restoration study. See Appendix F, Exhibits 1 through 7, for summary minutes of workshops and meetings.

Copies of the Draft Final Feasibility Report and Draft Environmental Impact Statement dated December 1981 (revised April 1982) for this project were distributed to the political leaders in the area, and to various local, State, and Federal agencies for their review and comment. Copies of the report were also supplied to local libraries for review by the general public and various civic groups. Personal copies of the report were also made available to interested parties free of charge. In addition, in accordance with National Environmental Policy Act (NEPA) procedures, the report was filed with the U. S. Environmental Protection Agency (EPA) for a 45-day NEPA review. The Notice of Availability of the Draft EIS was published in the Federal Register by EPA on 14 May 1982. The official 45-day review period for the Draft EIS extended from 15 May 1982 to 28 June 1982. Copies of letters from the public providing their comments and the Corps responses are provided in Appendix J.

SECTION 2 - PROBLEM IDENTIFICATION

Broadly stated, the primary water-related resource problems of the immediate study area at the partially developed Maumee Bay State Park are shoreline erosion and flood inundation from Lake Erie. For any significant future park development, the need for a swimming beach to help meet the unsatisfied demand is paramount. These problems and needs are summarized below.

PROBLEMS, NEEDS, AND OPPORTUNITIES

a. The Erosion Problem.

The predominant force causing shoreline erosion on the Great Lakes is wave action. The erodibility of the shoreline is highly dependent upon the type of soils existing along the nearshore and the bluffline; although such physical characteristics as bathymetry, predominant wind and storm direction, wind speed, fetch distance, availability of beach-building material, and lake levels are influencing factors. Soils in the study area are typically clays and silts with minor amounts of sand and gravel, and are highly erodible. In the absence of any significant protective beach along this reach of Maumee Bay, direct wave attack on the low bluffs does occur relatively frequently, particularly during periods of high Lake Erie levels - producing what has been categorized in past studies as the "most critically eroding shoreline on the south shore of Lake Erie."

(1) Historical Shoreline Recession - Because of differences in characteristics of the shoreline along the park, it was divided into the three reaches shown on Plate 16. The Western Reach is characterized by a low-lying glaciolacustrine clay shore; the Niles Beach Reach by a protective rubble revetment; and the Eastern Reach by eroding forested wetlands. Based on available shoreline information such as historical maps and aerial photos for more recent years, the historical shorelines at the park for selected years from 1877 to 1979 were established as depicted on Plate 5. Table 1, following, provides recession rates for the selected periods for each of the three reaches based on interpretation of the shoreline locations shown on Plate 5. From the tabulation, it is seen that for the entire 103-year period, the average recession rate for the entire park shoreline was nearly 12 feet per year, with the unprotected and more exposed Western Reach experiencing the highest rate at 13.5 feet per year. The historical rate of 5.7 feet per year in the Niles Beach Reach, which is now protected by a rubble revetment, can be expected to increase as the revetment is outflanked on its eastern and western limits. Inspection of the recession rate tabulation also shows that the recession rates have varied nonuniformly through time.

These variances are attributable to fluctuations in long-term Lake Erie levels and the occurrence/nonoccurrence of severe storms - i.e., higher recession rates occur during periods of above average lake levels than during low periods of levels for storms of comparable severity.

Table 1 - Historical Shoreline Recession Rates at Maumee Bay State Park
(feet per year)

Period	Western Reach (1)		Niles Beach (1)		Eastern Reach (1)		Entire Shoreline
	Maximum	Average	Maximum	Average	Maximum	Average	Average
1877-1940	16.7	13.0	8.3	7.6	9.3	8.0	10.4
1940-1950	17.0	12.8	12.0	8.1	10.0	6.8	9.9
1950-1957	14.3	10.3		*	21.0	12.7	10.0
1957-1969	20.0	13.5		*	13.3	8.0	9.7
1969-1979	25.0	19.5		*	82.4	21.9	18.1
1877-1979	15.3	13.5	6.3	5.7	15.3	11.5	11.8

(1) For reach location refer to Plate 5.
* No measurable change.
SOURCE: Listed in Plate 5.

(2) Projected Recession - Based on the historical average recession rates of 13.5 feet per year and 11.5 feet per year for the Western and Eastern Reaches, respectively, the 2040 shoreline shown on Plate 5 was estimated. From this projection, it is estimated that 80 and 60 acres of land will be lost from the Western and Eastern Reaches of the park, respectively, over this 50-year project life period assuming no shoreline protection is provided.

b. The Flooding Problem.

Much of the shoreline along Maumee Bay is low-lying and, therefore, susceptible to flooding, especially when storms out of the northeast occur during periods of high Lake Erie levels.

Topographic and bathymetric surveys were performed by the Buffalo District in June 1979 for this feasibility study. From this data, the top of bluff elevation along the Western Reach of Maumee Bay State Park between Norden and N. Curtice Roads averages about 5 feet above the Lake Erie Low Water Datum elevation of 568.6 (IGLD-1955), or 573.6. Landward to the southerly limit of the park at Cedar Point Road, ground elevations are between 5 and 8 feet above Low Water Datum. With the long-term average Lake Erie level at about elevation 570.4 IGLD, the top of the low scarp along the Western Reach is only about 3 feet above the Lake Erie level for extended periods of time. Elevations along the Eastern Reach are typically 2 to 4 feet lower than the Western Reach and the Eastern Reach contains areas of wetland and marsh embayments that are below Lake Erie level.

Flooding of Maumee Bay State Park can occur from direct inundation of the area and/or backup along the drainage network in the area. Because of the flat terrain, poor drainage from the land surface, and very mild stream slopes, flood waters can take from several days to several weeks to drain from the low-lying lands along Maumee Bay. From the stage-frequency curve of peak (instantaneous) annual Lake Erie levels at Toledo (shown previously on Plate 4c), the top of bluff (elevation 573.6) is overtopped about 75 times per 100 years, or about once every 1-1/3 years, on the average. Again from Plate 4c, for the 100-year peak level of 577.3, the average depth of flooding in the park would be about 3 feet based on an average ground elevation of about 574.3. Plate 6 shown previously, shows the flooded area in the park for the 100- and 500-year floods. These values do not include the effects of wave runup which can and do occur concurrently with high lake levels.

Because the physical structures and other features subject to damages from flood water inundation do not yet exist, any flood damage prevention measures which appear reasonable can be incorporated into the facility design. This is indeed the case. The ODNR is building all structures above the 100-year elevation of 577.3 or protecting the structures and contents to that elevation. A cursory analysis was done to verify the assumption that the more likely structural measures would be more costly then appropriate construction of the facilities.

Because of these findings and recognition of the desirability to design the facilities accordingly by the ODNR, addressing the flooding problem was not an objective of the study.

c. The Recreation Need.

The Ohio Department of Natural Resources in its 1975-1980 Ohio State Comprehensive Outdoor Recreation Plan (SCORP) has identified an excess demand (need) for various kinds of recreational opportunities in the region that would be served by Maumee Bay State Park. During discussions on selection of Maumee Bay State Park as the site to be developed, ODNR has strongly emphasized the need for additional recreational opportunity along the shoreline of Lake Erie in Lucas County. Of particular importance and concern to ODNR is utilization of Lake Erie for swimming, and this opportunity is highly limited in Lucas County at present. Development and restoration of the recreational beach as an integral part of the shore protection project at Maumee Bay State Park would satisfy much of this need. Other park facilities, such as the campgrounds, golf course, and picnic area would serve some of the excess demand for these activities.

NATIONAL OBJECTIVES

The Water Resources Council's Principles and Guidelines (P&G) direct that Federally assisted water related land and project planning be directed to achieve maximum National Economic Development (NED) benefits within the constraints of environmental laws and sound environmental planning as a national objective. NED benefits are to be achieved by increasing the value of the Nation's output of goods and services. In addition, the P&G directed that where appropriate, alternative plans are to be developed which do not

generate the maximum net national economic benefits but do not satisfy a particular worthwhile need identified by some other body or interest group.

PLANNING OBJECTIVES

Based on the previous sections, the following planning objectives were developed. Each objective is for the 1990-2040 planning period.

a. To stabilize 11,000 feet of shoreline subject to erosion between the Cedar Point unit of Ottawa National Wildlife Refuge and the community of South Shore Park.

b. To help satisfy an unmet need for beach recreation opportunity within the demand area of Maumee Bay State Park.

c. To preserve, protect, or enhance the fish and wildlife resources in the study area.

PLANNING CONSTRAINTS

Planning constraints are conditions that exist which could affect the implementation of a given alternative. For the Maumee Bay State Park shoreline protection and beach restoration project, this would include environmental, physical and economic constraints; willingness of the local sponsor to meet the conditions of local cooperation; and legislative constraints. These constraints are reviewed below.

a. Environmental Constraints.

As stated earlier, the eastern shoreline of the park is occupied by approximately 244 acres of actively eroding, forested wetlands. When wetlands are present in a study area, it is Corps policy to make protection and/or enhancement of the beneficial values of wetlands a planning objective. In accordance with Executive Order 11990 - Protection of Wetlands, issued 24 May 1977, the Corps must "take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities...for providing Federally undertaken, financed, or assisted construction and improvements." The EO states that "...each agency shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use. In making this finding the head of the agency may take into account economic, environmental, and other pertinent factors..." The presence of this wetland would preclude the construction of any park facilities in the area without further evaluation and authorization under the Corps of Engineers Regulatory Permit Program.

The Ohio Department of Natural Resources has stated that this nature area is to be considered an integral part of the park development which the State wants to preserve for its interpretive value. The State presently does not

plan to manage the area to promote any specific species of wildlife nor does it plan to regulate water levels within the area. The U.S. Fish and Wildlife Service has stated that allowing some wave activity may be beneficial in allowing marsh succession and a wider diversity of habitat and wildlife. Therefore, any structural measures which may be implemented along this reach must preserve the dependency of the marsh water levels upon the lake. Design of these structures must provide for the relatively free circulation of water into and out of the wildlife area. Although the prevention of shoreline erosion and the maintenance of the park wetland are complementary objectives, disruption of existing swamp-marsh vegetation should be minimized by siting any construction as far lakeward as is feasible.

b. Cultural Constraints.

The State Historic Preservation Officer, in a letter dated 20 June 1980, identified two archeological sites in the beach area which indicate a sequence of human occupation dating back 12,000 years. Although these sites have been subjected to considerable destruction from rising lake levels and beach erosion, they were considered possibly eligible for inclusion in the National Register of Historic Places (NRHP). One site, 33 LU-154, has since undergone damage due to erosion to such an extent that the possibility for the recovery of significant cultural data is minimal. In order to determine possible NRHP eligibility of the remaining site, 33 LU-247, and obtain compliance with Section 106 of the National Historic Preservation Act, a more complete archeological investigation has been carried out during Stage 3 of the project study. This cultural resources testing and evaluation study concluded that the proposed project would have no impacts on archeological Site 33 LU-247 or any other significant archeological resources. The National Park Service and Ohio Historic Preservation Office have concurred with this conclusion.

c. Availability of Beach Sand.

The shoreline is dominated by clayey lacustrine material deposits that form low banks from 1 to 5 feet high. These soils are very poorly drained on nearly level topography and are highly erodible. Because of this soil structure there is no suitable beach material available from nearby underwater sources. Through isolated spits or deposits of suitable sand do exist east of Cedar Point, these appear to be significant spawning and nursery areas for fish in the western basin of Lake Erie. Therefore, the most probable source of beach sand material may be a commercial sand and gravel operation mining granular material from an on-land site.

d. Sources of Benefits.

Much of the recreational demand analysis for Maumee Bay State Park is done for the multi-use park features being developed by ODNR. The purpose of this analysis has been to document the demand for the combined day-use and longer term uses of swimming, picnicking, golfing, camping, sightseeing, hiking, and nature studies. The demand data available, and being developed, estimated use of the park facilities as a unit. Some of the activities included in this demand analysis are regional in nature rather than national. Therefore,

to determine the net NED benefits for a plan, the national benefits must be separated from the regional.

e. Water Quality Constraints on Swimming Demand.

Water quality standards for bathing waters at State of Ohio beaches require that the following criteria be met:

Geometric mean fecal coliform content, based on not less than five samples within a 30-day period, shall not exceed 200 per 100 ml, and shall not exceed 400 per 100 ml in more than 10 percent of the samples taken during any 30-day period.

The Ohio Department of Health collected fecal coliform samples on the east and west side of the proposed bathing beach area during the 1981 season. An interpretation of this data shows that, under normal conditions, the fecal coliform content meets and exceeds all the criteria stated resulting in an acceptable water quality. For the period of record (1978, 1980, 1981), geometric mean fecal coliform content has exceeded the State standard twice.

The beach area at the proposed Maumee Bay State Park has never been used as a public recreation area; therefore, there have never been any beach closings, per se, from which to estimate the recurrence interval of such closings. The area also lacks a significant historical record of fecal coliform counts. From the available data, it appears that high bacterial counts are not a persistent problem at the park. Since the Ohio Department of Health recommends the posting of beaches during periods of excessive rainfall and the fact that swimming would not normally take place under these weather conditions, there appears to be no threat to public health at the park.

f. Sponsor Willingness.

No project can be constructed without the willingness of the local sponsor(s) to agree to conditions imposed by the Federal Government, including cost sharing. The Ohio Department of Natural Resources, as developer of the park for the State of Ohio, has repeatedly stated their position that, regardless of the method of analysis, they considered the future Maumee Bay State Park to function as one unit and as such, required the protection of the entire shoreline to keep the integrity of the park, as a unit, intact. They have since been asked to provide letters reiterating their intent to provide the assurances for the project currently under study, and have done so.

SECTION 3 - FORMULATION AND EVALUATION OF ALTERNATIVES

PLAN FORMULATION APPROACH

The "planning process" is an investigation which is designed to effectively and efficiently solve a particular water and land-related resource problem in an identified area given a set of objectives and constraints.

Plan formulation is the process whereby all reasonable alternative plans are identified, developed, evaluated, and compared. Impractical and unfeasible alternative plans were eliminated through the planning process, and those plans remaining became more refined through additional development and subsequent iterations. After all iterations have been performed, a recommendation as to the "best" solution is made. That recommendation is the basis for authorization of a project in the case of a positive report. In this section, the plan formulation approach will be presented to show: where alternative plans were proposed; how they were developed; what steps were taken in screening and evaluating them; and how they were compared to one another.

In general, alternative plans identified as potential solutions come from: earlier studies; plans identified by the publics; experience with similar water and land-related resource problems; and those required by law or regulation.

The development of alternative plans attempts to define the plan and its relative contributions to solving the problem. At this point, an initial screening of plans is made to determine whether or not they could potentially solve the problem. If they have potential, they are carried forward in the process; if not, they are noted and dropped from subsequent evaluation.

The evaluation of plan effects consists of assessment and appraisal. Assessment is the process of measuring or estimating the effects of an alternative plan, and it uses the difference between the "without plan" and "with plan" conditions for each of the categories of effects. Appraisal is the process of assigning social values to the technical information gathered as part of the assessment process. This appraisal includes setting up a system of accounts to determine the relative contribution of each plan to the national economic development, environmental quality, regional development, and social well-being accounts.

The comparison of plans focuses on the differences among the alternative plans as determined during the evaluation phase. The differences are organized on the basis of effects defined by the system of accounts. During the comparison, the Corps is required to designate an NED Plan and an EQ (or an LED (Least Environmentally Damaging)) Plan. The NED Plan is the plan which reasonably maximizes the net economic benefits; while the EQ (or LED) Plan is the plan which most enhances or does the least damage to the environment. The comparison phase will often require some type of trade-off analysis where one plan is not shown to be significantly superior to another.

After consideration of the various alternative plans and their effects, public input, and appropriate iterations, a plan is selected and recommended.

ASSOCIATED DEVELOPMENT

As stated earlier in this report, the Ohio Department of Natural Resources (ODNR) has developed a master plan for Maumee Bay State Park. This master plan provides a wide range of recreational facilities depending upon shore protection and construction of a beach along the western shoreline of the park. Since recreational benefits were taken for park activities, both Federal and ODNR park development costs were included in the economic evaluation to determine the benefit to cost ratio.

ODNR stressed that the park development was one complete entity and could not be separated into a beach area to the west and a nature area to the east. All recreation activities proposed for the park are dependent on erosion protection along the entire shoreline of the park in varying degrees, and therefore, evaluation of project benefits must be based on this integral and interdependent concept, and not on incremental justification that is dependent upon the type of shoreline protection provided. ODNR's position paper on this subject is included as Exhibit 17 of Appendix E.

a. ODNR First Costs.

On 12 June 1981 the Corps requested information from the ODNR (see Exhibit 23, Appendix E) relative to their Park Development Plans and associated Construction and Maintenance Costs. ODNR responded by letter dated 9 July 1981 (copy attached, Exhibit 24, Appendix E). Their letter provided some of the information requested in summary form which was later supplemented by telephone. The ODNR construction costs including lands required for the development with and without the Corps project, are summarized in Table 2. From the tabulation, ODNR's cost of constructing the recreational facilities would vary from $11.6 million without the Federal shore project, to $33.6 million with the Federal project. These costs were included as part of the total project costs in the economic evaluations.

b. ODNR Maintenance Costs.

The Corps orally requested Operation and Maintenance Costs from the Ohio Department of Natural Resources. ODNR was unable to provide this information, so these costs were estimated by the Corps. An existing facility in the State of Kentucky was chosen as a model. It offered comparable major facilities such as a lodge, golf course, and camp ground. In addition, the annual attendance closely approximated that anticipated at Maumee and Operation and Maintenance budgets were available for the current year, 1981-1982. Based on a comparison with Lake Barkley State Resort Park, Kentucky, the Operation and Maintenance Costs were determined for ODNR's development at Maumee and are as shown in Table 3, following.

Table 2 - Ohio Department of Natural Resources, Park Development Costs - Maumee Bay State Park, OH (1) June 1981 price level

Facility/Feature	Cost With Federal Project (shore protection/beach)	Cost Without Federal Project (No-Action)
	$	$
Lodge Complex	13.0 million	-
Cabins	2.0 million	-
Golf Course	2.5 million	-
Bathhouse, Park	3.0 million	-
Park Office Service Facilities	1.0 million	-
Nature	0.5 million	0.5 million
Camping Area	3.7 million	3.7 million
Picnic Area	1.5 million	1.0 million
Lands (2)	6.4 million	6.4 million
Total Cost ODNR Development	33.6 million	11.6 million

(1) SOURCE: Ohio Department of Natural Resources.

(2) Lands required for park development exclusive of the acreage required for the Federal shore protection beach restoration project.

Table 3 - Annual Operation and Maintenance Costs (1)
Maumee Bay State Park, OH, June 1981 price levels

	$
Campground - 256 Sites	225,000
18-Hole Golf Course	250,000
Bathhouse, Park Facilities	125,000
150-Room Lodge and 50 Cabins	400,000
Utilities and Insurances	500,000
Total	$1,500,000

(1) As estimated by the Corps of Engineers.

c. Park Development Schedule.

The Base Year for completion of construction of the shoreline protection project is currently estimated for the year 1990. The achievement of this date is contingent on several factors, including the time required to complete this Feasibility Study (August 1983), the time required for approval and processing the report to Congress, project authorization by Congress, and subsequent appropriation of funds for final design and construction.

The State of Ohio's development began in 1980. In 1981, they completed construction of a 256-site campground and associated roadways, which was opened to the public in July 1981. Their construction plans for the immediate future are to use additional appropriated funds for remaining land acquisitions (518 acres) and partially develop picnic and nature areas. They have indicated that construction of the remainder of their proposed development will only be accomplished concurrently with and after the Corps shoreline construction. Present plans call for construction of the bathhouse, lodge, cabins, and the golf course, in that order. Realistically, any and all proposed development is predicated on the availability of the necessary funds. Any references to their schedule by timeframe or a specific year is contingent upon legislative appropriations which, if not provided in a timely manner, would introduce delays in anticipated schedules. For this analysis it was assumed that a reasonable ODNR schedule for completing the aforementioned recreational facilities would be 6 years after completion of the Federal project.

PLAN FORMULATION OF PRELIMINARY PLANS

a. General.

Within the prescribed planning framework and established criteria, possible solutions are to be identified and evaluated in a three-stage iterative proc-

ess to address the needs of the study area and the overall planning objectives. Each stage includes the four functional planning tasks of problem identification, formulation of alternatives, impact assessment, and evaluation.

This section of the Main Report presents the results of the this Preliminary Stage evaluation. The level of study performed was consistent with the Preliminary Stage objective of evaluating a broad range of possible solutions and identifying the best general plan (or plans) for satisfying the shoreline erosion and the recreational beach needs at Maumee Bay State Park.

The Ohio Department of Natural Resources proposes to develop Maumee Bay State Park as a 1,855-acre multi-use recreational complex. At the time of the preliminary evaluation (fall 1981), ODNR had purchased approximately 1,337 acres of land and completed construction of a 256 site campground and associated roadways which opened to the public in July 1981. Future plans call for a recreational development which will add facilities for hiking, fishing, picnicking, nature studies, and swimming. Activities are interrelated, and full development and usage is contingent upon restoration and preservation of the swimming beach, and protection of the wetland area in the view of ODNR. As possible solutions to addressing this primary need, nine structural solutions and two nonstructural solutions in addition to the "no action" option, were initially considered. Various conceptual alternatives for providing shoreline protection were identified and are as follows:

(1) No Action Plan

(2) Headlands

(3) Detached Breakwaters

(4) Protective Beach

(5) Groin Field

(6) Floating Breakwaters

(7) Perched Beach

(8) Revetment

(9) Combinations of some of the above

A total of 12 structural and nonstructural plans were considered as possible solutions to the shoreline erosion problem at Maumee Bay State Park.

Of these 12 plans, eight were eliminated during initial assessment and evaluation because of their lack of sufficient contribution to the planning objectives and accounts. This was accomplished at a series of workshops conducted by Buffalo District, with the A/E firm of, Moffatt and Nichol, U.S. Fish and Wildlife; and the Project Sponsor, and the Ohio Department of Natural Resources, in attendance. This process left three intermediate structural alternatives for further assessment, preliminary designs, and evaluation.

These four alternatives were:

Alternative 1 - No Action Plan

Alternative Plan 2 - Protective Sand Beach at West End and Revetment

Alternative 3 - Protective Beach with Detached Breakwaters at West End and Revetment Along East End.

Alternative 4 - Protective Beach with Groin Field at West End and Revetment along East End.

The following pages provide a description of each alternative.

b. Description of Preliminary Plans.

(1) Alternative Plan 1 - No Action.

- Plan Description - The no-action plan provides the basis for evaluating the structural alternatives. It does not meet the planning objectives or satisfy the local sponsor, the Ohio Department of Natural Resources. Their planned development would be scaled down considerably if this option is chosen because the shoreline would continue to erode, resulting in a shoreline as shown on Plate 7. Further, no recreational beach would be provided and their total development plan would be scaled down considerably.

The no action or "do nothing" plan represents the base condition for evaluation of the three structural plans described later. If no Federal action is taken, the parkland will continue to erode and it will not be developed to its full potential. No beach would be provided and much of the area set aside for preservation and interpretive nature areas would be lost. Land would remain for picnicking, hiking, camping, and golf, but these activities would not develop or attract patronage as they would if shore protection and a beach were provided. This alternative would not satisfy the planning objectives.

- Implementability of Alternative 1 - No Action - As the name indicates, no action is the automatic result if a structural solution to the shoreline erosion problem is not implemented. In this event, the park would not be developed to the degree desired by State and local interests, and the recreational need of the Toledo metropolitan area will not be satisfied. This option is unsatisfactory to the Ohio Department of Natural Resources but is the only recourse available to the Corps if an action plan, that provides shoreline protection, is not implementable.

(2) Alternative Plan 2 - Protective Beach and Revetment.

- Plan Description - The plan view for Alternative 2 is shown in Plate 8. The principal features of Alternative 2 are: a 5,500-foot long protective sand beach with a storm dune over the western half of the park shoreline, a 5,500-foot long revetment along the eastern half of the park, a 450-foot long rubblemound jetty at the western end of the beach, and two 250-foot jetties at the eastern end of the beach at Berger Ditch.

The description and a typical section of the protective sand beach were discussed earlier in this section. Approximately 300,000 cubic yards of medium-grain sand would be required for initial construction of the protective beach. Annual nourishment and backpassing quantities have been estimated at 10,000 cubic yards each. However, these estimates are highly unreliable because methodologies are currently nonexistent to definitively estimate the requirements for sand losses in an environment such as exists at Maumee Bay. Because of this uncertainty the District and the Ohio Department of Natural Resources have serious concerns about the functional viability of Alternative 2, particularly when the average annual costs and net benefits are about the same as for the more reliable Alternative 3 which would provide offshore breakwaters to protect the sand beach.

The short jetties at McHenry and Berger Diches would prevent clogging by longshore transport of sand from the protective beach. The jetties would be of rubblemound construction with a concrete diaphragm to prevent movement of sand through the jetties. The crest elevation would be at +10.0 feet LWD to minimize movement of beach sand into the ditches from overtopping.

The 5,500-foot long rubblemound revetment at the eastern half of the park would prevent erosion of the wildlife/wetland area. It is designed with a permeable section above Low Water Datum which with occasional overtopping and designed gaps would permit relatively free circulation of water into and out of the wildlife area. Stone sizes would vary to a maximum size of 3 tons for the armor layer. The revetment, although overtopped during storms, would provide shoreline protection on the leeward side.

- Implementability of Alternative 2 - In view of the discussions the District has had with the Ohio Department of Natural Resources and the U.S. Fish and Wildlife Service; and considering the first cost, annual charges, net benefits, and B/C ratio; Alternative 2 would appear implementable. However, the District and ODNR are concerned that the actual amount of annual nourishment and back-passing that will be required in the prototype may be significantly greater than the qualitative amount estimated herein. If this is the case, the cost of annual nourishment and back-passing, and, therefore, the total annual costs, could be considerably higher then estimated herein. Unless reliable methods for estimating the annual nourishment and back-passing volumes are available, the implementability of Alternative 2 is questionable.

(3) Alternative Plan 3 - Protective Beach With Detached Breakwaters and Revetment.

- Plan Description - The plan view for Alternative 3 is shown in Plate 9. Except for the 250-foot jetty at the west end of the park and the four 600-foot breakwaters fronting the protective beach, all other features of Alternative 3 are identical to those for Alternative 2. Therefore, only these differing features will be discussed. The length of the westerly jetty would be 250 feet long instead of 450 feet for Alternative 2. The proposed offshore breakwaters would partially control longshore littoral transport, thus, allowing for this reduction.

The detached breakwaters would consist of four segments, each 600 feet long with a 600-foot gap between, located from 800 feet to 1,000 feet offshore at a depth of 3 feet below LWD. Construction would be of rubblemound stone varying in size to a maximum of 4-ton, with a base width of 60 feet. The crest would be at elevation +8.0 LWD, and have a 12-foot width. The top was designed for a significant wave of 8.3 feet and would be subjected to minor overtopping under design conditions. The breakwaters would provide beach stability resulting in a reduction of sand backpassing and nourishment quantities, when compared to Alternative 2. Estimates of 1,000 cubic yards per year for each would be required to maintain the average design width of 250 feet.

- Implementability of Alternative Plan 3 - Based on January 1980 price levels, the project cost for Alternative 3 ($10.3 million) is about $1.3 million higher than the project cost for Alternative 2 ($9.0 million), the annual charges for these two plans are comparable ($785,000 for Alternative 3 vs. $747,000 for Alternative 2) primarily because of the much higher annual nourishment and back-passing costs for Alternative 2. However, the annual charges for Alternative 3 are considered much more reliable by both the District and ODNR because there is no highly reliable method of estimating the annual nourishment and back-passing quantities of the exposed beach for Alternative 2. It is concluded that the State's initial investment of between $3 and $4 million for Alternative 3 is within the realm of financial feasibility, particularly in light of its commitment to provide a multiuse recreational facility on Lake Erie to serve its constituents in northwestern Ohio. No serious environmental issues have surfaced during Stage 2 planning, and the U. S. Fish and Wildlife Service considers Alternative 3 acceptable. Net annual benefits of $974,000 and a B/C ratio of 2.2 are indicative of an economically viable plan.

Considering engineering, functional, economic, environmental, social, financial, and institutional feasibilities, it is concluded that Alternative 3 was implementable.

(4) Alternative Plan 4 - Protective Beach With Groin Field, Revetment.

- Plan Description - The plan view for Alternative 4 is shown on Plate 10. As with Alternative 3, Alternative Plan 4 is also a modification of the basic structural plan, which is Alternative 2. For this alternative, the 250-foot protective beach of Alternative 2 would be stabilized by a groin field that prevents longshore transport of beach sand to the west. The four 450-foot long rubblemound groins would be spaced at 1,100 feet on centers. Each groin would have the same cross sectional area as the jetties described earlier in this section. Although the longshore transport of beach sand would approach zero with the groins, the beach would not be protected against offshore movement of sand and rip currents generated at the heads of the groins may accelerate the rate of offshore losses. For this reason, it was qualitatively estimated that the annual nourishment for Alternative 4 would be 15,000 cubic yards per year, or about a 5,000-cubic yard increase above the 10,000 cubic yards estimated for Alternative 2. An incidental amount (1,000 cubic yards) of back-passing would also be required.

Other principal features of Alternative 4 - i.e., jetties at the lake terminus of drainage ditches and the 5,500-foot rubblemound revetment along the eastern half of the park - would be the same as for Alternative 2.

- Implementability of Alternative Plan 4.

Alternative 4 was also eliminated for the following reasons:

1. Groins function by trapping littoral drift which is limited along Maumee Bay.

2. The U.S. Fish and Wildlife Service opposes this plan because it would be the most disruptive to existing littoral current and drift patterns.

3. ODNR was concerned for the safety of the swimmers due to scour which would form at the head of the groins.

4. Anticipated high annual nourishment costs due to significant offshore transport of beach sand.

5. Plan is the most costly of those being considered and has the lowest net benefits and B/C ratio.

c. Summary.

Table 4 provides a summary of the effects of Alternatives 1 through 4 on the NED, EQ, SWB, and RD accounts.

Of the three structural plans considered as alternatives for prevention of shoreline erosion, only Alternative 4 which provided a Protective Sand Beach protected by a Groin System and a Rubblemound Revetment has been eliminated.

PLAN FORMULATION OF INTERMEDIATE PLANS

a. General.

Near the conclusion of preliminary stage, a checkpoint conference was held to address comments based upon a review of the Draft Report. In attendance at the meeting held on 25 November 1980 were representatives of the Buffalo District, North Central Division, and the Office of Chief Engineers.

In an effort to determine which alternative plan would maximize net benefits, it was agreed that a "revetment plan" for protection of the entire shoreline at Maumee Bay State Park should be considered. This option had previously been explored in the preliminary stage but had been dropped from consideration because the Project Sponsor, ODNR, was opposed to it since it would not provide a beach, for swimming which would be the focal point of their planned development. Irrespective of this, Buffalo District did agree to consider this option during this stage of planning. Therefore, this alternative designated "Alternative 5, Revetments," was added to the two structural alternatives carried forward from earlier evaluation. Designs (and cost estimates) were prepared for this plan at the same level of detail as other structural alternatives so that a true economic comparison could be made.

Table 4 - Summary of Effects for Alternative Plans 1 through 4
(Preliminary Stage) January 1980 price levels

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
A. PLAN DESCRIPTION	Do nothing.	Principal features are a 5,500-long rubblemound revetment on the east side and a 5,500-long sand beach on the west half of the park. The beach would be 250-foot wide with rubblemound jetties at each end.	Same as Alternative 2 but also includes four 600-foot long rubblemound offshore breakwaters to stabilize the beach.	Same as Alternative 2 but also includes a rubblemound groin field to stabilize the beach against longshore transport.
B. SIGNIFICANT IMPACTS				
1. National Economic Development				
a. Beneficial Impacts				
(1) Recreation Benefits	None	$1,755,000	$ 1,755,000	$ 1,755,000
(2) Erosion Prevented Benefits	None	4,000	4,000	4,000
Total Annual Benefits	None	$1,759,000	$ 1,759,000	$ 1,759,000
b. Adverse Impacts				
(1) Project First Cost (1)	None	$8,424,000	$10,364,000	$10,028,000
(2) Annual Charges	$4,000 per year erosion damage.	747,000	785,000	885,000
(3) Park Development Costs	Less than Alternatives 2, 3, or 4 because ODNR will not provide all facilities called for in the Master Plan unless protection is provided.	More than Alternative 1 because ODNR will construct all facilities called for in the Master Plan.	Same as Alternative 2.	Same as Alternative 2.
c. Economic Efficiency				
(1) Net Annual Benefits	-	$1,012,000	$ 974,000	$ 874,000
(2) B/C Ratio	-	2.4	2.2	2.0

(1) Includes cost of lands required for the project.

Table 4 - Summary of Effects for Alternative Plans 1 through 4 (Cont'd)
(Preliminary Stage)

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
2. Environmental Quality				
a. Beneficial Impacts				
(1) Man-Made Resources	None	Erosion of parkland would be halted. 31.6-acre beach provided. Park development could proceed. Drainage ditches would be protected from shoaling. Fishing opportunities from jetties.	Erosion of parkland would be halted. 31.6-acre beach provided. Park development could proceed. Drainage ditches would be protected from shoaling. Fishing opportunities from jetties.	Erosion of parkland would be halted. 31.6-acre beach provided. Park development could proceed. Drainage ditches would be protected from shoaling. Fishing opportunities from jetties.
(2) Natural Resources	None	Protection of wetlands.	Protection of wetlands.	Protection of wetlands.
(3) Air Quality	None	None	None	None
(4) Water Quality	None	None	None	None
(5) Biological Resources	None	.98 acre of benthic habitat created. Protection of wetland habitat.	2.15 acres of benthic habitat created. Protection of wetland habitat.	1.92 acres of benthic habitat created. Protection of wetland habitat.
(6) Erosion	None	Shoreline erosion would be halted.	Shoreline erosion would be halted.	Shoreline erosion would be halted.
b. Adverse Impacts				
(1) Man-Made Resources	Continued loss of parkland. Existing drainage ditches and jetties subject to damage from continued erosion.	None	None	None
(2) Natural Resources	Continued erosion and further loss of beach and wetland areas.	Commitment of energy resources during construction and materials (stone, sand, etc.) for the life of the project.	Commitment of energy resources during construction and materials (stone, sand, etc.) for the life of the project.	Commitment of energy resources during construction and materials (stone, sand, etc.) for the life of the project.
(3) Air Quality	None	Temporary decrease during construction. Some decrease as the number of visitors increases.	Temporary decrease during construction. Some decrease as the number of visitors increases.	Temporary decrease during construction. Some decrease as the number of visitors increases.

Table 4 - Summary of Effects for Alternative Plans 1 through 4 (Cont'd)
(Preliminary Stage)

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
(4) Water Quality	None	Temporary turbidity during construction and maintenance.	Temporary turbidity during construction and maintenance. Natural circulation patterns are disrupted by breakwaters.	Temporary turbidity during construction and maintenance.
(5) Biological Resources	Continued erosion of wetlands resulting in reduced habitat for marsh species.	Temporary disruption of beach and wetland ecosystems during construction and maintenance. Loss of 1.42 acres of benthic habitat. Loss of 6.6 acres of woodland-swamp.	Temporary disruption of beach and wetland ecosystems during construction and maintenance. Loss of 4.42 acres of benthic habitat. Loss of 6.6 acres of woodland-swamp.	Temporary disruption of beach and wetland ecosystems during construction and maintenance. Loss of 4.11 acres of benthic habitat. Loss of 6.6 acres of woodland-swamp.
(6) Erosion	Present erosion rates will continue.	Temporary increase due to disruption of vegetation during construction.	Temporary increase due to disruption of vegetation during construction.	Temporary increase due to disruption of vegetation during construction.
(7) Compaction	None	Localized soil compaction due to the presence of construction equipment.	Localized soil compaction due to the presence of construction equipment.	Localized soil compaction due to the presence of construction equipment.
3. Social Well-Being				
a. Beneficial Impacts				
(1) Noise	None	None	None	None
(2) Aesthetic Values	None	Wider, more attractive beach with erosion scars eliminated.	Wider, more attractive beach with erosion scars eliminated.	Wider, more attractive beach with erosion scars eliminated.
(3) Community Cohesion	None	Secondary park development may attract region's inhabitants to one activity center.	Secondary park development may attract region's inhabitants to one activity center.	Secondary park development may attract region's inhabitants to one activity center.
(4) Desirable Community Growth	None	Minor commercial development to service park users.	Minor commercial development to service park users.	Minor commercial development to service park users.
(5) Cultural Resources	None	None	None	None

Table 4 - Summary of Effects for Alternative Plans 1 through 4 (Cont'd)
-- (Preliminary Stage)

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
(6) Leisure opportunities	Present park use, although limited, would be uninterrupted.	Increased opportunities for recreational swimming, fishing, and nature study.	Increased opportunities for recreational swimming, fishing, and nature study.	Increased opportunities for recreational swimming, fishing, and nature study.
(7) Displacement of People	None	None	None	None
b. Adverse Impacts				
(1) Noise	None	Temporary increase during construction. Increases as crowds and traffic increase.	Temporary increase during construction. Increases as crowds and traffic increase.	Temporary increase during construction. Increases as crowds and traffic increase.
(2) Aesthetic Values	Erosion scars will persist.	Temporary decrease during construction and maintenance periods. Obstruction of view along the shoreline.	Temporary decrease during construction and maintenance periods. Obstruction of view of lake and shoreline by breakwaters and jetties.	Temporary decrease during construction and maintenance periods. Obsruction of view along the shoreline by groins and jetties.
(3) Community Cohesion	None	None	None	None
(4) Desirable Community Growth	None	None	None	None
(5) Cultural Resources	None	Possible disturbance of two archaeological sites.	Possible disturbance of two archaeological sites.	Possible disturbance of two archaeological sites.
(6) Leisure Opportunities	Continued loss of parkland to erosion and a lessened potential for full park development.	Temporary disruption during construction and maintenance periods.	Temporary disruption during construction and maintenance periods.	Temporary disruption during construction and maintenance periods.
(7) Displacement of People	None	None	None	None
4. Regional Development				
a. Beneficial Impacts				
(1) Value of Increased Income	Some increase from partial development of the park and to businesses in the local area.	Additional increase to that for Alternative 1 because of complete development of proposed park facilities.	Same as Alternative 2.	Same as Alternative 2.

Table 4 - Summary of Effects for Alternative Plans 1 through 4 (Cont'd)
(Preliminary Stage)

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
(2) Quality of Increased Employment	Some increase in local and regional employment due to partial park development.	Temporary increase during construction of the shoreline protection project, and full development of the park. Permanent increase for operation of the fully developed park.	Same as Alternative 2.	Same as Alternative 2.
C. PUBLIC AND AGENCY ACCEPTABILITY	The Ohio Department of Natural Resources is opposed to this plan because it precludes development of the park to the desired level and recreational needs in the area will largely go unmet, and shoreline erosion will continue.	Preferred by U. S. Fish and Wildlife Service because it is least disruptive to existing resources. District interprets it is unacceptable to ODNR because of lack of reliability of estimating annual nourishment and backpassing requirements for the exposed beach, although it would allow for full development of the park. No identified opposition from the general public.	Preferred by ODNR because the breakwaters provide a reliable means of minimizing offshore and longshore losses from the protective beach, and therefore annual maintenance costs for nourishment can be reliably estimated. Acceptable to U. S. Fish and Wildlife Service provided breakwaters are constructed of large rock riprap. No identified opposition from the general public.	USF&WLS expressed concern because the groins would cause greatest disruption of existing current and drift patterns. Would require additional information on these factors before considering this plan further. ODNR does not support this plan because of possible hazard at head of groins and the offshore losses would be greater than Alternative 2 requiring even more annual nourishment. No identified opposition from the general public.
D. PLAN EVALUATION				
1. Contributions to Planning Objectives				
a. Protection from erosion and flooding	Objective not met as erosion and flooding will continue. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Erosion will be eliminated. Flooding will continue because of inundation from the flanks, but should be less severe due to elimination of wave runup. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Same as Alternative 2.	Same as Alternative 2.
b. Provide recreational beach	No effect.	31.6-acre beach would be provided.	Same as Alternative 2.	Same as Alternative 2.

Table 4 - Summary of Effects for Alternative Plans 1 through 4 (Cont'd)
(Preliminary Stage)

	Alternatives			
	Alternative 1 No-Action	Alternative 2 Beach and Revetment	Alternative 3 Beach with Detached Breakwaters, and Revetment	Alternative 4 Beach with Groins, and Revetment
c. Park development	Inhibited.	Multi-use park development, to a scale proposed in ODNR's Master Plan, could proceed.	Same as Alternative 2.	Same as Alternative 2.
d. Meet recreational needs of the area.	Partially meets some of these needs.	Significant contribution to meeting diversified needs of Toledo Metropolitan Area.	Same as Alternative 2.	Same as Alternative 2.
2. Design and Functional Reliability	Not applicable.	Would solve erosion problem and meet recreational need objectives. However, estimates of annual nourishment and back-passing requirements are considered unreliable. No apparent methologies for improving these estimates.	Considered reliable.	Same as Alternative 2.
3. Implementability	Outcome if no structural plan meets feasibility requirements.	Implementation is questionable because of the uncertainty associated with the amount of annual nourishment and back-passing that will be required.	Implementable based on the preliminary evaluation of Stage 2.	Highly improbable because of adverse effects on currents and littoral drift and uncertainty associated with annual nourishment required.

It was also suggested at the aforementioned Checkpoint Conference that the proposed protective sand beach be reoriented landward some distance. This, in effect, would reduce the quantity of sand required, due to the general upward slope of the land away from the lake. This option was discussed with ODNR at a late Orientation Workshop on 30 January 1981 (see Exhibit 6 of Appendix F for minutes). They agreed with the concept and stated that the loss of park land due to the beach reorientation should not be a problem. However, they did suggest that it might also be possible to affect a cost savings by substituting a grassy area for some portion of sand beach, possibly up to 80 feet. The turfed area could probably be constructed with material excavated for the beach. It would be constructed on the landward side of the beach and have a grass surface for use as a beach area. The District agreed that this modification would be accommodated in the upcoming designs.

The suggested additions and modifications, when incorporated with plans recommended for further study at the conclusion of the preliminary stage represent the alternatives as follows:

Alternative 1 - No-Action

Alternative 2a - Protective Sand Beach at West End of Park, Revetment at East End

Alternative 3a - Recessed Protective Beach at West End of Park Protected by Offshore Breakwaters, Revetment at East End.

Alternative 3b - Recessed Protective Beach at West End of Park with Turf Section Protected by Offshore Breakwaters, Revetment at East End

Alternative 5 - Revetment Across Entire 11,000 Feet of Park Shoreline

b. Description of Intermediate Plans.

(1) Alternative Plan 1 - No Action.

- Plan Description - The No Action Plan provides the basis for evaluating the structural alternatives. This option, although not favored by the local sponsor because it would preclude development or utilization of the park as currently envisioned by the Ohio Department of Natural Resources, avoids the monetary investment associated with the structural plans. The No Action Plan would not meet the recreation need that exists in the Metropolitan Toledo area, and particularly, the need for such opportunities on the shore of Lake Erie. Problems discussed earlier in this report would remain unchanged and unresolved. The No Action Plan would not meet the planning objectives to reduce, or eliminate, shoreline erosion or provide the desired level of additional recreation opportunities in the area to be served by Maumee Bay State Park.

The projected 50-year shoreline for the No Action Plan is shown on Plate 11. The 11,000 feet of park shoreline would continue to erode at an annual rate of about 12 feet per year resulting in a total loss of about 140 acres of

land over the next 50 years. To the east, the wooded wetlands would continue to erode, resulting in a loss of marsh and wildlife areas: along the western half of the park, erosion of the proposed picnicking area would occur. Most importantly, if shoreline protection is not provided, the park will not develop to its full potential. Limited camping, beach-use, and other day-use would occur, but to a degree far below the potential that a protected shoreline incorporating a sand beach would allow.

- Implementability of Alternative 1 - No Action - As the name indicates, "no action" is the automatic result if a structural solution to the shoreline erosion problem is not implemented. In this event, the park would not be developed to the degree desired by State and local interests, and the recreational need of the Toledo metropolitan area will not be satisfied.

This option is unsatisfactory to the Ohio Department of Natural Resources, but is the only recourse available to the Corps if an "action" plan, that provides shoreline protection, is not implementable.

(2) Alternative Plan 2a Protective Beach and Revetment.

- Plan Description - The plan view of Alternative 2a is shown in Plate 12. The principal features of Alternative 2a are:

a. A 5,500-foot long protective sand beach with a storm dune over the western half of the park shoreline.

b. A 6,200-foot long rubblemound revetment along the eastern half of the park.

c. A 450-foot rubblemound revetment immediately west of Berger Ditch.

d. A 450-foot long jetty at the western end of the beach and a rehabilitation - extension of an existing jetty at Berger Ditch.

Protective Sand Beach - The proposed, protective sand beach extends from McHenry Ditch on the west end to Berger Ditch on the east, a distance of 5,500 feet. The design width from the lakeward side of the vegetated storm dune to average lake level is 250-feet.

A landward berm of 50 feet at elevation +10 is connected to one at elevation +8 by a 1 on 15 slope. A slope of 1 on 20 leads from the lower berm to the toe at L.W.D+. The sandfill would be of a medium grade, and approximately 275,000 cubic yards would be required. The sand beach would be separated from the adjacent park by a vegetated storm dune, which provides a buffer and gives an additional 2 feet of freeboard to entrance areas. It also prevents overwash and inland transport of sand.

Offshore sand losses are a major concern of the bare protective sand beach. Quantities of sand which would be lost are not quantifiable, using existing methodologies. Estimates of losses have been made based on the best available information. However, as the quantities and cost estimates presented later show, the annual costs and, therefore, net benefits and Benefit/Cost Ratios for each of the alternatives are very sensitive to the

annual amount of beach nourishment that would be required. In an effort to assist in determining the adequacy of the estimated sand losses, both offshore and alongshore, a test program was initiated in 1981. The program consisted of placement and monitoring the movements of a known volume of sand at the proposed beach location. Tests have been concluded, although the results are nonclusive and suggest no change to estimated sand loss values. A detailed summary of results and actual test information is provided in Coastal Appendix D.

Wildlife Revetment - The rubblemound revetment proposed for protection of the shoreline at the eastern half of the park would begin at Berger Ditch and extend eastward where it would tie into an existing revetment at the Cedar Point Wildlife Refuge (see Plate). Gaps would be provided at ditch outlets and along the length to allow for circulation of water into and out of the nature area. In addition, the permeability of the rubblemound stone along with the low crest height will supplement the exchange of water.

The proposed wildlife revetment would be constructed of an underlayer stone from 50 to 150 pounds, and topped with armor stone ranging from 700 to 1,500 pounds. It is designed for occasional overtopping, with a crest height of +8.6 feet. Its top width of 12 feet provides a width sufficient for maintenance vehicles and a widened top surface at the gaps provides a turnaround. The total length of revetment including overlap and wraparounds is 6,200-feet.

Berger Ditch Revetment - A small, protrusion of wooded land exists along the shoreline west of Berger Ditch. Some crude protection was placed there years ago to protect a seasonal development called Niles Beach. This development has since been removed and the protection is in poor condition. Construction of this revetment would tie the proposed beach into a rehabilitated jetty along the west side of Berger Ditch and continue to protect existing lands.

The Berger Ditch Revetment is designed with an underlayer stone of 50 to 150 pounds, placed over the existing rubble and atop a filter cloth on the existing bottom. Armor stone from 700 to 1,500 pounds covers the underlayer, with a 5.9 foot top width at elevation LWD + 10 feet. The lakeside slope is 2 to 1 while the land side slope is 1.5 feet to 1.

Jetties - The proposed jetties would be constructed at the outlets of the drainage ditches and function to retain the beach fill and to prevent blockage of the drainage ditches from littoral materials transported along the shoreline. The jetties would be of rubblemound construction with a filter cloth and concrete diaphragm to prevent the passage of sand through the jetty. The 3-foot wide concrete diaphragm would also function as a walkway for fishermen.

Rubblemound stone proposed for the jetties consists of an 80 to 280 pound underlayer course topped with an armor stone ranging from 1,200 to 2,800 pounds. The top width of 7.2 feet is at elevation LWD + 10 feet and sideslopes are 1.5 feet to 1 foot.

This alternative proposes a 450-foot jetty along the east side of McHenry Ditch and rehabilitation and lengthening of an existing jetty on the west side of Berger Ditch to 250 feet. No jetties are proposed for the easterly Sautter Ditch although the revetment would wrap around the shoreline and alongside the ditch on both sides for a distance of 100 feet ±.

The key features described above would provide protection for the entire 11,000 feet of park shoreline. The protective sand beach would stabilize a rapidly eroding stretch of shoreline, satisfy a need for a recreational beach, and protect inland facilities from damage due to wave runup.

The revetment along the eastern half of the park will provide shoreline protection and still allow for water circulation into and out of the nature area. This protection is considered imperative by the Ohio Department of Natural Resources so that the park can develop to its full potential. Their ultimate plan calls for construction of a lodge, cabins, golf course, and nature area in this half of the park which are partially dependent on stabilization of this reach of shoreline.

- Implementability of Alternative Plan 2a - Plan 2a is both economically justified and environmentally acceptable. The U. S. Fish and Wildlife Service considers this plan the most acceptable because it is the least disruptive to the existing resources. ODNR, the project sponsor, has given a qualified acceptance of this plan, their ultimate acceptance being contingent upon assurances of the reliability of the estimates of annual nourishment and backpassing requirements. A sand monitoring and testing program completed in 1982 assisted in determining the adequacy of the estimated sand movements and losses. It appears that the estimated quantities of losses are reasonable and should not be exceeded except under extremely rare conditions. On this basis, it is concluded that Alternative 2a is implementable.

(3) Alternative Plan 3a - Protective Sand Beach With Offshore Breakwaters and Revetment.

- Plan Description - This plan, shown on Plate 13, incorporates all of the features of Plan 2a and would add eight offshore breakwaters in front of the protective sand beach. These breakwaters would reduce the offshore sand losses by stabilizing the protective sand beach.

Other key features of this plan are the protective sand beach, wildlife revetment and jetties. These features will be described only as they differ from descriptions provided under Alternative 2a.

Offshore Breakwaters - The purpose of the segmented, offshore rubblemound breakwaters is to stabilize the protective sand beach by reducing both longshore and offshore littoral transport. They would consist of eight segments, each 300 feet long, with a 300-foot gap and would be located approximately 600 feet offshore in a water depth of about 6 feet such that they can be constructed with a floating plant.

An underlayer stone ranging from 3 to 30 pounds would form the base and be placed on the existing bottom. The design base width is approximately 60 feet with a depth of 3 feet. The breakwater core would be formed of armor stone sized from 1.3 to 3.0 tons, with sideslopes of 1.5 feet horizontal to 1-foot vertical. The top width of 9.3 feet is at an elevation of LWD +9.4 feet, and was designed for a significant wave of 6.5 feet with minor overtopping during design conditions.

Protective Sand Beach - The protective sand beach for this alternative is similar to the one described previously under Alternative 2a except for its positioning with respect to the shoreline. Since the offshore breakwaters stabilize the shoreline by absorbing and diffusing wave energies, the beach can be repositioned landward and still provide protection of existing lands.

This repositioning takes advantage of the existing topography and reduces the initial volume of sand required by about 65,000 cy. A further savings is generated in the amounts of annual nourishment and backpassing required to maintain the design configuration. Alternative 2a, the plan without the breakwaters, would require 20,000 cy and 25,000 cy of sand annually for the aforementioned, while the estimate of comparable quantities for Alternative 3a, the Breakwater Plan, is for 5,000 cy and 0 cy, respectively.

