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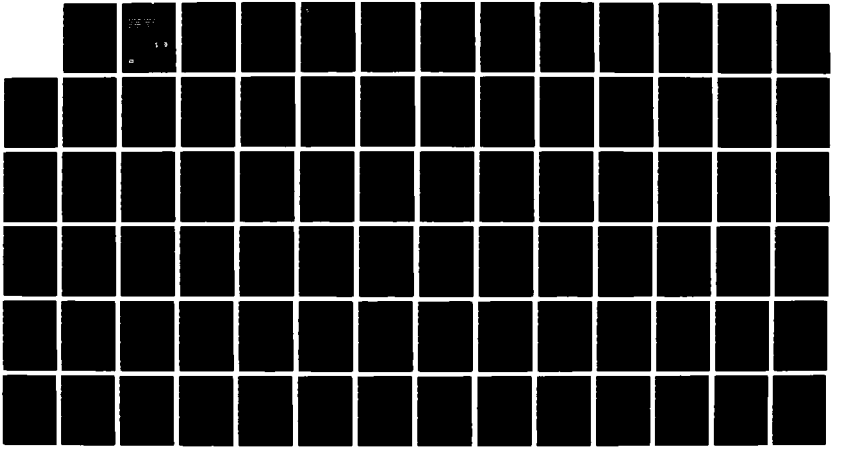

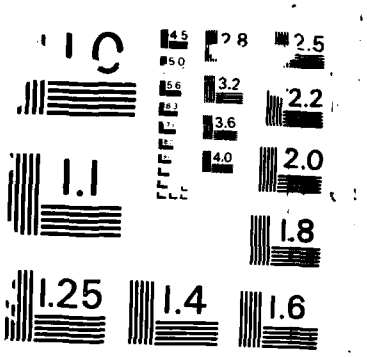

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Reconnaissance Report

Buffalo Metropolitan Area, NY Erie County Along Lake Erie and Niagara River Shoreline Protection Interim

US Army Corps of Engineers
Buffalo District

December 1987

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A194062 / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Buffalo Metropolitan Area, NY Erie County Along Lake Erie and Niagara River Shoreline Protection Interim Reconnaissance Report	5. TYPE OF REPORT & PERIOD COVERED Reconnaissance Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS CENCB-PD-F U.S. Army Engineer District, Buffalo 1776 Niagara Street Buffalo, NY 14207	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE December 1987 13. NUMBER OF PAGES 60 Pages plus 12 Plates
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Buffalo Metropolitan Area, Erie County, Lake Erie, New York, Woodlawn,NY Flooding, Lake Flooding, Levees, Flood Damages, Wave Runup, Niagara River, Flood Damage Prevention.

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

This report summarizes a "limited" reconnaissance study, or the initial phase of a two-phase planning process, addressing flood damage prevention at Woodlawn, New York.

Based on input from local officials, Woodlawn, New York, was the sole site in Erie County, New York, with flood damages meriting Federal investigation. The data presented in this report clearly demonstrates

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that Woodlawn, New York, receives minimal damages on an annualized basis from lake level induced damages. These damages are usually only experienced as the result of rare lake events, when lake water may enter Woodlawn from overtopping the south Blasdell Creek dike or from wave runup over high ground to the southwest. The one plan developed besides the no-action plan, namely levees, did not meet the economic efficiency criterion (having a benefit-to-cost ratio considerably less than 1.0). The general scope and detail of this preliminary evaluation did provide a sufficient basis for plan elimination. No economically feasible plan was found that reduced lake level induced damages.

The topography of Woodlawn and surrounding improvements make Woodlawn, New York, a man-made sink. Essentially, any inflow into Woodlawn must be pumped out. Based on data developed for this study, Woodlawn has a higher susceptibility to flooding from interior runoff due to rainfall than it does from lake level induced flood damages. The degree of protection from flooding from interior runoff due to rainfall appears minimal. Interior runoff from rainfall was not throughly investigated as there is no Federal interest. The study concludes that given the lack of a feasible plan at Woodlawn, New York, and the lack of other shoreline sites meriting examination, there is no Federal interest in implementation of a flood damage prevention plan within Erie County along Lake Erie and the Niagara River.

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

Plan Formulation Branch

BUFFALO METROPOLITAN AREA, NEW YORK

ERIE COUNTY ALONG LAKE ERIE AND NIAGARA RIVER

RECONNAISSANCE REPORT

BUFFALO METROPOLITAN AREA, NEW YORK
ERIE COUNTY ALONG LAKE ERIE AND NIAGARA RIVER
SHORELINE PROTECTION STUDY

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ACKNOWLEDGEMENTS

This Reconnaissance Report was prepared through the efforts of many individuals within the Buffalo District of the U.S. Army Corps of Engineers. The following are Corps personnel who were instrumental in conducting this investigation and preparing the text herein presented:

Timothy Byrnes	Study Manager; Civil Engineer
Steven Predmore	Hydrologist
Frederick Boglione	Hydraulic Engineer
Barbara Bickelman	Civil Engineering Technician
Richard Griffith	Civil Engineering Technician
Richard Gorecki	Civil Engineer
Todd Smith	Community Planner
Leonard Bryniarski	Ecologist
Jonathan Brown	Regional Economist

The following contributed significantly in production of the report itself:

Linda Sauberan	Word Processor
Mary Ann Schultz	Word Processor

Special acknowledgement is given to James Karsten and Joseph Raimond who, as early study managers, prepared the necessary documents to get this study off the ground. Special acknowledgement is also given to those who worked on the Advanced Measures Program for Woodlawn; the information they generated was invaluable to this study.

The Buffalo District conducted this investigation under the general supervision of Colonel Daniel R. Clark, District Commander; Kenneth R. Hallock, Chief Engineering Division; John Zorich, Chief, Planning Division; and Daniel T. Kelly, Chief Plan Formulation Branch.

Further, acknowledgement is extended to all those who in some respect contributed or supported the efforts which resulted in production of this document.

RECONNAISSANCE REPORT

BUFFALO METROPOLITAN AREA, NEW YORK
ERIE COUNTY ALONG LAKE ERIE AND NIAGARA RIVER
SHORELINE PROTECTION STUDY

THE STUDY AND REPORT

This section is to introduce the reader to the Buffalo Metropolitan Area, New York, Erie County along Lake Erie and Niagara River Study. It will address the study origin, its scope, including its geographical limits, prior studies, and reports which have a bearing upon this study, the study or planning process and the organization of this report. Later sections will sum up various phases of the study or planning process.

STUDY AUTHORITY

The authority for conducting this study is derived from a Congressional resolution dated 1 October 1986. The resolution was submitted by the Honorable Henry J. Nowak of the 37th New York Congressional District. Text of the resolution is as follows:

> "Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors is hereby requested to review previous reports on the Buffalo Metropolitan Area, New York, Study with a view to determining whether any improvements in the interests of beach erosion control and shoreline protection on Lake Erie and the Niagara River, including Strawberry Island, are advisable at the present time."

STUDY PURPOSE AND SCOPE

This study is an interim response to the study authority. This study is limited to addressing the needs for flood damage reduction. Other authorized study purposes for beach erosion control and shoreline protection improvements for other than flood damage reduction are primarily for recreational opportunities. The policy concerning Corps of Engineers participation in plans for recreation development is that studies addressing primarily recreation will not be budgeted during times of large budget deficits. Furthermore, projects designed primarily to provide recreational outputs are not consistent with current budget priorities and the implementation of such projects should be the responsibility of non-Federal public and private interests. Given the policy on recreational opportunities, no investigations were undertaken regarding beach erosion control nor for Strawberry Island.

The Buffalo Metropolitan Area along Lake Erie and the Niagara River consists of portions of Erie and Niagara Counties in western New York State. However, the scope of this study is limited to the portion of Buffalo Metropolitan Area in Erie County along Lake Erie and the Niagara in response to the intent of the committee report in conjunction with the FY 87 Appropriations Act (PL 99-591)

which provided initial funding for this study. The study limits, shown on Plate 1, encompass roughly 40 miles of mainland shoreline in Erie County, New York, not including shore along islands.

Initial funding was provided to conduct a "limited" reconnaissance study and was to be limited to one specific, most critical area within the study limits.

The study limits encompass all shoreline in Erie County along Lake Erie and the Niagara River and an initial scoping to identify key critical areas was necessitated. Based on initial scoping, as discussed in the section following on Study Participants and Coordination, the study became focused on the small 1/2-mile stretch of shoreline at Woodlawn, New York. The Woodlawn, New York, study area, as shown on Plate 2, consists of about an 65-acre portion of the hamlet of Woodlawn, located on the eastern shore of Lake Erie just south of the city of Lackawanna and west of the village of Blasdell, in the town of Hamburg, Erie County, New York.

STUDY PARTICIPANTS AND COORDINATION

One of the first actions accomplished upon initiation of this study was coordination with the New York State Department of Environmental Conservation, the non-Federal sponsor for any potential flood control project. This study, identified as a "limited" reconnaissance, is to be limited to one specific, most critical area in the study reach. Hoover Beach, New York, on the eastern shore of Lake Erie met the criteria of a critical flooding area and has served as a basis for the study authorization. However, the New York State Department of Environmental Conservation, when initially contacted regarding where the "limited" reconnaissance study should concentrate it efforts, indicated that Hoover Beach, New York, should not be investigated further as action was being taken by the Federal Emergency Management Agency (FEMA). FEMA, under Section 1362 of Publication 90-448, is progressing towards purchase of some houses in the Hoover Beach area that experienced significant damage as the result of flooding from the December 1985 storm.

Further coordination with the New York State Department of Environmental Conservation led to a 28 April 1987, jointly held, State-Federal meeting with officials from local governments and agencies with shoreline concerns or interests. The meeting's objective was to obtain views on what, if any, areas in the study reach should be evaluated. Three potential study areas were identified at the meeting. They were Woodlawn in the town of Hamburg, New York, and Muddy Creek and Fern Brook in the town of Evans, New York. No expression of interest in pursuing investigations at Hoover Beach, New York, was indicated.

Additional support for continuation of this study was received on 4 May 1987, in a letter from the town of Hamburg Supervisor requesting consideration of Woodlawn, New York, as a possible study area.

Coordination continued with the town of Evans regarding the potential for investigations at Muddy Creek and Fern Brook. Muddy Creek was already being investigated by the U.S. Army Corps of Engineers under Section 205 of the 1948

Flood Control Act. Therefore, no further investigation of Muddy Creek was undertaken under this study authority. However, a field investigation at Muddy Creek on 7 May 1987 found that there was no change in conditions since a prior 1977 examination, which found insufficient economic benefits to warrant Federal involvement under Section 205 of the 1948 Flood Control Act. Therefore, on 14 May 1987, a letter was sent to the town of Evans indicating that there was no Federal interest to study flooding at Muddy Creek. Further coordination with the town of Evans in July-August 1987 revealed that any flood problems at Fern Brook were being addressed by a project the town had contracted for using Community Development Funds. Therefore, no further investigation of Fern Brook was undertaken under this study authority.

PRIOR STUDIES, REPORTS, AND IMPROVEMENTS

In the post-World War II era, a pumping station was built at Woodlawn to relieve interior drainage problems. There is very little available information on the pumping station's capacity and effectiveness.

In the period May through July 1954, the U.S. Army Corps of Engineers studied the impacts of flooding at Woodlawn, New York, from the 3 March 1954 storm. During the study, emergency costs were identified including the temporary housing for 10 families, a stage-damage curve was developed, and a plan of improvement was developed. The plan of improvement included raising of the railroad embankment to the west of Woodlawn Avenue and construction of a levee along the south bank of Blasdell Creek. An internal study memo during that study indicated that the Hamburg town officials generally agreed that to solve the flood problem, consideration must be given to: backwater and flow in the creek at the north line of Woodlawn, prevention of influx of water directly from the lake over the low area at the foot of Lake View Avenue, and the internal storm drainage in the area between 1st and 7th Streets and west of Lake Shor Road. A plan for raising the railroad embankment and a levee along the creek addressed these considerations; however, at the time, town officials favored a plan for a breakwater which would provide protection to the frontage of Woodlawn against flooding and provide for a small-boat harbor. Nothing came of the study effort. (However, current topographical data indicates that the railroad embankment and diked areas were raised, although slightly and intermittently.)

In November 1955, a brief letter report on high water damage to Woodlawn by the storm of 3 November 1955, was prepared by the U.S. Army Corps of Engineers. The report indicated that about 75 houses were either reached or surrounded by water with damages limited to clean-up and whatever was in the cellars, though few homes had cellars. It was noted that damages were likely to be smaller than forecasted by the stage-damage curves developed in 1954.

Between 1983 and 1984, the town of Hamburg installed a pump station to replace a previous facility for which no specific information exists. It is located just north of First Street and Woodlawn Avenue. The pump station handles local runoff from rainstorms, but was not designed to provide protection against inundation of the area by lake storms. The pump station has one 500-gallon-per-minute (gpm) pump and one 2,800 gpm backup pump which are automatically activated. The total capacity of these two pumps is 7.4 cubic feet

per second (cfs). The water is collected by a system of pipes running along Woodlawn Avenue and First Street which convey the water to the pump station. The water is conveyed through a former Erie County Water Authority lake intake pipe for lake outlet. The station has capacity for one additional pump with a capacity of 13,000 gpm (29.0 cfs).

On 2 December 1985, Woodlawn, New York, experienced significant damages due to record-high lake levels caused by high winds. Although no reports were prepared, within a few days of that event the town of Hamburg collected photos of damage and prepared a one-page-letter estimate of structural damages in the Woodlawn area at $174,000. The U.S. Army Corps of Engineers also did a field reconnaissance and established the extent of flooding at First Avenue based on the extent of debris. These sources provided sufficient information to document the 2 December 1985 flooding event.

In the spring of 1986, the U.S. Army Corps of Engineers initiated a study of Woodlawn, New York, flooding problems as a part of the Advanced Measures Program authorized by PL 84-99. The program was initiated at the request of the Governor of New York State and for the purpose of taking actions due to the imminent flood threat of Lake Erie based on high lake level forecasts at the time. The State of New York, through coordination with interested Lake Erie shoreline interests, provided the Corps with a number of sites to investigate regarding the potential flood threat, including Woodlawn, New York. Investigations at Woodlawn, New York, for the Advanced Measures Program served as the starting point for this study. The investigations included examination of possible solutions such as raising levees and providing a dike to protect against wave runup. These were examined further during this study. In a letter to the New York State Department of Environmental Conservation Commissioner, dated 5 August 1986, the Corps stated the findings of the Advanced Measures Investigation that "possible damages prevented does not identify enough benefits to economically justify the estimated cost of protective works required."

THE REPORT AND STUDY PROCESS

This Reconnaissance Report summarizes the study methodology and accomplishments of the initial or reconnaissance phase of a two-phase planning process. Specific accomplishments this Reconnaissance Report progresses through include: a summary of existing and anticipated future conditions, definition of the problems and opportunities, identification and assessment of potential solutions, assessment of the level of support and interest of non-Federal interests in the identified potential solutions, and study recommendations including the need for and Federal interest in proceeding with the feasibility phase study.

The planning process used a multi-objective procedure for analyzing problems and opportunities and recommending potential solutions in compliance with the Water Resources Councils Principles and Guidelines for Water and Related Land Resources Implementation Studies (10 March 1983). That process yielded this report, to be made available to the decision makers and the interested public, so that they are aware of the basic assumptions employed, the data and information analyzed, the areas of risk and uncertainty, and the significant implications of alternatives.

EXISTING AND ANTICIPATED FUTURE CONDITIONS

The purpose of this section is to present an overview of study area conditions. Existing conditions and the future without project conditions are described to serve as a base case for later sections of this report where impact assessment and evaluation of any proposed solutions are described.

HUMAN ENVIRONMENT (MAN-MADE RESOURCES)

Desirable Regional/Community Growth - In the recent past, the Buffalo region was a major steel-producing region, and was for a long time the largest flour milling center in the United States. Lackawanna, New York, next door neighbor to Buffalo and Woodlawn, was a steel mill town and port-of-call for Great Lakes ore boats for nearly 85 years. Lackawanna's growth had significant impact on Woodlawn, virtually sandwiched within the steel operations at Lackawanna and surrounding environs.

Changes in national and regional economic growth and development has led to a virtual shutdown in steel production in the area, and a decrease in the importance of Buffalo as a flour milling center. These events have somewhat depressed the economy of the Buffalo Metropolitan area, raised the region's unemployment rate, and resulted in a large number of people leaving the area to find work elsewhere.

In light of these developments, the community and region is in transition; working where possible to sustain and revitalize existing viable economic development, while pursuing all avenues of new and/or alternative means of economic development. The trend seems toward a service-type economy. The regions waterfront is seen as an important resource in these revitalization efforts and a well-planned integrated multi-use and redevelopment of this resource is an important issue.

Plans by both public and private interests have emerged to develop the Buffalo area waterfront once more into a major transshipment center, but oriented toward light manufacturing and away from heavy industry. The plans generally include conversion of former steel works and Lackawanna lakefront surrounding the Lackawanna Ship Canal.

The region's recreational needs have also placed new demands on areas associated with the waterfront. New plans surface regularly recommending parks, linkages, more public access to the water's edge, and additional marina, and other water-related uses. The decline of heavy industry has had a positive effect on the quality of the waterfront environment in both air and water quality. It has also provided the opportunity to develop the waterfront in a more people-oriented fashion to keep in step with the recreational demand that is rapidly expanding in the region. The region and community are working to balance the needs for industry and recreation, with the desire that those concerns be incorporated into multi-use plans for the area. Erie County and town of Hamburg have developed a local waterfront revitalization plan.

Town of Hamburg officials indicate that they would like to see services associated with residential communities such as laundromat/grocery-type establishments move into the area, but feel the current population is insufficient to support such facilities. Town officials feel that changes in the flood plain may allow for increased residential development which possibly could aid in the support of residential service-type businesses in the Woodlawn area.

Population - Tables 1 through 3 represent population data for the study vicinity. The Woodlawn community has a population of about 750. About 140 people reside within the 100-year flood plain.

Land Use and Development - Woodlawn is primarily an extensively developed residential community of about 130 acres in the northern portion of the town of Hamburg, Erie County, New York. The area is bordered on the north by both former and operating Bethlehem Steel Company facilities which continue northward into the city of Lackawanna. To the east is the village of Blasdell, and industrial areas including additional steel plant facilities and railroad facilities. To the south and further into the town of Hamburg is an area of less heavily developed lands including some open space and the Gateway Executive Park, the former Bethlehem Steel local headquarters, including a seven-story office building on a 35-acre site. Further south is a heavily industrialized area which includes the Fort Motor Company Stamping Plant. Woodlawn is essentially a residential community surrounded by industrial development.

Open space within Woodlawn is primarily made up of the Woodlawn school grounds and associated sports fields and the Lake Erie beachfront, which is an undeveloped, sandy beach referred to as Woodlawn Beach. The beach area is about 35 acres in size, with about 2,500 feet of shoreline and considerable vegetation on the portion north of Lakeview Avenue. Moving from the beach, there is a north-south transportation corridor and then another strip of open space averaging about 120 feet in width, that extends to the north-south limits of Woodlawn which amounts to about 5 acres.

Flood Plain Description and Development - The 100-year flood plain in this case is defined by the limits of lake flooding because the creeks on the north and south extremities of the area have sufficient high ground or levees to prevent all but the largest of floods on their watersheds from flooding in the Woodlawn area. The lake flood plain consists primarily of that portion of Woodlawn west of Lake Shore Road or Route 5, as shown on Plate 3. The northern limit of the flood plain is about Blasdell Creek and First Street near its juncture with Route 5. The flood plain reaches south from its northern limit to about midway between Woodlawn Avenue and Route 5 at Lakeview Avenue and continues south midway between Woodlawn and Route 5 to Rush Creek, its southernmost end. The flood plain consists of about 2,500 feet of shore frontage and 35 acres of beach on Lake Erie, then a transportation corridor which, as you move east, consiste of a two-lane, paved access road and the South Buffalo Railway spur, both of which are used to move slag, etc. from the former Bethlehem Steel site located to the north. Continuing east, there is an overhead utility line and a strip of grassland of about 90 feet with a few trees and a fence on its eastern edge which is the extent of former steel company property. East of the fence - only breached at Lakeview Avenue to allow

Table 1 - Population Change

Area	1980	1990		2000		2010	
Erie County (Buffalo, PMSA)	1,015,472	983,773	-	987,749	+	984,665	-
Buffalo (C)	357,870	318,050	-	302,500	-	301,600	-
Hamburg (T)	53,270	55,350	+	58,600	+	58,500	

SOURCE: Population Projections 1985, NYS Water Quality Management Plan, NYS Department of Environmental Conservation.

Table 2 - Population Characteristics

Population Area	Total	Urban	%	Rural	%	Male	%	Female	%
Erie County (Buffalo PMSA)	1,015,472	870,354	86	116,925	14	483,238	48	532,234	52
Buffalo (C)	357,870	357,870	100	0		165,055	46	192,815	54

Table 2 - Population Characteristics (Cont'd)

	White	%	Black	%	All Other	%	Families
Erie County (Buffalo PMSA)	893,195	88	102,947	10	19,330	2	363,944
Buffalo (C)	252,365	71	95,116	27	10,389	2	87,387

Table 2 - Population Characteristics (Cont'd)

	Med. Age	0-(5)	%	5-17	%	18-64	%	65+	%
Erie County (Buffalo PMSA)	31.8	61,958	6	208,180	21	619,158	61	126,176	12
Buffalo (C)	30.9	23,572	7	66,574	19	214,000	60	53,724	15

SOURCE: 1980 Census of Population and Housing; U.S. Department of Commerce - Bureau of Census.

