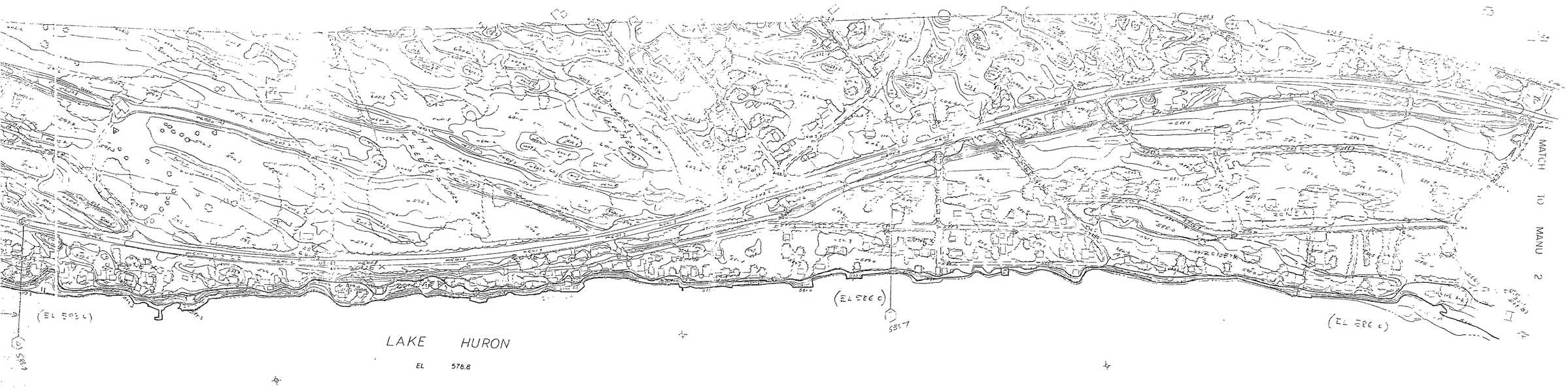
MATCH TO MANU 2
LAKE HURON
EL 576.8
(EL 576.0)
5857

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Baldwin

3) WATERCOURSE: Lake ~~Michigan~~ Huron ~~Wave run up~~

4) DOCUMENT TYPE: Wave Run-up Report ~~Report Wave~~

00BREAK00

TECHNICAL LETTER REPORT ON BALDWIN TOWNSHIP, MICHIGAN

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
November 1990

TECHNICAL LETTER REPORT ON
BALDWIN TOWNSHIP, MICHIGAN

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TECHNICAL LETTER REPORT ON
BALDWIN TOWNSHIP, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This report describes the application of the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" to flood levels on Saginaw Bay, specifically in Baldwin Township, Michigan. The flood levels applicable to Baldwin Township were developed in the September 1989 "Flood Levels Report for Saginaw Bay".

1.2 Authority and Acknowledgments

The "Great Lakes Wave Runup Methodology Study" was prepared in 1989 by the U.S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), for application to future coastal Flood Insurance Studies (FIS) and/or restudies of communities bordering the Great Lakes. The work was conducted under Inter-Agency Work Agreement, EMW-89-E-3218, Project Order No. 1, between the COE and FEMA. The 100-year and 500-year flood levels from the September 1989 report referenced above, were used to compute the maximum wave runup elevations required for updating the previous study in Baldwin Township on Lake Huron and Tawas Bay. TABLE 1 lists profile locations, and the 100-year and 500-year "base" flood levels at nine locations along the Baldwin Township shoreline. The nine profiles were plotted from data obtained from a June 1990 survey.

SHORELINE PROFILES
BALDWIN TOWNSHIP, MICHIGAN

	Profile Location	100-year Flood Level *	500-year Flood Level *
1.	Baldwin-1 (Tawas Beach Road)	584.0	585.0
2.	Baldwin-2 (Iosco Beach Club Drive)	584.0	585.0
3.	Baldwin-3 (Winona Street)	584.0	585.0
4.	Baldwin-4 (Pontiac Street)	584.0	585.0
5.	Baldwin-5 (Ottawas Lane)	584.0	585.0
6.	Baldwin-6 (Forest Street)	584.0	585.0
7.	Baldwin-7 (Media Drive)	584.0	585.0
8.	Baldwin-8 (Iris Drive)	584.0	585.0
9.	Baldwin-9 (AuSable Dunes Assoc.)	584.0	585.0

* NOTE: All elevations in FT, NGVD from the September 1989 "Flood Levels Report for Saginaw Bay"

TABLE 1

1.3 Coordination

The "Flood Levels Report For Saginaw Bay", along with examples of the application of the methodology from the 1989 "Great Lakes Wave Runup Methodology Study", were presented to FEMA on March 1, 1990. The procedures outlined in the above references were approved at this meeting for application to all Saginaw Bay FIS sites, including Baldwin Township.

2.0 AREA STUDIED

2.1 Community Description

Baldwin Township, Michigan, shown on FIGURE 1, is located in Iosco County along 13 miles of shoreline on Lake Huron and Tawas Bay. There are no major populated communities located along the Baldwin Township shoreline. The developed shoreline consists of small seasonal and year-round residential homes, having a population of 1393.

Bathymetry in Lake Huron and Tawas Bay varies from 30-50 foot depths offshore to less than five feet deep near shore. The Tawas Bay portion of the Baldwin Township shoreline is protected, to some extent, from northeasterly and easterly storms by Tawas Point.

The majority of the Baldwin Township shoreline on Lake Huron is exposed from the northeast to a fetch of about 180 miles. Ordinary fluctuations of water levels along this shoreline are of the same magnitude and frequency as apply generally to harbors on Lake Huron. The lowest seasonal lake stages usually prevail during the winter months and the highest during the summer

BALDWIN TOWNSHIP LOCATION MAP

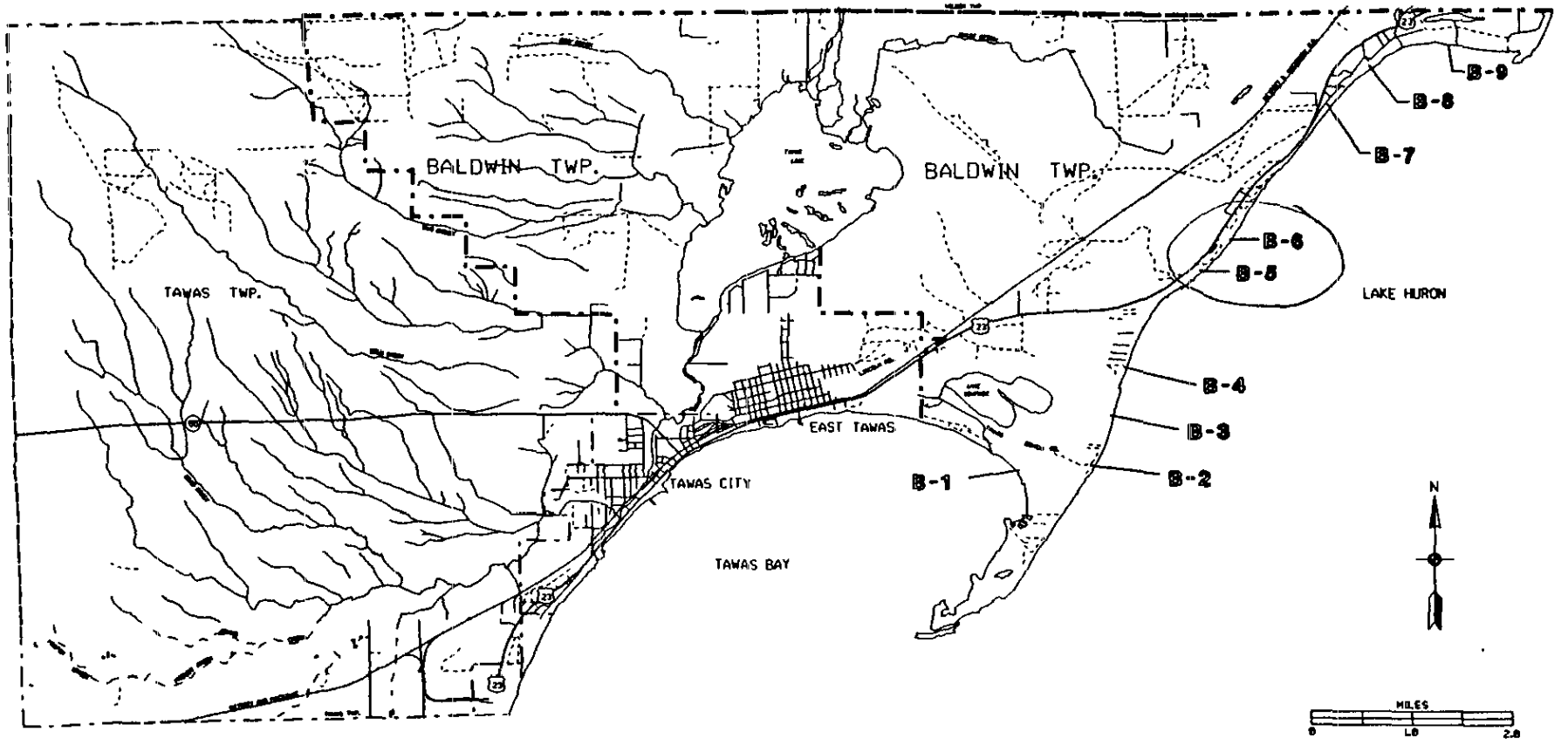


FIGURE 1

months. In the past 100 years, fluctuations of water levels on Lake Huron, as measured by monthly means, have ranged from a minimum of 575.35 feet to a maximum of 581.62 feet (IGLD, 1955).

2.2 Principal Flood Problems

Short-term Lake Huron water level fluctuations are most often due to variations in wind and barometric pressure. Occasionally, a surge of considerable proportions takes place within a few hours, due to strong and persistent northerly or southerly winds.

When lake levels are high and storms occur from the northeast to southwest, Baldwin Township shoreline communities are usually subjected to extreme conditions. Along the Baldwin Township shoreline, substantial flooding has occurred because of the flat topography along the reaches on Lake Huron and Tawas Bay.

3.0 ENGINEERING METHODS

The flood levels established in the U.S. Army Corps of Engineer's September 1989 "Flood Levels Report for Saginaw Bay" and the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" were used to analyze the flooding potential at the nine Baldwin Township FIS sites shown on FIGURE 1. The hydraulic analyses presented herein involved the determination of the wave runup components and maximum wave runup elevations for selected sites.

Input data used for flood calculations include site specific design wave, water depth at the toe of the structure, and wave

period. Additional data such as nearshore profiles, high water marks, and existing conditions, bathymetry and topography, were also analyzed to determine the maximum wave runup elevation at each site. This technical letter report presents the wave runup application procedures for each of the nine FIS sites located in Baldwin Township. Representative profiles for each site are included in APPENDIX A.

4.0 A-Zone and V-Zone Delineations

Reaches of the Baldwin Township shoreline in the surf zone which are subject to significant wave attack are referred to by FEMA as Coastal High Hazard Zones or velocity ("V") Zones. A "V" Zone is the flood insurance rate zone that corresponds to the 100-year coastal floodplain that has additional hazards associated with storm waves. The "V" Zone is defined in FEMA's "Guidelines For Great Lakes Wave Runup Computation And Mapping" as the maximum elevation reached by the wave runup associated with the 100-year flood level. This portion of the shoreline and/or structure is critical in terms of causing significant structural damage. An "A" Zone is the flood insurance rate zone that corresponds to the 100-year flood level that is determined in the FIS using the detailed method. It is further defined as that area that is inundated by the 100-year flood and shoreward of the "V" Zone.

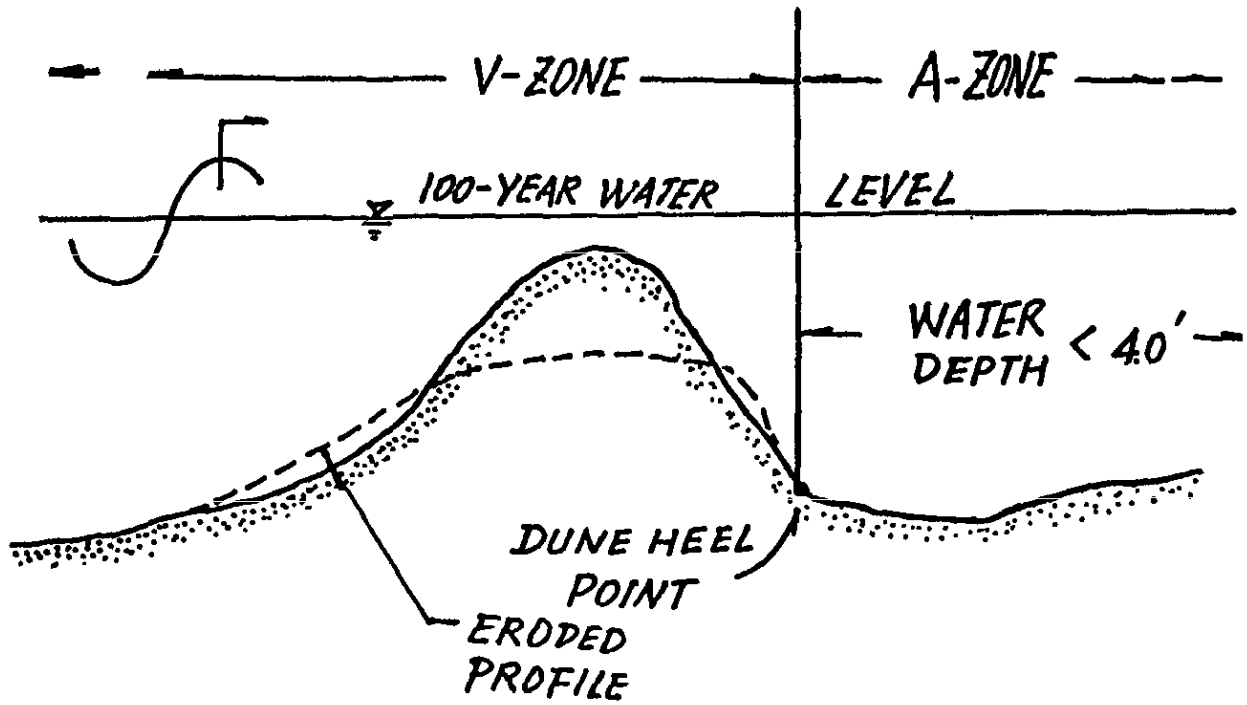
Three different A and V-Zone flood conditions as defined by FEMA, most closely represent the FIS sites in Baldwin Township. The first type of condition involves the flooding or breaching

of an existing beach/dune by the 100-year flood. In this case, the V/A-zone demarcation line is located where the largest 100-year water depth for the flooded area on the landward side of the beach/dune heel point is less than 4 feet. The V-zone is lakeward of this line, while the A-zone is landward. This mapping is considered appropriate for profile Baldwin-1, and is shown on FIGURE 2.

The second flood condition existing along the Baldwin Township shoreline involves a beach/bluff system where wave runup does not overtop the existing beach/bluff. The V/A demarcation line is fixed at the point where the 100-year storm water depth is equal to 4 feet on the lakeward side of the bluff. The A/X demarcation line is fixed at the point where the wave runup intersects the calculated post-storm profile. The V-zone is the maximum elevation reached by wave runup associated with the 100-year flood level. This type of flooding condition is representative of profiles Baldwin-2 thru Baldwin-8 and is shown on FIGURES 3-9. The higher 100-year and 500-year wave runup elevations for the Baldwin-5 and Baldwin-6 profiles shown on TABLE 2 are the result of deeper water depths at the toe of the existing structures and steeper slopes of the existing embankments.

In the last configuration, the beach/bluff is flooded. The largest water depth on the landward side of the beach/bluff crest is equal to or greater than 4 feet. The V/A demarcation line is fixed at the most landward point where the 100-year storm water

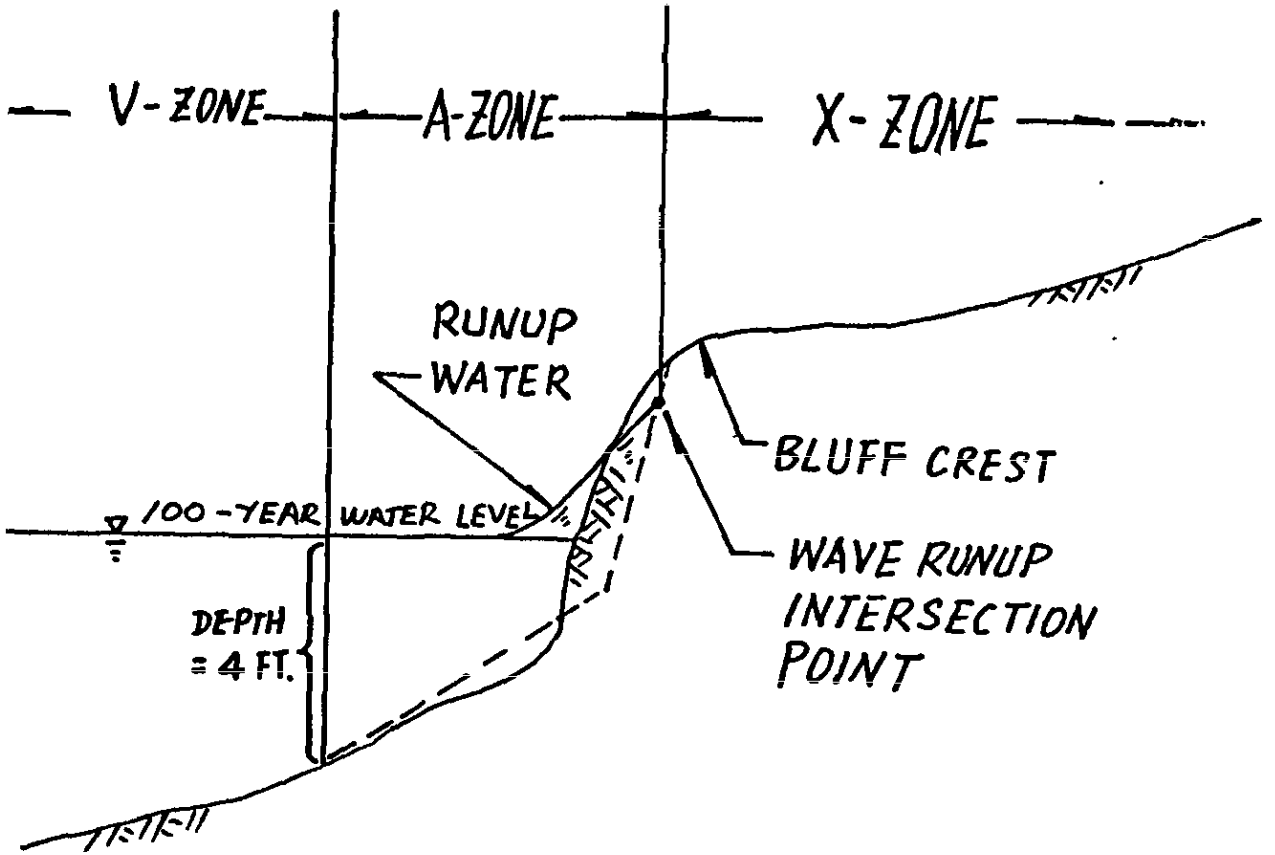
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-1

FIGURE 2

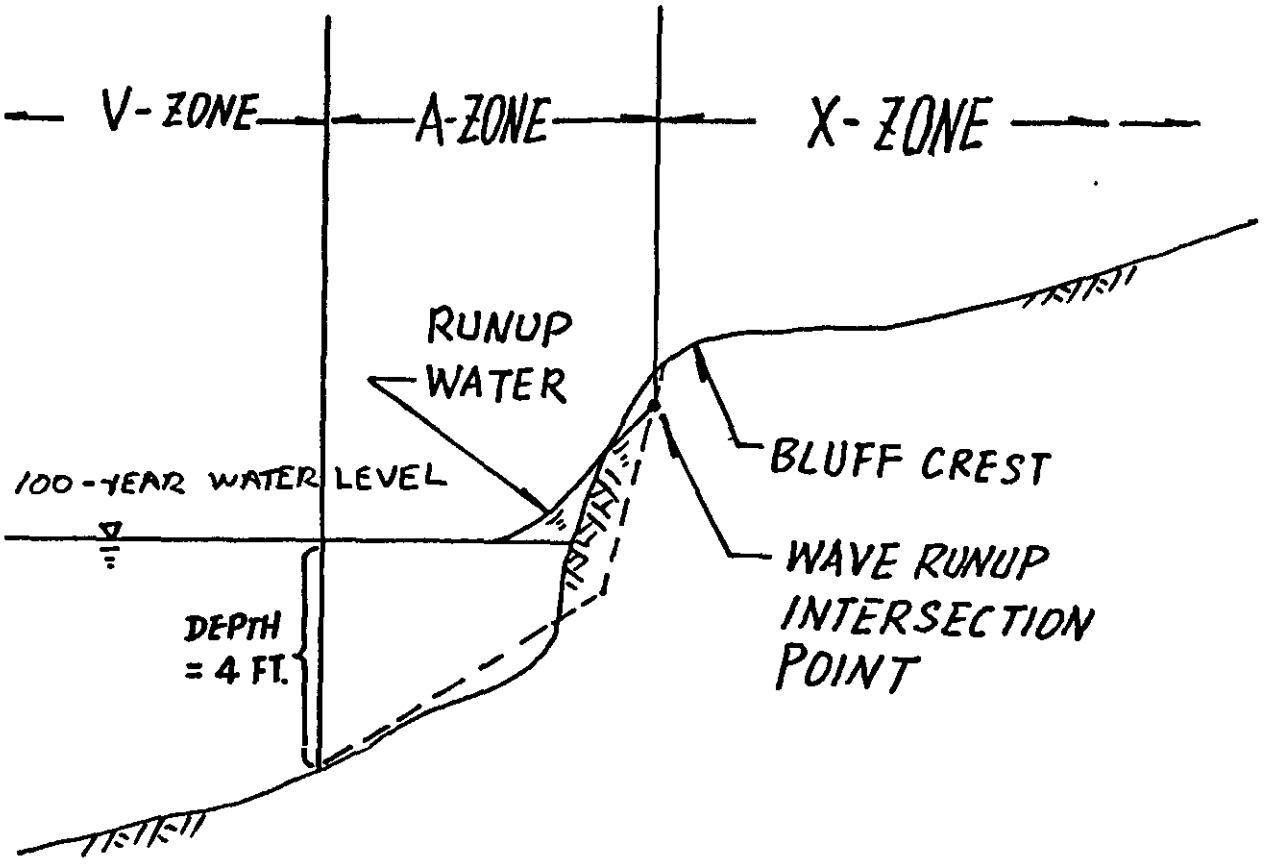
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-2