Berger Ditch Revetment - This structure remains the same as previously described for Alternative 2a.

Jetties - The jetties for Alternative 3a are identical with those required under Alternative 2a, except that the length of the jetty at the western end of the project is reduced to 250 feet from a comparable length of 450 feet. This reduction is possible because less sand beach protrudes beyond the ditch outlet in Alternative 3a than in Alternative 2a. In addition, the offshore breakwaters reduce the amount of alongshore transport available.

- Implementability of Alternative Plan 3a - Alternative Plan 3a, the protective beach, offshore breakwaters, and revetment had annual recreation benefits of $11.8 million, annual costs of $5.1 million, net benefits of $6.7 million, and a B/C ratio of 2.31 at August 1981 price levels. It meets the planning objectives of preventing shoreline erosion, fulfills a recreational need, and assists in preventing flooding from wave runup. When compared economically with Alternatives 2a and 3b, it compared favorably, with the actual B/C ratio of 2.31 versus 2.30 for Alternative Plan 2a and 2.32 for Alternative 3b. As previously discussed, the amount of annual nourishment for Plan 2a is uncertain and modest changes in this item could easily reverse the order of preference.

(4) Alternative Plan 3b - Protective Sand and Turf Beach With Offshore Breakwaters, and Revetment.

- Plan Description - Alternative Plan 3b, the Protective Sand Beach with Offshore Breakwaters, Revetment and Jetties is identical with Plan 3a except for a modification to the typical beach section (Plate 13). This option was recommended in the interest of a cost savings and involves substituting 50 feet of grassy area for an equal amount of sand beach. The overall beach

section width remains 250 feet, which includes 50-feet of turf on the landward side of the beach. This area would be separated from the sand beach by a vegetated storm dune which is 2 feet above the beach. For purposes of the benefit evaluation, it was assumed that the grassy area would function as a beach, and thus recreational benefits would be the same as for Alternative 3a.

- Implementability of Alternative Plan 3b - This plan is implementable based on the rationale provided for Alternative Plan 3a. The Ohio Department of Natural Resources has stated that the substitution of 50 feet of grassy turf for an equal amount of sand beach is not objectionable.

Annual charges for this option were actually $25,000 less than for 3a, and no one has come out in opposition to the plan (August 1981 price levels).

(5) Alternative Plan 5 - Revetment.

- Description of Plan 5 - The plan view for this alternative is shown on Plate 14. It shows protection of the entire 11,000 feet of park shoreline with rubblemound revetments. This alternative is being presented as the most economical and effective means of preventing shoreline erosion. Costs and benefits will be compared with other structural alternatives to see which of the options would maximize net benefits. Although Alternative 5 would satisfy the planning objective of protecting and stabilizing the park shoreline, it is unacceptable to the project sponsor, ODNR, because it would not provide a recreational beach. Without this beach, the park would not be developed, or utilized, to its ultimate potential.

Three different sections form the revetment, which is continuous except for gaps at ditches from McHenry Ditch on the west to the Cedar Point Wildlife Refuge on the east. The revetment over the east half of the park is designed for overtopping to assist in maintaining circulation of water into and out of the wildlife area. A second revetment section is termed the Berger Ditch Revetment. Its total length is approximately 450 feet and it ties the jetty at Berger Ditch to the revetment along the west shore, and protects a land protrusion of a former development, called Niles Beach. This small wooded protrusion exists because some crude rubble protection was placed there in the past.

The third revetment section is termed the West Shore Beach Revetment. It is similar to the wildlife revetment except for crest height and top width. The crest would be at +13.5 feet LWD (as compared to +8.6 for the wildlife revetment) to prevent undesirable overtopping into the developed west end of the park. Also, since maintenance could be performed from the landward side of the west shore revetment, the top width is only 6.1 feet versus the 12 feet for the wildlife revetment.

The total revetment plan does not include any jetties at the ditch outlets. Little littoral drift would occur because of the lack of available materials, making jetties unnecessary.

- Implementability of Alternative Plan 5 - Alternative Plan 5, the total revetment plan, solves the shoreline erosion problem but does not fulfill the recreational need. The Ohio Department of Natural Resources has stated that because this plan does not provide a swimming beach, they are not in favor of it and will not support it. At August 1981 price levels, the plan had an unfavorable B/C ratio of 0.57 with annual benefits of $2.4 million and average annual costs of $4.2 million. Net annual benefits totalled a $-1.8 million. Alternative 5 is not considered implementable for reasons stated.

c. Comparison of Detailed Plans.

Table 5, following compares the impacts of the four structural alternatives and the No-Action Plan. Impacts are measured and the results displayed or accounted for in terms of contributions to four accounts: National Economic Development (NED); Environmental Quality (EQ); Other Social Effects (OSE); and Regional Economic Development (RED). All plans were evaluated equally at August 1981 price levels.

With reference to Item B.1 of Table 5, it is noted that Alternatives 2a, 3a, and 3b would provide comparable net annual benefits of about $6.7 million, whereas Alternative 5 (Total Revetments) has negative net annual benefits of $1,823,000 (August 1981 price levels). In addition, the project sponsor has indicated that it would not support Plan 5 because it would not allow for full park development nor provide a recreational beach. This plan has a B/C ratio of 0.57 making it economically infeasible. For these reasons Plan 5, the Total Revetment Plan, will be eliminated from further study.

Alternatives 2a, 3a, and 3b each satisfy the planning objectives by preventing shoreline erosion and providing for full park development including a recreational beach. The U.S. Fish and Wildlife Service ranks Alternative 2a as the least damaging of the three alternatives. However, they have indicated that any of the three alternatives which utilize an upland sand source should be acceptable. From an economic standpoint, the three plans are comparable. Recreational benefits were $56,000 greater for Alternative 2a than for Alternatives 3a or 3b. This is due to the additional length of jetty protection at the ditch outlets which in turn provides for greater fishing capacity and benefits.

Average annual costs were least for Alternative Plan 3b and greatest for Alternative Plan 2a with Alternative Plan 3a about halfway between; although the annual costs for these three plans were not significantly different. First costs varied as much as $1.6 million with Alternative 2a the least costly at $8.8 million; Alternative 3a, the most expensive at $10.4 million; and Alternative 3b being only slightly lower than 3a at $10.0 million. First costs were higher for Alternatives 3a and 3b, primarily because of the cost of offshore breakwaters. On an annual basis, most of the difference is negated because of differences in annual maintenance costs for nourishment and backpassing. The exposed protective beach (Alternative 2a) would be more difficult and costly to maintain than a similar beach protected by offshore breakwaters (Alternatives 3a and 3b). The problem with making a firm, valid comparison, is that annual costs include annual maintenance, which is very sensitive to changes in magnitude of estimated sand losses.

In an effort to better quantify these losses the District initiated two different littoral-based tests, the results of which are included as Supplements 1 and 2 to the Coastal Appendix.

d. Summary.

At this stage in the study, Alternative 3b was selected as the recommended plan. Alternative 3b maximized net benefits when compared to the other structural plans and was designated the NED Plan.

All four structural alternatives provide equal beneficial EQ contributions by contributing to the preservation of the existing wetland at Maumee Bay State Park. However, Alternative 2a has the distinct advantage of being the least disruptive to existing current and drift patterns which influence fish and aquatic movement, recruitment, and utilization of nearshore areas.

Alternative 2a would also be the least damaging to the existing aesthetic conditions of the shoreline, while still providing a recreational beach and shoreline protection at Maumee Bay State Park. Therefore, Alternative 2a was selected as the EQ Plan.

At this point (June 1983), the Final Feasibility Report with Environmental Impact Statement, and Appendices dated September 1982 (Revised June 1983) was forwarded to North Central Division. The report recommendations were signed by the District Commander and concurred in by the Division Commander in the Division Engineer's Notice dated 30 August 1983.

Table 5 - Summary of Effects for Alternative Plans (Cont'd)

	Alternatives				
	Alternative 1	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 5
	No Action	Protective Beach and Revetment	Protective Sand Beach, Offshore Breakwaters and Revetment	Protective Sand and Turf Beach, Offshore Breakwaters, and Revetment	Total Revetment
(2) Natural Resources	None	Commitment of energy resources during construction and materials (stone, sand, etc.) for the life of the project.	Same as Alternative 2a.	Same as Alternative 2a.	Commitment of energy resources during construction and stone for the life of the project.
(3) Air Quality	None	Temporary decrease during construction. Some decrease as the number of visitors increases.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(4) Water Quality	None	Temporary turbidity during dredging, construction, and maintenance.	Temporary turbidity during dredging, construction, and maintenance. Natural circulation patterns would be disrupted by offshore breakwaters.	Same as Alternative 3a.	Temporary turbidity during construction and maintenance
(5) Biological Resources	Continued erosion of wetlands resulting in reduced habitat for marsh species. Loss of 60 acres of woodland-swamp over the next 50 years.	Temporary disruption of borrow area, beach, and wetland ecosystems during construction and maintenance. Loss of 4.96 acres of benthic habitat. Loss of 2.2 acres of woodland-swamp.	Temporary disruption of borrow area, beach and wetland ecosystems during construction and maintenance. Loss of 8.14 acres of benthic habitat. Loss of 2.2 acres of woodland-swamp.	Same as Alternative 3a.	Temporary disruption of beac and wetland ecosystems durin construction and maintenance Loss of 4.2 acres of benthi habitat. Loss of 2.2 acres woodland-swamp.
(6) Erosion	Present erosion rates would continue.	Temporary increase due to disruption of vegetation and substrate during construction.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(7) Compaction	None	Localized soil compaction due to the presence of construction equipment.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
3. Other Social Effects					
a. Beneficial Impacts					
(1) Noise	None	None	None	None	None
(2) Aesthetic Values	None	Wider, more attractive beach with erosion scars eliminated.	Same as Alternative 2a.	Same as Alternative 2a.	None
(3) Community Cohesion	None	Secondary park development may attract region's inhabitants to one activity center.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(4) Desirable Community Growth	None	Minor commercial development to service park users.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(5) Cultural Resources	None	Abatement of mechanical erosion.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(6) Leisure Opportunities	Present park use, although limited, would be uninterrupted.	Increased opportunities for recreational swimming, fishing, and nature study. Protection of present and future park development.	Same as Alternative 2a.	Same as Alternative 2a.	Protection of present and future park development
(7) Displacement of People	None	None	None	None	None
b. Adverse Impacts					
(1) Noise	None	Temporary increase during construction. Increases as crowds and traffic increase.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(2) Aesthetic Values	Erosion scars will persist.	Temporary decrease during construction and maintenance periods. Obstruction of view along the shoreline by jetties and revetments.	Temporary decrease during construction and maintenance periods. Obstruction of view of lake and shoreline by breakwaters, jetties, and revetments.	Same as Alternative 3a.	Temporary decrease during construction and maintenan periods. Major modificati shoreline by the construct of revetments.
(3) Community Cohesion	None	Residents may resent "outsiders" attracted by secondary park development.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(4) Desirable Community Growth	None	None	None	None	None
(5) Cultural Resources	None	No impact on significant cultural resources. Covering of disturbed shoreline areas. Disruption of inland areas by ODNR park development and recreational activity.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
(6) Leisure Opportunities	Continued loss of parkland to erosion and a lessened potential for full park development.	Temporary disruption during construction and maintenance periods.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a. Revetments would be a major obstacle for recreation at shore.
(7) Displacement of People		None	None	None	None

Table 5 - Summary of Effects for Alternative Plans (Cont'd)

	Alternatives				
	Alternative 1	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 5
	No Action	Protective Beach and Revetment	Protective Sand Beach, Offshore Breakwaters and Revetment	Protective Sand and Turf Beach, Offshore Breakwaters, and Revetment	Total Revetment
4. Regional Development					
a. Beneficial Impacts					
(1) Value of Increased Income	Some increase from partial development of the park and to businesses in the local area.	Additional increases to that for Alternative 1 because of complete development of proposed park facilities.	Same as Alternative 2a.	Same as Alternative 2a.	Somewhat less than the other action alternatives since no recreational beach would be provided and park attendance would be less.
(2) Quality of Increased Employment	Some increase in local and regional employment due to partial park development.	Temporary increase during construction of the shoreline protection project, and full development of the park. Permanent increase for operation of the fully developed park.	Same as Alternative 2a.	Same as Alternative 2a.	Somewhat less than the other action alternatives due to lack of recreational beach.
C. PUBLIC AND AGENCY ACCEPTABILITY	The Ohio Department of Natural Resources is opposed to this plan because it precludes development of the park to the desired level, recreational needs in the area would largely go unmet, and shoreline erosion would continue.	Preferred by U.S. Fish and Wildlife Service because it is least disruptive to existing resources. District interprets it is unacceptable to ODNR because of lack of reliability of estimating annual nourishment and backpassing requirements for the exposed beach, although it would allow for full development of the park. No identified opposition from the general public.	Acceptable by U.S. Fish and Wildlife and preferred by the Ohio Department of Natural Resources because it should provide a stable beach requiring the least amount of annual maintenance. No known opposition.	Same as Alternative 3a.	The Ohio Department of Natural Resources is opposed to this plan because it does not provide for a recreational beach, the focal point of their development. This plan would not provide development of the park to the desired level although it would arrest shoreline erosion. No identified opposition from the general public.
D. PLAN EVALUATION					
1. Contributions to Planning Objectives					
a. Protection from Erosion and Flooding	Objective not met as erosion and flooding would continue. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Erosion would be eliminated. Flooding would continue because of inundation from the flanks, but should be less severe due to elimination of wave runup. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
b. Provide Recreational Beach	No effect.	32-acre beach would be provided.	Same as Alternative 2a.	25-acre beach and 6-acre grassy area would be provided.	No effect.
c. Park Development	Inhibited.	Multiuse park development, to a scale proposed in ODNR's Master Plan, could proceed.	Same as Alternative 2a.	Same as Alternative 2a.	Recreational beach and contingent areas would not be developed.
d. Meet Recreational Needs of the Area	ODNR park development would partially meet some of these needs.	Significant contribution to meeting diversified needs of Toledo Metropolitan Area.	Same as Alternative 2a.	Same as Alternative 2a.	Would not meet need for additional swimming areas.
2. Design and Functional Reliability	Not applicable.	Would solve erosion problem and meet recreational need objectives. However, estimates of annual nourishment and backpassing requirements are considered unreliable. Tests are currently underway to more accurately quantify these losses.	Considered reliable.	Considered reliable.	Would solve erosion problem but would not provide a recreational sand beach and thus park would not develop to its full potential. Demand for swimming and other activities would be unfulfilled.
3. Implementability	Outcome if no structural plan meets feasibility requirements.	Implementability is questionable because of unreliability of sand nourishment and backpassing requirements which could increase annual costs substantially.	Plan is implementable.	Plan is implementable.	This plan is not considered implementable because it is not acceptable to the project sponsor, ODNR.

Table 5 - Summary of Effects for Alternative Plans; August 1981 price level 7.823 percent

	Alternatives				
	Alternative 1	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 4
	No Action	Protective Beach and Revetment	Protective Sand Beach, Offshore Breakwaters and Revetment	Protective Sand and Turf Beach, Offshore Breakwaters, and Revetment	Total Revetment
A. PLAN DESCRIPTION	Do nothing.	5,500-foot long protective sand beach with a vegetated storm dune; 450-foot long jetty on McHenry Ditch; 250-foot long jetty on Berger Ditch; 5,500-foot long revetment along wetland areas; and a 450-foot long revetment along the Niles Beach area.	5,500-foot long protective sand beach with a vegetated storm dune; eight 300-foot long offshore breakwaters; 250-foot long jetty on McHenry Ditch; 250-foot long jetty on Berger Ditch; 5,500-foot long revetment along wetland areas; and a 450-foot long revetment along the Niles Beach area.	Same as Alternative 3a except a 50-foot wide stretch of beach would be replaced by a 50-foot wide grassy area behind the storm dune.	11,000-foot long revetment along the entire shoreli
B. SIGNIFICANT IMPACTS					
1. National Economic Development					
a. Beneficial Impacts					
(1) Recreation Benefits	None	11,847,500	11,791,100	11,791,100	2,400,600
(2) Erosion Prevented Benefits	None	10,000	10,000	10,000	10,000
Total Annual Benefits	None	11,857,500	11,801,100	11,801,100	2,410,600
b. Adverse Impacts					
(1) Corps Project First Cost (1)	None	8,797,000	10,357,000	10,026,000	7,529,000
(2) Annual Charges (Shoreline Project)	None	1,024,000	980,000	955,000	706,000
(3) Park Development and Land Costs	11,600,000	33,620,000	33,620,000	33,620,000	29,120,000
(4) Annual Charges (ODNR Development)	1,133,000	4,130,000	4,130,000	4,130,000	3,528,000
(5) Grand Total Annual Charges Shoreline Project and ODNR Development	1,133,000	5,154,000	5,110,000	5,085,000	4,234,000
c. Economic Efficiency					
(1) Net Annual Benefits	-	6,703,500	6,691,100	6,716,100	-1,823,400
(2) B/C Ratio	-	2.30	2.31	2.32	0.57
2. Environmental Quality					
a. Beneficial Impacts					
(1) Man-Made Resources	None	Erosion of parkland would be halted. 25-acre beach provided. Park development could proceed. Drainage ditches would be protected from shoaling. Fishing opportunities from jetties.	Same as Alternative 2a.	Same as Alternative 2a, except 6 acres of beach would be replaced by a 6-acre grassy area.	Erosion of parkland would halted. Park development could proceed.
(2) Natural Resources	None	None	None	None	None
(3) Air Quality	None	None	None	None	None
(4) Water Quality	None	None	None	None	None
(5) Biological Resources	None	0.92 acre of benthic habitat created. Protection of wetlands.	3.98 acres of benthic habitat created. Protection of wetlands.	Same as Alternative 3a.	0.76 acre of benthic hab created. Protection of wetlands.
(6) Erosion	None	Shoreline erosion would be halted.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.
b. Adverse Impacts					
(1) Man-Made Resources	Continued loss of parkland. Existing drainage ditches and jetties subject to damage from continued erosion.	None	None	None	None

(1) Includes cost of lands required for the project.

SECTION 4

FORMULATION OF LATE STAGE ALTERNATIVES

When the report was elevated to the Washington level for review and approval by the Board of Engineers for Rivers and Harbors (BERH), it was determined that additional formulation, optimization studies, and a rewritten report, which includes all the updated information, were required.

In response to this decision, some minor modifications were incorporated into the previously designated EQ Plan 2a, and the previously designated NED/ Selected Plan 3b. To differentiate between these plans, these new, slightly changed candidate plans have been designated Plan 2b and Plan 3c in the remaining discussion of this report. The comparative evaluation of Plans 2b and 3c, along with the No-Action Plan, follows. Table 6, at the end of this section, presents a Summary of Effects for these three candidate plans.

ALTERNATIVE 1 (NO-ACTION)

a. Description.

The No-Action Plan provides the basis for evaluating the structural alternatives. It does not meet the planning objectives or satisfy the needs of local sponsor, the Ohio Department of Natural Resources (ODNR), whose planned development would be scaled down considerably, if this option is chosen, because the shoreline would continue to erode, resulting in a shoreline as shown on Plate 5. Further, no recreational beach would be provided and ODNR's total development plan would be scaled down to provide both fewer facilities and less capacity for the remaining recreational facilities, because a restored beach is the primary attraction inducing utilization of other park facilities. The No-Action Plan should, therefore, only be selected if no structural plans for shore protection/beach restoration are implementable.

b. Comparative Evaluation of Key Criteria.

(1) NED Criteria - Under the "without project" condition, the parkland will continue to erode over the next 50 years, resulting in an estimated loss of 140 acres of land with a market value of nearly $600,000. Without shoreline protection and a restored beach, the park will not be developed or utilized to its full potential. Although sufficient land would remain for the campgrounds and golf course, and picnic areas and biking trails could be developed at a reduced scale, all of these activities would not develop or attract patronage as they would if shore protection and a beach were provided. ODNR has also stated they will not construct the lodge/cabin complex without total shoreline protection. The accumulative effect under No-Action would be to leave unsatisfied a recreational demand in excess of a million recreation visitations annually that would be satisfied with the shoreline erosion/beach restoration project. This would result in a loss of recreational benefits to the NED account in excess of $5 million annually.

(2) EQ (or LED) Criteria - If No-Action is taken, the present rate of shoreline recession will continue. The aggregated effect will be a loss of 140 acres of parkland over a 50-year period. Of particular significance is the projected loss of 60 acres of productive wetlands in the eastern half of the park. This amounts to about 25 percent of the existing 244 acres of wetland in the park.

(3) Regional Development (RD) Criteria - If No-Action is taken to provide erosion protection/beach restoration, the contemplated multi-use recreational complex will not be developed to its full scale and the expected park patronage will not occur. On this basis, there will be some increase in local and regional employment from partial park development and some increase in development of local businesses for the No-Action Plan.

(4) Social Well-Being (SWB) Criteria - For the without project condition, the park will not be fully developed. However, there would be some increase in leisure opportunities if some of the recreational facilities are developed by the State. The aesthetic value of the park will continue to be degraded by the continued persistence of erosion scars.

ALTERNATIVE 2b (LED PLAN)

a. Description.

The plan view of Alternative 2b (250 feet W-5,500 feet L) is shown on Plate 12. The principle features of Alternative 2 are:

(1) A 5,500-foot long protective sand beach with a storm dune over the western half of the park shoreline.

(2) A 6,200-foot long rubblemound revetment along the eastern half of the park.

(3) A 450-foot rubblemound revetment immediately west of Berger Ditch.

(4) A 450-foot long jetty at the western end of the beach and a rehabilitation - extension of an existing jetty at Berger Ditch.

With total shoreline protection and a sand beach incorporated into this plan, total park development, as envisioned by the Ohio Department of Natural Resources, can take place. Erosion of an estimated 140 acres of parkland would be eliminated with this plan. Preservation of the existing 244-acre wetland would be accomplished, and Plan 2b is considered the least environmentally damaging (LED) shoreline protection plan because it is the least disruptive to existing current and drift patterns which influence fish and aquatic movement, recruitment, and utilization of nearshore areas. Concrete walkways would be constructed on the jetties to accommodate fishermen. The shoreline structures are designed to reduce wave runup and overwash, thus reducing the flood potential to park facilities in close proximity to the shoreline. However, nonstructural means will be required to protect critical park facilities, because Plan 2b will not reduce flooding due to high Lake Erie levels.

Although this discussion focuses on the 5,500-foot long by 250-foot wide beach, an array of 18 beach sizes varying from 2,500 feet to 5,500 feet in length and from 100 feet to 350 feet in width was evaluated to identify the most economically efficient beach size for Alternative 2b. The results of this analysis are presented in the Supplemental Information Report included in Appendix K.

Of the two candidate structural plans (the other candidate plan is Alternative 3c, which is nearly identical to Alternative 2b, except 3c includes offshore breakwaters as part of the beach component), Alternative 2b would have a lower first cost because it does not include breakwaters. However, this savings is more than offset by high periodic nourishment costs due to high sand losses from the exposed beach.

On February 1983 prices, the first cost of this alternative for the 250-foot wide by 5,500-foot long beach option would be $5.8 million and the total annual charge (including annual charges for the associated ODNR development) would be $2.1 million. With average annual benefits of $5.5 million, the net benefits for Plan 3c (250 feet W X 5,500 feet L) would be $3.4 million and the benefit-to-cost ratio would be 2.6. Plan 2b meets the planning objectives for this study, and is implementable. The system of accounts for Plan 2b is shown in Table 6.

b. Comparative Evaluation of Key Criteria.

(1) NED Criteria - Plan 2b does produce very large NED benefits, varying from about $1.8 million annually for a 100-foot wide by 2,500-foot long beach, to about $5.8 million annually for the optimal 300-foot wide by 5,500-foot long beach. As shown above, for the preferred 250 by 5,500-foot beach, the total project benefits are estimated at $5.5 million, consisting of: $30,000 in recreational fishing benefits; $368,000 in benefits associated with the wildlife revetment; and nearly $5.1 million of recreational beach benefits. Net benefits total approximately $3.4 million and the B/C is 2.6 for Plan 2b (250 W X 5,500 L).

(2) EQ Criteria - Beneficial affects would accrue to manmade, physical, and biological resources with Plan 2b. Erosion of parkland would be halted, thereby protecting and preserving 60 acres of wetland habitat. An additional 80 acres of upland area would be preserved for recreational development. With total shoreline protection to include provision of a 25-acre sand beach, park development could proceed as proposed, thus enhancing the recreational resources of the area. Construction of the jetties would protect existing ditches from shoaling and provide for land-based fishing opportunities. In addition, 0.92 acres of benthic habitat would be created. Adversely, there would be temporary decreases in air and water quality during construction. Similarily, temporary disruption of the wetland ecosystem, in addition to a loss of nearly 5 acres of benthic habitat and 2.2 acres of woodland/swamp, would occur during construction. Because Plan 2b would be least disruptive to natural currents and littoral movement of the structural alternatives while preserving 60 acres of productive wetland habitat, it has been designated the EQ Plan.

(3) RD Criteria - Implementation of this plan could be expected to increase income and enhance employment. Since this plan would permit full development of the park, employment would temporarily increase during construction and permanently increase for service positions required to operate and maintain these facilities. A similar result is expected for new businesses that would be constructed in the local area. A growth in per capita income can be foreseen as a result of these developments.

(4) SWB Criteria - The plan would produce a wider, more attractive beach and eliminate erosion scars that now exist, thereby increasing the aesthetics of the setting. Community growth will be enhanced by the expected peripheral commercial development to service park users. However, long-time residents may resent an influx of "outsiders" attracted to the park. Leisure opportunities will be significantly enhanced through increased opportunities for swimming, fishing, picnicking, and nature study.

ALTERNATIVE 3c (NED PLAN/SELECTED PLAN)

a. Description.

The plan view of Plan 3c (250 feet W X 5,500 feet L) is shown on Plate 15. The principle features of Plan 3c (250 feet W X 5,500 feet L) are:

(1) A 5,500-foot long by 250-foot wide protective sand beach with a storm dune and eight offshore rubblemound breakwaters each 800 feet long, along the western half of the park shoreline;

(2) A 250-foot long jetty at the western end of the beach, and a 250-foot long rehabilitation - extension of an existing jetty at Berger Ditch;

(3) A 450-foot long rubblemound revetment immediately west of Berger Ditch; and

(4) A 6,200-foot long rubblemound revetment along the eastern half of the park.

As noted in the descriptive narrative for Plan 2b, the primary difference between these two candidate plans is the offshore breakwaters incorporated into Plan 3c. The purpose of these breakwaters is to stabilize the sand beach, thereby reducing the amount of periodic nourishment required to maintain the beach. See Appendix D (Design and Coastal Processes) and Appendix K (Supplemental Information Report) for discussions on nourishment requirements. Since the offshore breakwaters stabilize the beach by absorbing and diffusing wave energy, the beach can be positioned further landward and still provide protection of existing lands. This reduces the amount of initial sand fill required and also provides fill material for constructing the storm dune. The repositioning can be seen by comparing the location of the beach in relation to the shoreline in Plates 12 (Plan 2b) and 13 (Plan 3c). The other difference between these two candidate plans is the jetty at McHenry Ditch on the western end of the beach is 250 feet long for Plan 3c as compared to 450 feet for Plan 2b. This reduction is possible because less

sand beach would protrude beyond the ditch outlet and the offshore breakwaters reduce the amount of longshore transport of sand. However, Plan 3c reduces land-based recreational fishing opportunities because of the shorter jetty.

As with Plan 2b, this plan is compatible with ODNR's total park development concept since it would provide total shoreline protection and incorporate a sand beach.

The presence of the offshore breakwaters would disrupt the natural littoral and circulation patterns in the near shore zone, although no specific fish and/or wildlife mitigation needs would be required for this plan. The other beneficial and adverse affects of Plan 3c would be comparable to those previously discussed for Plan 2b.

As was done for Plan 2b, optimization analysis was performed to determine the most economically efficient beach size for Plan 3c. From these results (see Appendix K, Supplemental Information Report), it was determined that a 300-foot wide by 5,500-foot long beach, Plan 3c (300 feet W X 5,500 feet L), would maximize net benefits; and therefore, is designated as the NED Plan. Based on February 1983 price levels and 7-7/8 percent interest, Plan 3c (300 feet W X 5,500 feet L) had estimated annual charges of $2.2 million, annual benefits of $5.8 million, net benefits of $3.62 million, and a B/C ratio of 2.7. In designating the NED Plan, the District is of the position that the multiuse recreational complex presently being developed by the Ohio Department of Natural Resources is an integrally dependent facility requiring erosion protection along the entire 11,000 feet of park shoreline incorporating a sand beach in the western half of the park. Therefore, to meet functional feasibility requirements, candidate NED plans must incorporate the most economically efficient features meeting these criteria. For the Federal shoreline protection/beach restoration project, these principle features are a protective sand beach along the western 5,500 feet of park and a 6,200-foot long rubblemound revetment along the eastern 5,500 feet of park shoreline. Plan 3c (300 feet W X 5,500 feet L) meets these criteria while maximizing net benefits. Plan 3c (300 W X 5,500 L) was selected as the NED Plan based on this rationale.

b. Comparative Evaluation of Key Criteria.

(1) NED Criteria - As was discussed above, Plan 3c (300 feet W X 5,500 feet L), with net benefits of $3,620,100 (February 1983 price levels and 7-7/8 percent interest rate) has been designated as the NED Plan because it maximizes net benefits when compared to the other candidate plans.

However, for the reasons presented in subparagraph a, above, Plan 3c (250 feet W X 5,500 feet L) has been designated as the Selected Plan. It would provide net benefits of $3,487,100 or $133,000 less than for the NED Plan. The Selected Plan 3c (250 feet W X 5,500 L) would be the same as the Ned Plan 3c (300 W X 5,500 L) except that the beach would be 50 feet narrower. As stated above, this additional capacity could readily be provided in the future by ODNR in the form of a grass beach landward of the storm dune, if desired.

(2) EQ Criteria - Except as discussed below, the environmental impacts of Plan 3c are the same as for Plan 2b. Plan 3c would enhance the biological resources by creating 4 acres of benthic habitat while resulting a loss of 3.1 acres, for a net gain of 0.9 acres as a result of breakwater construction. Water quality would be negatively impacted by disruption of natural circulation patterns in the nearshore zone by construction of the breakwaters.

(3) RD Criteria - Impacts would be the same as for Plan 2b.

(4) SWB Criteria - Same as Plan 2b except that the offshore breakwaters would obstruct the view of the lake, thereby adversely impacting on the aesthetic value of the setting.

DESIGNATION OF THE NED PLAN

For the reasons presented in above discussion, Plan 3c (300 feet W X 5,500 feet L), with maximum net benefits of $3,620,100, has been designated as the NED Plan.

DESIGNATION OF THE EQ PLAN

Plan 2b is selected as the EQ Plan primarily because it would be the least disruptive to existing current and drift patterns which influence fish and aquatic movement, recruitment, and utilization of nearshore areas. Plan 2b would also be the least damaging to the existing aesthetics of the open, unobstructed lake setting, while still providing a recreational beach sand erosion protection of the wetlands area, thereby preserving this productive habitat.

DESIGNATION OF THE SELECTED (RECOMMENDED) PLAN

Current policy requires that the NED Plan must be designated as the Selected Plan unless there are strong overriding factors dictating an alternative determination. Based on the NED criterion, Alternative 3c (300 feet W X 5,500 feet L), with net benefits of $3,620,100 (Feb 83 prices), would be the Selected Plan.

However, there are several other important considerations that the District feels are germane to the decision in plan selection for the Maumee Bay State Park project. First, it believes that although the primary objective is to realize the greatest national economic return for the dollars invested; another objective is to develop water resources projects that meet the planning objectives at the minimum possible cost. For the Federal project at Maumee Bay State Park, there are alternatives to the NED Plan that meet the lower cost criterion and the planning objectives. These alternatives would have a narrower beach, and, therefore, lower costs. Another important consideration in plan selection is the desire of the local sponsor. For the Maumee Bay State Park project, the Ohio Department of Natural Resources strongly prefers less beach capacity than would be provided by the 300-foot wide by the 5,500-foot long NED Plan because it is not consistent with the associated beach facilities (bathhouse, parking, picnic facilities) planned for the park. In addition, a 200-foot to 250-foot wide beach is considered

an optimal width for shoreline protection purposes. It would obviously be imprudent to consider an alternative to the NED Plan that significantly reduces net benefits below those that would be produced by the NED Plan. Therefore, if an alternative to the NED were to be selected, the net benefits for the alternative plan should reasonably approximate the net benefits for the NED Plan, thus limiting the reduction in beach size. Lastly, if at some future date, the State decides that additional beach capacity is necessary, this capacity could readily be provided in the form of a grass beach area immediately landward from the proposed storm dune.

Having considered all these factors, Alternative 3c (250 feet W X 5,500 feet L) has been designated as the Selected Plan. It is the same as the NED Plan in every respect except that the 5,500-foot long beach would be 250 feet wide instead of 300 feet wide. This will reduce the instantaneous beach capacity by 2,500 people. With total annual charges of $1,980,600 and total annual benefits of $5,467,200, the net benefits for Alternative 3c (250 feet W X 5,500 feet L) are $3,487,100, and the benefit-to-cost ratio is 2.76. When compared to the NED Plan, net benefits for the Selected Plan 3c (250 feet W X 5,500 feet L) are $133,000 lower and the B/C ratio is 0.09 higher. The first cost for Alternative 3c (250 feet W X 5,500 feet L) is $11,551,000, or $517,000 less than for the NED Plan (Comparative values are all on February 1983 price levels and 7-7/8 percent interest).

In summary, Plan 3c (250 feet W X 5,500 feet L) is designated as the Selected Plan for the following reasons:

a. First cost is $517,000 less, and annual charges are $219,400 less than for the NED Plan;

b. Although net benefits for the Selected Plan are $133,000 less than for the NED Plan, this only represents a reduction of 2 percent in the NED Plan net benefits. In addition, the B/C is greater than for the NED Plan;

c. The Ohio Department of Natural Resources has consistently preferred the 250-foot wide beach. The provided capacity is consistent with the associated facilities detailed in the park's Master Plan; and,

d. The beach area can readily be expanded by constructing a grass beach landward of the proposed storm dune, if necessary.

Plan 3c (250 feet W X 5,500 feet L) meets all planning objectives and is implementable; and, in conjunction with the reasons discussed above, is designated as the Selected Plan.

Table 6 - Summary of Effects for Alternative Plans - February 1983 price levels 7-7/8 percent interest

	Alternatives			
	Alternative 1	Alternative 2b	Alternative 3c	Alternative 3c
		250 Feet W X 5,500 Feet L	250 Feet W X 5,500 L	300 Feet W X 5,500 Feet L
		Protective Beach	Protective Sand Beach,	Protective Sand
	No-Action	and Revetment	Offshore Breakwaters, and Revetment:	Beach, Offshore Breakwaters and Revetment
A. PLAN DESCRIPTION	Do nothing.	5,500-foot long protective sand beach with a vegetated storm dune; 450-foot long jetty on McHenry Ditch; 250-foot long on Berger Ditch; 6,200-foot long revetment along wetland area; and a 450-foot long revetment along the Miles Beach area.	5,500-foot long protective sand beach with a vegetated storm dune; eight 300-foot long offshore breakwaters; 250-foot long jetty on McHenry Ditch; 250-foot long jetty on Berger Ditch; 6,200-foot long revetment along wetland area; and a 450-foot long revetment along Miles Beach area.	Same as Alternative 3c. 250 feet W X 5,500 L with a 50-foot wider beach.
B. SIGNIFICANT IMPACTS				
1. National Economic Development				
Total Annual Benefits	None	$5,467,700	$ 5,467,700	$ 5,800,000
b. Adverse Impacts				
(1) Corps Project First Cost (1)	None	$8,800,000	$11,551,000	$12,068,000
(2) Annual Charges (Shoreline Project)		$1,388,800	$ 1,301,700	$ 1,250,000
(3) Park Development and Land Costs	11,600,000	$5,820,000	$ 5,820,000	$ 8,100,000
(4) Annual Charges (ODNR Development)	1,133,000	$ 678,900	$ 678,900	$ 950,000
(5) Grand Total Annual Charges: Shoreline Project and ODNR: Development	1,133,000	$2,067,700	$ 1,980,600	$ 2,200,000
c. Economic Efficiency				
(1) Net Annual Benefits	-	$3,400,000	$ 3,487,100	$ 3,620,100
(2) B/C Ratio	-	2.6	2.76	2.7
2. Environmental Quality				
a. Beneficial Impacts				
(1) Man-Made Resources	None	Erosion of parkland would be halted. 25-acre beach provided. Park development could proceed. Drainage ditches would be protected from shoaling. Fishing opportunities from jetties.	Same as Alternative 2b.	Same as Alternative 2b.
(2) Natural Resources	None	None	None	None
(3) Air Quality	None	None	None	None
(4) Water Quality	None	None	None	None
(5) Biological Resources	None	0.92 acre of benthic habitat created. Protection of wetlands.	3.98 acres of benthic habitat created. Protection of wetlands.	Same as Alternative 3c.
(6) Erosion	None	Shoreline erosion would be halted.	Same as Alternative 2b.	Same as Alternative 2b.
b. Adverse Impacts				
(1) Man-made Resources	Continued loss of parkland. Existing drainage ditches and jetties subject to damage from continued erosion.	None	None	None
(2) Natural Resources	None	Commitment of energy resources during construction and materials (stone, sand, etc.) for the life of the project.	Same as Alternative 2b.	Same as Alternative 2b.
(3) Air Quality	None	Temporary decrease during construction. Some decreases as the number of visitors increases.	Same as Alternative 2b.	Same as Alternative 2b.

Table 6 - Summary of Effects for Alternative Plans (Cont'd)

	Alternatives			
	Alternative 1	Alternative 2b	Alternative 3c	Alternative 3c
		250 Feet W X 5,500 Feet L	250 Feet W X 5,500 L	300 Feet W X 5,500 Feet L
		Protective Beach	Protective Sand Beach,	Protective Sand Beach,
	No-Action	and Revetment	Offshore Breakwaters, and Revetment:	Offshore Breakwaters and Revetment
(4) Water Quality	None	Temporary decrease during construction. Some decrease as the number of visitors increases.	Same as Alternative 2b.	Same as Alternative 3b.
(5) Biological Resources	Continued erosion of wetlands resulting in reduced habitat for marsh species. Loss of woodland-swamp over the next 50 years.	Temporary disruption of borrow area, beach, and wetland ecosystem during construction and maintenance. Loss of 4.96 acres of benthic habitat. Loss of 2.2 acres of woodland-swamp.	Temporary disruption of borrow area, beach, and wetland ecosystem during construction and maintenance. Loss of 8.14 acres of benthic habitat. Loss of 2.2 acres of woodland-swamp.	Same as Alternative 3b.
(6) Erosion	Present erosion rates would continue.	Temporary increase due to disruption of vegetation and substrate during construction.	Same as Alternative 2b.	Same as Alternative 2b.
(7) Compaction	None	Localized soil compaction due to the presence of construction equipment.	Same as Alternative 2b.	Same as Alternative 2b.
3. Other Social Effects				
a. Beneficial Impacts				
(1) Noise	None	None	None	None
(2) Aesthetic Values	None	Wider, more attractive beach with erosion scars eliminated.	Same as Alternative 2b.	Same as Alternative 2b. Larger beach.
(3) Community Cohesion	None	Secondary park development may attract region's inhabitants to one activity center.	Same as Alternative 2b.	Same as Alternative 2b.
(4) Desirable Community Growth	None	Minor commercial development to service park users.	Same as Alternative 2b.	Same as Alternative 2b.
(5) Cultural Resources	None	Abatement of mechanical erosion.	Same as Alternative 2b.	Same as Alternative 2b.
(6) Leisure Opportunities	Present park use, although limited, would be uninterrupted.	Increased opportunities for recreational swimming, fishing, and nature study. Protection of present and future park development.	Same as Alternative 2b.	Same as Alternative 2b.
(7) Displacement of People	None	None	None	None
b. Adverse Impacts				
(1) Noise	None	Temporary increase during construction. Increases as crowds and traffic increases.	Same as Alternative 2b.	Same as Alternative 2b.
(2) Aesthetic Values	Erosion scars will persist.	Temporary decrease during construction and maintenance periods. Obstruction of view along the shoreline by jetties and revetments.	Temporary decrease during construction and maintenance periods. Obstruction of views of lake and shoreline by breakwaters, jetties, and revetments.	Same as Alternative 3c.
(3) Community Cohesion	None	Residents may resent "outsiders" attracted by secondary park development.	Same as Alternative 2b.	Same as Alternative 2b.
(4) Desirable Community Growth	None	None	None	None
(5) Cultural Resources	None	No impact on significant cultural resources. Covering of disturbed shoreline areas. Disruption of inland areas by ODNR park development and recreational activity.	Same as Alternative 2b.	Same as Alternative 2b.
(6) Leisure Opportunities	Continued loss of parkland to erosion and a lessened potential for full park development.	Temporary disruption during construction and maintenance periods.	Same as Alternative 2b	Same as Alternative 2b.
(7) Displacement of People		None	None	None
4. Regional Development				
a. Beneficial Impacts				
(1) Value of Increased Income	Some increase from partial development of the park and to business in the local area.	Additional increases to that for Alternative I because of complete development of proposed park facilities.	Same as Alternative 2b.	Same as Alternative 2b.

Table 6 - Summary of Effects for Alternative Plans (Cont'd)

	Alternatives			
	Alternative 1	Alternative 2b	Alternative 3c	Alternative 3c
		250 Feet W X 5,500 Feet L	250 Feet W X 5,500 L	300 Feet W X 5,500 Feet L
		Protective Beach	Protective Sand Beach,	Protective Sand
		and Revetment	Offshore Breakwaters,	Beach, Offshore
	No-Action		and Revetment	Breakwaters and Revetment
4. Regional Development				
a. Beneficial Impacts				
(1) Value of Increased Income	Some increase from partial development of the park and to businesses in the local area.	Additional increases to that for Alternative 1 because of complete development of proposed park facilities.	Same as Alternative 2b.	Same as Alternative 2b.
(2) Quality of Increased Employment	Some increase in local and regional employment due to partial park development.	Temporary increase during construction of the shoreline protection project, and full development of the park. Permanent increase for operation of the fully developed park.	Same as Alternative 2b.	Same as Alternative 2b.
C. PUBLIC AND AGENCY ACCEPTABILITY	The Ohio Department of Natural Resources is opposed to this plan because it precludes development of the park to the desired level, recreational needs in the area would largely go unmet, and shoreline erosion would continue.	Preferred by U. S. Fish and Wildlife Service because it is least disruptive to existing resources. District interprets it is unacceptable to ODNR because of lack of reliability of estimating annual nourishment and backpassing requirements for the exposed beach, although it would allow for full development of the park. No identified opposition from the general public.	Acceptable by U. S. Fish and Wildlife and preferred by the Ohio Department of Natural Resources because it should provide a stable beach requiring the least amount of annual maintenance. No known opposition.	
D. PLAN EVALUATION				
1. Contributing to Planning Objectives				
a. Protection from Erosion and Flooding	Objective not met as erosion and flooding would continue. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Erosion would be eliminated. Flooding would continue because of inundation from the flanks, but should be less severe due to elimination of wave runup. Nonstructural means of protecting critical park facilities should be implemented by ODNR.	Same as Alternative 2b.	Same as Alternative 2c.
b. Provide Recreational Beach	No effect.	32-acre beach would be provided.	Same as Alternative 2b.	Same as Alternative 2b.
c. Park Development	Inhabited	Multiuse park development to a scale proposed in ODNR's Master Plan could proceed.	Same as Alternative 2b.	Same as Alternative 2b.
d. Meet Recreational Needs of the Area	ODNR park development would partially meet some of these needs.	Significant contribution to meeting diversified needs of Toledo Metropolitan Area.	Same as Alternative 2b.	Same as Alternative 2b.
2. Design and Functional Reliability	Not applicable.	Would solve erosion problem and meet recreational need objectives. However, estimates of annual nourishment and backpassing requirements are considered unreliable. Tests are currently underway to more accurately quantify these losses.	Considered reliable.	Considered reliable.
3. Implementability	Outcome if no structural plan meets feasibility requirements.	Implementability is questionable because of unreliability of sand nourishment and backpassing requirements which could increase annual costs substantially.	Plan is implementable.	Plan is implementable.

SECTION 5
THE RECOMMENDED PLAN

FEATURES OF THE RECOMMENDED PLAN

The Recommended (Selected) Plan (see Plate 15) is designated Plan 3c (250'W X 5,500'L). It would provide erosion protection along the entire 11,000 feet of highly erodible (average of 12 feet per year) park shoreline and provide for beach restoration along the western half of the partially developed park. There are no mitigation requirements for the Recommended Plan. The principal components of Plan 3c (250'W X 5,500'L) are:

a. A sand beach 250 feet wide and 5,500 feet long along the western half of the park shoreline. The beach would be stabilized by eight 300-foot long offshore rubblemound breakwaters, and a vegetated storm dune would be provided to prevent overwash of sand to inland areas;

b. A 250-foot long rubblemound jetty with a concrete walkway for fishing access at the western end of the beach;

c. A 450-foot long rubblemound revetment immediately west of Berger Ditch at the center of the park. The existing jetty at this location would be lengthened to 250 feet and provided with a concrete walkway for fisherman access.

d. A 6,200-foot long rubblemound revetment along the eastern half of the park shoreline.

HYDROLOGY/PHYSICAL LIMNOLOGY

The topography in the Maumee Bay State Park area is low-lying and very flat. Typically, the bluff line in the park is only about 4 to 5 feet above the average lake level of 570.6 (IGLD-1955), while the park lands are only from 5 feet to about 8 feet above this level. As a result, park lands are subject to flooding from Lake Erie.

The park is located in Maumee Bay which lies in the Western Basin of Lake Erie. Bathmetrically, the bay is a broad shallow shelf sloping gently downward toward the northwest. The bay, with a surface area of 30 square miles is extremely shallow having a mean depth of about 5 feet and a maximum depth of about 10 feet below the Lake Erie Low Water Datum (LWD) of 568.6 feet (IGLD-1955).

a. Surface Runoff.

Maumee Bay lies in the South Maumee Bay sub-basin (d.a. = 43 sq. mi.) of the Maumee River Basin. There are no major waterways crossing the park. Local drainage ditches in the park (see Plate 15) are McHenry, Berger, and Sautter Ditches running south to north, and R. Ames and St. John Ditches running east-west. These ditches have very flat hydraulic gradients and

limited hydraulic capacity, although they adequately handle surface runoff and groundwater flow from existing drain tiles with average levels in Lake Erie. No further consideration of local drainage requirements are required for the Federal project except to ensure that the capacity of the existing drainage system is maintained.

b. Lake Levels.

Water levels of Lake Erie fluctuate from year to year, season to season, and on a short-term basis. Long-term and seasonal variations are a function of basin precipitation, runoff, evapotranspiration, and evaporation, while short-term fluctuations are caused by wind stress and barometric pressure differences on the lake's surface. Seasonal fluctuations are generally consistent from year to year with highs occurring during the summer months and lows in the winter as shown on Plate 4. The extreme monthly values depicted on Plate 4 are indicators of the long-term fluctuations which have a maximum recorded range of about 4.6 feet between the average annual high of 572.7 in 1973 and the average annual low of 568.1 in 1934. High water periods are particularly critical along the park shoreline because of accelerated erosion and more extensive flooding of low-lying areas during storms on Lake Erie.

Wind tides and seiches have a dramatic effect on Lake Erie levels, particularly in areas such as Lucas County due to its location at the western extremity of the lake. Winds blowing shoreward from the northeast tend to increase the water level at Maumee Bay State Park, while westerly winds have the opposite effect. An example of the rapid, short-term changes in water levels on Lake Erie is shown on Plate 4A, a stage hydrograph for the 6 April 1979 storm event. During this storm, the water level at Toledo experienced a "setdown" of 9.3 feet in direct response to strong winds primarily from the west through southwest. Prolonged strong winds from the opposite direction can produce a wind "setup" of up to about 5 feet in Maumee Bay. This condition is critical to the project area because of accompanying flooding and increased erosion. Plate 4B is the frequency curve of annual peak rises (setup) at Toledo. The frequency curve of annual maximum instantaneous levels for Lake Erie at Toledo is shown on Plate 4C. This curve was used in the design of project features. The control structures (offshore breakwaters, revetment, etc.) were designed using the 10-year water level of 576.0 IGLD in combination with the 20-year recurrence wave to produce the coincident 200-year condition standardly used for design on the Great Lakes. Likewise, the 100-year instantaneous maximum level of 577.3 feet IGLD was determined to be the level the Ohio Department of Natural Resources should use in the design of their park facilities. As noted earlier, natural ground elevations in the park vary between about 575 and 578, so flooding of these lands can be expected to occur.

c. Wave Conditions and Design Wave.

Waves that reach the shoreline at the project site are height-limited by the shallow depths in the bay. The bay is semi-sheltered with waves from the east affected by Little Cedar Point which juts from the shoreline, while waves from the west are limited by fetch. Waves break in the shallow

offshore areas in depths slightly greater than the wave height, and then reform and break again as they continue toward shore. The amount of wave energy reaching the near shore zone is strongly influenced by lake levels and setup. Based on wave analyses performed by the District, it is concluded that maximum wave heights at Maumee Bay State Park seldom exceed 6 feet with the typical period from 2 to 5 seconds.

In determining the design waves, the significant deep-water wave characteristics for the unsheltered area immediately off Maumee Bay were obtained from the Waterways Experiment Stations's Technical Report H-76-1, "Design Wave Information for the Great Lakes, Report 1", dated March 1976. Computer analysis were then performed to determine the effects of diffraction and refraction on wave transmission into Maumee Bay. Analysis of the resulting combination of wave heights and lake stages showed that the critical combination was for the 10-year wave and 20-year lake level (Elev. 576.5). On this basis, the design waves for the various project coastal structures are:

Feature	Design Wave Height
Sand Beach/Offshore Breakwater	6.5 feet
Jetties	5.0 feet
Wildlife Revetment and Berger Ditch Revetment	4.8 feet

SHORELINE RECESSION

a. Historical Shoreline Recession.

Because of differences in characteristics of the shoreline along the park, it was divided into the three reaches shown on Plate 5. The Western Reach is characterized by a low-lying glaciolacustrine clay shore; the Niles Beach Reach by a protective rubble revetment; and the Eastern Reach by eroding forested wetlands. Based on available shoreline information such as historical maps and aerial photos for more recent years, the historical shorelines at the park for selected years from 1877 to 1979 were established as depicted on Plate 5. Table 7, provides recession rates for the selected periods for each of the three reaches based on interpretation of the shoreline locations shown on Plate 5. From the tabulation, it is seen that for the entire 103-year period, the average recession rate for the entire park shoreline was nearly 12 feet per year, with the unprotected and more exposed Western Reach experiencing the highest rate at 13.5 feet per year. The historical rate of 5.7 feet per year in the Niles Beach Reach, which is now protected by a rubble revetment, can be expected to increase as the revetment is outflanked on its eastern and western limits. Inspection of the recession rate tabulation also shows that the recession rates have varied nonuniformly through time. These variances are attributable to fluctuations in long-term Lake Erie levels and the occurrence/nonoccurrence of severe storms - i.e., higher recession rates occur during periods of above average lake levels more than during low periods of levels for storms of comparable severity.