Buffalo, NY (PMSA)

Table 3—Population, Personal Income, and Earnings, 1969–1983, and Projected, 1990–2035

	1969[1]	1973[1]	1978	1983	1990	1995	2000	2005	2015	2035
Population as of July 1 (thousands)	1,108.8	1,099.4	1,043.7	1,001.8	1,016.0	1,033.4	1,045.8	1,055.3	1,080.7	1,095.8
	Millions of 1972 dollars									
Total personal income (place of residence)	4,884.8	5,312.9	5,446.6	5,345.7	6,292.0	6,842.9	7,296.5	7,706.6	8,611.0	10,186.0
By place of work										
Total earnings[2]	3,861.3	4,263.4	4,117.3	3,630.0	4,307.7	4,699.6	4,998.4	5,291.0	5,747.0	6,612.8
Farm	17.0	18.0	10.7	6.7	11.4	12.1	12.8	13.7	15.3	18.1
Nonfarm	3,934.3	4,245.4	4,106.6	3,623.3	4,296.3	4,687.5	4,985.6	5,277.3	5,731.7	6,493.7
Private	3,347.1	3,527.8	3,459.1	2,979.9	3,640.1	3,976.3	4,274.7	4,534.7	4,936.4	5,613.3
Agricultural services, forestry, fisheries, and other[3]	(*)	8.5	(*)	8.0	10.9	13.0	14.7	16.4	18.3	21.7
Mining	(*)	3.1	(*)	11.1	17.5	20.8	24.0	27.2	32.3	42.0
Construction	222.5	234.4	193.8	149.3	214.6	236.2	256.0	271.8	294.3	341.8
Manufacturing	1,471.0	1,498.3	1,480.9	1,059.2	1,231.3	1,291.4	1,335.0	1,393.5	1,492.1	1,646.9
Nondurable goods	364.7	380.7	360.1	333.0	398.0	420.9	439.9	453.8	484.4	540.7
Durable goods	1,106.4	1,135.6	1,120.7	726.2	833.4	880.5	895.2	939.7	1,007.7	1,106.2
Transportation and public utilities	329.4	361.6	336.4	262.7	348.1	381.9	414.8	444.7	487.8	556.4
Wholesale trade	236.4	257.7	262.2	242.9	298.8	322.9	350.3	378.3	422.5	490.8
Retail trade	384.4	405.7	370.9	324.3	366.2	396.2	421.9	438.1	480.8	617.8
Finance, insurance, and real estate	186.1	170.6	184.7	196.0	235.7	259.1	277.3	291.0	310.8	343.8
Services	618.1	688.9	614.0	708.4	918.8	1,064.9	1,181.1	1,272.7	1,419.3	1,662.3
Government and government enterprises	587.1	717.6	647.5	643.4	656.2	681.2	710.8	742.8	783.3	880.4
Federal, civilian	81.3	99.0	109.7	99.5	113.5	120.9	127.5	133.6	143.9	164.1
Federal, military	10.3	10.4	8.3	8.6	9.6	10.1	10.6	11.1	12.3	15.0
State and local	495.5	608.1	529.5	535.3	533.1	550.3	572.8	597.9	637.2	701.3

BUFFALO, NY (PMSA)

Table 4—Employment by Place of Work, by Industry, 1969–1983, and Projected, 1990–2035

[Thousands of jobs]

	1969[1]	1973[1]	1978	1983	1990	1995	2000	2005	2015	2035
Total employment	458.8	482.3	458.1	428.2	466.3	487.0	501.2	506.3	505.7	478.9
Farm	3.0	3.3	3.5	3.7	3.9	3.9	3.9	4.0	3.6	3.9
Nonfarm	455.8	459.0	454.6	424.5	462.4	483.1	497.3	504.4	501.7	475.0
Private	381.0	379.0	379.6	352.7	396.1	416.0	432.8	440.4	440.0	418.5
Agricultural services, forestry, fisheries, and other[3]	(*)	1.2	(*)	1.4	1.8	2.1	2.2	2.4	2.4	2.3
Mining	(*)	.3	(*)	.7	1.0	1.1	1.2	1.3	1.4	1.5
Construction	16.6	16.0	17.8	15.0	19.4	20.5	21.4	22.1	22.3	21.8
Manufacturing	137.4	123.4	110.8	81.6	84.4	82.6	81.4	80.2	76.6	66.4
Nondurable goods	38.6	34.6	32.4	29.4	30.7	30.5	30.1	29.4	26.2	25.7
Durable goods	98.8	88.8	78.4	52.2	53.6	52.2	51.3	50.8	48.6	40.7
Transportation and public utilities	31.0	26.8	25.4	21.3	22.4	23.1	23.6	24.1	23.8	22.2
Wholesale trade	23.6	24.7	25.0	25.2	27.6	28.6	29.7	30.9	31.7	31.2
Retail trade	75.4	76.3	80.7	76.9	85.5	90.9	94.4	95.8	95.2	90.2
Finance, insurance, and real estate	16.7	19.6	21.5	23.1	26.5	28.4	29.7	30.3	30.3	28.9
Services	73.6	85.7	96.8	107.4	127.5	140.6	149.2	153.6	156.1	151.0
Government and government enterprises	74.8	79.9	75.0	71.8	66.4	65.2	64.5	64.0	61.7	56.6
Federal, civilian	8.3	8.6	8.6	8.4	8.5	8.5	8.6	8.5	8.2	7.7
Federal, military	5.7	4.8	3.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
State and local	60.7	66.5	62.9	61.0	55.4	54.2	53.5	53.0	51.0	46.4

See footnotes at end of tables.

Source: 1985 OBERS
Dept. of Commerce

foot access to Woodlawn Beach - is a small utility corridor, then Woodlawn Avenue, and then the residential area of the flood plain.

The residential area of Woodlawn within the flood plain consists of about 50 homes, with the structures valued on the average at $26,000. About 40 percent of these homes have basements. As you move west from Route 5 into the flood plain, there is considerably more open space in the form of vacant lots. Local officials indicate that the vacant lots are the result of a policy of Bethlehem Steel regarding expansion of their facilities, where for a while they bought back structures as they aged or came on the market. The structures were subsequently leveled, the result being, residences interspersed with vacant lots being more prevalent in the flood plain. The lake flood plain also contains one commercial property locted at Woodlawn Avenue and Fifth Street.

Flood Plain Management - The town of Hamburg participates in the regular program of the National Flood Insurance Program administered by the Federal Emergency Management Agency. Flood insurance and flood plain management maps have been developed and local ordinances pertaining to new or redevelopment in the flood plain (100-year) and flood protection to the intermediate regional or 100-year flood level have been enacted. Low cost flood insurance helps to compensate residents for flood damages to existing developments, while flood plain development ordinances reduce the potential of flood damage of any future developments or redevelopments.

Business and Industry/Employment and Income - Much of the regional economy is devoted to agricultural activity including: dairy, field crop, and fruit production. Tables 4 through 7 depict labor force, unemployment, business, employment, and income characteristics for Erie County (Buffalo - Primary Metropolitan Statistical Area - PMSA), and the city of Buffalo.

The industrial economy of the Erie County PMSA was built on shipping, grain, steel, transportation, metallurgy, and hydropower for a diversity of manufacturing operations. Buffalo was a major shipping, steel, and petroleum refining center and is still an important grain, automotive, and industrial center. The economy is shifting, however, from heavy manufacturing, to a more business finance, and service orientation. Buffalo is also an important area for research with about 150 research laboratories in the area.

In 1982, there were an estimated 15,755 business establishments located in Erie County. The greater number of these establishments pertained to wholesale and retail establishments followed closely by selected services. Of these, 5,834 (37 percent) were located in the city of Buffalo.

Likewise, of the 223,290 persons employed in the Buffalo (Erie County) PMSA in 1982, 39 percent were employed in the city of Buffalo. The leading employment sectors for both the county and the city pertain to manufacturing, professional and related services, and retail business. In 1980, the median family income in Erie County was $20,711 as compared to $15,432 for the city of Buffalo.

Woodlawn itself is surrounded by heavy industry or the remnants thereof. With the loss of the majority of the major steel operations at the Bethlehem Steel Plant, there has been a transformation and conversion of former steel

Table 5 - Civilian Labor Force & Unemployment 1984

Area	Labor Force	Employed	Unemployed	Unemployment Rate
Erie County (Buffalo PMSA)	439,000	400,600	38,400	8.7
Buffalo (C)	141,900	124,600	17,300	12.2

Table 6 - Business Establishments 1982

Area	Total	Manufact.	Wholesale	Retail	Services
Erie County (Buffalo PMSA)	15,755	1,314	1,783	7,721	4,937
Buffalo (C)	5,834	637	713	2,549	1,935

Table 7 - Employment and Income 1982

Area	Total	Manufact.	% Total	% 77	Wholesale	% Total
Erie County (Buffalo PMSA)	223,290	87,500	39	-19.6	23,390	10
Buffalo (C)	87,111	36,900	42	--	10,011	11

Table 7 - Employment and Income 1982 (Cont'd)

Area	Retail	% Total	Service	% Total		Income (1980)
Erie County (Buffalo PMSA)	66,800	30	45,600	20		20,711
Buffalo (C)	19,400	22	20,800	24		15,432

SOURCE: U.S. Department of Commerce - Bureau of Census; State and Metopolitan Area Data Book 1986.

facilities to light industry or storage-type facilities. Woodlawn itself has service-type businesses located mostly along Route 5.

Tables 3 and 4 depict the past, present, and some projected population, employment, and income figures for the Buffalo PMSA (Erie County). Generally, both population and total employment are expected to gradually decline then increase. Generally, anticipated employment growth sectors include: service oriented businesses, some construction, and retail trade; while gradually declining sectors include manufacturing. Other sectors show moderating growth and decline. Continued moderate growth of income is anticipated.

Recreation - The two-county Niagara region (Niagara and Erie Counties) with Lake Erie to the west and Lake Ontario to the north and the Niagara River connecting both lakes, provides a multitude of water-related, recreational opportunities. The Erie-Barge Canal now also contributes significantly to this resource. Plate 4 identifies many major water-oriented, regional, recreational areas.

Tables 8 and 9 depict some State and regional (water-related) recreational development data including: recreational facility supply, and anticipated recreational demands. These data indicate that even with the past decrease in area population, demand for sufficient water-oriented, recreational activities and facilities continue to grow. This may be attributed to several factors including: community development changes, improved water quality, and increased leisure time and income. Recent regional, county, and city studies also identify demands to improve and develop water-related, recreational facilities including: beaches, parks, and marinas. The State, county, and city continue to develop plans and facilities in addressing these needs.

Erie County and the town of Hamburg have developed a local waterfront revitalization plan. It is proposed that Woodlawn Beach be designed as a major water-oriented, mixed-use development. Included would be an 800-slip marina, bathing beach and accompanying picnic areas, as well as waterside restaurant, lakeside housing, and a high-technology office complex. These plans are already in the conceptual design stage by Buffalo Crushed Stone, who owns the beach area at Woodlawn. The facility would be privately owned, but include provisions for public access.

Unfortunately, the beach has water quality problems associated with high bacteria counts in Rush and Blasdell Creeks and turbidity in Lake Erie. Due to these conditions, the Erie County Health Department prohibits public use of the beach. In order for public use to be allowed, the water quality problems must be corrected.

Currently, Woodlawn has limited recreational facilities associated with the community park between Lake View Avenue and Fourth Street and the Woodlawn school. The Woodlawn beach is used for limited recreation, but restricted to about 75 easement holders who have residences within Woodlawn. Access is provided for foot traffic only. Efforts have been undertaken the last 2 years to clean up the Woodlawn beach by an association made up of Woodlawn homeowners.

Table 8 - Niagara Region Recreation Supply for Selected Facilities (Niagara & Erie Counties)

1980 Population	1,242,573
Total Acreage	1,022,080
Est. Rec. Acreage	49,011
No. of Rec. Facilities	567
Facilities with Picnic	88
Facilities with Pools	75
Facilities with Beaches	43
Cartop Launch Areas	2
Full Launch Areas	117
Mooring/Dock Areas	59
Vacation Camp Areas	53

SOURCE: People Resources Recreation - New York Statewide Comprehensive Recreation Plan 1983; NYS Department of Parks, Recreation, and Historic Preservation.

Table 9 - Niagara Region Recreation Demand for Selected Activities (Niagara & Erie Counties)

	Total Participants (000)			Total Demand (000 Activity Days)			Activity Days Per Participant		Activity Deficiencies
	1980	2000	Δ%	1980	2000	Δ%	1980	2000	2000
Boating	384	439	14	2,591	2,816	9	7	6	2,232
Camping	223	226	1	2,267	2,696	19	10	12	0
Fishing	325	358	10	3,437	4,078	19	11	11	0
Swimming	696	734	5	18,586	19,705	6	27	27	37,868
Biking	511	522	2	11,252	11,131	1	22	22	113,211
Hiking	352	363	3	2,233	3,257	46	6	9	15,536
Picnicking	627	669	7	4,131	4,531	10	7	7	0
Playground	509	489	-5	5,690	5,125	-10	11	11	2,010
Relaxing in Park	755	797	6	8,895	9,179	3	12	12	43,444

SOURCE: People, Resources, Recreation - New York Statewide Comprehensive Recreation Plan 1983; NYS Department Parks, Recreation, and Historic Preservation.

Public Facilities and Services -

1. Utilities - Utilities which service the community include water, sewer, electric, gas, and telephone. A pump station is owned and operated by the town of Hamburg to provide for interior drainage.

2. Police and Fire Protection - The immediate project area police district is serviced by the village and town police. These services are also supplemented by the County Sheriff's Department and the New York State Police. Similarly, the immediate project area fire district is serviced by the village and town fire department. Generally, existing services are considered good.

3. Transportation - The project area has an adequate network of highway facilities. Major roadways which service the immediate project area include Route 5, Lake Avenue, and Milestrip Road. Route 5 is a seven-lane highway which creates a significant barrier to pedestrian movement. At the south end of Woodlawn is a pedestrian bridge over Route 5; however, this is at the extreme end of the residential community. The result is the limiting of access between Woodlawn areas east and west of Route 5. An active South Buffalo Railway railroad spur and truck/service road run between the beach area and the community. Plate 2 shows the major transportation facilities.

Property Value and Tax Revenue - The average structural value of the 190 homes in the Woodlawn community west of Route 5 is about $26,000. The property tax rate in 1987 per assessed $1,000 value for the town of Hamburg is $14.68.

Noise and Aesthetics - No significant adverse noise problems or sources were noted in the immediate project area. The major source of noise is generated from the movement of vehicular traffic along Route 5 and the periodic movement of rail cars along the tracks paralleling the beach. The stream banks are primarily in a grass and scrub-shrub vegetation state. The community is primarily residential in nature and most of the structures are well maintained. The existing residential neighborhood at Woodlawn would continue to utilize Federal community development funds for housing rehabilitation and infrastructure improvements.

Community Cohesion - The Woodlawn community is long established with many long-time residents. There is at least one community organization, namely the Woodlawn Beach Taxpayers Association. Route 5 does provide a community barrier between Woodlawn areas west and east of Route 5. To date, the town and community support investigations for potential additional flood damage reduction measures.

Cultural Resources - Project coordination was initiated with the U.S. Department of the Interior, and the New York State Office of Parks, Recreation, and Historic Preservation via letter in August 1987. The New York State Office of Parks, Recreation, and Historic Preservation indicated in their August 1987 letter response that, based upon the SHPO's archaeological sensitivity model, the project lies in an area that is archaeologically sensitive. Unless substantial gound disturbance can be documented, an archaeological survey should be undertaken to determine the nature and extent of archaeological resources in the project area. Additionally, any buildings or structures

proximal to or within the project area should be documented and evaluated for potential importance. Of note, lake water areas which have not been dredged, offer the potential for containing submerged cultural resources and may warrant additional evaluation, if these areas would be impacted.

NATURAL ENVIRONMENT (NATURAL RESOURCES)

Air Quality - Utilizing information provided in Chapter III of Title 6 - Compilation of Codes, Rules and Regulations of the State of New York - with regard to air resources in Erie County, Woodlawn and the potential project area is within a zone identified by the New York State Department of Environmental Conservation (NYSDEC) as having an air quality classification of Level IV. The land uses associated with this classification level broadly include areas that are densely populated, primarily commercial office buildings, department stores and industries in large metropolitan complexes, or areas of heavy industry.

Water Quality - Coordination with the NYSDEC in September 1987 regarding water quality in the general area of Woodlawn indicated that, based on best usage, the Lake Erie water quality classification is "Class A." The beach area water quality is identified as Class "B" and "C" in closer proximity to the shoreline, due to reduced circulation and sediment outflow from Rush and Blasdell Creeks. From its mouth to about 1/8 mile upstream, Rush Creek is presently classified as being "Class B". Further upstream, the water quality classification changes to "Class C" or "Class D." Blasdell Creek is presently not classified, but may be somewhat similar in classification to that of Rush Creek. With regard to best usage of waters: Class A waters are a source of water supply for drinking, culinary or food processing purposes and any other usages; Class B waters may be used for primary contact recreation and any other uses except as a source of water supply for drinking, culinary or food processing purposes; Class C waters are suitable for fishing and all other uses except as a source of water supply for drinking, culinary or food processing and primary contact recreation. Finally, Class D waters are suitable for secondary contact recreation, but due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the waters will not support the propagation of fish.

As previously mentioned, the beach has water quality problems associated with high bacteria counts in Rush and Blasdell Creeks and turbidity in Lake Erie. Due to these conditions, the Erie County Health Department prohibits public use of the beach. In order for public use to be allowed, the water quality problems must be corrected.

Benthos - Presently, there is no current available information on the variety, distribution, or abundance of benthic invertebrates inhabiting the submerged aquatic substrates of Lake Erie along Woodlawn Beach and nearby Blasdell and Rush Creeks. It is likely that a variety of such organisms live on the surface and within the submerged substrate. A number of these invertebrates such as gastropods, leeches, crustaceans, and annelids are probably utilized as food by fish inhabiting these waters.

Fisheries - A variety of fish are found along the Hamburg shoreline - which also includes streams in the general vicinity of the Woodlawn area.

Coordination with the NYSDEC in June 1986 indicated that both game and nongame fish species use the aquatic habitats nearshore. Fish species that probably use the Lake Erie shoreline and to some degree the creeks that enter Lake Erie in this locale include smallmouth bass, rockbass, perch, white suckers and a variety of small minnows, shiners, and darters. Other warmwater fish species seasonally found along the nearshore zone include freshwater drum, channel catfish, gizzard shad, and smelt. When nearshore waters are cooler in the spring and fall, coldwater fish such as brown trout, rainbow trout, and coho salmon may also inhabit nearshore aquatic habitats. Blasdell and Rush Creeks - with their slow-moving waters and overhanging riparian shade cover - probably provide spawning and nursery habitat for some warmwater species.

Wildlife - During a cursory field trip to the Woodlawn area by Corps personnel on 24 August 1987, some wildlife species and wildlife signs were observed, suggesting that the general vicinity of Rush Creek, Blasdell Creek, the nearby Lake Erie shoreline and Woodlawn Beach habitats are utilized by birds and, to some degree, by small mammals (i.e.; songbirds, seagulls, terns, shorebirds, waterfowl, raccoon, rodents (including rabbits and muskrats)). Herring gulls, Great Blue Heron, and a Belted Kingfisher were seen during the field trip. Additionally, although not observed at the time of the field trip, some species of reptiles and amphibians probably use the riparian habitat along both creeks. See Plan Assessment and Evaluation section regarding endangered species.

Vegetation - During the aforementioned August 1987 field trip, vegetation along both Blasdell and Rush Creeks was densely established on both banks with a variety of woody and herbacious plant species. Plants seen in the general vicinity of the existing levee site along the terrestrial south bank of Blasdell Creek include some large overhanging hardwood trees such as white ash, red maple, eastern cottonwood, and Blackwillow, as well as a dense mixture of shrubs and herbaceous plants consisting of willow and red-osier dogwood, staghorn sumac, wild grape, goldenrod, Queen Ann's lace, Virginia creeper, milkweed, thistle, curly dock, clover, chickory, common and giant ragweed, buckhorn plantain, evening primrose, nightshade, burdock, mustard, sweet clover, daisy fleabane, squirrel tail, cocklebur, barnyard grass, foxtail, and various grasses. On some of the wetter soils adjacent to this creek, there was a scattered establishment of wetland plant species such as jewelweed, iris, blue vervain, rice cutgrass, smartweed, cattail, and sedge. No significant growth of aquatic submergent or floating plants were seen in the creek at the time of the site visit. Plants observed in the general vicinity of the existing levee along the north side of Rush Creek included a number of the tree, shrub, and herbaceous species previously mentioned. No significant growth of aquatic submergent of floating plants were seen in Rush Creek at the time of the site visit. The site of the low levee site near the railroad is terrestrial herbaceous vegetated-type habitat. Beach vegetation shoreward of the potential low levee site - that is, the area between the Lake Erie shoreline and the existing access roadway/railroad tracks - is a scattered, sparse, growth of young eastern cottonwood trees, willow shrubs, horsetail, smartweed, evening primrose, sandbur, barnyard grass, sweet clover, and some giant reedgrass. See Plan Evaluation and Assessment section regarding endangered species.

Wetlands - There are no wetlands in the immediate vicinity of the potential project sites of either the existing levees or the potential dike site. The Erie County Soil Survey Report (issued December 1986) identifies soils in the general study area as being urban land. Coordination with the NYSDEC in September 1987 revealed that although there are no wetlands in the immediate potential project vicinity, there are two portions of regulated wetlands about 1.5 miles upstream along Blasdell Creek. Also, there is a regulated wetland along Rush Creek about 1 mile upstream of the potential project site.