FIGURE 3

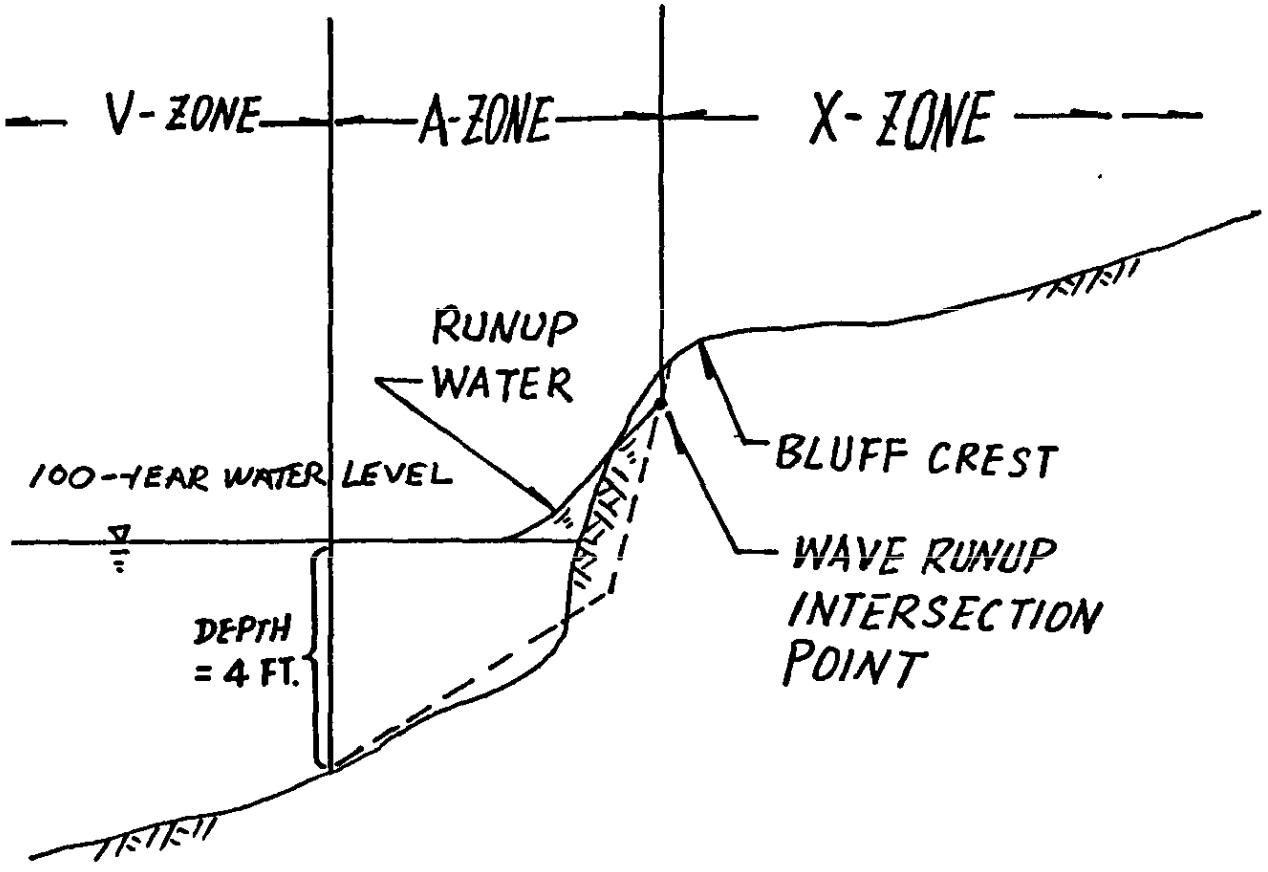
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-3

FIGURE 4

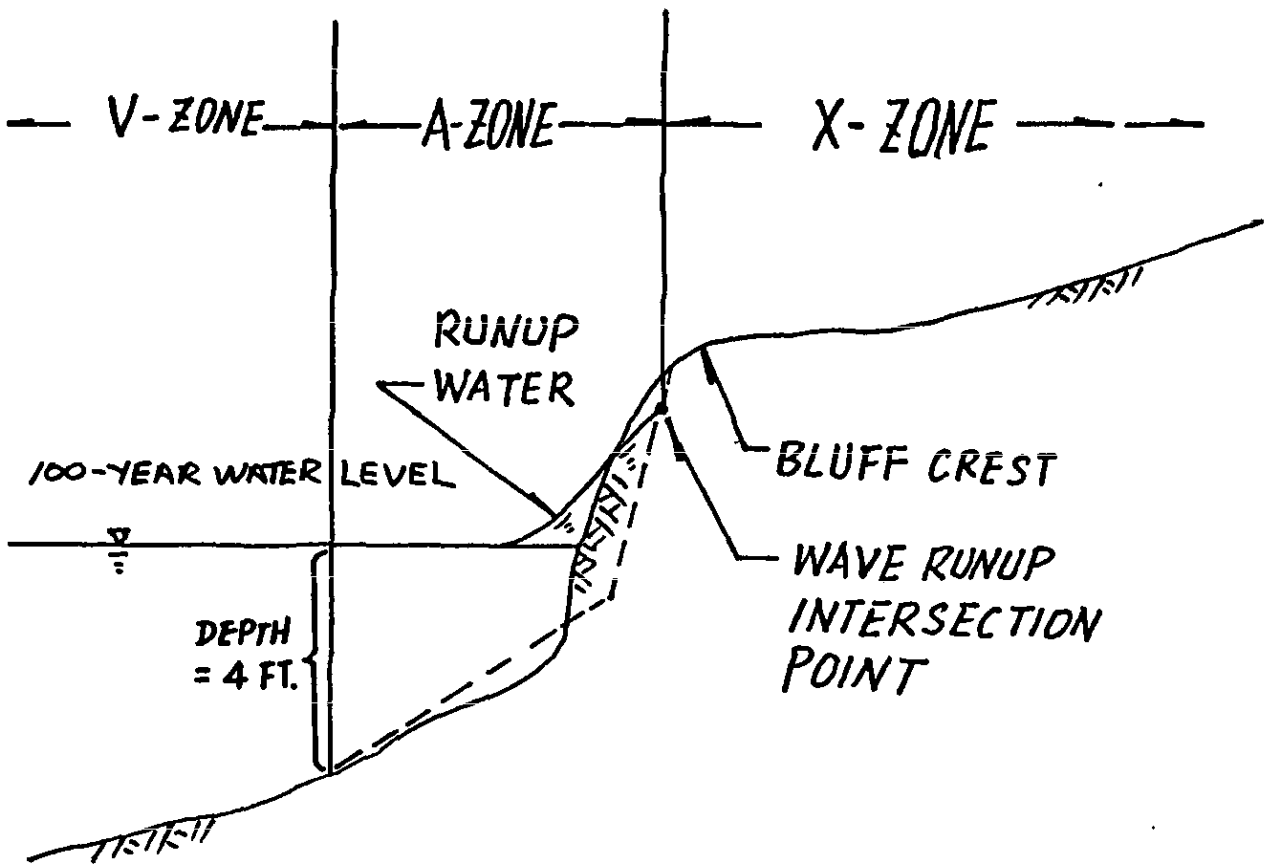
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-4

FIGURE 5

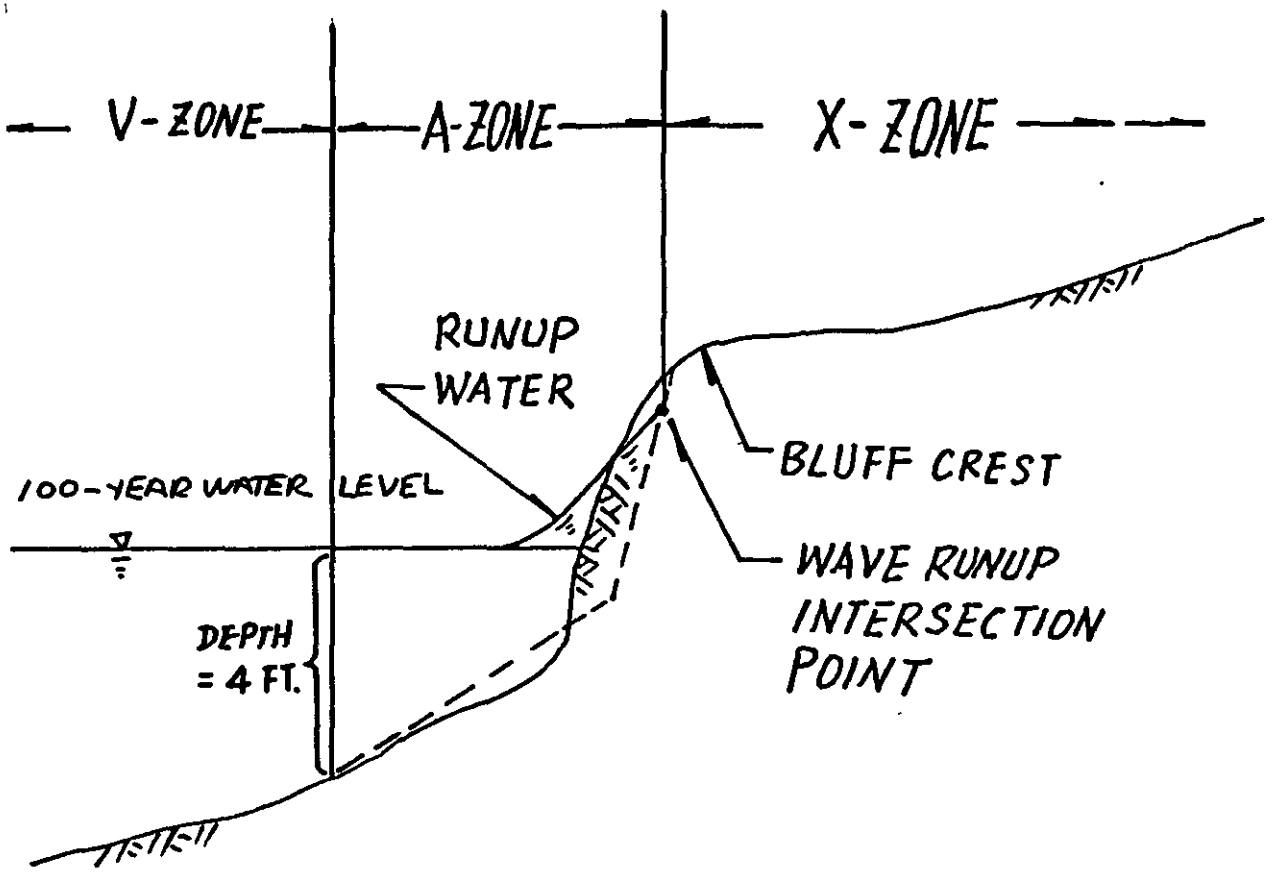
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-5

FIGURE 6

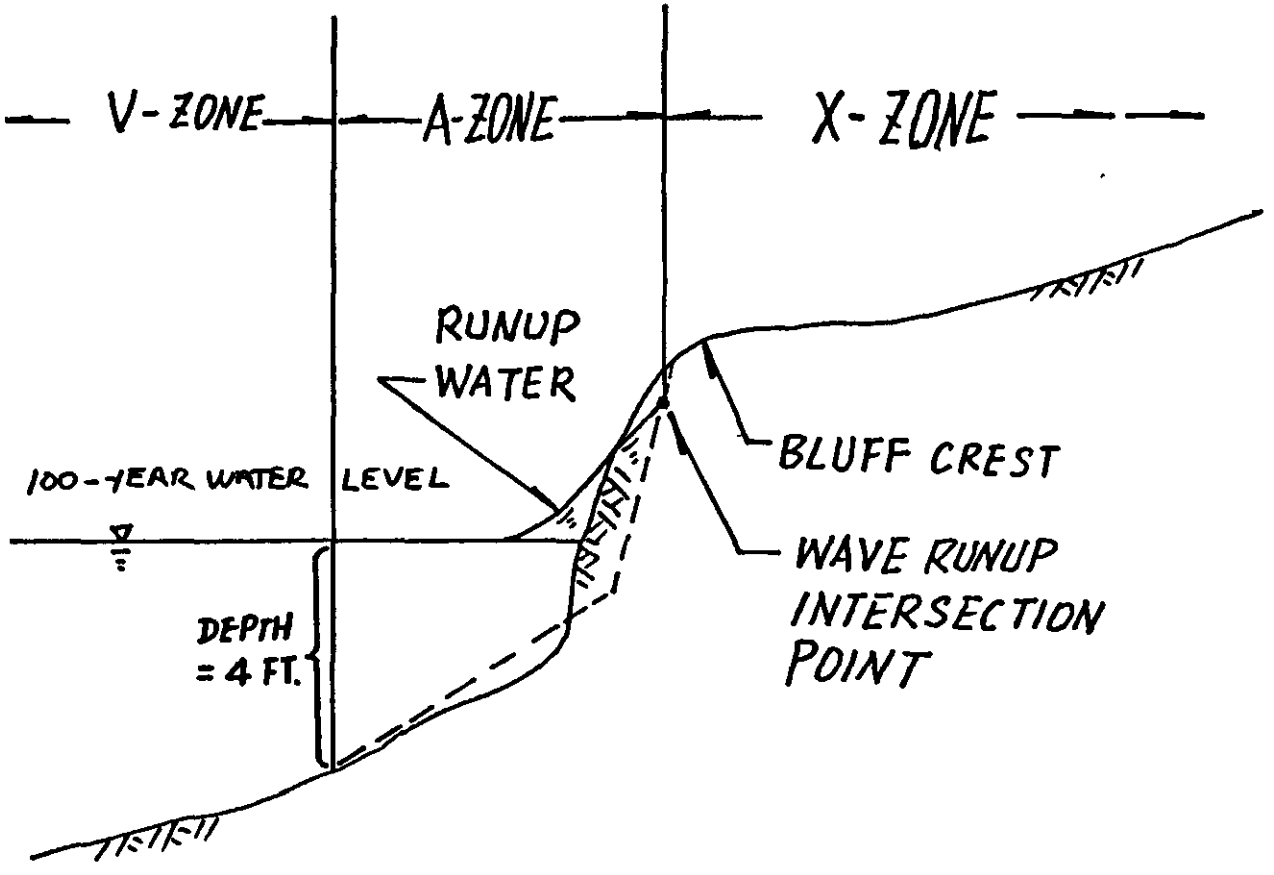
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-6

FIGURE 7

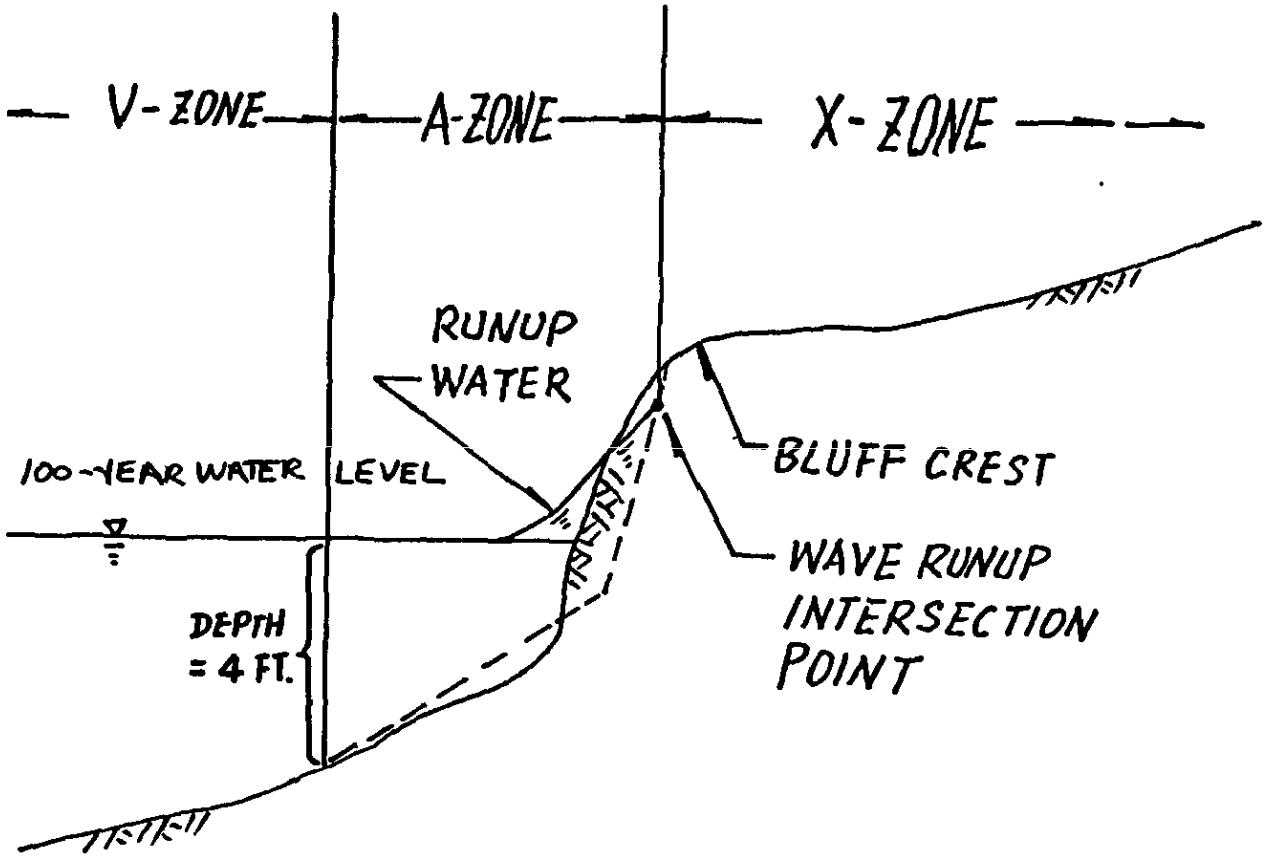
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-7

FIGURE 8

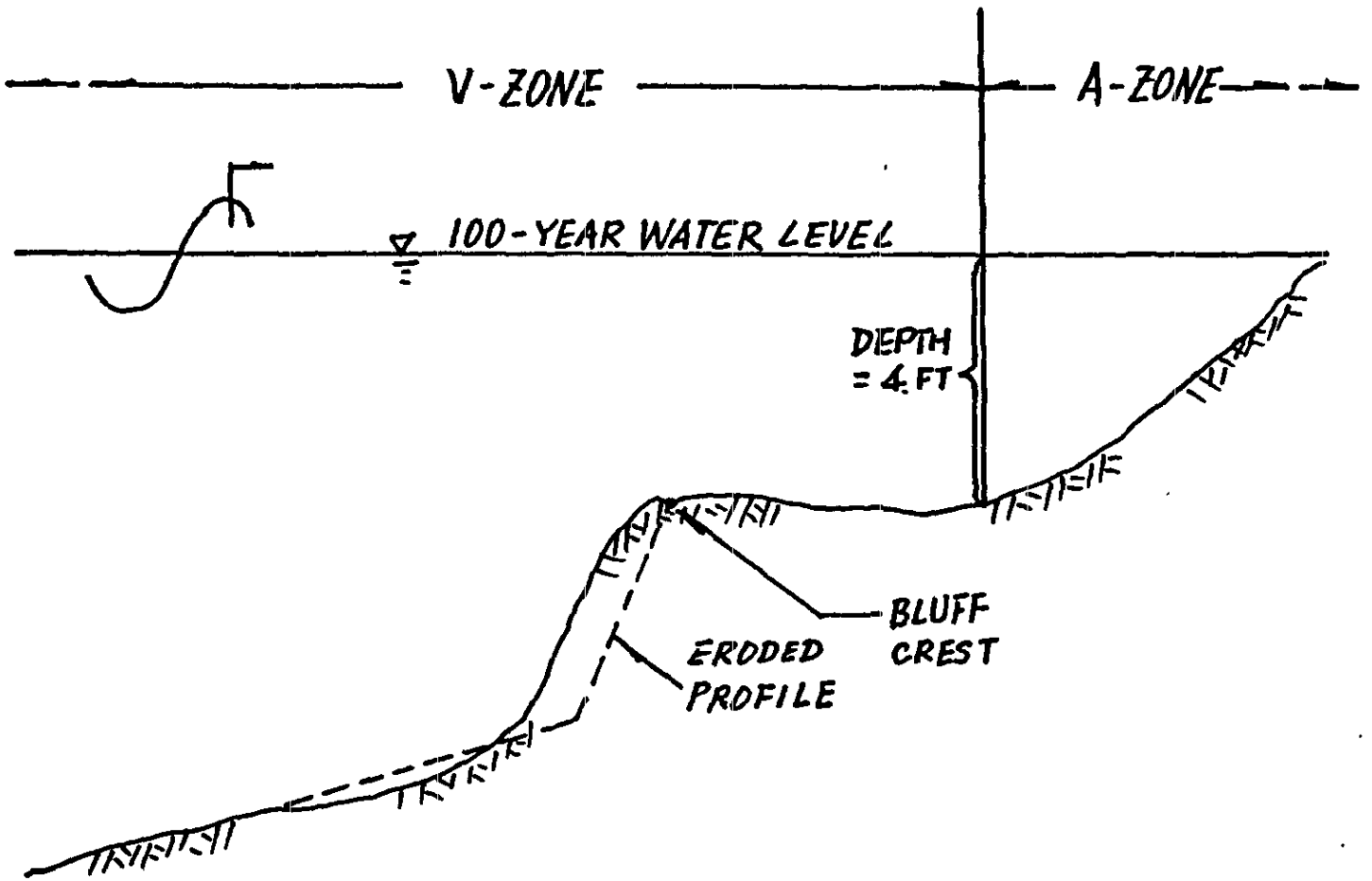
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-9

FIGURE 9

BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/DUNE SYSTEM



Baldwin-9

FIGURE 10

level is equal to 4 feet. FIGURE 10 depicts this condition, which is representative of Baldwin-9.