Table 7 - Historical Shoreline Recession Rates at Maumee Bay State Park (feet per year)

Period	Western Reach (1)		Niles Beach (1)		Eastern Reach (1)		Entire Shoreline
	Maximum	Average	Maximum	Average	Maximum	Average	Average
1877-1940	16.7	13.0	8.3	7.6	9.3	8.0	10.4
1940-1950	17.0	17.8	12.0	8.1	10.0	6.8	9.9
1950-1957	14.3	10.3		*	21.0	12.7	10.0
1957-1969	20.0	13.5		*	13.3	8.0	9.7
1969-1979	25.0	19.5		*	82.4	21.9	18.1
1877-1979	15.3	13.5	6.3	5.7	15.3	11.5	11.8

(1) For reach location refer to Plate 5.
* No measurable change.
SOURCE: Listed in Plate 5.

Volumetrically, the average annual long-term erosion rates were 5.3 and 3.8 cubic yards per year per linear foot of shoreline for the Western and Eastern Reaches of the park, respectively.

b. Projected Recession. Based on the historical average recession rates of 13.5 feet per year and 11.5 feet per year for the Western and Eastern Reaches, respectively, the year 2040 shoreline shown on Plate 5 was estimated. From this projection, it is estimated that (the shoreline will recede 675 feet and 575 feet, and that 80 and 60 acres of land will be lost from the Western and Eastern Reaches of the park, respectively, over the 50-year project life period assuming no shoreline protection is provided.

The year 2040 projected shoreline is also shown on Plate 2, along with the key features of ODNR's Conceptional Master Plan. ODNR is presently (November 1983) preparing the site-specific Master Plan, and based on information available, the location of some of the park facilities have been changed (see 14 November 1983 letter in Appendix E). The draft report on the site-specific Master Plan is scheduled for completion in late 1983 or 1984.

GEOTECHNICAL CONSIDERATIONS

a. Regional and Local Geotechnical Information.

The soil strata which exist at the project site are generally glaciolacustrine soils and clays. These soils are underlain by thick sedimentary

rock sequences, including limestones, dolomites, and shales. The soil overburden is relatively thick, and bedrock is deep enough so it will have no effect on the project design features.

A subsurface program, consisting of three hand auger borings, was conducted by Buffalo District personnel in May 1981. This very preliminary and minimal program provided general data about the site soil stratification.

b. Geotechnical Design.

The subsurface conditions at the project site are favorable to the design features of this project. No problems are foreseen regarding overstressing the foundation, excessive settlement, stability, filter criteria, or other concerns. Note that only land subsurface explorations were performed, at this early report level. Offshore subsurface conditions must be determined later in the design process in the vicinity of offshore breakwaters and jetties.

c. Construction Considerations.

Based on a preliminary survey, it appears that adequate local sources of materials exist for the construction of this project, including armor, underlayer, bedding stone, concrete aggregates, and beachfill.

Refer to the Geotechnical Design Appendix for additional details.

ECONOMIC CRITERIA

Costs presented in this section are on October 1983 price levels, and annual charges were obtained using a 50-year project life and an interest rate of 8-1/8 percent per annum.

PLAN DESCRIPTION AND FEATURES

a. General.

The Selected Plan 3c (250'W X 5,500'L), shown on Plate 15 would consist of a 5,500-foot long sand beach with rubblemound offshore breakwaters along the western half of the park shoreline, and a 6,200-foot long low-crested rubblemound revetment along the eastern half of park shoreline. The 250-foot wide sand beach would be separated from the adjacent park by a vegetated storm dune which would minimize inland transport of sand from overwash. Rubblemound jetties would be constructed at the ends of the beach. The purposes of these jetties are to retain the beachfill and prevent blockage of the drainage ditches from littoral materials transported along the shoreline. Sixty acres of State-owned parks lands would be required for construction of the Federal project.

b. Beach Component.

The beach component would provide shoreline protection for the western half of the park thereby preventing an estimated loss of 80 acres of park

lands over the 50-year project life. In addition, it would provide for a restored beach which would serve as the prime attraction for optimal use of other park recreational facilities.

(1) Sand Beach - The beach would be 250 feet in width and 5,500 feet long, extending from McHenry Ditch on the west to Berger Ditch on the east. The beach would be constructed of a medium grain sand (0.1 to 0.5 mm). The sand would likely be mined from an offshore site in the vicinity of Maumee Bay. A typical section of the beach is shown on Plate 16. The beach crest elevation was set at +10.0 LWD because Maumee Bay frequently experiences lake levels and wave runup combinations that approach this elevation, lower crest elevations would provide little cost savings and would jeopardize the beach stability due to inland overwash. Beach slopes were set to conform to slopes of other Lake Erie beaches. Since the offshore breakwaters would absorb and diffuse much of the wave energy, the beach could be repositioned landward as shown on Plate 16 and still provide protection of the shoreline from erosion. This would produce both fill material and a cost savings since less sand would be required for initial construction and the excavated material would be used in constructing the storm dune. The eastern half of St. Johns Ditch would be relocated to accommodate the beach construction. Approximately 200,000 cubic yards of sand would be required for the initial beach construction.

(2) Offshore Breakwaters - The purpose of the segmented, offshore rubblemound breakwaters is to stabilize the protective sand beach by reducing both longshore and offshore littoral transport. They would consist of eight segments, each 300 feet long, with a 300-foot gap between each segment, and would be located approximately 600 feet offshore in a water depth of about 6 feet such that they can be constructed with a floating plant. A typical section of the breakwater is shown on Plate 17.

An underlayer stone ranging from 3 to 30 pounds would form the base and be placed on the existing bottom. The design base width is approximately 60 feet with a depth of 3 feet. The breakwater core would be formed of armor stone sized from 1.3 ton to 3.0 tons, with sideslopes of 1.5 feet horizontal to 1-foot vertical. The top width of 9.3 feet is at an elevation of LWD +9.4 feet, and was designed for a significant wave of 6.5 feet with minor overtopping during design conditions.

(3) Jetties - Plate 18 shows a typical section of the proposed jetties. They would be constructed at the outlets of McHenry and Berger Ditches and function to retain the beachfill and to prevent blockage of the drainage ditches from littoral materials transported along the shoreline. The jetties would be 250 feet long and of rubblemound construction with a filter cloth to prevent the passage of sand through the jetty. A 3-foot wide concrete walkway with a handrail would be provided for fishermen access.

Rubblemound stone proposed for the jetties consists of an 80 to 280 pound underlayer course topped with an armor stone ranging from 1,200 to 2,800 pounds. The top width of 7.5 feet is at elevation LWD + 10 feet and sideslopes are 1.5 feet to 1 foot, and were designed for a significant wave height of 5.0 feet.

(4) Berger Ditch Revetment - A small protusion of wooded land exists along the shoreline west of Berger Ditch. Some crude protection was placed there years ago to protect a seasonal development called Niles Beach. This has since been partially removed and the protection is in poor condition. Construction of this revetment would tie the proposed beach into a rehabilitated jetty along the west side of Berger Ditch and continue to protect existing lands.

The Berger Ditch Revetment is designed for a significant wave of 4.8 feet with an underlayer stone of 50 to 150 pounds, placed over the existing rubble and atop a filter cloth on the existing bottom. Armor stone from 700 to 1,500 pounds covers the underlayer, with a 5.9-foot top width at elevation LWD + 10 feet. The lake sideslope is 2 to 1 while the land side slope is 1.5 feet to 1. Plate 19 shows the typical section.

(5) Periodic Beach Nourishment - Nourishment rates are difficult to ascertain because of the numerous uncertainties associated with the coastal processes in Maumee Bay. Because of these uncertainties, it was concluded that the most accurate estimate of nourishment rates for the sand beach would be obtained by using existing erosion losses at the park. Experience with other sand beach/breakwater projects on Lake Erie indicates that these projects are about 75 percent effective in reducing nourishment rates. On this basis, the 5,500-foot beach/breakwater component of the Maumee Bay project would require an average nourishment rate of 5,500 cubic yards a year based on the 20,000 cubic yards per years loss now being experienced for this reach of shoreline. The breakwaters would effectively halt any longshore transport of beach sand, so backpassing would not be required.

(a) Cost Sharing of Beach Nourishment Costs - Current guidance, contained in paragraph 4-2 of ER 1105-2-20 (RRAP), states in part that "Periodic nourishment is considered construction for cost-sharing purposes when in the opinion of the CDR USACE, such periodic nourishment is found to be a more economical erosion protection measure." For Maumee Bay State Park, the beach is a partial alternative to a continuous revetment and the beach is desired by the State to achieve beach use benefits. Projects recommending periodic nourishment should not, however, include structures which materially reduce littoral drift from reaching downdrift shores. At Maumee Bay State Park, the existing net littoral drift is estimated at 5,000 cubic yards annually. Estimated nourishment quantities (offshore-downdrift losses) equal this value for the Selected Plan. The Maumee Bay jetties and detached offshore breakwaters should not reduce littoral drift because the beach is recessed from the shoreline and can be categorized as a pocket beach, and because there is little naturally occurring sand size material at the site, in all likelihood there will be an increase in littoral material reaching adjacent shores with the beach project.

Therefore, the Maumee Bay State Park project periodic nourishment is considered "construction" for cost-sharing purposes. Further, it has been determined that the nourishment should be cost-shared for the life of the project. Based on the traditional apportionment of costs, the periodic nourishment for the Selected Plan will be cost-shared 70 percent Federal and 30 percent non-Federal.

(6) ODNR Park Facilities Associated With the Beach Component - With an instantaneous beach capacity of 13,750 people, the State will provide sufficient parking, access roads, bathhouses, and change booths to accommodate these people. Therefore, the cost for these facilities was alloted to the beach component of the Federal project for evaluation purposes, and would be apportioned 100 percent non-Federal.

c. The Wildlife Revetment Component.

(1) General - As shown on Plate 15, the 6,200-foot long wildlife revetment would begin at Berger Ditch and extend eastward where it would tie into an existing revetment at the Cedar Point Wildlife Refuge. The revetment would prevent erosion of 60 acres of primarily wetlands over the 50-year project life. The Ohio Department of Natural Resources is of the opinion that the revetment (or some other type of shoreline protection) is required for the planned development of the park recreational facilities. This protection will allow ODNR to construct nature trails in the wetlands and a lodge/cabin complex at the shoreline immediately east of Berger Ditch. ODNR's view is that these facilities, in conjunction with the campground, picnic areas, recreational beach, golf course, and interpretive center will achieve an optimum balance between active and passive forms of recreation as well as an optimum balance between development and preservation. Without total shoreline protection, the State cannot and will not develop the lodge/cabin complex (see Appendix E, for 14 November 1983 ODNR letter). Although not specifically stated by ODNR, it is expected other proposed park facilities will be similarly affected to some degree, and in all probability utilization of the recreational facilities that are constructed will be less than desired. The District agrees with this "integrally dependent" park development concept, and concludes that total shoreline protection is needed to achieve the desired goals of total planned development and optimal recreational use for Maumee Bay State Park. On this basis, the wildlife revetment is required for functional viability.

(2) Description and Design - A typical section of the rubblemound proposed for protection of the shoreline at the eastern half of the park is shown on Plate 20. The revetment would be constructed of an underlayer stone from 50 to 150 pounds, and topped with armor stone ranging from 700 to 1,500 pounds. It is designed for occasional overtopping, with a crest height of +8.6 feet. Its top width of 12 feet provides a width sufficient for maintenance vehicles and a widened top surface at the gaps provides a turnaround. The total length of revetment including overlap and wraparounds is 6,200 feet. Gaps would be provided at ditch outlets and along the length to allow for circulation of water into and out of the nature area. In addition, the permeability of the rubblemound stone along with the low crest height will supplement the exchange of water.

(3) ODNR Facilities Associated with the Revetment - As stated previously, the total park development concept requires that total shoreline protection, including protection along the eastern half of the park, be provided. However, construction of the lodge/cabin complex at the western end of the revetment on the shoreline is specifically dependent upon construction of the revetment. The lodge would provide 150 rooms with an expected occupancy rate of 75 percent at the shoreline location. ODNR plans to construct 50 cabins at this site at a cost of about $1.1 million.

RECOMMENDED PLAN COSTS

a. First Cost of Construction.

The detailed cost estimate, at October 1983 price levels, for Plan 3c (250'W X 5,500'L) is shown in Table 8. Costs for the Federal project and the associated costs for the associated ODNR development are shown separately. From the tabulation, the first cost for the Federal project is $11,830,000 and $3,330,000 for the associated ODNR development, for a total first cost of $15,160,000 allocable to the Federal shoreline erosion/beach restoration project. Based on the traditional apportionment of costs (70 percent Federal and 30 percent non-Federal), the Federal share of the project is $8,136,900 and the non-Federal share is $7,023,100, as shown in Table 8.

b. Annual Charges for the Selected Plan.

Annual charges for Plan 3c (250'W X 5,500'L), including apportionment thereof based on traditional apportionment, are listed in Table 8. These charges are based on a 50-year economic life and 8-1/8 percent interest rate. As discussed earlier in this section, periodic beach nourishment is considered to be a "construction" item, and, therefore, would be cost-shared 70 percent Federal and 30 percent non-Federal for the 50-year project life as shown in Table 9. From the tabulation, the total annual charges for the Recommended Plan are $1,677,000, apportioned $771,300 Federal, and $905,700 non-Federal.

OPERATION AND MAINTENANCE

The local cooperator would be financially and operationally responsible for maintenance of the Federal project, except for periodic beach nourishment and beach monitoring which would be cost-shared. The probable local cooperator for the project is the Ohio Department of Natural Resources, the constructor and operator of Maumee Bay State Park. It is expected that this State agency will carry out, in accordance with written directions from the District Commander, the periodic beach nourishment program with the only cost to the United States being the annual reimbursement to the State of 70 percent of the State's expenditure for monitoring and nourishment.

PLAN ACCOMPLISHMENTS

The Recommended Plan would provide erosion protection along the entire 11,000 feet of park shoreline, thereby permitting the Ohio Department of Natural Resources to construct the desired multi-use recreational complex consisting of campgrounds, picnic areas, golf course, lodge, cabins, nature trail, and an interpretive center along with necessary utilities and service facilities. In addition to providing shoreline protection on the eastern half of the park, the project would incorporate a protective sand beach over the western half of the park. The beach will serve a large recreational swimming need that presently exists in northwestern Ohio. The plan would also serve a recreational fishing need in the project area by providing for

Table 8 - First Cost and Apportionment of Costs for Selected Plan 3c (250'WX5,500'L) (October 1983 Price Levels)

Item	Quantity	Unit	Unit Price	Traditional Apportionment: Total Cost	Federal - 70 Percent (1)	Non-Federal - 30 Percent(2)
			$	$	$	$
FEDERAL PROJECT - Plan 3c (250'WX5,500'L):						
Clearing and Grubbing	8	Acres	3,650.00	29,200	20,440	8,760
Ditch Excavation	1,670	C.Y.	5.85	9,770	6,839	2,931
Stripping	22,800	C.Y.	7.95	181,260	126,882	54,378
Sandfill	300,000	Tons	5.95	1,785,000	1,249,500	535,500
Earthfill	45,200	C.Y.	2.60	117,520	82,264	35,256
Armor Stone (1-3 Tons)	31,100	Tons	37.25	1,158,475	810,933	347,542
Armor Stone (1,200-2,800 Lbs.)	5,400	Tons	43.65	235,710	164,997	70,713
Armor Stone (700-1,500 Lbs.)	46,750	Tons	43.65	2,040,638	1,428,447	612,191
Underlayer Stone (80-280 Lbs.)	1,900	Tons	31.40	59,660	41,762	17,898
Underlayer Stone (50-150 Lbs.)	23,700	Tons	31.40	744,180	520,926	223,254
Underlayer Stone (3-30 Lbs.)	25,900	Tons	25.00	647,500	453,250	194,250
Aids to Navigation	-	L.S.	-	87,200	87,200 (1)	-
Concrete Walkway (4)	500	L.F.	61.00	30,500	15,250	15,250
Filter Fabric	36,000	S.Y.	7.15	257,400	180,180	77,220
Topsoil	4,500	C.Y.	11.25	50,625	35,438	15,187
Seeding	8	Acres	1,750.00	14,000	9,800	4,200
Mobilization and Demobilization	-	L.S.	-	150,000	105,000	45,000
Total Contractor's Earnings				7,598,638	5,345,208	2,253,430
Contingencies at 25 ± Percent				1,901,362	1,334,792	566,570
Total Contractor's Earnings Plus Contingencies				9,500,000	6,680,000	2,820,000
Engineering and Design				900,000	630,000	270,000
Supervision and Administration				1,190,000	833,000	357,000
Lands				240,000	-	240,000 (2)
Total First Cost of Construction				11,830,000	8,136,900	3,693,100
Land Development (2)(3):					-	
Bathhouses				810,000	-	510,000
Parking Facilities				1,260,000	-	1,260,000
				750,000	-	250,000
				100,000	-	100,000
Utilities				250,000	-	250,000
Lands				160,000	-	160,000
TOTAL COST, ODNR DEVELOPMENT				3,330,000	-	3,330,000
TOTAL COST, FEDERAL PROJECT AND ODNR DEVELOPMENT				15,160,000	8,136,900	7,023,100

(1) Total Federal Cost.

(2) Total Non-Federal Cost.

(3) Does not include the cost for the lodge/cabin complex which are self-liquidating.

(4) Concrete walkway is for recreational fishing from the jetties, so it is cost-shared 50-50.

Table 9 - Annual Charges for Plan 3c (250'W X 5,500'L) (October 1983 Price Levels)

Item	Total Annual Costs (1)	Traditional Apportionment (2) Federal Annual Costs	Traditional Apportionment (2) Non-Federal Annual Costs
	$	$	$
FEDERAL PROJECT			
First Cost Alternative 3c (250'WX5,500'L)	11,830,000	8,136,900	3,693,100
Interest during Construction (.08187)	970,000	670,000	300,000
Total Investment Cost	12,800,000	8,806,900	3,993,100
Annual Charges			
Interest and Amortization (0.08292)	1,061,000	730,000	331,000
Beach Nourishment (3) (5,000 cy)	45,000	31,500	13,500
Beach Monitoring (4)	14,000	9,800	4,200
Maintenance of Structures (5)	156,000	-	156,000
Total Annual Charges, Federal Project	1,276,000	771,300	504,700
ODNR DEVELOPMENT (6)			
First Cost	3,170,000	-	3,170,000
Lands	160,000	-	160,000
Total First Cost, ODNR Development	3,330,000	-	3,330,000
Annual Charges			
Interest and Amortization	276,000	-	276,000
Operations and Maintenance	125,000	-	125,000
Total Annual Charges, ODNR Development	401,000	-	401,000
Grand Total Annual Charges-Federal Project Plus Associated ODNR Development	1,677,000	771,300	905,700

(1) Based on 50-year project life and 8-1/8 percent interest rate.
(2) Based on traditional cost sharing, 70 percent Federal and 30 percent non-Federal except lands which are 100 percent non-Federal and Aids to Navigation which are 100 percent Federal.
(3) Annual beach monitoring costs consist of $45,000 per year for first 3 years of project, and $45,000 once every 10 years thereafter.
(4) Beach nourishment to be performed for the life of the project, apportioned 70 percent Federal and 30 percent non-Federal.
(5) 100 percent non-Federal.
(6) 100 percent non-Federal costs.

fisherman access on the proposed jetties. In summary, the Recommended Plan meets the planning objectives for this water resources project by:

a. Contributing to the stability of 11,000 feet of shoreline subject to erosion for the period 1990-2040.

b. Contributing to water and related land-based recreation for swimming, fishing, picnicking, camping, nature studies, hiking, and golfing for the project life.

c. Contributing to the reduction of flooding by reducing wave runup into the park.

d. Contributing to the preservation and/or enhancement of the fish and wildife habitat, particularly in the wetlands.

BENEFITS OF THE RECOMMENDED PLAN

The benefit categories associated with the Recommended Federal Project are recreational beach use (swimming and sunbathing), recreational fishing from the jetties, land loss prevented, and benefits allocable to the rubble-mound revetment consisting of lodge and cabin benefits and construction features (cut-off walls eliminated). The resulting benefits for each of these categories are discussed below.

a. Recreational Beach Use Benefits.

The beach use benefit analysis was accomplished using the Travel Cost Method (TCM). This method was applied using the "similar project technique" to estimate future recreational usage at Maumee Bay State Park. East Harbor State Park (EHSP) was selected as the similar site for determining the recreational usage of Maumee Bay State Park. EHSP is located on Lake Erie, 81 miles west of Cleveland and 45 miles east of Toledo. The 1,613-acre park offers a wide range of resource attributes including access to Lake Erie for swimming and fishing. EHSP was selected among all other Ohio State Parks based on similar park characteristics including type, size, and quality of the park as well as market area demographic and socioeconomic characteristics; and location of competing recreational opportunities.

The historic East Harbor State Park visitation data was analyzed to determine user preference and characteristics. The types of activities available and EHSP's estimate of use by activity were crucial input to the demand analysis of Maumee Bay. The travel cost method also requires visitor origin data; however, this was not available for EHSP. The origin or travel distance data is crucial in estimating the first stage demand curve in the TCM. Recreation day use visitor origin data, however, was available in a 1977 Pennsylvania Department of Environmental Resources study.

(1) Recreational Beach Use Demand for Maumee Bay State Park - The recreation demand at Maumee Bay is based on per capita use rates developed for various distances from the park site. Per capita use rates were used to

develop total beach visitation from each zone and eventually, by adjusting for the average number of occupants per vehicle, in estimating the number of vehicle trips from each distance zone. County Census population data for 1980 were used to develop the population in each of eight zones 25 miles wide around East Harbor State Park. This is the first step in the analysis for determining per capita trip rates for swimming. A 200-mile radius was established as a reasonable maximum travel distance for this analysis based on park survey data for people engaging in day use activities. Road mileage distances were measured from the centroid of each county within the 200-mile radius.

The second step in deriving beach use per capita trip rates is by distributing EHSP swimming attendance by distance zone. This is accomplished by multiplying historical attendance for swimming by the percentage distribution of day use attendance origin for each 25-mile distance zone. Swimming attendance is based on the 1980 historical attendance of East Harbor State Park.

The distribution of park visitor trips by origin zone is based on a 1977 summer origin survey conducted by the Pennsylvania Department of Environmental Resources. The seven Pennsylvania State Parks included in the origin survey are primarily day use parks having the same available recreation activities as Maumee Bay State Park. Estimated vehicle trips by distance zone is calculated by dividing the historical 1980 swimming attendance for each distance zone by the average occupants per car (3.5). Dividing estimated vehicle trips by the total population for each zone yields per capita trip rates by distance zone. This relationship is then multiplied by the eight 25-mile wide distance population zones constructed around Maumee Bay State Park to calculate the estimated swimming demand at Maumee Bay State Park. The resulting recreational beach demand, by decade, is shown in Table 10.

(2) Projected Annual Beach Attendance for Recommended Plan - Projected swimming demand presented in Table 11 is calculated based on an unconstrained beach size at Maumee Bay State Park. The 250-foot wide by 5,500-foot long beach - with an area of 1,375,000 square feet, an instantaneous capacity of 13,750 swimmers/sunbathers (100 square feet/person) and a daily capacity of 20,625 swimmers (daily turnover rate of 1.5) - is the constrained beach size at Maumee Bay State Park. 1980 historical daily attendance figures for swimming at East Harbor State Park were used to simulate the distribution of annual demand at Maumee Bay on a daily basis. The daily attendance was ranked from the highest use day to the least use day and the percentage distribution for the 122 day swimming season was calculated. These daily percentages were multiplied by the total annual swimming demand at Maumee Bay State Park to estimate daily swimming demand.

The daily capacity was calculated for the beach area using a space standard of 100 square feet per person and a daily turnover rate of 1.5. Annual beach attendance was calculated as the sum of daily swimming demand. For those days where swimming demand was estimated as being greater than daily capacity, the smaller number is used in the sum. Maximum daily capacity and projected annual beach attendance by decade for the Recommended Plan is presented in Table 11.

Table 10 - Maumee Bay State Park Swimming Demand by Decade

Zone Number	Zone in Miles	Swimming Demand						
		1980	1990	2000	2010	2020	2030	2040
1	0-25	1,473,920	1,545,845	1,618,131	1,709,194	1,815,534	1,939,872	2,085,458
2	25-50	55,405	60,036	63,907	69,300	75,317	82,033	89,551
3	50-75	23,020	23,748	23,345	23,163	23,174	23,398	23,846
4	75-100	14,424	14,872	15,036	15,316	15,722	16,258	16,919
5	100-125	7,851	8,712	9,527	10,577	11,813	13,262	14,973
6	125-150	16,293	17,192	18,295	19,425	20,682	22,099	23,695
7	150-175	15,278	16,405	17,234	18,617	20,227	22,110	24,049
8	175-200	4,221	4,494	4,736	5,079	5,499	6,027	6,682
Total		1,610,412	1,691,304	1,770,211	1,870,671	1,987,968	2,125,059	2,285,173

Table 11 - Projected Annual Beach Attendance at Maumee Bay State Park for Recommended Plan 3c (250'WX5,500'L)

Beach Width	Beach Length	Beach Area	Daily Capacity	Projected Annual Beach Attendance 1980	1990	2000	2010	2020	2030	2040
250	5,500	1,375,000	20,625	1,532,693	1,582,451	1,627,700	1,679,982	1,732,772	1,788,560	1,847,788

Table 12 - Maumee Bay State Park - Swimming Second Stage Demand Curve, 1990 Motor Vehicle Cost

Distance Shift	Swimming Trips	Cost per Mile	Total Cost per Shift	Travel Cost
		$	$	$
0	483,229	.133	0.00	1,464,719.00
25	42,712	.133	6.65	1,464,719.00
50	14,763	.133	13.30	278,791.30
75	11,703	.133	19.95	50,872.50
100	7,329	.133	26.60	101,804.90
125	2,408	.133	33.25	147,260.90
150	1,124	.133	39.90	46,962.30
175	203	.133	46.55	39,810.20
200	0	.133	53.20	10,124.60
Total Consumer Surplus				2,140,345.70

Table 13 - Maumee Bay Recreational Value, Motor Vehicle Cost, 1990

Alternative		Beach Area	Annual Swimming Trips	Total Annual Value (1)
Width	Length			
				$
100	2,500	250,000	121,945	540,126
100	3,000	300,333	143,240	634,447
150	2,500	375,000	174,798	774,225
100	4,000	400,000	185,133	820,002
150	3,000	450,000	205,773	911,427
200	2,500	500,000	226,066	1,001,305
100	5,500	550,000	245,797	1,088,698
200	3,000	600,000	264,667	1,172,278
150	4,000	600,000	264,667	1,172,278
250	2,500	625,000	273,955	1,213,417
250	3,000	750,000	317,338	1,405,579
200	4,000	800,000	334,045	1,479,571
150	5,500	825,000	341,830	1,514,053
250	4,000	1,000,000	386,976	1,714,016
200	5,500	1,110,000	409,786	1,815,048
250	5,500	1,375,000	452,131	2,022,605
300	5,500	1,650,000	475,493	2,106,081
350	5,500	1,925,000	481,025	2,130,584

(1) 4.43 Ave. Value/Trip.

Table 14 - Maumee Bay State Park - Swimming Second Stage Demand Curve, 1990 Opportunity Cost of Time

Distance Shift	Swimming Demand	Average Speed MPH	Average Distance of Drive (Two-Way)	Average Hours of Drive (Two-Way)	Average Hours Stay	Total Hours	Opportunity Rate/Hours	Total Cost Per Shift	Travel Cost
0	1,691,304	44.0	0.0	0.00	4.38	4.38	1.86	8.15	
25	149,494	44.0	50.0	1.14	4.73	5.87	1.86	10.91	14,696,761
50	51,671	44.0	100.0	2.27	5.08	7.35	1.86	13.67	1,202,288
75	40,961	44.0	150.0	3.41	5.42	8.83	1.86	16.43	161,172
100	25,653	44.0	200.0	4.55	5.77	10.32	1.86	19.19	272,590
125	8,429	44.0	250.0	5.68	6.12	11.80	1.86	21.94	354,217
150	3,935	44.0	300.0	6.82	6.46	13.28	1.86	24.70	104,816
175	711	44.0	350.0	7.95	6.81	14.76	1.86	27.46	84,088
200	0	44.0	400.0	9.09	7.16	16.25	1.86	30.22	20,505
Gross Willingness to Pay									16,896,438
Net Willingness to Pay (Consumer Surplus)									3,107,236

(3) Recreational Values and Beach Use Benefits -

Recreational Valuation Methodology - Recreational values have been calculated for swimming. Total recreational value by alternative is calculated by summing up consumer surplus for motor vehicle costs and opportunity costs of onsite and driving time (via travel cost method) and user fee revenues ($0 in this case).

Recreational Values - Table 12 presents the resultant calculated second stage demand curve for hypothetical shifts in motor vehicle costs for 1990 unconstrained by supply. The area under each curve represents the motor vehicle cost portion of consumer surplus which partially comprises the total recreational value of each alternative with no supply constraint. The average value per visit is calculated as the total area under the second stage demand curve (above actual travel cost expenditures) divided by the estimated number of annual visits (demand) with a zero distance shift ($2,140,350 - 483,229). Because the annual demand estimate is greater than the annual supply provided under each alternative, the recreational value for motor vehicle costs is calculated as the product of average value per visit and the annual attendance (trips) with supply constraint. Table 13 provides the recreational value for motor vehicle costs in 1990 for each alternative with the supply constraint.

The derivation of the recreational value attributed to the opportunity cost of time unconstrained by supply for 1990 is presented in Table 14. The opportunity cost of time is the value of work or leisure activities foregone to travel to and recreate at the site. The calculation for the opportunity cost of time is similar to that for motor vehicle costs with the exception of the inclusion of on-site time. A relationship between travel time and length of stay in State parks has been established based on the 1978 Parks Visitor Survey conducted by New York State Office of Parks, Recreation, and Historic Preservation (NYSOPR). The survey was aimed at day use patrons at State parks. A regression analysis performed by NYSOPR relating length of stay with minutes of travel quantified the positive relationship between these two variables. It produced the equation, length of stay = .61 (travel time) + 263. Both variables are expressed in minutes. This relationship was utilized in travel cost method calculations for opportunity cost of time valuation for swimming. Table 14 shows the calculated second stage demand curve for hypothetical shifts in opportunity time costs for 1990 with no supply constraint. The recreational value for opportunity time costs for each alternative is calculated in the same method as motor vehicle costs.

(4) Summary - Total recreational beach benefits for the Recommended Plan at a October 1983 price level is $5,300,000.

b. Jetty Fishing Benefits.

Jetty fishing was evaluated as an incremental recreation activity. The incremental costs are based on adding a concrete walkway the entire length of each jetty. For the Recommended Plan, each jetty would be 250 feet long, thereby providing 500 feet of jetty for additional fishing opportunity.

The demand for jetty fishing is constrained by supply with only minor increase in attendance over the project evaluation period. Without the project, the evaluation showed that approximately 31,269 fishermen would use the area in 1990 and 31,384 in 2040. With the addition of 500 feet of jetty for fishing, the estimated participation would increase to 39,172 in 1990 and 39,378 in 2040.

Fishing recreation values were based on the variable motor vehicle cost and opportunity cost of time in travel. Fishermen origins were considered similar to those for other day use activities. On this basis, the value of a fishing day was $3.25.

The average annual fishing benefits for the Recommended Plan (October 1983 prices) would be $32,000 as shown in the following summary.

	No Action Plan	Recommended Plan
Recreational Values	$102,000	$128,000
Fishing Benefits	-	$ 32,000

With an investment cost of $51,000 for the concrete walkway, the average annual cost, including O&M, would be $5,200. The net benefits for the jetty fishing increment would be $26,800 and the B/C ratio is 6.2.

c. Benefits Associated with the Wildlife Revetment.

(1) General - The 6,200-foot long wildlife revetment recommended in the Final Feasibility Report is shown on Plate 15. The purpose of the revetment would be to prevent further erosion of the shoreline along the easterly half of the park, thereby preserving the contiguous valuable wetland habitat while, in the view of the Ohio Department of Natural Resources (ODNR), permitting them to proceed with multi-use recreational development of the park. The State's position has been that all features (facilities) of the park are integrally dependent and require shoreline protection over the entire 11,000 feet of shoreline to realize ultimate utilization of the complex. In this way, the State will achieve the optimum balance between development and preservation while realizing a balance between active and passive forms of recreation. The District agrees with the State's "integrally dependent" park development concept, and formulated the feasibility study plans using this concept including the need for total shoreline protection. On this basis, the wetland revetment was incorporated into the Recommended Plan based on economic justification of the total shoreline protection project. Considering these past and recent developments, benefits specifically related to the revetment were obtained as discussed below.

(2) Benefits Associated with the Revetment - The benefit categories for the easterly park revetment are: Land-loss prevented benefits; Elimination of on-shore cut-off walls; and Lodge benefits and cabin benefits. These categories and their associated benefits are discussed below.

(a) Land-Loss Prevented Benefits - Since a portion of the lands to be protected from shoreline erosion are wetlands, it was concluded that the monetary value of these lands is greater than the market value of about

$4,000 per acre. To establish the monetary value of the estimated 60 acres adversely impacted without the project, the cost to create a similar environment through structural measures was used as a proxy. This approach seems reasonable since the Corps and others often use this practice to mitigate loss of wetlands in water resources development projects.

The principle construction features of the proxy wetland project are a low height earthen berm and a control structure. The first cost including lands for this proxy project is estimated at $519,000 (October 1983 Prices). The total annual charges, including O&M, for this proxy project are $54,200. Therefore, on the basis that this proxy project is a reasonable estimate of the value of the wetlands, the annual "land loss prevented" benefits allocable to the revetment are $54,200 (Say $54,000).

(b) Cut-Off Wall Benefits - Without the revetment, a 600-foot on-shore cut-off wall would be required at the eastern end of the sand beach to prevent flanking of the beach as the unprotected portion of the shoreline recedes. Similarly, the existing U.S. Fish and Wildlife Service "Cedar Point Wildlife Refuge" revetment will require like construction as the now unprotected shoreline immediately to the west recedess. The wetland revetment under consideration for Maumee Bay State Park would eliminate the need for both of these cut-off walls. On this basis, it is concluded that eliminating the cost of these two cut-off walls with construction of the revetment is a benefit allocable to the revetment. The first cost of the walls is $500,000 and the annual charges, including O&M are $61,000. Thus, the annual benefits allocable to the revetment are $61,000.

(c) Lodge Benefits - As previously stated, the Ohio Department of Natural Resources by letter dated 14 November 1983 (Enclosure 3), stated that the lodge and cabins will not and cannot be developed without total shoreline protection. Since development of the lodge/cabins complex is dependent upon shoreline protection, the District concluded that appropriate categories of benefits associated with the lodge and cabins are allocable to any type of shoreline protection provided at this site. The rubblemound revetment was selected because it is the least costly structural alternative.

Recreational benefits associated with the construction of a 150-room lodge have been calculated based on travel cost method procedures. The average annual equivalent benefits for the lodge total $219,000 (October 1983 prices). This is based on opportunity time cost in travel and the variable vehicle cost. User fee revenues generated from the lodge are excluded from total recreational benefits, but are applied in demonstrating the cost of the lodge as being self liquidating. An engineering consultant analyzed the financial feasibility of ODNR's proposed lodge development based on a projected 75 percent annual occupancy rate.

The construction cost of $14.5 million (Feb 83) for the lodge would generate $557,400 annually to the State. The undiscounted payback period equates to approximately 26 years and the rate of return on investment is about 4 percent. The associated costs of lodge construction, therefore, is considered self liquidating and are not included in benefit cost calculations.

d. Cabin Benefits - ODNR also has plans to construct 50 cabins at a cost of around $1.1 million. Recreational benefits are calculated using the travel cost approach. Average annual equivalent benefits with the cabins total $34,000 (October 1983 prices). Like the lodge analysis, user fee revenues for the cabins are excluded from recreational benefits and the associated costs for cabins development are treated as self liquidating.

e. Summary of Benefits Allocable to the Rubblemound Revetment - The average annual benefits for the 6,200-foot revetment are:

Land Loss Prevented Benefits	$ 54,000
Cut-Off Walls Eliminated	61,000
Lodge Benefits	219,000
Cabin Benefits	34,000
Total Annual Benefits	$368,600 (1)

(1) October 1983 Price Levels.

d. Total Average Annual Benefits for the Recommended Plan.

From the following tabulation, the total annual benefits for Recommended Plan 3c (250'W X 5,500'L), are $5,711,000.

Benefit Category	Annual Benefits (1)
Recreational Beach Benefits	$5,300,000
Land Loss Prevented (Beach Area)	7,000
Jetty Fishing Benefits	32,000
Revetment	
Land-Loss Prevented	54,000
Cut-Off Walls Eliminated	61,000
Lodge Benefits	219,000
Cabin Benefits	34,000
Total Project Benefits	$5,707,000

(1) Based on 8-1/8 percent interest rate and October 1983 price levels.

ECONOMIC EFFICIENCY OF SELECTED PLAN 3c (250'W X 5,500'L).

From the summary below, the net benefits (on October 1983 price levels, 50-year project life, and 8-1/8 percent interest rate) for Alternative 3c (250'W X 5,500'L) are $4,034,000 and the benefit-to-cost ratio is 3.4.

Annual Charges	$1,677,000
Annual Benefits	$5,707,000
Net Benefits	$4,030,000
Benefit-to-Cost Ratio	3.4

ENVIRONMENTAL AND SOCIAL EFFECTS

a. Social Effects.

Construction of the Recommended Plan would result in temporary increases in noise levels associated with an extended truck haul operation, on-site construction and dredging activities, and long-term increases from anticipated increased park attendance. No people would be displaced by this plan although additional lands must still be purchased by ODNR for both the total development of the park. The restoration of a 5,500-foot long by 250-foot wide, more uniform beach would be potentially more aesthetically pleasing than the present eroding shore. This plan would add significantly to recreational resources in the area by providing approximately 32 acres of sand beach. Recreational fishing would also be enhanced through jetty design which would provide access for shore fishermen. Beach and park use may be somewhat restricted however, during construction and annual nourishment activities. Rubblemound structures at the shore may detract from its natural character and may disrupt the view of Maumee Bay from the shore. The transport of construction equipment and materials to the park would disrupt local traffic during construction and periods of annual nourishment. A secondary impact of park development would be a local increase in traffic congestion during the recreation season. The development of Maumee Bay State Park would enhance local community cohesion as the park could serve as a focus for community activities. Conversely, the attraction of "outsiders" to the park could possibly negatively impact on community cohesion. The development of the park would benefit community growth by serving as an attraction to many who would like to relocate in the area.

The Recommended Plan would have no effect upon significant (eligible for inclusion in the National Register of Historic Places) cultural resources. The proposed revetments would cover only a narrow strip along the existing shoreline. Most, if not all, of the cultural material in this area has recovered through intensive and repeated surface collections. A possible beneficial impact of the shoreline erosion protection measures would be the abatement of mechanical erosion of cultural materials located further inland with the development of the park and more intensive use of the area. However, previously unsurveyed areas of the park would be disturbed. It has been recommended to ODNR, therefore, that a professional archaeologist monitor all construction activities in these areas and that sufficient time is provided for the recovery of any exposed significant archaeological features or data.

b. Socioeconomic Effects.

The value of surrounding properties would be enhanced with construction of the Federal project. The tax base is directly related to property values and would rise along with it. Additional income and sales tax revenues which would accompany any increased commercial development and employment would also add to the tax base. Increased park attendance would increase demands on local public facilities and services. The only direct impact of the Recommended Plan on public facilities would be the protection against shoaling of Berger and McHenry Ditches (county drainage ditches) with jetties. The development of Maumee Bay State Park would be an asset to the

Toledo area and should increase the regional growth potential. Employment would increase briefly during construction. Local employment may increase as commercial development increases to service the needs of park users. Visitors to the park would increase business at existing outlets. Since the surrounding area is mainly rural, new retail establishments may open. Existing zoning regulations would limit such growth to major intersections in the area. Approximately 1,200 acres of farmland would be displaced by the ODNR development associated with the implementation of the Recommended Plan.

c. Environmental Effects.

The Recommended Plan would not affect any man-made resources. Natural resources, in the form of sand, stone, and earthfill, would be committed for the life of the project. Approximately 200,000 cubic yards (cy) of sand (plus and estimated 5,000 cy for annual nourishment), 134,750 tons of stone 45,200 cy of earthfill, and 4,500 cy of topsoil would be used in the construction of Alternative 3c. An unspecified amount of fuel would be consumed by construction equipment. The use of construction equipment would result in a short-term degradation in local air quality during initial construction and annual beach nourishment. Increased park usage would also result in increased dust, odors, and vehicle emissions during the recreation season. Possible dredging at offshore borrow areas and placement of this material along the shore would result in a short-term increase in turbidity at both locations. Clearing and grubbing and construction activities at the shore would also cause the suspension of silt and clay particles. Some inadvertent spilling of fuels, oil, and grease may also occur. Dredging at the offshore borrow areas would result in the direct destruction of the existing benthic organisms utilizing those areas. Approximately 26 acres of bottom habitat would be affected during initial construction and 3 acres during annual beach nourishment. While dredging, entrainment of planktonic organisms could occur. The pumping of beach fill along the shore would virtually cover and destroy all benthic organisms present. Recolonization would occur within a year or less. The construction of rubblemound structures (jetties and revetments) would result in the loss of approximately 5 acres of benthic habitat, but at the same time provide at least 1 acre of new, more diverse habitat. Dredging activities would reduce ichthyoplankton numbers through entrainment. Adult fish exhibit avoidance behavior to any major disruptions, including turbidity; therefore, there would be little direct adverse impact on fish. The presence of the wildlife revetment may interfere with fish access to the marsh areas of the wetland. The number and placement of revetment openings will be designed to minimize the impact on fish movement and water quality. No Federal threatened or endangered species or critical habitat would be affected by the implementation of the Recommended Plan. Approximately 25 acres of the present shoreline would be cleared and grubbed and some natural vegetation would be destroyed. Revetment construction would have a significant long-term beneficial impact on wetland habitat in the park, although construction would necessitate the loss of some wetland areas (2.2 acres would be lost by the construction of a revetment abutting the shoreline). During future engineering and design, attempts will be made to minimize this impact and the amount of clearing and grubbing by locating the revetment as far offshore as feasible), future losses caused by erosion (1.2 acres annually) would be prevented.

d. Environmental Features of the Recommended Plan.

(1) Environmental Features of Alternative 3c - No specific fish and wildlife mitigation needs were identified during plan formulation. However, several environmental features have been incorporated into the Recommended Plan. All shoreline structures would be constructed of large rock riprap, thereby providing a more diverse aquatic habitat and benefiting local fisheries. Adverse impacts to the aesthetic qualities of the area would be less severe than if steel sheet pile or concrete structures were used. The proposed storm dune behind the beach would be vegetated to stabilize the dune, to prevent the loss of sand to inland areas, and to provide a travel lane for wildlife. The proposed wildlife revetment would be sited as far lakeward as feasible to avoid disruption of the wetland. One or more gaps would be located in the revetment at those locations which would provide for optimum water circulation and fish movement into and out of the marsh areas of the wetland. Dredging-related impacts, including turbidity, are considered to be best addressed by employing efficient and environmentally acceptable dredging practices. Scheduling the dredging and placement of beachfill during periods of reduced biological activity would minimize the disruption/destruction of fish spawning, juvenile fish, and benthic organisms.

SECTION 6
PLAN IMPLEMENTATION

INSTITUTIONAL REQUIREMENTS

The Recommended Plan for shoreline protection/beach restoration would be implemented over a period of several years. The steps necessary to implement the plan are as follows:

a. Review and approval of this report by the Board of Engineers for Rivers and Harbors.

b. Coordination with the Governor of Ohio and interested Federal agencies at the Washington level by the Chief of Engineers to obtain thier views and comments.

c. Review of the Chief of Engineers report and other agencies views and comments by the Office of Management and Budget to determine consistency with administration goals and guidelines.

d. Review, approach, and forwarding to Congress by the Secretary of the Army of the Chief of Engineers' reports accompanied by this report, views and comments of the Governor and interested Federal agencies, and views and comments of OMB.

e. Congressional authorization and funding.

f. Receipt of required assurances of local cooperation from the Local Cooperator, presently identified as the Ohio Department of Natural Resources.

g. Advanced engineering and design, and award of the construction contract by the Corps.

DIVISION OF PLAN RESPONSIBILITIES

Federal and non-Federal responsibilities for implementation of the Recommended Plan are outlined. The non-Federal interest having responsibility for implementation action is the Ohio Department of Natural Resources acting for the State of Ohio. ODNR is a duly authorized public body capable of entering into a written contract with the U.S. Government and otherwise fulfilling the required items of local cooperation.

The cost-sharing requirements of the Recommended Plan are shown in Table 15. The costs of initial construction and periodic nourishment are shared 70 percent Federal and 30 percent non-Federal, except for construction of the concrete walkways on the jetties which are for land-based fishing and cost shared on a 50-50 basis, aids-to-navigation which are 100 percent Federal, lands which are 100 percent non-Federal, and associated ODNR development costs which are 100 percent non-Federal. It should be noted that final cost-sharing is subject to financial arrangements which are satisfactory to the President and the Congress.

Table 15 - Cost-Sharing Requirements for the Recommended Plan (1)

Item	Total Cost $	Federal Share $	Non-Federal Share $
FIRST COSTS (2)			
Federal Project	11,830,000	8,136,900	3,693,100
ODNR Development	3,330,000	-	3,330,000
Totals	15,160,000	8,136,900	7,023,100
ANNUAL CHARGES (3)			
Federal Project	1,276,000	771,300	504,700
ODNR Development	401,000	-	401,000
Totals	1,677,000	771,300	905,700

(1) October 1983 price levels, 50-year project life, and 8-1/8 percent interest rate.
(2) See Table 8 in previous section for details.
(3) See Table 9 in previous section for details.

In addition to the above cost-sharing requirements, the local sponsor will be required to provide certain items of local cooperation. These items are specified in the Recommendations Section of this report.

VIEWS OF THE LOCAL SPONSOR

The Ohio Department of Natural Resources will serve as local sponsor for the recommended plan. ODNR has indicated its support of the plan, most recently by letter dated 14 November 1983 stating that the Department "will not and cannot develop the lodge, cabins, and ancillary facilities without total shoreline protection. Accordingly, our participation in any Federally authorized project is contingent upon this factor." The Recommended Plan meets this requirement.

ODNR, by letter dated 1 July 1982, stated its intent to provide the items of local cooperation as then written. However, recent developments (November 1983) resulted in some changes to the "items." These changes can be addressed by the State of Ohio during coordination of the Final Report with the Governor by the Chief of Engineers.

NON-FEDERAL RESPONSIBILITIES

The State of Ohio, acting through the Ohio Department of Natural Resources would be responsible for providing the items of local cooperation, in addition to the non-Federal share of the final cost of construction. The State would also be responsible for funding 30 percent of the periodic beach nourishment costs. They would be responsible for all of the maintenance costs of the structural features of the Recommended Plan. In addition, the State will construct, operate, and maintain all recreational facilities appurtenant to the Federal shoreline protection/beach restoration project.

REQUIRED REAL ESTATE

The project will be totally constructed within Maumee Bay State Park, all of which is owned by the State of Ohio, and administered by the Ohio Department of Natural Resources. The real estate requirements for the Federal project are presented in the "Items of Local Cooperation" contained in the Recommendations section of this report.

FEDERAL RESPONSIBILITIES

The Federal Government would be responsible for providing the Federal share of the final cost of construction, and for carrying out the initial construction activities if a shore protection/beach restoration project is authorized for construction. They would provide aids to navigation on the offshore breakwaters and would be responsible for maintaining these aids. In addition, the Federal Government would cost-share in the periodic nourishment for the 50-year economic life of the project.

SECTION 7
COORDINATION

GENERAL

In 1975, the Detroit District of the Corps agreed to assist the Ohio Department of Natural Resources in evaluating the feasibility of providing erosion protection of Lake Erie at Maumee Bay State Park under the Section 103 Continuing Authority Program. The Corps began the study by contacting area officials, Governmental representatives, and local newspapers. Pertinent informaton concerning this matter was requested. In November 1976, the Section 103 Reconnaissance Report on Shore Erosion was issued and approved. The results of this reconnaissance study were then discussed with ODNR (project sponsor) at which time ODNR indicated the desire to obtain specific Congressional project authorization because of the disproportionate cost to be borne by the State under the Continuing Authority program. It was agreed that the existing 1974 House resolution authorizing the Western Lake Erie Shore Study should be used as the vehicle to obtain specific project autorization.

Funding for additional work was first made available in Fiscal Year 1979. At that time, monies were made available to begin feasibility studies of shoreline protection/beach restoration for Maumee Bay State Park under the Western Lake Erie Shore Study Authorization.

COORDINATION WITH KEY AGENCIES

This Feasibility Report is the result of a joint study effort involving Federal and State agencies. Principal study participants were representatives of U.S. Army Engineer District, Buffalo, U.S. Fish and Wildlife Service from the Columbus, Ohio, field office, and the Ohio Department of Natural Resources. The U.S. Fish and Wildlife Service prepared Interim and Draft Fish and Wildlife Coordination Act Reports for the preliminary and final stages of the study, respectively. Their Final Coordination Act Report is included in this report as Appendix G.

Copies of the Draft Final Feasibility Report and Draft Environmental Impact Statement dated December 1981 (revised April 1982) for this project were distributed to the political leaders in the area, and to various local, State, and Federal agencies for thier review and comment. Copies of the report were also supplied to local libraries for review by the general public and various civic groups. Personal copies of the report were also made available to interested parties free of charge. In addition, in accordance with National Environmental Policy Act (NEPA) procedures, the report was filed with the U.S. Environmental Protection Agency (EPA) for a 45-day NEPA review. The Notice of Availability of the Draft EIS was published in the Federal Register by EPA on 14 May 1982. The official 45-day review period for the Draft EIS extended from 15 May 1982 to 28 June 1982. Copies of letters from the public providing their comments and the Corps responses are provided in Appendix J.

Subsequent to submission of the Final Report to the Board of Engineers on 30 August 1983, several concerns and issues have been raised at that level that required recoordination with the Ohio Department of Natural Resources and the U.S. Fish and Wildlife Service who are the principal agency participants for this study. One concern led to a modification from the Recommended Plan presented in the September 1982 (revised June 1983) version of the Final Report. This change was recoordinated with U.S. Fish and Wildlife Service in conformance with requirements of the 1958 Coordination Act. Their letter of concurrence with this modified plan dated December 1983 is included in Appendix G. The Ohio Department of Natural Resources has been kept abreast of developments and their views solicited on proposed changes to the previously Recommended Plan.

PUBLIC COORDINATION

Coordination and direction for the study has been achieved through a series of workshops. Orientation workshops were held at the beginning of the preliminary and final stages of study. In addition, technical workshops were held throughout the course of the study to discuss and review the various alternatives as they developed. To date, a total of seven workshops have been held and copies of the minutes of the meetings are provided in this report in Appendix F.

In addition to the seven technical workshops conducted specifically for the Maumee Bay Study, Orientation Workshops for the overall Western Lake Erie Shore Study were held on 10 and 11 January 1979. Various officials and citizens were in attendance at these meetings, and numerous public and private organizations were reprinted. Maumee Bay State Park and ODNR's development were discussed at the 10 January 1979 workshop.

On 4 June 1981, the Corps conducted a Public Meeting at Oak Harbor, OH, to discuss the results of the Reconnaissance Report for the Western Lake Erie Shore Study. Discussions at this time also included the current status and plans for this Maumee Bay State Park Shoreline protective beach restoration study. See Appendix F, Exhibits 1 through 7, for summary minutes of workshops and meetings.

SECTION 8
CONCLUSIONS

Maumee Bay State Park, as envisioned, will ultimately provide a full range of recreational activities on a 1,855-acre site off Maumee Bay. The proposed park and beach will satisfy a portion of the recreational need for camping, swimming, and other activities for the city of Toledo and adjacent areas. Full development of the park can only occur with total shoreline erosion protection that incorporates a restored beach as a project feature over the westerly half of the park shoreline, as the existing shoreline is currently eroding at an average rate of about 12 feet per year.