PROBLEM AND OPPORTUNITIES IDENTIFICATION

The purpose of this section is to inform the reader of water and related land resource problems, needs, and opportunities with the emphasis on those dealing directly with flood damage reduction. At the same time, those needs are described which may be considered secondary to flood damage reduction, yet which may be addressed as a part of any potential solution for flood damage reduction. As stated previously in the section on STUDY PURPOSE AND SCOPE and STUDY PARTICIPANTS AND COORDINATION, this study is focused on a portion of Woodlawn, New York, namely that west of Route 5. Further references to Woodlawn relative to flooding or flood areas are referring to that portion of Woodlawn west of Route 5 unless otherwise specified.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Historical Flooding - Flooding has been a historic problem for Woodlawn. Woodlawn is partially protected from flooding by existing dikes and high ground. See Plate 3 for layout of area. The south side is protected by a dike having a minimum crest elevation of 582.2; the west side (parallel to the railroad tracks) by high ground at a minimum 580.5; the north side (parallel to Blasdell Creek) by high ground or by a dike having a minimum elevation of 578.1; and the east side (parallel to Route 5) by high ground at or above elevation 581.0. Flooding at Woodlawn can come from three sources. The first potential source of flooding is the basin runoff from the Blasdell Creek and Rush Creek watersheds. The dikes along these creeks were raised some years ago. No overtopping of these dikes by streamflow has occurred since then and there is no previous record of such upland induced flooding, so this source was not considered in this study. The second source of flooding is interior runoff when during periods of intense rainfall, the Woodlawn area becomes inundated having no natural outlet. A third source of flooding, and the one particularly addressed by this report, is Lake Erie which floods Woodlawn from two sides. On the north side of Woodlawn, Lake Erie levels extend up Blasdell Creek and begin inundating Woodlawn at lake elevations above 578.1 (IGLD). Lake Erie also discharges water into Woodlawn along the southwest side of the community when wave runup exceeds the shoreline embankment near the railroad tracks at elevation 580.5. Storms of moderate severity from the west or southwest cause high lake levels to back up Blasdell Creek and overtop the levee there. More extreme storms, usually from the southwest and utilizing the entire fetch of the lake, cause wave runup along a portion of the southwest side between Lakeview Avenue and Seventh Street, where the shoreline is, in some places, only a few hundred feet from the low-lying community.

A pump station, located at First Street and Woodlawn Avenue was constructed between 1983 and 1984 to handle local runoff from rainstorms. Additionally, improvements have been made to the pump station's storm sewer delivery system since 1984 and as recent as 1987. However, these improvements were not designed to provide protection against inundation of the area by lake storms. Local runoff from rainstorms caused recurrent flooding prior to 1983-1984.

Flooding in the area has occurred as recent as 2 December 1985 as the result of lake storms. Flooding data are presented in Table 10.

Table 10 - Historical Flooding from Lake Erie

Rank	Date of Flood	Lake Elevation (IGLD)	Exceedence Frequency (percent)	Reported Damages
1	2 December 1985	580.65	0.4	$174,000 structural damage.
2	6 April 1979	579.21	3.0	Unquantified.
4	10 November 1975	578.84	4.5	No record.
3	3 November 1955	579.09	3.5	Unquantified
	22 March 1955	577.60	16	Unquantified
	3 March 1954	578.05	11	Unquantified

Survey data indicates the railroad embankment on the west side was raised since the 1950's, and although flooding occurred in the 1950's, conditions are not the same today. Therefore, pre-1960 flood data were not used for this study.

Lake Erie Elevation-Frequency - During the period 1900 to 1985, mean monthly Lake Erie levels have fluctuated about 6 feet. This variation is the result of meteorological causes, seasonal and long-term. Water level cycles on Lake Erie do not follow a regular pattern. Long-term and seasonal changes in the volume of water in Lake Erie are directly related to inflow from the upper lakes (from which Lake Erie receives 77 percent of its water), local inflow and precipitation, evaporation from the lake surface, and lake outflow. A change in lake level is due to the change in volume.

In addition to the long-term and seasonal variations in lake levels, short-term variations occur at specific locations due to wind and barometric pressure effects. The most important types of short-term variations on Lake Erie are wind setups, storm surges, and seiches. Changes in water levels due to wind action result from the actual transfer of water from windward to leeward, by friction of the wind on the lake surface. The effect of the wind action is like blowing water up on the sloping side of a shallow saucer. Storm surges are caused by a fast-moving squall line across large water areas such as those of Lake Erie. The two main forces acting during a surge are rapid changes in barometric pressure and strong winds. Seiches result from any condition which concentrates a volume of water up on one shore and then ceases to act, causing periodic oscillation resembling the rocking back and forth of water in a bowl which has been suddenly tilted.

The long-term average water level for Lake Erie is 570.32 feet IGLD. Flooding conditions at Woodlawn have occurred in periods of extreme or near-extreme long-term, high lake levels combined with short-term water level variations. Plate 5 shows the elevation-frequency curve for Lake Erie at Woodlawn, New

York. The higher the elevation, the less frequently the elevation occurs. Some of the significant events at Woodlawn are shown in Table 10.

The elevation-frequency curve for Lake Erie at Woodlawn, New York, was developed by first tabulating the annual maximum instantaneous elevations for the lake gage at Buffalo, New York, for the years 1900 through 1986. These values were assigned Weibull plotting positions and subsequently plotted in Plate 5.

The distribution of the annual maximum instantaneous values was then compared to six theoretical distributions: normal, log-normal, Gumbel, log-Gumbel, Pearson-III, and log-Pearson-III. Log transformation of the values yielded elevation-frequency curves which were nearly identical to non-log distributions. Therefore, only three elevation-frequency curves are displayed in Plate 5 for the six theoretical distributions.

Of the six theoretical distributions, the Pearson-III and log-Pearson-III distributions exhibited the lowest least squares standard error. The Pearson-III and log-Pearson-III elevation-frequency curves also appeared to fit the Weibull plotting positions very well. Therefore, the Pearson-III curve was chosen for use in this study.

Interior Area Elevation-Frequency Curve Due to Lake Flooding - The Woodlawn area has limited protection from lake flooding. The protection is provided by the railroad embankment on the west (lakeward) side, creek dikes on the north and south sides, and the pumping station in the northwest corner of the residential area. The existing flood protection influences the interior area elevation-frequency relationship resulting in an interior elevation-frequency curve which is different than the lake elevation-frequency curve.

The interior area elevation-frequency curve, due to lake flooding, is displayed on Plate 6, and was determined using both historical flood data and computer simulation. The recent 2 December 1985 event provided excellent elevation data to define the upper end of the interior elevation-frequency curve. This event exhibited the highest lake elevation on record with a maximum instantaneous elevation of 580.65 feet IGLD (static water level) which corresponds to a 250-year event. The lake elevation of 580.65, extending up Blasdell Creek, exceeded the lowest point in the Blasdell Creek dike by 2 feet and provided major inflow to Woodlawn. In addition, wave inflow over the railroad embankment was largely due to wave runup which had the potential to rise 3 feet higher than the embankment. The inflow from this event filled the interior area to an elevation of 579.2 feet IGLD (1), and was plotted at that level on the interior area elevation-frequency curve on Plate 6.

A lower point on the interior elevation-frequency curve was determined by computer simulation. The 6 April 1979 event exhibited a maximum lake elevation of

(1) An interior water surface elevation of 580.5 feet NGVD for the 2 December 1985 event was provided by Mr. Jim Ryan, Town of Hamburg, New York, Engineer. The conversion from NGVD to IGLD is -1.3 feet.

579.21 feet IGLD. It was approximately a 30-year event and the second highest on record. According to town of Hamburg officials, the interior area was flooded solely by water flowing over the Blasdell Creek dike, but the exact interior flood elevation was unknown. The computer program HEC-1 was used to storage route the inflow over the Blasdell Creek dike through the 7.4-cfs pump station to determine the interior flood elevation.

Lake inflow over the Blasdell Creek dike for the 6 April 1979 event was determined using the broadcrested weir equation, $Q = CLH^{1.5}$, with C equal to 3.6, L equal to the length of dike overtopped, and H equal to the average height of the lake above the dike. The C value of 3.6 is for a broadcrested weir of trapezoidal cross section. Plate 7 shows the lake stage hydrograph for the 6 April 1979 event, while Plate 8 displays the associated Blasdell dike inflow.

Routing of the Blasdell creek dike inflow through the pump station yielded an interior flood elevation of 577.2 feet IGLD for the 6 April 1979 event. This interior elevation, although not verifiable, appears to agree with town of Hamburg officials' recollection of the event.

The third and lowest point on the interior elevation-frequency curve was based on historical data. The 10 November 1975 event exhibited a maximum lake elevation of 578.84 feet IGLD and represents approximately a 20-year event. This event resulted in no damage to Woodlawn and, therefore, its exceedence frequency of 4.5 percent was plotted at the zero damage interior elevation of 576.0 feet IGLD. In addition, a peak lake level of 578.6, with an exceedance of 6 percent, occurred on 15 December 1987. Although the intersection of Woodlawn Avenue and First Street was inundated, no damage resulted, further verifying the above plotted point.

The elevation-frequency curve was drawn through the three points discussed above, considering flooding characteristics of wave overtopping of the railroad embankment and lake inflow from Blasdell Creek. The interior area elevation-frequency curve, displayed in Plate 6 includes the influence of wave overtopping for exceedence frequencies less than 3 percent (based on characteristics of the 6 April 1979 event) and the lake inflow over the Blasdell Creek levee for exceedence frequencies less than 10 percent (based on the dike initial overflow elevation of 578.1), and was subsequently used in the damage-frequency analysis.

Interior Area Elevation Frequency Due to Rainfall-Runoff - The interior area elevation-frequency curve due to rainfall runoff was developed by routing the rainfall runoff for various recurrence intervals through the Woodlawn pump station. The rainfall runoff for various recurrence intervals was determined using SCS Urban Hydrology for Small Watersheds, TR-55. The hydrographs developed using TR-55 were then routed through the 7.4-cfs pump station using HEC-1 and the elevation-storage characteristics of the interior areas. The resultant peak interior elevation was then plotted versus the exceedence frequency of the rainfall and a line was drawn between plotted points to define the rainfall-runoff elevation-frequency curve.

The elevation-frequency curve of Plate 9 indicates that the interior area has slightly less than a 2-year degree of protection with respect to rainfall

runoff. This does not agree with the actual experience of Woodlawn residents. Town of Hamburg officials believe the pump station provides a much greater degree of protection than 2 years. However, the pump station was designed for about a 10-year degree of protection, using three pumps or considering a 29-cfs pump in addition to those two that are now in place. The limited scope of this reconnaissance study precluded the additional topographic and residential structure surveys necessary to refine this interior rainfall-runoff analysis.

Flood Damages - Damages experienced at Woodlawn fall into three categories: residential, commercial, and public and other. Calculation of residential damages required the first-floor elevation, type, and value of each affected structure. The first-floor elevation of each structure in Woodlawn was surveyed in August 1987. In addition, each structure was placed into one of the following categories:

Type 1N = 1 story, no basement
Type 2N = 2 story, no basement
Type 1B = 1 story, with basement
Type 2B = 2 story, with basement
Type 3B = split level

Structure values were obtained from the town of Hamburg assessment rolls which are based on 100 percent of value. These values were on 1986 price levels and were updated to June 1987. Price change between June 1987 and November 1987 was considered insignificant. For this analysis, November 1987 prices were assumed and are stated here. Content value was considered to be 50 percent of the structure value. The average residential structure value is $26,000.

Damages to structures and contents were then estimated at various flood depths based on the depth-percent damage relationships shown in Table 11. All depths are relative to first-floor elevations. For residential structures with basements, flooding was assumed to occur no sooner than 2.5 feet below the first floor or the low opening which is usually the basement window.

Estimates of commercial damages were obtained using the same methodology given above for residential properties. That is, using the assessment rolls for structure value and a percentage for contents value. Only one commercial property, at Woodlawn and Fifth Street, was evaluated and it has a considerable inventory of vehicles or rolling stock for which no damages were assigned.

Public and other damages include damages to streets, water and sewer systems, recreation facilities, and other unique damages generally associated with public facilities. These damages were either undocumented or unavailable, and this analysis does not reflect damages in these areas.

Emergency costs are those nonrecurring public expenditures involved in flood fighting, evacuation, and police protection. Special services were provided by police and firemen during the 2 December 1985 flood. Several homes were evacuated by use of an Army Duck-type vehicle when other than boat or floating vehicle access was impossible. Additionally, firemen worked to pump out the flooded areas. Although specifics, including costs, are not thoroughly documented, other flood emergency actions, including evacuation, have occurred for

Table 11 - Depth-Percent Damage (1)

Depth	Structural Damage in Percent					Contents Damage in Percent				
	1N	2N	1B	2B	3B	1N	2N	1B	2B	3B
-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-2.4	0.0	0.0	6.6	2.8	4.5	0.0	0.0	14.7	8.5	9.7
-2.0	0.0	0.0	6.8	3.3	6.1	0.0	0.0	15.0	8.8	11.0
-1.6	1.0	1.0	7.0	4.0	7.7	0.0	0.0	15.2	9.2	12.5
-1.2	1.8	1.8	7.3	4.7	9.2	0.0	0.0	16.2	9.5	14.1
-0.8	2.8	2.4	8.0	5.6	10.3	0.0	0.0	18.0	10.0	15.8
-0.4	4.0	3.4	9.0	6.9	11.9	0.0	0.0	20.4	11.8	17.4
0.0	5.8	4.6	10.0	8.0	13.7	7.0	5.5	23.7	13.5	19.2
0.4	8.2	6.0	12.8	9.4	15.5	21.0	11.5	27.7	15.6	21.1
0.8	11.3	7.8	15.6	10.7	17.5	32.5	16.7	32.3	18.0	23.2
1.2	15.2	9.5	18.1	12.0	21.0	42.0	21.2	38.0	20.7	25.6
1.6	19.1	11.8	20.2	15.0	23.0	49.5	25.3	43.8	24.1	28.0
2.0	23.0	14.5	22.3	17.0	26.0	56.0	29.0	49.6	28.2	30.7
2.4	26.3	17.5	23.7	20.0	29.5	61.0	32.5	55.0	32.0	33.1
2.8	29.1	20.3	25.1	23.0	33.5	66.0	35.5	59.3	35.6	35.6
3.2	32.5	22.8	27.5	26.5	38.0	69.7	38.5	62.9	38.8	38.2
3.6	35.5	25.3	33.0	30.0	45.0	72.5	41.2	65.7	41.7	41.0
4.0	38.2	27.5	39.0	35.0	52.0	75.2	43.7	68.0	44.5	43.9
4.4	43.0	31.5	47.0	40.0	65.0	77.3	46.2	70.0	47.0	46.8
4.8	47.5	35.5	57.5	45.5	71.0	79.2	48.5	71.6	49.3	49.5
5.2	52.5	41.0	67.5	53.0	76.0	80.8	51.2	73.3	52.0	52.5

(1) 0.0 depth is first floor or entryway elevation. See Flood Damage writeup.

some of the other recorded floods which are shown in Table 10. Without specifics, this analysis does not reflect emergency costs other than mentioned here.

Flood stages and corresponding damages for residential and the sole commercial property were combined to form one total stage-damage curve representing damages to the entire area. The total stage-damage curve represents existing conditions as of 1987. Table 12 shows some points on the stage-damage curve including zero damage at 576.0 IGLD. With no change in development expected in the future, neither by the base year 1995 (the year the proposed project is functional), nor over the 50-year expected project life, no modifications were made to the existing conditions stage-damage curve to reflect future development. The stage-damage curve was the same for lake inflow or interior rainfall-caused flooding.

Table 12 - Damage Data - Lake Level, Existing Conditions

Frequency (%)	Interior Elevation Due to Lake Flooding (IGLD)	Total Damage ($1,000)	Accumulated Annualized Damages ($1,000)
4.5	576.0	0.00	2.34
3.0	577.3	24.99	2.19
2.0	577.8	39.14	1.87
1.0	578.5	73.45	1.34
0.5	579.1	115.12	0.90
0.2	579.7	193.24	0.44
0.1	580.0	232.30	0.23
TOTAL			2.34

Expected Average Annual Damages - Expected average annual damage is defined as the frequency-weighted sum of damage for the full range of possible damaging flood events and can be viewed as what might be expected to occur in the present or any future year. It represents the annual damage for a particular set of hydrologic, hydraulic, and damage conditions. Expected annual damage is calculated by first computing a damage-frequency relationship from stage, frequency, and damage data for each damage category. Points from the damage-frequency curve for lake inflow and interior rainfall-caused flooding are given in Tables 12 and 13, respectively. Each damage value is then weighted according to its percent chance of exceedence. Damage caused by rare events is, thus, weighted less. The sum of the weighted damages represents the expected annual flood damage. The generalized computer program to perform computation of Expected Annual Flood Damage-EAD, developed by the Hydrologic Engineering Center, was used. Tables 12 and 13 list the Expected Annual Flood Damage for existing conditions. Expected annual damages from lake flooding are about $2,300, and from interior rainfall-cause flooding are about $5,600.

Table 13 - Damage Data - Interior Rainfall Runoff, Existing Conditions and Pumps

Frequency (%)	Interior Elevation Due to Rainfall-Runoff (IGLD)	Total Damage ($1,000)	Accumulated Annualized Damages ($1,000)
70.00	576.00	.00	5.58
50.00	576.30	4.95	5.04
20.00	576.60	9.90	2.84
10.00	576.80	13.20	1.70
6.00	576.90	14.85	1.14
4.00	577.00	16.50	.83
2.00	577.10	19.33	.47
1.00	577.20	22.16	.26
.50	577.30	24.99	.15
.20	577.50	30.65	.07
.10	577.60	33.48	.03
TOTAL			5.58

Recreation - As described in the subsection on the Human Environment and Recreation, there is significant demand for recreational facilities. Woodlawn Beach is the only beach of significant size in the Buffalo Metropolitan area that essentially remains undeveloped. Many plans by private and public groups have been proposed to realize the potential of the beach area. However, this study focused on the mitigation or elimination of problems and associated damages incurred by present development. Although the study focus was not recreation, the opportunity to realize recreational potential or, at least, to minimize any detriment to that potential was considered during this study.

PLANNING OBJECTIVES AND CONSTRAINTS

National Objective - Current Federal policy, as developed by the President's Water Resources Council, requires that alternative water and related resource plans be formulated in accordance with the national objective of 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 consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Therefore, in accordance with the guidance established in Engineering Regulation 1105-2-30, "General Planning Principles," dated 18 October 1985, this study is consistent with the planning requirements of the Water Resources Council "Principles and Guidelines" (P&G) and related policies.

Specific Planning Objectives - Specific planning objectives are the National, State, and local water and related land resources management needs (opportunities and problems) specific to a study area that can be addressed to

enhance National Economic Development. The specific planning objectives for the Woodlawn, New York, study area are based on a review of the authorizing legislation, previous reports for the area, input from officials at many levels of Government, and an analysis of the problems and needs of the study area, as discussed previously. Each objective is for the 1991-2041 planning period.

° Enhance National Economic Development through means of reducing flood damages in the study area.

° Promote the study area and region's ability to meet its unfulfilled needs for additional recreational opportunities including, but not limited to, boating, fishing, and lake access.

° To reduce through flood damage reduction measures, health, and safety hazards related to flooding in the study area.

° To preserve or enhance the natural environmental quality in the study area including fish, and wildlife resources (habitat).

° To preserve cultural resources in the study area.

° To encourage future land use practices consistent with national flood insurance and flood plain management policies that preserve or enhance future community economic and social well-being and environmental quality.

Planning Constraints - A significant number of improvements are planned for the areas surrounding Woodlawn to transition from heavy industry/steel to other usages. Those improvements span almost the entire area around Woodlawn, much as the steel industry developments did, and will have significant impact on the future of Woodlawn. Therefore, any plans for flood control or other related water resource uses which would use lands or be adjacent to lands proposed for site development as a portion of a larger site development plan should consider the constraints of utilizing one piece of land in a way which may provide other or multi-purpose use of those same lands.

PLAN FORMULATION

The purpose of this sections is to provide a summary of the plan formulation effort conducted for this study. The section provides: a discussion of the rationale/methodology used, a brief review of alternative plans in previous studies, formulation and evalulation criteria considered, a discussion of management measures, and a description of plans developed.

PLAN FORMULATION RATIONALE

The objective of this reconnaissance phase study is to formulate and assess plans in the interest of flood damage reduction and other allied purposes for Woodlawn, New York, with a view towards determining if such plans warrant further study. To warrant further study, at least one potential solution must have Federal interest, have economic justification, have minimal or no negative impacts on the environment, and have sufficient support of non-Federal interests to include cost-sharing of future study.

Cursory consideration is given to measures or plans which may address the problems and needs, once even preliminary definition of the problems and needs are established. However, the planning process is iterative, and, as initial study emphasis shifts from the problems and needs as they become further defined, the shift is to plan formulation and consideration of measures and/or plans. Initial consideration of plans generally begins by examination of plans from previous studies with careful consideration given to what the objective of the previous study was. Then, as plan formulation takes precedent, formulation and evaluation criteria are derived, always keeping in mind the planning objectives and measures, and plans/alternatives are derived.

ALTERNATIVES ADDRESSED IN PREVIOUS STUDIES

Past studies for Woodlawn, New York, have primarily been related to flood damage prevention and performed by the U.S. Army Corps of Engineers. However, a number of recent reports deal with the environs surrounding Woodlawn, addressing the need to convert idle former steel industry lands. The focus of this study is flood damage prevention, so any prior studies which addressed that problem were scrutinized.

The earliest known study of flooding was by the U.S. Army Corps of Engineers in 1954. Two plans of improvement were considered. One plan of improvement considered was to:

° Raise the elevation of the railroad to elevation 582.0 feet (United States Lake Survey Datum (580.15 IGLD)) with impervious fill.

° Provide a highway ramp from foot of Lake View Avenue over the raised track.