The "A" and "V" Zones for these sites have been delineated according to FEMA's Guidelines for Great Lakes Wave Runup Computation and Mapping and are shown on the attached work maps.

The formal submittal of the Baldwin Township study will include original mylar copies showing sufficient detail for submittal to FEMA's technical review contractor.

5.0 CONCLUSIONS

For each of the Baldwin Township sites where the 100-year and 500-year flood levels inundate shoreline property, the inundated area will experience a minimal water depth shoreward of the shoreline protection. This water depth will generate a negligible wave across the property. Therefore, the 100-year and 500-year flood levels will be used to delineate the flood profiles at each site.

Accordingly, where structures protect against flooding, the 100-year and 500-year "A" and "V" Zones, based on wave runup elevations, will be delineated on the work maps in the final FIS for the site. TABLE 2 lists the 100-year and 500-year wave runup elevations for the nine sites.

In conclusion, it is recommended that the delineated 100-year and 500-year flood profiles for the nine Baldwin Township sites included herein be used by FEMA for updating the Baldwin Township FIS.

TABLE 2

WAVE RUNUP ELEVATIONS

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)	500-year Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0 *	584.0	585.0
2. Baldwin-2	0.4	584.4	585.4
3. Baldwin-3	3.0	587.0	588.0
4. Baldwin-4	3.0	587.0	588.0
5. Baldwin-5	10.0	594.0	595.0
6. Baldwin-6	9.0	593.0	594.0
7. Baldwin-7	2.0	586.0	587.0
8. Baldwin-8	2.0	586.0	587.0
9. Baldwin-9	2.0	586.0	587.0

* NOTE: No wave runup computed since shoreline is completely inundated by the 100- and 500-year flood levels obtained from the September 1989 "Flood Levels Report for Saginaw Bay"

6.0 GLOSSARY

Annual Maximum Instantaneous Water Level: The highest water level that was recorded during a year by a gage with a sampling frequency of an hour or less.

A-Zone: The Flood Insurance Rate Zone that corresponds to the 100-year floodplain that is determined in the Flood Insurance Study by detailed methods.

AO-Zone: The Flood Insurance Rate Zone that corresponds to the inland termination point of water overtopping a beach and/or dune condition.

Beach: The zone of sedimentary material that extends landward from the low water line to the place where there is a marked change in material or form, or to the line of permanent vegetation.

Bluff: A high, steep bank composed of erodible materials.

Floodplain: The area adjoining a river, stream, watercourse, ocean, lake or other body of standing water that has been or may be covered by floodwater.

International Great Lakes Datum (IGLD): Common reference datum for the Great Lakes area established in 1955 based on mean water level in the St. Lawrence River at Father Point, Quebec (near Atlantic Ocean).

Runup: The rush of water up a beach or structure from the breaking of a wave. Also, the vertical height of uprush above the still-water level.

Still-water level: The elevation that the water surface would assume if all wave action were absent.

Storm-water level: The rise above the normal water level on the open-coast, due to wind stress on the water surface.

V-Zone: The maximum elevation reached by the wave runup associated with the 100-year flood level.

Wave height: The vertical distance between the wave crest and the preceding trough.

Wave setup: The superelevation of the water surface over normal surge elevation due to the onshore mass transport of the water by wave action alone.

Wind setup: The vertical rise in the still-water level on the leeward side of a body of water caused by wind stresses on the surface of the water.

X-Zone: The Flood Insurance Rate Zone that corresponds to the landward side of a dune heel point.

7.0 REFERENCES

1. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Vicksburg, MS, "Shore Protection Manual," Volumes I & II, 1984.

2. U.S. Army Corps of Engineers, Detroit District, "Phase I, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

3. U.S. Army Corps of Engineers, Detroit District, "Phase II, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

4. U.S. Army Corps of Engineers, Detroit District, "Appendices, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

5. U.S. Army Corps of Engineers, Coordinating Committee on Great Lakes Basin Hydraulic and Hydrologic Data, "History of Water Level Gauges, Upper Great Lakes and the St. Clair - Detroit Rivers," January 1978.

6. U.S. Army Corps of Engineers, North Central Division, "Great Lakes Region Inventory Report National Shoreline Study," August 1978.

7. U.S. Army Corps of Engineers, Detroit District, "Flood Levels Report - Saginaw Bay," September 1989.

8. U.S. Army Corps of Engineers, Detroit District, "Flood Levels Report - Anchor Bay," September 1989.

9. Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan, SCHWAB, D.J., and LYNN, E.W., "Great Lakes Storm Surge Planning Program," 1987.

10. U.S. Army Corps of Engineers, Detroit District, "Phase II Report on Great Lakes Flood Levels - Little Bay De Noc," August 1981.

11. U.S. Army Corps of Engineers, Detroit District, "Phase II Report on Great Lakes Flood Levels - Big Bay De Noc", July 1981.

12. FEMA Great Lakes "A" Zone and "V" Zone Delineations

TECHNICAL LETTER REPORT ON BALDWIN TOWNSHIP, MICHIGAN

APPENDIX A

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
October 1990

SYNOPSIS

Appendix A outlines the procedures utilized to calculate the wave runup component and the maximum wave runup elevation associated with the 100-year flood level for the Baldwin Township shoreline. The following list shows the nine Baldwin Township sites and the 100-year wave runup flood profiles. Computations of these elevations are included in this Appendix.

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0	584.0
2. Baldwin-2	0.4	584.4
3. Baldwin-3	2.5	586.5
4. Baldwin-4	2.5	586.5
5. Baldwin-5	10.0	594.0
6. Baldwin-6	7.7	591.7
7. Baldwin-7	1.7	585.7
8. Baldwin-8	1.7	585.7
9. Baldwin-9	0.0	584.0

TABLE 2

WAVE RUNUP ELEVATIONS

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0	584.0
2. Baldwin-2	0.4	584.4
3. Baldwin-3	2.5	586.5
4. Baldwin-4	2.5	586.5
5. Baldwin-5	10.0	594.0
6. Baldwin-6	7.7	591.7
7. Baldwin-7	1.7	585.7
8. Baldwin-8	1.7	585.7
9. Baldwin-9	0.0	584.0

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-2

```
                runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
  100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015     (enter per Ref. 4, Figure 10)
       Hs in deep water:  11.3                (significant wave)
            beach slope:   0.00430  (tan 30H:1V = 0.03333)
             beach zeta:   0.033              2nd: wave runup computation
            beach runup:   0.4
         runup elevation: 584.4 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-3

```
              runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
     water depth at toe:  26.0 feet            1st: significant wave computation
  100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015     (enter per Ref. 4, Figure 10)
        Hs in deep water:  11.3                (significant wave)
             beach slope:   0.03000  (tan 30H:1V = 0.03333)
              beach zeta:   0.232              2nd: wave runup computation
             beach runup:   2.5
         runup elevation: 586.5 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-4

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
     Hs in deep water:  11.3                 (significant wave)
          beach slope:   0.03000  (tan 30H:1V = 0.03333)
           beach zeta:   0.232                2nd: wave runup computation
          beach runup:   2.5
        runup elevation: 586.5 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-6

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015     (enter per Ref. 4, Figure 10)
      Hs in deep water:  11.3                (significant wave)
           beach slope:   0.09100  (tan 30H:1V = 0.03333)
            beach zeta:   0.704               2nd: wave runup computation
           beach runup:   7.7
        runup elevation: 591.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-7

```
                runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet           1st: significant wave computation
 100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015     (enter per Ref. 4, Figure 10)
       Hs in deep water:  11.3                (significant wave)
            beach slope:   0.02000  (tan 30H:1V = 0.03333)
             beach zeta:   0.155              2nd: wave runup computation
            beach runup:   1.7
         runup elevation: 585.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-8

```
             runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
     water depth at toe:  26.0 feet          1st: significant wave computation
  100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015     (enter per Ref. 4, Figure 10)
       Hs in deep water:  11.3                (significant wave)
            beach slope:   0.02000  (tan 30H:1V = 0.03333)
             beach zeta:   0.155              2nd: wave runup computation
            beach runup:   1.7
         runup elevation: 585.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