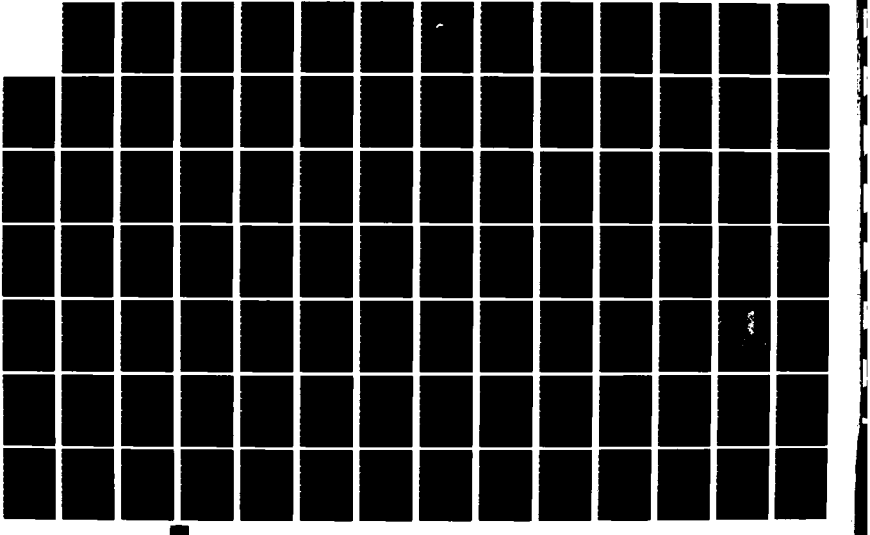
The Corps, at the request and with the assistance of the Ohio Department of Natural Resources, has formulated and selected a plan which will provide a recreational beach and revetment and stabilize the entire 11,000 feet of park shoreline. This Selected Plan is Alternative 3c and would provide a sand beach 5,500 feet long X 250 feet wide over the western half of the park, with additional protection provided by eight offshore rubblemound breakwaters, each 300 feet long. A rubblemound revetment would be provided along the easterly half of the park to protect this wildlife area and still allow water circulation into and out of the area. Jetties would protect the ditches from clogging due to sand movement. This plan satisfies the Planning Objectives, is economically justified and environmentally sound, and has no known opposition. The plan would provide net annual benefits of $4,030,000 and has a benefit-to-cost ratio of 3.4 to 1.

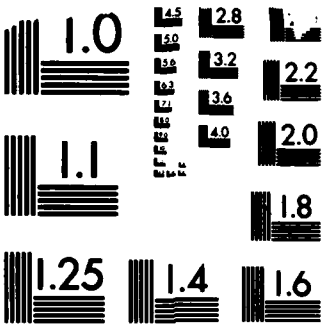
The Selected Plan provides a conservative solution to the beach stabilization uncertainties. The beach should require minimal annual nourishment in the way of sand replenishment no backpassing because of the additional protection provided by the breakwaters.

As formulated, the Selected Plan is implementable, meeting the criteria for engineering, functional, economic, environmental, social, and institutional feasibility. However, ODNR, by letter dated 14 November 1983, has indicated that construction of the lodge/cabin complex requires total shoreline protection, and their participation in any Federal project is contingent upon total protection. Therefore, it would appear that any water resources project not providing total shoreline protection would not be institutionally implementable.

AD-A138 419 MAUMEE BAY STATE PARK OHIO SHORELINE EROSION BEACH RESTORATION STUDY FINA.. (U) CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT DEC 83 2/2

UNCLASSIFIED F/G 13/2 NL





SECTION 9
RECOMMENDATIONS

After consideration of environmental, social, economic, and institutional effects, as well as engineering feasibility, I have concluded that the optimum plan for accomplishing the planning objectives is Alternative 3c (250'W X 5,500'L). I, therefore, recommend that the Selected Plan be authorized for implementation as a Federal project, subject to cost-sharing and financing arrangements with the responsible non-Federal agency sponsoring the project, which are satisfactory to the President and Congress. This plan would provide a protective sand beach 250 feet wide and 5,500 feet long, with offshore breakwaters and a rubblemound revetment, with such modifications as in the discretion of the Chief of Engineers may be advisable for the prevention of shoreline erosion while providing for beach restoration over the western half of the shoreline. The first cost of the Federal project is presently estimated at $11,830,000, with a first cost to the United States of $8,136,900. The associated non-Federal annual operations and maintenance costs are estimated at $156,000. In addition $59,000 would be apportioned for periodic nourishment and beach monitoring ($41,300 Federal, $17,700 Non-Federal).

The project sponsor, the Ohio Department of Natural Resources, has indicated their intent to provide the following Items of Local Cooperation, except for Items c and g, which have recently been changed and, therefore, require recoordination (to be performed during coordination of this report with the Governor of Ohio by the Chief of Engineers):

a. Provide without cost to the United States, all lands, easements, and rights-of-way, including borrow and spoil disposal areas as determined by the Chief of Engineers, necessary for the construction and subsequent maintenance of the project.

b. Contribute in cash 30 percent of the project construction cost, including periodic beach nourishment, to be paid in a lump sum prior to initiation of such work. In the event such work is scheduled over more than one Federal Fiscal Year, said contribution may be made in annual installments over the period of construction at a rate proportionate to the proposed or scheduled apportionment of Federal funds to the project with the final apportionment of cost to be made after actual completion of construction and determination of actual costs;

c. Provide appurtenant facilities shown on the State's Master Plan, for which recreational benefits have been taken;

d. Hold and save the United States free from all claims for damage due to construction, operation, and maintenance of project, except for damage due to the fault or negligence of the Government or its Contractors;

e. Provide without cost to the United States all alterations and relocations to existing improvements including highways, buildings, utilities, sewers, and other facilities which may be required in connection with the construction of the project;

f. Construct permanent park structures and park roads above the 100-year water surface elevation of 577.3 IGLD and consider such elevation when constructing other facilities, which would be significantly affected by high waters;

g. Maintain and repair the protective structures and improvement measures during the useful life thereof as may be required to serve their intended purposes.

h. Control water pollution from within the park to the extent necessary to safeguard the health of the bathers;

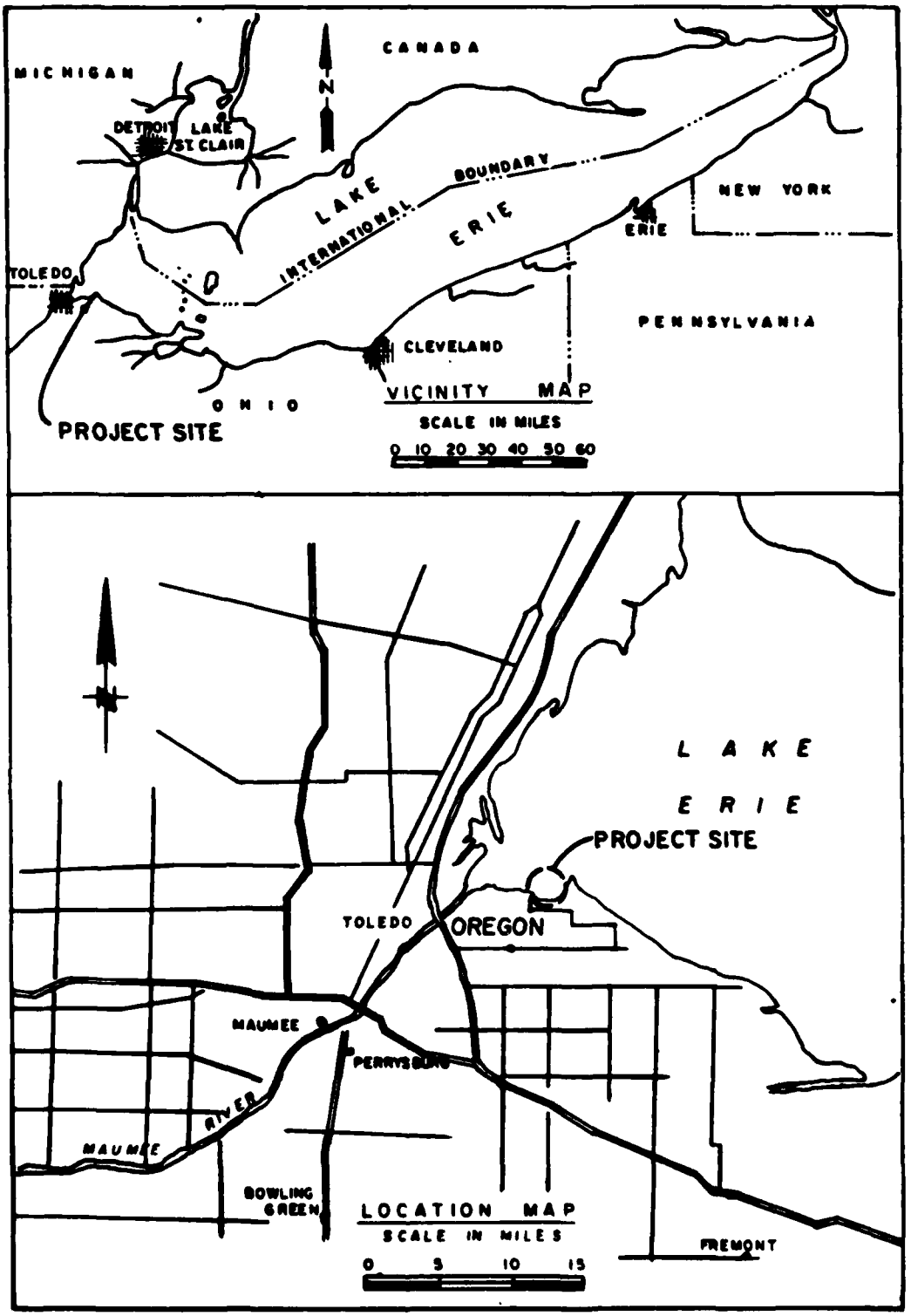
i. Maintain continued public ownership and use of the shore upon which the Federal participation is based during the economic life of the project;

j. Provide and maintain necessary access roads, parking areas, and other public use facilities open and available to all on equal terms; and,

k. Comply with the applicable provisions of the "Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970, Public Law 91-646, approved 2 January 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent maintenance of the project, and inform affected persons of pertinent benefits, policies, and procedures in connection with said Act.

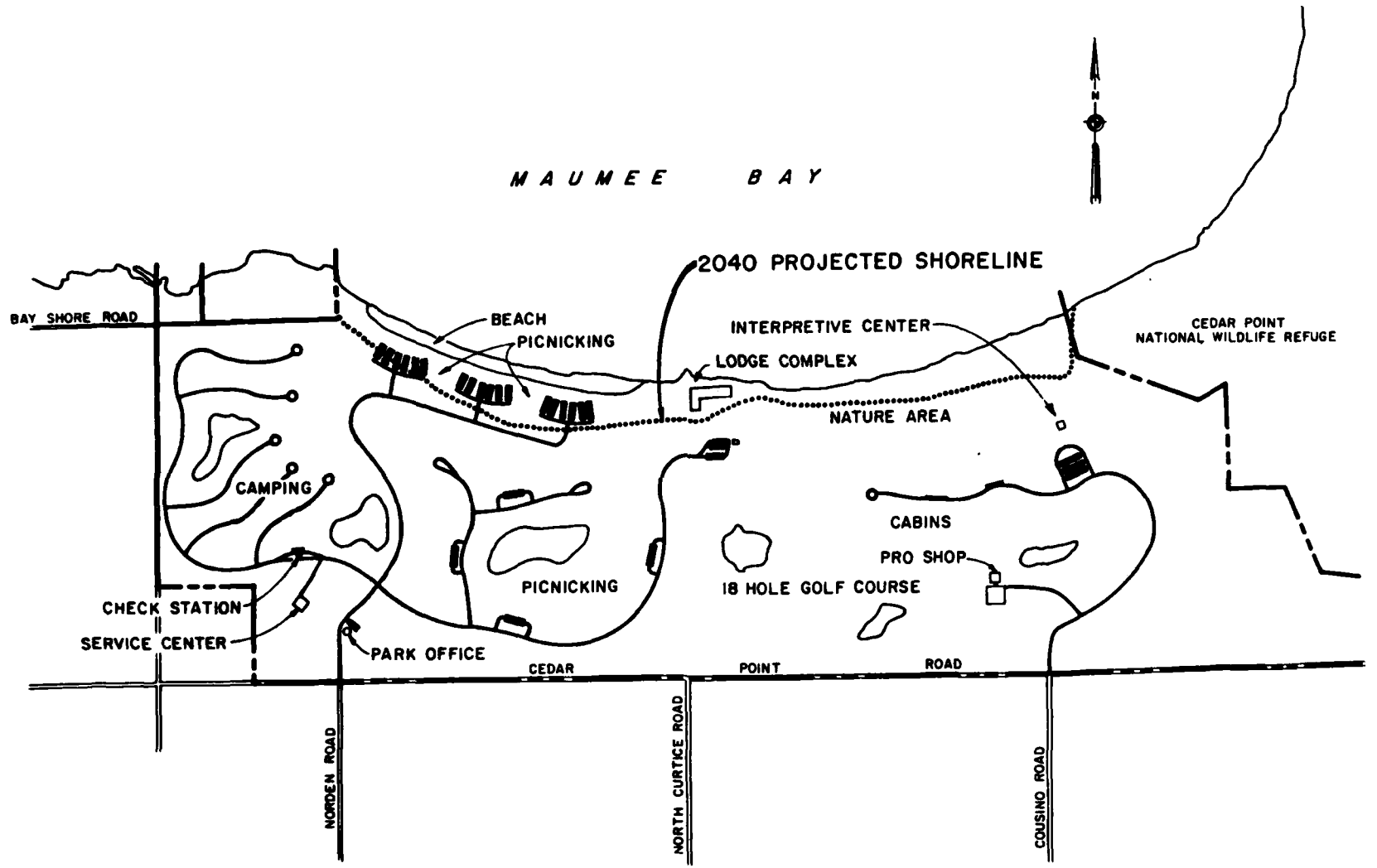
Robert R. Hardiman

ROBERT R. HARDIMAN
Colonel, Corps of Engineers
District Commander



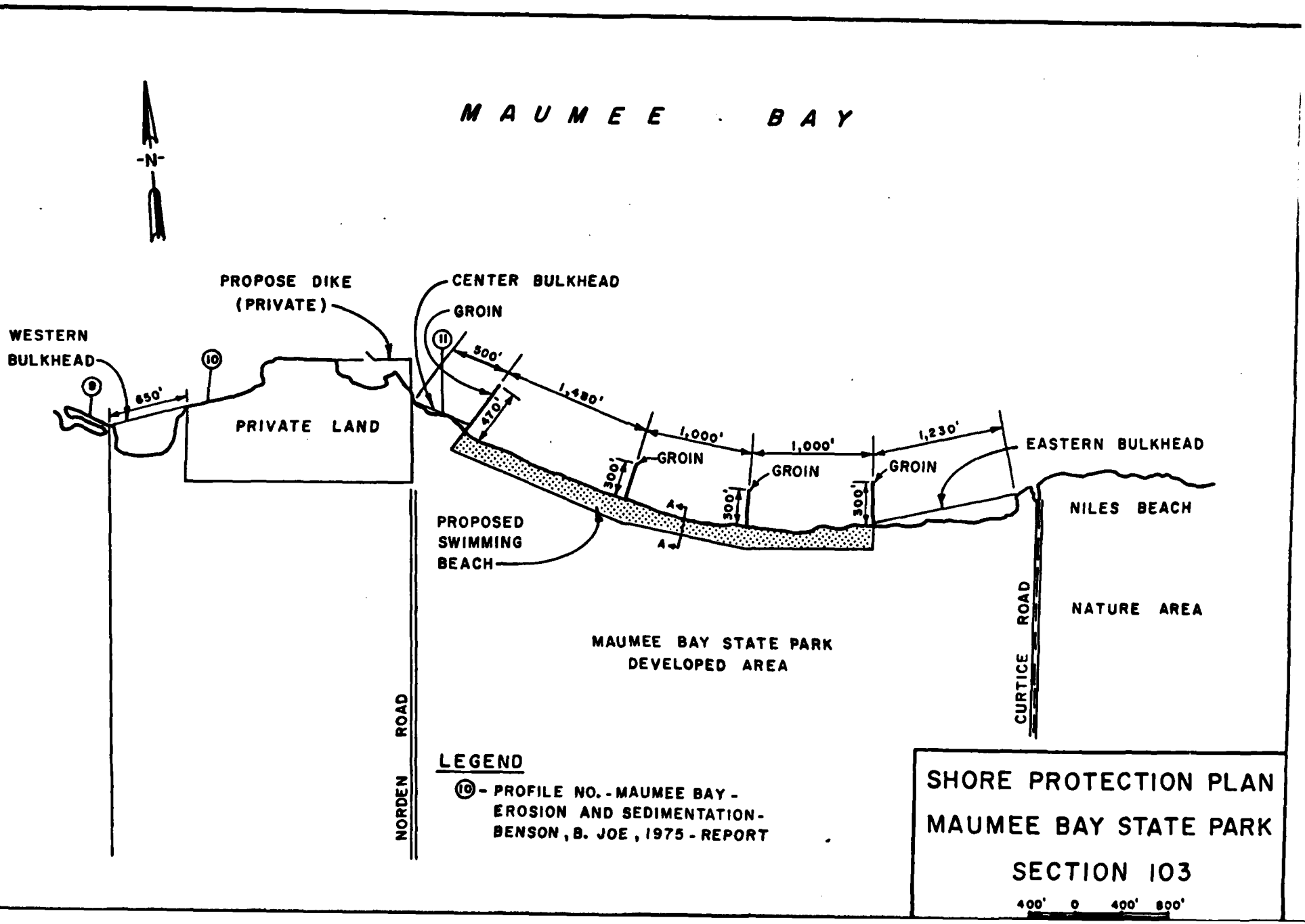
VICINITY AND LOCATION MAPS

PLATE 1



MASTER PLAN WITH PROJECTED 50 YEAR (2040) SHORELINE
MAUMEE BAY STATE PARK, OHIO

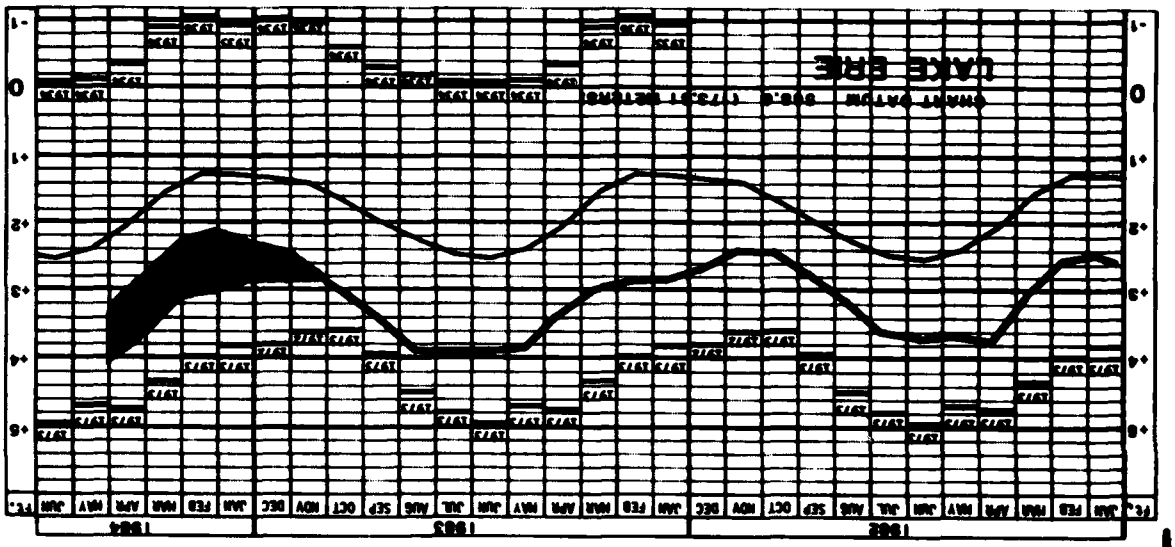
PLATE 2


MAUMEE BAY
-N-
PROPOSE DIKE
(PRIVATE)
CENTER BULKHEAD
GROIN
WESTERN
BULKHEAD
9
10
11
650'
500'
1,480'
470'
1,000'
1,000'
1,230'
PRIVATE LAND
EASTERN BULKHEAD
300'
GROIN
GROIN
GROIN
300'
300'
A
A
PROPOSED
SWIMMING
BEACH
NILES BEACH
NATURE AREA
MAUMEE BAY STATE PARK
DEVELOPED AREA
NORDEN ROAD
CURTICE ROAD
LEGEND
⑩ - PROFILE NO. - MAUMEE BAY - EROSION AND SEDIMENTATION - BENSON, B. JOE, 1975 - REPORT
SHORE PROTECTION PLAN
MAUMEE BAY STATE PARK
SECTION 103
400' 0 400' 800'

88

PLATE

ELEVATION IN FEET REFERRED TO CHART DATUM



LEGEND

LAKE LEVELS

RECORDED

PROBABLE

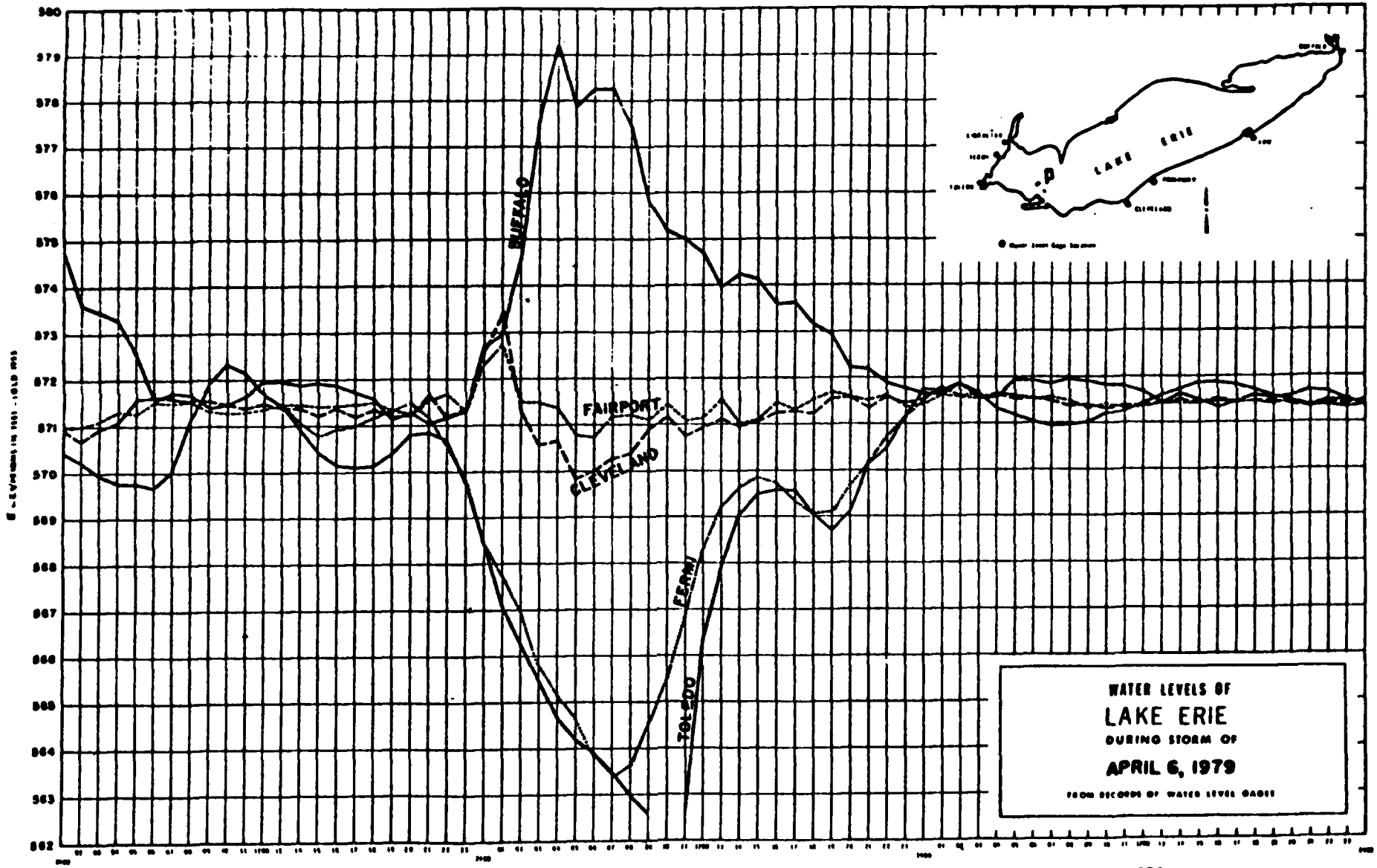
1900–1979 AVERAGE

MAXIMUM	1974	1974	1973	1973
MINIMUM	1936	1934	1926	1934

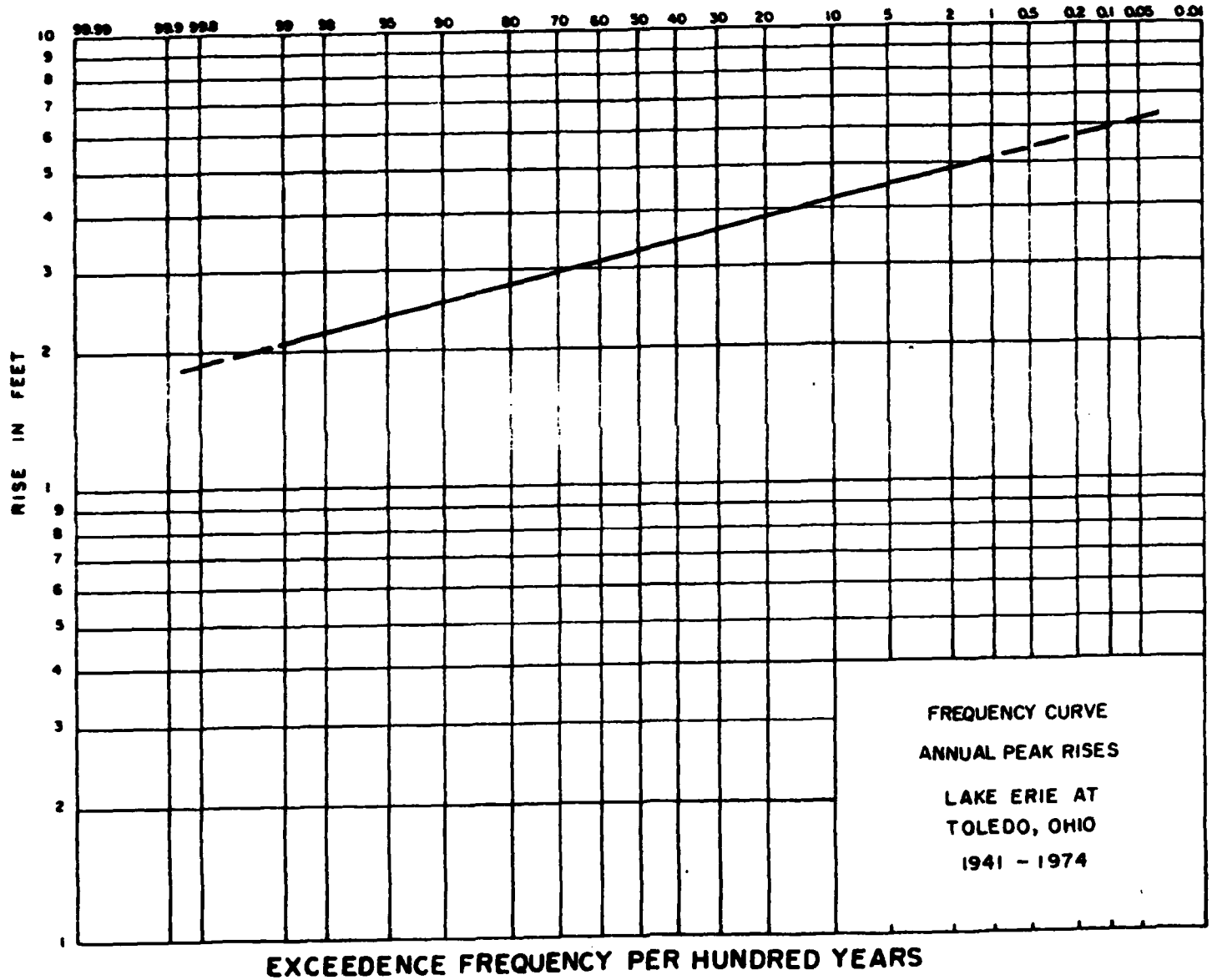
MONTHLY MEAN LEVEL OF LAKE ERIE

PLAT

NATIONAL OCEAN SURVEY, NOAA

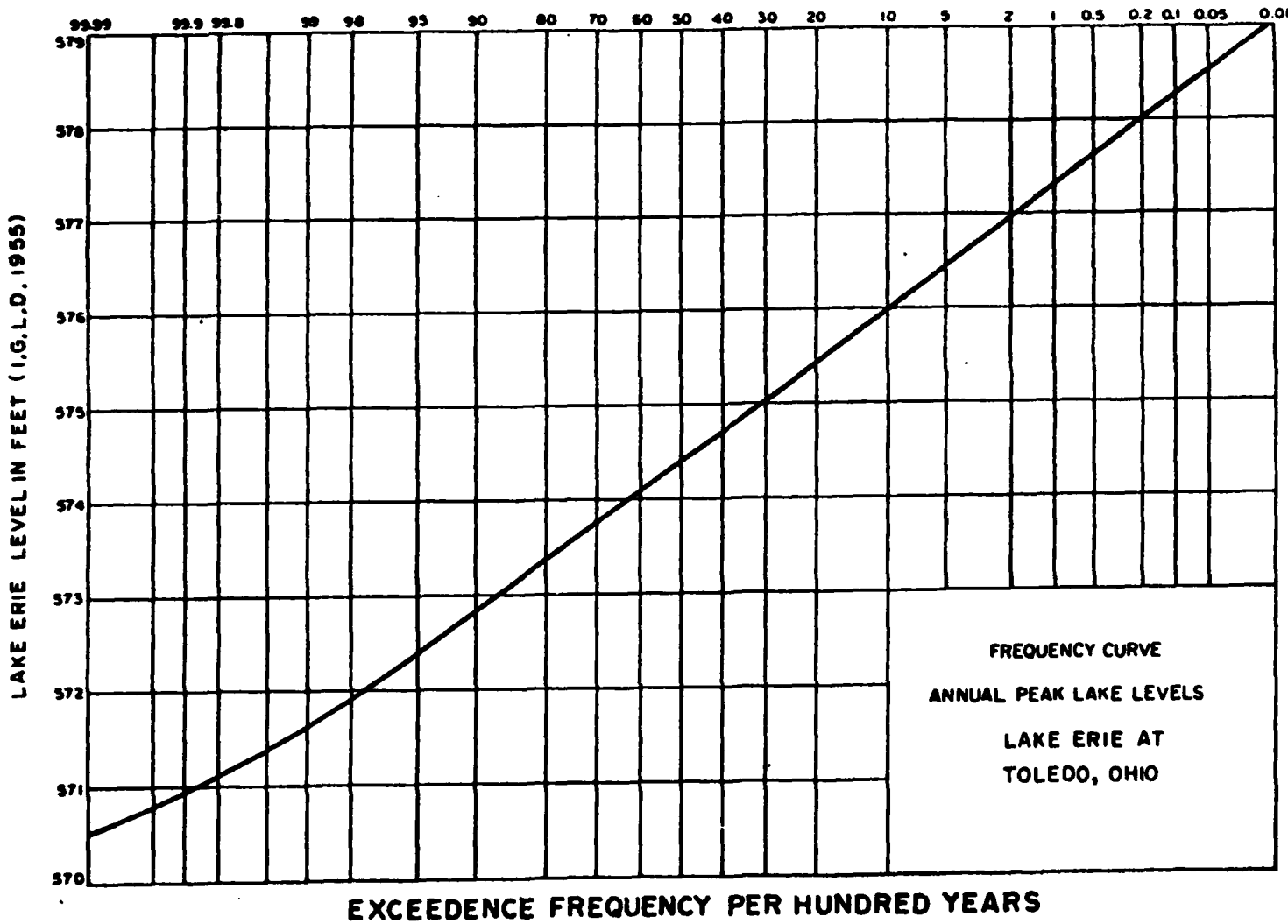


PLATE



SOURCE: STANDARDIZED FREQUENCY CURVES FOR DESIGN WATER LEVEL DETERMINATION ON THE GREAT LAKES. MAY 1979

PLATE 48



SOURCE: STANDARDIZED FREQUENCY CURVES FOR DESIGN WATER LEVEL DETERMINATION ON THE GREAT LAKES, MAY 1979

PLATE 4C

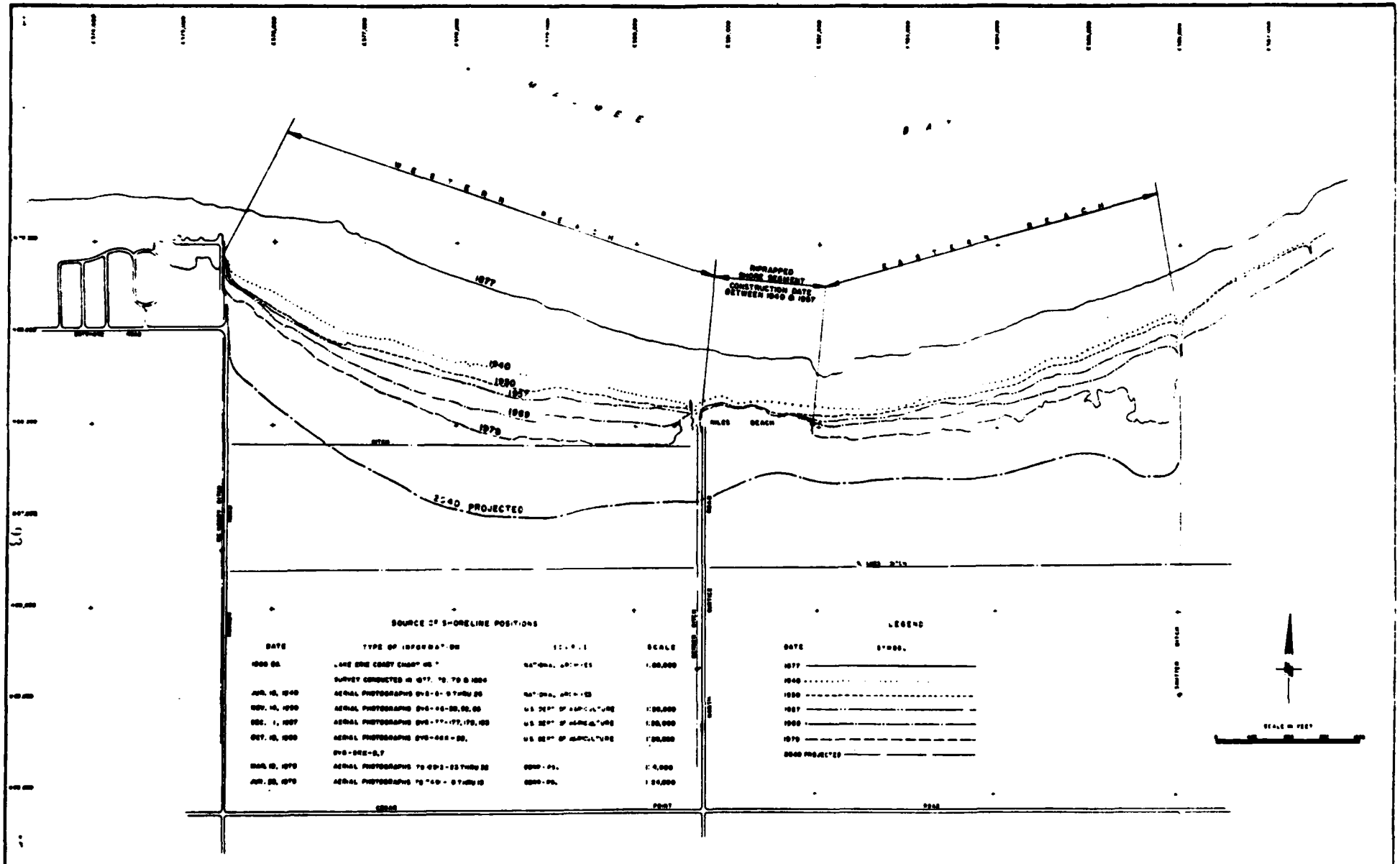
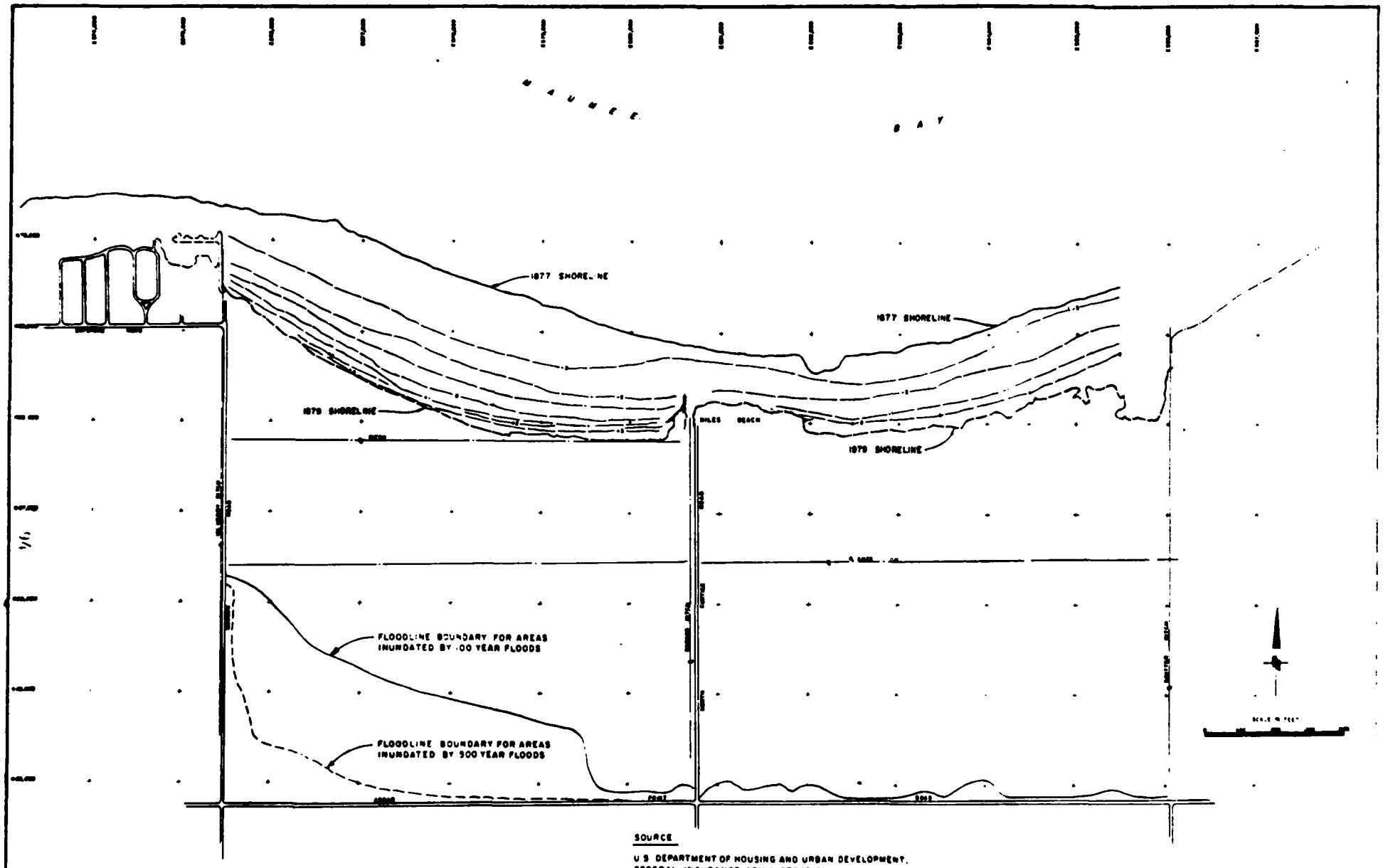


PLATE 5

LUCAS CO., OHIO
MAUMEE BAY STATE PARK
SHORELINE PROTECTION STUDY

HISTORICAL SHORELINES

BUFFALO DISTRICT, CORPS OF ENGINEERS



PLATE

SOURCE

U S DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, FEDERAL INSURANCE ADMINISTRATION

FLOOD BOUNDARY AND FLOODWAY MAP CITY OF OREGON, OHIO LUCAS COUNTY (EFFECTIVE MARCH 15, 1979)

FLOOD HAZARD BOUNDARY MAP LUCAS COUNTY, OHIO, UNINCORPORATED AREAS (EFFECTIVE MAY 20, 1977)

LUCAS CO., OHIO
MAUMEE BAY STATE PARK
SHORELINE PROTECTION STUDY

FLOOD BOUNDARY MAP

BUFFALO DISTRICT CORPS OF ENGINEERS
PREPARED BY [illegible]

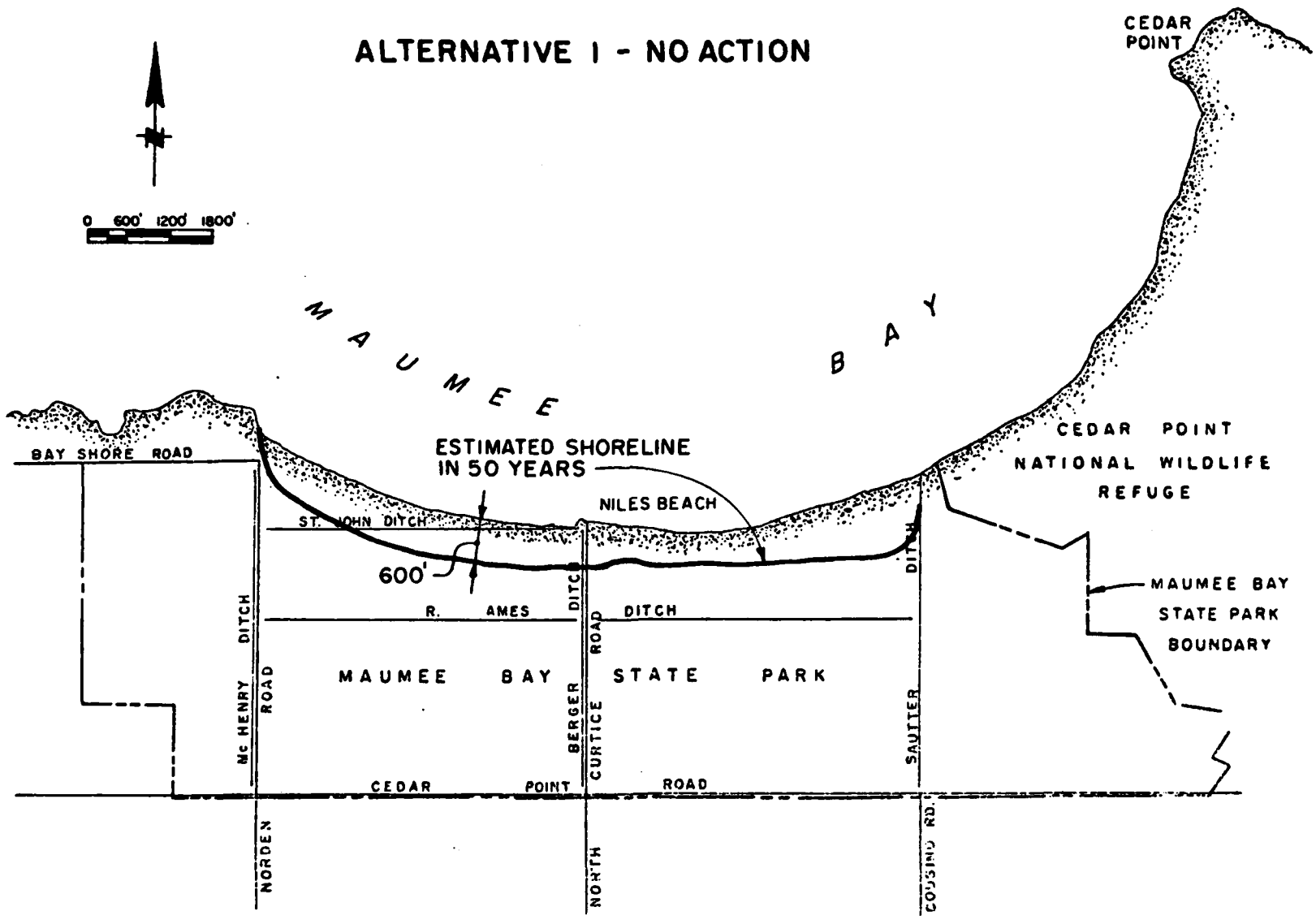

ALTERNATIVE I - NO ACTION
0 600' 1200' 1800'
MAUMEE BAY
CEDAR POINT
CEDAR POINT NATIONAL WILDLIFE REFUGE
BAY SHORE ROAD
ESTIMATED SHORELINE IN 50 YEARS
NILES BEACH
ST. JOHN DITCH
600'
R. AMES DITCH
MAUMEE BAY STATE PARK
MAUMEE BAY STATE PARK BOUNDARY
Mc HENRY ROAD DITCH
BERGER ROAD
CURTICE DITCH
SAUTTER DITCH
CEDAR POINT ROAD
NORDEN ROAD
NORTH CURTICE ROAD
COUSINO RD.