° Provide a flap gate or manually operated gate at the Blasdell Creek outlet of an existing 20-inch pipe at north end of Woodlawn Avenue. (A ditch west of Woodlawn Avenue apparently feeds into the 20-inch pipe; the only apparent outlet for interior drainage at that time.)

° Construct a dike along the south bank of the Blasdell Creek. Top height of dike at 580.0 feet USLS Datum (578.15 IGLD).

Based on 1987 surveys for this study and making a conversion for datum differences, some of the above improvements, namely the raising of the railroad and construction of the dike along Blasdell Creek appear to have been made. However, the raised railroad appears to have been raised about 2 feet or about a half-foot lower than the proposed level and the low point on the existing Blasdell dike is as proposed. No information is available as to when these improvements were made. The idea to raise the frontage or railroad track to protect against wave runup and to raise or put a dike on the south side of Blasdell Creek were considered further in this study.

The other plan of improvement considered was suggested by town of Hamburg officials. The improvement consisted of an offshore breakwater extending from the Lackawanna plant of the Bethlehem steel Company, past Woodlawn and Bayview to the vicinity of the Athol Springs Circle. In their opinion, such a breakwater would:

° Protect the enclosed frontage against flooding.

° Provide a small-boat harbor.

° Provide a commercial deep-draft harbor to accommodate future development of industrial areas in the vicinity of the Ford plant and the Federal Portland Cement plant.

The improvement was not considered further, apparently because of problems with combining flood control and navigation authorizations and the breakwater serving as a solution to the flood problem. The concept of a breakwater was considered further in this study.

The most recent study of flooding at Woodlawn was conducted by the U.S. Army Corps of Engineers for the Advanced Measures program. The concerns of Advanced Measures were immediate; to deal with the record high lake levels of 1985-1986.

Four alternatives for provision of flood protection were considered; three structural (earth dikes, sandbags, and pumping) and no-action.

The earth dike alternative proposed construction of approximately 2,200 l.f. of earth dikes along the north and southwest sides of the community. On the north side, the proposed new dike would be built adjacent to, and 2 feet higher than, the existing dike which runs along Blasdell Creek. On the southwest side, the new dike would extend along the area which is subject to wave overtopping; parallel to Woodlawn Avenue, between Lakeview Avenue and Seventh Street. This alternative is essentially that proposed in 1954 which included raising of the railroad.

The sandbags alternative is similar to the earth dike alternative except that sandbags would be used instead of earth fill to obtain the required section and crest elevation. This alternative was considered economically infeasible

during the Advanced Measures study due to the extensive labor that would be involved, relatively short design life, and construction and maintenance costs.

The pumping alternative included an outlet structure on Blasdell Creek at the 6-foot by 12-foot box culvert running under the railroad tracks on the northwest corner of Woodlawn. The outlet structure would contain a gate which would prevent lake water from backing up the creek. High ground along the west side (parallel to the railroad tracks) was considered sufficient elevation, except where the creek is, to prevent static lake levels from backing up into the community. Pumping would be required during periods of reduced or blocked gravity flow (i.e., during high lake levels). Additional pumping capacity would have to be added to the existing pump station, and improvements made to convey flow to the pump station. This alternative was considered economically infeasible due to the anticipated high costs of constructing the outlet structure and providing the required pumping.

Another alternative considered was "no-action", which would result in periodic inundation of the community. Other plans reviewed had considered recreational use or redevelopment of lands surrounding Woodlawn. The significant endeavors to investigate recreational use and redevelopment in the area were considered, but only secondary to flood damage prevention.

FORMULATION AND EVALUATION CRITERIA

Federal policy on multiobjective planning, derived from both legislative and executive authorities, establishes and defines the national objective for water resources planning, specifies the range of impacts that must be assessed, and sets forth the conditions and criteria which must be applied when evaluating plans. Plans were formulated and evaluated to address the national objective and specific planning objectives stated earlier for this study.

The planning framework used by this study is in the Water Resources Council's "Economic and Environmental Principles and Guidelines for water and Related Land Resources Implementation Studies." The process requires that the impacts of a proposed action be measured and the results displayed or accounted for in terms of contributions to four accounts: National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (SE). The formulation process must be conducted without bias as to structural and nonstructural measures.

Within the structure of the overall planning framework, other more specific criteria relative to general policies, technical engineering, economic principles, social and environmental values, and local conditions must be established. These criteria, noted as "Technical," "Economic," "Socioeconomic and Environmental," and "Other" are as follows:

Technical Criteria

° Assume that sideslopes of 2:1 are adequate for functional design of levees, berms, and riprapped creek banks during the reconnaissance phase of the study. Verify this assumption, as appropriate, during the feasibility phase of the study.

° For levee plans considered during the reconnaissance phase of the study, assume that an acceptable borrow area that contains suitable semi-impervious material is within a 10-mile radius of the construction site: and foundation material at the proposed levee site will not present underseepage problems. These facets will be investigated in detail during the feasibility phase of the study, if levee plans are carried forward.

Economic Criteria

° Tangible benefits should exceed project economic costs.

° Each separable unit of improvement or purpose should provide benefits at least equal to its cost unless justifiable on a noneconomic basis.

° Each plan, as ultimately formulated, should provide the maximum net benefits possible within the formulation framework.

° The costs for alternative plans of development should be based on preliminary layouts, estimates of quantities, and November 1987 unit prices.

° The benefits and costs should be in comparable economic terms to the fullest extent possible.

° A 50-year economic life and 8-5/8 percent interest rate are used for the economic evaluation of local protection plans.

° The project evaluation period for local protection plans is a 50-year interval beyond the estimated implementation date of 1991.

° The base case for comparison of alternative plans is a condition that is expected to exist without any Federal action or the "no action" plan.

Socioeconomic and Environmental Criteria

The criteria for socioeconomic and environmental considerations in water resources planning are prescribed by the National Environmental Policy Act of 1969 (PL 91-190) and Section 122 of the River and Harbor Act of 1970, (PL 91-611). These criteria prescribe that all significant adverse and beneficial economic, social, and environmental effects of planned developments be considered and evaluated during plan formulation. In addition, any plan should take into account Executive Order 11988, Flood Plain Management, which discourages Federal agencies from undertaking projects in the flood plain or that would encourage development in a flood plain.

Other Criteria

1. Mitigation - There is insufficient environmental data at this time to determine the precise need for mitigation or the type of mitigation that might be required. Therefore, plans and associated costs for mitigation are not included in the estimates for this Reconnaissance Report. Mitigation needs would be evaluated in the feasibility phase, as appropriate.

2. Cost Sharing - Project cost-sharing and financing, as specified in the Water Resources Development Act of 1986 (PL 99-662), is as follows:

a. Flood Control (Structural) - Federal Responsibilities include up to a maximum of 75 percent of the cost of the flood control project. Non-Federal interests are required to: pay 5 percent of the cost of the project during construction; provide all lands, easements, rights-of-way, and dredged material disposal areas; relocate all utilities; pay an additional amount during construction such that the total contribution of the non-Federal sponsor is equal to 25 percent of the cost of the project, if required; and operate and maintain the completed project. However, in no instance shall the non-Federal share exceed 50 percent of the cost of the project.

b. Flood Control (Nonstructural) - Federal responsibilities include 75 percent of the cost of the project. Non-Federal interests are required to provide all lands, easements, rights-of-way, and dredged material disposal areas; and relocate all utilities up to a maximum of 25 percent of the cost of the project; pay an additional amount during construction such that the total contribution of the non-Federal sponsor is equal to 25 percent of the cost of the project, if required; and operate and maintain the project.

c. Add-On Recreation - Federal responsibilities include 50 percent of the construction cost of separable project features. Non-Federal interests are responsible for providing 50 percent of the cost of separable project features; and operating and maintaining the separable project features. Cost-sharing for the joint project features are as specified above.

3. Local Sponsor - Formal assurances of local cooperation must be furnished by a municipality or other public agency fully authorized under State law to give such assurances and financially capable of fulfilling all items of local cooperation. The New York State Department of environmental Conservation is the designated local sponsor for Corps-built flood control projects in New York State, and has indicated their qualified intent to become the local sponsor for a flood control project at Woodlawn.

4. Financial - The financing options for any plan be considered.

MANAGEMENT MEASURES

Measures are broad spectrum type solutions for flood damage reduction. Measures do not have any dimensions or specifics but measures are the basis of plans which have specifics such as size, shape, specific location, etc. Measures were first evaluated before development of specific plans.

The specific problems at Woodlawn that were addressed by this study involve wave runup on the southwest side and overtopping of the existing dike along Blasdell Creek. Often the measures discussed here will only address one facet of the problem. There combination to address all facets of the problem is discussed here and in the following section on plan development.

Measures considered for flood management at Woodlawn are of two different kinds, nonstructural and structural. The two kinds are not necessarily

different in physical character, as their names imply, but rather are different in function. Nonstructural measures protect against flood damage at specific sites but do not manage the flooding itself. Conversely, structural measures protect against flood damage by altering the characteristics of flooding.

Several nonstructural and structural measures are discussed in this Section of this report. This initial part of a screening process is to develop, identify, and select the most suitable, feasible, and appropriate measure to satisfy the Planning Objectives and evaluation criteria stated earlier in this report. The measure should have reasonable social acceptance for implementation.

Nonstructural Measures

Nonstructural measures for use in flood management have two general functions: to protect against flood-related losses at individual sites, and to reduce overall need for flood protection. Flood warning and emergency action, floodproofing, and flood insurance are designed to partially protect against flooding at individual sites of possible flood damage. Flood plain management and permanent evacuation reduce need for flood protection by regulating flood-damageable uses, but provide no protection for existing development.

1. Flood Warning and Emergency Action.

Flood warning measures provide information about possible flooding so that those who might be affected by such flooding can escape with some belongings, or can employ emergency measures, such as sandbags, to protect themselves.

Normally, a storm which has potential to produce high lake levels approaches slowly enough so that there are several hours or even days for warning. Currently the National Weather Service issues Lake Shore Erosion and Flood Warning statements and Woodlawn is within the range of weather band radio transmissions to receive these alert signals. Also local radio and television stations often issue weather bulletins regularly during normal broadcasts when there is a threat of high lake levels.

It is viewed that flood warning is sufficient and that any specific system for Woodlawn would be redundant. Therefore, no further consideration was given that measure.

2. Floodproofing.

Floodproofing measures, both temporary and permanent, provide onsite protection of individual properties against flood-related damages. Temporary measures include closure devices and barricades. Permanent measures include watertight substructures, building anchors, pedestal foundations, and individual dikes, levees, and floodwalls. Floodproofing should only be considered on a voluntary basis. Condemnation is not considered practicable.

Many of the houses at Woodlawn are older and built on cinder block foundations. Based on the number and age of the structures, the apparent stability

of structures and the likely cost of either temporary or permanent measures, this measure was not given further consideration.

3. Flood Insurance.

Flood insurance provides some financial protection to victims of flood-related property losses, but does nothing to prevent such losses.

The town of Hamburg participates in the regular program of the National Flood Insurance Program administered by the Federal Emergency Agency. With the current ability to utilize low cost insurance and sufficient flood plain ordinances to reduce the potential of flood damage to any future developments or redevelopment, this measure was not considered further.

4. Flood Plain Management (Land Use Regulation).

Flood plain management measures regulate land use to prevent or reduce future flood-damageable development in flood plains. Flood plain management does not address the problem of damageable structures already in the flood plain.

Besides the provision for insurance, one intent of the National Flood Insurance Program is to encourage communities to adopt effective flood plain management regulations. By means of zoning laws, building codes, and subdivision regulations, a flood plain management program would prevent highly damageable uses of floodlands, while permitting less susceptible uses such as farming and recreation.

Based on requirements of the National Flood Insurance Program, the town of Hamburg has established flood plain management regulations and flood insurance zones based on a 100-year frequency of flooding. Therefore, this measure was not considered further.

5. Permanent Evacuation.

Permanent evacuation measures remove existing flood-damageable structures from flood susceptible lands and thereby eliminate to some degree the need for flood damage management.

Based solely on the high cost of this measure even to evacuate one residence this measure was not considered further based on the relative significance of potential benefits.

Structural Measures

There are two basic kinds of structural measures for flood management: local protection and regional protection measures. Modified channels, diversions, levees, and floodwalls, conduct floodwater through or away from flood-damageable areas, and local protection measures protect properties only in their immediate vicinities. Regional measures protect, to some degree, all properties within the watershed downstream from them. Lake level regulation is an example of a regional protection measure. Regional protection measures are

beyond the scope of this study and will not be discussed here. Therefore, the following structural measures are all local protection measures.

1. Levees.

Levees generally function to protect by providing an impermeable barrier higher than the design water level. Levees were considered in previous studies as functionally addressing the flooding problem. For purposes of this study, levees were considered to perform two functions - to hold back static water levels resultant of high lake levels, and to prevent wave runup from entering the area. On the basis of previous studies and initial analysis this measure appears technically adequate and of low cost that it will be considered further.

2. Floodwalls.

Floodwalls function as levees; however, they perform the same function using lesser area and cost more. Since the availability of lands for levees is not restrictive and floodwalls generally are more costly consideration of floodwalls was not carried forward. Since this is a reconnaissance effort if it appeared later that land use was restrictive, floodwalls could be reconsidered during later study. However, the significantly higher costs weighted against the significantly small amount of total benefits in the area negate such a possibility.

3. Diversion.

Diversions are used to convey water away from the floodprone site. At Woodlawn part of the problem is lake levels and diversion of waters which essentially back up the lake. Two methods of diversion were considered here. One method carried forward from previous studies, was to divert waters that normally back flow up Blasdell Creek back into the lake using a control structure. This measure by itself is not fully functional and is discussed later with pumps.

Diversion could also include diverting Blasdell Creek elsewhere such that high ground, enclosure, or overtopping banks would not allow destructive flooding. Such diversion would call for relocation likely through the commercial section of Woodlawn along Route 5 or through the heavily industrialized are around Woodlawn. Those diversions would most likely require use of substantially sized closed conduit. No analysis was done of the needed carrying capacity for upstream inflows yet. The cost of relocating an open channel of the needed size in a developed area would be excessive and the additional need for a closed channel would further increase costs. Therefore, diversions were not considered further.

4. Covered Channel or Closed Conduit.

Covered channel and closed conduit are used to convey flow essentially like open channels; however the flow is contained for the given capacity. Flooding is shifted upstream to the inflow point on the channel or conduit when capacity is not sufficient for all inflows. The costs of covered channel or closed

conduit for a channel the size of Blasdell Creek and for the length needed are considered excessive.

5. Pumps.

Pumps are used to raise or move water out of a generally low lying area. At Woodlawn, because of the topography, all water which inflows into the area must be pumped out. The current pump station has a capacity of 7.4 cfs. The existing stations capacity could be raised to 36.4 cfs and provide between 2 and 10-year protection for interior runoff but would not be able to handle any lake flooding event. The cost for an additional pump station of substantial size to handle any lake inflows would be cost prohibitive. Further, additional improvements for conveyance to the pump station would be necessary. Previous studies of this area substantiate the high costs of pumping and this alternative alone or with other measures was not considered further regarding lake flooding. However, for interior drainage, for which their is no Federal interest, provision of a 10-year level of protection would provide for a significant reduction in interior rainfall expected average annual damages.

6. Breakwaters.

Breakwaters are constructed offshore to dissipate the energy of approaching waves and they may be detached or attached to shore. Generally attached breakwaters are used to protect marina type developments and the additional length of breakwater substantial cost could not be justified to prevent wave runup. A detached breakwater could serve to reduce wave runup; however, its costs are excessive compared to other methods. Any breakwater in this area would primarily be of benefit in trapping sediment movement which is not a purpose of this study.

7. Bulkheads and Seawalls.

Bulkheads generally considered retaining walls which hold or prevent sliding of the soil while providing protection from wave action. Bulkheads are often used for land reclaimation or where deep water is needed near shore. Seawalls are generally hardened structures of massive size used to protect the back shore from heavy wave erosion.

Both of the above permanent type structures are generally used for conditions or purposes other than fond at Woodlawn. Also based on the significant costs of these types of structures compared with others such as dikes, these structures were not considered further.

Bulkheads of the non-permanent type such as a Huguire Fencing and stacked bag bulkhead are relatively inexpensive structures. Since they are not permanent, they were considered along with sandbags to be emergency or short-term solutions. Emergency type solutions of this nature were not considered within the scope of this study.

8. Beach Fill.

Beach fill is generally used to protect the area behind it with the primary value in recreation. At Woodlawn the beach fill would have to be substantial in order to create a dune to prevent against wave runup. Beach filling is a recurrent measure with an excess of fill placed initially to allow for losses. At Woodlawn the beach is in the major fetch of the lake which would subject the beach to significant wave action which would require significant fill. Additionally, a source for sand would have to be identified as natural sources are likely insufficient. Beach fill costs are likely to be in excess of other measures such as dikes, so no further consideration was given them.

9. Vegetation.

Vegetation is used to keep the shoreline stabilized. It is generally used to prevent shore erosion. At Woodlawn, vegetation would have to be used in conjunction with beach fill because the existing conditions which provide a harsh environment of flooding, sand blasts, wind, and water erosion along with other conditions that would not be conducive to plant survival. Beach fill with the addition of vegetation to stabilize conditions would be more feasible. However, as discussed, beach fill would already have excessive cost. Therefore, vegetation alone or in combination with beach fill was not considered further.

PLAN DEVELOPMENT AND DESCRIPTION

Only one measure, levees, besides the no-action measure, passed an initial screening that was based on how measures addressed the planing objectives and formulation and evaluation criteria. With minimal damages and thus minimal subsequent benefits of any improvement special attention was given to economic efficiency. Measures that performed relatively the same function with the least cost were chosen. Other measure impacts often lesser known, were considered equal in this initial evaluation unless initial information indicated otherwise. Therefore, refinement of the levee measure was the only plan developed in addition to the No-Action Plan. This level of plan development is consistent with the reconnaissance phase objective of evaluating a broad range of possible solutions and identifying the best general plan (or plans) for satisfying flood damage reduction needs.

Levee Plan.

The levee alternative consists of construction of earth levees along the north and southwest sides of Woodlawn. This plan was formulated to provide protection against storm events having exceedence frequencies of one percent or more. This level of protection was used because it appeared to be the highest degree of protection that could likely be provided that had some potential for benefit, and local officials were seeking to remove the area from the 100-year flood plain. The design water level (DWL) for the Blasdell Creek dike (north side) is El. 580.0 (100-year storm from Plate 5). For the Woodlawn Avenue levee (southwest side), the damaging water level and design elevation is El. 583.3 which includes DWL plus 3.3 feet of wave runup at the levee.

The 3.3 feet of wave runup for the 100-year lake event was determined from two historical lake events, the 2 December 1985 event and the 10 November 1975 event. The 2 December 1985 event, with a recurrence interval of about 250-year, exhibited a potential wave runup of 3.3 feet, while the 10 November 1975 event, a 20-25 year event, exhibited a potential wave runup of 3.2 feet. Since these two historical events encompass the 100-year exceedence frequency, a wave runup of 3.3 feet was chosen for addition to the 100-year lake level of 580.0 to provide elevation 583.3, the top elevation of the proposed lakeward levee.

The design life of the levee alternative is estimated to be 50 years. The plan is shown on Plate 10, and the associated typical cross sections on Plates 11 and 12.

The work along the north side includes construction of two earth levees along the left bank of Blasdell Creek. Both levees will be built to crest elevation 580.5 (0.5-foot freeboard). The first levee (Reach A-B) is approximately 600 feet long and will extend from high ground at Route 5 to high ground 600 feet west thereof. This levee is about 5 feet high and will be built adjacent to, and landward of, the relatively low existing dike located here. The second levee (Reach C-D) is approximately 200 feet long and will extend from high ground 1,000 feet west of Route 5 to high ground at the railroad tracks. This levee will be about 2 feet high.

The work along the southwest side includes construction of a 1,450-foot long earth levee (Reach E-F) built to crest elevation 583.3. The levee, about 3.5 feet high, will run between and essentially parallel to Woodlawn Avenue and the utility poles (just east of the railroad tracks). It will extend from Lakeview Avenue to the existing dike located just south of Seventh Street. The levee can be moved east or west within the about 90-feet corridor between Woodlawn Avenue and the utility poles just east of the railroad tracks to avoid trees there. However, the western most portion of the corridor is high ground and will be utilized where possible.

The above levees will be constructed of impervious fill, have 2H:1V side-slopes, 5-foot crest widths, and will be topsoiled and seeded to prevent erosion. Maintenance will consist primarily of lawn mowing and where necessary maintenance of the levee embankment.

No-Action Plan.

The No-Action plan indicates that the Corps of Engineers acting for the Federal Government could take no-action based on an evaluation of the problems and possible solutions as directed by the study authority. The No-Action alternative is always a possibility and serves as the basis of comparison by which the other possible alternatives may be compared.

PLAN ASSESSMENT AND EVALUATION

This section provides a general but brief description of the 2 preliminary alternative plans formulated in the interest of lake flood management and allied purposes at Woodlawn, New York. It also compares their economic and environmental impacts, and discusses the rationale for rejecting from or selecting preliminary plans for further detailed study in the feasibility phase.

ASSESSMENT, EVALUATION, AND COMPARISON OF PRELIMINARY PLANS

Flooding is a periodic problem in the project area. Preliminary average annual damages for without project conditions were estimated at $2,340. The Buffalo District is investigating public concerns and potential alternative measures for addressing these concerns. Initially, a wide spectrum of both nonstructural and structural measures are considered. They are examined alone, and in combinations; for their engineering and economic feasibility, environmental and social acceptability, and overall ability to meet the identified planning objectives. Measures investigated for this study include: No-Action, Flood Insurance, Flood Plain Management, Flood Warning, Floodproofing, Permanent Evacuation, Levees, Floodwalls, Diversion, Covered Channel, Pumps, Breakwaters, Bulkheads, Seawalls, Beach Fill, and Vegetation.