FIS PROFILE
BALDWIN - 1

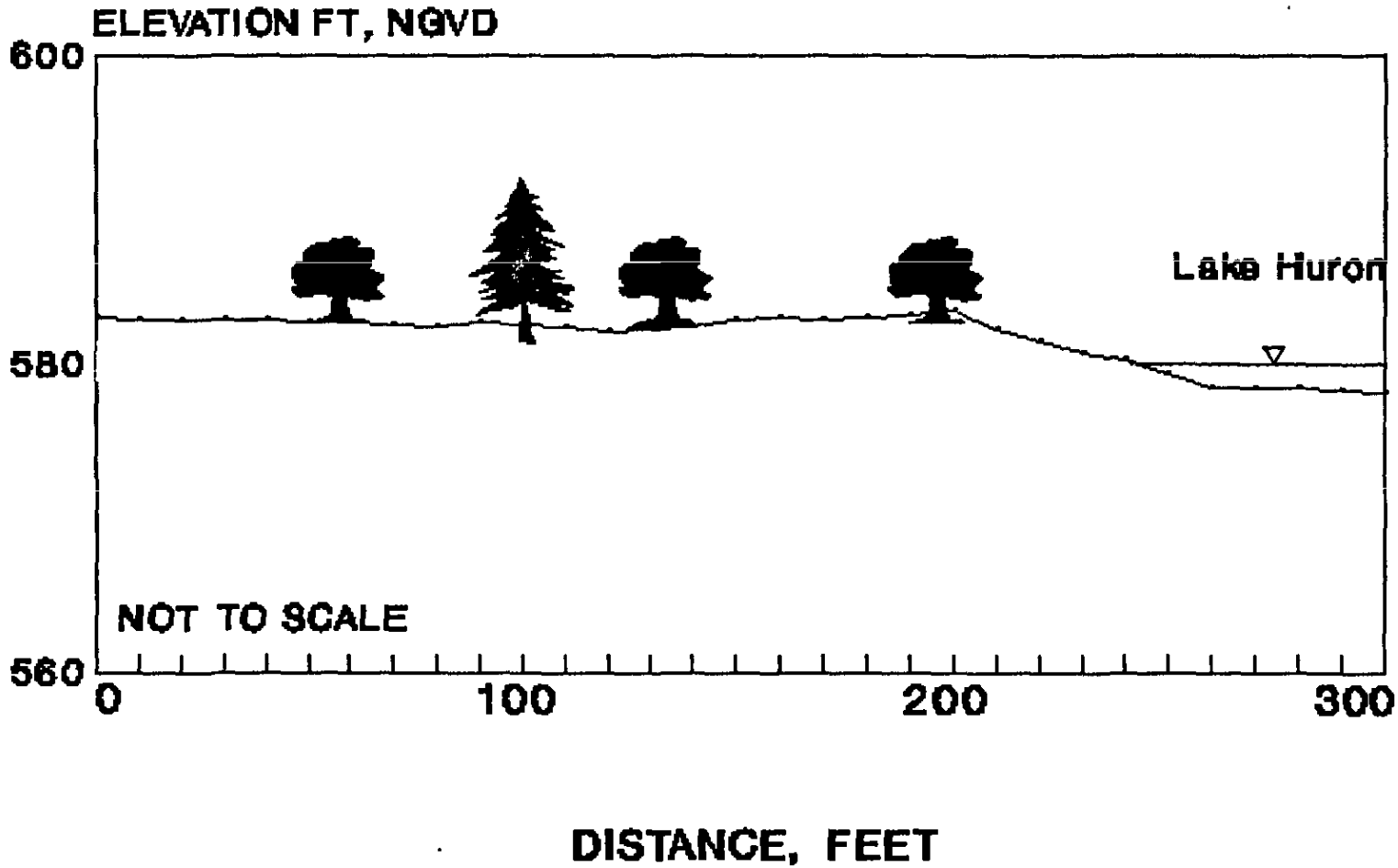


FIGURE B-1

FIS PROFILE
BALDWIN - 2

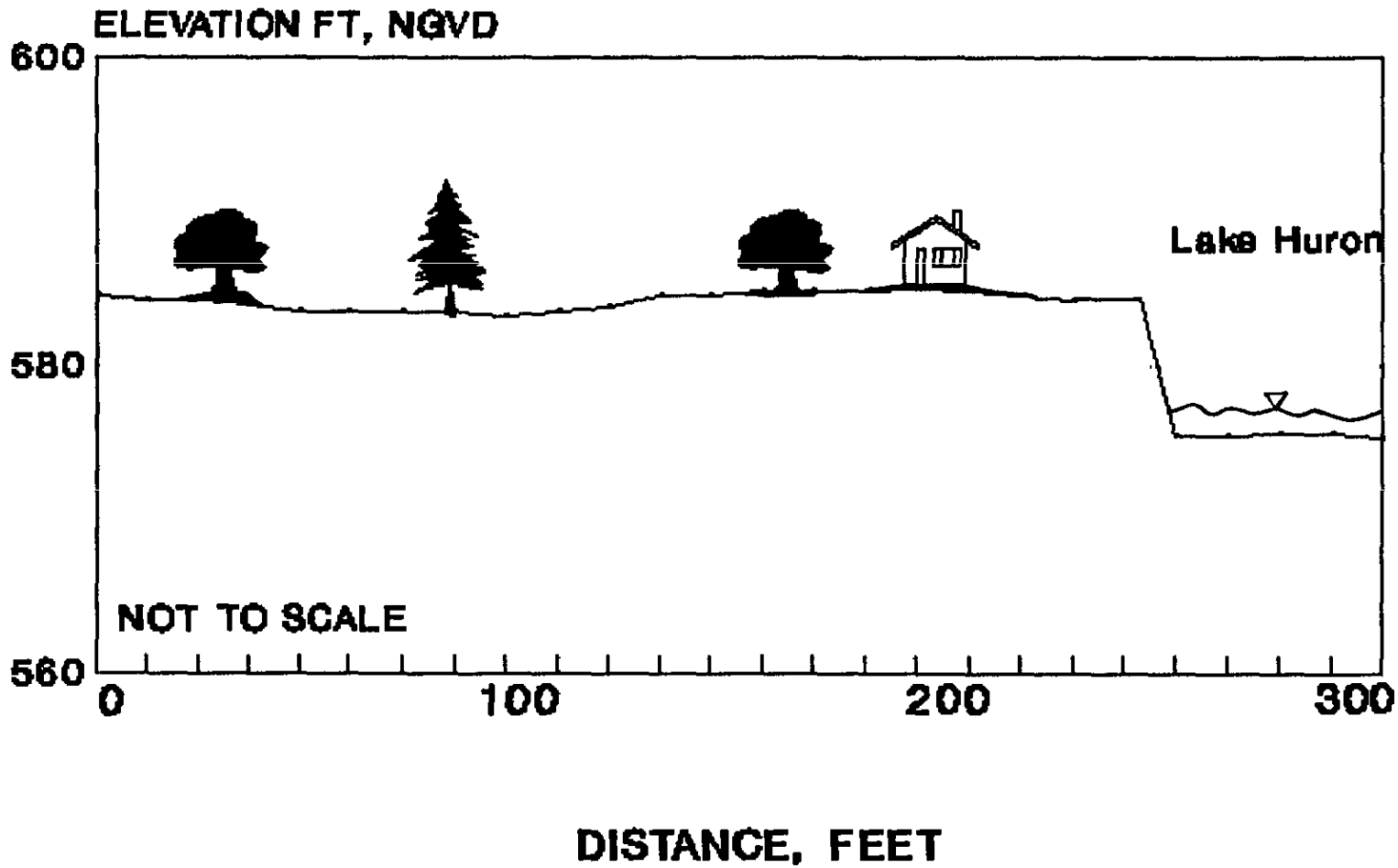


FIGURE B-2

FIS PROFILE
BALDWIN - 3

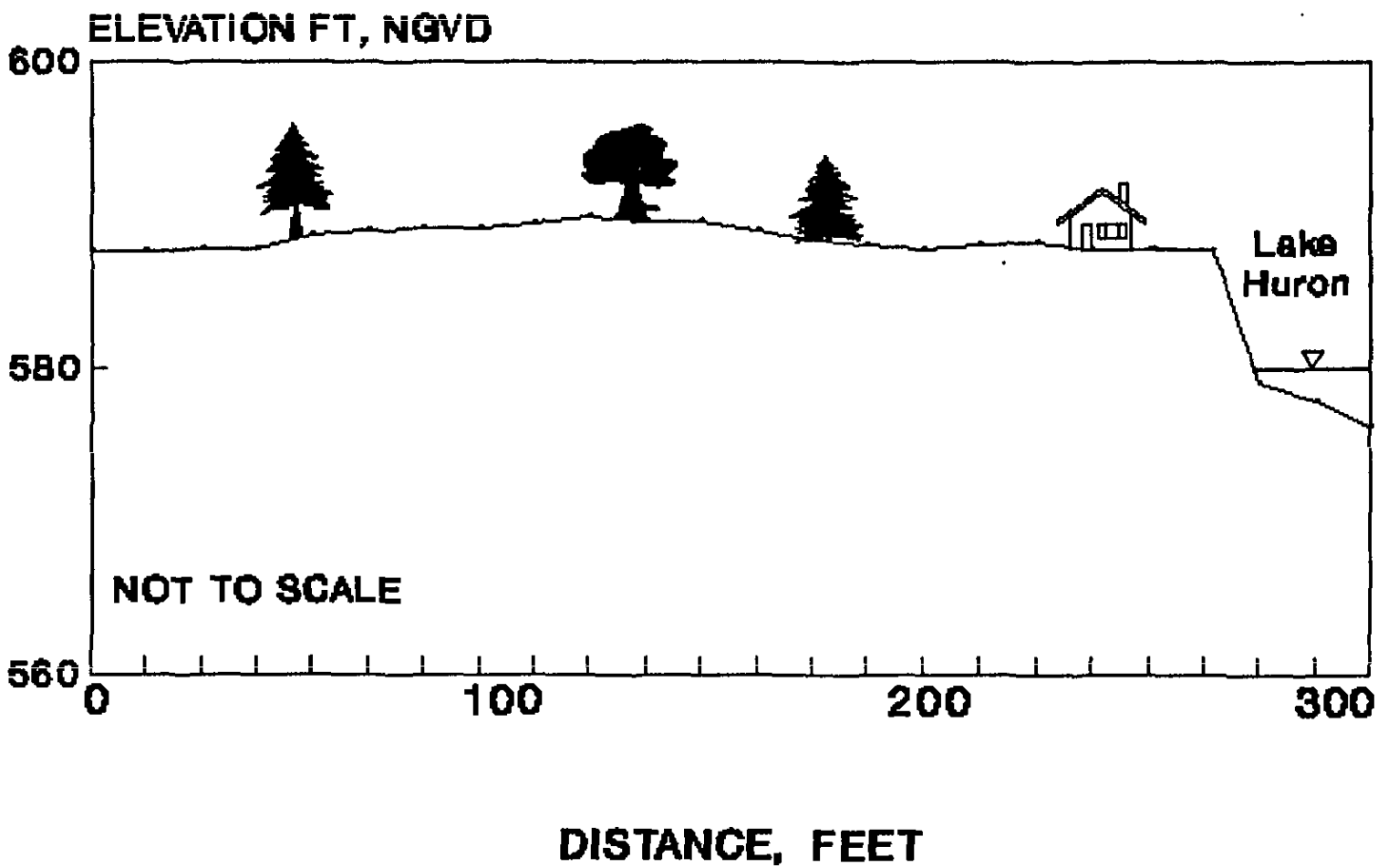


FIGURE B-3

FIS PROFILE
BALDWIN - 4

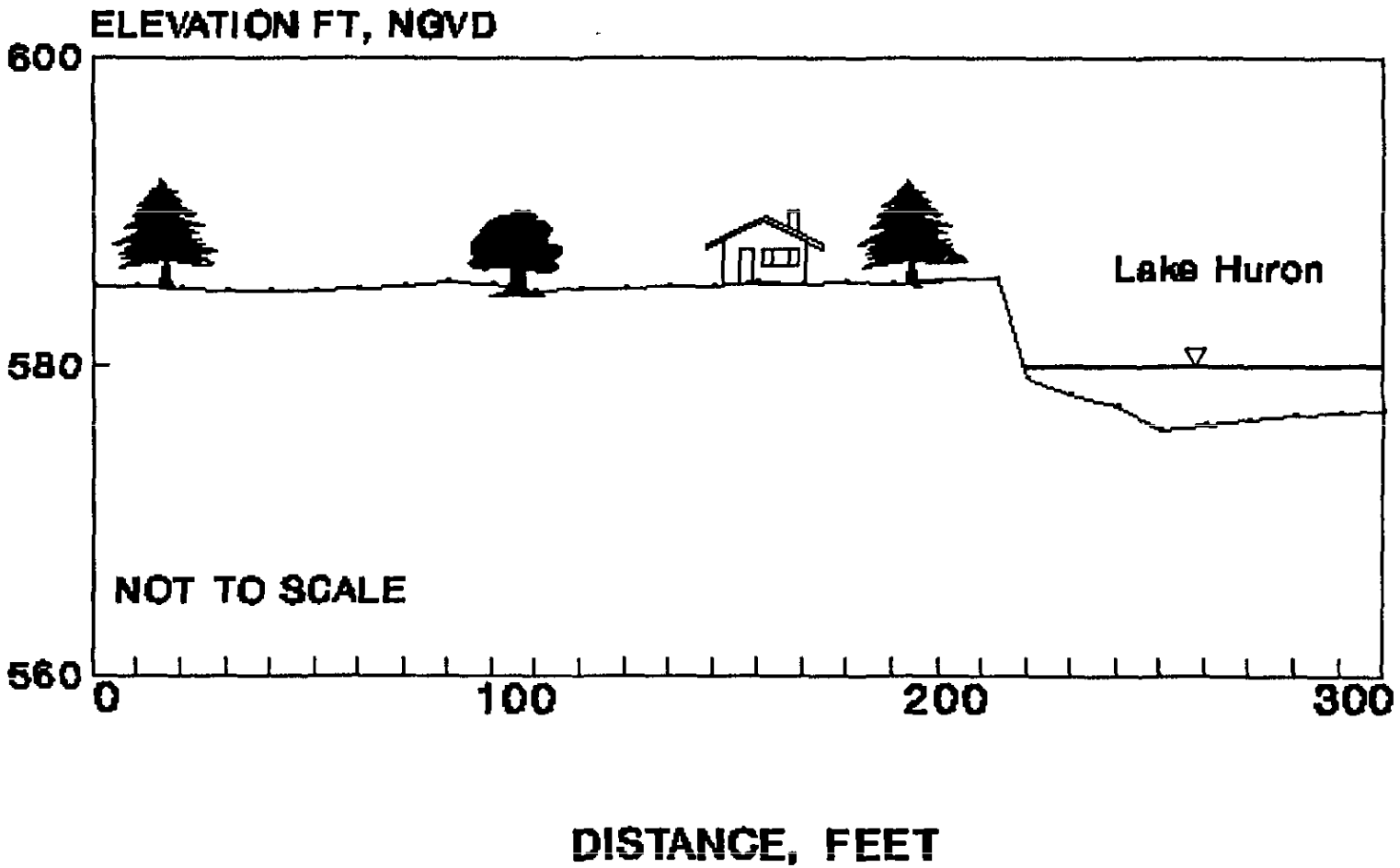


FIGURE B-4

FIS PROFILE
BALDWIN - 5

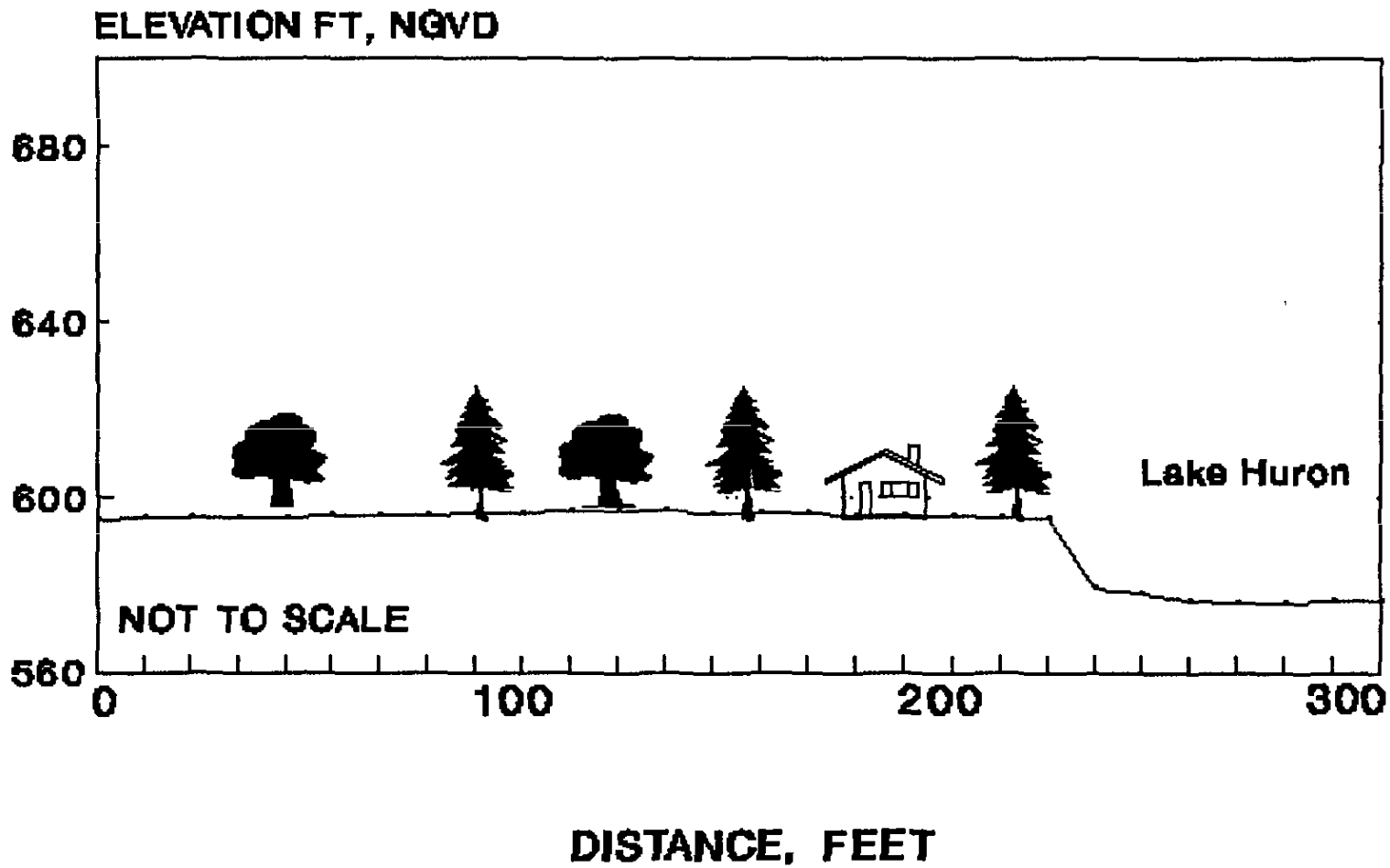


FIGURE B-5

FIS PROFILE
BALDWIN - 6

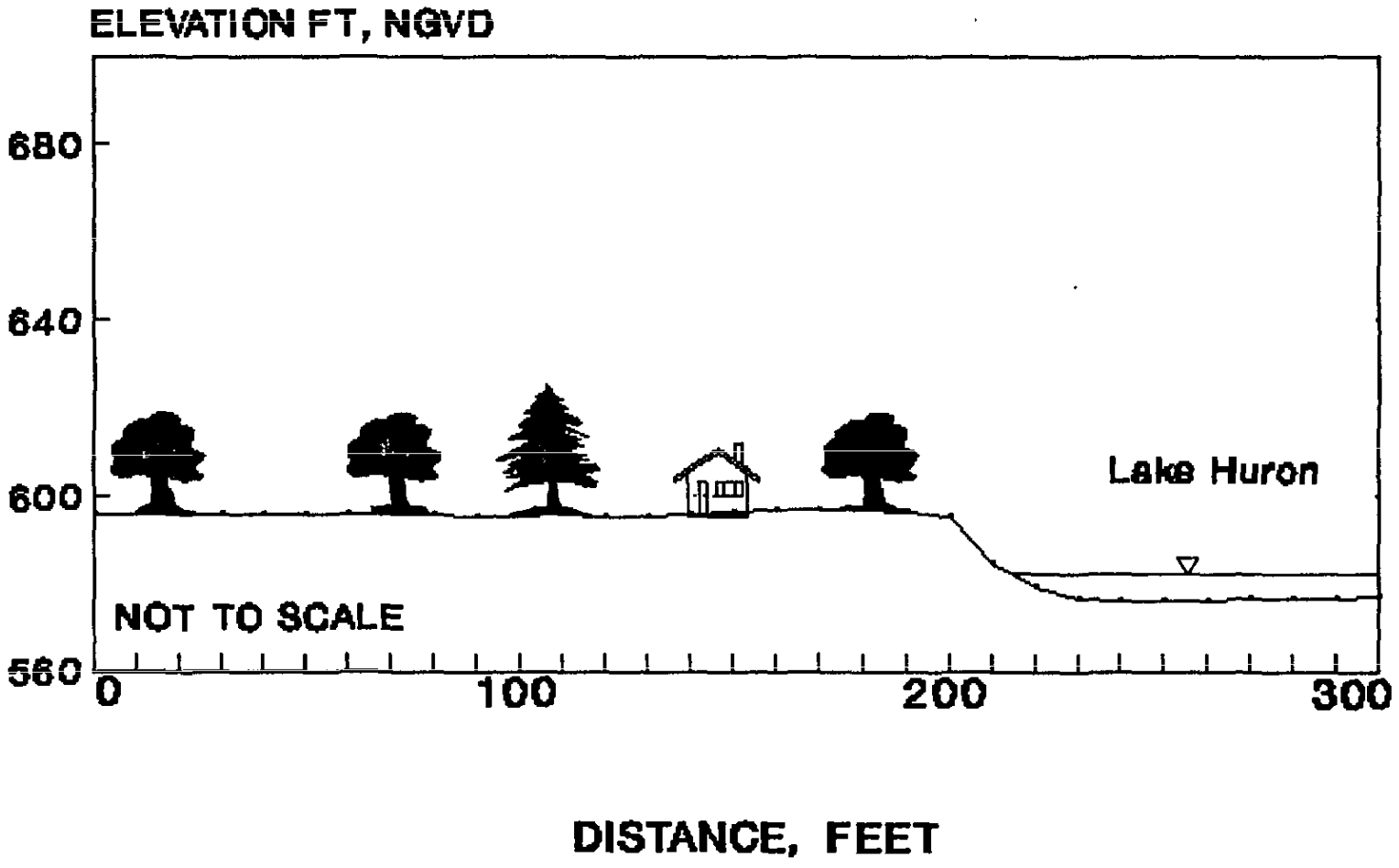


FIGURE B-6

FIS PROFILE
BALDWIN - 7

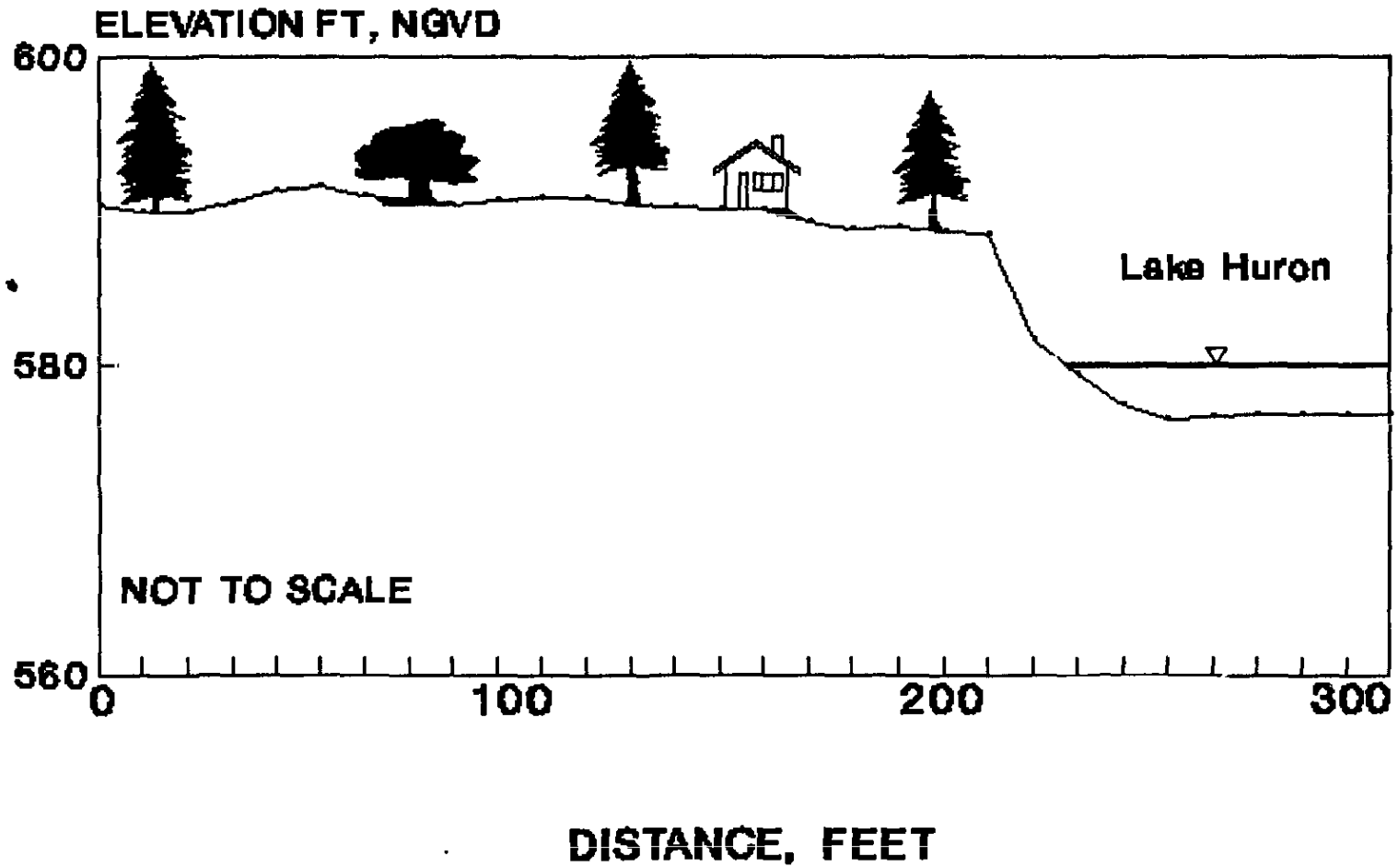


FIGURE B-7

FIS PROFILE
BALDWIN - 8

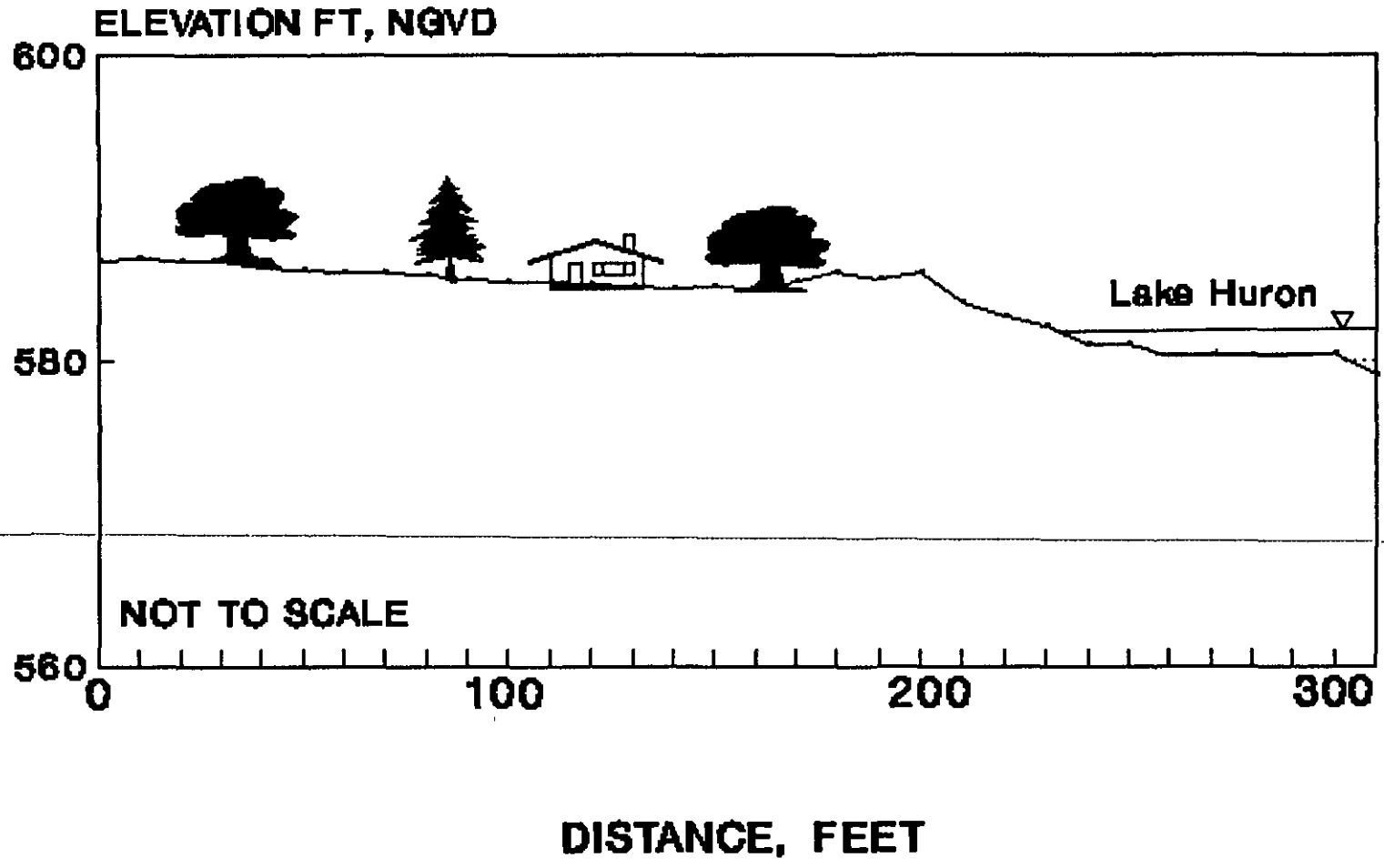


FIGURE B-8

FIS PROFILE
BALDWIN - 9

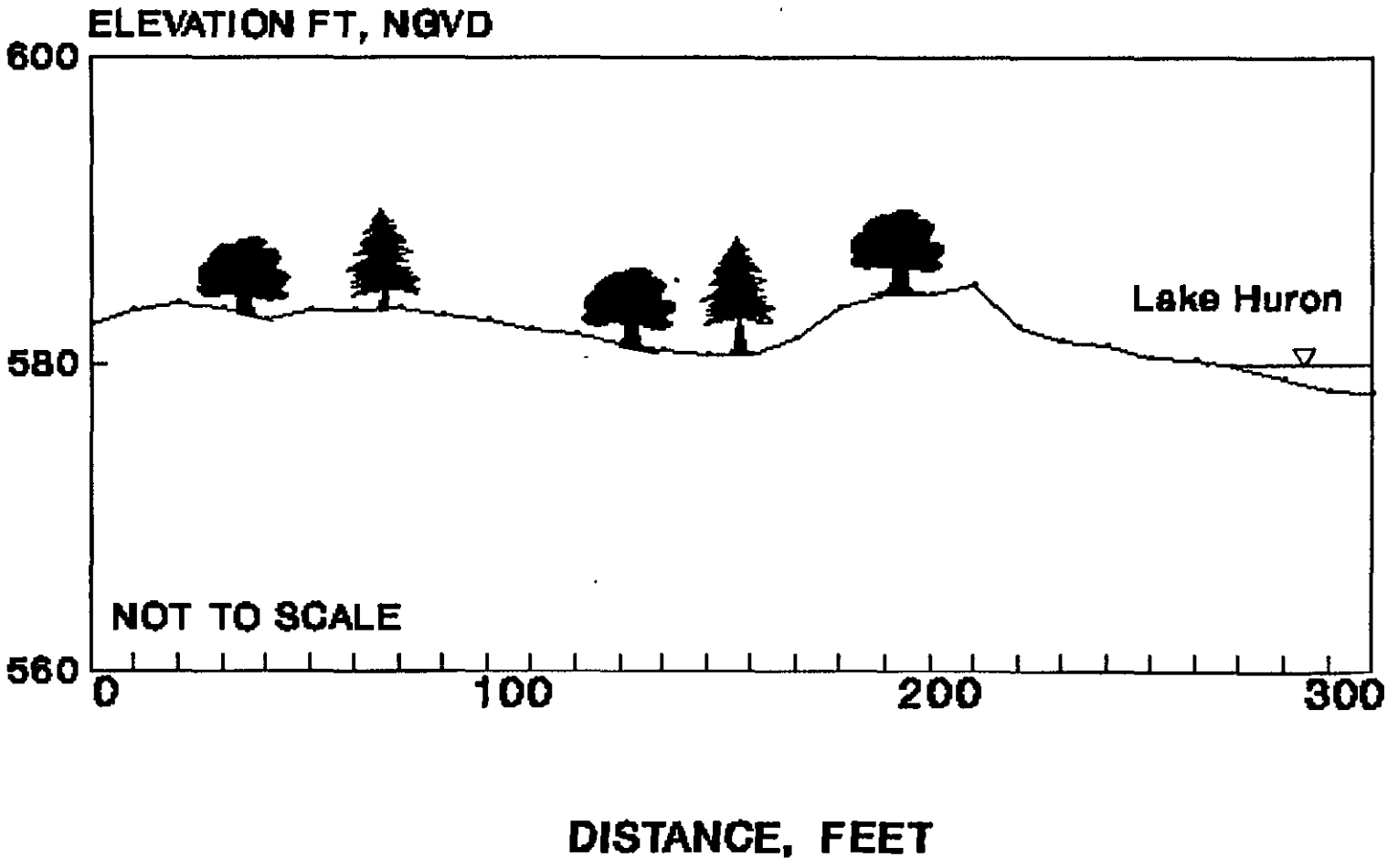
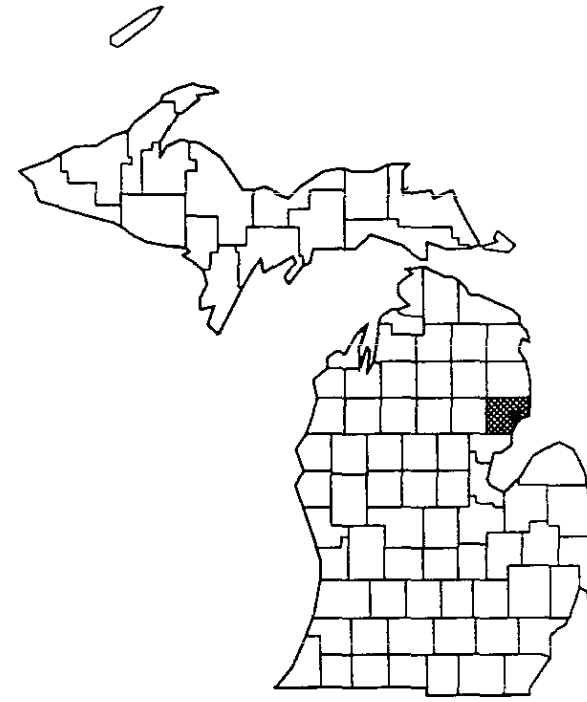


FIGURE B-9

FLOOD INSURANCE STUDY

TOWNSHIP OF BALDWIN, MICHIGAN
IOSCO COUNTY



REVISED
PRELIMINARY

REVISED

Federal Emergency Management Agency

COMMUNITY NUMBER -260099

JUN 0 4 1992

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY

TOWNSHIP OF BALDWIN,
IOSCO COUNTY,
MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Rate Map for the Township of Baldwin, Iosco County, Michigan (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Detroit District (the Study Contractor), for the Federal Emergency Management Agency (FEMA) under Interagency Agreement No. EMW-90-E-3263, Project Order No. 2. This study was completed in February 1991.