PLATE 7

ALTERNATIVE 2 - PROTECTIVE BEACH AND REVETMENT

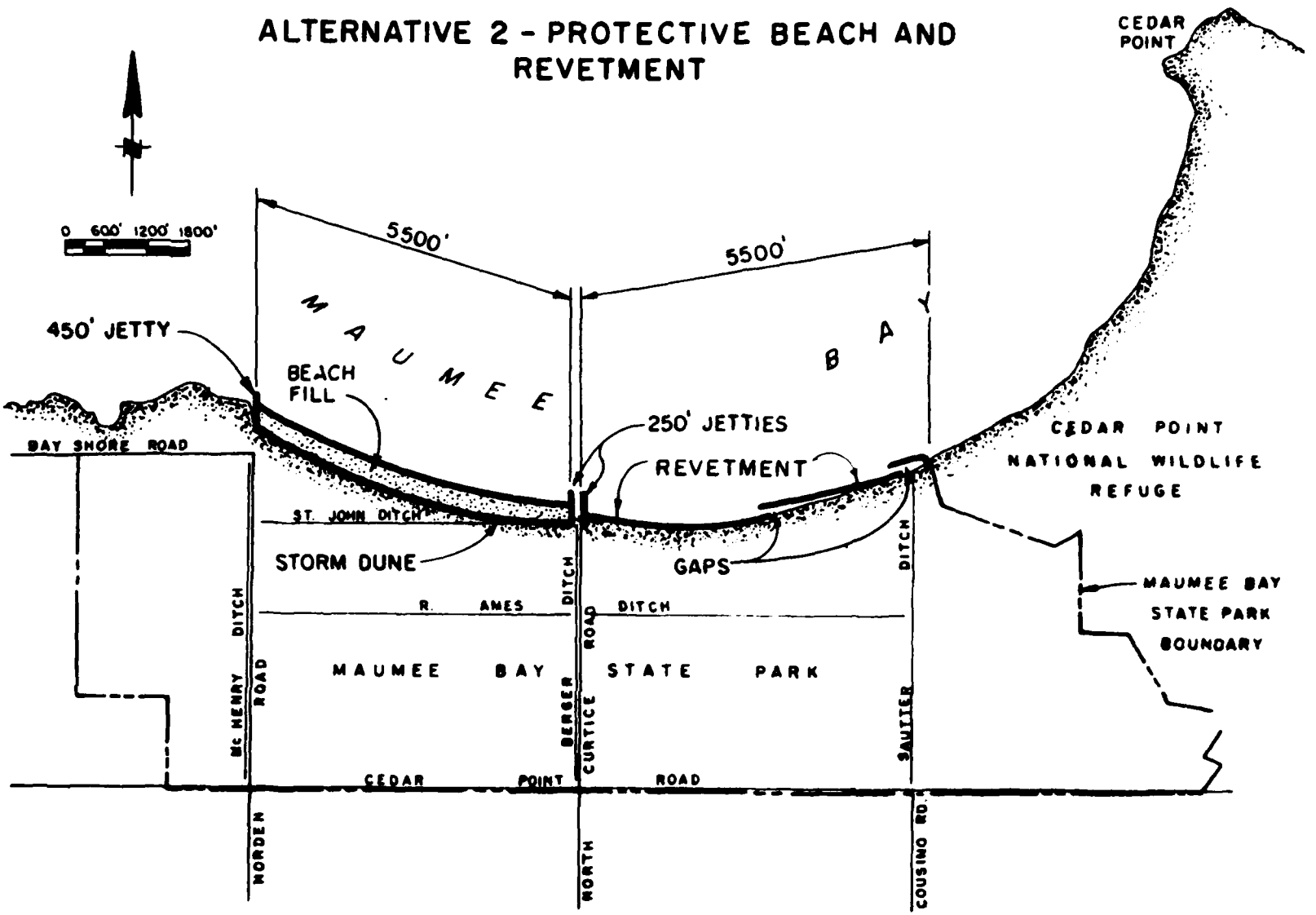
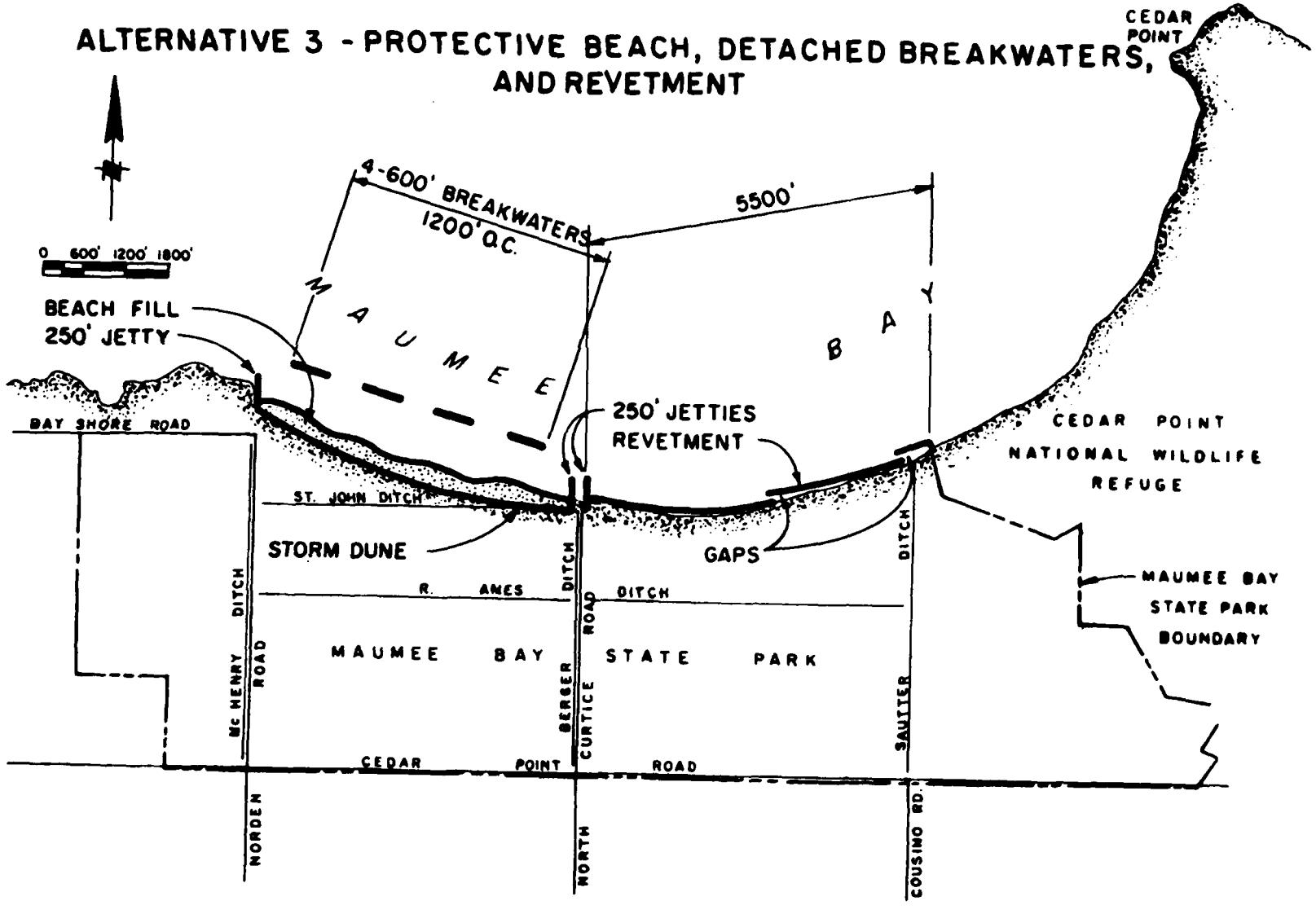
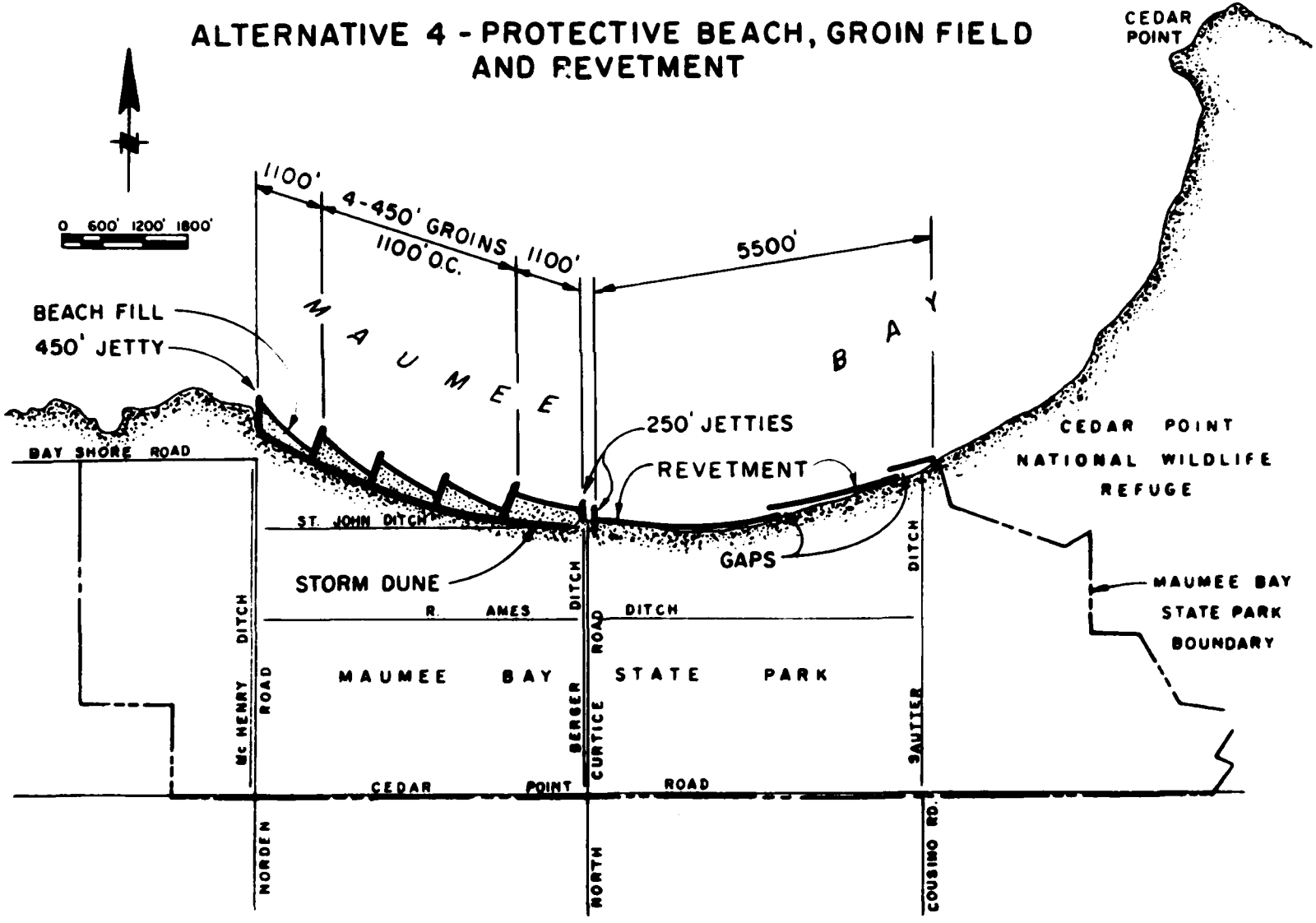


PLATE 96


ALTERNATIVE 3 - PROTECTIVE BEACH, DETACHED BREAKWATERS, AND REVETMENT
CEDAR POINT
4-600' BREAKWATERS
1200' O.C.
5500'
0 600' 1200' 1800'
BEACH FILL
250' JETTY
MAUMEE BAY
250' JETTIES
REVETMENT
BAY SHORE ROAD
ST. JOHN DITCH
STORM DUNE
GAPS
CEDAR POINT NATIONAL WILDLIFE REFUGE
R. AMES DITCH
MAUMEE BAY STATE PARK BOUNDARY
Mc HENRY ROAD DITCH
BERGER ROAD DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CEDAR POINT ROAD
NORDEN
NORTH CURTICE
COUSINO RD.

PLATE

ALTERNATIVE 4 - PROTECTIVE BEACH, GROIN FIELD AND REVETMENT



PLATE

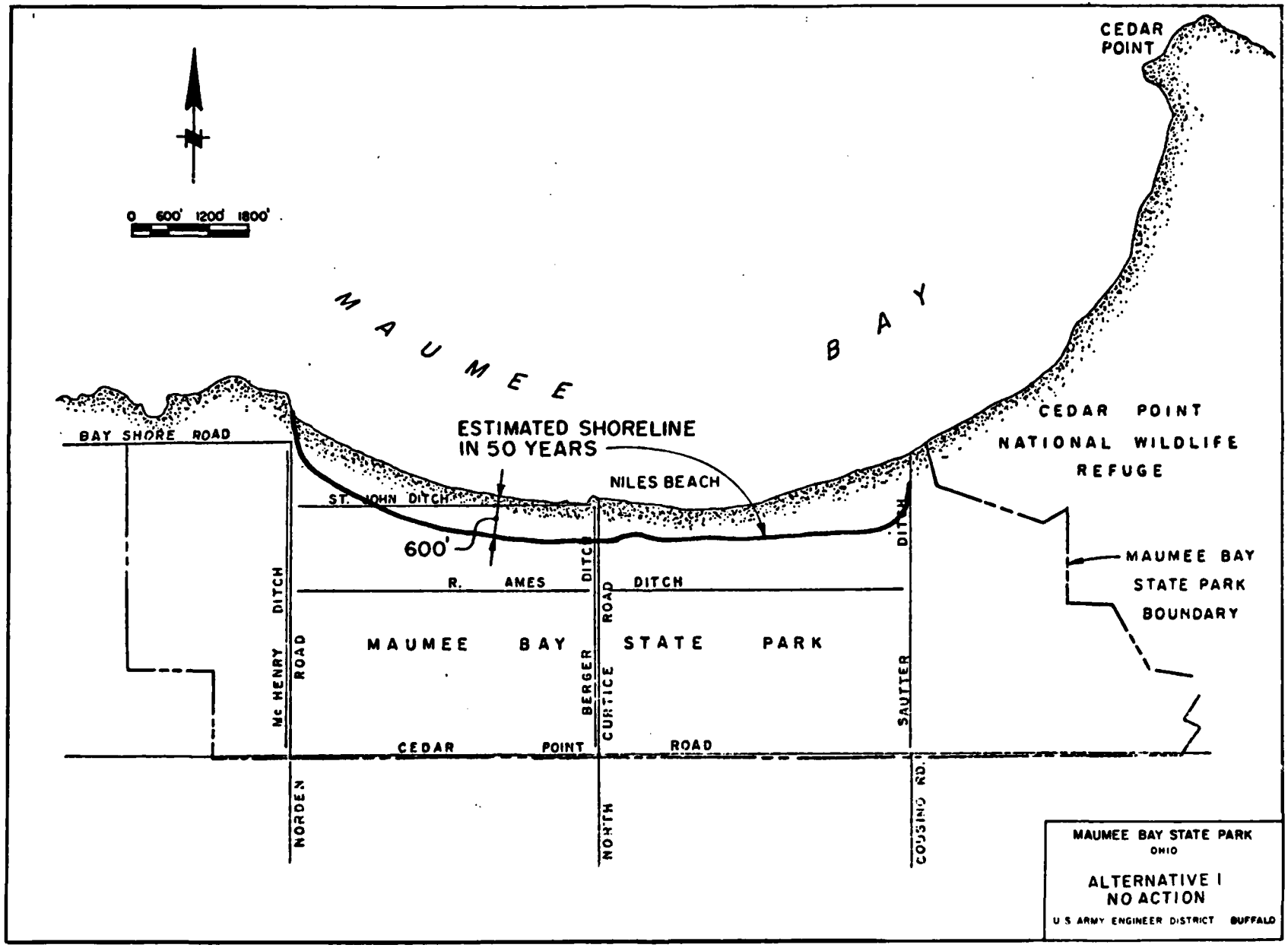

CEDAR POINT
0 600' 1200' 1800'
MAUMEE BAY
BAY SHORE ROAD
ESTIMATED SHORELINE IN 50 YEARS
NILES BEACH
ST. JOHN DITCH
600'
CEDAR POINT NATIONAL WILDLIFE REFUGE
MAUMEE BAY STATE PARK BOUNDARY
R. AMES DITCH
Mc HENRY ROAD DITCH
BERGER DITCH
CURTICE ROAD
SAUTTER DITCH
MAUMEE BAY STATE PARK
CEDAR POINT ROAD
NORDEN ROAD
NORTH
COUSINO RD.
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVE I
NO ACTION
U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE 11

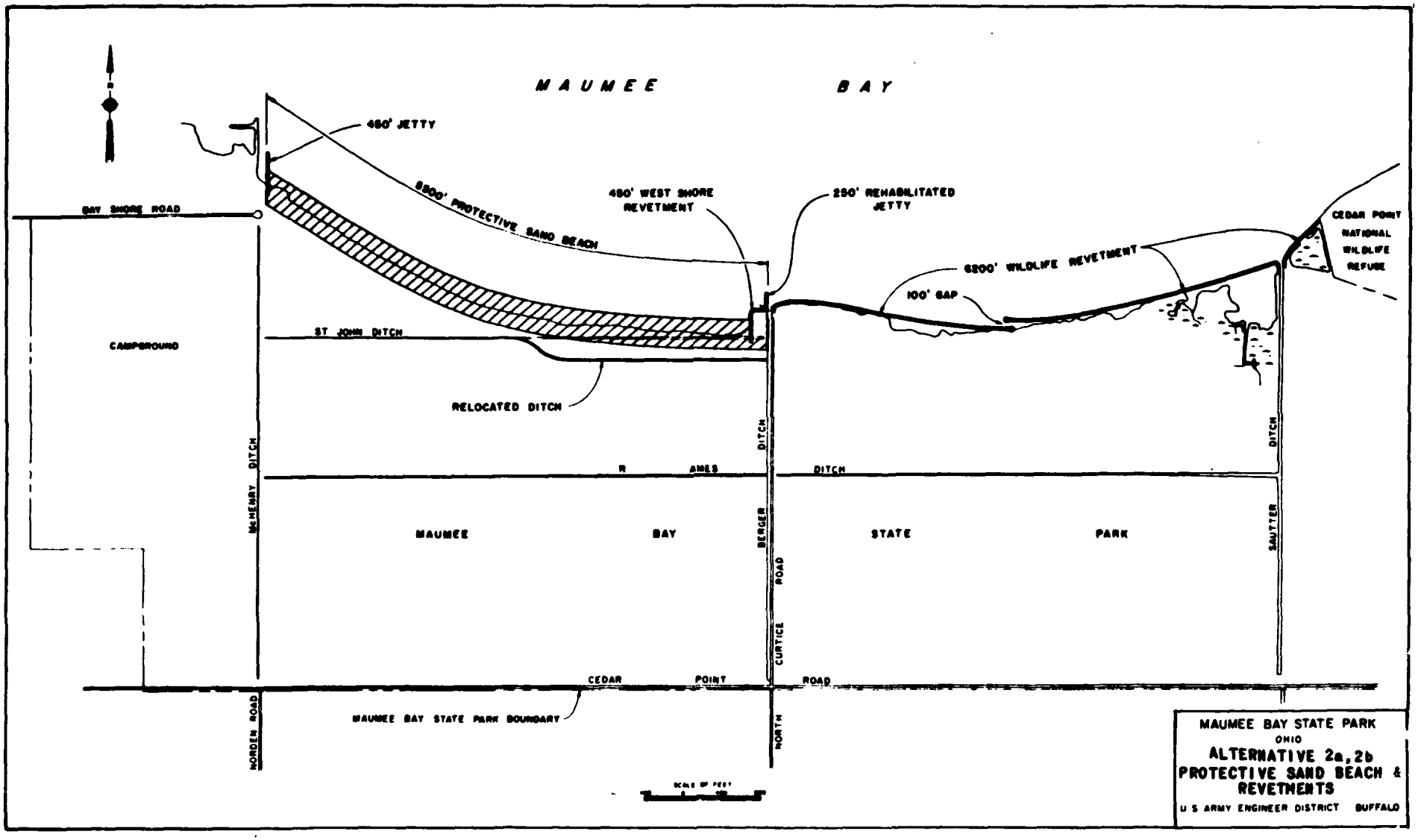

MAUMEE BAY
450' JETTY
8800' PROTECTIVE SAND BEACH
450' WEST SHORE REVETMENT
250' REHABILITATED JETTY
6800' WILDLIFE REVETMENT
100' GAP
CEDAR POINT NATIONAL WILDLIFE REFUGE
BAY SHORE ROAD
CAMPGROUND
ST JOHN DITCH
RELOCATED DITCH
McHENRY DITCH
BERGER DITCH
R AMES DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
NORTH
MAUMEE BAY STATE PARK BOUNDARY
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVE 2a, 2b
PROTECTIVE SAND BEACH & REVETMENTS
U S ARMY ENGINEER DISTRICT BUFFALO

PLATE 12

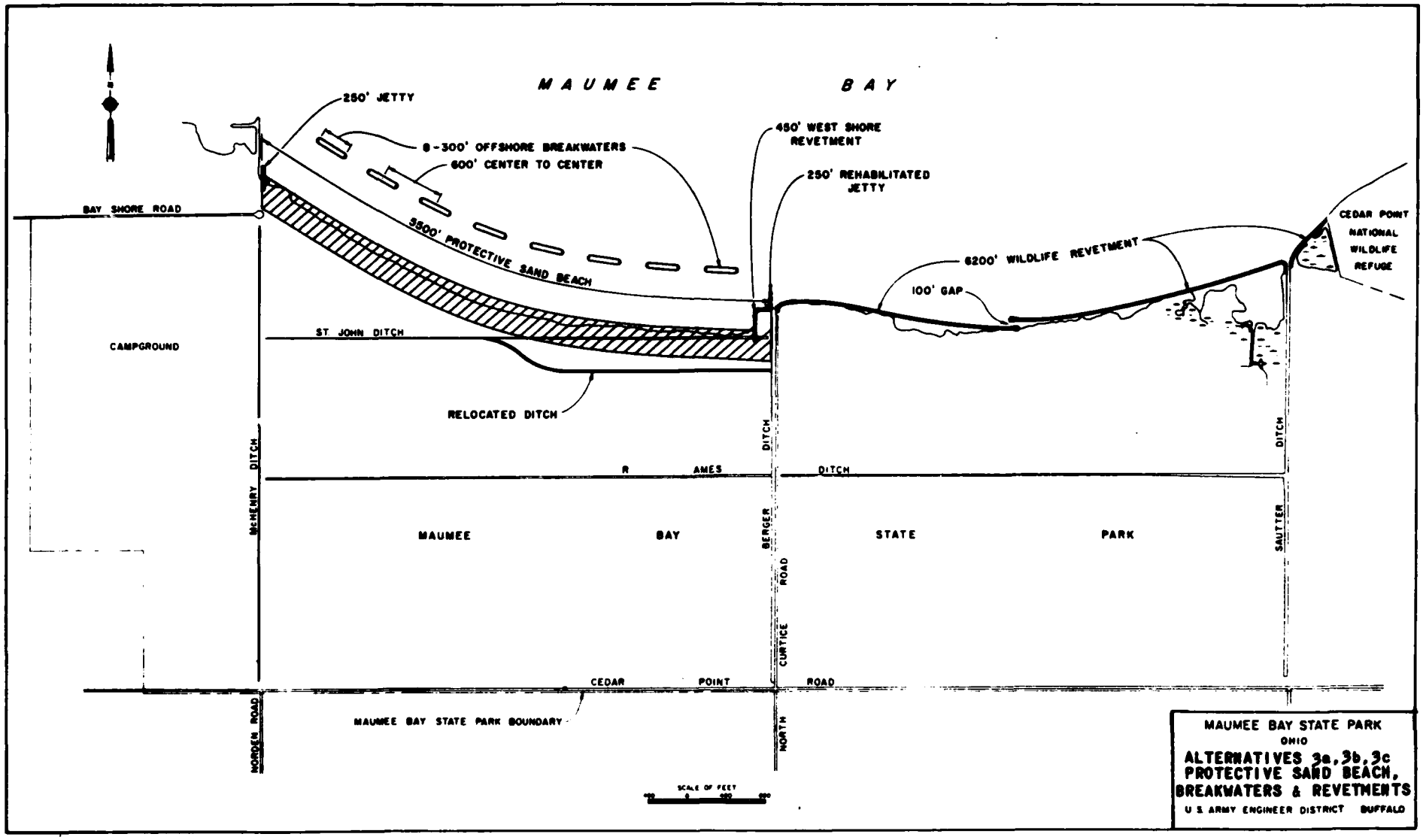

MAUMEE BAY
250' JETTY
8-300' OFFSHORE BREAKWATERS
600' CENTER TO CENTER
450' WEST SHORE REVETMENT
250' REHABILITATED JETTY
BAY SHORE ROAD
3500' PROTECTIVE SAND BEACH
6200' WILDLIFE REVETMENT
100' GAP
CEDAR POINT NATIONAL WILDLIFE REFUGE
CAMPGROUND
ST. JOHN DITCH
RELOCATED DITCH
McHENRY DITCH
R AMES DITCH
BERGER DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
MAUMEE BAY STATE PARK BOUNDARY
NORTH
SCALE OF FEET
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVES 3a, 3b, 3c
PROTECTIVE SAND BEACH, BREAKWATERS & REVETMENTS
U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE 13

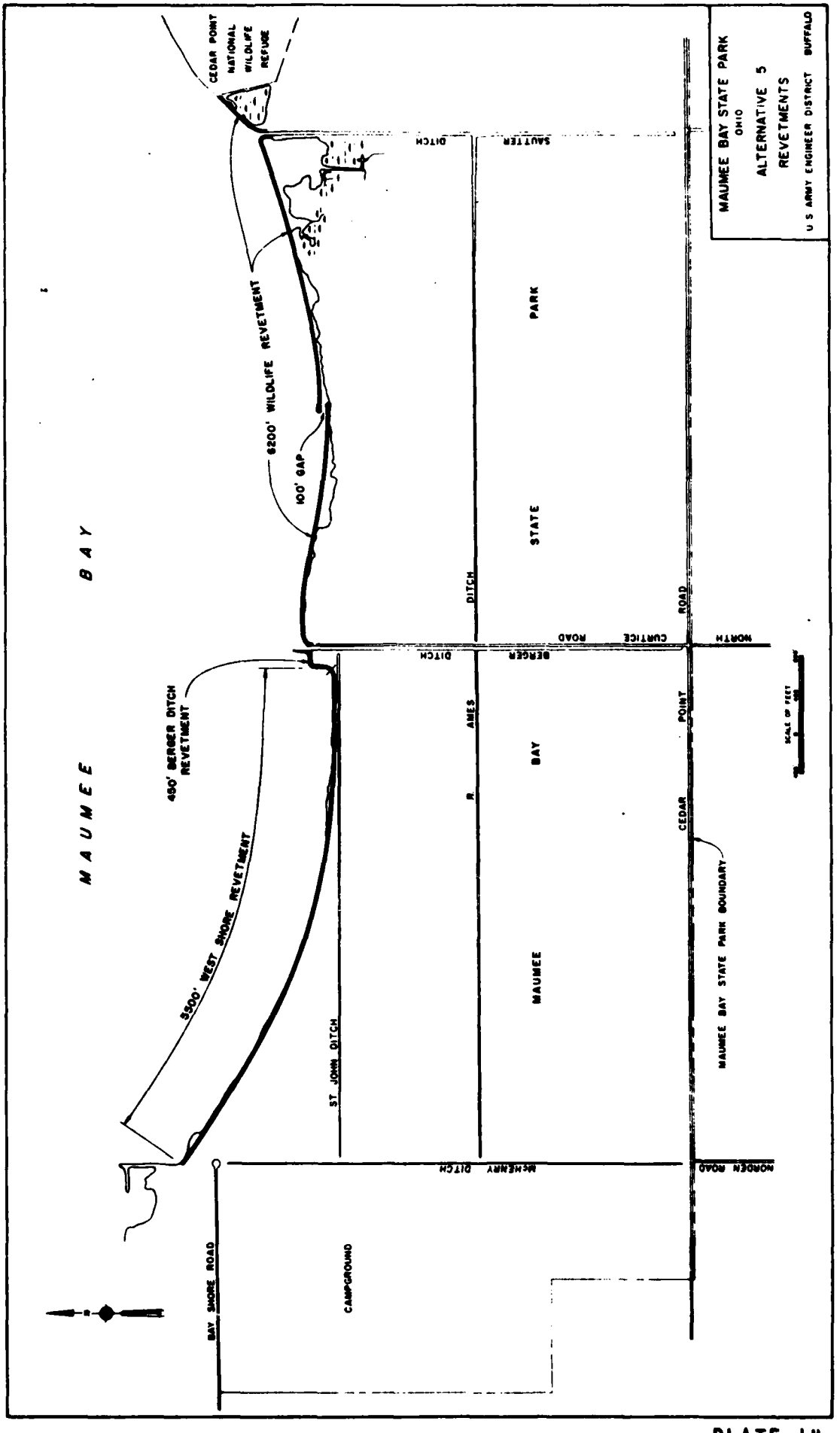
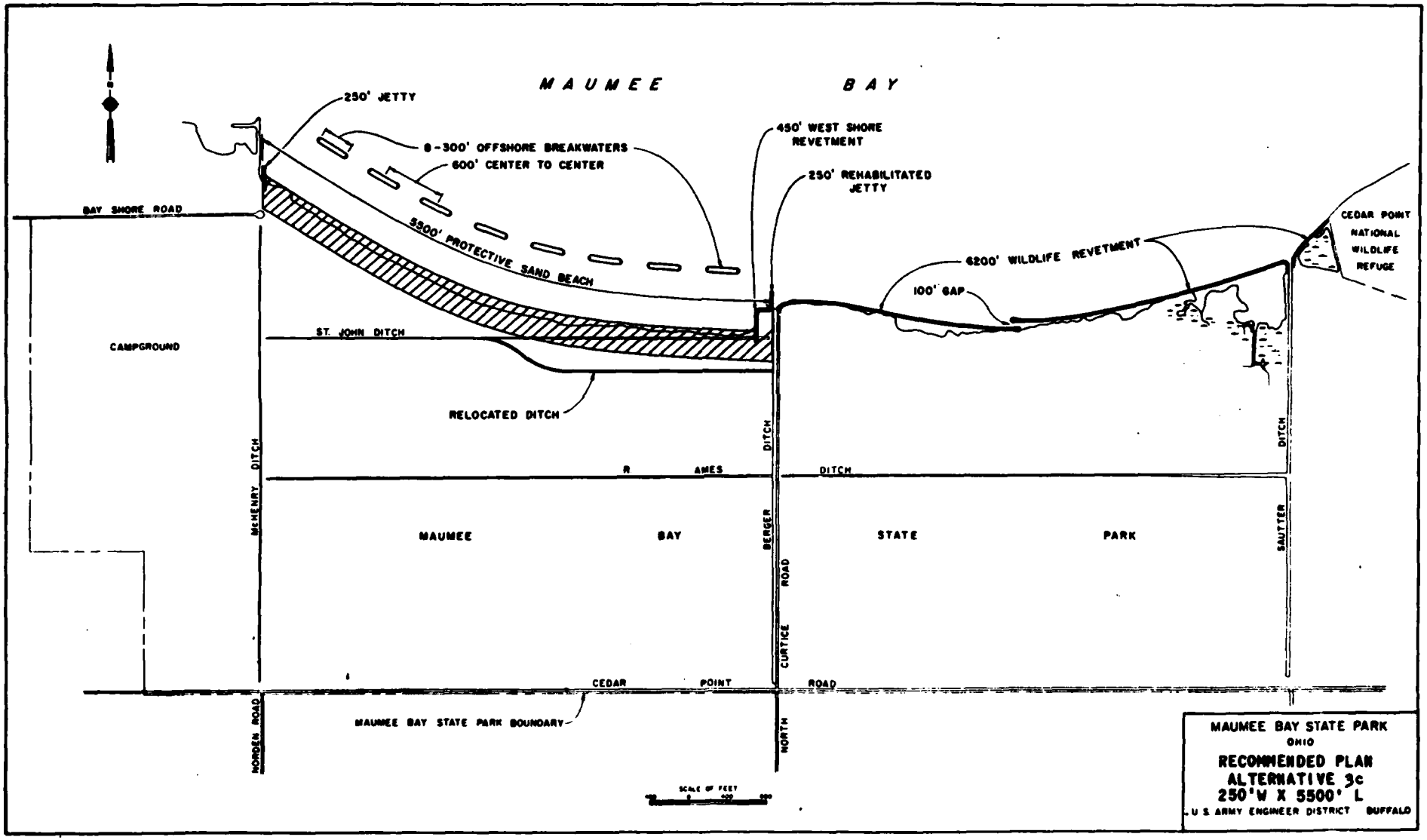
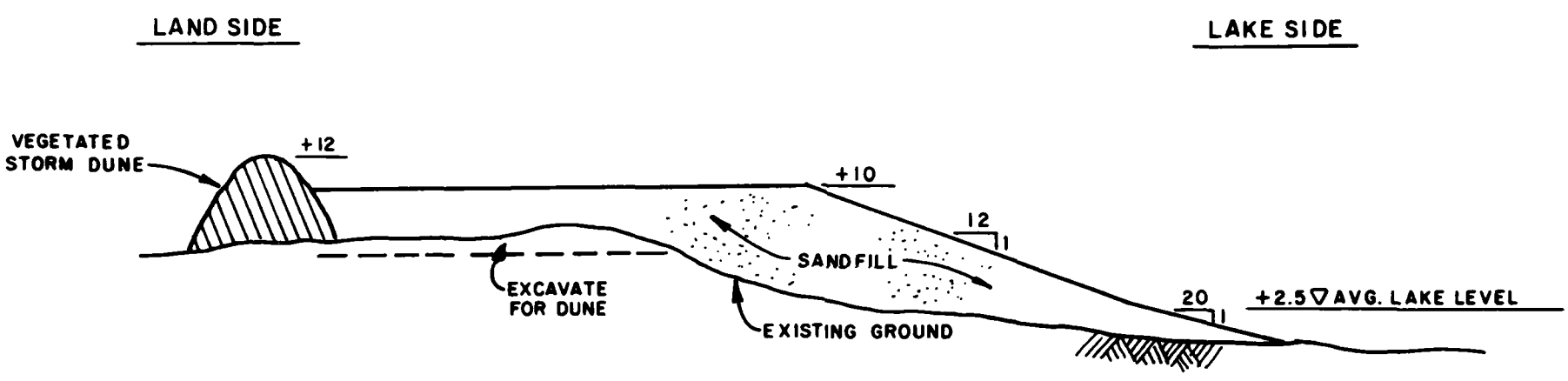

MAUMEE BAY STATE PARK
OHIO
ALTERNATIVE 5
REVETMENTS
U S ARMY ENGINEER DISTRICT BUFFALO
CEDAR POINT NATIONAL WILDLIFE REFUGE
6200' WILDLIFE REVETMENT
100' GAP
450' BERGER DITCH REVETMENT
3500' WEST SHORE REVETMENT
MAUMEE BAY
PARK
STATE
CAMPGROUND
MAUMEE BAY
SAUTTER DITCH
DITCH
CURTICE ROAD
BERGER DITCH
AMES
ST JOHN DITCH
MCHENRY DITCH
NORDEN ROAD
NORTH POINT
CEDAR
MAUMEE BAY STATE PARK BOUNDARY
BAY SHORE ROAD
SCALE OF FEET

PLATE 14


MAUMEE BAY
250' JETTY
8-300' OFFSHORE BREAKWATERS
600' CENTER TO CENTER
450' WEST SHORE REVETMENT
250' REHABILITATED JETTY
BAY SHORE ROAD
5300' PROTECTIVE SAND BEACH
6200' WILDLIFE REVETMENT
100' GAP
CEDAR POINT NATIONAL WILDLIFE REFUGE
CAMPGROUND
ST. JOHN DITCH
RELOCATED DITCH
McHENRY DITCH
BERGER DITCH
R AMES DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
MAUMEE BAY STATE PARK BOUNDARY
NORTH
SCALE OF FEET
MAUMEE BAY STATE PARK
OHIO
RECOMMENDED PLAN
ALTERNATIVE 3c
250'W X 5500' L
U.S. ARMY ENGINEER DISTRICT BUFFALO

103

PLATE 15



TYPICAL SAND BEACH SECTION - ALTERNATIVE 3C
SELECTED PLAN

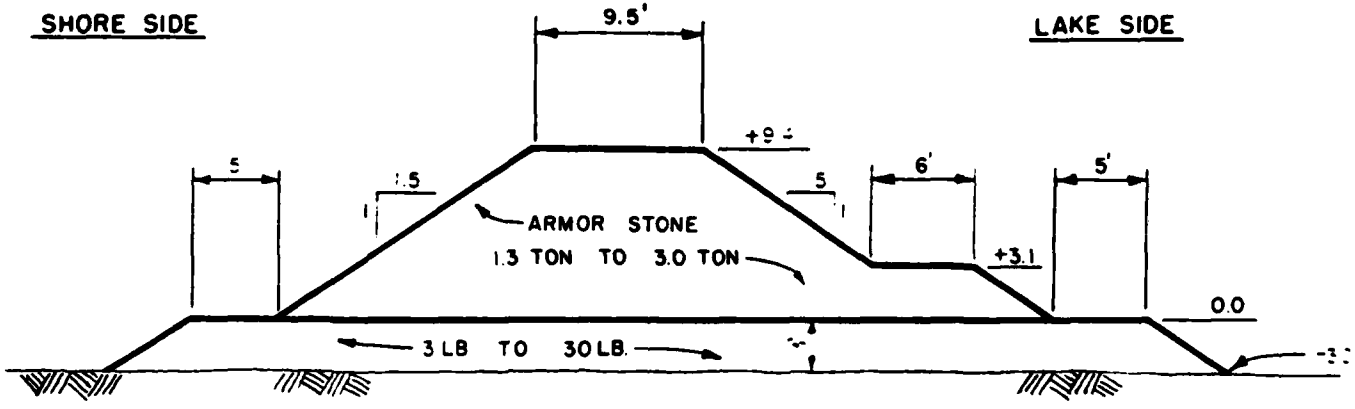
SCALE: HORIZ 1"= 50'
VERT. 1"= 10'

MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3C
TYPICAL SAND BEACH SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE



TYPICAL OFFSHORE BREAKWATER CROSS SECTION

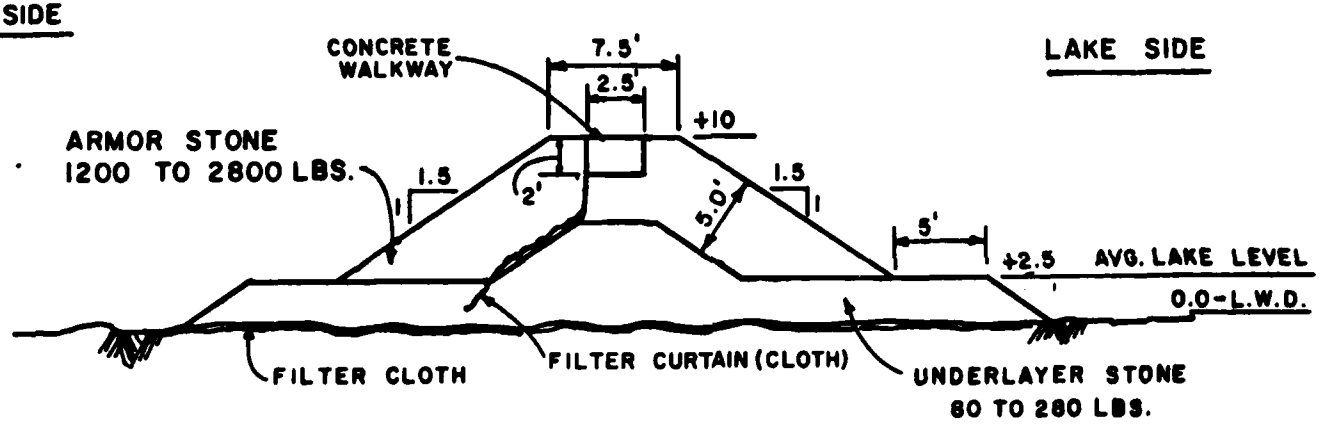
SCALE 1" = 10'

MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3C
TYPICAL OFFSHORE
BREAKWATER SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE 17



TYPICAL JETTY CROSS SECTION

SCALE 1" = 10'

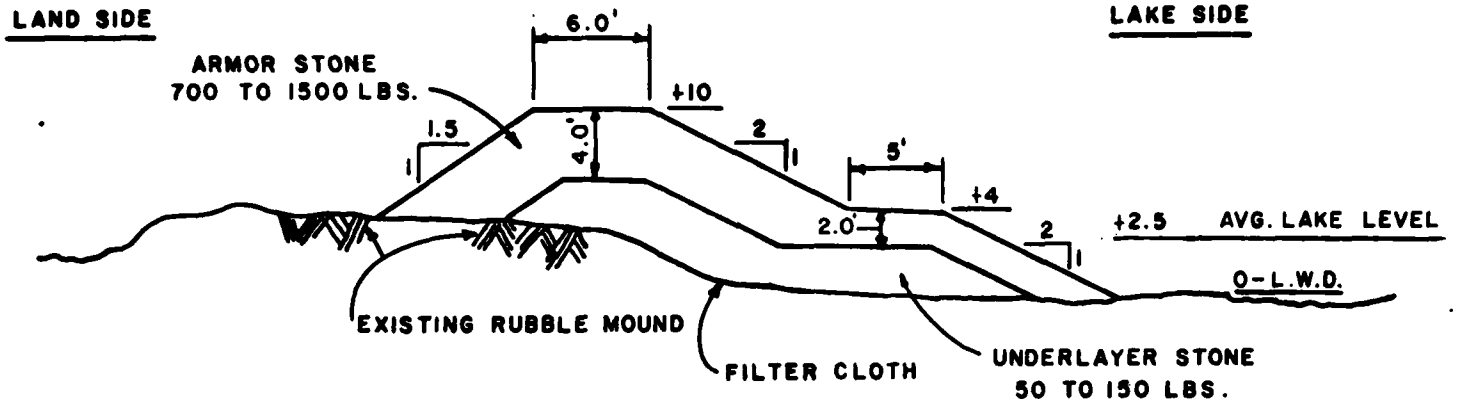
MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3C
TYPICAL JETTY SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

106

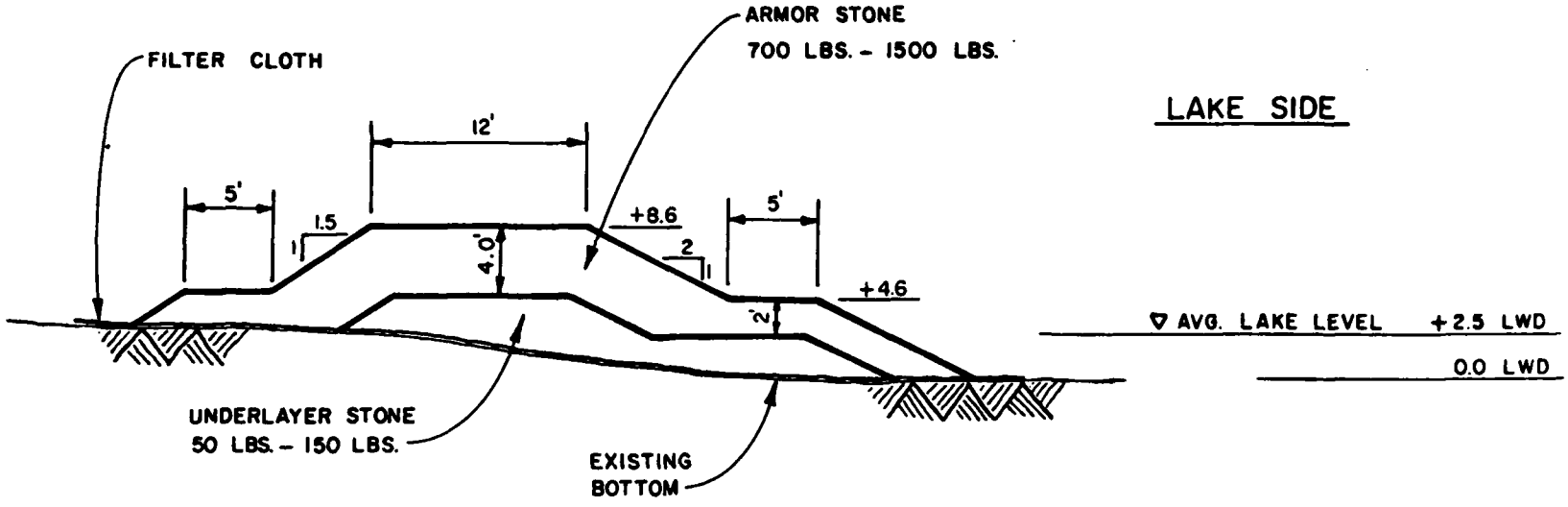
PLATE



TYPICAL REVETMENT SECTION
AT BERGER DITCH
SCALE 1" = 10'

MAUMEE BAY STATE PARK, OHIO
ALTERNATIVE 3C
TYPICAL REVETMENT SECTION
AT BERGER DITCH
U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE 107



TYPICAL WILDLIFE REVETMENT CROSS SECTION

SCALE 1"= 10'

MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3C
TYPICAL WILDLIFE REVETMENT
SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

PLATE 108

Revised: June 1983
Revised: August 1983
Revised: November 1983

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED PLAN FOR SHORELINE PROTECTION AND BEACH RESTORATION AT MAUMEE BAY STATE PARK LUCAS COUNTY, OHIO

The responsible lead agency is the U. S. Army Engineer District, Buffalo.

Abstract: When completed, Maumee Bay State Park will consist of 1,855 acres of lakefront property located in Lucas County, OH. The Buffalo District has investigated public concerns of the Maumee Bay State Park study area related to shoreline protection and the restoration of a recreational beach.

Of the four plans considered during preliminary planning, three were selected for detailed study and two new additional plans were formulated. Alternative 1, the No Action Plan, would provide no structural protection or beach restoration, nor would it protect existing wetlands. Alternative 2a, which includes a 250-foot wide protective beach and a revetment, would prevent shoreline erosion, provide a recreational beach, and protect existing wetlands. Alternative 3a, which includes a revetment and a beach protected by eight offshore breakwaters, would prevent shoreline erosion, lessen annual beach nourishment costs, provide a recreational beach, and protect existing wetlands. Alternative 3b, a modification of Alternative 3a, would produce the same results except the beach width would be lessened by 50 feet and replaced by a 50-foot grassy area. Alternative 5, consisting of rubble-mound revetments along the entire shoreline, would prevent shoreline erosion and protect existing wetlands, but would not provide a recreational beach.

Initially, alternative 3b was chosen as the Selected Plan based on its performance in addressing the identified public concerns and its net positive contributions to the goals of National Economic Development (NED) and Environmental Quality.

Subsequent to the selection of Alternative 3b, a new plan (Alternative 3c), in which the 250-foot beach area would be constructed lakeward of the storm dune, was evaluated. This new plan has been designated the Selected Plan.

SEND YOUR COMMENTS TO THE DISTRICT BY:

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NOTE: Information, displays, maps, etc. discussed in the Maumee Bay State Park Main Report are referenced in the EIS.

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR
PROPOSED PLAN FOR SHORELINE PROTECTION AND
BEACH RESTORATION AT MAUMEE BAY STATE PARK
LUCAS COUNTY, OH

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LUCAS COUNTY, OH

1. SUMMARY

This chapter presents the major factors which were considered in and influenced planning-related decisions. It is presented in the following four discussions:

a. Major Conclusions and Findings. This discussion identifies the alternatives that were considered and a brief rationale of why they were not selected. The rationale for the study's NED Plan, EQ Plan and Selected Plan, and other major conclusions and findings of the District Engineer are presented.

b. Areas of Controversy. This section describes those issues that were the subject of major disagreement among public interests during the course of the study and the outcome of any resolved controversies.

c. Unresolved Issues. This section describes the unresolved major disagreements among study area interests and actions proposed or taken to resolve these disagreements.

d. Relationship to Environmental Protection Statutes and Other Environmental Requirements. This section summarizes the relationship of each plan included in the final array of alternatives to the requirements of environmental laws, executive orders, and other policies; the Federal, State, and local land use plans, policies, and controls applicable to the study area and other related State and local plans and laws; and any Federal permits, licenses, and other entitlements needed to implement the detailed plans. Table EIS-1 presents a summary of compliance with these requirements.

1.1 Major Conclusions and Findings

1.1.1 As a first task in the planning process, problems in a study area are identified by eliciting information from the public about water and related land resource management needs. The needs identified for Maumee Bay State Park include elimination of shoreline erosion along the 11,000-foot shoreline, the restoration of a 5,500-foot recreational beach, and protection of 244 acres of eroding wetlands, while at the same time being consistent with the Ohio Department of Natural Resources' (ODNR) overall park development plan. The need for flood protection at the park was also identified during the course of the study.

1.1.2 As mandated by the Corps planning process, various alternative plans have been formulated to address area needs and planning objectives.

These plans have been addressed and evaluated for social, economic and environmental impacts. During preliminary planning, four alternatives, including the No Action Plan, were analyzed. The plans were refined and two alternatives, Alternatives 2 and 3, capable of providing shoreline erosion protection and a recreational beach as well as the No Action alternative, were recommended for further study. During detailed planning, design changes were made to Alternative 2 (Alternative 2a) and Alternative 3 was modified from a four to an eight-breakwater system (Alternative 3a). In addition to Alternative 3a, modification of this plan (Alternative 3b and 3c) which replaces 50 feet of sand beach with a 50-foot turf area were developed. A new alternative, Alternative 5, consisting of an 11,000-foot revetment along the entire shore was also developed during the detailed planning stage.

1.1.3 The National Economic Development (NED) Plan addresses the planning objectives in a way which maximizes net economic returns. As a minimum, the NED Plan will produce net economic benefits; that is, annual benefits will exceed annual costs. With net annual economic benefits totaling $3,620,000, Alternative 3c (300-foot X 5,500-foot beach) has been designated as the NED Plan. It should be noted that the net benefits are not significantly different for any of the action alternatives. Also, estimated sand nourishment is a very subjective quantity. A minor adjustment in these losses could result in a reversal of the order of project preferability, if based strictly on net annual benefits.

1.1.4 Recognizing that environmental quality (EQ) has both natural and human manifestations, an EQ Plan addresses the planning objectives in the way which emphasizes aesthetic, ecological, and cultural contributions. Beneficial EQ contributions are made by preserving, maintaining, restoring, or enhancing the significant cultural and natural environmental attributes of the study area. Determination of EQ benefits involves subjective analysis, underscoring the need for interdisciplinary planning with extensive public input to place values on the environmental contributions of plans. Designating an EQ Plan involves measuring the environmental changes related to different plans and selecting the plan which, based on public input, contributes to, or is most harmonious with environmental objectives. At a minimum, an alternative plan must make net positive contributions to the EQ account in order to be designated the EQ Plan.

1.1.5 The five structural alternatives considered during detailed planning would have provided equal beneficial EQ contributions by preserving and maintaining the existing wetland at Maumee Bay State Park. However, Alternative 2a had the distinct advantage of being the least disruptive to existing current and drift patterns which influence fish and aquatic movement, recruitment, and utilization of nearshore areas. Alternative 2a would also be the least damaging to the existing aesthetic conditions of the shoreline, while still providing a recreational beach and shoreline protection at Maumee Bay State Park. Therefore, Alternative 2a was been designated as the EQ Plan. NOTE: The designation of an EQ Plan is dependent upon the source of the beachfill. If a lake source is used, adverse impacts to local fisheries could sway the EQ account in favor of Alternative 3b since the amount of sand required would be less. These adverse impacts could be avoided if a land source is used.

1.1.6 Alternative 1 (No Action) was not chosen as the Selected Plan because it does not prevent shoreline erosion, restore a beach to satisfy recreational needs in the area, or protect existing wetlands. Alternative 2a (Protective Sand Beach and Revetments) was not chosen because of the high annual nourishment costs associated with a beach with no structural protection. Alternative 3a (Protective Sand Beach, Breakwaters and Revetments) was also not selected because of its relatively higher costs for beachfill ($25,000 more expensive than Alternative 3b and 3c). Alternative 3b was not chosen because a turf area constructed landward of the storm dune would serve no purpose as erosion protection. Finally, Alternative 5 (Total Revetment) was not selected because it fails to meet the need for a recreational beach in the study area, would not facilitate complete park development, and would bring about a significant degradation in the aesthetic qualities of the park and shoreline.

1.1.7 The Selected Plan, therefore, is Alternative 3c. The rationale behind the selection of this plan is that it provides net economic benefits and net beneficial EQ contributions. The plan addresses all planning objectives which were used to guide its formulation. Although the USFWS prefers Alternative 5, Alternatives 2a, 3a, 3b and 3c are acceptable, if an upland sand source is used. If a lake source is used, impacts would have to be more fully assessed before USFWS's preferred plan could be selected. The local cooperator, the Ohio Department of Natural Resources, prefers Alternative 3c since beachfill and annual beach nourishment costs would be minimized. Public coordination to date has uncovered no opposition to this plan.

1.1.8 In accordance with Executive Order 11990, Protection of Wetlands, a determination has been made that no practicable alternative to undertaking the proposed action within a wetland exists. Efforts have been made to minimize the loss and degradation of the beneficial values of the wetland; in fact, these values would be preserved and maintained through implementation of the proposed project. The general objective of Executive Order 11988, Flood Plain Management, is to avoid, to the maximum extent possible, long and short-term adverse impacts associated with the occupation and modification of the base flood plain whenever there is a practicable alternative to such an action. The Corps has concluded that there is no practicable alternative to the proposed action, which would occur within the 100-year flood plain of Lake Erie and within an existing wetland, and that the recommended action is in conformance with both Executive Orders.

1.1.9 An evaluation in compliance with Section 404 of the Clean Water Act has not been completed. Additional information will be developed to comply with Section 404 during further engineering and design studies and prior to the actual discharge of dredged or fill material. A preliminary Section 404 Evaluation and Public Notice would be prepared and circulated during the general design phase of the study, if the proposed project is authorized for construction.

1.2 Areas of Controversy

1.2.1 During early study activities, an official of the city of Oregon expressed concern over the impact of the proposed project on the existing drainage system. To address this concern, jetties were incorporated into

those alternatives which involve the placement of beachfill. These jetties would effectively prevent the shoaling of littoral materials at the mouths of existing ditches, thereby maintaining unimpeded drainage.

1.3 Unresolved Issues

1.3.1 The Ohio Department of Natural Resources' (ODNR) master plan for park development proposes the construction of a golf course and lodge in the eastern portion of the park. Since either one or both facilities may encroach upon or be partially located within existing wetlands, further evaluation and authorization under the Corps of Engineers regulatory permit program would be required. It is anticipated that any adverse impacts of such an undertaking, if permitted, would have to be mitigated.

1.3.2 The U. S. Fish and Wildlife Service has expressed concern about water quality behind the proposed wildlife revetment, fish passage to marsh areas, and the utilization of offshore sand resources. If a wildlife revetment is authorized for construction, the optimum number and location(s) of gaps in the revetment to facilitate water circulation and fish utilization would be investigated during furture engineering and design studies.

1.3.3 As a "worst case" analysis, dredging of the Cedar Point sand spit for beachfill has been assessed in this EIS. However, due to the possibility of significant adverse impacts and the potential for reopening this area to commercial dredging, other sources are being investigated and have been incorporated in the economic analysis of the various alternatives.

1.3.4 The Toledo Metropolitan Area Council of Governments (TMACOG) is the recognized transportation planning agency for the Toledo area. TMACOG did not concur with the recommendation made in ODNR's Access Road Study for Maumee Bay State Park 1/ and recommended an alternate highway route. In a letter dated 28 July 1982 (see Appendix I, p. I-34), ODNR stated that the conclusions of the report will be reevaluated and that "further refinement of the access roads to be improved will be coordinated with local planning and governmental agencies."

1.4 Relationship to Environmental Requirements

1.1.4 The detailed plans have been considered in relation to a number of Federal laws and policies as well as State laws, which have a bearing on the issues involved. Table EIS-1 presents a summary of environmental review and consultation requirements applicable to Corps Civil Works actions.

1/ McDonnell and Proudfoot Associates, Inc., January 1980.