Preliminary overall evaluation indicated the most feasible alternatives (incorporating combinations of measures where appropriate) to be: No-Action, or Levee Construction. These were examined in more detail.

Table 14, following, provides a brief description of the two plans considered during the reconnaissance phase of the study to provide flood damage prevention for Woodlawn, New York. The table also compares the economic impacts of these plans. Table 15 compares the environmental impacts of these plans with sections following giving more specifics of environmental impacts.

Reconnaissance assessment of the No-Action and Levee Plan indicate that with implementation of the Levee Plan, minor short-term adverse impacts would probably be anticipated for: air quality, water quality, benthos, fisheries, vegetation, public facilities and services, property value and tax revenue, and noise and aesthetics. Minor long-term adverse impacts may be expected for vegetation. Minor to moderate short and long-term beneficial impacts would be expected for: community and regional growth, business and industry, employment and income, public facilities and services, property value and tax revenue, and community cohesion. Reference Table 15 and the ENVIRONMENTAL ASSESSMENT Section.

For the levee plan, no adverse impacts to endangered species or wetlands would be anticipated. No significant areas of prime or unique soils are located in the area, and no adverse impact to any agricultural activity or designated farm district would occur. Since the area has been disturbed previously, no adverse impacts to any cultural resources would be expected. The levee plan would likely be in compliance with coastal zone management and local land use policies. Preliminary compliance with Federal environmental

Table 14 - Assessment, Evaluation, and Comparison of Preliminary Plans

Item	Plan 1 Levees	Plan 2 No-Action Plan
1. Plan Description	This plan consists of levees along the north and southwest sides of Woodlawn, New York. This would reduce the occurrence of lake caused flooding.	Under the No-Action Plan no project for flood control and allied purposes would be constructed by the federal Government (Corps of Engineers) at Woodlawn, New York. As such, flooding would continue, with average annual damages totaling about $2,300. In addition demand for water recreational activities would not be met.
2. First Cost: (1)	101,000	0.00
3. Annual Charges: (2)		
Interest and Amortization	8,850.00	0.00
Annual O&M	1,600.00	0.00
Total	10,450.00	0.00
4. Average Annual Benefits: (2)		
Flood Damage Reduction	1,170.00	0.00
Recreation	0.00	0.00
Total	1,170.00	0.00
5. Benefit-to-Cost Ratio	0.11 to 1.0	N/A
6. Average Annual Net Benefits	(9,280.00)	
7. Significant Environmental Impacts	No significant impacts.	No change.
8. Carry Forward Into Feasibility Phase	No.	Yes

(1) Based on November 1987 price levels.

(2) Based on November 1987 price levels, 8-5/8 percent interest rate, and 50-year period of analysis.

Table 15 - Levee Plan Impacts Relative to the No-Action (Without Project) Conditions

Evaluation Parameter		Levee Plan
Human Environment and Man-Made Resources		
Community and Regional Growth (Population/Land Use & Development)	ST:	Moderate Beneficial
	LT:	Moderate Beneficial
Displacement of People	ST:	Not Significant
	LT:	Not Significant
Displacement of Farms (Soils and Farmland)	ST:	Not Significant
	LT:	Not Significant
Flood Plain	ST:	Minor Adverse
	LT:	Minor Adverse
Coastal Zone	ST:	Not Significant
	LT:	Not Significant
Business and Industry/ Employment and Income	ST:	Minor Beneficial
	LT:	Minor Beneficial
Recreation	ST:	Not Significant
	LT:	Not Significant
Public Facilities and Services	ST:	Minor Adverse
	LT:	Moderate Beneficial
Property Value and Tax Revenue	ST:	Minor Adverse
	LT:	Minor Beneficial
Noise	ST:	Minor Adverse
	LT:	Not Significant
Aesthetics	ST:	Minor Adverse
	LT:	Minor Adverse
Wild and Scenic River	ST:	Not Significant
	LT:	Not Significant
Community Cohesion	ST:	Minor Beneficial
	LT:	Minor Beneficial
Cultural Resources		
Archaeological	ST:	Not Significant
	LT:	Not Significant
Historic	ST:	Not Significant
	LT:	Not Significant

Table 15 - Levee Plan Impacts Relative to the No-Action (Without Project) Conditions (Cont'd)

Evaluation Parameter	Levee Plan
Natural Environment and Resources	
Air Quality	ST: Minor Adverse LT: Not Significant
Water Quality	ST: Minor Adverse LT: Not Significant
Benthos	ST: Minor Adverse LT: Not Significant
Fisheries	ST: Minor Adverse LT: Not Significant
Wildlife	ST: Minor Adverse LT: Not Significant
Endangered Species	ST: Not Significant LT: Not Significant
Vegetation	ST: Minor Adverse LT: Minor Adverse
Endangered Species	ST: Not Significant LT: Not Significant
Wetlands	ST: Not Significant LT: Not Significant

Key	Range	Note
ST: Short-Term LT: Long-Term	Major Beneficial Moderate Beneficial Minor Beneficial Not Significant Minor Adverse Moderate Adverse Major Adverse	Reference ENVIRONMENTAL ASSESSMENT for narrative.

statutes and executive orders are discussed in more detail in the ENVIRONMENTAL COORDINATION AND COMPLIANCE section.

As a result of no action, flooding in Woodlawn will continue periodically. However, since no new development in the flood plain is projected for Woodlawn, flood damages should not increase. The periodic trauma and inconvenience experienced by flood victims in the Woodlawn area will also continue.

Based upon overall review and evaluation of alternative plans the No-Action Plan is identified as being the tentatively recommended plan.

ECONOMIC ASSESSMENT

The plans evaluated are the levee plan and the no-action plan. The no-action plan serves as an alternative and as a basis of comparison for other plans.

Existing Average Annual Damages, Without Project Conditions, Study Year 1987 Conditions of Development. Average annual damages are the expected value of flood damages for any given year. The existing "Without Project" average damages at November 1987 levels of development and prices are presented in Table 12. Existing "Without Project" average annual damages at November 1987 levels of development and prices are $2,340.

Existing Average Annual Damages, Without Project Conditions, Base Year 1991. Without Project damages as of the study year (1987) were projected to the base year 1991. These damages are based upon Table 16 which shows the distribution of residential structures by elevation categories under 1991 conditions of development.

Table 16 - Number of Homes with Flooding Depths Above First Floor

Index Elevation	-8-0	0-1	1-2	2-3	3-4	4-5	Homes Total
582.0	128	10	16	26	9	1	190
581.0	138	16	26	9	1	0	190
580.0	154	26	9	1	0	0	190
579.0	180	9	1	0	0	0	190
578.0	189	1	0	0	0	0	190
577.0	190	0	0	0	0	0	190
576.0	190	0	0	0	0	0	190

Residential content damages at the study year (1987) were adjusted to reflect the projected increases in the real value of residential contents between the was based upon the real increases in regional per capita income between the study year and base year.

Existing "Without Project" average annual damages as of the base year, 1991, are presented in Table 17 in the column labeled "Base Year, 1991." The existing average annual damages, in November 1987 prices, are $2,430.

Average Annual Damages Under Future Conditions. An evaluation of the potential for future growth in land use indicated there would be no change in land use. However, future residential content damages will rise due to an increase in residential content value over time. The increase in the value of contents is assumed to grow at a similar annual rate as the projected growth in per capita income as reported in 1985 OBERS BEA REGIONAL PROJECTS for the Buffalo PMSA (1.1%). Also, this increase in residential content value is calculated using the value of residential contents to residential structures for the study year (November 1987), as 50 percent. Growth in residential contents is capped at 75 percent of the value of residential structures. This cap is not reached in the 50-year project evaluation period.

Residual Average Annual Damages. Without project damages were calculated up to the .1 percent chance of occurrence. However, the levee plan proposed will not eliminate all damages. The residual damages from a levee plan providing a 100-year degree of protection are shown in Table 18. Benefits for freeboard were not considered.

Computation of NED Benefits.

The benefits that are derived from the plan are primarily inundation reduction benefits accruing to the existing residential activities located in the project area. Residential benefits include affluence applicable to residential contents.

Benefits developed in this section reflect conditions of development over the evaluation period (1991-2041), November 1987 price levels, an 8.625 percent annual interest rate, and a 50-year project life.

Each plans inundation reduction benefit is arrived at by subtracting from average annual damages under "Without Project" conditions (Table 17) each plans corresponding "With Project" residual average annual damages (Table 18). This is performed in Table 19.

Average Annual Costs.

The first cost of the levee plan is shown in Table 20. Table 21 presents a summary of average annual costs for the levee plan. Annual charges were based on an 8.625 percent annual interest rate and a 50-year project life. Annual maintenance costs applicable to the levee plan are also included.

Table 17 - Damages Due to Lake-Caused Flooding, Existing and Future Without Project

Damage Categories		Base Year	Decade Years					End of Period	Equivalent Annual
	1987	1991	10	20	30	40	50	2044	Damage (1)
			2004	2014	2024	2034	2044		
1 Res-structure	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
2 Res-contents	1.09	1.18	1.34	1.51	1.67	1.84	2.01	2.01	1.37
Total	2.34	2.43	2.58	2.75	2.92	3.09	3.26	3.26	2.62

(1) Annual Equivalent in thousands of dollars at 8-5/8 percent.

Table 18 - Residual Damages with 100-Year Protection from Lake-Caused Flooding

Damage Categories	Study Year	Base Year	Decade Years					End of Period	Equivalent Annual
	1987	1991	10	20	30	40	50	2044	Damage (1)
			2004	2014	2024	2034	2044		
1 Res-structure	.67	.67	.67	.67	.67	.67	.67	.67	.67
2 Res-contents	.62	.68	.76	.86	.96	1.05	1.15	1.15	.78
Total	1.29	1.35	1.44	1.53	1.63	1.73	1.82	1.82	1.45

(1) Annual Equivalent in thousands of dollars at 8-5/8 percent.

Table 19 - Average Annual Inundation Reduction Benefits

Plan/Damage Caregories	Without Project Average Annual Inundation Damages	With Project Average Annual Inundation Damages	With Project Average Annual Inundation Reduction Benefits
Levee Plan - 100 Year Protection			
Residential			
Structures	1,250	670	580
Contents	1,370	780	590
Total	2,620	1,450	1,170

Table 20 - Levee Plan Cost Estimate
Woodlawn, New York (1)

Item No.	Description	Estimated Quantity	Unit	Unit Price	Estimated Amount
				$	$
1.	Impervious Fill	4,680	CY	11.70	54,756
2.	Stripping	800	CY	5.30	4,240
3.	Fert., Seed, & Mulch	1.30	Acre	3,100	4,030
	Total Contractors Earnings				63,026
	Contingencies 25% + / -				15,974
	Total Contractors Earnings Plus Contingencies				79,000
	Engineering & Design				12,000
	Supervision & Adminsration				10,000
	Total First Cost of Construction				101,000

(1) November 1987 price levels.

Table 21 - Annualized Costs of 100-Year Levee Plan

First Cost	Annual First Cost	Annual O&M Cost	Total Annaul Cost
$	$	$	$
101,000	8,853	1,600	10,453

Benefit Cost Analysis.

Table 22 summarizes the average annual benefits, the average annual costs, the benefit-cost ratio, and net benefits for the plan evaluated. The benefits of the levee plan did not exceed the costs.

Table 22 - Comparison of Benefits and Costs
100-Year Levee Plan

Annual First Cost	Annual O&M	Annual Total Cost	Existing Benefits	Future Affluence	Total Benefits	Net Benefits	Benefit Cost Ratio
$	$	$	$	$	$	$	
8,850	1,600	10,450	1,080	90	1,170	(9,280)	0.11 to 1

ENVIRONMENTAL ASSESSMENT

Human Environment - Alternative Effects

1. Community and Regional Growth (Population/Land Use and Development).

a. No-Action (Without Conditions). Continued periodic flooding and associated damages and disruption to the existing flood plain development would be anticipated. Preliminary average annual damages for without project conditions were estimated at $2,340. Some damages might be reduced by individual floodproofing or local measures. Some compensation could be expected from flood insurance policies. In the future, some development pressures affecting present land use may occur in the locale, but continued development would need to comply with current flood insurance policies.

b. Levees Alternative Plan. The levee would provide at least 100-year level of flood protection to the Woodlawn subdivision, consisting of about 60 acres and 190 homes (about 25-acre flood plain with about 50 homes). Since the area is almost entirely developed, no substantial additional new development would be anticipated due to levee construction. This plan would not significantly affect existing 100-year event flood levels in other areas of the flood plain.

2. Displacement of People.

a. No-Action (Without Conditions). Some residents would continue to be temporarily displaced from their homes during times of substantial flooding.

b. Levees Alternative Plan. No relocations would be anticipated. Acquisition and/or easements for some properties would be required to facilitate levee construction and maintenance and to provide for internal drainage facilities. Any acquisitions or relocations would comply with policies as set forth in the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970".

3. Displacement of Farms.

a. No-Action (Without Conditions). No farms are located in the vicinity of Woodlawn. Reference ENVIRONMENTAL COORDINATION AND COMPLIANCE Section also.

b. Levees Alternative Plan. No displacement of farms.

4. Business and Industry/Employment and Income.

a. No-Action (Without Conditions). Some residents may periodically miss days of work while addressing flooding problems. Some business and work is periodically generated in addressing flooding problems. Similar to existing conditions regionally. Reference EXISTING AND ANTICIPATED FUTURE CONDITIONS.

b. Levees Alternative Plan. Levee construction would provide business, employment, and income opportunities for one or more construction contractors and/or suppliers with small workforces during one or two construction seasons.

5. Recreation.

a. No-Action (Without Conditions). Conceptual plans exist for the development of the surrounding Woodlawn Beach area as a revived recreation area.

b. Levees Alternative Plan. The proposed plan would not interfere with the proposed land use and/or recreational development plans.

6. Public Facilities and Services.

a. No-Action (Without Conditions). Periodic flooding would continue to disrupt normal public facilities and services. Public facilities and services would be needed to facilitate associated flood emergency operations. Some local streets are periodically inundated by flood waters.

b. Levees Alternative Plan. The Woodlawn development would be protected at least to the 100-year event flood level. Fewer public facilities and services would be needed to facilitate flood emergency operations. Some minor relocation of utilities may be required to facilitate project construction, but no significant disruption to services would be expected. Area access during potential flooding periods would be improved. Area roads should sufficiently facilitate movement of heavy construction equipment. Project maintenance
would likely be a local responsibility.

7. Property Value and Tax Revenue.

a. No-Action (Without Conditions). Similar to existing conditions. The threat of flooding would continue to reduce the value of land in the flood plain. Land value and associated tax revenue would be increased by continued developments; but new and redevelopment plans would need to comply with flood insurance policies.

b. Levees Alternative Plan. The levee would provide at least 100-year event flood protection to the Woodlawn subdivision consisting of about 60 acres and 190 homes (about 25-acre flood plain with about 50 homes). Since the area is almost entirely developed, no substantial, additional, new development would be anticipated. Some home improvements, and increase in property value and associated tax revenue would be anticipated with flood protection. The local governments and people would likely share in project cost and maintenance.

Acquisition and/or easements for some properties, particularly along the creek, will be required to facilitate levee construction and maintenance and to provide for internal drainage facilities.

8. Noise and Aesthetics.

a. No-Action (Without Conditions). Similar to existing conditions.

b. Levees Alternative Plan. Construction noises would be generated in close proximity to many residences with the operation and movement of heavy equipment in the project area. Construction should be limited to working daylight hours and routings should be planned primarily along main routes to minimize adverse effects. Operations may need to be modified, as warranted.

A levee structure would perimeter the existing development, thereby, partially obstructing views to and from the area, particularly at homes near the creek and Lake. The levee would be slightly set back from the creek, where possible, and most of the riparian vegetation maintained. The levee would be revegetated with grasses and/or legumes soon after construction to protect soils from erosion and to improve aesthetics. Additional landscaping and planting of trees and/or shrubs off of, but in the general vicinity of the levees, would facilitate aesthetics.

9. Community Cohesion.

a. No-Action (Without Conditions). Continued concerns relative to flooding problems would be anticipated. Local flood protection measure implementation is limited.

b. Levees Alternative Plan. Local and State interests have expressed an interest in flood damage reduction measures, if they are shown to be economically and engineeringly feasible, and environmentally and socially acceptable. Environmental considerations have been incorporated into the plan formulation to minimize any adverse impacts. Federal, State, and local cost-sharing and other agreements will need to be finalized.

10. Cultural Resources - Alternative Effects

Reference the ENVIRONMENTAL COORDINATION AND COMPLIANCE section which follows.

Natural Environment - Alternative Effects

1. Air Quality.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, no significant adverse impact on air quality would be anticipated in the near future. Air quality would probably continue to remain the same or possibly improve if Federal and New York State water quality standards, compliance and enforcement continue to be upgraded in the future.

b. Levees Alternative Plan. Operation of construction equipment such as dump trucks, front end loaders, backhoes, and bulldozers would probably introduce some temporary smoke, odor, fugitive dust, suspended particulates, nitrogen dioxide, carbon dioxide, and carbon monoxide into the local atmosphere in the general vicinity of the project area. Air quality in the project locale would be expected to soon return to pre-project conditions after construction is completed and equipment is removed.

2. Water Quality.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, no significant adverse impact on water quality would be anticipated in the near future. Water quality would probably continue to remain the same or possibly improve, if Federal and New York State water quality standards, compliance, and enforcement continue to be upgraded in the future.

b. Levees Alternative Plan. Levee construction along the south bank of Blasdell Creek, would probably cause some short-term adverse impact on water quality. A temporary increase in water turbidity may occur due to siltation from disturbed terrestrial soils adjacent to the creeks, and possibly from some minor spillage of fuel, oil, and/or grease during operation of heavy equipment. No significant adverse impact on water quality is expected by construction of a short levee on Woodlawn Beach, since the levee would be located well away from the immediate shoreline. In general, to help minimize adverse impacts on water quality from the project, construction would occur as much as feasibly possible during the summer low-flow period, disturbed soils would be promptly seeded, and the Contractor would be required to comply with Federal and State lows on water quality. Additionally, the Contractor would also be required to follow the "Construction Guide Specification for Environmental Protection" (CW-01430, dated July 1978) which includes protection of water quality.

3. Benthos.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, no significant adverse man-made disruption to benthic invertebrate organisms would be anticipated, unless the aquatic environment was significantly altered by natural influences or by development at some time in the future.

b. Levees Alternative Plan. Water turbidity that would occur during temporary suspension and disruption of silt, sediment, and/or detritus (caused by disruption of terrestrial bank soils and vegetation), may stress or destroy (by smothering) some benthic invertebrates. Once construction ceased and turbidity dissipated when silt, sediment, and/or detritus resettled, benthic organisms that survived in the construction area, as well as those that drifted downstream into the waters of the project zone from upstream, would soon recolonize such submerged material along aquatic creek bed.

4. Fisheries.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, no significant adverse alteration in fisheries and fish habitat would be anticipated in the near future along Blasdell Creek, and the Lake Erie shoreline in the general vicinity of the Woodlawn project area, unless the aquatic environment was significantly altered by natural influences or by development at some time in the future.

b. Levees Alternative Plan. Removal of about 1/3 of an acre of terrestrial vegetation adjacent to the south bank of Blasdell Creek will destroy overhanging vegetation that presently contributes some shade cover to the slow-flowing creek. This would expose a portion of this creek to more direct sunlight that could cause some increase in water temperature. Short-term water turbidity caused by siltation from surface water runoff where terrestrial bank soils are disrupted, may temporarily cause some stress on fish inhabiting the creek by aggravating their gill systems. Some small forage fish may be destroyed, whereas large fish would probably tend to leave turbid waters in the immediate construction zone, by going to less disturbed habitat either up or downstream, until such turbidity dissipated.

5. Wildlife.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, no significant adverse man-made disruption to wildlife would be anticipated. Wildlife such as birds, small mammals, amphibians, and reptiles would continue to utilize existing terrestrial, riparian, and aquatic habitats in the general vicinity of the potential Woodlawn area project site.

b. Levees Alternative Plan. Construction of the levee would alter about 1/3 of an acre of creek riparian habitat and about 1 acre of terrestrial herbaceous vegetated-type habitat. The existing variety of natural woody and shrubby food, cover and nesting habitat in such areas would be eliminated. Since the levees would probably be seeded to a grass mixture or grass/legume mixture, followed by periodic mowing to discourage woody plant and herbaceous weed growth, the levees would likely provide poor wildlife cover or nesting habitat. However, the mowing would probably tend to discourage use of these seeded areas as harborage by nuisance rodents such as rats or mice. No endangered species or habitat would be expected to be affected.

6. Vegetation.

a. No-Action (Without Conditions). Since no Federal action would occur with this alternative, vegetation conditions in the vicinity of the proposed project site would probably continue to remain unchanged in the near future, unless it was significantly altered by natural influences or by development.

b. Levees Alternative Plan. The adverse impact would primarily be on terrestrial vegetation - most of which would be in the vicinity of the potential levee construction along Blasdell Creek. The species of vegetation that would be adversely impacted in the potential project locale was previously addressed in EXISTING AND ANTICIPATED FUTURE CONDITIONS section of this report. Construction of an earth levee along the south bank of Blasdell Creek would destroy a number of large hardwood trees and shrubs, as well as other plants (including some wetland type plants) identified as inhabiting this area. In general, a variety of naturally established vegetation would be destroyed by construction of the levees. Although disturbed soils at these sites would be replanted, the grass or grass/legume mixture coupled with periodic mowing would provide a more man-made appearance and decrease the variety of vegetation.