1.3 Coordination

On September 25, 1989, an initial coordination meeting was held with representatives of FEMA, the Michigan Department of Natural Resources (MDNR), the Township of Baldwin, and the Study Contractor. The technical results of this study were reviewed and approved by the MDNR, the State coordinating agency, and FEMA.

On , the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Township of Baldwin, Iosco County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

A detailed coastal flooding analysis was performed on the entire coastline of the Township of Baldwin, where the flooding sources are Lake Huron, Tawas Bay, and Saginaw Bay.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Insurance Rate Map for the Township of Baldwin (Reference 1), and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through February 1996. The scope and methods of study were proposed to and agreed upon by FEMA and the community.

2.2 Community Description

The Township of Baldwin is located in the east-central portion of Iosco County, in the north-central part of Michigan's lower peninsula. The total land area contained within the township limits is 26.0 square miles. The community is bordered on the north by the Townships of Wilber and Au Sable, Michigan; on the west by the Township of Tawas, Michigan; on the southwest by the City of Tawas, Michigan; and on the east by Lake Huron. The 1980 population of the Township of Baldwin was reported to be 1,393 (Reference 2).

The climate of the Township of Baldwin is modified somewhat by Lake Huron. The lake provides a cooling effect during the summer months and a warming influence during the winter months. July is normally the warmest month, with a mean monthly temperature of 69.1 degrees Fahrenheit (^{o}F); whereas January is the coldest month, with a mean monthly temperature of 20.8^{o}F. The mean annual temperature from 1951 to 1975 was 45.6^{o}F. The record high for this period at the Township of Baldwin was 102°F on August 21, 1955; the record low was -37°F on January 30, 1951. Precipitation is distributed fairly equally throughout the year. The average annual precipitation is about 34.15 inches. August, with an average of 12.80 inches, is the wettest month, while February, with a 3.34-inch average, is the driest month (Reference 3).

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

VICINITY MAP

Soil material in the Township of Baldwin varies greatly and ranges from clay to very coarse sand. Most of the soils of the community are poorly drained (Reference 4).

Bathymetry in Lake Huron and Tawas Bay varied from 30- to 50-foot depths offshore to less than 5 feet deep close to shore. In the Township of Baldwin, the Tawas Bay shoreline is protected to some extent from northeasterly and easterly storms by Tawas Point.

The majority of the shoreline of the township is exposed on the northeast to a fetch of about 180 miles. Ordinary fluctuations of water levels along this shoreline are of the same magnitude and frequency as generally apply to harbors on Lake Huron. The lowest lake stages usually prevail during the winter months and the highest during the summer months. Since 1900, the monthly mean water levels on Lake Huron have ranged from a minimum of 576.55 feet National Geodetic Vertical Datum of 1929 (NGVD) to a maximum of 582.82 feet NGVD.

Development in the floodplains of both Lake Huron and Tawas Bay has been relatively minor.

2.3 Principal Flood Problems

The shoreline of the Township of Baldwin is subject to severe wind and wave conditions during a large percentage of the time. When lake levels are high and storms occur from the northeast to southwest, shoreline communities located in the Township of Baldwin are usually subjected to extreme conditions.

Due to the relatively flat topography of the township along the shoreline of Lake Huron and Tawas Bay, substantial flooding has occurred, and will continue to occur, in this area during high bay stages.

Levels on Lake Huron are affected by three types of fluctuations: long-term, seasonal, and short-term. Long-term fluctuations are principally caused by persistent high or low water-supply conditions within the Great Lakes basin. Flooding can occur along the shoreline as a result of several consecutive years of above-average precipitation. This study is primarily concerned with long-term fluctuations combined with seasonal and short-term variations of the lake levels. Seasonal fluctuations are reflected by the occurrence of high lake levels in the spring, when runoff increases due to snowmelt, and because of low rates of evaporation from the lake and evapotranspiration from the land surface. However, because of the sluggish hydrologic response of the large bodies of water involved, peak seasonal levels usually do not occur until July. Short-term fluctuations in lake levels can be caused by strong winds and by sharp differences in barometric pressure. The winds drive surface water in great volumes toward the shore, thus raising the water level at one

side of the lake while lowering the water level at the other side. This phenomenon is termed a "seiche."

As a result of record high levels on Lake Huron in 1985-86, combined with periodic strong winds, portions of the shoreline of the Township of Baldwin frequently incurred flooding during this period. Additionally, the low-lying, floodprone areas along the shoreline, both on Lake Huron and Tawas Bay, were often inundated.

2.4 Flood Protection Measures

Shoreline protection structures exist in some areas along the shoreline of Lake Huron and Tawas Bay that provide the community with some degree of protection against flooding. However, it has been ascertained that these structures will not protect the community from rare events such as the 100-year flood. Structures that do not protect against the 100-year flood are not considered in the hydraulic analysis of the 100-year floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (one-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for each flooding source studied in detail affecting the community.

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Saginaw Bay shoreline of the

Township of Baldwin from the COE flood levels report for Saginaw Bay (Reference 5), and are shown in Table 1, Summary of Stillwater Elevations.

The analyses reported in this study reflect the stillwater elevations due to wind-setup effects and include the contributions from wave action. The effects of wave action were also considered in the determination of flood hazard areas. Coastal structures located above stillwater flood elevations can still be severely damaged by wave runup, wave-induced erosion, and wave-borne debris. The extent of wave runup above stillwater levels depends greatly on the wave conditions, slope of the beach or structure, and local topography.

Wave heights and wave period can be found in the report entitled "Design Wave Information for the Great Lakes" (Reference 6), and computed from procedures described in "The TMA Shallow-Water Spectrum Description and Applications" (Reference 7). The wave-runup component was determined using the procedures developed in a Great Lakes wave-runup methodology study (Reference 8).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Hydraulic analyses for areas along the shoreline of Lake Huron and Tawas Bay were studied to estimate the wave-runup elevations associated with the 100-year flood level.

The wave-runup components and maximum wave-runup elevations for individual sites located on Tawas Bay and Lake Huron were determined using methodologies established in the technical letter report for the Township of Baldwin, Michigan (Reference 9).

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 2, Transect Location Map. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering

FLOODING SOURCE AND TRANSECT	FLOOD INSURANCE RATE MAP PANEL	STILLWATER ELEVATION (FEET NGVD)				ZONE	BASE FLOOD ELEVATION [1] (FEET NGVD)
		10-YEAR	50-YEAR	100-YEAR	500-YEAR		
LAKE HURON/SAGINAW BAY/ TAWAS BAY							
1	0016	582.5	583.6	584.0	585 0	VE AE	584 584
2	0016	582.5	583.6	584.0	585.0	VE AE	584[2] 584
3	0008	582.5	583.6	584.0	585.0	VE	587[2]
4	0008	582.5	583.6	584.0	585.0	VE	587[2]
5	0008	582.5	583.6	584.0	585.0	VE	589[2]
6	0007	582.5	583.6	584.0	585.0	VE	589[2]
7	0007	582.5	583.6	584.0	585 0	VE	586[2]
8	0007	582.5	583.6	584.0	585 0	VE	586[2]
9	0007	582.5	583.6	584.0	585.0	VE AE	584 584

[1]ROUNDED TO THE NEAREST FOOT AND MAY INCLUDE EFFECT OF WAVE ACTION
BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS
[2]INCLUDES EFFECT OF WAVE RUNUP

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

SUMMARY OF STILLWATER ELEVATIONS

LAKE HURON/SAGINAW BAY/TAWAS BAY

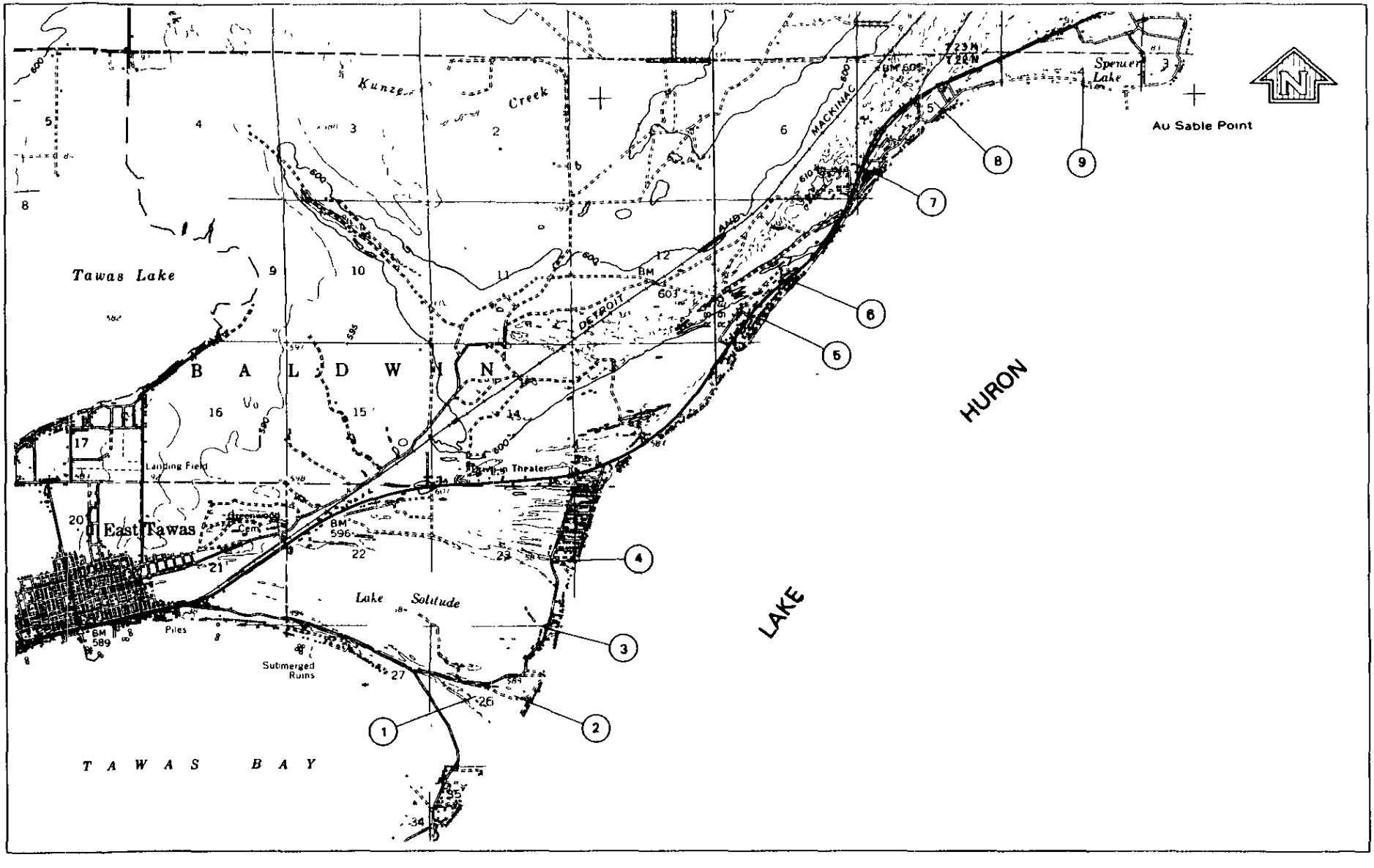

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

TRANSECT LOCATION MAP

the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the three-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was computed at each transect. The inland extent of the V-zone designation applies to all areas lakeward of a beach, dune, or bluff based on the limits of the runup elevation, or the four-foot stillwater depth when wave runup is not computed. Table 2 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave-runup elevations.

TABLE 2 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND WAVE RUNUP ELEVATIONS

TRANSECT	LOCATION	ELEVATIONS (FEET NGVD) 100-YEAR STILLWATER	WAVE RUNUP
1	From Tawas Bay shoreline, about 2,000 feet southeast of intersection of Baldwin Resort Road and Tawas Beach Road, extending northeast	584.0	N/A
2	From Lake Huron shoreline, about 4,600 feet east of intersection of Baldwin Resort Road and Tawas Beach Road, extending west	584.0	584.4
3	From Lake Huron shoreline, about 5,750 feet south of intersection of Baldwin Resort Road and U.S. 23, extending west	584.0	586.5
4	From Lake Huron shoreline, about 3,100 feet south of intersection of Baldwin Resort Road and U.S. 23, extending west	584.0	586.5
5	From Lake Huron shoreline, about 700 feet southwest of intersection of Scott Road and Forest Street, extending northwest	584.0	588.9

TABLE 2 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND WAVE RUNUP ELEVATIONS (Continued)

TRANSECT	LOCATION	ELEVATIONS (FEET NGVD) 100-YEAR STILLWATER	WAVE RUNUP
6	From Lake Huron shoreline about 1,000 feet northeast of intersection of Scott Road and Forest Street, extending northwest	584.0	588.9
7	From Lake Huron shoreline, about 300 feet southwest of intersection of U.S. 23 and Birchcrest Drive, extending northwest	584.0	585.7
8	From Lake Huron shoreline, about 3,550 feet northeast of intersection of Birchcrest Drive and U.S. 23, extending northwest	584.0	585.7
9	From Lake Huron shoreline, about 1,400 feet south of southern shoreline of Spencer Lake, extending north	584.0	N/A

Figure 3 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

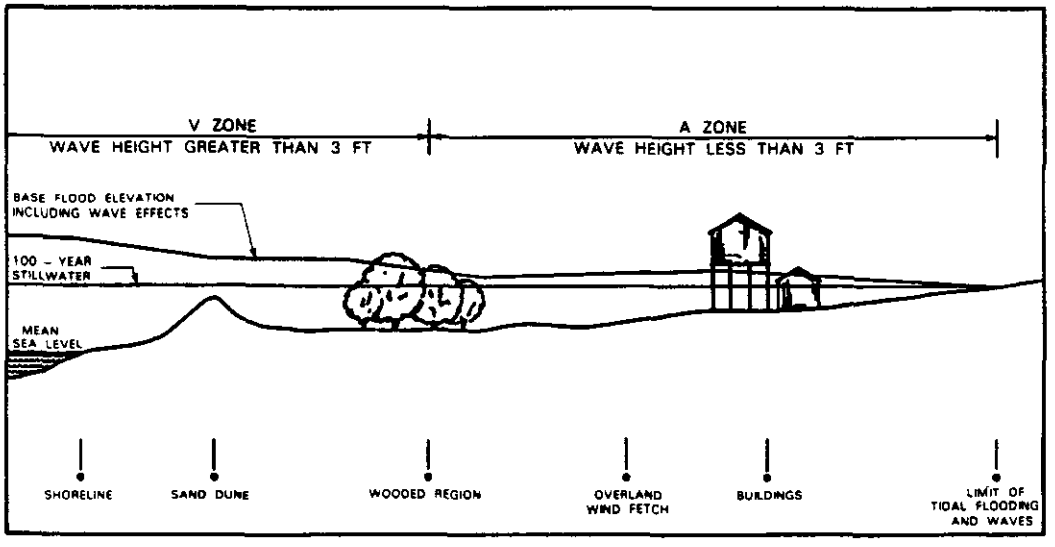

FIGURE 3 - Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (References 10-12), aerial photographs (Reference 13), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

All elevations are referenced to the NGVD. Elevation reference marks used in this study are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the one-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each flooding source studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each transect cross section. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet and topographic maps at a scale of 1:24000 with a contour interval of 2 feet (References 10-12).

Floodplain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, VE, and numbered A and V zones), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B and Zone X). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For streams studied by approximate methods, only the 100-year floodplain boundaries are shown on the Flood Insurance Rate Map.

4.2 Floodways

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

Floodways have not been shown or computed for this community. Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause an increase in the base flood elevations greater than the state's allowable surcharge at any point within the community.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. Previously, the detailed data included the determination of reaches and Flood Hazard Factors (FHF) and numbered flood insurance zone designations. To the extent presented in this revised Flood Insurance Study, the reach determinations and FHFs are no longer applicable and zones are redesignated. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one foot and three feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated

with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than one foot, areas of 100-year flooding where the contributing drainage area is less than one square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, for 100-year floodplains studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Flood Insurance Studies published for the City of East Tawas, Michigan, and the Township of Au Sable, Michigan (References 14 and 15), agree with this study.

A revision in progress to the published Flood Insurance Study for the City of Tawas City, Michigan (Reference 16), agrees with this study.

This Flood Insurance Study supersedes the previously printed Flood Insurance Rate Map for the Township of Baldwin, Michigan (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604-2698.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To ensure that any user is aware of

all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Rate Map, Township of Baldwin, Iosco County, Michigan, February 1988.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, Michigan, Washington, D.C., September 1982.

3. National Oceanic and Atmospheric Administration, Climates of the States, Volume 1, 1980.

4. Federal Emergency Management Agency, Flood Insurance Study, Township of Alabaster, Iosco County, Michigan, February 1987.

5. U.S. Army Corps of Engineers, Detroit District, Flood Levels Report - Saginaw Bay, September 1989.

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00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Baldwin

3) WATERCOURSE: Lake ~~Michigan~~ Huron ~~Wave run up~~

4) DOCUMENT TYPE: Wave Run-up Report ~~Report Wave~~

00BREAK00

TECHNICAL LETTER REPORT ON BALDWIN TOWNSHIP, MICHIGAN

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
November 1990

TECHNICAL LETTER REPORT ON
BALDWIN TOWNSHIP, MICHIGAN

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TECHNICAL LETTER REPORT ON
BALDWIN TOWNSHIP, MICHIGAN

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TECHNICAL LETTER REPORT ON
BALDWIN TOWNSHIP, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This report describes the application of the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" to flood levels on Saginaw Bay, specifically in Baldwin Township, Michigan. The flood levels applicable to Baldwin Township were developed in the September 1989 "Flood Levels Report for Saginaw Bay".

1.2 Authority and Acknowledgments

The "Great Lakes Wave Runup Methodology Study" was prepared in 1989 by the U.S. Army Corps of Engineers (COE) for the Federal Emergency Management Agency (FEMA), for application to future coastal Flood Insurance Studies (FIS) and/or restudies of communities bordering the Great Lakes. The work was conducted under Inter-Agency Work Agreement, EMW-89-E-3218, Project Order No. 1, between the COE and FEMA. The 100-year and 500-year flood levels from the September 1989 report referenced above, were used to compute the maximum wave runup elevations required for updating the previous study in Baldwin Township on Lake Huron and Tawas Bay. TABLE 1 lists profile locations, and the 100-year and 500-year "base" flood levels at nine locations along the Baldwin Township shoreline. The nine profiles were plotted from data obtained from a June 1990 survey.

SHORELINE PROFILES
BALDWIN TOWNSHIP, MICHIGAN

	Profile Location	100-year Flood Level *	500-year Flood Level *
1.	Baldwin-1 (Tawas Beach Road)	584.0	585.0
2.	Baldwin-2 (Iosco Beach Club Drive)	584.0	585.0
3.	Baldwin-3 (Winona Street)	584.0	585.0
4.	Baldwin-4 (Pontiac Street)	584.0	585.0
5.	Baldwin-5 (Ottawas Lane)	584.0	585.0
6.	Baldwin-6 (Forest Street)	584.0	585.0
7.	Baldwin-7 (Media Drive)	584.0	585.0
8.	Baldwin-8 (Iris Drive)	584.0	585.0
9.	Baldwin-9 (AuSable Dunes Assoc.)	584.0	585.0

* NOTE: All elevations in FT, NGVD from the September 1989 "Flood Levels Report for Saginaw Bay"

TABLE 1

1.3 Coordination

The "Flood Levels Report For Saginaw Bay", along with examples of the application of the methodology from the 1989 "Great Lakes Wave Runup Methodology Study", were presented to FEMA on March 1, 1990. The procedures outlined in the above references were approved at this meeting for application to all Saginaw Bay FIS sites, including Baldwin Township.

2.0 AREA STUDIED

2.1 Community Description

Baldwin Township, Michigan, shown on FIGURE 1, is located in Iosco County along 13 miles of shoreline on Lake Huron and Tawas Bay. There are no major populated communities located along the Baldwin Township shoreline. The developed shoreline consists of small seasonal and year-round residential homes, having a population of 1393.

Bathymetry in Lake Huron and Tawas Bay varies from 30-50 foot depths offshore to less than five feet deep near shore. The Tawas Bay portion of the Baldwin Township shoreline is protected, to some extent, from northeasterly and easterly storms by Tawas Point.