Tabel EIS-1 - Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements (Selected Plan - Alternative 3c)

	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 3c	Alternative 5
Federal Statutes					
Archaeological and Historic Preservation Act, as amended, 16 USC 469 et seq.	Full	Full	Full	Full	Full
Clean Air Act, as amended. 42 USC 7401, et seq.	Full	Full	Full	Full	Full
Clean Water Act as amended, (Federal Water Pollution Control Act) 33 USC 1251 et seq.	Full	Full	Full	Full	Full
Coastal Zone Management Act as amended, 16 USC 1451 et seq.	Full	Full	Full	Full	Full
Endangered Species Act as amended, 16 USC 1531 et seq.	Full	Full	Full	Full	Full
Estuary Protection Act, 16 USC 1221 et seq.	N/A	N/A	N/A	N/A	N/A
Federal Water Project Recreation Act as amended, 16 USC 460-1(12) et seq.	Full	Full	Full	Full	Full
Fish and Wildlife Coordination Act as amended, USC 661 et seq.	Full	Full	Full	Full	Full
Land and Water Conservation Fund Act as amended, 16 USC 4601-4601-11 et seq.	Full	Full	Full	Full	Full
Marine Protection, Research and Sanctuaries Act, 22 USC 1401 et seq.	N/A	N/A	N/A	N/A	N/A
National Historic Preservation Act as amended, 16 USC 470a et seq.	Full	Full	Full	Full	Full
National Environmental Policy Act as amended, 42 USC 4321 et seq.	Full	Full	Full	Full	Full
Rivers and Harbors Act, 33 USC 401 et seq.	Full	Full	Full	Full	Full
Watershed Protection and Flood Prevention Act, 16 USC 1001 et seq.	N/A	N/A	N/A	N/A	N/A
Wild and Scenic Rivers Act as amended, 16 USC 1271 et seq.	N/A	N/A	N/A	N/A	N/A
Executive Orders, Memoranda, etc.					
Flood Plain Management (EO 11988)	Full	Full	Full	Full	Full
Protection of Wetlands (EO 11990)	Full	Full	Full	Full	Full
Environmental Effects Abroad of Major Federal Actions (EO 12114)	N/A	N/A	N/A	N/A	N/A
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum, 30 Aug 76)	Full	Full	Full	Full	Full
State and Local Policies					
Section 401 Water Quality Certificate	Full	Full	Full	Full	Full
Land Use Plans					
U. S. Department of Agriculture - Soil Conservation Service	Full	Full	Full	Full	Full
U. S. Environmental Protection Agency	Full	Full	Full	Full	Full
U. S. Department of Housing and Urban Development	Full	Full	Full	Full	Full
U. S. Department of the Interior - Fish and Wildlife Service	Full	Full	Full	Full	Full
Ohio Department of Natural Resources	Full	Full	Full	Full	Full
Lucas County Planning Commission	Full	Full	Full	Full	Full
Toledo Metropolitan Area Council of Governments	Full	Full	Full	Full	Full
Jerusalem Township Trustees	Full	Full	Full	Full	Full

NOTES: The compliance categories used in this table were assigned based on the following definitions:

a. Full Compliance - All requirements of the statute, EO, or other policy and related regulations for the current stage of planning have been met.

b. Partial Compliance - Some requirements of the statute, EO, or other policy and related regulations for the current stage of planning remain to be met.

c. Noncompliance - None of the requirements of the statute, EO, or other policy and related regulations have been met.

d. Not Applicable - N/A statute, EO, or other policy not applicable.

2. NEED FOR AND OBJECTIVES OF ACTION

This chapter explains how and why the Corps of Engineers became involved in the study and what public concerns and consequent planning objectives were identified as the basis for plan formulation. It is presented in the following three discussions:

a. Study Authority. This discussion identifies the study's authorizing document and summarizes the Congressional intent for undertaking the study.

b. Public Concerns. This section describes the public concerns and related resource management needs (problems and opportunities) which were identified in the study.

c. Planning Objectives. This discussion states the planning objectives which were derived from the aforementioned resource management needs and employed in plan formulation.

2.1 Study Authority

2.1.1 In a letter dated 21 March 1975, the Ohio Department of Natural Resources requested the Corps of Engineers to initiate a study of an erosion problem along State-owned property located at Maumee Bay State Park, Oregon, OH. A copy of the letter is reproduced in Appendix E, Exhibit 1.

2.1.2 Under Section 103(a) of the River and Harbor Act of 1962, as amended, a Reconnaissance Report on shore erosion was prepared and issued by the Detroit District of the Corps in November 1976. The considered plan of improvement would have provided a 3,500-foot sand beach protected by steel sheet pile groins along the westerly half of the park. The estimated total first cost, in August 1976 price levels, was $2.7 million with a non-Federal share of about $1.7 million because of the $1 million Federal share limitation under Section 103. The report recommended that a detailed project report be authorized to further study the erosion problem at Maumee Bay State Park. Because the proposed project would be considerably larger than projects normally constructed under Section 103 authority and Federal cost-sharing under Section 103 is limited, the Ohio Department of Natural Resources subsequently requested that further studies be performed using the Congressional authorization route. The Buffalo District requested and obtained approval in November 1978 to have Maumee Bay State Park studied as an interim report of the Western Lake Erie Shore Feasibility Study (see Exhibits 2, 3, 4, and 5 in Appendix E for pertinent correspondence). On 11 April 1974, the House Committee on Public Works authorized the Western Lake Erie Shore Study with the following resolution:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report, Lake Erie Shoreline from the Michigan-Ohio State Line to Marblehead, Ohio, published as House Document Number 63, 87th Congress, 1st Session, and other pertinent reports, with a view

to determining the advisability of providing for beach erosion control, flood protection, and related purposes in the study area, with particular reference to the advisability of protection works against storm waves and wind-generated high lake levels."

2.1.3 Initial funding for the Western Lake Erie Shore Study was appropriated in Fiscal Year 1979.

2.2 Public Concerns

2.2.1 Erosion Problem. The Maumee Bay shoreline has been described as the "most critically eroding shoreline on the south shore of Lake Erie." The predominant force causing shoreline erosion on the Great Lakes is wave action. Although such physical characteristics as bathymetry, predominant wind and storm direction, wind speed, fetch distance, availability of beach-building material, lake levels, etc. are influencing factors, the erodibility of the shoreline is highly dependent upon the types of soil existing along the nearshore and bluffline. Soils in the study area are typically clays and silts with minor amounts of sand and gravel, and are highly erodible. In the absence of any significant protective beach along this reach of Maumee Bay, direct wave attack of the low bluffs occurs relatively frequently particularly during periods of high Lake Erie levels.

2.2.2 Based on available shoreline information, such as historical maps and aerial photographs for more recent years, the historical shorelines at the park for selected years from 1877 to 1979 were established as depicted on Plate 16, of the Main Report. For the entire 103-year period, the average recession rate for the entire park was nearly 12 feet per year, with the unprotected and more exposed western reach experiencing the highest rate at 13.5 feet per year. At the Niles Beach reach where the shore is protected by a rubble revetment, historical erosion rates of 5.7 feet per year can be expected to increase as the revetment is outflanked on its eastern and western limits.

2.2.3 Recession rates have varied nonuniformly through time. These variances are attributable to fluctuations in long-term Lake Erie levels and the occurrence/nonoccurrence of severe storms; i.e., higher recession rates occur during periods of above-average lake levels than during low periods of levels for storms of comparable severity.

2.2.4 Based on the historical average recession rates of 13.5 feet per year and 11.5 feet per year for the western and eastern reaches, respectively, it is estimated that 80 and 60 acres of land would be lost from the western and eastern reaches of the park within the next 50 years. Elimination of erosion along the park shoreline is absolutely mandatory in the view of the Ohio Department of Natural Resources in order to facilitate total park development.

2.2.5 Flooding Problem. Much of the shoreline along Maumee Bay is low-lying and, therefore, susceptible to flooding which is especially severe when storms out of the northeast occur during periods of high lake levels.

Flooding of the park can occur from direct inundation of the area and/or from backup along the drainage network in the area. Because of the flat terrain, poor drainage from the land surface and very mild stream slopes, flood waters can take from several days to several weeks to drain from the low-lying lands.

2.2.6 From the stage-frequency curve of peak (instantaneous) annual Lake Erie levels at Toledo, the top of bluff at the park (elevation 573.6) is overtopped about 75 times per 100 years, or about once every 1-1/3 years. For the 100-year peak lake level of 577.3, the average depth of flooding in the park would be about 3 feet based on an average ground elevation of about 574.3. These values do not include the effects of wave runup which can and do occur concurrently with high lake levels.

2.2.7 Recreation Need. The Ohio Department of Natural Resources (ODNR) in its 1975-1980 Ohio State Comprehensive Outdoor Recreation Plan (SCORP) has identified an excess demand (need) for various kinds of recreational opportunities in the region that would be served by Maumee Bay State Park. During discussions on selection of Maumee Bay State Park as the site to be developed, ODNR has strongly emphasized the need for additional recreational opportunities along the Lake Erie shoreline of Lucas County. Of particular importance and concern to ODNR is utilization of Lake Erie for swimming, an opportunity which is highly limited in Lucas County at present. Recreational needs, by activity, for Lucas County for 1980 and 1990 as presented in the Ohio-SCORP projected the need for over 1 million square feet of additional swimming area by 1990.

2.2.8 Wetland Protection. Wetlands are important natural resources that contribute significant benefits to both the natural and human environment. Executive Order 11990, Protection of Wetlands, recognizes the significant values provided by wetlands warranting specific measures for their preservation. The order sets forth several major requirements for Federal agencies whenever new construction may be undertaken in wetlands. The requirements are:

a. Prior to undertaking any action in wetlands, determine whether a practicable alternative to the action exists.

b. Minimize the loss and degradation of the beneficial values of wetlands.

c. Preserve and enhance the beneficial values of wetlands.

d. Involve the public early in the decision-making process.

2.2.9 ODNR has stated that the 244-acre wetland along the eastern shoreline is to be considered an integral part of the park development which the State wants to preserve for its interpretive value. Since proposed park development envisions the construction of a golf course and lodge in this area, the State of Ohio would be required to obtain a Corps of Engineers permit, and possibly be responsible for the mitigation of any adverse impacts if wetlands are involved.

2.2.10 U. S. Fish and Wildlife Service (USFWS) has stated that allowing some wave activity in the wetland may be beneficial in allowing marsh succession and a wider diversity of habitat and wildlife. Therefore, structural measures which may be implemented along this reach must prevent erosion and also provide for the relatively free circulation of water and movement of fish into and out of the nature area. Also, in order to minimize the disruption of the existing swamp-marsh vegetation, the USFWS recommended that any construction activities be sited as far lakeward as feasible.

2.2.11 Archaeological Sites. In a letter dated 20 June 1980, the Regional Archaeological Preservation Officer identified two archaeological sites in the beach area which indicate a sequence of human occupation dating back 12,000 years. These two sites, 33 LU-154 and 33 LU-247, were both considered potentially eligible for inclusion in the National Register of Historic Places (NRHP). As a result, the Corps of Engineers contracted with John Milner and Associates of West Chester, PA, to assess the possible NRHP eligibility of site 33 LU-247 (subsequent erosion of site 33 LU-154 has eliminated the possibility of its inclusion). The draft report was received from the Contractor in November 1981 and has been reviewed by the appropriate State and Federal agencies. The National Park Service and Ohio Historic Preservation Office concur with the findings and recommendations of the report that site 33 LU-247 is not eligible for inclusion in the NRHP and that the proposed project would have no effect on significant archaeological resources.

2.2.12 U. S. Fish and Wildlife Service Concerns. In a letter dated 15 September 1981, the USFWS expressed three concerns regarding the proposed project. First, it was requested that the adequacy of overtopping and filtration through the proposed wildlife revetment, to maintain water quality during low lake level years, be assessed. Second, it was suggested that during future planning, the optimum number and location(s) of gaps in the revetment to maximize fish access to the marsh areas of the wetland be investigated. Finally, concern was expressed involving the use of sand resources from the Cedar Point spit. Possible adverse effects on local fisheries and the potential for reopening the area to commercial dredging were noted. It was recommended that the Corps continue examining the possibility and costs involved with obtaining sand from other sources. In a letter dated 26 January 1982 (see Appendix G), the USFWS stated that the impacts associated with obtaining beachfill from Maumee Bay would have to be more fully assessed before a preferred plan could be selected. If a lake source for sand is still under consideration during the general design phase of the study, an ichthyoplankton survey conducted during the spawning season would be required.

2.2.13 Maumee Valley Audubon Society Concerns. In a letter dated 16 January 1981, Mr. Edwin Gehung of the Maumee Valley Audubon Society expressed concern that the construction of shoreline revetments would destroy the natural beach that exists at the park. Mr. Gehung suggested that the revetments be constructed in the lake and away from the shore in order to preserve the beach for shore walking and use by shorebirds and sand fleas.

2.3 Planning Objectives

2.3.1 Development of the various alternative plans for shoreline protection and beach restoration at Maumee Bay State Park considered the national objectives for planning water resource projects as set forth in the U. S. Water Resource Council's "Principles and Standards for Planning Water and Related Land Resources." These two national objectives are:

2.3.2 National Economic Development (NED). National Economic Development is achieved by increasing the value of the nation's output of goods and services and improving economic efficiency. For the Maumee Bay State Park Shoreline Erosion and Beach Restoration project, the primary tangible benefits associated with the NED account are shoreline erosion prevention, water-related recreational development, and flood damage reduction. The NED Plan is based on the alternative which maximizes net benefits according to the 14 April 1980 Principals and Standards.

2.3.3 Environmental Quality (EQ). Environmental Quality is achieved by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

2.3.4 Specific planning objectives were formulated to meet the national, State, and local water and related land management needs, opportunities and problems specific to the study area that relate to NED and EQ. The Buffalo District has established the following planning objectives to guide the formulation of a plan of improvement for the Maumee Bay State Park shoreline protection and beach restoration project:

a. Contribute to the stability of 11,000 feet of shoreline subject to erosion during the project life.

b. Contribute to water and related land-based recreation for swimming, fishing, picnicking, camping, nature studies, hiking, and golfing for the period 1990-2040.

c. Contribute to the reduction of flooding from high Lake Erie levels and wave runup for the period 1990-2040.

d. Contribute to the preservation and/or enhancement of the fish and wildlife habitat in the study area over the project life.

e. Contribute to the enhancement of the environment during the project life.

3. ALTERNATIVES

This chapter identifies and describes all reasonable and feasible alternatives considered, and assesses and evaluates the most responsive solutions (detailed plans). It is presented in the following four discussions:

a. Plans Eliminated from Further Study. This discussion describes each plan considered in preliminary planning, but not included in the final array of alternatives, and the rationale for eliminating such plans.

b. Without Conditions (No Action). This section describes the without conditions that are expected to occur in the absence of any Federal action to address the planning objectives. Non-Federal actions to address the planning objectives are described and the agency(ies) or group(s) responsible for their implementation and any mitigation requirements of such actions are identified.

c. Plans Considered in Detail. This section describes each plan included in the final array of alternatives. It summarizes each plan description, implementation responsibilities, and any mitigation requirements. The designated NED and EQ Plans, and the Selected Plan are identified.

d. Comparative Impacts of Alternatives. This section describes in comparative form, the base and without condition, the impacts of the detailed plans on significant resources, and plan economic characteristics (i.e., total costs, net benefits, benefit-cost ratio). This information is presented in Table EIS-2, page EIS-33 (The Environmental Effects section (page EIS-43) contains a detailed analysis of the environmental consequences of each alternative and provides sufficient back-up analysis for the comparative table.)

3.1 Plans Eliminated from Further Study

3.1.1 Alternative 4 - Protective Beach with Groin Field and Revetment. This alternative involved the restoration of a 250-foot wide protective sand beach with a vegetated storm dune along the 5,500-foot long western half of the park shoreline. The proposed beach would require an initial placement of 300,000 cubic yards (cy) of beach fill, of which 30,000-45,000 cy would have to be replaced on an annual basis. The beach would be stabilized by four 450-foot rubblemound groins with concrete diaphragms placed perpindicular to the shore at 1,100-foot intervals. To prevent blockage of drainage ditches from littoral materials transported along the shoreline, a 450-foot long rubblemound jetty would be constructed at the western end of the beach. Two similar 250-foot jetties would be constructed on Berger Ditch at the eastern end of the beach. Wetlands along the eastern shoreline would be protected by the construction of a 5,500-foot long rubblemound revetment (see Figure 9, Main Report).

3.1.2 Although the longshore transport of beach sand would approach zero with this plan, the beach would not be protected against the offshore

movement of sand. Rip currents generated at the heads of the groins may accelerate the rate of offshore losses. The Buffalo District and ODNR have expressed the opinion that reliable methods for estimating the offshore sand losses and annual nourishment requirements for the exposed beach are not available. Thus, it is a distinct possibility that the required annual nourishment for this alternative may even be higher than initially estimated. ODNR also expressed concern that scour holes would form at the head of the groins and pose a hazard to unsuspecting bathers, particularly small children. The U. S. Fish and Wildlife Service opposes this plan because it would be most disruptive to existing littoral current and drift patterns which influence fish and aquatic movement, recruitment, and utilization of nearshore areas. From an economic standpoint, Alternative 4 was the most costly and had the lowest net benefits and B/C ratio of the three structural plans considered during preliminary planning. For these reasons, Alternative 4 was not considered viable and, therefore, was eliminated from further study.

3.1.3 Structural Flood Protection. Inundation at the park is sufficiently frequent and severe to require that park development be undertaken with the flood potential in mind. The only practical structural measure for preventing flooding would be to construct armor dikes fronting Lake Erie and earth dikes around the periphery of the remainder of the park. These dikes would be 8 to 12 feet in height, including freeboard. An interior drainage system would be required to handle local runoff, and rerouting of existing ditches that would cross the line of protection would be required.

3.1.4 A structural approach to flood damage reduction was eliminated early in preliminary planning for the following reasons:

a. The cost of the dike and appurtenant construction would be expensive and costly to maintain, and would not be incrementally justified on an economic basis.

b. Such protection would destroy the existing wetland/proposed nature area in the eastern reach unless the dike was constructed landward thereof. In this case, shoreline protection in the form of a revetment, protective beach, etc., would still be needed to prevent further erosion of the wetland.

c. Dike construction around the periphery of the park would detract from the recreational setting in which it was placed.

d. Low-damage potential use such as recreation is advocated for flood plain development. Structural means of flood damage reduction is inconsistent with this philosophy for the general case.

3.1.5 Various Beach Widths and Lengths. An economic evaluation of various combinations of beach widths (100, 150, 200, 250, 300, and 350 feet) and lengths (2,500, 3,000, 4,000, and 5,500 feet), with and without offshore breakwaters, identified that beach configuration alternative which would maximize net benefits. Of the 36 possible configurations evaluated, a 250-foot wide by 5,500-foot long beach protected by eight offshore breakwaters was selected for detailed study and the remaining 35 configurations were eliminated from further consideration.

3.2 Without Conditions (No Action)

3.2.1 If no action is taken to prevent erosion at Maumee Bay State Park, the 11,000 feet of shoreline would continue to erode at an annual rate of about 12 feet per year resulting in a total loss of about 140 acres of land over the next 50 years. The projected 50-year shoreline is shown on Plate EIS-1. To the east, the wooded wetlands would continue to erode, resulting in a loss of marsh and wildlife areas; along the western half of the park, erosion of the proposed picnicking areas would occur. Most importantly, if shoreline protection is not provided, the park will not develop to its full potential. Limited camping, beach-use, and other day-use would occur, but to a degree far below the potential that a protected shoreline incorporating a sand beach would allow.

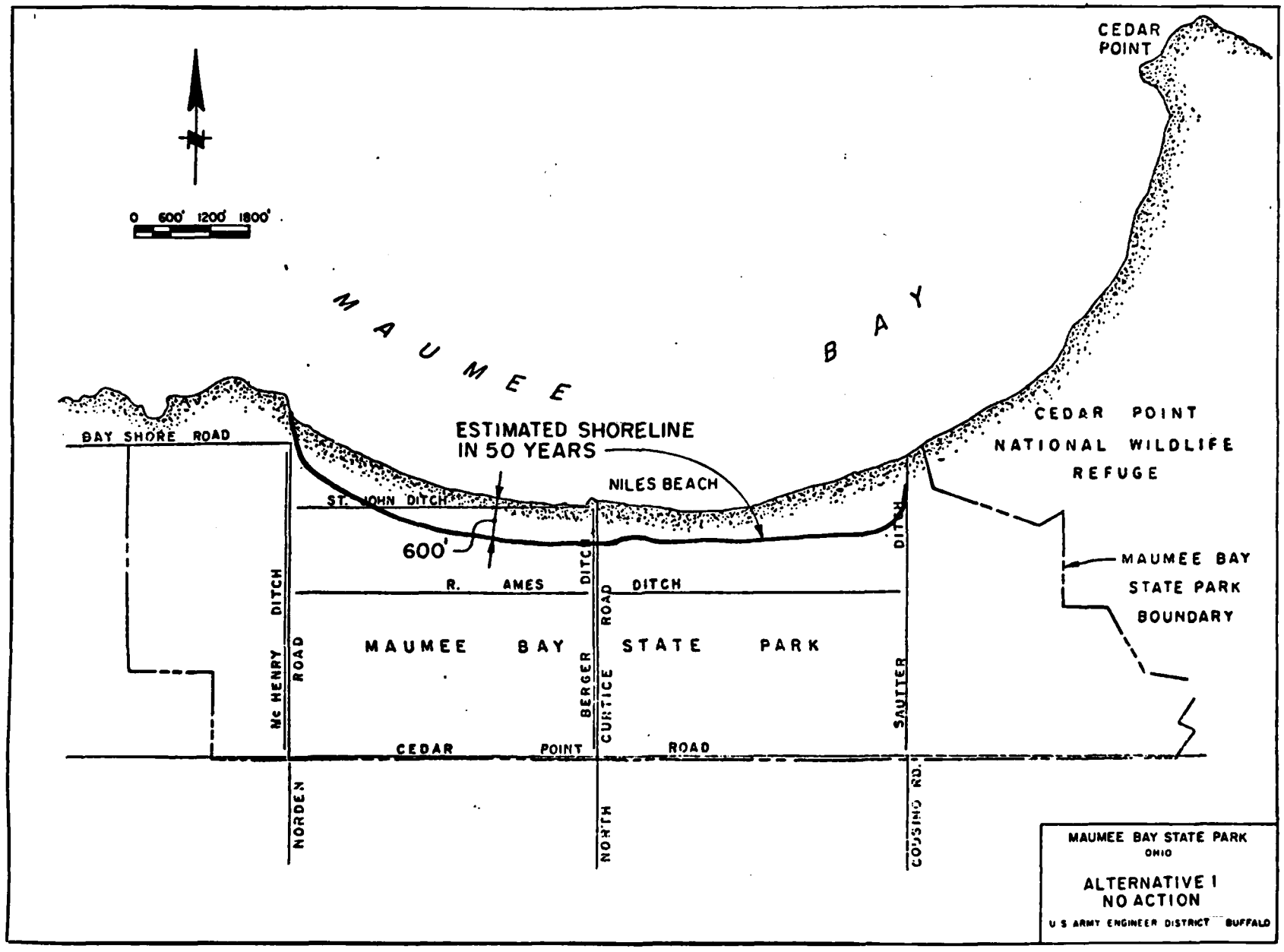
3.3 Plans Considered in Detail

3.3.1 Alternative 1 - No Action. The No Action Plan (Plate EIS-1) provides the basis for evaluating the structural alternatives. This option, although not favored by the local sponsor because it would preclude development or utilization of the park as currently envisioned by the Ohio Department of Natural Resources, avoids the monetary investment associated with the structural plans. The No Action Plan would not meet the recreation need that exists in the Metropolitan Toledo area, and particularly, the need for such opportunities on the shore of Lake Erie. Problems discussed earlier in this report would remain unchanged and unresolved. The No Action Plan would not meet the planning objectives to reduce, or eliminate, shoreline erosion or provide the desired level of additional recreation opportunities in the area to be served by Maumee Bay State Park. Non-Federal actions (ODNR park development) would contribute to land-based recreation and address the potential for flooding at the park.

3.3.2 Standard Features of Alternative Plans. Several features which are common to most structural alternatives are as follows:

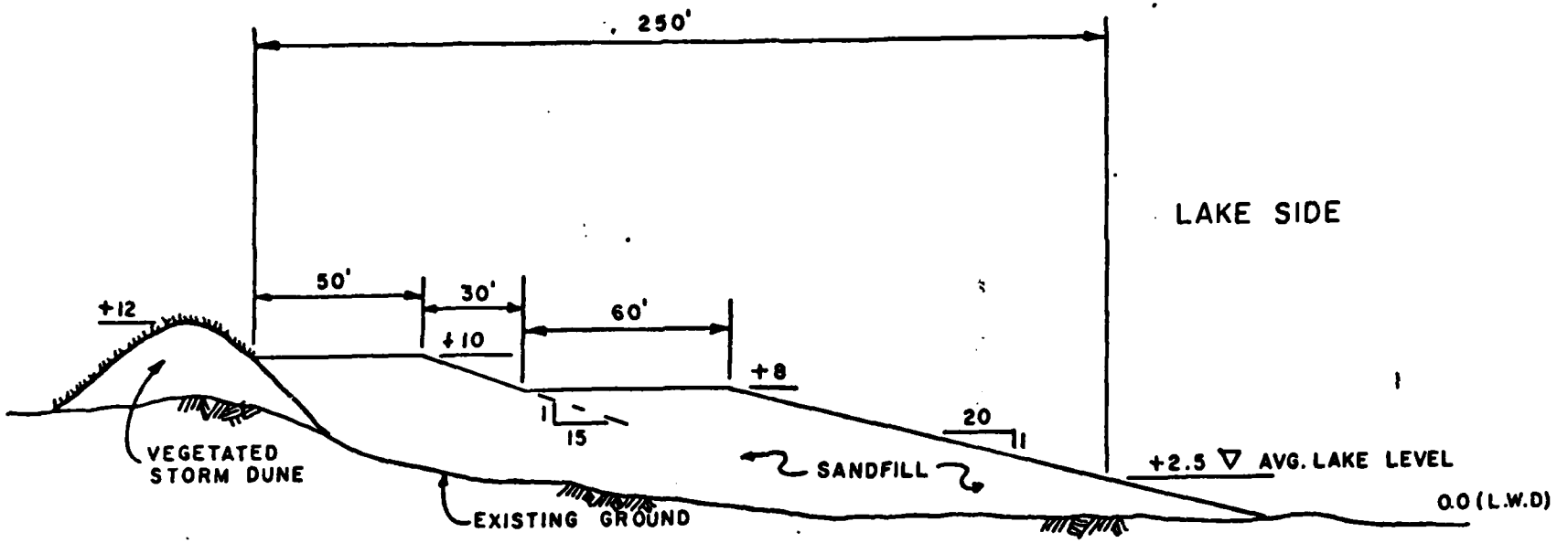
a. Protective Sand Beach (Alternatives 2a, 3a, 3b and 3c). Typical cross sections of the sand beach are shown on Plates EIS-2, 3, 4, and 13b. The beach was designed using a medium-grade sand (0.1 to .5 mm), producing a beach slope of 1V on 20H. The berm elevation of +8.0 feet LWD (Elevation 576.6 IGLD) was selected to prevent overtopping by waves in a typical year. Table EIS-4, p. EIS-47, presents initial placement and annual nourishment quantities for the various alternatives. A 50-foot wide storm berm at elevation +10 feet LWD (Elevation 578.6 IGLD) would provide protection against a rare storm, occurring on the average, about once every 20 years. An additional 2 feet of freeboard would be provided by a vegetated storm dune which would prevent overwash and inland transport of sand. This dune would be constructed of material excavated by ODNR in the construction of ponds in the park.

The beach for Alternatives 2a, 3a, 3b and 3c would be 5,500 feet long, which in combination with a width of 250 feet, would provide a total beach area of approximately 1,375,000 square feet. (For Alternative 3b and 3c, a 50-foot wide grassy area would replace 50 feet of sand beach). Varying amounts of



EIS-15

PLATE E



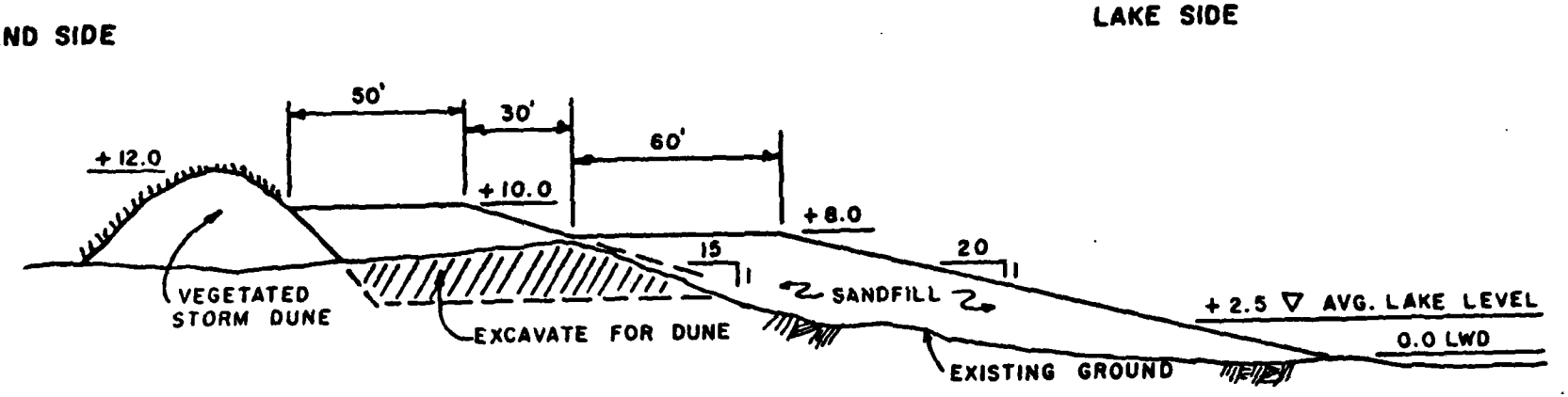
TYPICAL BEACH CROSS-SECTION - ALTERNATIVE 2a

SCALE HORIZ. 1"= 50'
VERT. 1"= 10'

EIS-16

PLATE EIS-2

MAUMEE BAY STATE PARK, OHIO
ALTERNATIVE 2a
TYPICAL SAND BEACH SECTION
U.S. ARMY ENGINEER DISTRICT BUFFALO



TYPICAL SAND BEACH SECTION–ALTERNATIVE 3a

SCALE HORIZ. 1"= 50'
VERT. 1"= 10'

EIS-17

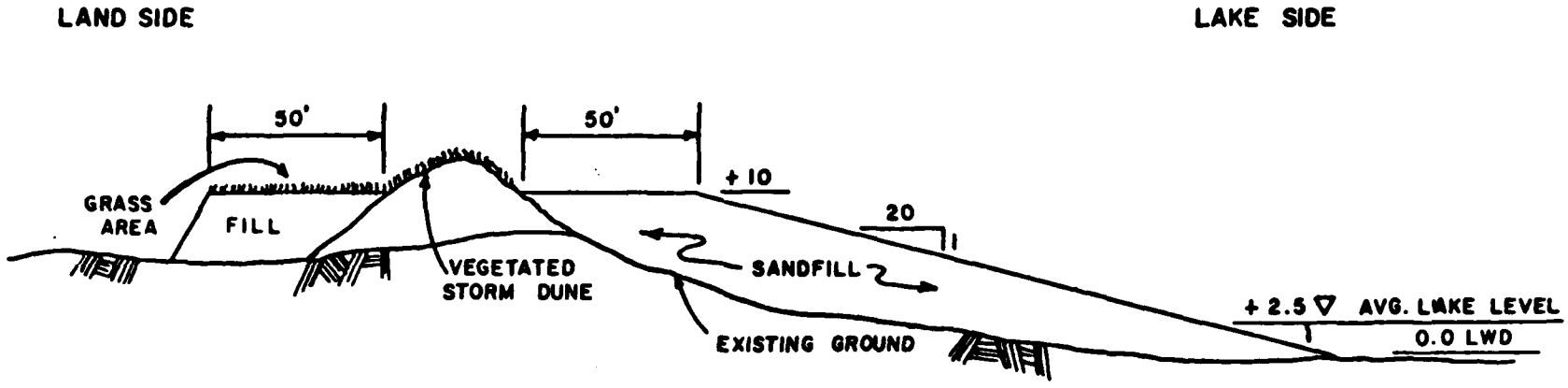
PLATE EIS-3

MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3a
TYPICAL SAND BEACH SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

JULY 1981



EIS-18

TYPICAL SAND AND TURF SECTION—ALTERNATIVE 3b

SCALE HORIZ. 1"= 50'
VERT. 1"= 10'

PLATE EIS-4

MAUMEE BAY STATE PARK, OHIO
ALTERNATIVE 3b
TYPICAL SAND AND TURF
BEACH SECTION
U. S. ARMY ENGINEER DISTRICT BUFFALO

sand would be lost offshore for each of the beach alternatives, and periodic backpassing (Alternative 2a only) and beach nourishment would be required (see Table EIS-5, p. EIS-49).

The least-cost alternative sources for beachfill are offshore areas in Maumee Bay northeast of Cedar Point (see Plate EIS-5). Two alternatives exist for transporting the dredged sand to the project site. The conventional method is to dredge the sand and haul it to unloading docks at Toledo, OH. The sand would then be trucked approximately 5 miles to the project site. The second alternative is to dredge the sand and pump it via pipeline directly to the beach area. If significant adverse environmental impacts preclude the use of offshore sources of beachfill, existing commercial sand sources would be used.

b. Jetties (Alternatives 2a, 3a, 3b and 3c). Two jetties are proposed for several of the structural alternatives. The purpose of these jetties is to prevent blockage of the drainage ditches from littoral materials transported along the shoreline. A typical cross section of the jetties is shown on Plate EIS-6. The jetties would be of rubblemound construction and incorporate a 2.5-foot wide fisherman walkway and a filter curtain to prevent passage of sand through the structure. This walkway would provide increased access for shore fishermen. The crest of the jetties would be at elevation +10.0 LWD. Alternative 2a would have a 450-foot long jetty at its west end on McHenry Ditch, and a 250-foot long jetty at its east end on Berger Ditch, while Alternatives 3a and 3b would have 250-foot long jetties at both locations.

c. Wildlife Revetment (All Alternatives). For all alternatives, a revetment would be constructed to stabilize the shoreline along the park's nature area/wetland. A typical cross section of the 6,200-foot long, low-height revetment fronting the nature area is shown on Plate EIS-7. The armor stone, weighing between 700 and 1,500 pounds, was designed to withstand a 6-foot high design wave. The rubblemound revetment, with a crest height of +8.6 LWD and crest width of 12 feet to provide a maintenance road, would be permeable to allow for relatively free circulation of water into and out of the wetland area. Tentatively, the revetment would be constructed with a 100-foot gap at its approximate center. In order to maximize water circulation and fish access to the marsh areas of the wetlands, the optimum number and location(s) of gaps would be determined during future engineering and design phases. With a crest elevation of +8.6 LWD, the revetment would be overtopped during storm conditions, but the existing shoreline would be protected from erosion and wave transmittal to the lee would be minor.

In order to minimize disturbance, access to the wildlife area for construction of the revetment would be obtained over the existing roads just east of Berger and Sautter Ditches. Once the shoreline is reached, the revetment would be constructed from each end by placing and traveling on the underlayer. The armor stone would then be placed in an outward direction from the gap in the revetment. In order to construct the revetment along the shore, approximately 12.6 acres of the existing wetland would be cleared and grubbed. This figure could be reduced greatly by constructing the revetment further offshore as suggested by the USFWS and the Maumee Valley Audubon Society. This possibility will be investigated in future study phases.

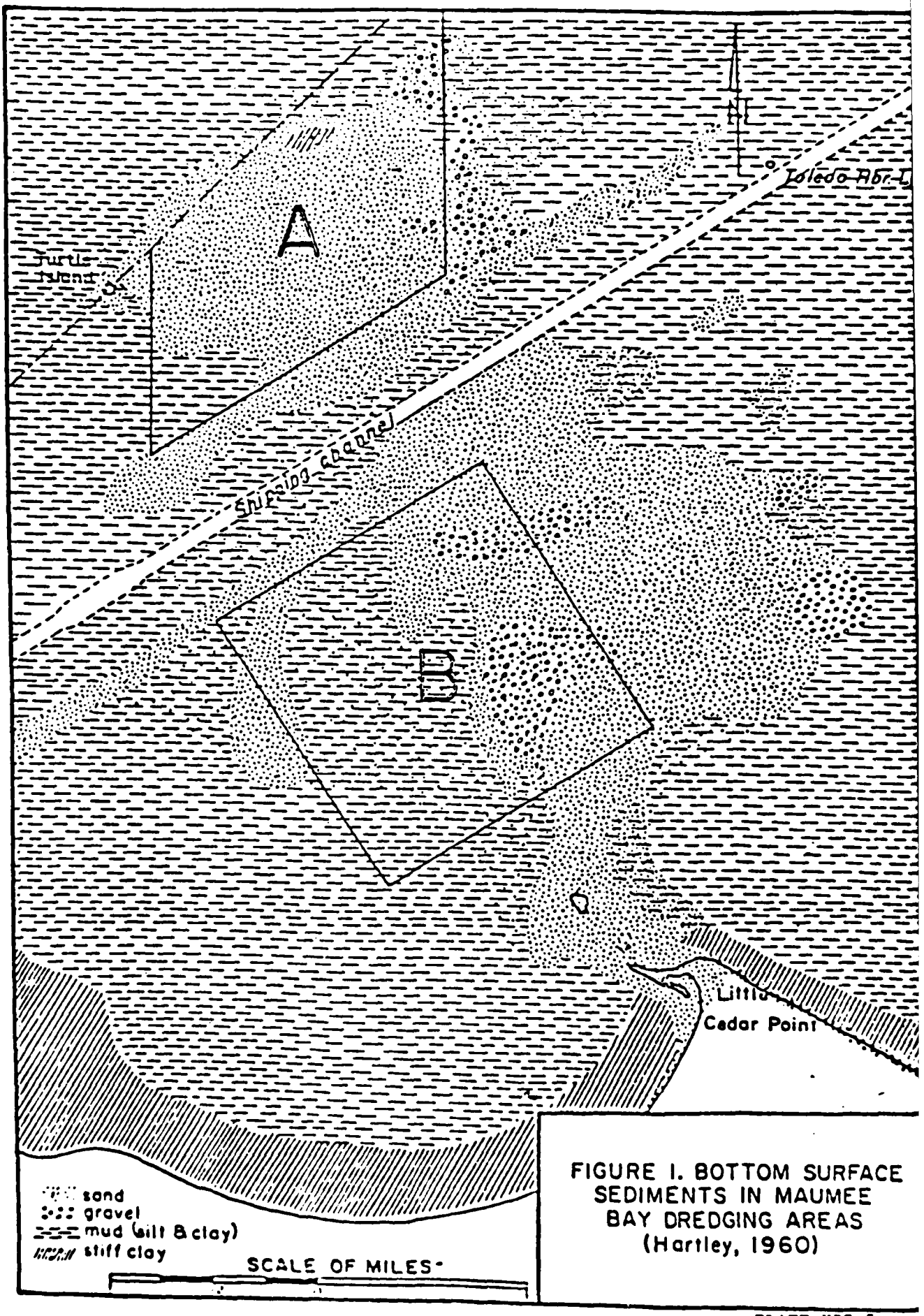
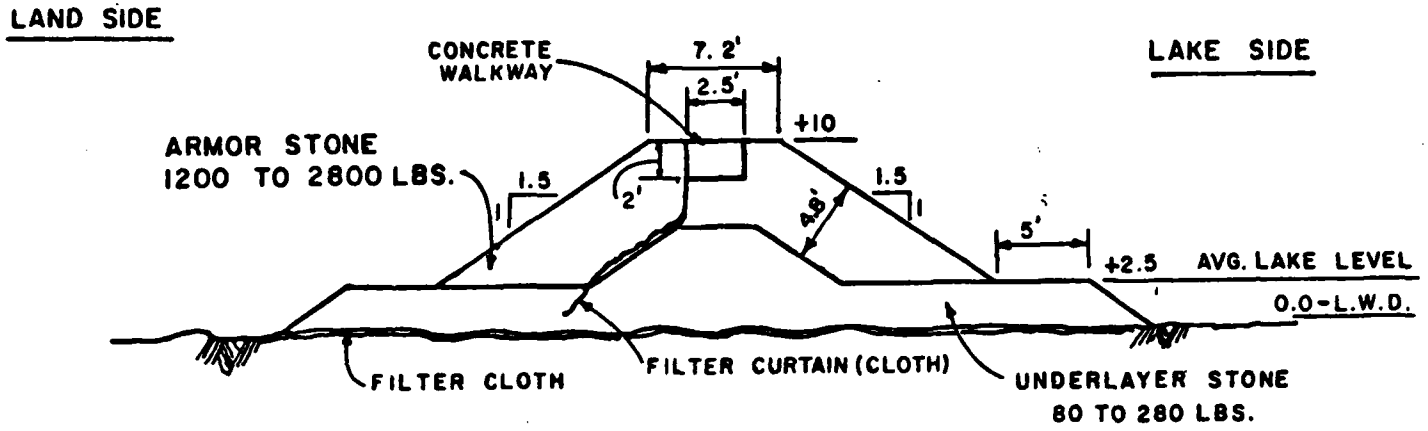


FIGURE I. BOTTOM SURFACE SEDIMENTS IN MAUMEE BAY DREDGING AREAS (Hartley, 1960)



TYPICAL JETTY CROSS SECTION

SCALE 1" = 10'

EIS-21

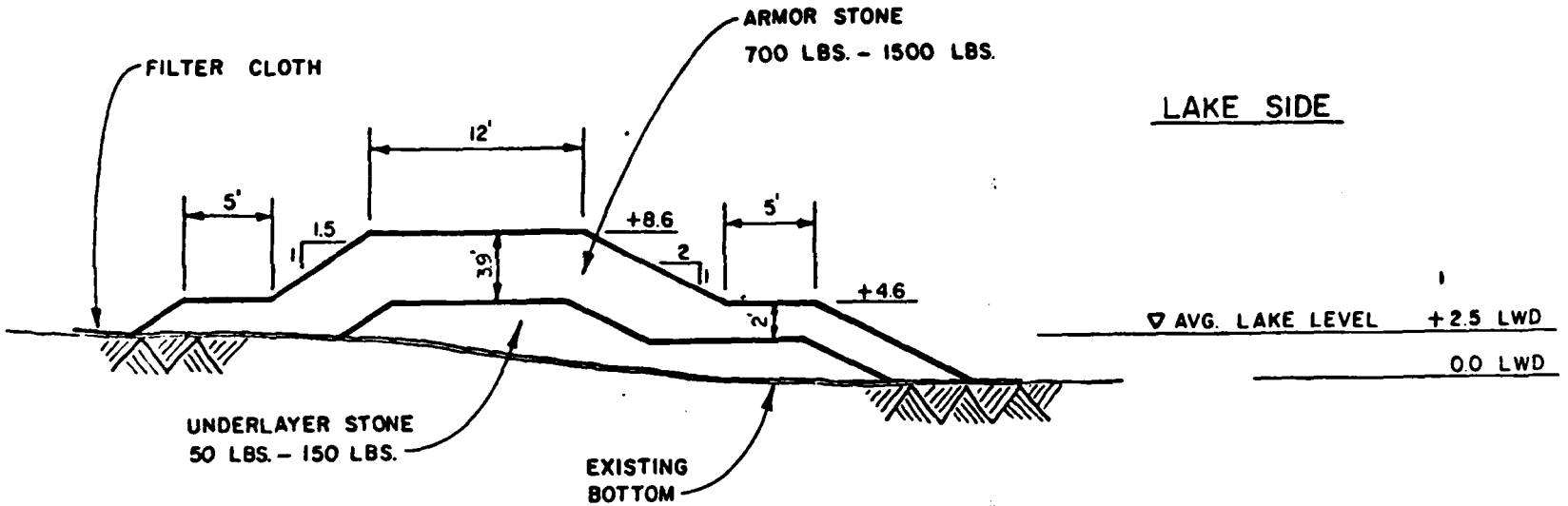
PLATE EIS-6

MAUMEE BAY STATE PARK, OHIO

TYPICAL JETTY SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

JULY 1981



TYPICAL WILDLIFE REVETMENT CROSS SECTION

SCALE 1" = 10'

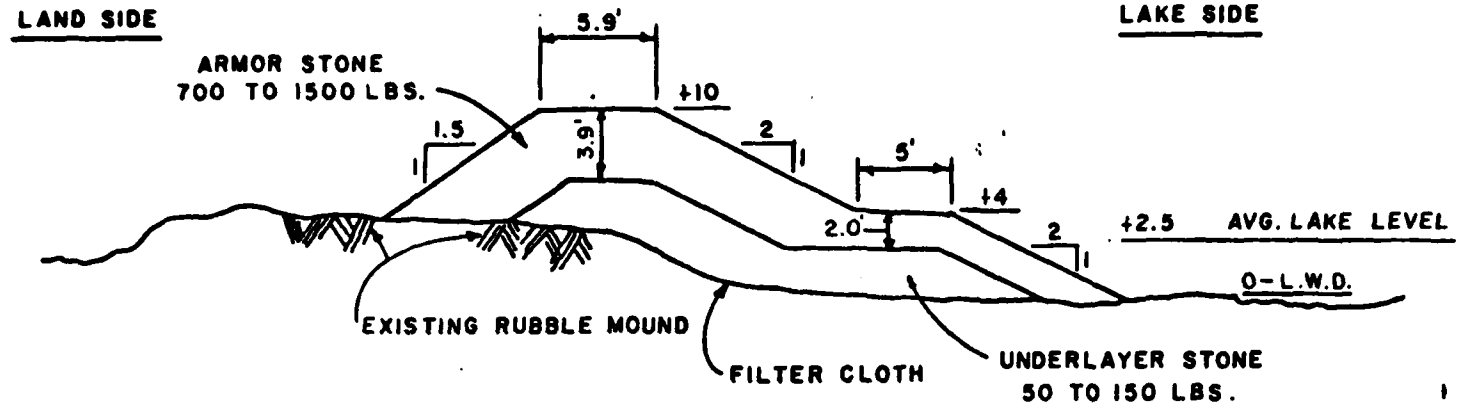
EIS-22

PLATE EIS-7

MAUMEE BAY STATE PARK, OHIO

TYPICAL WILDLIFE REVETMENT SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO



TYPICAL REVETMENT SECTION
AT BERGER DITCH

SCALE 1" = 10'

EIS-23

PLATE EIS-8

MAUMEE BAY STATE PARK, OHIO

TYPICAL REVETMENT SECTION
AT BERGER DITCH

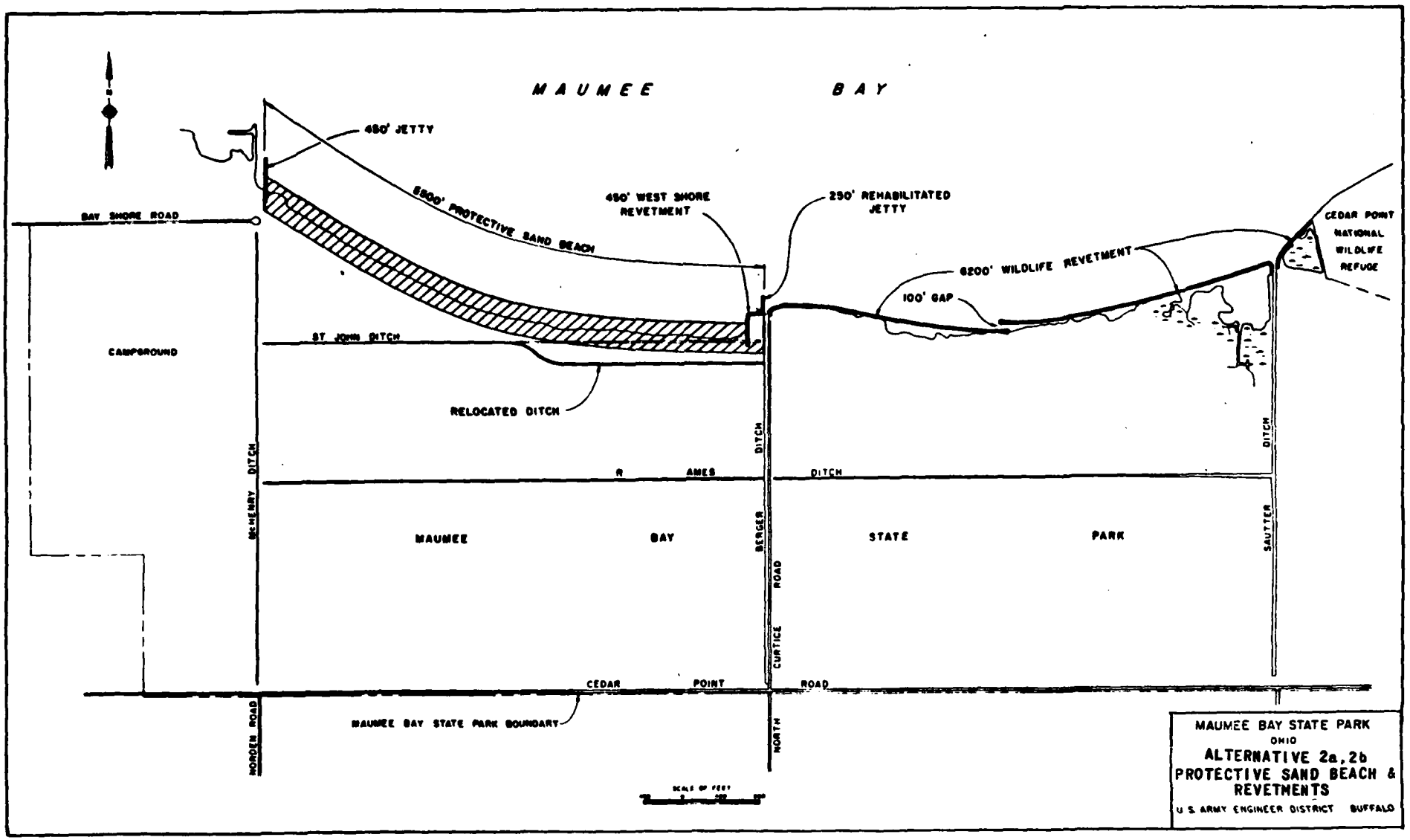
U.S. ARMY ENGINEER DISTRICT BUFFALO

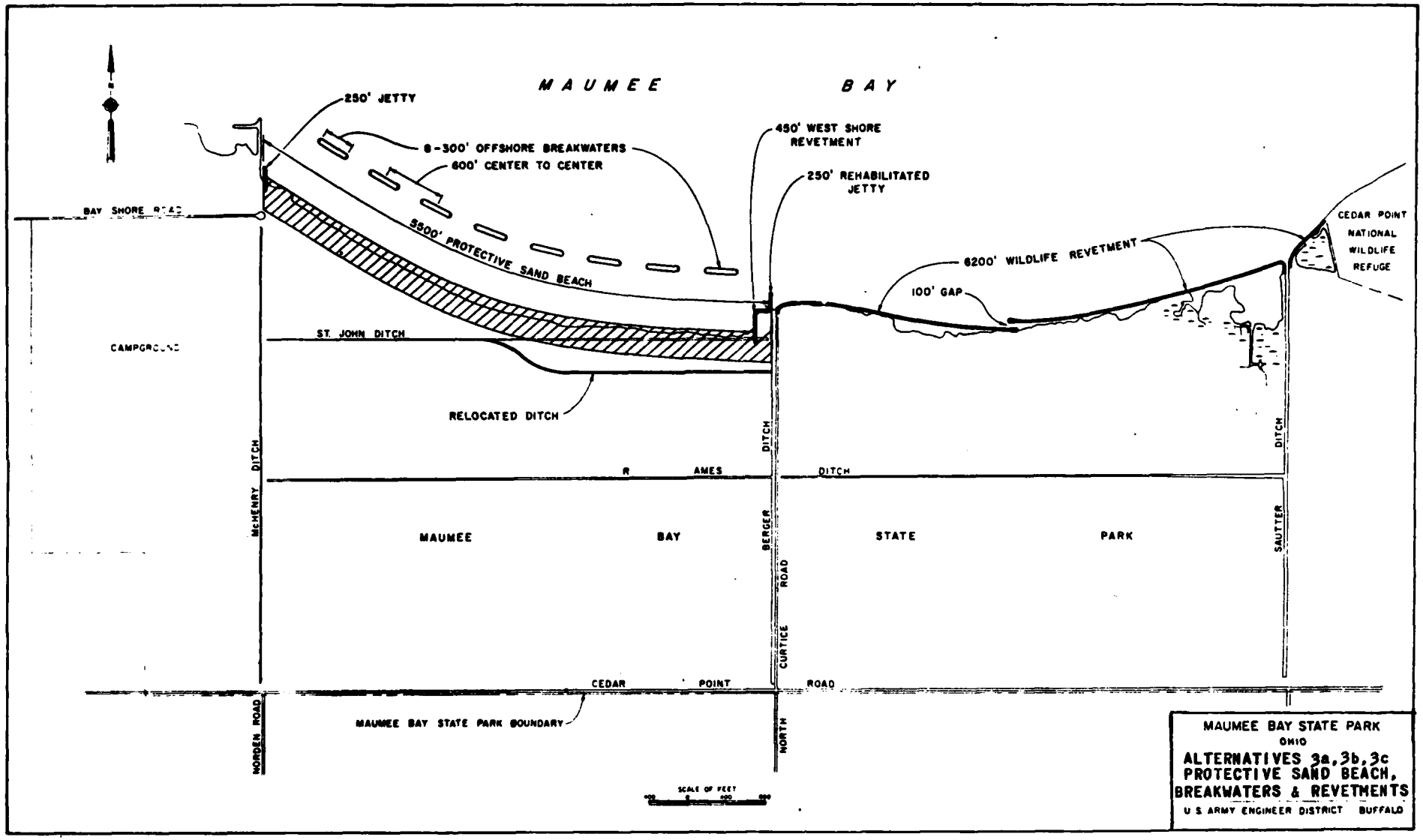
JULY 1981

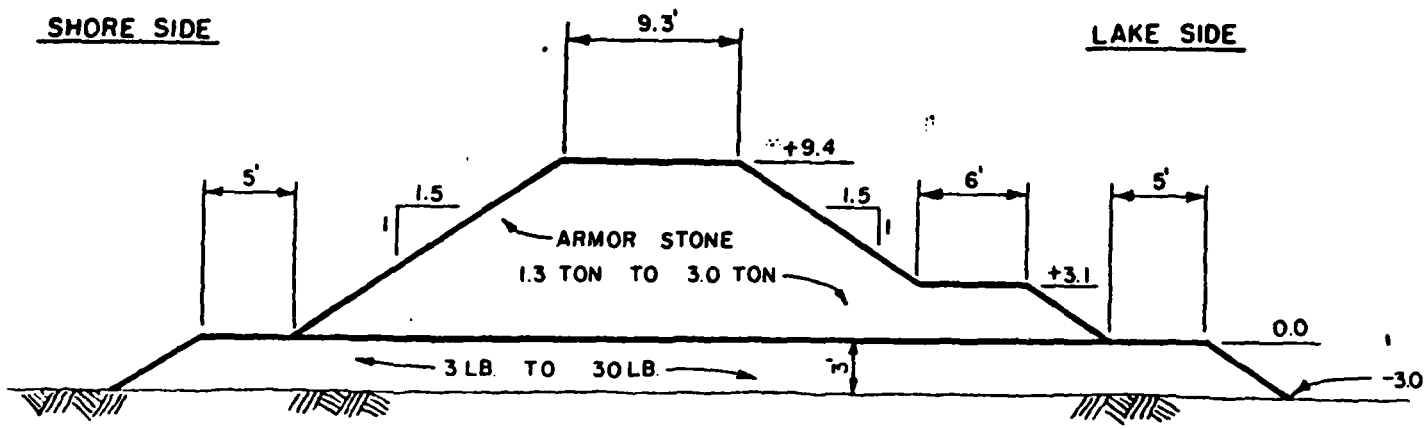
d. Berger Ditch Revetment (All Alternatives). A typical cross section of the 450-foot long, low height revetment fronting the west shore of the Niles Beach area is shown on Plate EIS-8. The same considerations were used in its design except this section would have a crest width of 5.9 feet and crest elevation of +10.0 LWD.