7. Wetlands.

a. No-Action (Without Conditions). There are no New York State designated wetlands, or significant wetlands smaller in size than 12.4 acres at any of the immediate potential levee or dike construction sites, nor are there any such wetlands downstream to the Lake Erie shoreline in the general vicinity of Woodlawn. Any State regulated wetlands some distance upstream of Woodlawn along Blasdell Creek would probably continue to exist unless they were significantly altered by natural influences or by development in the future.

b. Levees Alternative Plan. No significant adverse impact on wetlands would be anticipated. Some scattered aquatic plant species growing on damp soils along the creek banks would be destroyed (i.e., iris, jewelweed, cattail, etc.) primarily at the site of the Blasdell Creek levee.

8. Borrow and Disposal Areas. Generally due to construction contract language requirements and potential savings to the government, project contractors are allowed to supply alternate borrow and/or disposal sites for Corps related projects. Contractors, however, are required to obtain the necessary Federal, State, and local review and permits before utilization. Initial area environmental assessment is therefore, in part, by permit review. The contractor and/or agent and project inspectors are also advised to notify appropriate personnel of any items of potential environmental and/or cultural resources significance, if uncovered.

Initially, project excavated material would likely be stockpiled on vacant land within the project vicinity and reutilized where possible. The borrow material for the levee proposal would likely be from a local source, generally: a material supplier, an ongoing construction project with excess excavated material, or a negotiated borrow area from a land owner. The earthen borrow site is normally a vacant upland area.

A relatively small amount of borrow material would be needed for project construction (4,680 cy of earthen material). Material would need to be of specification quality.

Generally, minor to moderate short term adverse impacts associated with utilization of the site would pertain to: noise and air quality due to operation of heavy equipment; and soils, vegetation, wildlife, and aesthetics due to material extraction. However, with proper clearing, excavation, environmental protection and restoration measures, and short and/or long-term adverse impacts should be minimized.

Generally, materials to be disposed of are processed (separated, stored, etc.) on vacant land within the project area then transported and appropriately disposed of in a permitted active upland disposal/landfill area or as clean upland landfill in a nearby permitted area. Anticipated impacts would be similar to those stated for the borrow area.

Table 23 - Relationship of Plans to Environmental Protection Statutes and Other Environmental Requirements this Stage

	Plan
Federal Statutes	
Archeological and Historic Preservation Act, as amended, 16 USC 469, et seq.	Full
National Historic Preservation Act, as amended 16 USC 470a, et seq.	Full
Fish and Wildlife Coordination Act, as amended USC 661, et seq.	Full
Endangered Species Act, as amended, 16 USC 1531, et seq.	Full
Clean Air Act, as amended, 42 USC 7401, et seq.	Full
Clean Water Act, as amended (Federal Water Pollution Control Act), 33 USC 1251, et seq.	Full
Federal Water Project Recreation Act, as amended, 16 USC 460-1(12), et seq.	Full
Land and Water Conservation Fund Act, as amended, 16 USC 4601-11, et seq.	Full
National Environmental Policy Act, as amended, 42 USC 4321, et seq.	Full
Rivers and Harbors Act, 33 USC 401, et seq.	Full
Wild and Scenic Rivers Act, as amended, 16 USC 1271, et seq.	Full
Coastal Zone Management Act, as amended, 16 USC 1451, et seq.	Full
Estuary Protection Act, 16 USC 1221, et seq.	N/A
Marine Protection, Research, and Sanctuaries Act, 22 USC 1401, et seq.	N/A
Watershed Protection and Flood Prevention Act, 16 USC 1001, et seq.	Full
Farmland Protection Policy Act	Full
Executive Orders, Memoranda, Etc.	
Protection and Enhancement of the Cultural Environment (EO 11593)	Full
Flood Plain Management (EO 11988)	Full
Protection of Wetlands (EO 11990)	Full
Environmental Effects Abroad of Major Federal Actions (EO 12114)	N/A
Analysis of Impacts on Prime and Unique Farmlands (CEQ Memorandum, 30 Aug 76)	Full
New York State Freshwater Wetlands Act (Wetlands >12.4 acres)	Full
Environmental Conservation Law - Article 15 (Protection of Water)	Full
Local Land Use Plans (See Flood Plain Management, EO 11988, also)	Full

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 have been met for this stage of the study.

b. Partial Compliance. Some requirements of the statute, EO, or other policy and related regulations, which are normally met by this 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. N/A. The statute, EO, and other policy and related regulations are not applicable for this study.

Reference: ENVIRONMENTAL COORDINATION AND COMPLIANCE Section for details.

ENVIRONMENTAL COORDINATION AND COMPLIANCE

Plan Coordination. Agencies, interest groups, and publics which have been and/or are being coordinated with include:

1. Congressional

U.S. Senator Alfonse M. D'Amato
U.S. Senator Daniel P. Moynihan

U.S. Representative Jack F. Kemp
U.S. Representative Henry J. Nowak
U.S. Representative John J. LaFalce

2. Federal

Advisory Council on Historic Preservation
Department of Agriculture
* Forest Service
* Soil Conservation Service

2. Federal (Cont'd)

Department of Commerce
Department of Defense
Department of Energy
Environmental Protection Agency
Federal Emergency Management Administration
Department of Health and Human Services
Department of Housing and Urban Development
Department of the Interior
* Fish and Wildlife Service
Department of Transportation

3. State

Office of the Governor
New York State Clearinghouse
New York State Department of Agriculture and Markets
New York State Department of Commerce
New York State Department of Environmental Conservation
New York State Department of Health
New York State Department of Transportation
New York State Department of Parks, Recreation, and Historic Preservation

4. State, Regional, and Local

Erie and Niagara Counties Regional Planning Board
Erie County
Town of Hamburg
Community of Woodlawn
Western New York Economic Development Corporation

5. Other Organizations and Individuals

League of Woman Voters (NYS)
National Audubon Society
Trout Unlimited
Sierra Club
Gateway Trade Center, Inc.

Individuals are not listed. A complete mailing list is on file at the U.S. Army Corps of Engineers, Buffalo District Office.

Coordination and Compliance. As summarized in Table 23, compliance with Federal and State environmental statutes is as follows:

1. Preservation of Historical Archeological Data Act of 1974, 16 USC et seq.; National Historic Preservation Act of 1966, as amended, 16 USC 470 et seq.; Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971. Project coordination was initiated with the U.S. Department of the Interior, and the New York State Office of Parks, Recreation, and Historic Preservation via letter in August 1987. The New York State Office of Parks, Recreation, and Historic Preservation indicated in their August 1987 letter response that based upon the SHPO's archaeological sensitivity model, the project lies in an area that is archaeologically sensitive. Unless substantial ground disturbance can be documented, an archaeological survey should be undertaken to determine the nature and extent of archaeological resources in the project area. Additionally, any buildings or structures proximal to or within the project area should be documented and evaluated for potential importance. Of note, lake water areas which have not been dredged, offer the potential for containing submerged cultural resources and may warrant additional evaluation, if these areas would be impacted.

2. Clean Air Act, as amended, 42 USC 7401 et seq. As indicated in this Environmental Assessment, no significant adverse impacts to air quality would be expected due to project implementation. This Environmental Assessment is being coordinated with the U.S. Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC) in this regard.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 USC 1251 et seq. Project coordination was initiated with the USEPA and the NYSDEC via letter in May of 1986. NYSDEC indicated that the stream sections are classified as Class B for Rush Creek and Unclassified for Blasdell Creek. If the proposed project is authorized to proceed to the Feasibility phase of the planning process, and fill material is proposed for placement below the ordinary high water line of the creek channel, and/or wetlands are affected, a Section 404(b)(1) Public Notice and Evaluation Report would be prepared and coordinated with concerned Federal and State agencies and the public. Also, a Section 401 Water Quality Certification or waiver thereof would also be requested from NYSDEC. Erosion and sediment control measures would be incorporated into project plans and specifications.

4. Coastal Zone Management Act, as amended, 16 USC 1451 et seq. Project coordination was initiated with the New York State Department of State - Coastal Zone Management office in this regard via letter in June 1986. With respect to the scale of the potential project, it is not anticipated that the project would conflict with coastal zone policies. A coastal zone policy consistency evaluation report would need to be coordinated during the next study phase, if a potential project is evident.

5. Endangered Species Act, as amended, 16 USC 1531 et seq. Project coordination was initiated with the U.S. Fish and Wildlife Service (USF&WS) and the NYSDEC in this regard via letter in May of 1986. The USF&WS indicated in their 2 July letter response that, except for occasional transient individuals, no Federally listed or proposed endangered or threatened species under their jurisdiction are known to exist in the project impact area. The NYSDEC - Wildlife Resource Center indicated in their 29 April 1985 letter response that they would not anticipate a conflict with protected species in New York State.

6. Estuary Protection Act, 16 USC et seq. Not applicable in this case.

7. Federal Water Project Recreation Act, as amended, 16 USC 460-1(12) et seq. Project coordination was initiated with the U.S. Department of the Interior (USDI); the USF&WS; NYSDEC; and the New York State Office of Parks, Recreation, and Historic Preservation via letters in April and May 1985. This would be coordinated in further detail during the next phase of study.

8. Fish and Wildlife Coordination Act, 16 USC 661 et seq. Project coordination was initiated with the USDI, USF&WS, and NYSDEC via letters in May of 1986. These agencies provided preliminary information pertaining to fish and wildlife resources and threatened or endangered species and/or habitat in the project vicinity. In general summary, the agencies indicated the following:

Lake Erie supports populations of introduced anadromous chinook and coho salmon as well as steelhead trout. The proposed project areas may also support various species of migratory waterfowl on a seasonal basis. Migratory species are Federally protected under the appropriate statutes.

The aquatic areas within the proposed project sites are inhabited by a variety of fish species found in Lake Erie. Distribution and abundance of fish species in these areas probably varies to some degree seasonally.

Gamefish species likely to use these areas seasonally include: smallmouth bass, walleye, brown trout, rainbow trout, and coho salmon. Bass and walleye probably use these nearshore areas for spawning. The areas probably serve as nursery habitat for bass and walleye. A nearshore spring/early summer nighttime trolling fishery suggests that the aquatic areas provide forage habitat for walleye.

Panfish species found in the aquatic zones in the vicinity of the potential project site include rock bass and yellow perch. Rock bass probably use these areas for spawning and nursery habitat. Other fish species found in nearshore waters of Lake Erie include sheephead, white suckers, channel catfish, white perch, gizzard shad, smelt, and a variety of species of minnows, shiners, and

darters. Lake sturgeon, which are considered a threatened species in New York, may occasionally utilize nearshore habitats such as those found in the study locale.

To minimize potential adverse impacts on nearshore aquatic habitat, it is suggested that proposals for the emergency flood protection project consider limiting fill to those areas landward of the mean high water elevation (572.8 IGLD).

9. Land and Water Conservation Fund Act (1 USC 4601 et seq.). Project coordination was initiated with the U.S. Department of the Interior (USDOI) via letter in May of 1986. Further coordination will be conducted in the next phase of study. Pertinent planning and environmental documentation will be coordinated with the USDOI for review of conformance with their comprehensive outdoor recreation plan.

10. Marine Protection Research and Sanctuaries Act of 1972, as amended, 16 USC 1401 et seq. Not applicable in this case.

11. National Environmental Policy Act, 42 USC 470a, et seq. Alternative plans are developed and evaluated in accordance with environmental considerations as set forth by this Act, as promulgated by the Water Resources Council and the Department of the Army's: Principles and Guidelines; ER 200-2-2 Environmental Quality - Policies and Procedures for Implementing NEPA; and COE Section 122 Guidelines. Requirements of the Act are accomplished via the Corps' planning process.

12. River and Harbor Act, 33 USC 401 et seq.. Requirements of this Act are fulfilled via the Corps permit and planning authorities.

13. Watershed Protection and Flood Prevention Act, 16 USC 1001 et seq.. Requirements of the Act are fulfilled via the Corps planning process. Protection is limited primarily to existing floodprone developments without inducing significant additional development in the flood plain. The locale is recently enrolled in the regular program at the National Flood Insurance Program. Project coordination was initiated with the U.S. Department of Agriculture - Soil Conservation Service via letter in May of 1986. Erosion sediment control measures would be incorporated into project plans and specifications. Further coordination would continue in the next phase of study.

14. Wild and Scenic Rivers Act, 16 USC 1271 et seq.. In accordance with the National Wild and Scenic Rivers Act, Public Law 90-542, the final lists of rivers identified as meeting the criteria for eligibility dated January 1981 were consulted. Neither Rush nor Blasdell Creek were listed.

15. Executive Order 11988, Flood Plain Management, 24 May 1977. Project coordination was initiated with the Federal Emergency Management Agency - Regional Office via letter in May of 1986. Flood protection is limited primarily to existing floodprone developments without inducing significant additional developments in the flood plain. The locale is currently involved in the regular program of the National Flood Insurance Program.

16. Farmland Protection Policy Act (PL 97-98). Reference s. Executive Memorandum - Analysis of Impacts on Prime and Unique Farmlands. The immediate project area is developed residentially and no significant impact to farmland, other than the existing loss of some important farmland soil usage, would be expected due to project implementation. This would be coordinated in further detail with the U.S. Department of Agriculture - Soil Conservation Service, if the study is authorized and funded for the feasibility phase of the planning process.

17. Executive Order 11990, Protection of Wetlands, 24 May 1977. Project coordination was initiated with the USF&WS, the USEPA, and the NYSDEC in May of 1986. Review of the Buffalo District's most recent copy of the NYSDEC wetland map, on which the potential project area is located, indicates that no wetland areas are located in the immediate proposed project area or would be affected by project implementation.

18. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979. Not applicable for this study.

19. Executive Memorandum - Analysis of Impacts on Prime and Unique Farmlands, CEQ Memorandum, 30 August 1976. Project coordination was initiated with the U.S. Department of Agriculture - Soil Conservation Service in May of 1986. The project area is residentially developed. Soils in the area of the development are mapped as Urban and Wayland silt loam. No county agricultural district would be impacted by the project.

20. State and Local. Project coordination was initiated with State and local agencies. The project would need to be consistent with State and local environmental legislation and local land use plans.

Other Views and Comments. The NYSDEC is the designated local cooperator for all flood control projects in New York State. To date, coordination indicates that the local cooperator and the local communities are supportive of the proposed project.

RATIONALE FOR SELECTING PLANS FOR FURTHER STUDY

Usually the primary consideration used in selecting those plans recommended for further study is economic efficiency. As such, only those plans that have a benefit-to-cost ratio greater than 1.0 are recommended for further study. Other factors considered include plan completeness, environmental acceptability, and local acceptance. The one plan developed besides the no-action plan, namely levees, does not meet the economic efficiency criterion (having a benefit-to-cost ratio considerably less than 1.0). The general scope and detail of this preliminary evaluation does provide a sufficient basis for plan elimination when the benefit-to-cost ratio is far less than unity. Therefore, no plan warrants further investigation.

FUTURE ACTIONS

This is a "limited" reconnaissance study addressing flood damage prevention at Woodlawn, New York, one specific flooding site within Erie County, New York. No additional flood problems along Lake Erie and the Niagara River meriting Federal interest were identified within Erie County.

The Niagara County, New York shoreline - namely about 24 mainland miles of shore along the Niagara River excluding islands that are within the authorized study area - was never examined nor budgeted for examination. Niagara County agencies and governments with shoreline concerns along the Niagara River only within that portion of Niagara County upstream of Niagara Falls, were invited to attend the 28 April 1987 joint State-Federal meeting held at Buffalo District to identify shore problems. Only one representative from within Niagara County (namely, from the city of North Tonawanda) attended that meeting and had no comments regarding flood problems. Given this lack of interest in flood damage prevention studies in the remainder of the study area, the Corps of Engineers will not pursue additional flood damage prevention studies. The Corps of Engineers will pursue additional studies only in response to new local initiatives.

No examination was conducted regarding shore protection as it relates to beach erosion control - an authorized study purpose. Also, Strawberry Island was not examined - a specific site identified in the study authorization. Without specific examination, Strawberry Island appears to be concerned with beach erosion control and shoreline protection for recreational purposes. The Corps of Engineers does not presently budget for purposes without a necessary and complementary flood control purpose.

In the event that there is a change in Federal fiscal priorities and policies on recreation projects, the study will require that the remaining items for the reconnaissance effort be completed regarding beach erosion control and shore protection for other than for flood damage prevention. Items remaining to be done include: examination of Strawberry Island and definition of problems there and elsewhere in the study area along Lake Erie and the Niagara River: identification of potential solutions; determination of the need for additional study within the Federal interest; determination of the cost of future study, if warranted; and, assessment of the level of interest and support of non-Federal interests.

SUMMARY OF STUDY MANAGEMENT, COORDINATION, VIEWS OF NON-FEDERAL SPONSOR, AND OTHERS

This study was managed and conducted in compliance with the Water Resources Councils' Principles and Guidelines for Water and Related Land Resources Implementation Studies (10 March 1983). This report summarizes the initial or reconnaissance phase of a two-phase planning process. This reconnaissance phase is not meant to be all-inclusive and was managed to focus-in on aspects of: preliminary definition of needs and opportunities; identification and appraisal of potential solutions including Federal interest, cost, benefits, and environmental impacts; and an assessment of support of non-Federal interests.

Coordination was carried out on an as-needed basis with Federal, State, and local agencies. Coordination with the New York State Department of Environmental Conservation, the potential sponsor, was on-going. The Planning Department of the Town of Hamburg served as the principal contact regarding technical information on the extent and type of flooding.

The most recent coordination meeting with the NYSDEC and the town of Hamburg was held at Hamburg Town Hall on 18 November 1987. Preliminary information was presented regarding this reconnaissance effort and the levee plan, including indication that the levee plan may be marginally feasible at best. The liklihood of a negative report or finding of no Federal interest was discussed due to the apparent lack of a feasible plan. No opposition was given to closing the study relative to Woodlawn, with a negative report including a presentation of the results in a formal document which could be used at a later date, if conditions changed.

CONCLUSIONS

Based on input from local officials, Woodlawn, New York, was the sole site in Erie County, New York, with flood damages meriting Federal investigation. The data presented in this report clearly demonstrates that Woodlawn, New York, receives minimal damages on an annualized basis from lake level induced damages. These damages are usually only experienced as the result of rare lake events, when lake water may enter Woodlawn from overtopping the south Blasdell Creek dike or from wave runup over high ground to the southwest. No economically feasible plan was found that reduces lake level induced damages.

The topography of Woodlawn and surrounding improvements make Woodlawn, New York, a man-made sink. Essentially, any inflow into Woodlawn must be pumped out. Based on data developed for this study, Woodlawn has a higher susceptibility to flooding from interior runoff due to rainfall than it does from lake level induced flood damages. The degree of protection from flooding from interior runoff due to rainfall appears minimal. Interior runoff from rainfall was not throughly investigated as there is no Federal interest; but cursory investigation indicates a potential solution may be a pipe with a flap gate leading from the existing pump station to Blasdell Creek. This would provide additional capacity to convey interior runoff due to rainfall out of the community for other than rare high lake levels.

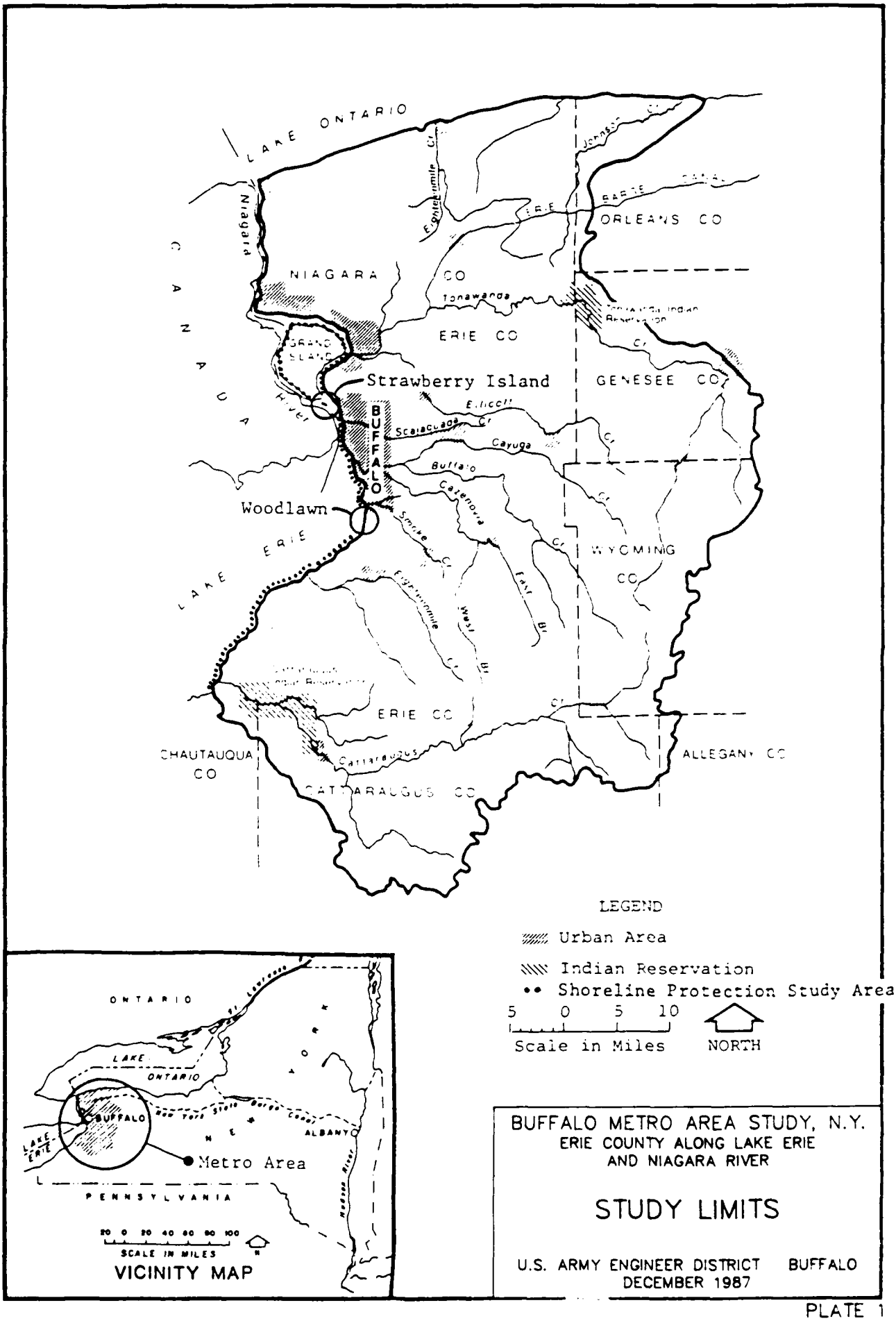
On this basis there is no Federal interest in plan implementation within Erie County along Lake Erie and the Niagara River.