The majority of the Baldwin Township shoreline on Lake Huron is exposed from the northeast to a fetch of about 180 miles. Ordinary fluctuations of water levels along this shoreline are of the same magnitude and frequency as apply generally to harbors on Lake Huron. The lowest seasonal lake stages usually prevail during the winter months and the highest during the summer

BALDWIN TOWNSHIP LOCATION MAP

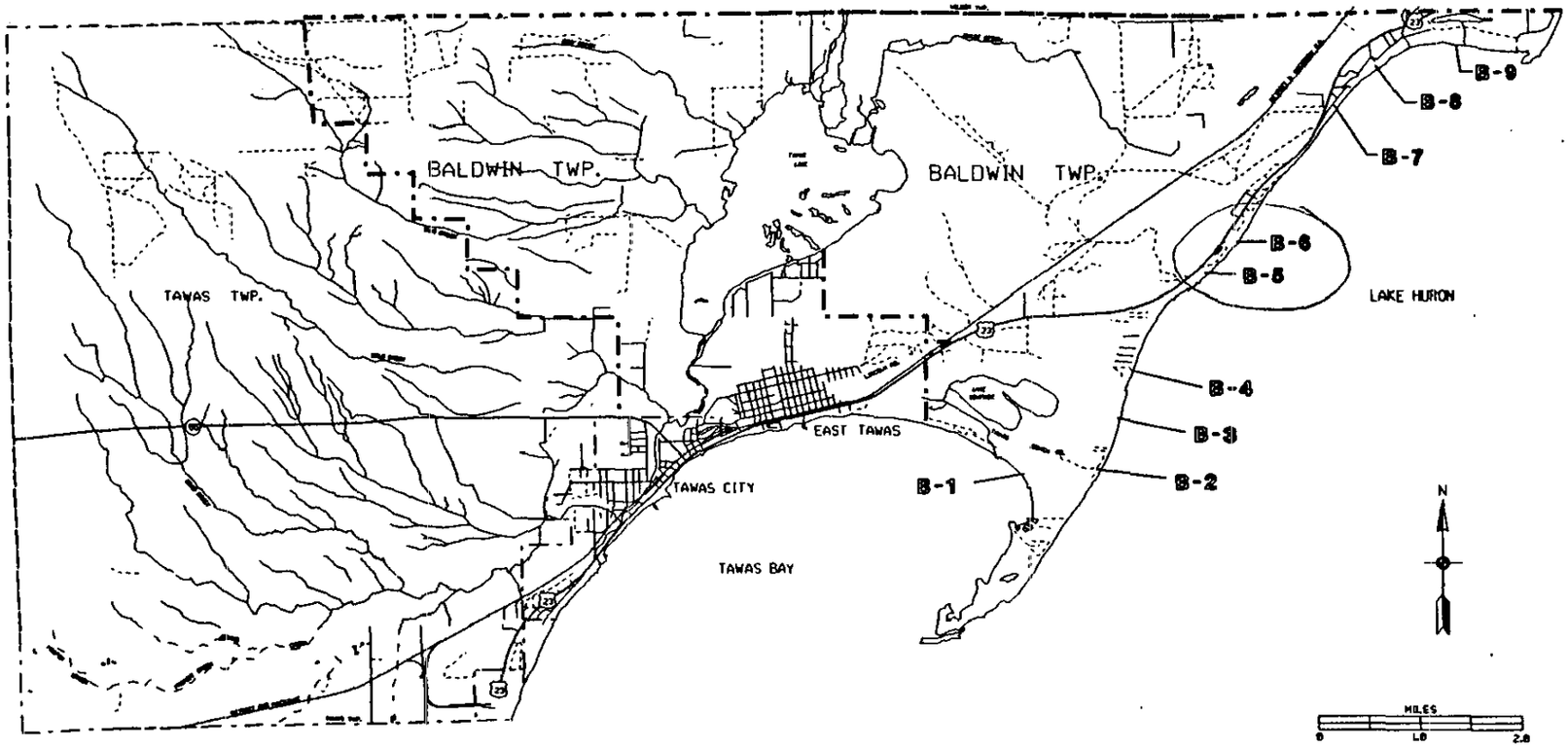


FIGURE 1

months. In the past 100 years, fluctuations of water levels on Lake Huron, as measured by monthly means, have ranged from a minimum of 575.35 feet to a maximum of 581.62 feet (IGLD, 1955).

2.2 Principal Flood Problems

Short-term Lake Huron water level fluctuations are most often due to variations in wind and barometric pressure. Occasionally, a surge of considerable proportions takes place within a few hours, due to strong and persistent northerly or southerly winds.

When lake levels are high and storms occur from the northeast to southwest, Baldwin Township shoreline communities are usually subjected to extreme conditions. Along the Baldwin Township shoreline, substantial flooding has occurred because of the flat topography along the reaches on Lake Huron and Tawas Bay.

3.0 ENGINEERING METHODS

The flood levels established in the U.S. Army Corps of Engineer's September 1989 "Flood Levels Report for Saginaw Bay" and the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" were used to analyze the flooding potential at the nine Baldwin Township FIS sites shown on FIGURE 1. The hydraulic analyses presented herein involved the determination of the wave runup components and maximum wave runup elevations for selected sites.

Input data used for flood calculations include site specific design wave, water depth at the toe of the structure, and wave

period. Additional data such as nearshore profiles, high water marks, and existing conditions, bathymetry and topography, were also analyzed to determine the maximum wave runup elevation at each site. This technical letter report presents the wave runup application procedures for each of the nine FIS sites located in Baldwin Township. Representative profiles for each site are included in APPENDIX A.

4.0 A-Zone and V-Zone Delineations

Reaches of the Baldwin Township shoreline in the surf zone which are subject to significant wave attack are referred to by FEMA as Coastal High Hazard Zones or velocity ("V") Zones. A "V" Zone is the flood insurance rate zone that corresponds to the 100-year coastal floodplain that has additional hazards associated with storm waves. The "V" Zone is defined in FEMA's "Guidelines For Great Lakes Wave Runup Computation And Mapping" as the maximum elevation reached by the wave runup associated with the 100-year flood level. This portion of the shoreline and/or structure is critical in terms of causing significant structural damage. An "A" Zone is the flood insurance rate zone that corresponds to the 100-year flood level that is determined in the FIS using the detailed method. It is further defined as that area that is inundated by the 100-year flood and shoreward of the "V" Zone.

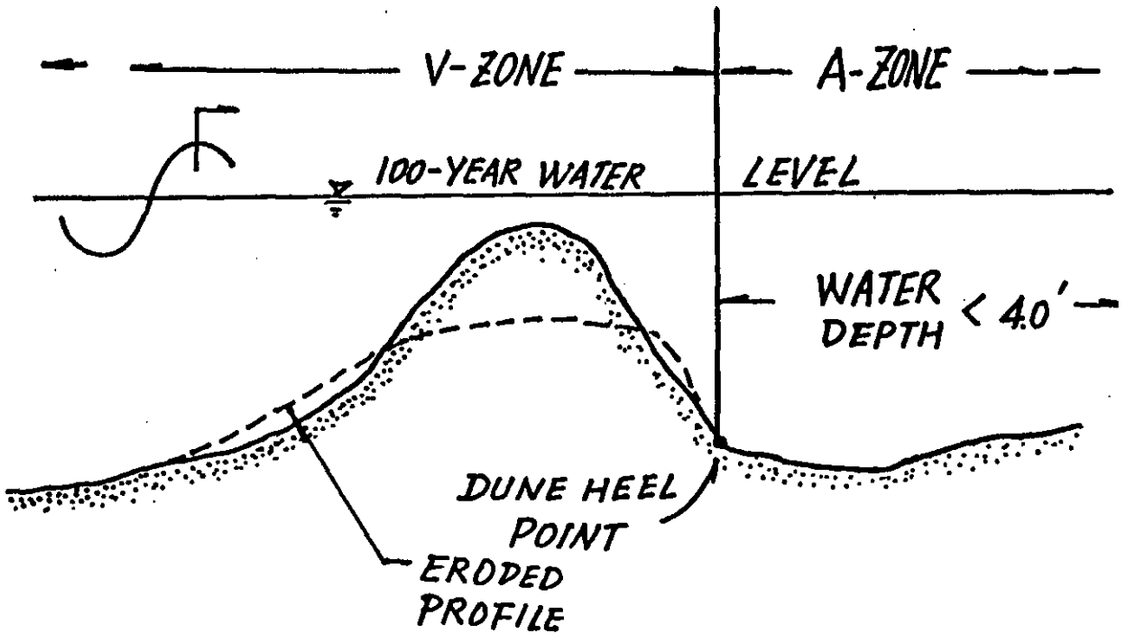
Three different A and V-Zone flood conditions as defined by FEMA, most closely represent the FIS sites in Baldwin Township. The first type of condition involves the flooding or breaching

of an existing beach/dune by the 100-year flood. In this case, the V/A-zone demarcation line is located where the largest 100-year water depth for the flooded area on the landward side of the beach/dune heel point is less than 4 feet. The V-zone is lakeward of this line, while the A-zone is landward. This mapping is considered appropriate for profile Baldwin-1, and is shown on FIGURE 2.

The second flood condition existing along the Baldwin Township shoreline involves a beach/bluff system where wave runup does not overtop the existing beach/bluff. The V/A demarcation line is fixed at the point where the 100-year storm water depth is equal to 4 feet on the lakeward side of the bluff. The A/X demarcation line is fixed at the point where the wave runup intersects the calculated post-storm profile. The V-zone is the maximum elevation reached by wave runup associated with the 100-year flood level. This type of flooding condition is representative of profiles Baldwin-2 thru Baldwin-8 and is shown on FIGURES 3-9. The higher 100-year and 500-year wave runup elevations for the Baldwin-5 and Baldwin-6 profiles shown on TABLE 2 are the result of deeper water depths at the toe of the existing structures and steeper slopes of the existing embankments.

In the last configuration, the beach/bluff is flooded. The largest water depth on the landward side of the beach/bluff crest is equal to or greater than 4 feet. The V/A demarcation line is fixed at the most landward point where the 100-year storm water

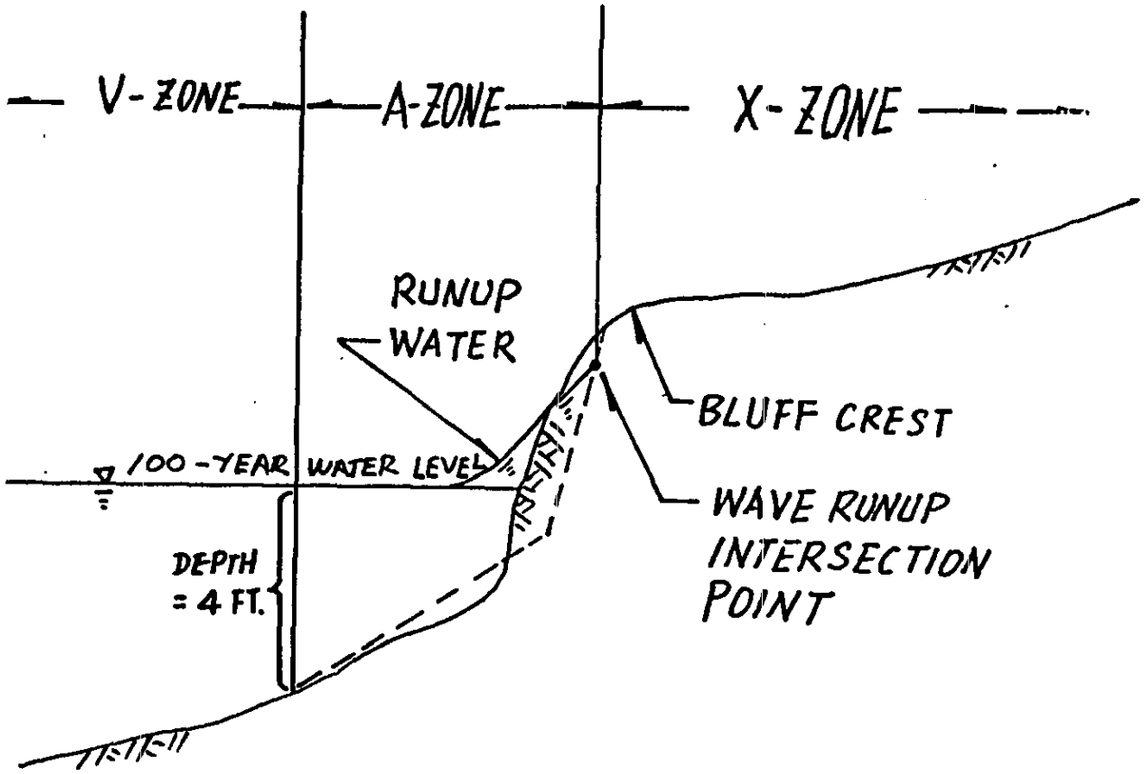
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-1

FIGURE 2

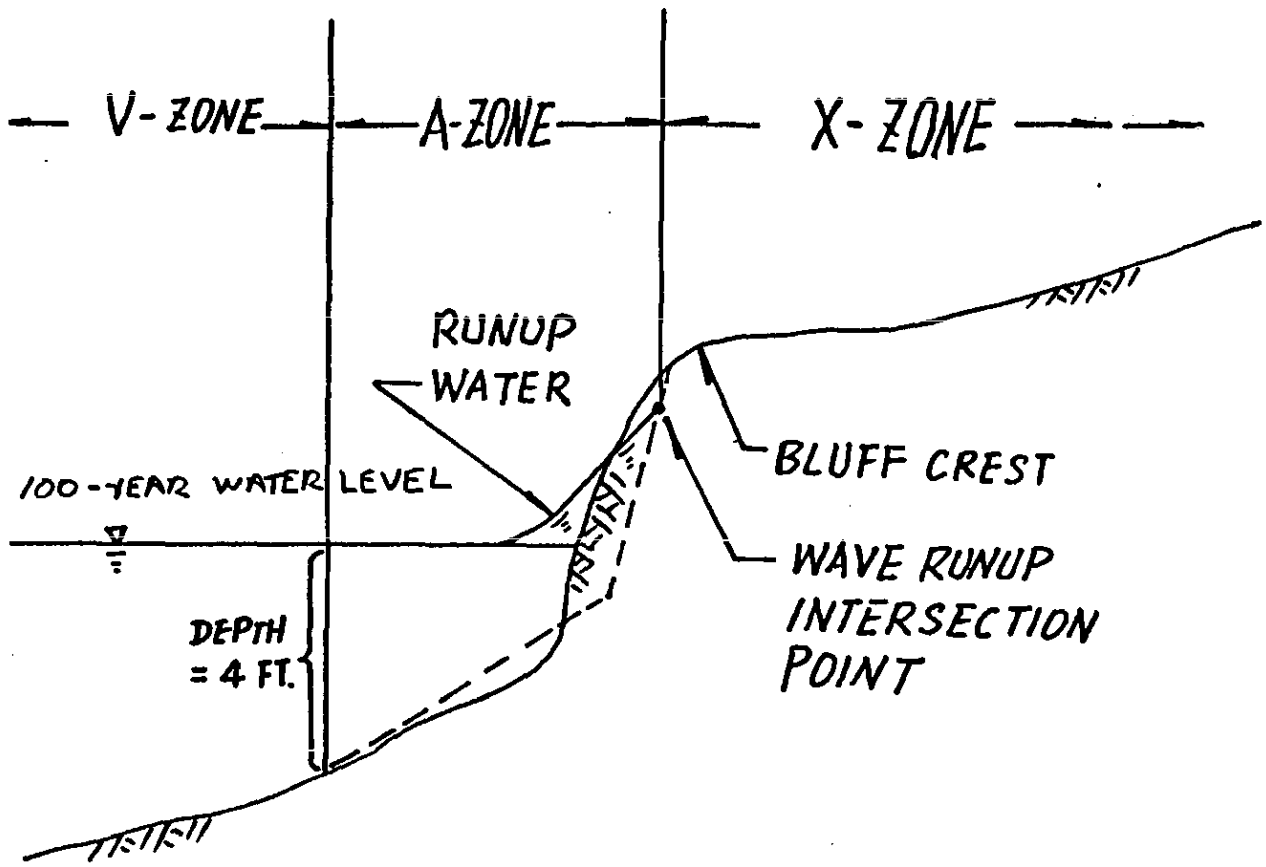
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-2

FIGURE 3

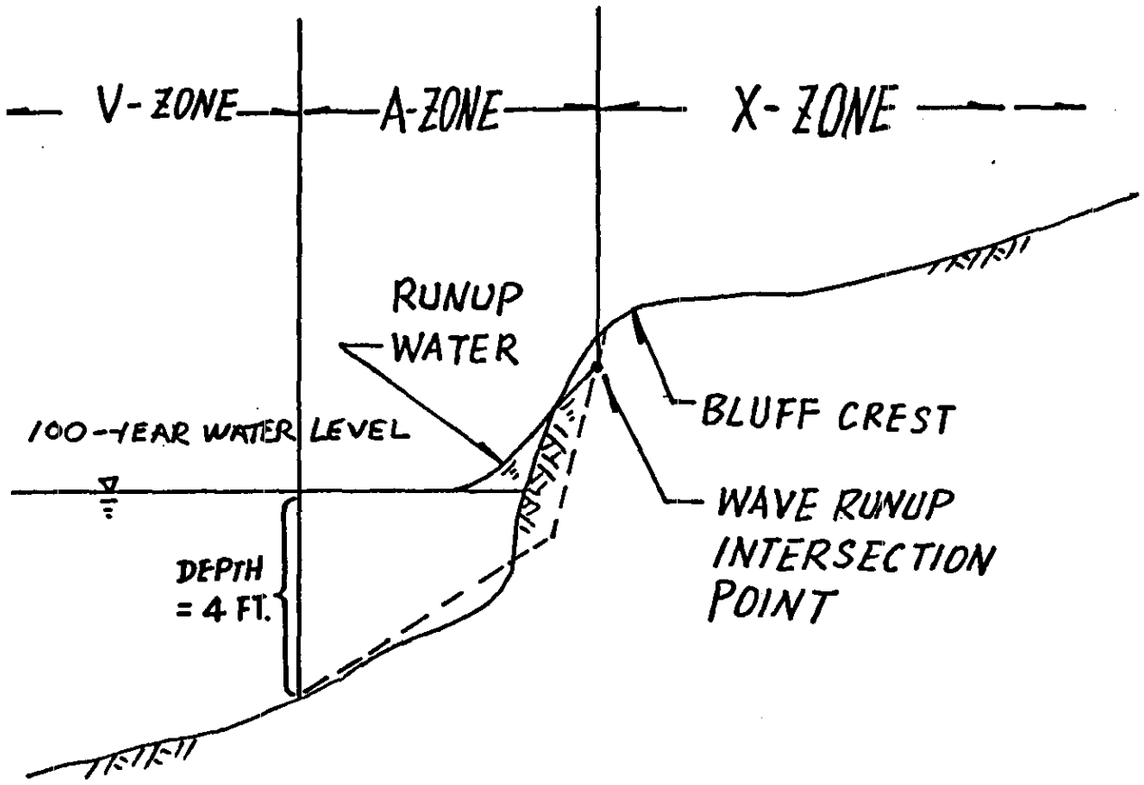
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-3

FIGURE 4

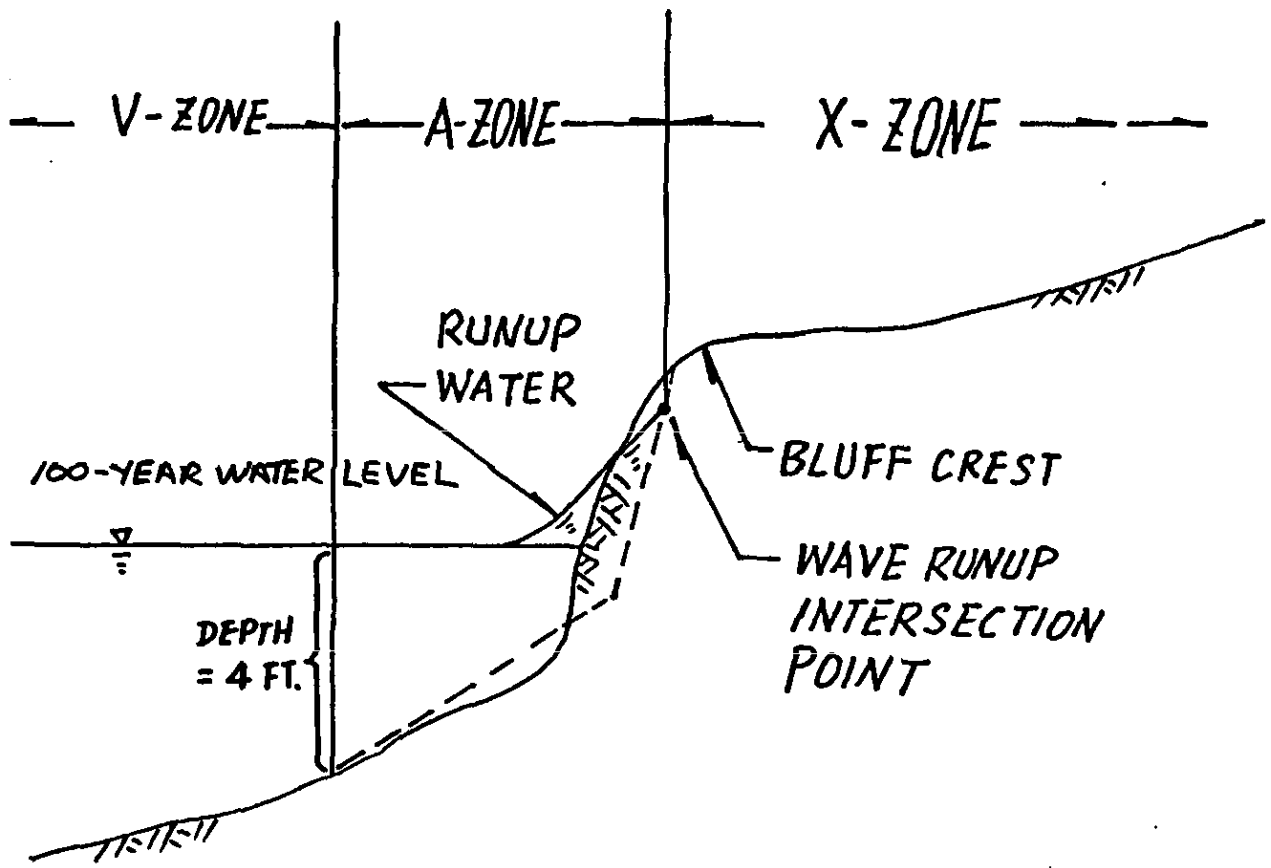
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-4