3.3.3 Alternative 2a - Protective Beach and Revetment. The plan view of Alternative 2a is shown on Plate EIS-9. The principal features of Alternative 2a are: a 5,500-foot long protective sand beach with a vegetated storm dune along the western half of the park shoreline; a 450-foot long rubblemound jetty at the western end of the beach at McHenry Ditch; a 250-foot jetty at the eastern end of the beach at Berger Ditch; a 6,200-foot long revetment along wetland areas in the eastern half of the park; and a 450-foot long revetment along the western shore of the Niles Beach area. Approximately 275,000 cubic yards of medium-grain sand would be required for initial construction of the protective beach. With a width of 250 feet, the beach would absorb variations in littoral transport rates on a seasonal basis, but materials would be shifted from the easterly to the westerly end of the beach, in the long-term, over several seasons. In anticipation that the beach would become wider on the western end and narrower on the eastern end, back-passing of beach material from the west to the east would be required. It is estimated that approximately 5,000 cubic yards of sand would be back-passed annually to maintain the proposed configuration. In addition, beach sand would be transported offshore during storm-induced wave attack, and there would be little opportunity for natural replenishment. The present estimate is that about 20,000 cubic yards of annual renourishment would be required to make up for these offshore losses for Alternative 2a. Since this plan would preserve and maintain the existing wetland at the park and is the least disruptive to existing current and drift patterns at the shore, it has been selected as the EQ Plan.

3.3.4 Alternative 3a - Protective Beach, Detached Breakwaters, and Revetment. The plan view of Alternative 3a is shown on Plate EIS-10. The principal features of Alternative 3a are: a 5,500-foot long protective sand beach with a vegetated storm dune along the western half of the park shoreline; eight 300-foot long offshore breakwaters with 300-foot gaps; two 250-foot long rubblemound jetties at the western and eastern ends of the beach; a 6,200-foot long revetment along the eastern half of the park; and a 450-foot revetment along the western shore of the Niles Beach area. The purpose of the segmented detached breakwater is to stabilize the protective beach by reducing both longshore and offshore littoral transport. It would consist of eight segments, each 300 feet long with a 300-foot gap between, constructed by a floating plant at a depth of 6 feet. Plate EIS-11 shows a typical section for the breakwater. The base of the breakwater would be 60 feet wide and 3 feet thick, consisting of 3 to 30-pound stone for the underlayer. The breakwater core would be formed of armor stone sized from 1.3 to 3.0 tons. Sideslopes would be at 1 vertical to 1.5 horizontal. The crest, with a 9.3-foot width, would be at elevation +9.4 LWD, and would be subjected to minor overtopping for the design condition. Because of the beach stability provided by the detached breakwaters, the annual nourishment (5,000 cubic yards) and back-passing (0 cubic yards) requirements, would be substantially less than for Alternative 2a. At the gaps, the beach would be


MAUMEE BAY
450' JETTY
5800' PROTECTIVE SAND BEACH
450' WEST SHORE REVETMENT
250' REHABILITATED JETTY
6200' WILDLIFE REVETMENT
100' GAP
CEDAR POINT NATIONAL WILDLIFE REFUGE
BAY SHORE ROAD
CAMPGROUND
ST JOHN DITCH
RELOCATED DITCH
McHENRY DITCH
R AMES DITCH
BERGER DITCH
DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
MAUMEE BAY STATE PARK BOUNDARY
NORTH
SCALE OF FEET
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVE 2a, 2b
PROTECTIVE SAND BEACH & REVETMENTS
U.S. ARMY ENGINEER DISTRICT BUFFALO


MAUMEE BAY
250' JETTY
8-300' OFFSHORE BREAKWATERS
600' CENTER TO CENTER
450' WEST SHORE REVETMENT
250' REHABILITATED JETTY
BAY SHORE ROAD
5800' PROTECTIVE SAND BEACH
6200' WILDLIFE REVETMENT
100' GAP
CEDAR POINT NATIONAL WILDLIFE REFUGE
CAMPGROUND
ST. JOHN DITCH
RELOCATED DITCH
McHENRY DITCH
BERGER DITCH
R AMES DITCH
SAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
MAUMEE BAY STATE PARK BOUNDARY
NORTH
SCALE OF FEET
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVES 3a, 3b, 3c
PROTECTIVE SAND BEACH, BREAKWATERS & REVETMENTS
U S ARMY ENGINEER DISTRICT BUFFALO



TYPICAL OFFSHORE BREAKWATER CROSS SECTION

SCALE 1" = 10'

EIS-27

PLATE EIS-11

MAUMEE BAY STATE PARK, OHIO
TYPICAL OFFSHORE
BREAKWATER SECTION
U.S. ARMY ENGINEER DISTRICT BUFFALO
JULY 1981

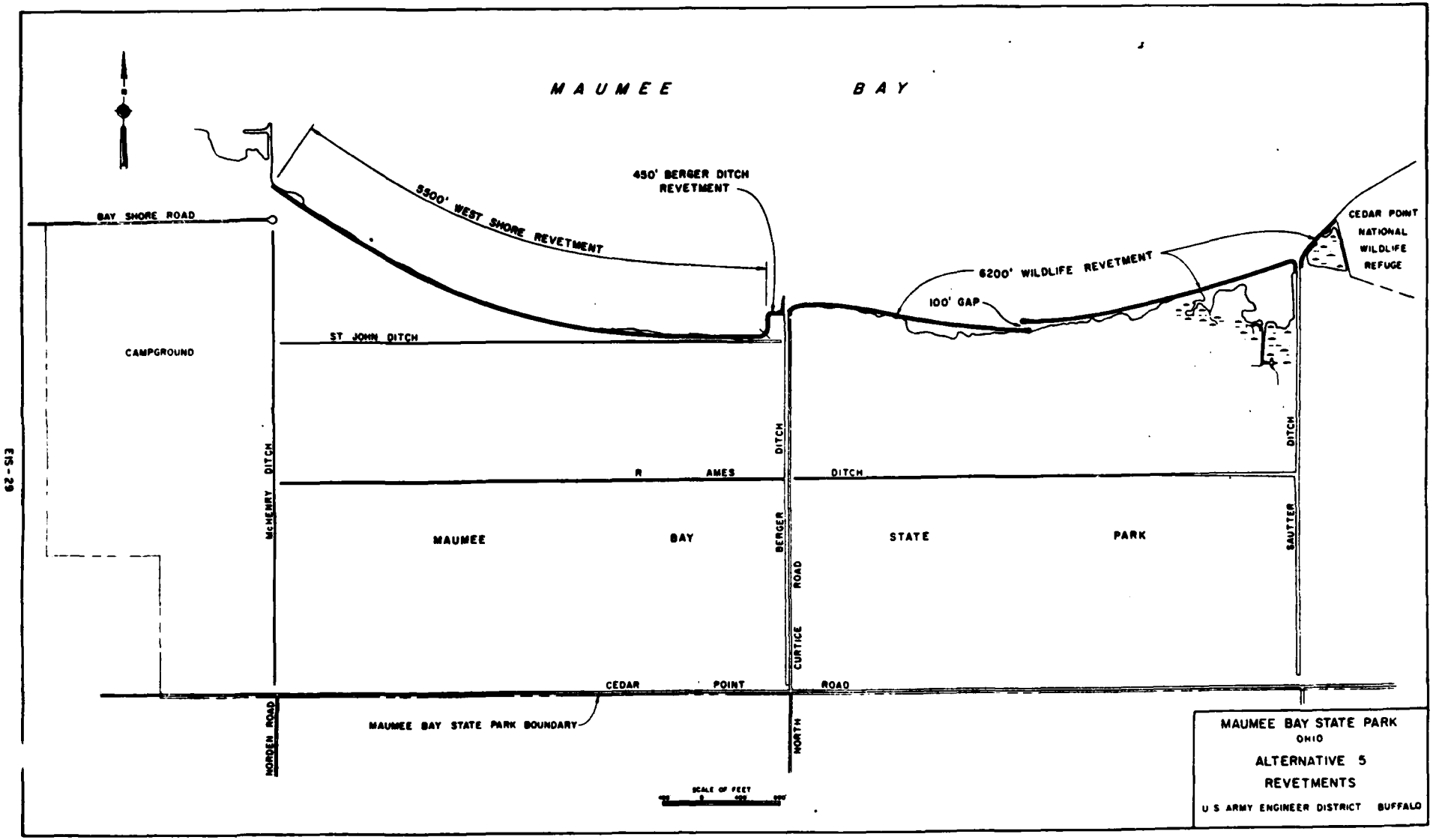
exposed to the full design wave conditions producing a cuspate form. Because of the narrowing at the gaps, it was concluded that the beach width (250 feet) should be the same as for the exposed beach of Alternative 2a.

3.3.5 Alternative 3b - Protective Beach, Grassy Area, Detached Breakwaters, and Revetment. The plan view of Alternative 3b is shown on Plate EIS-10. The principal features of Alternative 3b are: a 5,500-foot long protective sand beach with vegetated storm dune along the western half of the park shoreline; a 50-foot wide grassy area behind the storm dune; eight 300-foot long offshore breakwaters with 300-foot gaps; two 250-foot long jetties at the western and eastern ends of the beach; a 6,200-foot long revetment along the eastern half of the park; and a 450-foot revetment along the western shore of the Niles Beach area. This alternative is identical to Alternative 3a except for the modification to the typical beach section. This option was recommended in the interest of a cost savings and involves substituting 50 feet of grass turf for an equal area of sand beach. The overall section width remains 250 feet, which includes the 50-foot of turf landward of the storm dune. For the purposes of benefit evaluation, it was assumed that the grassy area would function as a beach, and thus recreational benefits would be the same. The substitution of turf for beach area would result in an initial first cost savings of approximately $330,000.

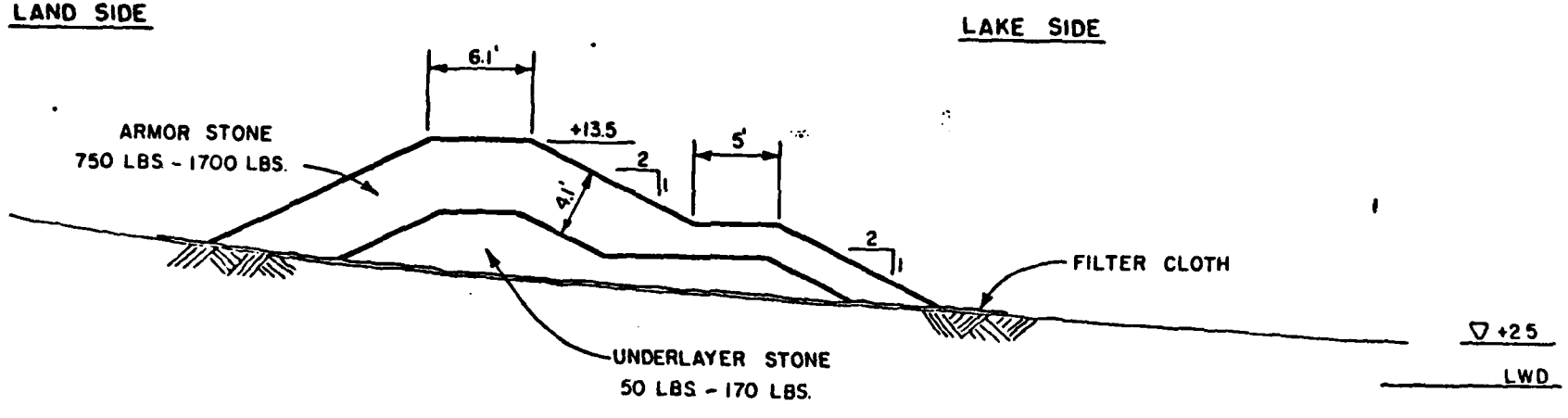
3.3.6 Alternative 5 - Revetment. The plan view of Alternative 5 is shown on Plate EIS-12. Alternative 5 involves the construction of an 11,000-foot long revetment along the entire park shoreline. Three different sections form the revetment which runs from McHenry Ditch on the west to the Cedar Point Wildlife Refuge on the east. The Wildlife and Berger Ditch Revetments are identical to those for the other alternatives. The third revetment section, as shown on Plate EIS-13, is termed the West Shore Beach Revetment. It is similar to the Wildlife Revetment except for its top elevation which is +13.5 feet LWD. Along the developed west end of the park, overtopping is not desired. Also, maintenance could be performed from the landward side, and thus the top width is only 6.1 feet versus the 12 feet for the Wildlife Revetment. This plan does not involve beachfill and, therefore, no jetties would be required at the ditch outlets.

3.3.7 Alternative 3c - Protective Sand Beach, Detached Breakwaters, and Revetment - The Selected Plan. The plan view of Alternative 3c is shown on Plate EIS-13a. The principal features of Alternative 3c are: a 5,500-foot long by protective sand beach with vegetated storm dune along the western half of the park shoreline; eight 300-foot long offshore breakwaters with 300-foot gaps; two 250-foot long jetties at the western and eastern ends of the beach; a 6,200-foot long revetment along the eastern half of the park; and a 450-foot revetment along the western shore of the Niles Beach area. This plan is similar to Alternative 3b except that a 50-foot sand area would be constructed lakeward of the storm dune rather than a landward turf area. The total beach width would be 250 feet (see Plate EIS-13b). Since this plan has excess net annual benefits ($4,030,000) and meets all planning objectives, it has been chosen as the Selected Plan.

3.4 Implementation Responsibilities


MAUMEE BAY
450' BERGER DITCH REVETMENT
5900' WEST SHORE REVETMENT
6200' WILDLIFE REVETMENT
100' GAP
BAY SHORE ROAD
CAMPGROUND
ST JOHN DITCH
CEDAR POINT NATIONAL WILDLIFE REFUGE
McHENRY DITCH
R AMES DITCH
BERGER DITCH
DITCH
BAUTTER DITCH
MAUMEE BAY STATE PARK
CURTICE ROAD
CEDAR POINT ROAD
NORDEN ROAD
NORTH ROAD
MAUMEE BAY STATE PARK BOUNDARY
SCALE OF FEET
MAUMEE BAY STATE PARK
OHIO
ALTERNATIVE 5
REVETMENTS
U S ARMY ENGINEER DISTRICT BUFFALO

ES-29



WEST SHORE BEACH REVETMENT

SCALE 1" = 10'

EIS-30

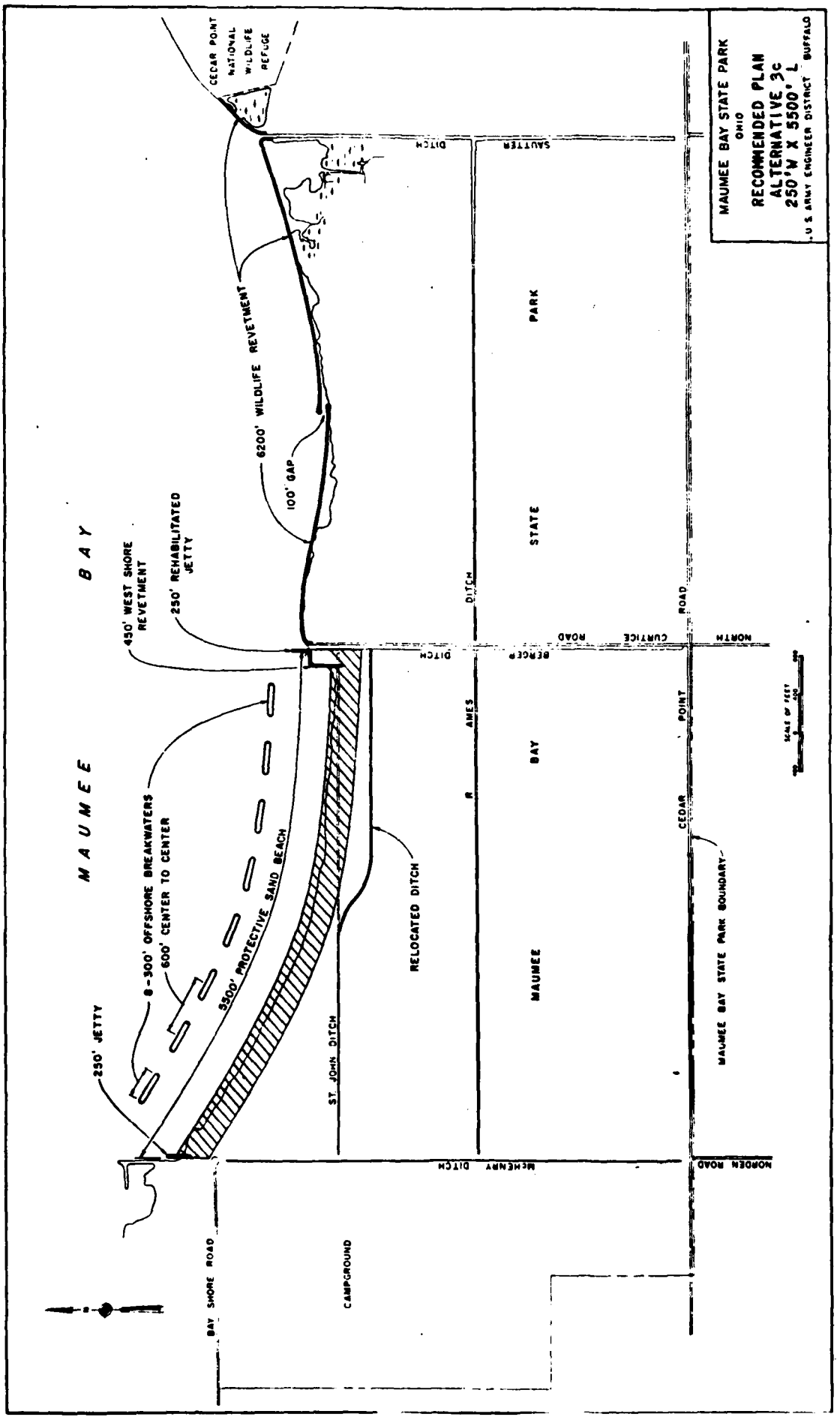
PLATE EIS-13

MAUMEE BAY STATE PARK, OHIO

TYPICAL REVETMENT SECTION

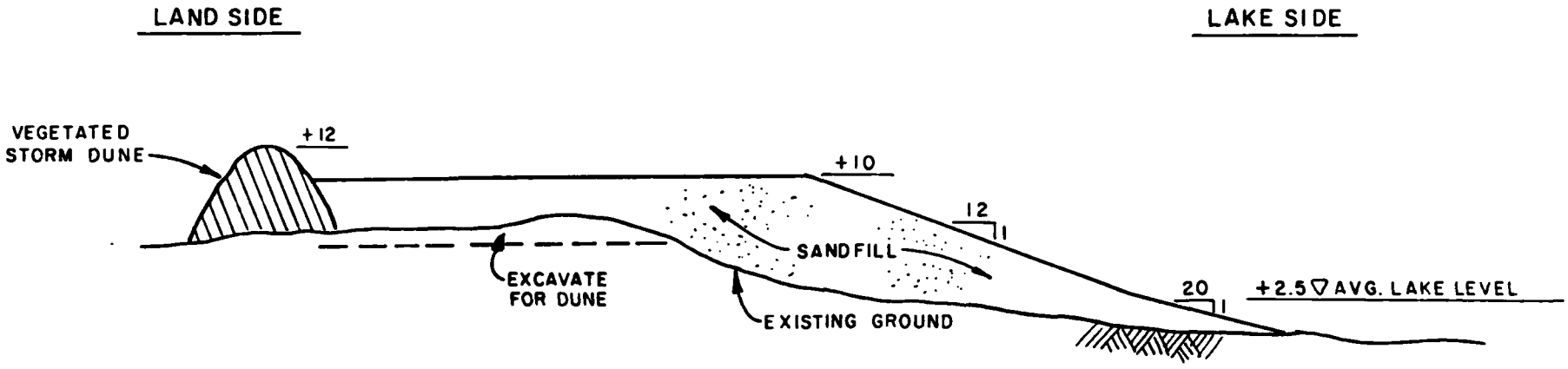
WEST BEACH

U.S. ARMY ENGINEER DISTRICT BUFFALO



EIS-30a

, PLATE EIS-13a



TYPICAL SAND BEACH SECTION - ALTERNATIVE 3C
SELECTED PLAN

SCALE: HORIZ 1"= 50'
VERT. 1"= 10'

EIS 306

Plate EIS 130

MAUMEE BAY STATE PARK, OHIO

ALTERNATIVE 3C
TYPICAL SAND BEACH SECTION

U.S. ARMY ENGINEER DISTRICT BUFFALO

3.4.1 Federal. The Federal Government would be responsible for providing the Federal share of the final construction cost and for carrying out the initial construction activities for the Selected Plan of Improvement if a shore protection/beach restoration project is authorized for construction. They would provide aids to navigation on the offshore breakwaters and would be responsible for maintenance of same. During the 5-year nourishment period, the Federal Government would participate in the beach nourishment costs. After this period, the project would be reevaluated to determine the course of action for the remainder of the project life. At this time modifications to the structures and/or cost-sharing of the sand nourishment would be discussed based on the actual volume of sand lost as determined by field surveys.

3.4.2 Local. The State of Ohio would be responsible for providing the standard items of local cooperation, in addition to the non-Federal share of the final construction cost. The State would also be responsible for funding 100 percent of the maintenance costs for the structural features and for carrying out the actual maintenance and nourishment activities.

3.4.3 Based on the study results to date and the project components contemplated, the following "Items of Local Cooperation" will be required:

a. Provide without cost to the United States, all lands, easements, and rights-of-way, including borrow and spoil disposal areas as determined by the Chief of Engineers, necessary for the construction and subsequent maintenance of the project;

b. Contribute in cash 30 percent of the project construction cost, including periodic beach nourishment, to be paid in a lump sum prior to initiation of such work. In the event such work is scheduled over more than one Federal Fiscal Year, said contribution may be made in annual installments over the period of construction at a rate proportionate to the proposed or scheduled apportionment of Federal funds to the project with the final apportionment of costs to be made after completion of construction and determination of actual costs;

c. Provide appurtenant facilities shown on the State Master Plan, for which recreational benefits have been taken;

d. Hold and save the United States free from all claims for damage due to construction, operation, and maintenance of project, except for damage due to the fault or negligence of the Government or its Contractors;

e. Provide without cost to the United States all alterations and relocations to existing improvements including highways, buildings, utilities, sewers, and other facilities which may be required in connection with the construction of the project;

f. Construct permanent park structures and park roads above the 100-year water surface elevation of 577.3 IGLD and consider such elevation when constructing other facilities, which would be significantly affected by high waters;

g. Maintain and repair the protective structures and improvement measures during the useful life thereof as may be required to serve their intended purposes;

h. Control water pollution from within the park to the extent necessary to safeguard the health of the bathers;

i. Maintain continued public ownership and use of the shore upon which the Federal participation is based during the economic life of the project;

j. Provide and maintain necessary access roads, parking areas, and other public use facilities open and available to all on equal terms;

k. Comply with the applicable provisions of the "Uniform Relocation Assistance and Real Property Acquisitions Policies Act of 1970, Public Law 91-646, approved 2 January 1971, in acquiring lands, easements, and rights-of-way for construction and subsequent maintenance of the project, and inform affected persons of pertinent benefits, policies, and procedures in connection with said Act.

Table EIS-2 - Comparative Impacts of Alternatives
(Alternative 3c is the Selected Plan)

Base Condition and Alternatives	Beach	Wetlands	Borrow Area	Water Quality	Threatened and Endangered Species	Cultural Resources	Land Use	Plan Economics
Base Condition	Narrow, actively eroding shore with minor amounts of sand and gravel.	244 acres of forested and cattail wetland.	5.7 million cubic yards of commercial quality sand.	Meets State standards for primary contact recreation. Two periods in 1981 when fecal coliform content exceeded standards for bathing waters.	Within the range of Federal endangered species (Indiana bat, peregrine falcon, Kirtland warbler, bald eagle, blue pike), State endangered species (Upland sandpiper, spotted turtle), and State threatened species (marsh hawk, short-eared owl, dickcissel).	Archaeological site 33 LU-247. Paleoindian, Archaic, Woodland, and historic artifacts.	South Shore Park currently zoned as a single family district. Commercial zoning at major intersections on Corduroy and Jerusalem Roads. Approximately 1,200 acres of prime farmland within ODNR planning area.	Not applicable.
Alternative 1 (No Action)	No impact.	Loss of 60 acres.	No impact.	No impact.	No impact.	No impact on significant cultural resources. Continued erosion of cultural materials.	Less intensive park development.	Investment Costs: $0 Average Annual Costs: $0 Total Discounted Recreational Value: $8,944,500 Net Annual Benefits: $0 B/C Ratio: Not Applicable
Alternative 2a (Unprotected Beach)	Provides a 32.6-acre sand beach.	Loss of 2.2 acres. Projection against future erosion. 32.5 acres impacted by the proposed ODNR golf course.	1.3 million cubic yards of sand removed. 42.6 acres bottom habitat disturbed during initial construction, 3.1 acres annually.	Temporary turbidity during construction, dredging and maintenance activities.	Vegetational changes caused by secondary park development may result in decreased nesting by upland sandpipers.	No impact on significant cultural resources. Covering of the more disturbed areas at the existing shoreline. ODNR development and more intensive use of the park would disturb previously unsurveyed areas located further inland.	Present zoning regulations would limit commercial development to those areas on Corduroy & Jerusalem Roads - Approximately 1,200 acres of prime farmland converted to park land by ODNR.	Investment Costs: $8,593,100 Average Annual Costs: $5,154,000 (ODNR park development = $3,627,900) Total Discounted Recreational Value: $20,792,013. Net Annual Benefits: $11,857,500 B/C Ratio: 2.56
Alternative 3a (Beach & Offshore Breakwaters)	Same as Alternative 2a.	Same as Alternative 2a.	455,000 cubic yards of sand removed. 32.5 acres bottom habitat disturbed during initial construction, 0.8 acre annually.	Same as Alternative 2a. Disruption of nearshore circulation patterns caused by the presence of offshore breakwaters.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.	Investment Costs: $10,152,900 (1) Average Annual Costs: $5,110,000 (ODNR park development = $3,627,900) Total Discounted Recreational Value: $20,735,579 Net Annual Benefits: $11,801,100 B/C Ratio: 2.53
Alternative 3b (Beach, Turf, & Offshore Breakwaters)	Provides a 25.3-acre sand beach.	Same as Alternative 2a.	415,000 cubic yards of sand removed. 26.3 acres bottom habitat disturbed during initial construction, 0.8 acre annually.	Same as Alternative 3a.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.	Investment Costs: $9,822,300 Average Annual Costs: $5,085,000 (ODNR park development = $3,627,900) Total Discounted Recreational Value: $29,735,579 Net Annual Benefits: $11,801,100 B/C Ratio: 2.58
Alternative 3c (Beach, & Offshore Breakwaters)	Same as Alternative 3b.	Same as Alternative 2a.	45,000 cubic yards of sand removed. 26.3 acres bottom habitat disturbed during initial construction, 0.8 acres annually.	Same as Alternative 3a.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.	Investment Costs: $15,160,000 Total Annual Cost: $1,677,000 Net Annual Benefits: $5,701,000 B/C Ratio: 3.
Alternative 5 (Revetment)	No beach provided.	Same as Alternative 2a.	No impact.	Temporary turbidity during construction and maintenance activities.	Same as Alternative 2a.	Same as Alternative 2a.	Same as Alternative 2a.	Investment Costs: $7,325,300 Average Annual Costs: $4,234,000 (ODNR park development = $3,025,900) Total Discounted Recreational Value: $11,345,125 Net Annual Benefits: $2,410,600 B/C Ratio: 0.67

(1) See paragraph 5.5.2 for an economic reevaluation of Alternative 3b.

4. AFFECTED ENVIRONMENT

This chapter describes the study area's existing and without conditions in the following discussions:

a. Environmental Conditions. This discussion describes the major characteristics of the study area's natural and human resources to provide a general understanding of physical, ecological, social, cultural, and economic conditions.

b. Significant Resources. This section describes each significant resource included in the Comparative Impacts of Alternatives table (p. EIS-33), including its location, quantity, and quality. In further identifying and characterizing resources, consideration is also given to the following criteria for resource significance:

(1) Resources identified in the laws, regulations, guidelines, or other institutional standards of national, regional, and local public agencies. Resources identified in the guidelines of certain private groups were also considered.

(2) Resources meeting certain study-specific technical criteria for measuring characteristics that may be critical to resource existence. Technical criteria include, but are not limited to, measurement of resource scarcity, fragility, resiliency, reproducibility, and tolerance.

(3) Resources specifically identified as a concern by public interests.

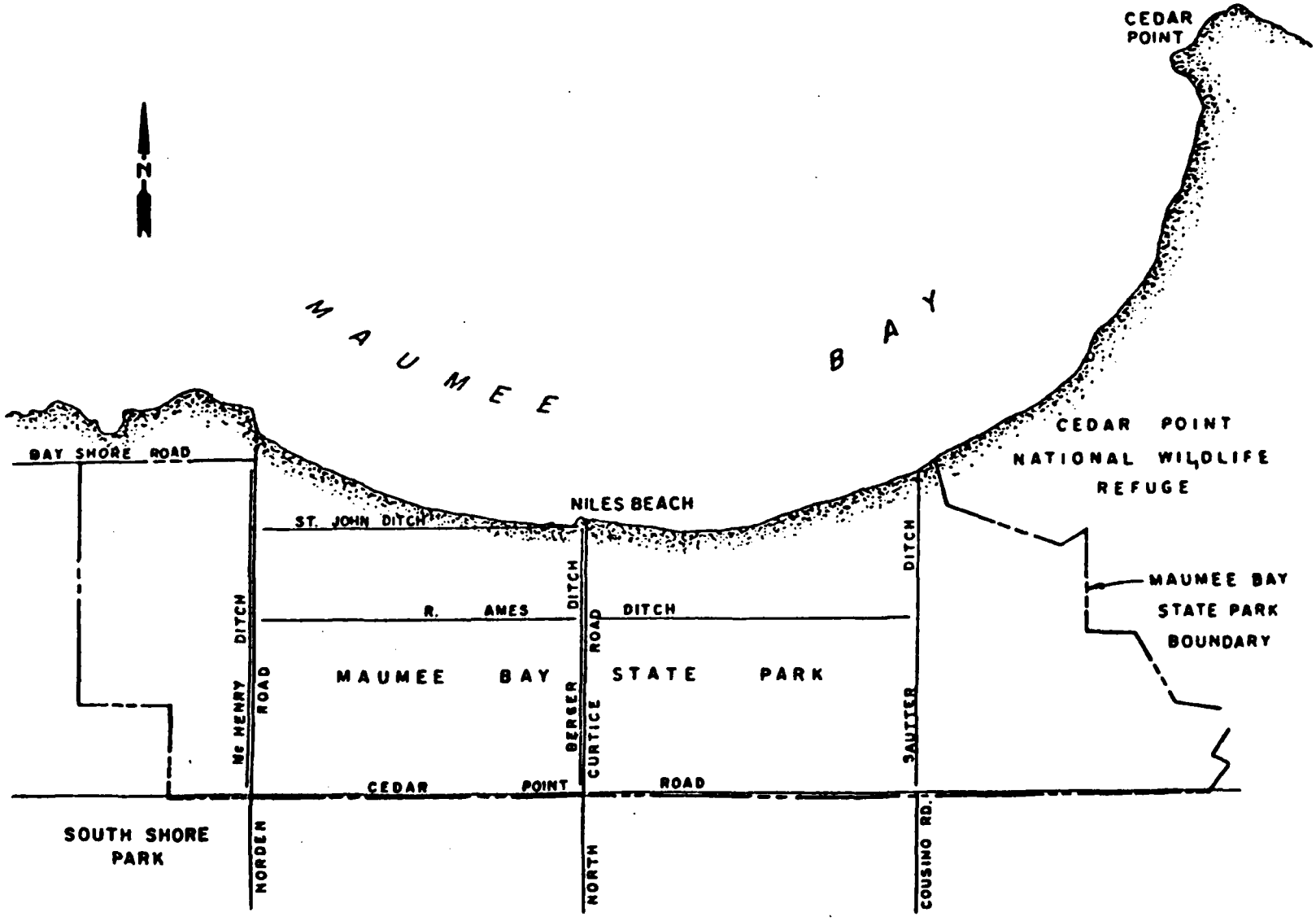
(4) Resources which, if affected by a plan, would violate an institutional standard, meet a study-specific technical criterion, or become the subject of public concern.

4.1 Environmental Conditions

4.1.1 Geographical Setting. Maumee Bay State Park is located in Lucas County, OH, approximately 5 miles east of Toledo. Plate EIS-14 shows the vicinity and location of the park. The 1,855-acre park occupies approximately 11,000 feet of shoreline along the south shore of Maumee Bay in the western basin of Lake Erie. The Cedar Point Unit of the Ottawa National Wildlife Refuge, which is managed solely for the conservation of wildlife, with special emphasis on migratory waterfowl, borders the east park boundary. To the west is the medium-density residential community of South Shore Park. Agricultural lands, raising primarily corn and soybeans, occupy those areas south of Cedar Point Road.

4.1.2 The study area is low-lying and flat with an average elevation of about 6 feet above LWD.(1) Historically, the area proposed for the park was a

(1) Low Water Datum for Lake Erie is 568.6 feet above sea level (International Great Lakes Datum - 1955).



DITCHES AND PARK BOUNDARY LINE

EIS-35

PLATE EIS-14

part of the "Great Black Swamp," an extensive wooded wetland which extended across 120 miles of northwestern Ohio. The western portion of the park was woodland and the eastern portion was marsh. With the arrival of the first white settlers, the area was gradually converted from woodland and marsh to agricultural land. By 1940, a small residential area, which has since been abandoned, was established at Niles Beach. Flooding, erosion, high lake levels, and the abandonment of agricultural and residential areas has caused certain areas to revert to marsh. Currently, approximately 244 acres of forested and cattail wetlands exist along the eastern 5,500 feet of the park shoreline.

4.1.3 The Ohio Department of Natural Resources (ODNR) is proceeding to develop the park as a multiuse recreation complex. Plate EIS-15 shows ODNR's master plan for park development (ODNR has revised its master plan by relocating the lodge and cabin complex east of North Curtice Road and adjacent to the shoreline). When completed, the park will provide opportunities for camping, swimming, picnicking, hiking, nature study, fishing, and golf. Development began in 1979 and to date (summer 1981) a park office, camping area, and internal roadways have been constructed and saplings have been planted. A new 256-site camping area, opened in July 1981, is a "Class A" area with all sites equipped with electrical hookups, picnic tables, and fire rings. There are four shower houses within the campground. Future developments planned at the park include a lodge and cabin complex, a golf course, and picnicking facilities.

4.1.4 Vegetation. The primary vegetation type of the park is old field. The area is in its fifth to sixth year of natural succession and supports a wide variety of grasses and broad-leaved herb species, including goldenrod, aster, wild carrot, teasel, yellow sweet clover, Canadian thistle, and mustard species. The wetland area is composed of areas of cattail and wooded swamp. (This area is discussed in more detail in the Significant Resources Section, para. 4.2.2.) Secondary growth vegetation can be found along forest and swamp edges, roads, and ditches. This vegetation is typified by a variety of vines and shrubs, including dogwood, sumac, wild plum, honeysuckle, wild grape, blackberry, honey locust, hawthorn, and choke cherry.

4.1.5 The large extent of old field vegetation at Maumee Bay State Park is fairly uncommon in Lucas County due to extensive and intense agricultural practices in the region. The presence of a very early successional vegetation stage has made it possible for uncommon bird species such as the bobolink to nest in the area and for pheasants to nest without risk of disturbance from mowing or other agricultural practices. The swamp-marsh area is particularly valuable to a wide range of species. Bird use and species diversity is especially noteworthy in this area of the park. Intermittent flooding of upland and inland areas by Lake Erie helps to maintain the early successional and swamp-marsh vegetation in the park.

4.1.6 Birds. The general area experiences particularly high concentrations of birds in the spring and fall. This appears to be due to the fact that the park lies within the pathway of four migration routes. On 19 April, 3 May, 25 June, and 26 June 1979, bird surveys were conducted at the park by U. S. Fish and Wildlife Service (USFWS) biologists. A list of

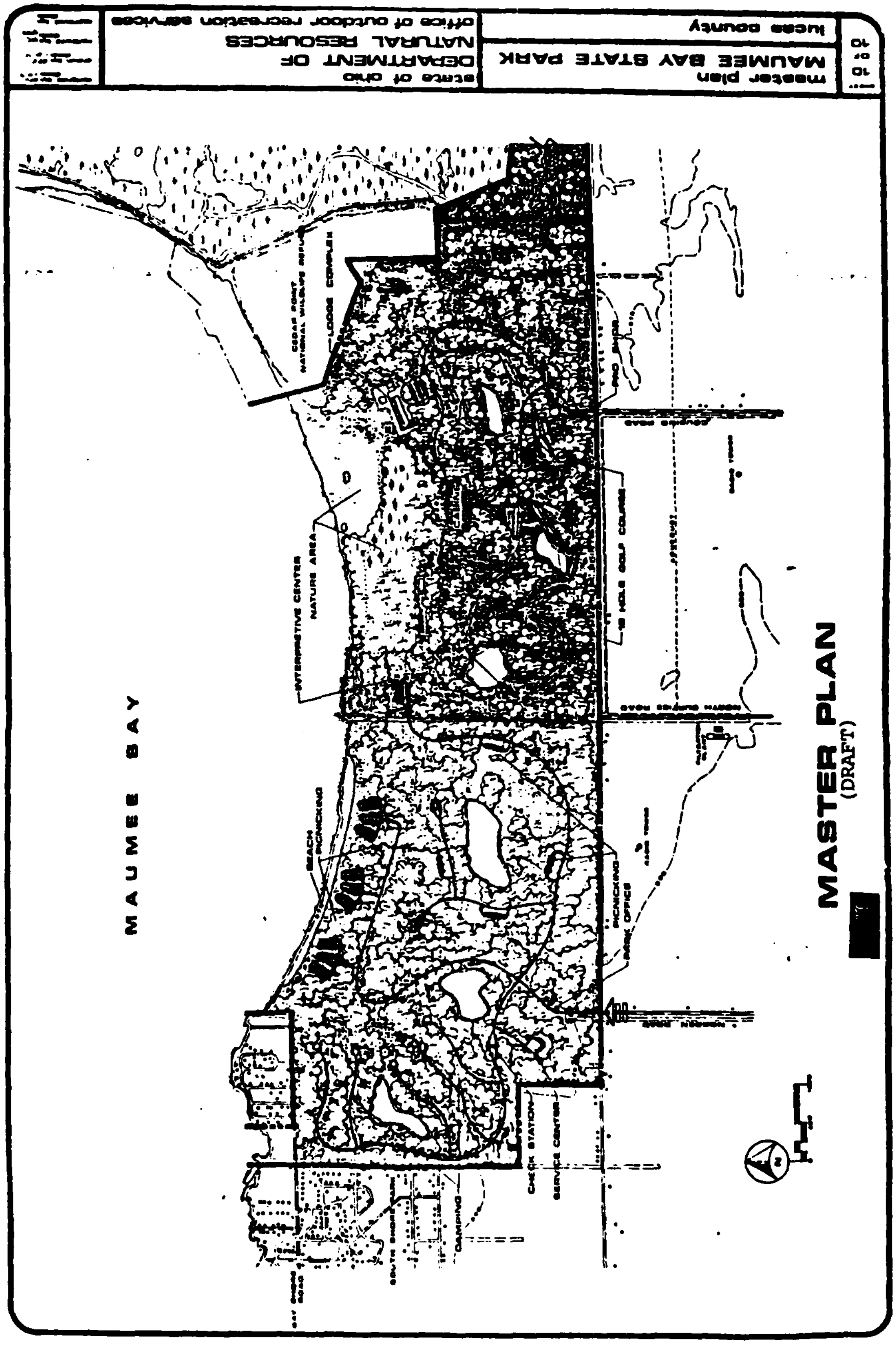

master plan
MAUMEE BAY STATE PARK
lucas county
state of ohio
DEPARTMENT OF NATURAL RESOURCES
office of outdoor recreation services
MAUMEE BAY
LODGE COMPLEX
INTERPRETIVE CENTER
NATURE AREA
18 HOLE GOLF COURSE
BEACH
PICNICKING
PARK OFFICE
CHECK STATION
SERVICE CENTER
CAMPING
MASTER PLAN
(DRAFT)

PLATE EIS-15

the birds observed is presented in Table 1, in Appendix EIS-A. Table 2 in Appendix EIS-A presents a bird survey provided by ODNR's Natural Heritage Program. Nesting by mallards and pheasants can be expected to occur in the old field habitat that comprises the major part of the park. The staff of the Ottawa National Wildlife Refuge have listed these old fields as one of the few remaining areas in Lucas County with good pheasant habitat. No colonial birds are known to nest in the area. Herons and egrets, however, can be observed feeding along the ditches and more secluded shallow water areas. Gulls and terns can be observed feeding over marshes and along the near-shore areas.

4.1.7 Surficial Geology. The park shoreline is dominated by glaciolacustrine deposits of medium-gray to grey-brown silty clays that form low banks from 1 to 5 feet high. Slopes in the nearshore zone are gentle; areas within 1,000 feet of the shore are generally less than 5 feet below LWD. Offshore deposits consist of lacustrine clay with a thin overburden of recently deposited silt. Sand is generally lacking along the shore and within the nearshore area. However, a significant deposit of sand is present in a modified spit extending to the northwest of Cedar Point. The deposit, formed by littoral currents moving northwesterly along Cedar Point, is a commercial source of sand and gravel. Currently, no commercial dredging is being conducted in this area.

4.1.8 Water Quality. According to Chapter 3745*1 of the Administrative Code (Ohio Environmental Protection Agency Water Quality Standards), Maumee Bay is designated Warmwater Habitat, Agricultural Water Supply, Industrial Water Supply, and Primary Contact Recreation. Lake Erie waters in the bay must meet the most stringent standards established for each use designation. Available water quality data obtained from USEPA's STORET system indicate that, for the sampling period between April and October 1978 at two locations near Cedar Point, mean concentrations of iron, manganese, and zinc exceeded State standards. All other measured parameters were within the established limits for the above designated uses.

4.1.9 Fish. A limited fisheries survey of the area was conducted on 26 June 1979 by USFWS biologists. Table 3, in Appendix EIS-A, presents a list of species collected during the fisheries survey. Three of the seven species collected, yellow bullhead, white bass, and yellow perch, are fish of sport and/or commercial value. A slight increase in species diversity was noted near the rock rubble structure near Norden Road (Niles Beach). Other species which are found in shallow, turbid, unsheltered waters with clay and silt substrates and no aquatic vegetation may also utilize the project area.

4.2 Significant Resources

4.2.1 Beach. The present park shoreline is dominated by glaciolacustrine deposits of medium-gray to gray-brown silty clays that form low bluffs from 1 to 5 feet high. This 5,500-foot reach is an active erosion area with an average recession rate of 13.5 feet per year. The shore contains negligible amounts of sand and is currently of minimal importance as a recreational resource.

4.2.2 Wetlands. Approximately 244 acres of forested wetlands exist along the eastern 5,500 feet of park shoreline. The area is composed of areas of cattail and wooded swamp which are maintained by intermittent flooding by Lake Erie. During field investigations, little free-standing water was found in the cattail area; however, the soil was generally saturated. Dominant tree species within the wooded swamp include species which are common to bottomland and flood plain areas. Red maple, cottonwood, sycamore, elm, ash, and box elder are among the hardwoods which can be found in the moist and swamp conditions. This swamp-marsh area is particularly valuable to a wide range of species, with bird use and species diversity especially noteworthy. Plate EIS-16 displays the various wetland types located within the park and Table EIS-3 lists their acreages. For a more detailed description of the wetlands and vegetation types, see pages I-1-15 in Appendix I.

Table EIS-3 - Wetland Acreages of Maumee Bay State Park

Wetland Classification *		Acres
P FO/SS 1Y	Palustrine; deciduous forested-scrub/shrub; saturated/semipermanent/seasonally flooded.	113.0
P SS1/EM Y	Palustrine; deciduous scrub/shrub-emergent; saturated/semipermanent; seasonally flooded.	53.0
PFO1Y	Palustrine; deciduous forested; saturated/ semipermanent/seasonally flooded.	12.5
PEMY	Palustrine; emergent; saturated/semipermanent/ seasonally flooded.	65.5
TOTAL		244.0

*Classification of Wetlands and Deepwater Habitats, by Cowardin, et al., U. S. Fish and Wildlife Service (1980).

SOURCE: Draft Fish and Wildlife Coordination Act Report, U. S. Fish and Wildlife Service, Columbus, OH, December 1981.

4.2.3 Borrow Area. The potential offshore borrow areas, as shown on Plate EIS-5, are part of a modified spit extending northward from Cedar Point which were deposited by littoral currents from the southeast. This sand and gravel deposit is a low ridge widening from less than 1/2-mile at Cedar Point to more than 2 miles at its northern end near Turtle Island. On its western and northern sides, the deposit terminates abruptly with a sharp sand-mud boundary. Eastward, the change is more gradational. The higher surfaces of the sand deposit rise to a maximum of about 7 feet above the underlying lake bottom materials. As of December 1974, the quantity of commercial quality sand in the deposit was estimated to be 5,751,228 cubic yards.

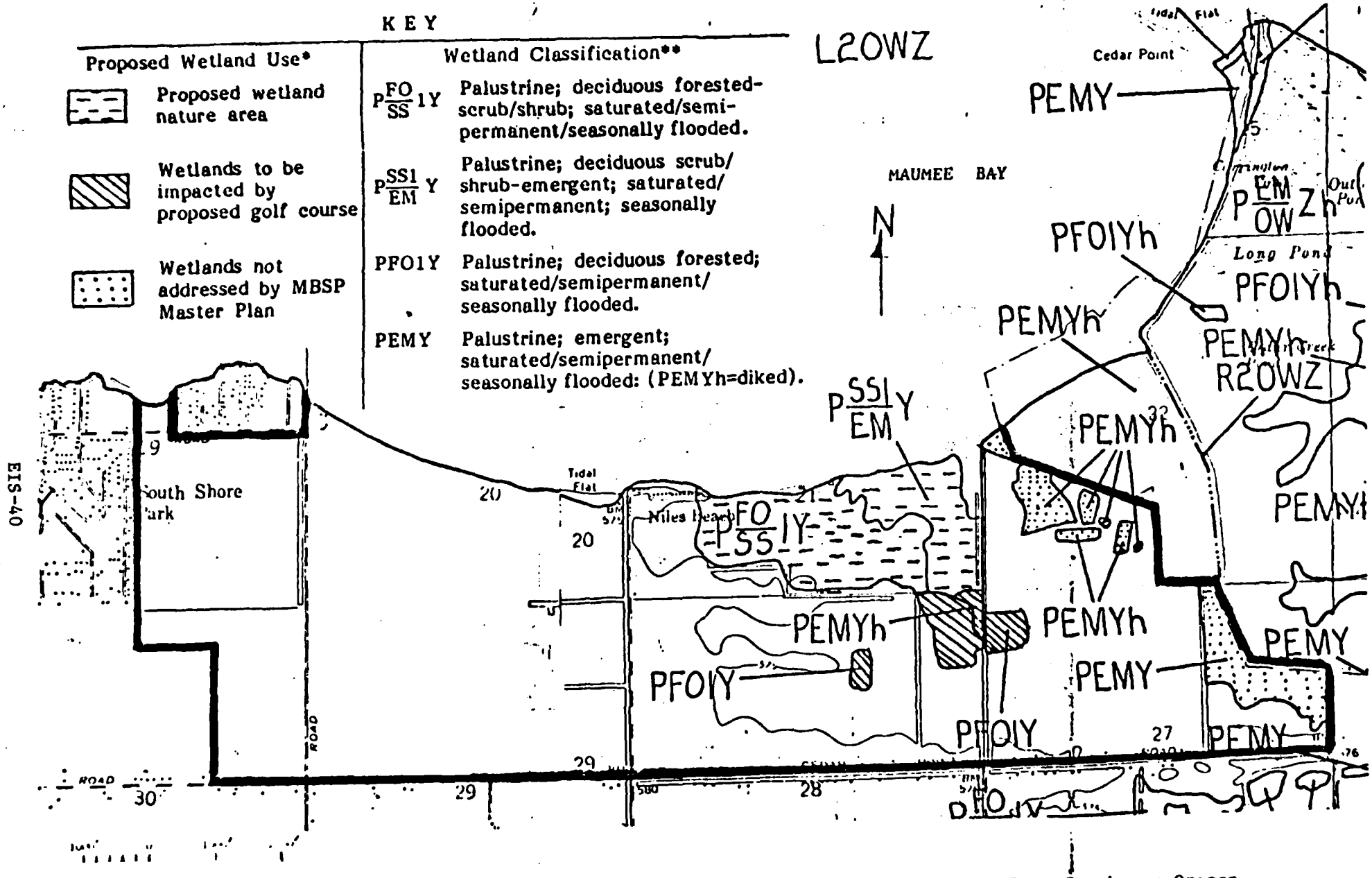


Plate EIS-16. Wetlands of Maumee Bay State Park (National Wetlands Inventory maps: Reno Beach and Oregon quads, April 1977).