RECOMMENDATIONS

On the basis that lake induced flood damage at Woodlawn, New York, is minimal and no solution economically justified, I recommend no additional Federal action regarding flood damage reduction at this time. Further, I recommend that non-Federal local interests reassess their needs for flood damage reduction due to interior rainfall.

Daniel R. Clark

DANIEL R. CLARK
Colonel, U.S. Army
Commanding

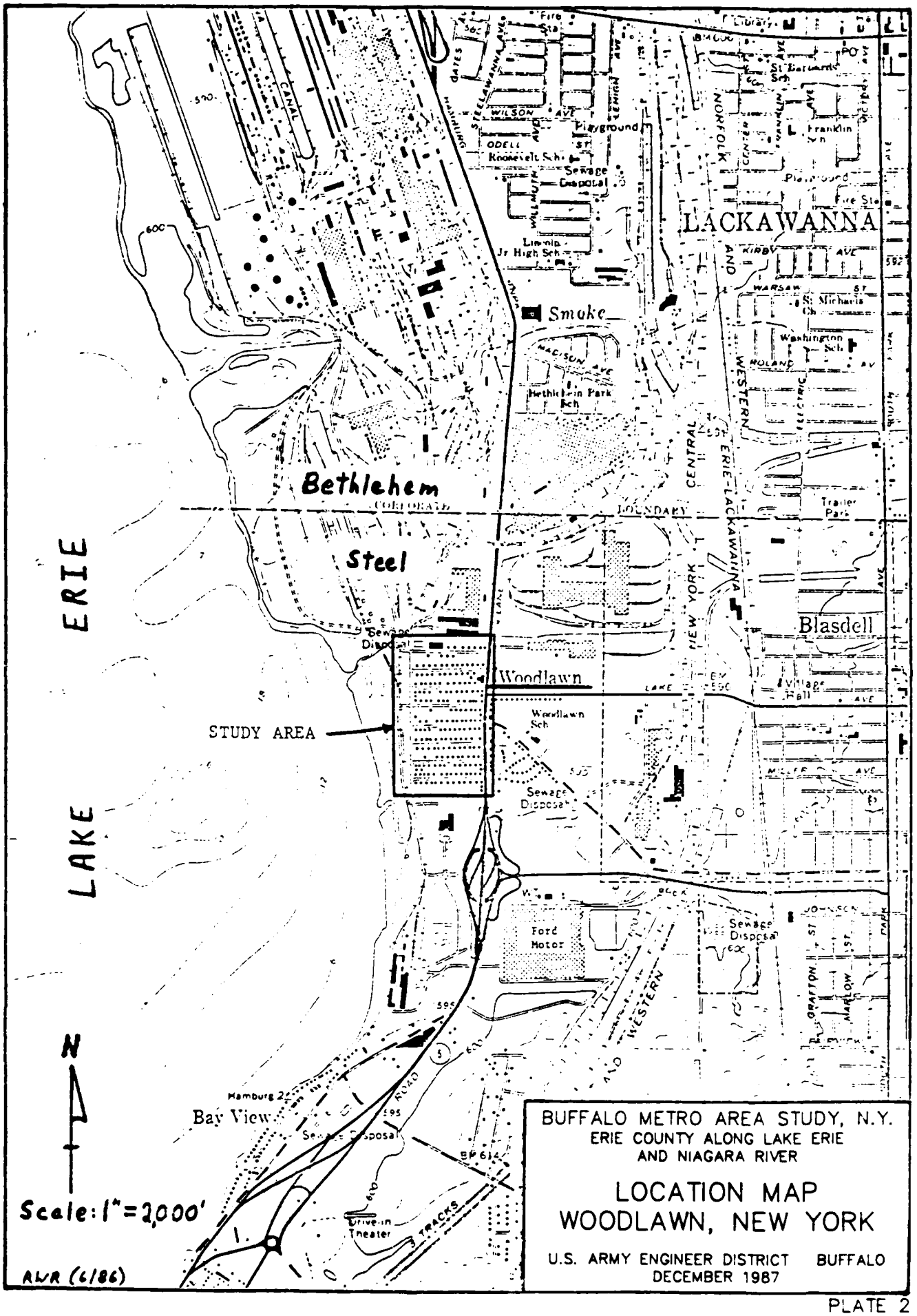


BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

STUDY LIMITS

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 1

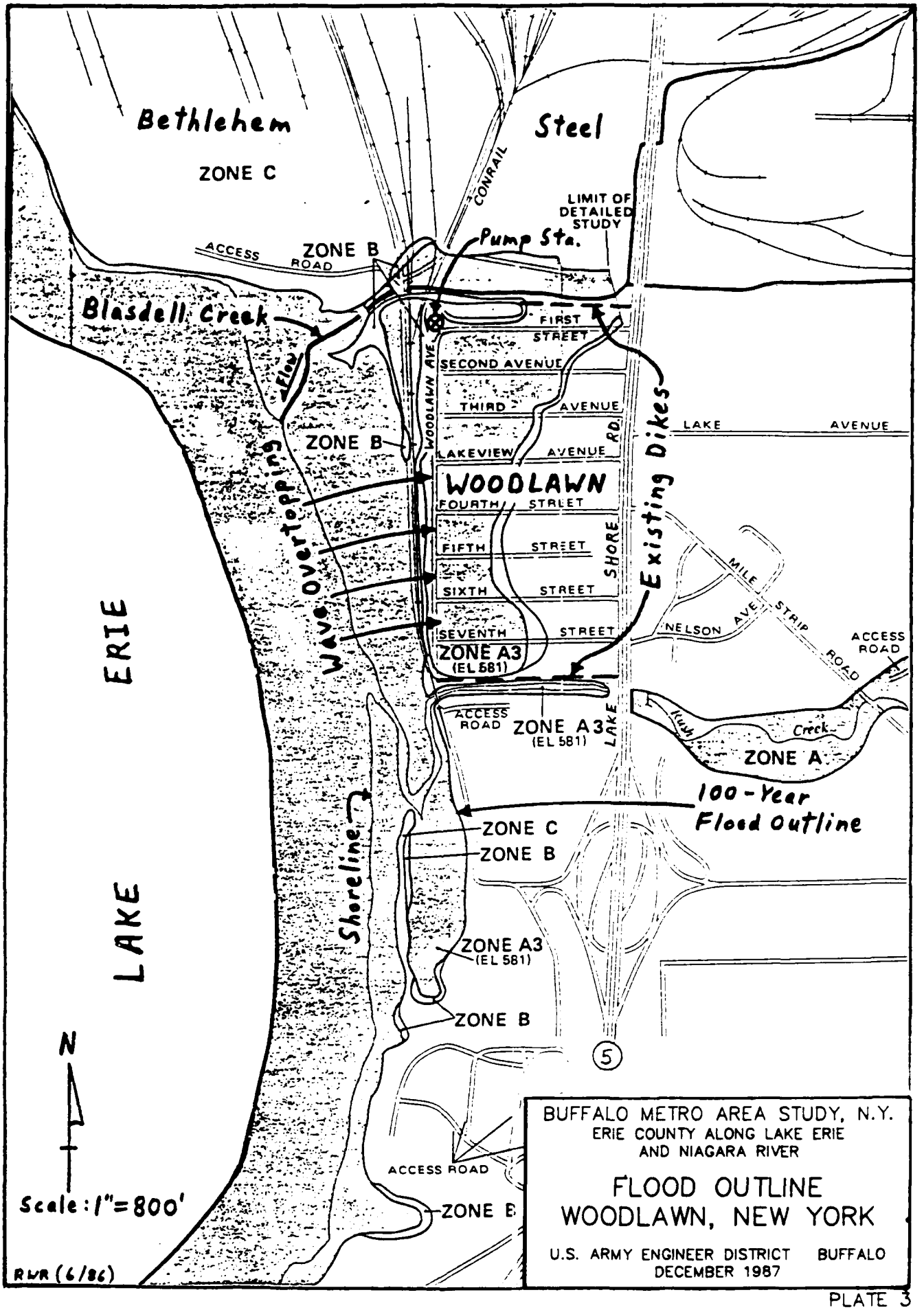


BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

LOCATION MAP
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 2

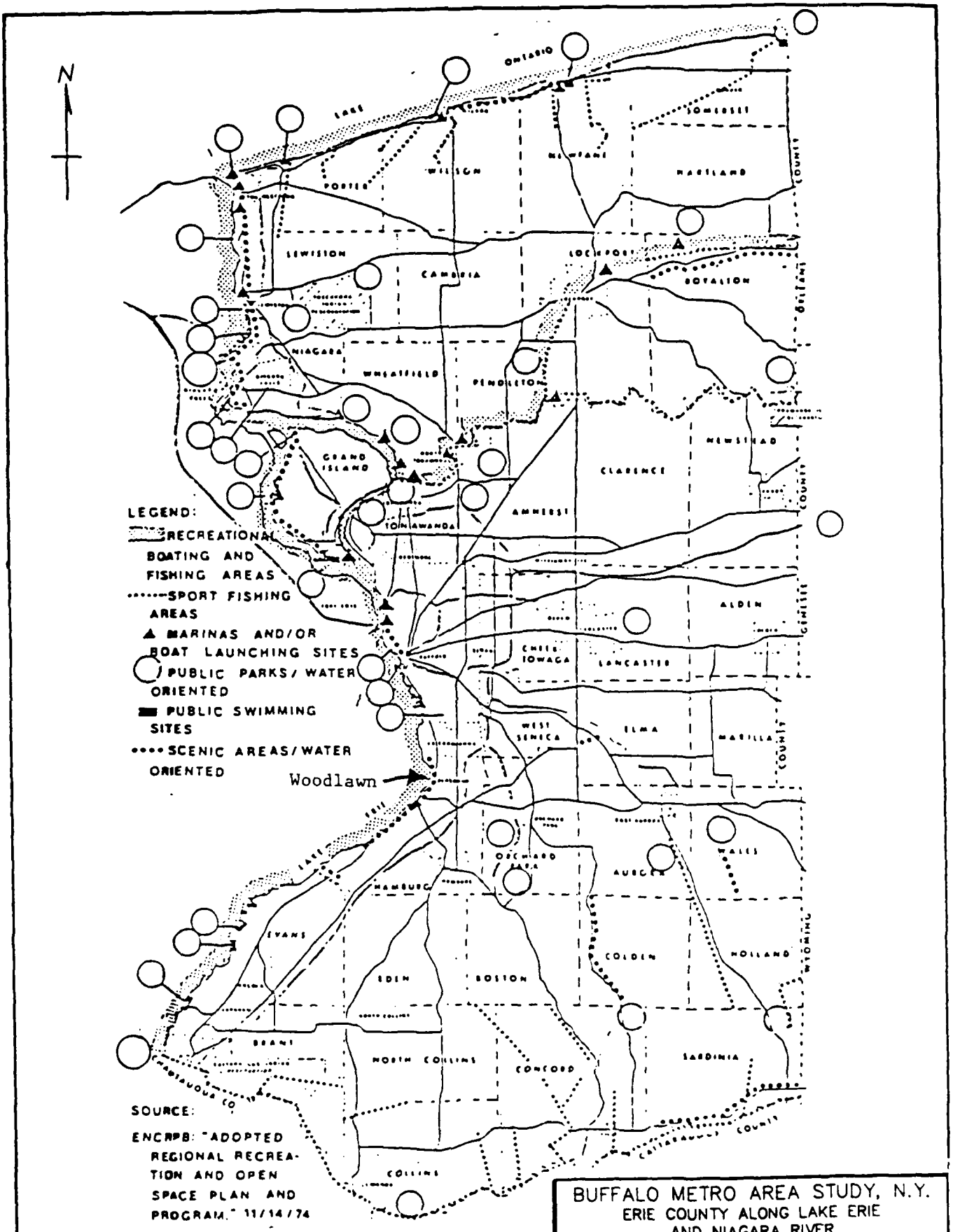


BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

FLOOD OUTLINE
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 3



BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE AND NIAGARA RIVER

MAJOR WATER ORIENTED RECREATION AREAS

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 4

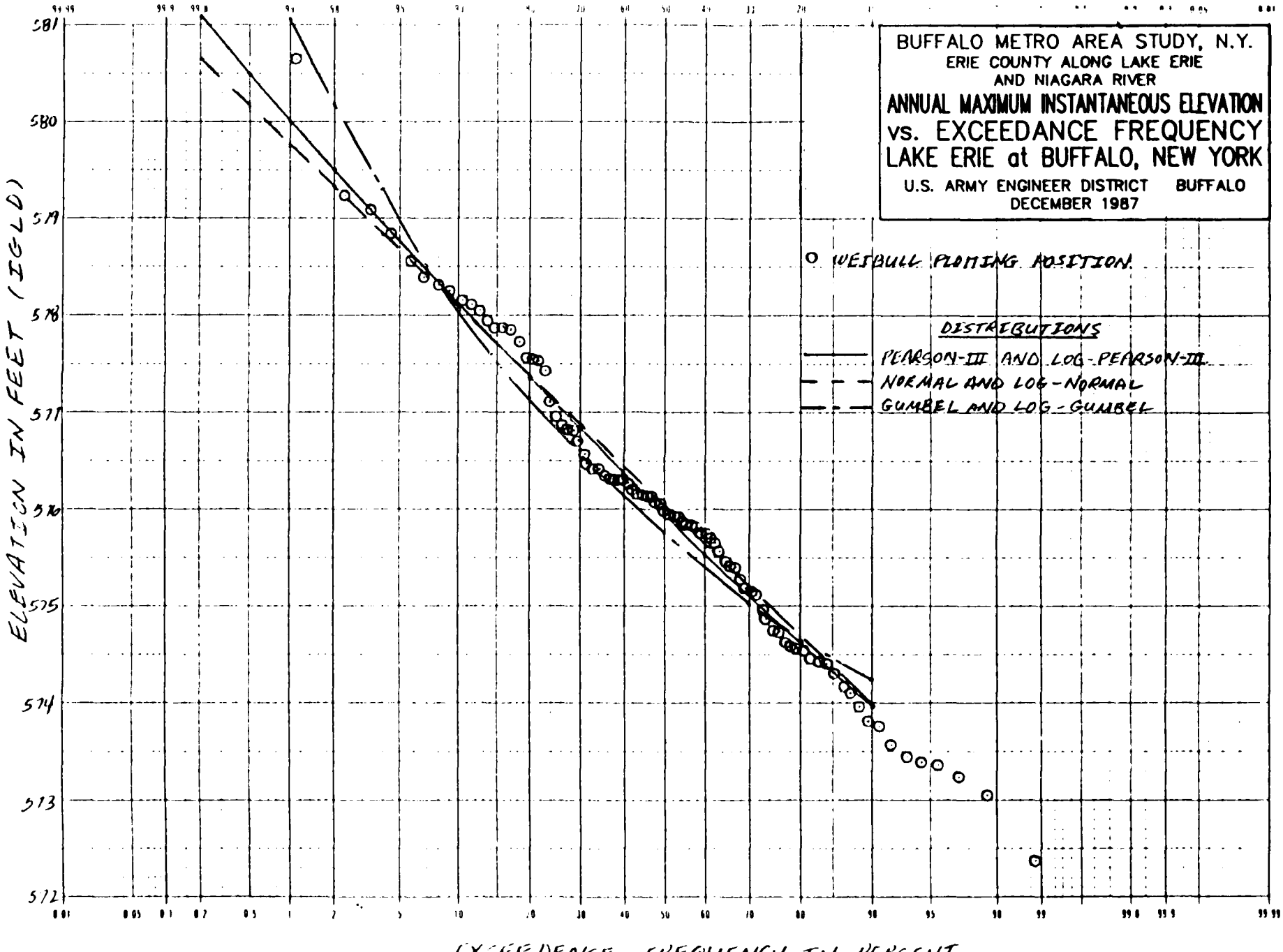
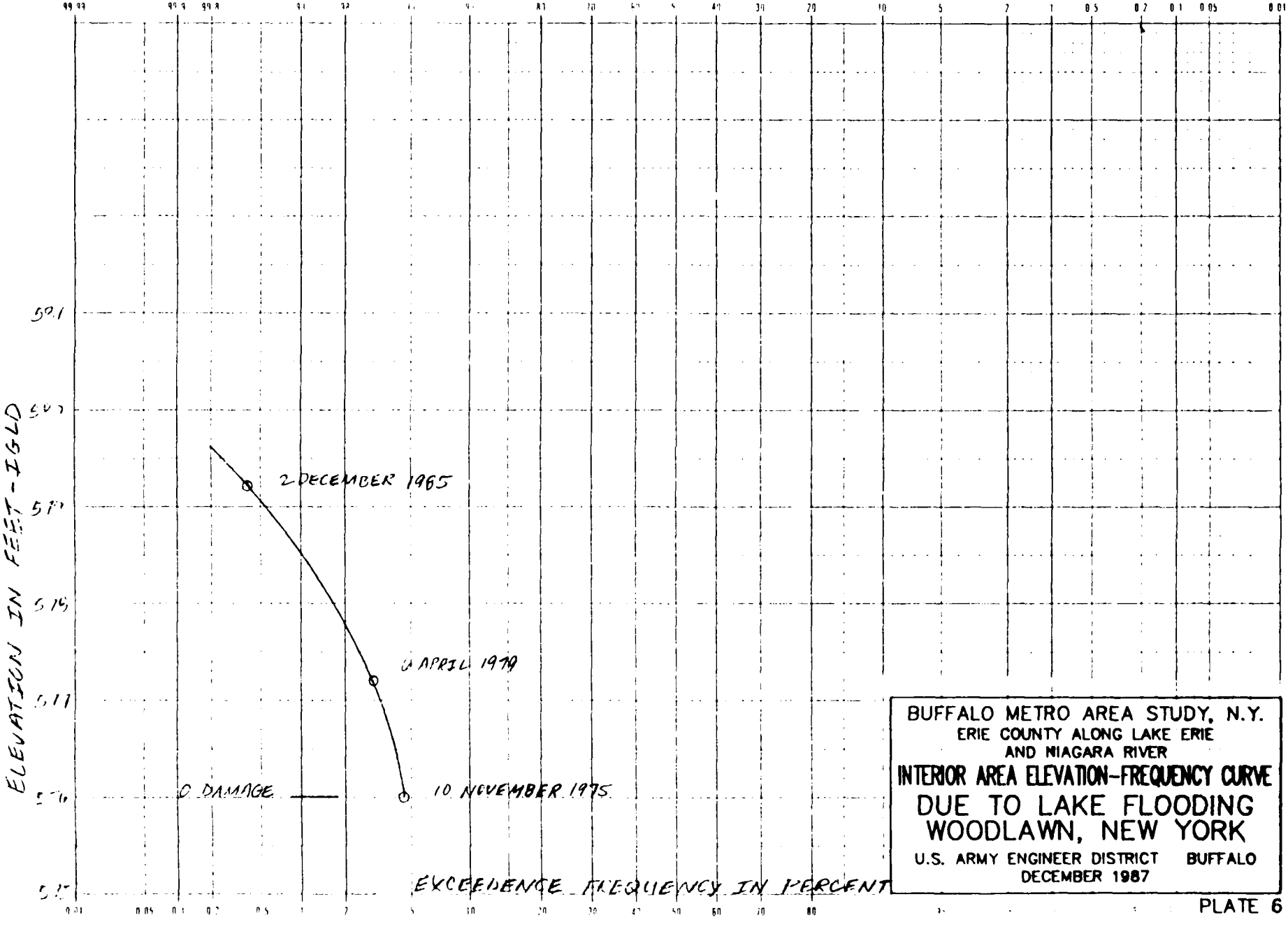

BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER
ANNUAL MAXIMUM INSTANTANEOUS ELEVATION
vs. EXCEEDANCE FREQUENCY
LAKE ERIE at BUFFALO, NEW YORK
U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987
WEIBULL PLOTTING POSITION
DISTRIBUTIONS
PEARSON-III AND LOG-PEARSON-III
NORMAL AND LOG-NORMAL
GUMBEL AND LOG-GUMBEL
ELEVATION IN FEET (IGLD)
581
580
579
578
577
576
575
574
573
572
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
EXCEEDENCE FREQUENCY IN PERCENT