FIGURE 5

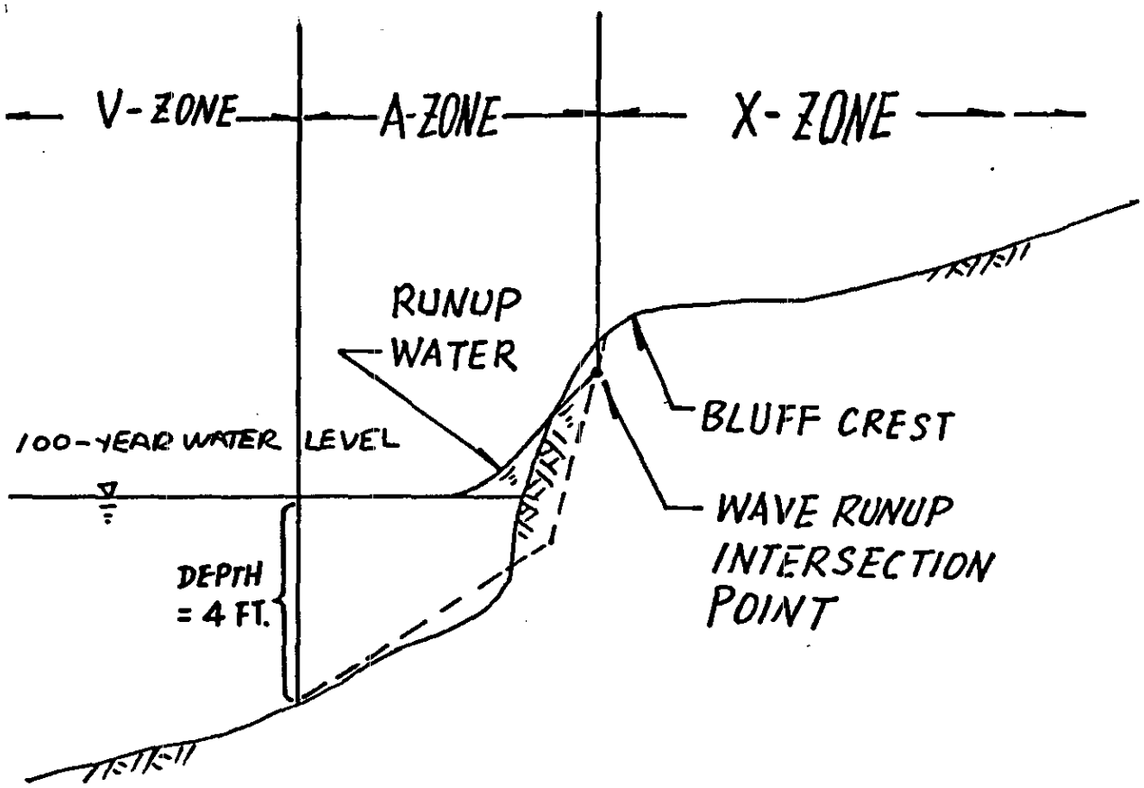
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-5

FIGURE 6

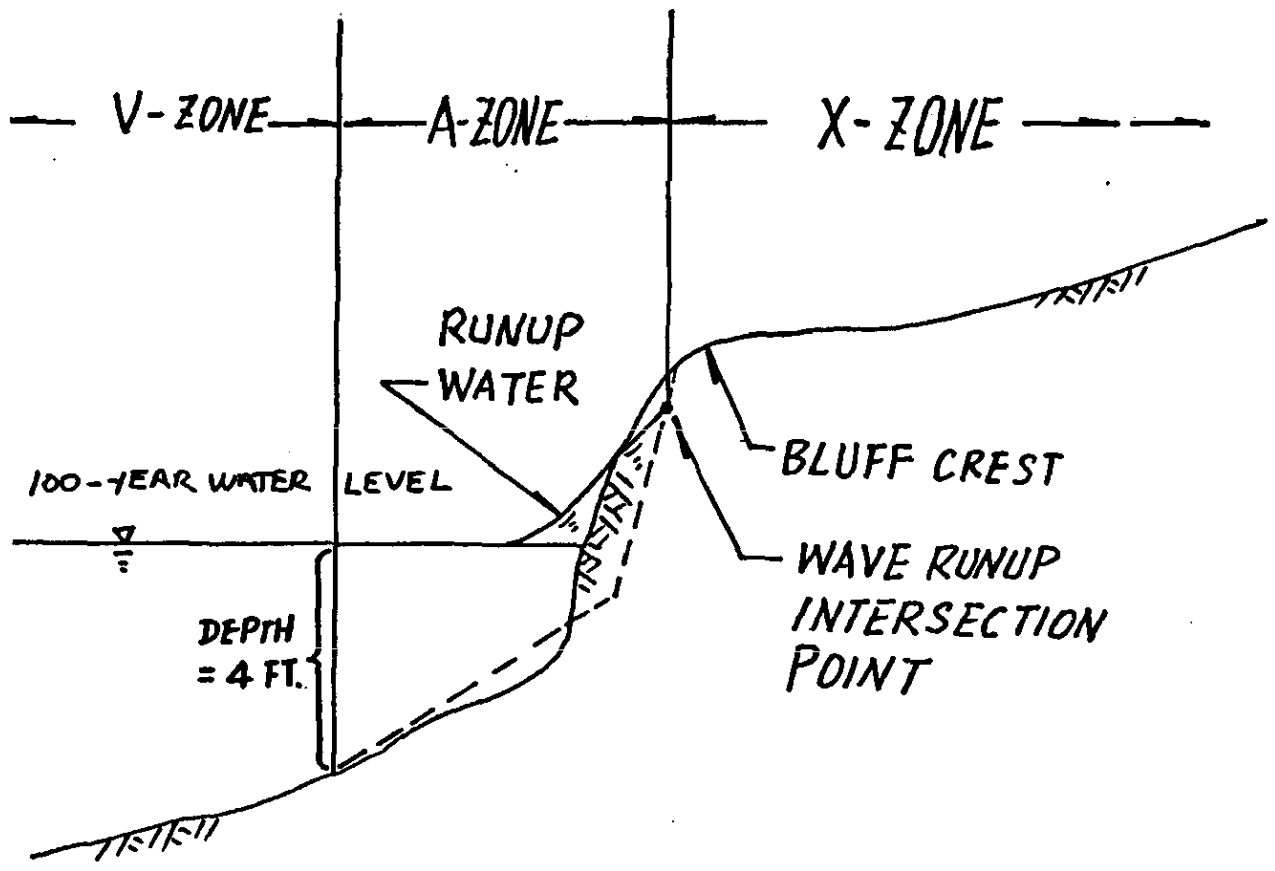
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-6

FIGURE 7

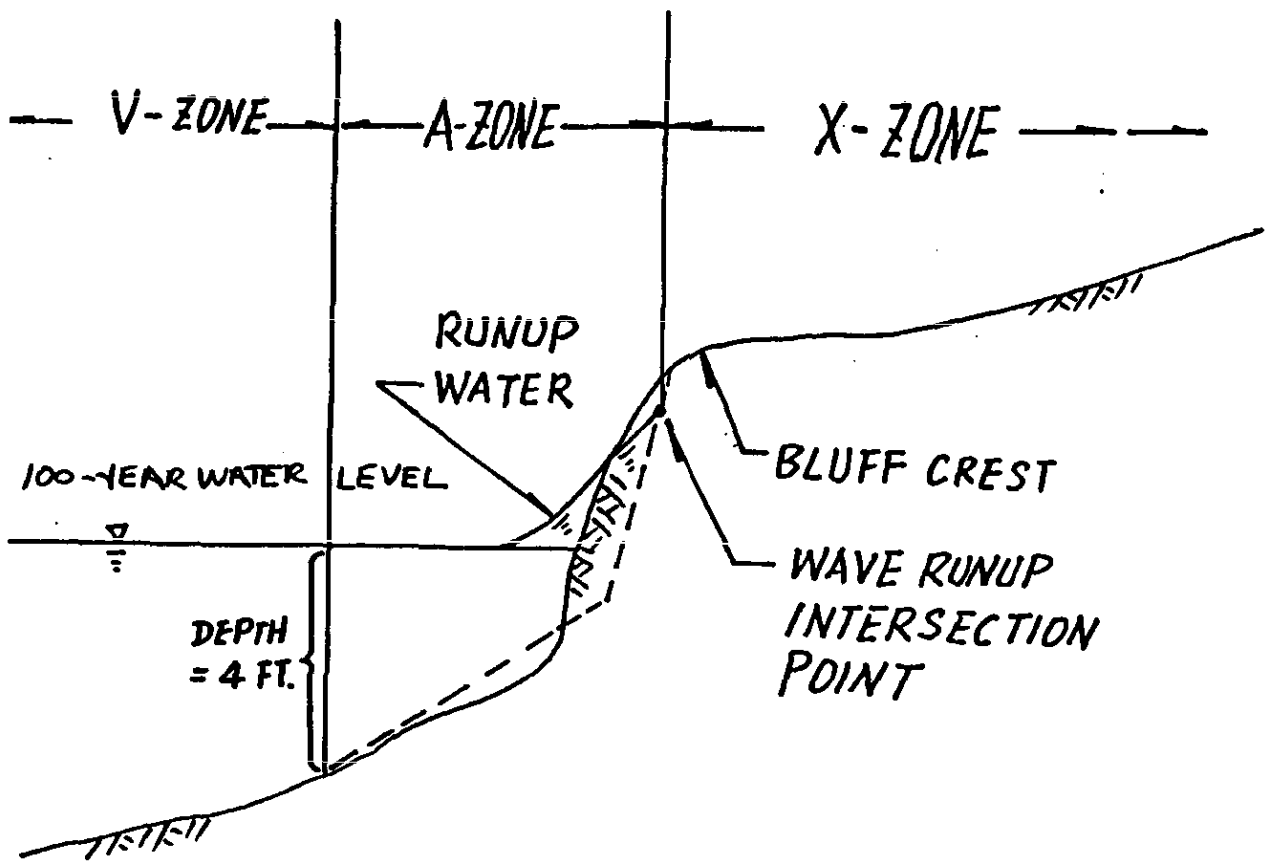
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-7

FIGURE 8

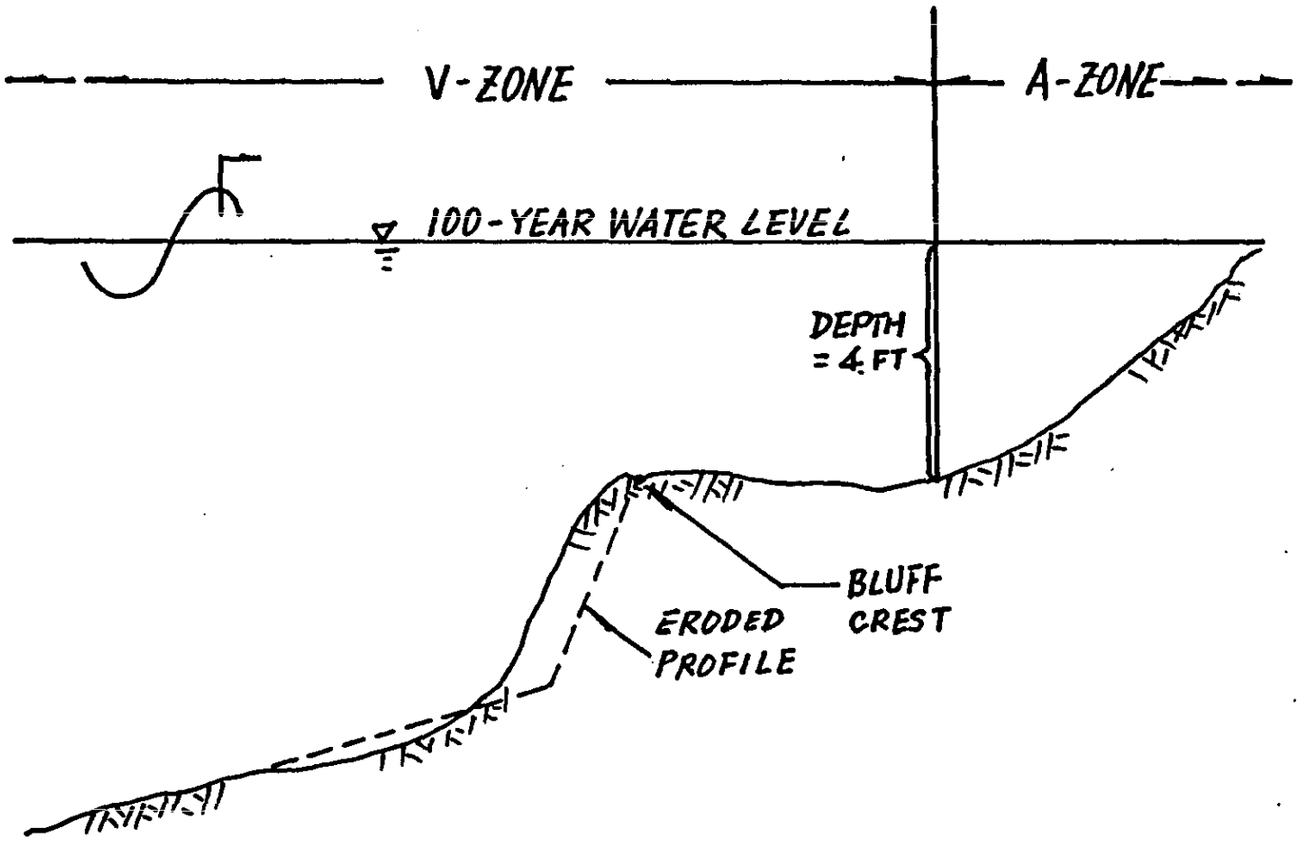
BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/BLUFF SYSTEM



Baldwin-9

FIGURE 9

BALDWIN TOWNSHIP A & V ZONE DELINEATIONS ON A BEACH/DUNE SYSTEM



Baldwin-9

FIGURE 10

level is equal to 4 feet. FIGURE 10 depicts this condition, which is representative of Baldwin-9.

The "A" and "V" Zones for these sites have been delineated according to FEMA's Guidelines for Great Lakes Wave Runup Computation and Mapping and are shown on the attached work maps.

The formal submittal of the Baldwin Township study will include original mylar copies showing sufficient detail for submittal to FEMA's technical review contractor.

5.0 CONCLUSIONS

For each of the Baldwin Township sites where the 100-year and 500-year flood levels inundate shoreline property, the inundated area will experience a minimal water depth shoreward of the shoreline protection. This water depth will generate a negligible wave across the property. Therefore, the 100-year and 500-year flood levels will be used to delineate the flood profiles at each site.

Accordingly, where structures protect against flooding, the 100-year and 500-year "A" and "V" Zones, based on wave runup elevations, will be delineated on the work maps in the final FIS for the site. TABLE 2 lists the 100-year and 500-year wave runup elevations for the nine sites.

In conclusion, it is recommended that the delineated 100-year and 500-year flood profiles for the nine Baldwin Township sites included herein be used by FEMA for updating the Baldwin Township FIS.

TABLE 2

WAVE RUNUP ELEVATIONS

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)	500-year Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0 *	584.0	585.0
2. Baldwin-2	0.4	584.4	585.4
3. Baldwin-3	3.0	587.0	588.0
4. Baldwin-4	3.0	587.0	588.0
5. Baldwin-5	10.0	594.0	595.0
6. Baldwin-6	9.0	593.0	594.0
7. Baldwin-7	2.0	586.0	587.0
8. Baldwin-8	2.0	586.0	587.0
9. Baldwin-9	2.0	586.0	587.0

* NOTE: No wave runup computed since shoreline is completely inundated by the 100- and 500-year flood levels obtained from the September 1989 "Flood Levels Report for Saginaw Bay"

6.0 GLOSSARY

Annual Maximum Instantaneous Water Level: The highest water level that was recorded during a year by a gage with a sampling frequency of an hour or less.

A-Zone: The Flood Insurance Rate Zone that corresponds to the 100-year floodplain that is determined in the Flood Insurance Study by detailed methods.

AO-Zone: The Flood Insurance Rate Zone that corresponds to the inland termination point of water overtopping a beach and/or dune condition.

Beach: The zone of sedimentary material that extends landward from the low water line to the place where there is a marked change in material or form, or to the line of permanent vegetation.

Bluff: A high, steep bank composed of erodible materials.

Floodplain: The area adjoining a river, stream, watercourse, ocean, lake or other body of standing water that has been or may be covered by floodwater.

International Great Lakes Datum (IGLD): Common reference datum for the Great Lakes area established in 1955 based on mean water level in the St. Lawrence River at Father Point, Quebec (near Atlantic Ocean).

Runup: The rush of water up a beach or structure from the breaking of a wave. Also, the vertical height of uprush above the still-water level.

Still-water level: The elevation that the water surface would assume if all wave action were absent.

Storm-water level: The rise above the normal water level on the open-coast, due to wind stress on the water surface.

V-Zone: The maximum elevation reached by the wave runup associated with the 100-year flood level.

Wave height: The vertical distance between the wave crest and the preceding trough.

Wave setup: The superelevation of the water surface over normal surge elevation due to the onshore mass transport of the water by wave action alone.

Wind setup: The vertical rise in the still-water level on the leeward side of a body of water caused by wind stresses on the surface of the water.

X-Zone: The Flood Insurance Rate Zone that corresponds to the landward side of a dune heel point.

7.0 REFERENCES

1. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Vicksburg, MS, "Shore Protection Manual," Volumes I & II, 1984.

2. U.S. Army Corps of Engineers, Detroit District, "Phase I, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

3. U.S. Army Corps of Engineers, Detroit District, "Phase II, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

4. U.S. Army Corps of Engineers, Detroit District, "Appendices, Revised Report on Great Lakes Open-Coast Flood Levels," April 1988.

5. U.S. Army Corps of Engineers, Coordinating Committee on Great Lakes Basin Hydraulic and Hydrologic Data, "History of Water Level Gauges, Upper Great Lakes and the St. Clair - Detroit Rivers," January 1978.

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7. U.S. Army Corps of Engineers, Detroit District, "Flood Levels Report - Saginaw Bay," September 1989.

8. U.S. Army Corps of Engineers, Detroit District, "Flood Levels Report - Anchor Bay," September 1989.

9. Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan, SCHWAB, D.J., and LYNN, E.W., "Great Lakes Storm Surge Planning Program," 1987.

10. U.S. Army Corps of Engineers, Detroit District, "Phase II Report on Great Lakes Flood Levels - Little Bay De Noc," August 1981.

11. U.S. Army Corps of Engineers, Detroit District, "Phase II Report on Great Lakes Flood Levels - Big Bay De Noc", July 1981.

12. FEMA Great Lakes "A" Zone and "V" Zone Delineations

TECHNICAL LETTER REPORT ON BALDWIN TOWNSHIP, MICHIGAN

APPENDIX A

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
October 1990

SYNOPSIS

Appendix A outlines the procedures utilized to calculate the wave runup component and the maximum wave runup elevation associated with the 100-year flood level for the Baldwin Township shoreline. The following list shows the nine Baldwin Township sites and the 100-year wave runup flood profiles. Computations of these elevations are included in this Appendix.

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0	584.0
2. Baldwin-2	0.4	584.4
3. Baldwin-3	2.5	586.5
4. Baldwin-4	2.5	586.5
5. Baldwin-5	10.0	594.0
6. Baldwin-6	7.7	591.7
7. Baldwin-7	1.7	585.7
8. Baldwin-8	1.7	585.7
9. Baldwin-9	0.0	584.0

TABLE 2

WAVE RUNUP ELEVATIONS

Baldwin Township FIS Sites	Computed Wave Runup (ft.)	100-year Wave Wave Runup Elevation (ft., NGVD)
1. Baldwin-1	0.0	584.0
2. Baldwin-2	0.4	584.4
3. Baldwin-3	2.5	586.5
4. Baldwin-4	2.5	586.5
5. Baldwin-5	10.0	594.0
6. Baldwin-6	7.7	591.7
7. Baldwin-7	1.7	585.7
8. Baldwin-8	1.7	585.7
9. Baldwin-9	0.0	584.0

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-2

```
                runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
     water depth at toe:  26.0 feet            1st: significant wave computation
  100-year wave period T:  11.5       (enter per Ref. 3)
                     T':   5.7
                      L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   2.0
                  alpha:   0.0110
                    Hmo:  11.1
                  d bar:   0.0061
                epsilon:   0.0083
                 Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
       Hs in deep water:  11.3                (significant wave)
            beach slope:   0.00430  (tan 30H:1V = 0.03333)
             beach zeta:   0.033               2nd: wave runup computation
            beach runup:   0.4
         runup elevation: 584.4 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-3

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                    T':   5.7
                     L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.1
                 d bar:   0.0061
               epsilon:   0.0083
               Hs/Hmo:    1.015      (enter per Ref. 4, Figure 10)
      Hs in deep water:  11.3                (significant wave)
           beach slope:   0.03000  (tan 30H:1V = 0.03333)
            beach zeta:   0.232              2nd: wave runup computation
           beach runup:   2.5
       runup elevation: 586.5 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-4

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
   water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                    T':   5.7
                     L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.1
                 d bar:   0.0061
               epsilon:   0.0083
               Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
     Hs in deep water:  11.3                (significant wave)
          beach slope:   0.03000  (tan 30H:1V = 0.03333)
           beach zeta:   0.232               2nd: wave runup computation
          beach runup:   2.5
       runup elevation: 586.5 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-6

```
                runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                    T':   5.7
                     L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.1
                 d bar:   0.0061
               epsilon:   0.0083
               Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
      Hs in deep water:  11.3                (significant wave)
           beach slope:   0.09100  (tan 30H:1V = 0.03333)
            beach zeta:   0.704              2nd: wave runup computation
           beach runup:   7.7
        runup elevation: 591.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-7