4.2.4 Sandy substrates typically exhibit a fauna of limited numbers and diversity. Benthic organisms present in the Maumee Bay area are those generally considered to be pollution-tolerant and not highly valued. These are primarily Oligochaete worms and midge larvae which show a preference for silt/mud habitats. The zooplankton community is of limited diversity, dominated by Cladocera and Copepoda. Phytoplankton types are limited by the available substrate which is unsuitable for the propagation of attached algal types. Common fish species which utilize Maumee Bay as a nursery area are, in order, gizzard shad, white bass, freshwater drum, and yellow perch. According to the USF&WS, existing information offers fairly conclusive evidence that the spit is used for spawning by gizzard shad, alewife, white bass, yellow perch, emerald shiner, sauger, walleye, spottail shiner, trout-perch, logperch, and freshwater drum. However, it is not possible to deduce from existing information the extent of contribution of the spit to recruitment of fish to their respective populations in Lake Erie. It appears possible that species such as smelt, Johnny darter, sand shiner, white sucker, white perch, whitefish, and channel darter also utilize the spit. Additional sampling would be necessary to more fully document the utilization of the Cedar Point spit by fish species.

4.2.5 Water Quality. Discharge sources within the study area include the Bay Shore Edison Power Plant; the Oregon Sewage Treatment Plant (both of which outfall approximately 2-1/2 miles west of the park); and McHenry, Berger, and Sautter Ditches. The Toledo Environmental Services Agency of the Department of Public Utilities has stated that neither the power plant (mean discharge = 1,200 cfs) nor the sewage treatment plan (discharge = 2 MGD) will generally have much effect on swimming conditions at the park. Effluents are significantly dispersed and diluted before reaching the park. With regard to the sewage treatment plant, final effluent is chlorinated April through November. The system is new and has been designed to service 62,500 people. The projected population for the city of Oregon in the year 2000 is 27,000. The power plant effluent is used only for cooling purposes and contains no added pollutants. Water temperature and dissolved oxygen are raised (7-8°F and 1 ppm, respectively), and sometimes chlorine is added.

4.2.6 Drainage ditch discharge may be of more consequence. The county ditches drain primarily agricultural lands south of the park and empty to the east and west of the proposed beach. Since water quality at the shore meets State standards for bathing waters, local runoff currently does not have a significant adverse effect. However, water samples will be collected annually to ensure that a public health hazard does not exist.

4.2.7 In assessing Maumee Bay as a recreational resource, two of the most important factors to consider are its aesthetic quality and its relationship to public health standards. Due to the fine texture of the existing nearshore materials and shallowness of the bay, the water at the park is often quite turbid. Turbidity is highest in the early spring and lowest in early fall. Bacteriological samples obtained by the Ohio Departments of Health and Natural Resources for the 1979, 1980, and 1981 swimming seasons show that water quality at the park meets those health criteria for primary contact recreation (<1,000 fecal coliforms per 100 ml) and, under normal conditions, the standards for bathing waters (<200 fecal coliforms per 100 ml) (see pages I-16-18, in Appendix I). If a recreational beach is developed

at the park, the Ohio Department of Health would apply the more stringent standards. In 1981, fecal coliform content at the park slightly exceeded this standard on two occasions (202 and 258 fecal coliforms per 100 ml). Consultation with the Ohio Department of Health (ODH) revealed that this is a problem for all Ohio Lake Erie beaches and is related to heavy rainfall rather than a persistent pollution problem. The policy of the Department of Health is to post Lake Erie beaches after such storms in order to protect the public health.

4.2.8 The relatively high turbidity levels do not affect beach use at nearby State parks in the western Lake Erie basin with similar water quality conditions. Conversations with park personnel revealed that no complaints are normally received regarding periodic water cloudiness and the only limiting factors related to swimming activity at the parks appears to be the lack of beach and parking areas.

4.2.9 According to ODH, Maumee Bay State Park water quality is essentially the same as that at a nearby State park - Crane Creek. Since no recent beach closings have occurred at Crane Creek State Park, ODH anticipates uninterrupted use of the proposed beach at Maumee Bay State Park.

4.2.10 Threatened and Endangered Species. On 14 May 1981, the U.S. Fish and Wildlife Service presented the following list of endangered species which may be present in the study area:

Common Name	Scientific Name
Indiana bat	Myotis sodalis
Peregrine falcon	Falco peregrinus
Kirtland's warbler	Dendroica kirtlandii
Bald eagle	Haliautus leucocephalus
Blue pike	Stizostedion vitreum glaucum

Onsite inspections and coordination with the U. S. Fish and Wildlife Service and Ohio's Natural Heritage Program failed to identify any of these species or their critical habitat as being present in the study area. However, the Heritage Program did identify a State endangered species, the upland sandpiper (Bartramia longicauda), as a probable nester in the nonwetland portion of the park. Upland sandpipers frequent plains, prairies, old pastures, and short-grass fields, such as golf courses and airports. State threatened species which have been observed in the park include the marsh hawk (Circus cyaneus), short-eared owl (Asio flammeus), and dickcissel (Spiza americana). In 1975, a few specimens of larval mooneye (Hiodon tergisus), a State endangered species, were taken in Maumee Bay. The spawning area for this species is uncertain. The U. S. Fish and Wildlife Service noted that the spotted turtle (Clemmys guttata), a State endangered reptile, is known to occur in the southwestern Lake Erie area. However, the Heritage Program inventory did not identify it as occurring in the study area.

4.2.11 Land Use. South Shore Park which borders the west park boundary is a medium-density residential community whose only permitted use is for single family dwellings. Present zoning regulations for the city of Oregon restrict commercial development in this area. Areas where general commercial

development is permitted are the intersections of North Curtice and Corduroy and Jerusalem Roads (Jerusalem Township). Approximately 1,200 acres of prime farmland have been or will be acquired by ODNR for park development.

4.2.12 Cultural Resources. In April 1979, the University of Toledo conducted an archaeological reconnaissance survey of Maumee Bay State Park. The survey consisted of a literature search and limited field survey designed to assess the area's potential for containing significant prehistoric or historic cultural resources. Field activities were designed to sample both the shoreline areas which were known to have yielded cultural materials and the interior area where no cultural materials had been previously reported. During this survey, two significant archaeological sites were located. Although these sites had been badly disturbed by erosion, the Ohio Historic Preservation Office recommended that the Corps of Engineers undertake additional studies in order to better evaluate the possible eligibility of the two sites for inclusion in the National Register of Historic Places (NRHP).

4.2.13 Based upon a subsequent cultural resource testing and evaluation of archaeological site 33-LU-247 (intense erosion of site 33 LU-154 had eliminated the possibility of its inclusion in the NKHP), John Milner Associates of West Chester, PA, concluded:

> . . .the Maumee Bay site, 33-LU-247, is not considered eligible for the National Register of Historic Places. The site's ability to provide important scientific data has been lost due to the combined effects of beach erosion and inundation. Mechanical action has removed artifacts from their original deposits, destroying the site's contextual integrity and precluding the isolation of discrete cultural or temporal associations. The water-worn condition of most of the artifacts further limits their usefulness in investigations of production technology or in functional analysis. Despite the large artifact collections from the site, the material is not unusual or of outstanding scientific value. It is believed that the site contains no data which could not be recovered more efficiently elsewhere.

The cultural resources testing and evaluation draft report was forwarded to the Ohio State Historic Preservation Office, Regional Archaeological Preservation Office, and the Midwest Regional Office of the National Park Service for review and comment, as prescribed in Section 106 of the National Historic Preservation Act. Both the National Park Service and the State Historic Preservation Office concurred that the site is not eligible for inclusion in the National Register of Historic Places (see Appendix H).

5. ENVIRONMENTAL EFFECTS

This chapter describes the effects of each detailed plan on the previously described significant resources. Its purpose is to provide the reader with a detailed analysis of the impacts displayed in the Comparative Impacts of Alternatives Table (p. EIS-33). This section contains a detailed analysis of the environmental consequences of each alternative, including the Selected Plan, and provides backup analysis for the comparative table. Although all costs for the various alternatives are based on beachfill obtained from existing commercial sources, less expensive offshore sources are still under consideration. The impacts of obtaining sand from these offshore areas are assessed in this EIS as a "worst case" analysis. Ichthyoplankton surveys of these areas during the spring and summer would be required to supplement existing spawning and nursery data. If a recommendation is made against using these sites as a sand source, other existing commercial sources would be used.

ALTERNATIVE 1 - NO ACTION

5.1 Social Effects

5.1.1 Noise, Displacement of People, Public Health, Transportation, Community Cohesion, Community Growth. No effect.

5.1.2 Aesthetic Values. If no action is taken to prevent present recession rates, erosion scars at the shoreline would persist.

5.1.3 Recreation Opportunities. The current beach at Maumee Bay State Park is a result of present erosion rates. Therefore, as the shoreline recedes, the basic dimensions of the beach (length and width) would not change significantly. Use of the beach as a recreational resource would remain minimal. Erosion would result in a continued loss of parkland (2.8 acres annually) and would threaten present and future park development.

5.1.4 Cultural Resources. The continued loss of archaeological sites and cultural artifacts may accompany the erosion of parkland.

5.2 Economic Effects

5.2.1 Tax Revenues, Property Values, Public Facilities, Public Services, Regional Growth, Employment/Labor Force, Business and Industrial Activity, Displacement of Farms, Land Use. No effect.

5.3 Environmental Effects

5.3.1 Man-Made Resources, Natural Resources, Air Quality, Water Quality, Fish and Wildlife, Plankton and Benthos, Vegetation. No effect.

5.3.2 Wetlands. Assuming that current shoreline recession rates would continue, approximately 1.2 acres of wetland habitat would be lost annually. This habitat would be replaced by shallow aquatic habitat similar to that which exists in the nearshore area.

5.4 Social Effects

5.4.1 Noise. The use of construction equipment (trucks, front-end loaders, cranes, bulldozers, etc.) required for the implementation of each alternative would result in a short-term local increase in noise levels. For those alternatives which involve beach restoration (Alternatives 2a, 3a, 3b, and 3c), an additional noise source - dredge - would be involved. The noise level immediately adjacent to a dredge is comparable to that of a truck; at 500 feet, it drops to within the range of an automobile, and at the shore it is slightly below the level of a normal conversation. An additional offshore noise source would be present for those plans which involve the construction of offshore breakwaters (Alternatives 3a, 3b, and 3c). The clearing and grubbing of the shoreline, construction of a storm dune, revetments and jetties, and the spreading of beachfill during initial construction and annual nourishment would be onshore noise sources. The transport of stone for the jetties and revetments from commercial quarries in Clay Center, OH, (most feasible possible source) would result in a slight short-term increase in noise levels along the transportation route. As park attendance increases, local noise levels at the park and along major access routes would also increase.

5.4.2 Displacement of People. No effect.

5.4.3 Public Health. During construction of any of the alternatives, the Contractor would be required to maintain a safe, restricted work site. After implementation of the proposed project, rubblemound structures may pose a hazard to park users, especially children. It would be the responsibility of park personnel to prohibit climbing on these structures. Breakwaters (Alternatives 3a, 3b, and 3c) would be equipped with navigational aids and should not pose a threat to watercraft. The U. S. Department of Health and Human Services has noted that the enhancement and/or construction of existing or new recreational areas and facilities adjacent to the wetland area may increase human exposure to potential disease vectors; i.e., mosquitos. ODNR will cooperate with State and local health departments in the monitoring and control of mosquitos.

5.4.4 Aesthetic Values. The presence of heavy equipment during construction (all alternatives) and annual nourishment activities (Alternatives 2a, 3a, 3b, and 3c) would disrupt the visual aesthetics of the area. Construction of a storm dune, revetments, and jetties would alter the natural appearance of the shoreline and in some places may confine the view of Maumee Bay from the shore. This impact would be greatest for Alternative 5 which involves the construction of a revetment along the entire shore. Offshore breakwaters (Alternatives 3a, 3b, and 3c) would obstruct the view of the bay from the beach portion of the park. The restoration of a wider, more uniform beach (Alternatives 2a, 3a, 3b, and 3c) would eliminate erosion scars and create a potentially more aesthetically pleasing sight than the present eroding beach. More intensive park development and increased attendance may detract from the natural character of the area.

5.4.5 Transportation. The transport of materials to the study site would cause a short-term congestion of local traffic during construction and annual nourishment. County roads which would be used as the primary transport routes for stone from Clay Center, OH, would experience a temporary increase in truck traffic. Local traffic would also be disrupted by trucks delivering beachfill. Since Alternative 2a would on an annual basis, require substantially greater quantities of beachfill than the other beach alternatives (20,000 cubic yards vs. 5,000 cubic yards), its adverse impacts on local transportation would be proportionately greater. Dredges used in the excavation of beachfill could temporarily interfere with local navigation. However, all dredges are required to display proper lighting and to comply with specific navigation regulations and, therefore, should not pose any hazard to local boaters.

5.4.6 A secondary impact of park development would be a local increase in traffic congestion during the recreation season. Currently, access roads are inadequate to handle or accommodate the estimated demand for full park development. The peak season, peak day traffic load would be 5,400 vehicles in the year 2040. Annual traffic volume is expected to reach 604,200. Since the development of a beach at the park would be a major traffic generator, Alternatives 2a, 3a, 3b, or 3c would cause a stress on an already limited transportation network.

5.4.7 Recreation Opportunities. Alternatives 2a, 3a, 3b, and 3c, which include the placement of beachfill and restoration of a beach, would add significantly to recreational opportunities at Maumee Bay State Park. Alternatives 2a and 3a would provide approximately 32 acres of sand beach, while Alternatives 3b and 3c would provide 25 acres. Alternatives 3b and 3c would also provide a 6.3-acre grassy area which would have a use similar to the beach area. Beach and park use may be somewhat restricted by construction and annual nourishment activities. However, long-term benefits would be realized by the potential for increased recreational usage and added erosion protection of park land. Recreational fishing would also be enhanced through jetty design which would provide access for shore fishermen. If, as anticipated, the rubblemound structures proposed in each alternative help diversify benthic habitat and thereby the local sport fishery, boat-fishing opportunities may also be enhanced. Alternative 5 would facilitate a lesser degree of park development and would limit access to the shore for recreational purposes.

5.4.8 Community Cohesion. As a secondary impact, the development of Maumee Bay State Park would enhance community cohesion as the park could serve as a focus for community activities. Local residents would no longer have to leave the area to find equivalent recreation sites. Conversely, the attraction of "outsiders" to the park could have a negative impact on community cohesion.

5.4.9 Community Growth. The development of a recreation resource on Maumee Bay would prove to be an attraction to many who would like to relocate to the Toledo area.

5.4.10 Cultural Resources. As preliminary testing and evaluation findings conclude that archaeological site 33-LU-247 does not contain

significant research potential and is not considered eligible for listing in the National Register, the proposed alternatives are expected to have no effect upon significant archaeological resources. The proposed revetments would cover only a narrow strip along the existing shoreline. Most, if not all, of the cultural material in this area has been recovered through intensive and repeated surface collections. A possible beneficial impact of the shoreline erosion protection measures in each alternative would be the abatement of mechanical erosion of cultural materials located further inland. With the development of the park and more intensive use of the area, however, previously unsurveyed areas of the park would be disturbed. It has been recommended to ODNR, therefore, that a professional archaeologist monitor all construction activities in these areas and that sufficient time is provided for the recovery of any exposed significant archaeological features or data.

5.5 Economic Effects

5.5.1 National Economic Development. Each detailed alternative would result in significant costs and benefits to the national economy. Table EIS-4 summarizes the NED costs and benefits of each plan under consideration.

Table EIS-4 - Summary of Benefits and Costs for Alternative Plans (August 1981 Price Levels)

Item	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 5
Average Annual Costs	5,154,000	5,110,000	5,085,000	4,234,000
Annual Benefits	11,857,500	11,801,100	11,801,100	2,410,600
Benefit/Cost Ratio	2.30	2.31	2.32	0.57

5.5.2 Based upon an economic reevaluation (June 1983) of Alternative 3b, the total estimated project cost for the plan would be $11,368,000. The total annual costs of Alternative 3b and related park development is estimated to be $1,872,900; apportioned $707,000 Federal and $1,165,900 non-Federal. The plan has total annual benefits of $3,099,500 and has resultant net annual benefits of $1,226,600. The benefit-to-cost ratio of Alternative 3b is 1.65 to 1. Additional details are contained in the economic analysis supplement (Appendix B) and Section VI in the Main Report.

5.5.3 In November 1983, the Buffalo District conducted an economic evaluation (October 1983 price levels) of Alternative 3c. The total first cost of the Selected Plan would be $15,160,000. The total annual costs of Alternative 3c and associated park development is estimated to be $1,677,000. The plan would have total annual benefits of $5,707,000 and resultant net annual benefits of $4,030,000. The benefit-to-cost ratio of Alternative 3c would be 3.4 to 1.

5.5.4 Property Values. Approximately 1,200 acres of privately owned agricultural land, have been or would eventually be acquired by ODNR for park development. The value of surrounding properties should be enhanced with total park development.

5.5.5 Tax Revenues. The tax base is directly related to property values and would rise along with them. Additional income and sales tax revenues, which would accompany any increased commercial development and employment, would also add to the tax base.

5.5.6 Public Facilities. The only direct impact of the proposed project on public facilities would be the protection against shoaling of Berger and McHenry Ditches (county drainage ditches) with jetties. No jetties would be constructed for Alternative 5. As attendance at the park increases, use demands on the local utility infrastructure (water, sewage, power lines, etc.) would increase.

5.5.7 Public Services. Increased park attendance would increase local demands for police and fire protection, trash collection, and other public services.

5.5.8 Regional Growth. The development of a recreational resource such as Maumee Bay State Park would be an asset to the Toledo SMSA and should increase its growth potential. Park development accompanying Alternative 5 would be significantly less than with the other three alternatives. Therefore, its impact on regional growth would also be less.

5.5.9 Employment/Labor Force. Implementation of any of the structural alternatives under consideration would result in a minor short-term increase in employment in the construction trades. After project construction and subsequent park development, local employment may increase as commercial development increases to service the needs of the park users.

5.5.10 Business and Industrial Activity. Visitors to the park would increase "beer, ice cube, and gas" trade at existing outlets. Since the surrounding area is mainly rural, new retail establishments may open along major thoroughfares in the area.

5.5.11 Displacement of Farms. No farms would be displaced by the implementation of any of the proposed shoreline erosion control measures. ODNR park development, however, would eventually replace prime farmland (approximately 1,200 acres) with recreational areas.

5.5.12 Land Use. Current zoning regulations for Jerusalem Township and the city of Oregon would limit commercial development associated with increased park attendance, to major intersections in the area, such as Corduroy and North Curtice Roads and Jerusalem and North Curtice Roads. South Shore Park, which borders the west park boundary, is currently zoned medium-density residential, therefore, no commercial encroachment is anticipated. ODNR park development would result in the eventual conversion of 1,200 acres farmland to parkland. Through coordination with the U. S. Department of Housing and Urban Development, U. S. Soil Conservation Service, U. S. Environmental Protection Agency, U. S. Fish and Wildlife Service, ODNR,

Lucas County Planning Commission, Toledo Metropolitan Area Council of Governments, and Jerusalem Township, it has been determined that the proposed project would not conflict with existing or proposed land use plans.

5.6 Environmental Effects

5.6.1 Man-Made Resources. No effect.

5.6.2 Natural Resources. Implementation of the various alternatives would require the commitment of sand, stone, and earth fill in the following quantities.

5.6.3 Air Quality. The use of construction equipment would result in a short-term degradation in local air quality during initial construction (all alternatives) and annual beach nourishment (Alternatives 2a, 3a, 3b, and 3c). Increased park usage would also result in increased dust, odors, and vehicle emissions during the recreation season.

5.6.4 Water Quality. Alternatives 2a, 3a, 3b,and 3c would have similar impacts on water quality. Possible dredging at offshore borrow areas and placement of this material along the beach would result in increased turbidity at both locations. Turbidity increases resulting from dredging activities are of a temporary nature generally noticeable within a 200-foot radius of an active dredge. Although the sediment is clean and comprised primarily of sand, some organic material would be released into the water column. This would result in a slightly depressed dissolved oxygen concentration. Soluble phosphates, which chemically attach themselves to settling silt and clay particles, would show a decrease adjacent to dredge effluents. Turbidity would cause fish to avoid the area and would create an aesthetically displeasing view. Also, the amount of light penetration available for photosynthesis would be reduced. These conditions would be short-term and minor due to the nature of the material. For all alternatives, clearing and grubbing and construction activities at the shore would cause the suspension of silt and clay particles and a short-term increase in turbidity. Some inadvertent spilling of fuels, oil, and grease may also occur.

5.6.5 The presence of offshore breakwaters (Alternatives 3a, 3b, and 3c), implemented to control shoreline erosion, may cause a degradation in water quality in their lee by interrupting normal circulation patterns, resulting in a tendency towards stagnation with a concomitant increase in concentrations of coliform bacteria originating either from bathers or from outside sources. This effect should be lessened by breakwater design which would incorporate open flanks, voids in the stone, and gaps between the structures.

5.6.6 Plankton and Benthos. The dredging of beachfill for Alternatives 2, 3a, 3b, and 3c would have some negative impacts on plankton and benthos. In 1976, C. E. Herdendorf of the Center for Lake Erie Area Research conducted a study of the environmental impact of sand and gravel removal at the two proposed borrow sites.(1) The following discussion summarizes some of his conclusions.

(1) "Environmental Impact Assessment of Commercial Sand and Gravel Dredging in Maumee River and Maumee Bay of Lake Erie," Charles E. Herdendorf and C. Lawrence Cooper, CLEAR Technical Report No. 41, December 1975.

5.6.7 Dredging activities would reduce the total number of phytoplankton and zooplankton at the borrow areas. This reduction in numbers is a result of: (a) cellular disruption and subsequent mortality of zooplankton caught in wash water used to process the dredged material; (b) increased turbidity in the vicinity that would tend to restrict the photosynthetic zone to or very near surface level, inhibiting reproduction; and (c) "absorption of phosphates" phenomenon would tend to restrict growth and development.

5.6.8 Table EIS-6 shows the area of bottom habitat that would be disturbed by the dredging of sand for initial construction and annual nourishment for the various alternatives. Macroinvertebrate populations in the area being excavated would be completely eliminated. However, the surficial sediments would be disrupted in relatively narrow zones, so wholesale destruction of benthic inhabitants over the entire dredging area would not occur. It is estimated that recolonization of the excavations would occur within a year or less. The impact of Alternatives 2a, 3a, 3b, and 3c on macro-benthic populations can be considered extensive over a short term and minimal in the long run.

5.6.9 The construction of rubblemound structures would result in the loss of some benthic habitat, but at the same time provide new, more diverse habitat. Table EIS-7 shows the habitat losses/gains of the various alternatives (considerably more area would be available for colonization in the interstices of the structures). These structures can provide a major beneficial effect on local ecological conditions. The quarrystone armor units offer habitat features which are not found in the natural sedimentary bottom areas of Maumee Bay. This solid substratum can be colonized by a high diversity of attached biota.

5.6.10 Fish and Wildlife. Dredging activities (Alternatives 2a, 3a, 3b, and 3c) reduce ichthyoplankton numbers in the same way as plankton numbers. Larval fish caught in the wash water would be destroyed. Most fish larvae live in a planktonic state for several weeks after hatching. It is only during this period, when they are unable to freely move in the water column, that they would be vulnerable to the dredge. In 1975, the density of mooneye larvae in the borrow areas was the lowest computed for any fish species. This low density means that the probability of destroying a mooneye larva during dredging operations would be remote. However, destruction of even small numbers of this organism may pose a threat to its continued existence in Lake Erie. Dredging activities have little direct impact on adult fish. Fish exhibit avoidance bahavior to any major disruptions, including turbidity. An ichthyoplankton survey conducted during the spawning season would be required in order to more fully assess the impacts of dredging activities.

5.6.11 The construction of rubblemound structures (all alternatives) would have a long-term beneficial impact on fish in the area. High relief and vast amounts of interstitial space attract many species of fish which are seldom encountered over sedimentary bottom areas. This is evidenced by the increase in species diversity at the existing rubblemound structure in the Niles Beach area. Local wildlife species may avoid the area during construction activities.

5.6.12 The immediate adverse effects of beach restoration (Alternatives 2a, 3a, 3b, and 3c) are few except for direct burial of less mobile organisms.

5.6.13 Secondary impacts of park development include the replacement of substantial areas of old field and possibly wetlands with mowed grass (golf course, picnic areas, and camp sites). The vegetational change may result in decreased nesting by pheasants, bobolinks, and upland sandpipers, a State endangered species. Also, it may decrease utilization of the area by marsh hawks (State threatened species) and other raptors.

5.6.14 No Federal threatened or endangered species or critical habitat would be affected by the proposed project.

5.6.15 Vegetation. For all alternatives, a maximum of 25 acres of the present shoreline (12.6 acres woodland-swamp and 12.6 acres beach) would be cleared and grubbed and altered by the placement of beachfill and/or construction of stone revetments. This would necessitate the destruction of some natural vegetation and replacement of the silt and clay substrate with sand and/or rubblemound armor units. The acreage figures presented above are based on preliminary design of a wildlife revetment abutting the shoreline. During advanced engineering and design, the revetment would be located as far offshore as feasible in order to minimize this impact. The storm dune (Alternatives 2a, 3a, 3b, and 3c) along the beach portion of the park would be revegetated with grass.

5.6.16 Wetlands. The wildlife revetment proposed for each alternative would prevent the loss of significant wetland habitat through erosion throughout the life of the project. Revetment design would allow the relatively free circulation of water into and out of the wetland; therefore, no impact on water levels within the wetland is anticipated. Approximately 2.2 acres (above average lake level) of the present wetland shoreline would be lost by the construction of the wildlife revetment (based on preliminary design of a revetment abutting the shoreline). When compared to the No Action Plan, however, these losses are greatly outweighed by the protection provided (2.2 vs. 60 acres).

5.6.17 Secondary development (construction of a lodge and golf course) may result in the loss of wetland habitat. According to the preliminary park master plan, approximately 32.5 acres of wetlands would be impacted by golf course construction. Prior to undertaking any construction activities in the wetland, the State of Ohio would have to apply for a permit through the Corps of Engineers regulatory permit program. At that time, a more detailed evaluation of such an action would be made.

5.6.18 Borrow Area. According to a report prepared by the Ohio Division of Shore Erosion (R. P. Hartley, "Sand Dredging Areas in Lake Erie," Technical Report No. 5, 1960), "the (sand) deposit does not appear to be receiving noticeable replenishment . . ." Therefore, the removal of sand in quantities displayed in Table EIS-5, preceding, would result in an irreversible loss of a nonrenewable resource.

Table EIS-5 - Quantities

Materials	Alternative 2a	Alternative 3a	Alternative 3b	Alternative 3c	Alternative 5
Sand (cy)					
Initial Placement	275,000	210,000	170,000	300,000	-
Annual Nourishment	20,000	5,000	5,000	5,000	-
Stone (tons)	80,450	134,750	134,750	134,750	166,550
Earth Fill (cy)	42,500	47,000	83,000	45,200	-
Topsoil (cy)	4,700	4,700	6,500	4,500	-

Table EIS-6 - Area Disturbed at Offshore Borrow Area (Acres)*

	Alternative 2a (Beach with No Protection)	Alternative 3a (Beach Protected by Offshore Breakwaters)	Alternative 3b (Beach and Landward Grassy Area Protected by Offshore Breakwaters)	Alternative 3c (Beach Protected by Offshore Breakwaters	Alternative 5 (Revetment)
Initial Placement	42.6	32.5	26.3	26.3	-
Annual Nourishment	3.1	0.8	0.8	0.8	-

*Based on an average sand thickness of 4 feet.

Table EIS-7 - Benthic Habitat Lost/Gained (Acres)

	Alternative 2a (Beach with No Protection)	Alternative 3a (Beach Protected by Offshore Breakwaters)	Alternative 3b (Beach and Grassy Area Protected by Offshore Breakwaters)	Alternative 3c (Beach Area Protected by Offshore Breakwaters)	Alternative 5 (Revetment)
Lost	5	8	8	8	4
Gained	1	4	4	4	1

6. LIST OF PREPARERS

The following people were primarily responsible for preparing this Environmental Impact Statement:

Name	Discipline/ Expertise	Experience	Role in Preparing EIS
William E. Butler	Geography/ Social Science	One year, cartographic aid, Bureau of Land Management; 4 years, geographer, EIS studies, Buffalo District.	EIS Coordinator. Socioeconomic impacts.
Timothy T. Daly	Social Science/ Cultural Resources	Five years, EIS studies, Buffalo District.	Cultural Resources Impact Assessment
David W. Heicher	Biology/ Environ-mental Resource Management	One-half year, aquatic biologist, Ichthyo-logical Associates, Inc.; 6 years, environmental impact analysis and EIS studies, Buffalo District.	Effects on Biological Resources
Richard Mammoser	Civil Engineering	Three years, project manager, Buffalo District.	Project Manager, Formulation of Alternatives, Needs, Assessment
David MacPherson	Civil Engineering/ Planning	Six years, project Buffalo District; 3 years, project manager, Krehbiel Associates.	Project Manager, Formulation of Needs, Assessment
Richard Leonard	Soils, Physical Geography, Environ-mental Analysis	Five years, soil scientist, U.S. Department of Agriculture; 13 years, environmental research, Calspan Corporation; 3-1/2 years, environ-mental analysis, Buffalo District.	General EIS Review

7. PUBLIC INVOLVEMENT

This section describes public involvement in the study and how public views guided and were incorporated into the study's decisionmaking process. It is presented in the following four discussions:

a. Public Involvement Program. This discussion describes the means used to involve the public in the study and the major results of such involvement, including scoping activities.

b. Required Coordination. This section describes remaining required coordination with other agencies and groups, particularly coordination that is to be satisfied by circulation of the EIS for review and comment.

c. Statement Recipients. This section lists agencies, groups, and individuals to whom copies of the EIS were sent.

d. Public Views and Responses. This section describes public views that have had a major influence on the study and how such views were incorporated into the study's decisionmaking process.

7.1 Public Involvement Program

7.1.1 Study activities have been coordinated with appropriate Governmental agencies, local private clubs and associations, and the general public. In addition to the four technical workshops conducted specifically for the Maumee Bay Study, orientation workshops for the overall Western Lake Erie Shore Study were held on 10 and 11 January 1979. A public meeting was held on 4 June 1981 to discuss the results of the Western Lake Erie Shore Stage 1 Study and the Stage 2 Maumee Bay State Park Interim Study.

7.1.2 On 10 January 1979, an orientation workshop was held at Jerusalem Township Hall in Curtice, OH, to inform public officials and other local interests in Lucas County of the Western Lake Erie Shore Study and to solicit their views on water resource problems and needs in the study area. At this workshop, ODNR (Ohio Department of Natural Resources) presented an overview of the State of Ohio's intentions for developing Maumee Bay State Park. ODNR stated that the State's position is to incorporate its recreational development plan into potential flood and erosion protection measures including a recreational beach which the Corps would investigate as a part of the Western Lake Erie Shoreline Study. Two major concerns about ODNR's Maumee Bay State Park project were expressed by local officials. First, Mr. Anthony Horvath, of the city of Oregon, was concerned that the proposed park development could adversely affect the existing drainage system and the area to be developed. Secondly, Mr. George Wilson, Lucas County Engineer, was concerned that heavy construction vehicle traffic on existing area roadways could likely cause damage and require repairs or possible replacements.

7.1.3 On 29 August 1979, an orientation workshop was held at the Columbus, OH, offices of ODNR to coordinate with the Corps of Engineers, U. S. Fish and Wildlife Service (USFWS), ODNR, and Moffatt and Nichol, Consulting Engineers, the desires and needs for the Maumee Bay State Park

development with the Stage 2 Interim Preliminary Feasibility Report and shoreline erosion and flood control at the park. The main objective of this workshop was to establish a range of possible alternatives. A Phase I park master plan presented by ODNR included a 3,000-foot beach, overnight camping use, and day use for picnicking. The wetland area of the park is considered an integral part of the park development which the State wants to preserve for its interpretive value. ODNR does not plan to manage the area to promote any specific species of wildlife or plan to regulate water levels. ODNR expects a large percentage of park users to be from the Toledo metropolitan area with overnight camping facilities drawing people from all over the State. Ninety percent of the park users would use the beach. Moffatt and Nichol expressed concern that shallow offshore depths would limit the value of the park as a swimming beach. ODNR countered that there is presently bathing in the area and depths are not a problem.

7.1.4 After these preliminary discussions, Mr. Kimo Walker, of Moffatt and Nichol, presented these conceptual plans for comments and suggestions:

a. No Action. ODNR was opposed to this plan since park development is contingent on erosion protection for the entire shore and $1.5 million in Federal funds (Federal Land and Water Conservation Fund) was already committed to the acquisition of park land.

b. Headlands, Detached Breakwaters, Groin Fields, and Protective Beach. These plans received little comment other than a reaffirmation that these beach solutions were compatible with park development.

c. Floating Breakwaters, Perched Beach. Moffatt and Nichol concluded that these are not suitable solutions for the conditions at the park.

d. Revetment and Swimming Hole. This plan was rejected on the grounds that it was not compatible with the proposed park development.

Erosion control measures for the nature area included a protective beach with and without retaining devices, a low berm, a sheet pile sea wall, and a high dike. USFWS stated that allowing some wave activity may be beneficial in allowing natural marsh succession and wider diversity. ODNR stated that a high dike was not desirable since the area should be natural, diverse, and typical to the area.

7.1.5 On 21 September 1979, an intial iteration workshop was held with the Corps of Engineers, USFWS and ODNR to eliminate unfavorable alternatives from further study. ODNR stated that different types of erosion protection for the west and east sides of the park would not be acceptable. ODNR contended that dividing the park into passive use on the east and active use on the west would cause the two sides to be treated separately in the economic evaluation. ODNR preferred to see one type of erosion protection along the entire shoreline and acknowledged that a beach is desired for the western end of the park, but did not want to eliminate the evaluation of rubble revetment or bulkhead alternatives. No decisions were made on alternatives which could be eliminated except the headlands concept which was eliminated on the basis

that it may create a potential safety hazard for children. USFWS stated that rubblemound would be perferable to vertical sheetpile structures if economically feasible.

7.1.6 On 27 February 1980, a second iteration workshop was held in Columbus, OH, with the Corps of Engineers, USFWS, ODNR, and Moffatt and Nichol to obtain the views of ODNR regarding the three detailed alternatives. ODNR questioned the integrity of the concrete retaining wall, proposed in all three alternatives, should the sand berm be washed out. A decision was made to eliminate the retaining wall concept in favor of a storm dune with a vegetative cover. ODNR insisted that runoff through the park be maintained either through protection and/or maintenance of existing ditches or relocation of the ditches. It was agreed to provide jetty protection of the ditches in each alternative. ODNR was also concerned with the possibility of toe scouring along the revetment. The Corps of Engineers suggested covering the toe with a layer of "A" stone, and Moffatt and Nichol agreed with the changes. ODNR questioned the inclusion of two gaps in the revetment, feeling that one would suffice. The Corps opted to leave two gaps until future studies are made. ODNR felt that beach nourishment estimates for Alternative 2 (unprotected beachfill) were too low. Moffatt and Nichol agreed to reconsider and adjust if warranted. The Corps of Engineers was concerned with the use of the same amount of sand fill in Alternatives 2 and 3 considering that breakwater design should have eliminated a portion of the sand needed to prevent overtopping. Moffatt and Nichol agreed to recheck the analysis used and lower the elevation of the berm for Alternative 3 if warranted.

7.1.7 On 30 January 1981, an orientation workshop for the Final Feasibility Report was held at ODNR offices in Columbus, OH. The purpose of the meeting was to review the plans recommended in Stage 2 and to discuss study direction in Stage 3. Attending the meeting were representatives of ODNR, USFWS, and the Corps of Engineers. Two possible sources of beachfill were identified; one a lake source offshore Cedar Point, and the other on Marblehead Peninsula. ODNR expressed concern that if an offshore site is opened up, others seeking sand may also wish to use this source. The Buffalo District stated that this usage could be controlled. USFWS did not expect any major problems with obtaining sand from Cedar Point and stated that they would investigate this possible source. The Buffalo District stated that the Federal participation in the cost of beach construction would be limited to a width necessary to prevent shoreline erosion and suggested moving the beach landward up to 100 feet resulting in a loss of 10-12 acres of parkland. ODNR stated that this would not be a problem and suggested that 50-80 feet of grassy area could be constructed on the landward side in lieu of a beach. It was agreed that ODNR would construct sufficient parking for full beach usage as the beach is constructed. Parking for other park activities will not be required until such time as these are developed. ODNR requested that Item i of local cooperation be revised to reflect control of water pollution from the park only. Concern was expressed that the clay bottom of the bay, when disturbed, would create turbid water which would be objectionable to swimmers. In addition, if silt and clay settled on the beach when washed ashore by waves, a mud residue would be left.

7.1.8 On 4 June 1981, a public meeting was held in Oak Harbor, OH, to present the findings of the Reconnaissance Report for the Western Lake Erie Shore Study. The status of the study at Maumee Bay State Park was also reviewed. The only concerns regarding Maumee Bay State Park raised by those in attendance dealt with the degree to which ODNR was planning to develop the park. One attendee suggested that a golf course, lodge, and swimming pool were not necessary. Another recommended that the golf course be replaced with a marina.

7.2 Required Coordination

7.2.1 A Notice of Intent to prepare a Draft Environmental Impact Statement (DEIS) was published in the Federal Register on 18 February 1981. Throughout the study, coordination has been maintained with the U. S. Fish and Wildlife Service (USFWS) who have provided Interim, Draft, and Final Fish and Wildlife Coordination Act Reports on the possible impacts of the proposed project (Appendix G). USFWS expressed no objections to the proposed project and offered recommendations which have been considered in project planning and development. In a letter dated 15 September 1981, the USFWS recommended that consideration be given to the adequacy of overtopping and filtration through the wildlife revetment to maintain water quality during low lake level years. Also, it was recommended that fish access to the marsh areas of the wetland be maximized by the location and number of gaps in the revetment and its location relative to the shore. These concerns will be incorporated during preconstruction planning of the revetment. Finally, the USFWS also recommended that sand sources other than the Cedar Point spit be examined. In this study, all costs are based on alternative commercial sand sources. Consultation with the USFWS and the Ohio Natural Heritage Program under Section 7 of the Endangered Species Act helped to identify those threatened or endangered species which might be affected by the proposed project.

7.2.2 This FEIS is adequate to comply with the Clean Water Act of 1977 for this stage of project development. Additional information will be developed to comply with Section 404 of the Act during further engineering and design studies and prior to actual disposal of dredged or fill material. A Section 401 State Water Quality Certificate would be obtained at that time. The National Environmental Policy Act of 1969 (NEPA) requires that this FEIS be circulated for review and comment to all Federal and State agencies having jurisdiction by law or special expertise with respect to any environmental impact involved, or which is authorized to develop and enforce environmental standards. In order to obtain full compliance with the Coastal Zone Management Act, National Historic Preservation Act, Clean Air Act, Federal Water Project Recreation Act, and Land and Water Conservation Fund Act, the DEIS was circulated to the appropriate Federal and State agencies for review and comment. Comments have also been requested from all other parties on the project mailing list and from State and local clearinghouses in accordance with OMB Circular A-95 (Revised). This FEIS, any comments received, and any underlying documents will be made available to the general public pursuant to the provisions of the Freedom of Information Act (5 USC 552).

7.2.3 In accordance with Executive Order 11990, Protection of Wetlands, a determination has been made that no practicable alternative to undertaking the proposed action within a wetland exists. Efforts have been made to minimize the loss and degradation of the beneficial values of the wetland; in fact, these values would be preserved and maintained through implementation of the proposed project. The general objective of Executive Order 11988, Flood Plain Management, is to avoid to the maximum extent possible, long and short-term adverse impacts associated with the occupation and modification of the base flood plain whenever there is a practicable alternative to such an action. Low damage-potential land use, such as recreation, is advocated for flood plain development. The proposed Corps project would not influence the frequency of flooding in the study area, but would induce ODNR park development. The Corps has received assurances from ODNR that any park construction would be undertaken with the flood potential in mind. All permanent structures would be elevated to prevent flood damage and a flood warning system would be implemented. The Corps has concluded, therefore, that there is no practicable alternative to the proposed action, which would occur within the 100-year flood plain of Lake Erie and within an existing wetland, and that the recommended action is in conformance with both Executive Orders.

7.3 Statement Recipients

7.3.1 The DEIS presenting Alternative 3b as the tentatively Selected Plan was distributed to the agencies, individuals, and groups listed below for review and comment. At the same time, the DEIS was filed with the Council on Environmental Quality and a notice of availability was recorded in the Federal Register dated 14 May 1982 commencing the official 45-day review period.

7.3.2 Federal

Advisory Council on Historic Preservation
Council on Environmental Quality
Great Lakes Fishery Commission
U. S. Department of Agriculture
U. S. Department of Commerce
U. S. Department of Health and Human Services
U. S. Department of Housing and Urban Development
U. S. Department of the Interior
U. S. Department of Transportation
U. S. Environmental Protection Agency
Water Resources Council

7.3.3 State

Ohio State Clearinghouse
Ohio Department of Health
Ohio Environmental Protection Agency
Ohio Department of Natural Resources
Ohio Department of Energy
Ohio Historic Preservation Office
Ohio Department of Transportation

7.3.4 Local

Jerusalem Township Trustees
Lucas County Commissioners
Lucas County Department of Public Safety and Health
Lucas County Engineer
Lucas County Soil and Water Conservation Service
Regional Archaeological Preservation Office
Toledo Chamber of Commerce
Toledo-Lucas County Planning Commission
Toledo-Lucas County Public Library - Main, Oregon, and Locke Branches
Toledo-Lucas County Port Authority
Toledo Metropolitan Area Council of Governments
Toledo Metropark District
Toledo Pollution Control Agency
Toledo Regional Planning Unit

7.3.5 Public Officials

Honorable James A. Rhodes, Governor
Honorable John Glenn, U. S. Senator
Honorable Howard M. Metzenbaum, U. S. Senator
Honorable Delbert L. Latta, U. S. Representative
Honorable Ed Weber, U. S. Representative
Mayor, City of Oregon
Mayor, City of Toledo

7.3.6 Private Organizations and Individuals

Columbia Gas Company
Environmental Resources Commission
Kitao Publications Trading Company
League of Ohio Sportsmen
League of Women Voters
Maumee Valley Audubon Society
National Wildlife Federation
Northwest Ohio Natural Resource Council
Oregon News Company
Ralph M. Field Associates, Inc.
Sierra Club
Toledo Blade Company
Toledo Union Journal
University of Toledo

7.4 Public Views and Responses

7.4.1 Public input, in the form of statements presented through public meetings, technical workshops, and written correspondence, have influenced this study and have been incorporated into the study's decisionmaking process. ODNR, the local sponsor, has kept the Corps of Engineers informed of their master plan for park development and the needs of the study area.

The wetland area of the park was identified as an integral part of the park development which the State wants to preserve for its interpretive value. Since ODNR has no plans to manage the area to promote any specific species or to regulate water levels, the revetments proposed in each action alternative were designed to allow wave overtopping. The revetments were also designed to be permeable above low water datum to allow the relatively free circulation of water into and out of the wetland. The USF&WS has expressed concern about water quality behind the proposed wildlife revetment, fish passage to marsh areas, and the utilization of offshore sand sources. These concerns can be adequately addressed during future engineering and design studies, during which time, the optimum number and location(s) of gaps in the revetment will be investigated. Although the possibility of using offshore sand sources for beachfill is addressed in this report, a complete fisheries and ichthyoplankton survey of the borrow areas would be required in order to more fully assess the impacts of dredging the Cedar Point sand spit. If it is determined that the use of the Cedar Point spit would cause significant adverse impacts on local fisheries, other existing commercial sources would be used. During a workshop session, the possible adverse effects of shoaling at the mouths of existing county drainage ditches were identified. For this reason, jetties were incorporated into all plans which involved the placement of beachfill at the shore.

7.4.2 Both the USF&WS and the Maumee Valley Audobon Society have suggested that any proposed revetments be located as far lakeward as feasible. This would minimize the adverse impacts to vegetation and the use of the shoreline for shorewalking and as habitat for shorebirds and sand fleas. During the advanced engineering and design phases of the study, these views will be addressed.

7.4.3 During the official review period, several comments were received on the DEIS which have been incorporated into the FEIS. Copies of these letters and the Corps responses are included in Appendix J. Comments which required the inclusion of additional information in the FEIS concerned water quality, public health effects, and impacts on local traffic. Several comments dealt with ODNR's development and administration of the park. Generally, these included the maintenance of county drainage ditches within the park, highway access to the park, alternatives to golf course construction within a wetland, water safety program, and mosquito surveillance and control program. These comments have been forwarded to ODNR. Comments were also made which will be addressed in future engineering and design phases of the project. These include the suitability of the soils for recreational development, wildlife revetment design, source of beachfill, annual nourishment requirements, and breakwater design. Staged construction (i.e., construct the Selected Plan without breakwaters, monitor sand losses for 5 years, then decide if breakwaters would be required) was also proposed.

7.4.4 In November 1983, USF&WS reviewed the details of the Selected Plan and considered it not significantly different from previous plans. USF&WS would be opposed to the elimination of the wildlife revetment as a project feature.

8. INDEX, REFERENCES, AND APPENDICES
(Selected Plan is Alternative 3c)

Subject	Study Documentation: Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Affected Environment	EIS-33-40	pp. 11-16	Appendix G, H, I
Alternatives	EIS-12-28	pp. 20-52	Appendix D
Areas of Controversy	EIS-4		
Beach	EIS-37	p. 11	Appendix D
Borrow Areas	EIS-38	p. 15	Appendix D
Comparative Impacts of Alternatives	EIS-32	pp. 20-52	
Cover Sheet	EIS-1	p. i	
Cultural Resources	EIS-39-40	p. 75	Appendix H
Environmental Conditions	EIS-33-40	pp. 75-77	Appendix G, H, I
Environmental Effects	EIS-41-47	pp. 75-77 43-48 14-16	
Implementation Responsibilities	EIS-28-31	pp. 79-80	Appendix E
Land Use	EIS-39		Appendix I
List of Preparers	EIS-48	p. i	
Major Conclusions and Findings	EIS-2-4	p. 83	
Need for and Objectives of Action	EIS-7-11	pp. 11-16	
Plan Economics	EIS-32; EIS-43	pp. 64-73	Appendix B
Planning Objectives	EIS-11	p. 14	
Plans Considered in Detail	EIS-14-28	pp. 43-52	Appendix D

8. INDEX, REFERENCES, AND APPENDICES (Cont'd)
(Selected Plan is Alternative 3c)

Subject	Study Documentation: Environmental Impact Statement	Main Report (References Incorporated)	Report Appendices (References Incorporated)
Plans Eliminated from Further Study	EIS-12-13	pp. 20-42	
Public Concerns	EIS-8-10	p. 82	Appendix F
Public Involvement	EIS-49-55	pp. 9-10, 82	Appendix F
Public Involvement Program	EIS-49-52	pp. 9-10, 82	Appendix F
Public Views and Responses	EIS-55	pp. 9-10, 82	Appendix E, F, J
Relationship to Environmental Requirements	EIS-6		
Required Coordination	EIS-52-53	p. 81	Appendix F, I
Significant Resources	EIS-37-40	pp. 75-77	Appendix G, H, I
Statement Recipients	EIS-53-54		
Study Authority	EIS-7-8	p. 2	
Summary	EIS-2-6	p. i	
Table of Contents	i	pp. iii-viii	
Threatened and Endangered Species	EIS-39	pp. 75-77	Appendix I
Unresolved Issues	EIS-4-5		
Water Quality	EIS-37; EIS-38	pp. 75-77, 16	Appendix I
Wetlands	EIS-37-38	pp. 75-77	Appendix I
Without Conditions (No Action)	EIS-13-14	pp. 32-33 22, 43	

APPENDIX EIS-A

ENVIRONMENTAL INFORMATION

Table A1 - Breeding Birds of Maumee Bay State Park

WETLANDS - NESTING SPECIES	
Great blue heron	Ring-billed gull
Great egret	Eastern kingbird
Mallard	Willow flycatcher
Pintail	Tree swallow
Blue-winged teal	Barn swallow
Killdeer	Red-winged blackbird
Spotted sandpiper	Yellowthroat
Herring gull	Song sparrow

NONWETLAND SPECIES	
Upland sandpiper	Bobolink
Marsh hawk	Dickcissel
Short-eared owl	Grasshopper sparrow
Western meadowlark	

SOURCE: "Breeding Birds of Ohio's Lake Erie Marshes," prepared by Elliott J. Tramer, Ph.D. and Eric J. Durbin for the Ohio Department of Natural Resources - Division of Natural Areas and Preserves, 15 October 1980.

Table A2 - List of Birds Observed 19 April, 3 May, 25 June, and 26 June of 1979 at Maumee Bay State Park

Great blue heron	Bank swallow
Green heron	Barn swallow
Common egret	Purple martin
Black-crowned night heron	Blue jay
Canada goose	Black-capped chickadee
Snow goose	Long-billed marsh wren
Mallard	Catbird
Blue-winged teal	Brown thrasher
Common merganser	American robin
Red-tailed hawk	Ruby-crowned kinglet
Marsh hawk	Starling
American kestrel	Warbling vireo
Ring-necked pheasant	Yellow warbler
American coot	Yellowthroat
Killdeer	Bobolink
Spotted sandpiper	Red-winged blackbird
Ring-billed gull	Rusty blackbird
Common tern	Brown-headed cowbird
Black tern	Cardinal
Mourning dove	Indigo bunting
Short-eared owl	American goldfinch
Belted kingfisher	Rufous-sided towhee
Common flicker	Slate-colored junco
Red-headed woodpecker	Tree sparrow
Downy woodpecker	Field sparrow
Eastern kingbird	White-throated sparrow
Willow flycatcher	Song sparrow
Tree swallow	

SOURCE: U. S. Fish and Wildlife Service, 20 April 1980.

Table A3 - Fish Species Collected on 26 June 1979
Offshore of Maumee Bay State Park

Gizzard shad	*Dorosoma cepedianum*
Carp	*Cyprinus carpio*
Emerald shiner	*Notropis atherinoides*
Spottail shiner	*Notropis hudsonius*
Yellow bullhead	*Ictalurus natalis*
White bass	*Morone chrysops*
Yellow perch	*Perca flavescens*

SOURCE: U. S. Fish and Wildlife Service, 29 April 1980.

END