PLATE 5



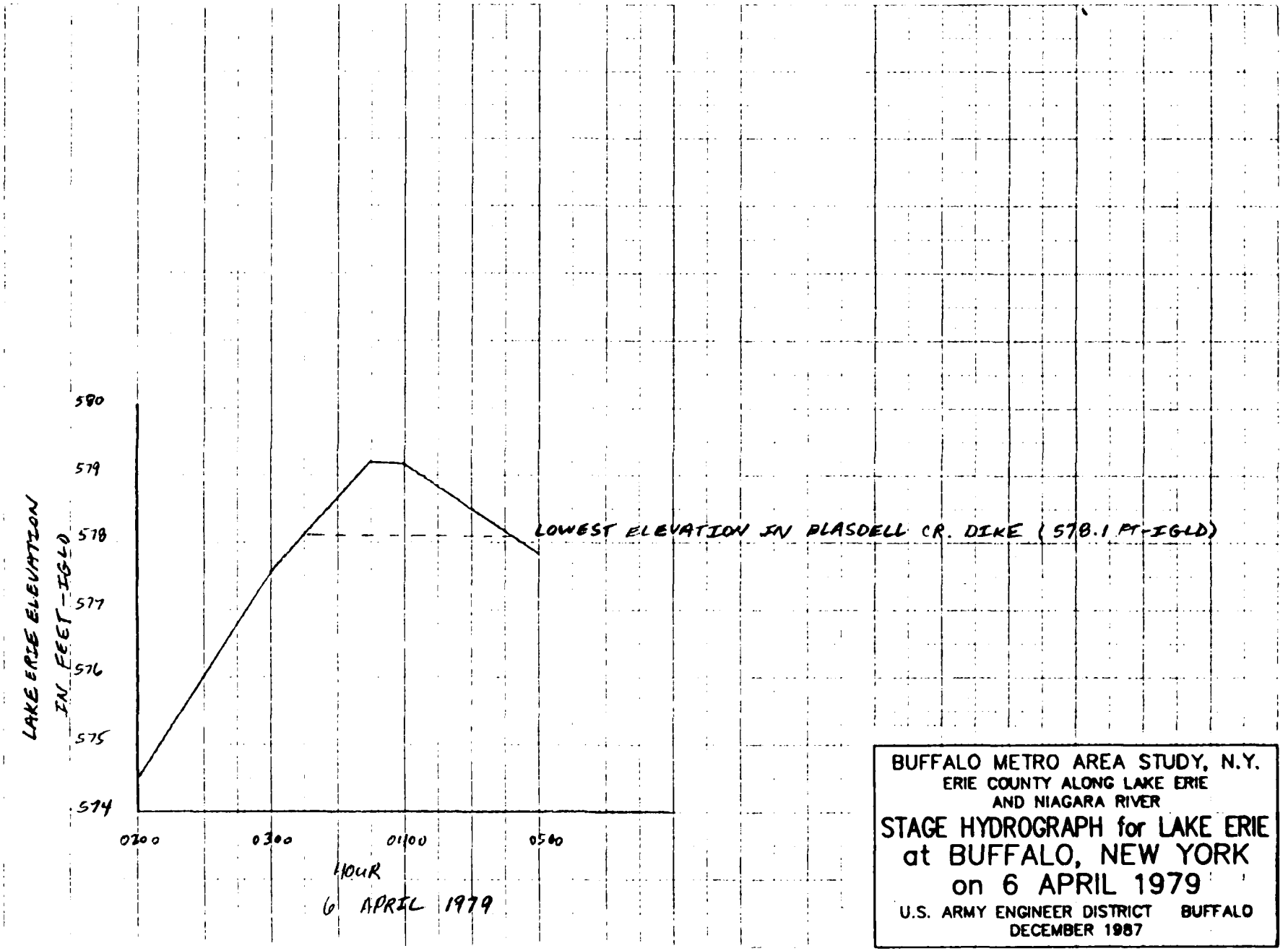
BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

INTERIOR AREA ELEVATION-FREQUENCY CURVE

DUE TO LAKE FLOODING
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 6

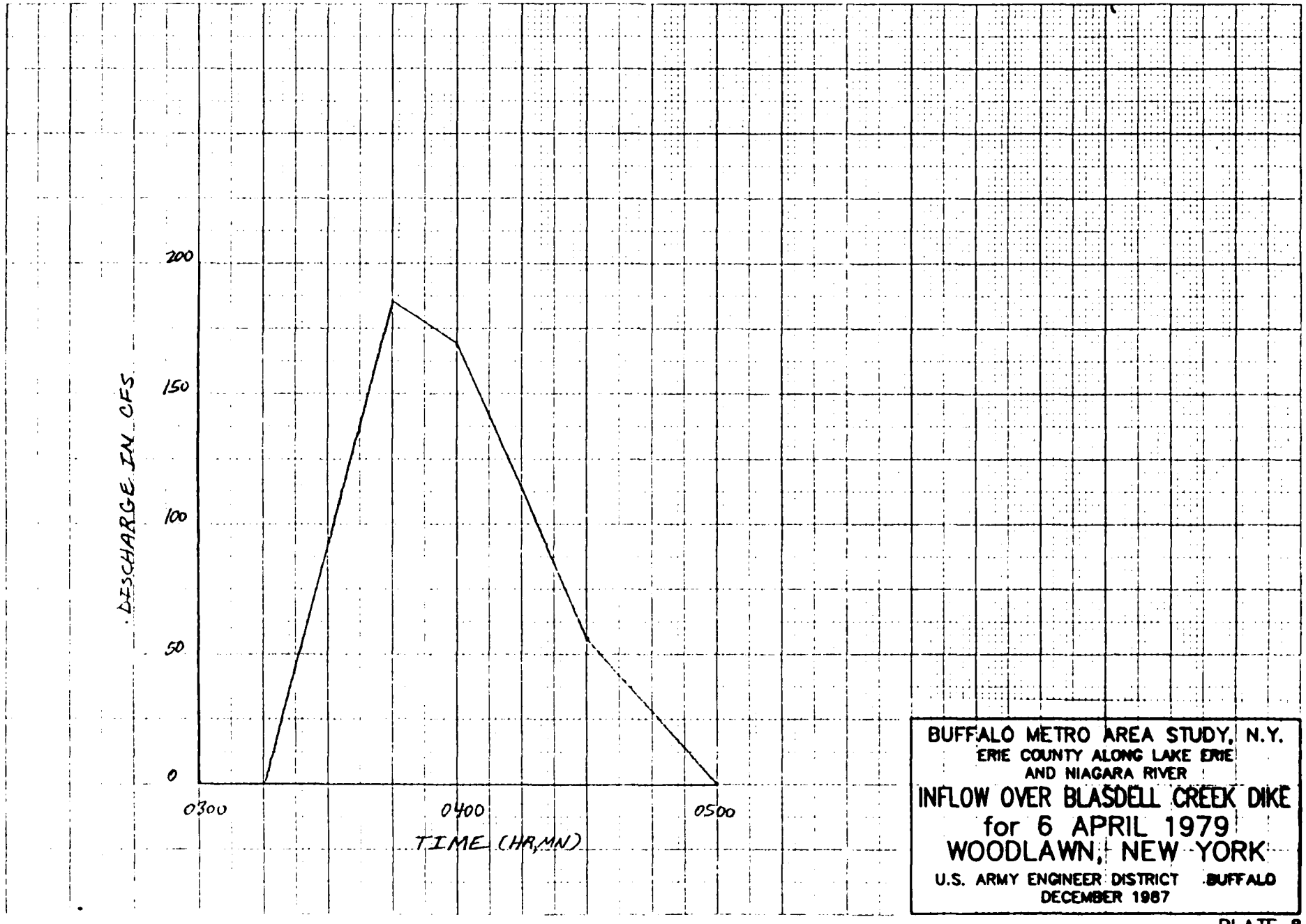


BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

STAGE HYDROGRAPH for LAKE ERIE at BUFFALO, NEW YORK on 6 APRIL 1979

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 7



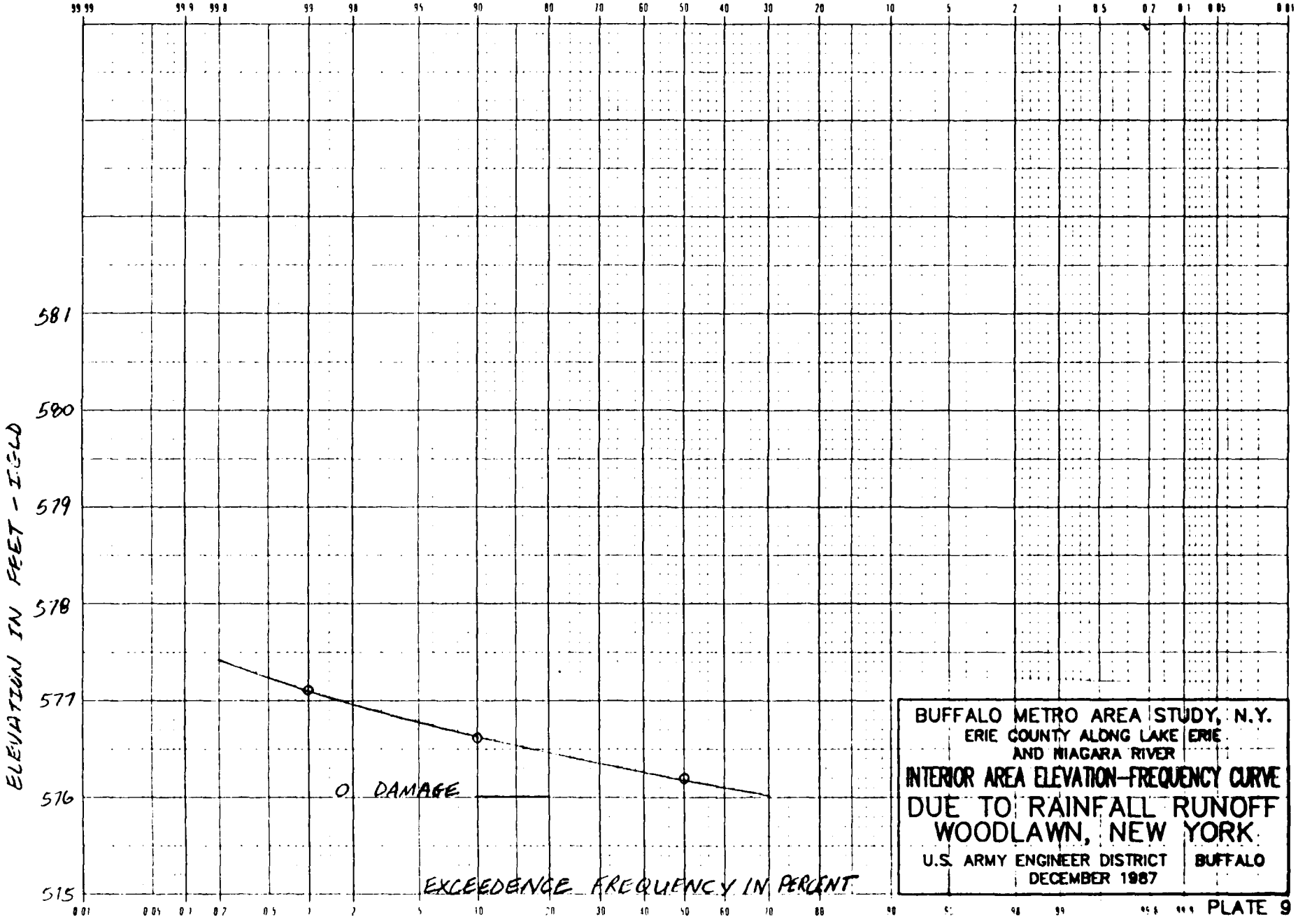
BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

INFLOW OVER BLASDELL CREEK DIKE
for 6 APRIL 1979
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

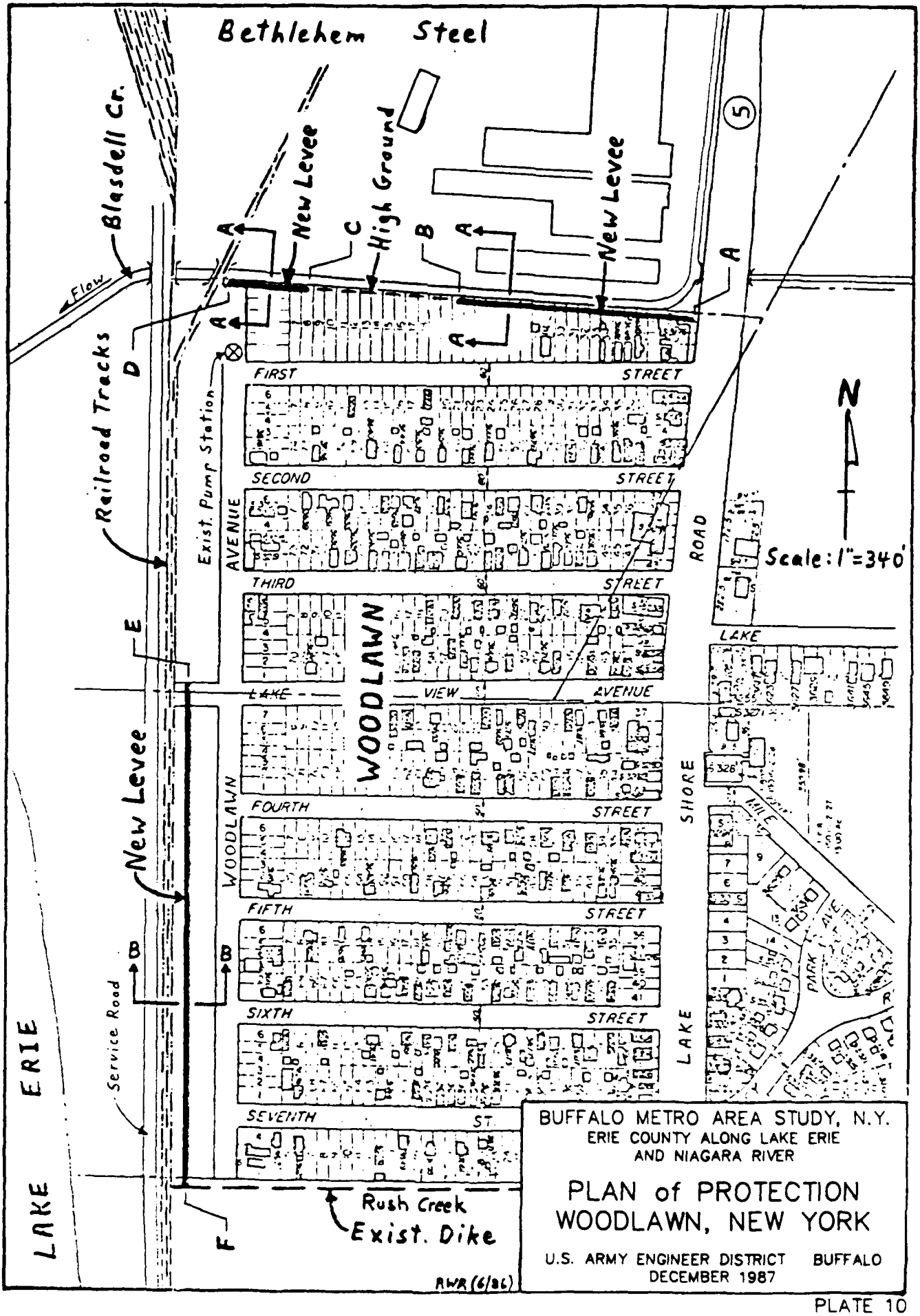
PLATE 8

PROBABILITY BY 90 DIVISIONS AP 8756-GB



BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE AND NIAGARA RIVER
INTERIOR AREA ELEVATION-FREQUENCY CURVE
DUE TO RAINFALL RUNOFF
WOODLAWN, NEW YORK
U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 9

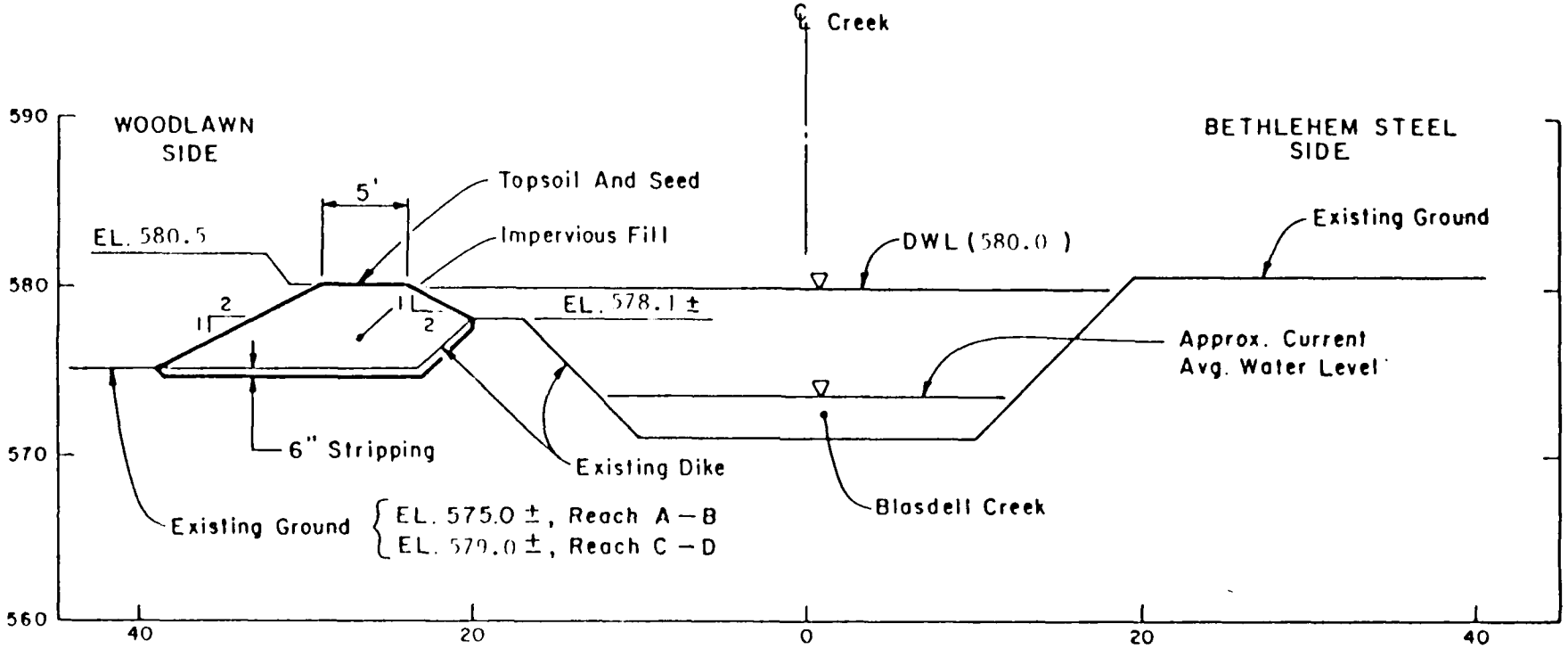


BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

PLAN of PROTECTION
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 10



REACH A-B
L = 600'

REACH C-D
L = 200'

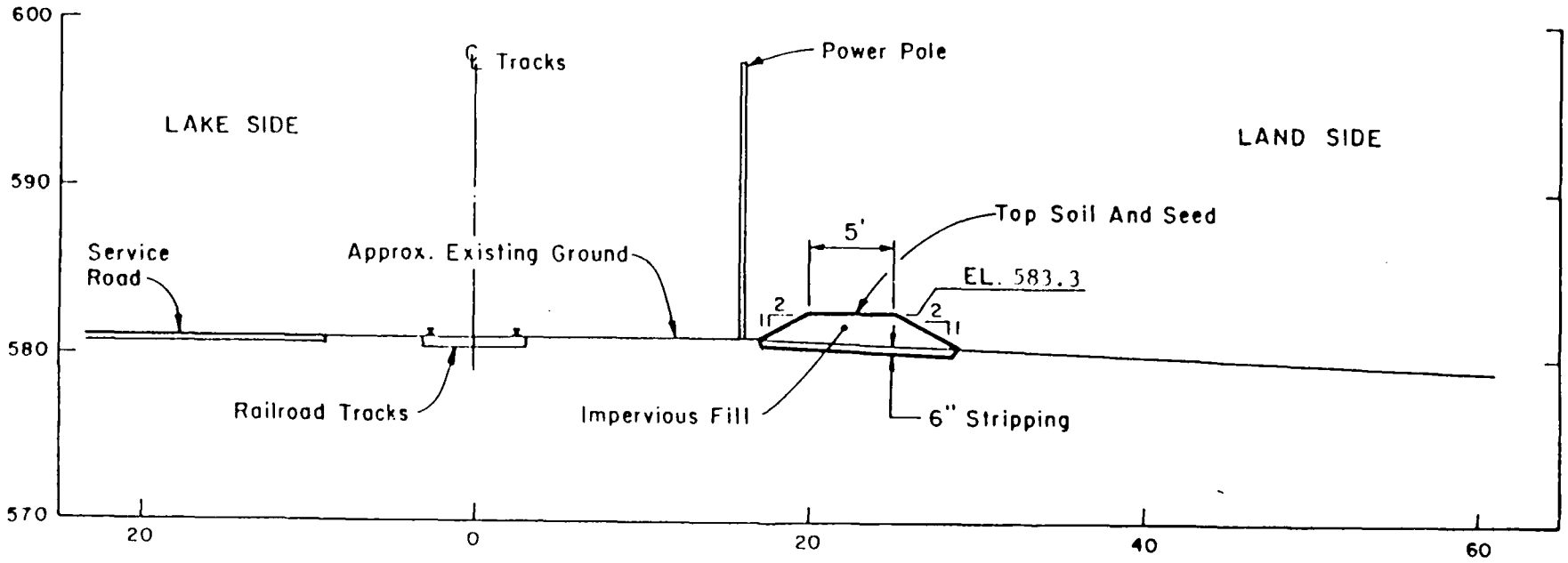
Revised REB (12/87)
RWA (6/86)

BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

TYPICAL CROSS SECTION A–A
PLAN of PROTECTION
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 11



REACH E-F

L = 1,450

Revised TEB (12/87)
RWR (6/86)

BUFFALO METRO AREA STUDY, N.Y.
ERIE COUNTY ALONG LAKE ERIE
AND NIAGARA RIVER

TYPICAL CROSS SECTION B-B
PLAN of PROTECTION
WOODLAWN, NEW YORK

U.S. ARMY ENGINEER DISTRICT BUFFALO
DECEMBER 1987

PLATE 12

END

DATE

FILMED

DTIC

JULY 88