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
   water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                    T':   5.7
                     L: 332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.1
                 d bar:   0.0061
               epsilon:   0.0083
               Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
      Hs in deep water:  11.3                (significant wave)
           beach slope:   0.02000  (tan 30H:1V = 0.03333)
            beach zeta:   0.155              2nd: wave runup computation
           beach runup:   1.7
        runup elevation: 585.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION
WAVE RUNUP AT BALDWIN TOWNSHIP, BALDWIN-8

```
                runup on:  beach
        100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.5        (enter per Ref. 3)
                    T':   5.7
                     L:  332.48
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.1
                 d bar:   0.0061
               epsilon:   0.0083
               Hs/Hmo:   1.015      (enter per Ref. 4, Figure 10)
      Hs in deep water:  11.3                (significant wave)
           beach slope:   0.02000  (tan 30H:1V = 0.03333)
            beach zeta:   0.155              2nd: wave runup computation
           beach runup:   1.7
       runup elevation: 585.7 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

FIS PROFILE
BALDWIN - 1

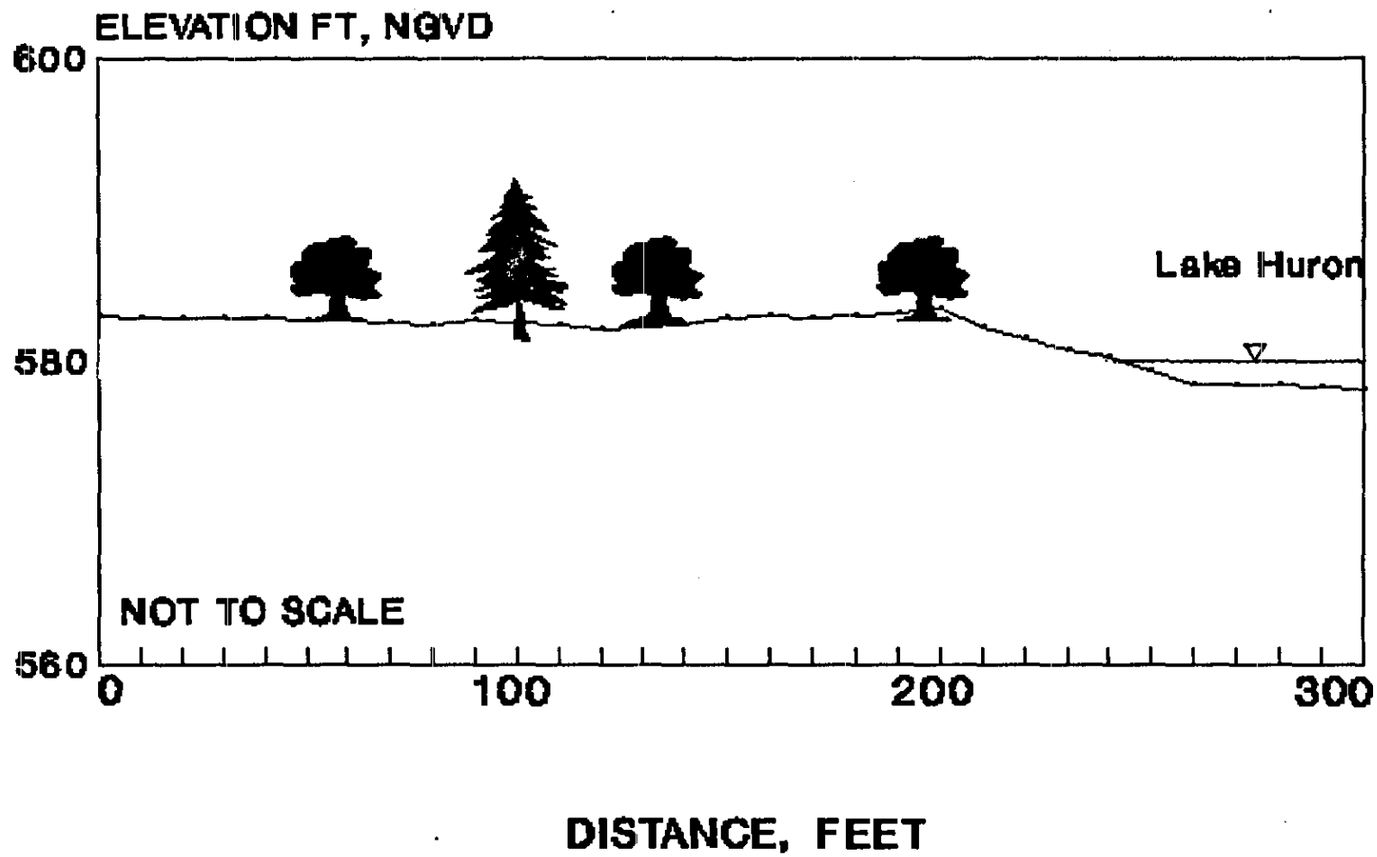

FIGURE B-1

FIS PROFILE
BALDWIN - 2

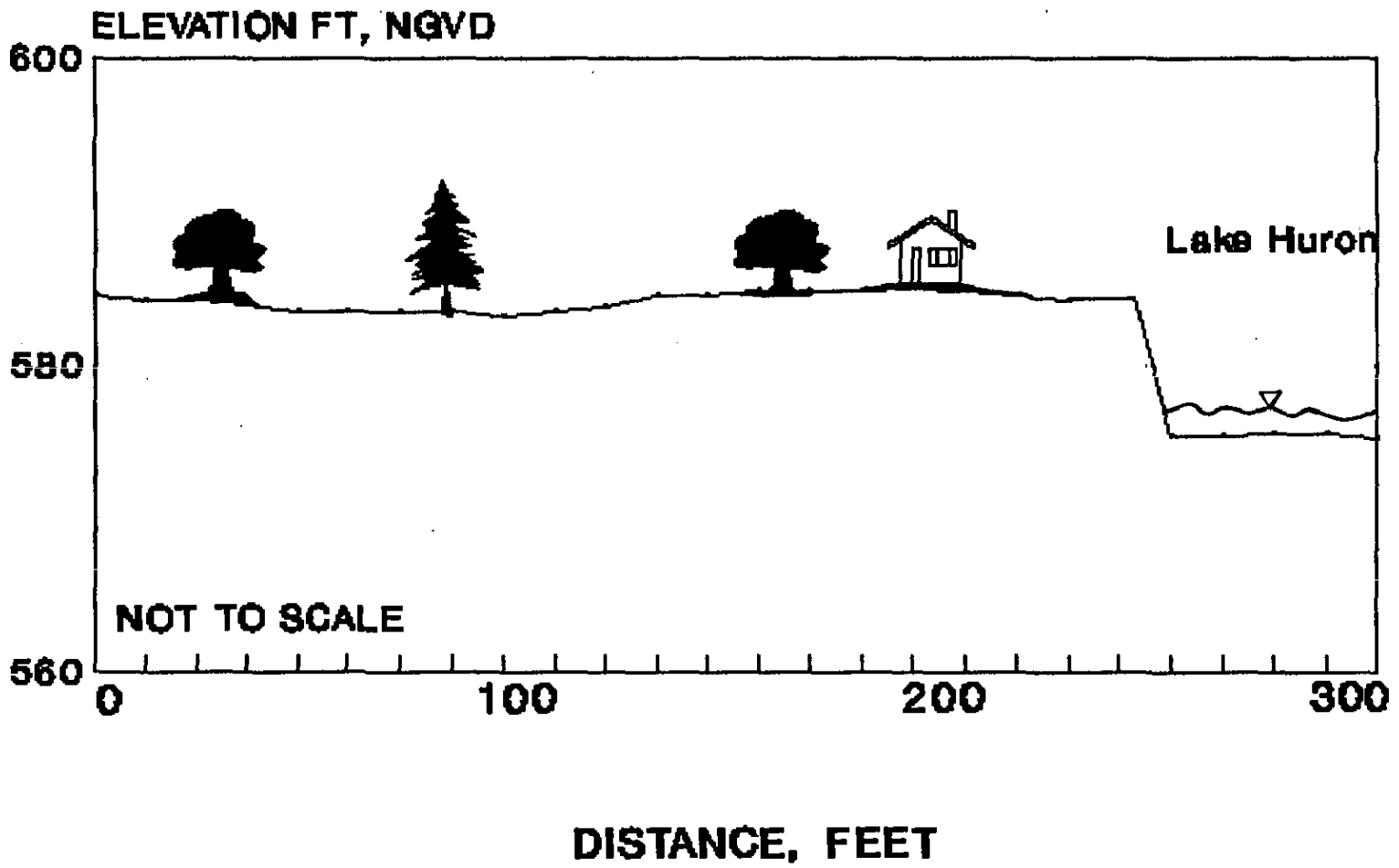

FIGURE B-2

FIS PROFILE
BALDWIN - 3

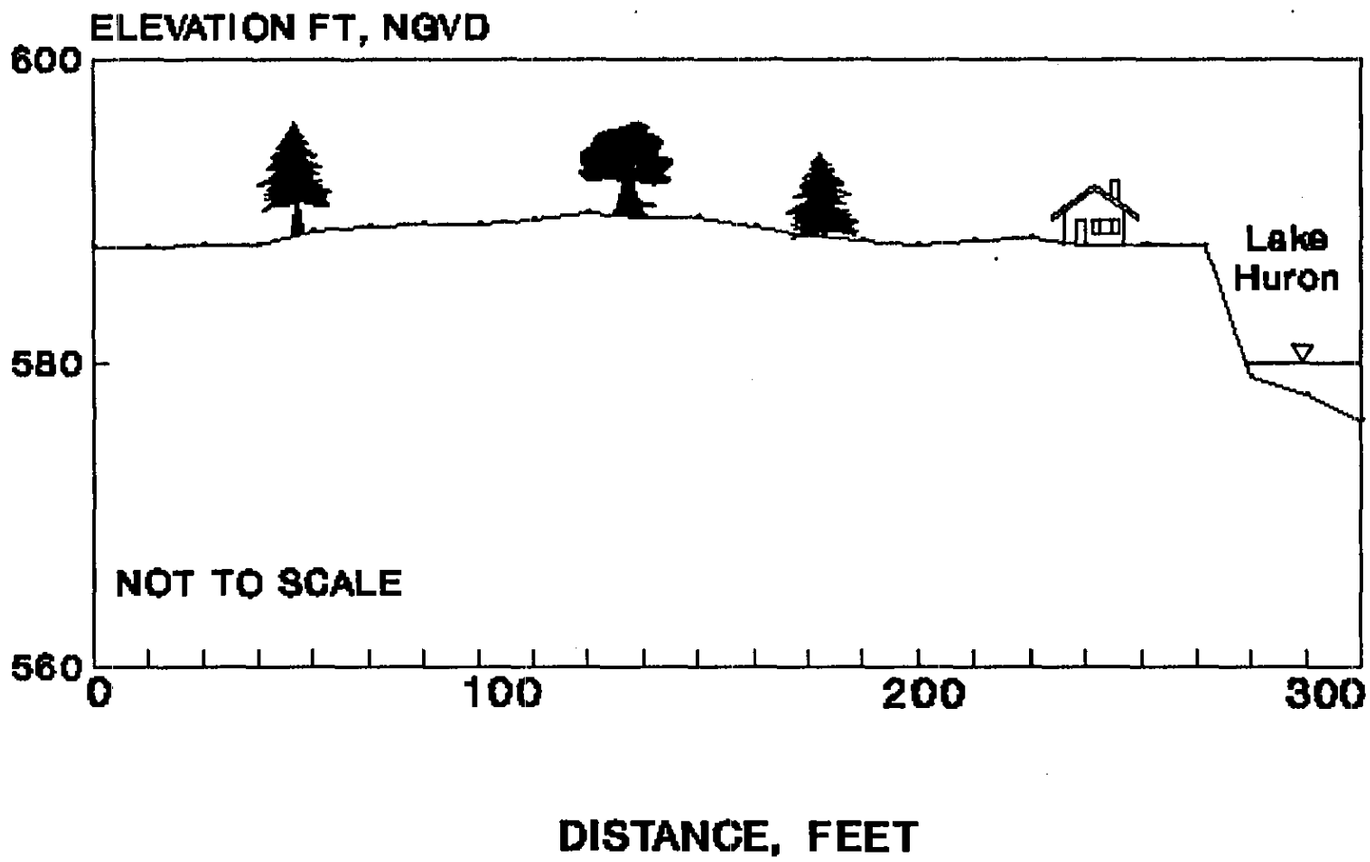

FIGURE B-3

FIS PROFILE
BALDWIN - 4

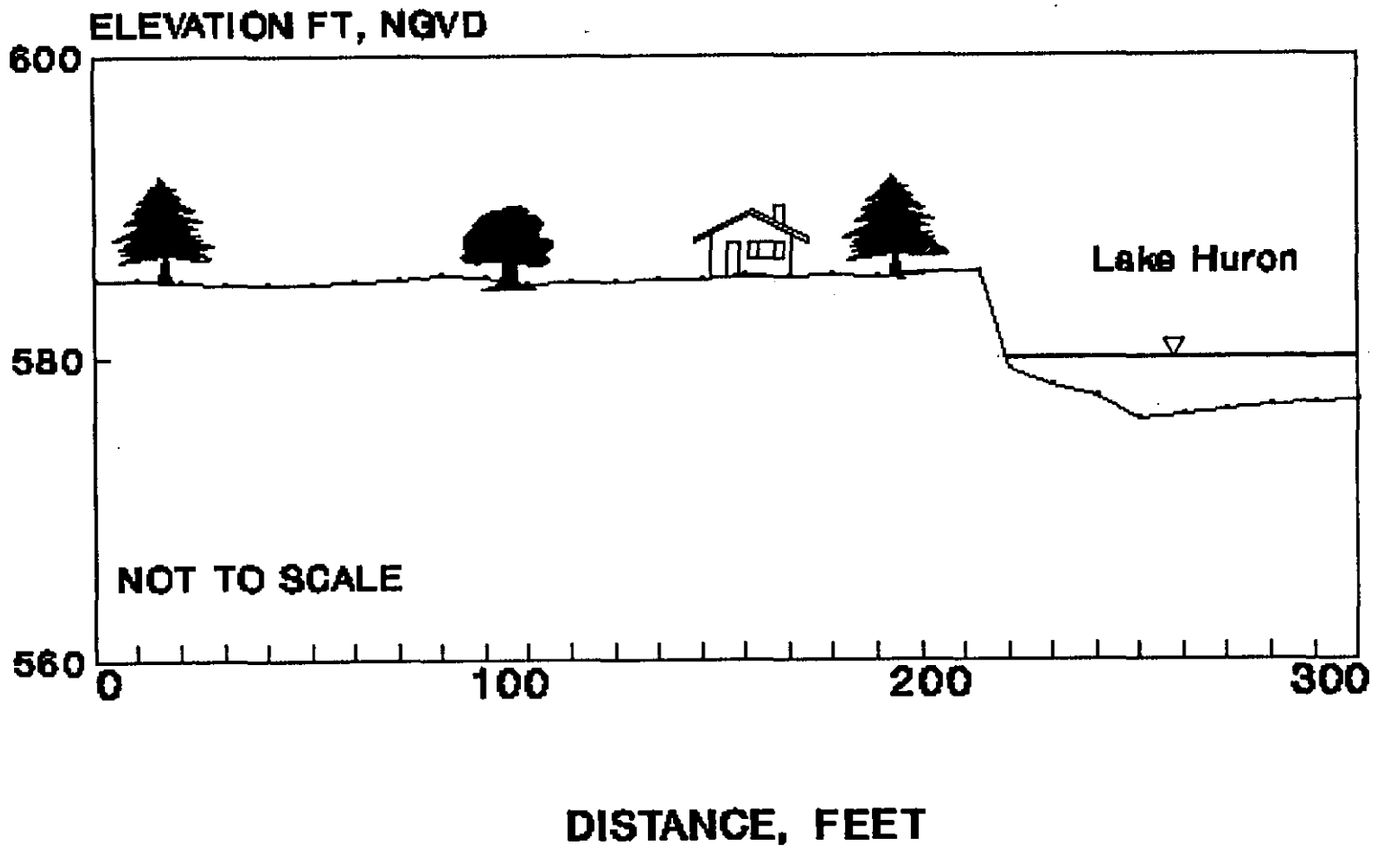

FIGURE B-4

FIS PROFILE
BALDWIN - 5

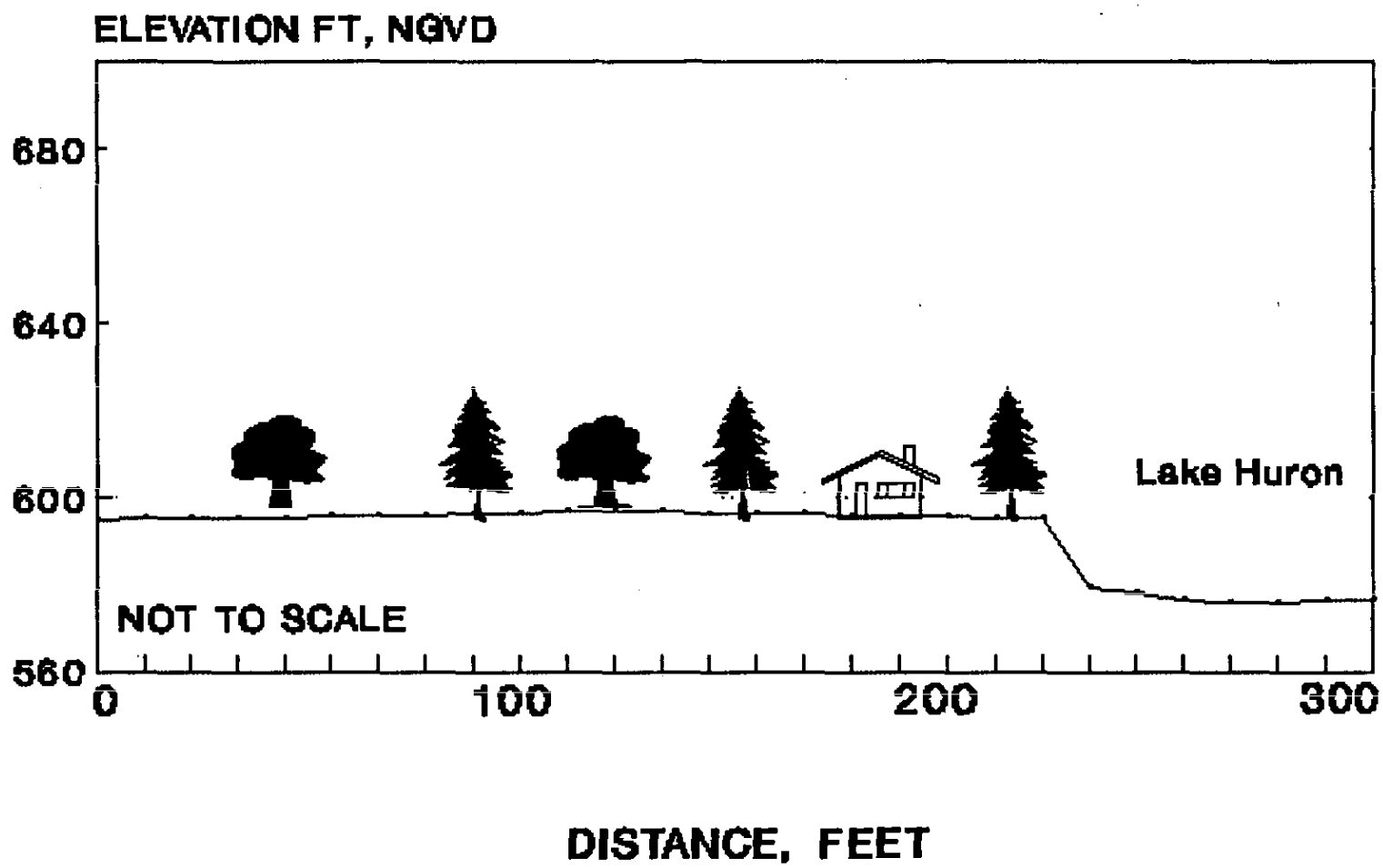

FIGURE B-5

FIS PROFILE
BALDWIN - 6

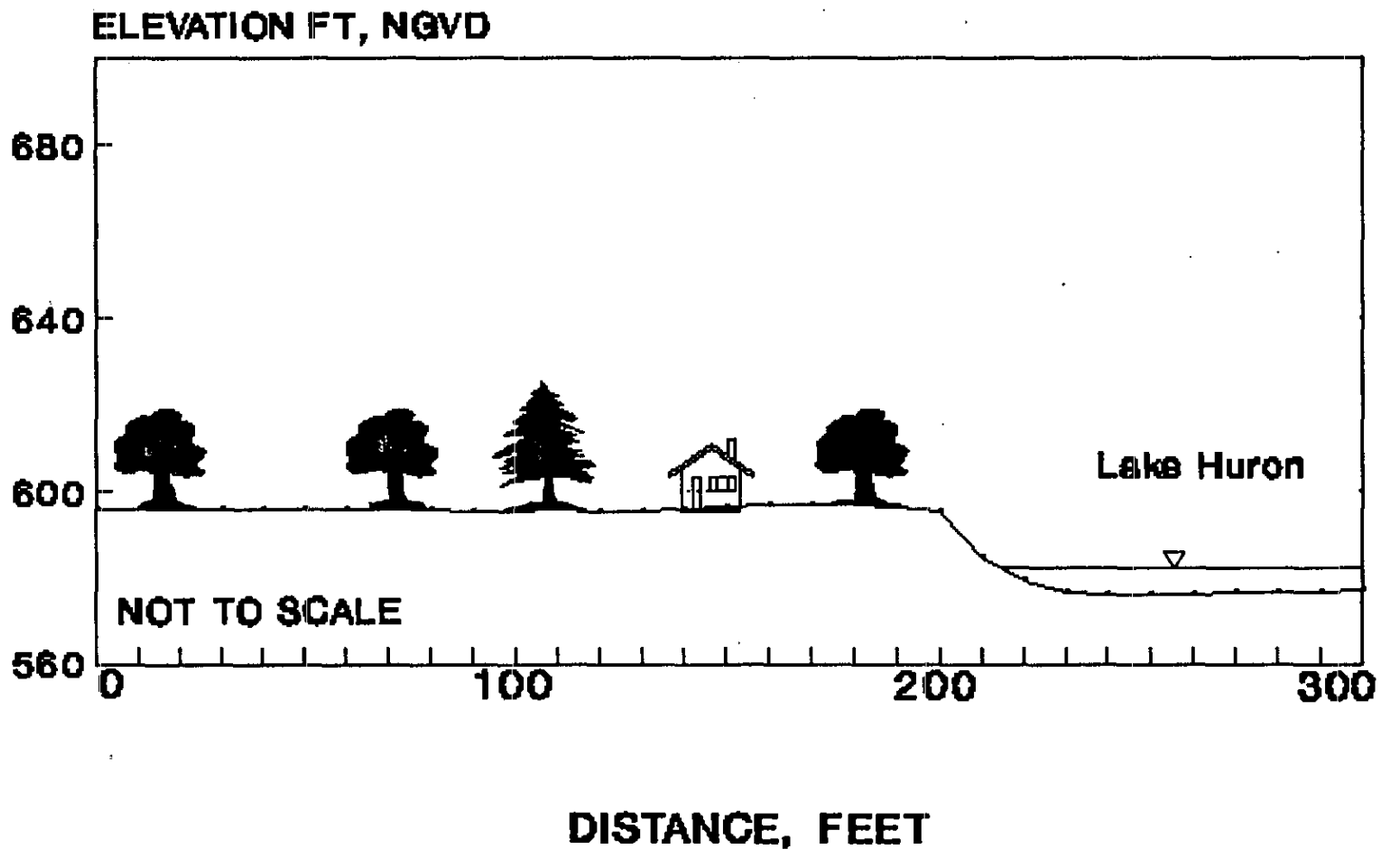

FIGURE B-6

FIS PROFILE
BALDWIN - 7

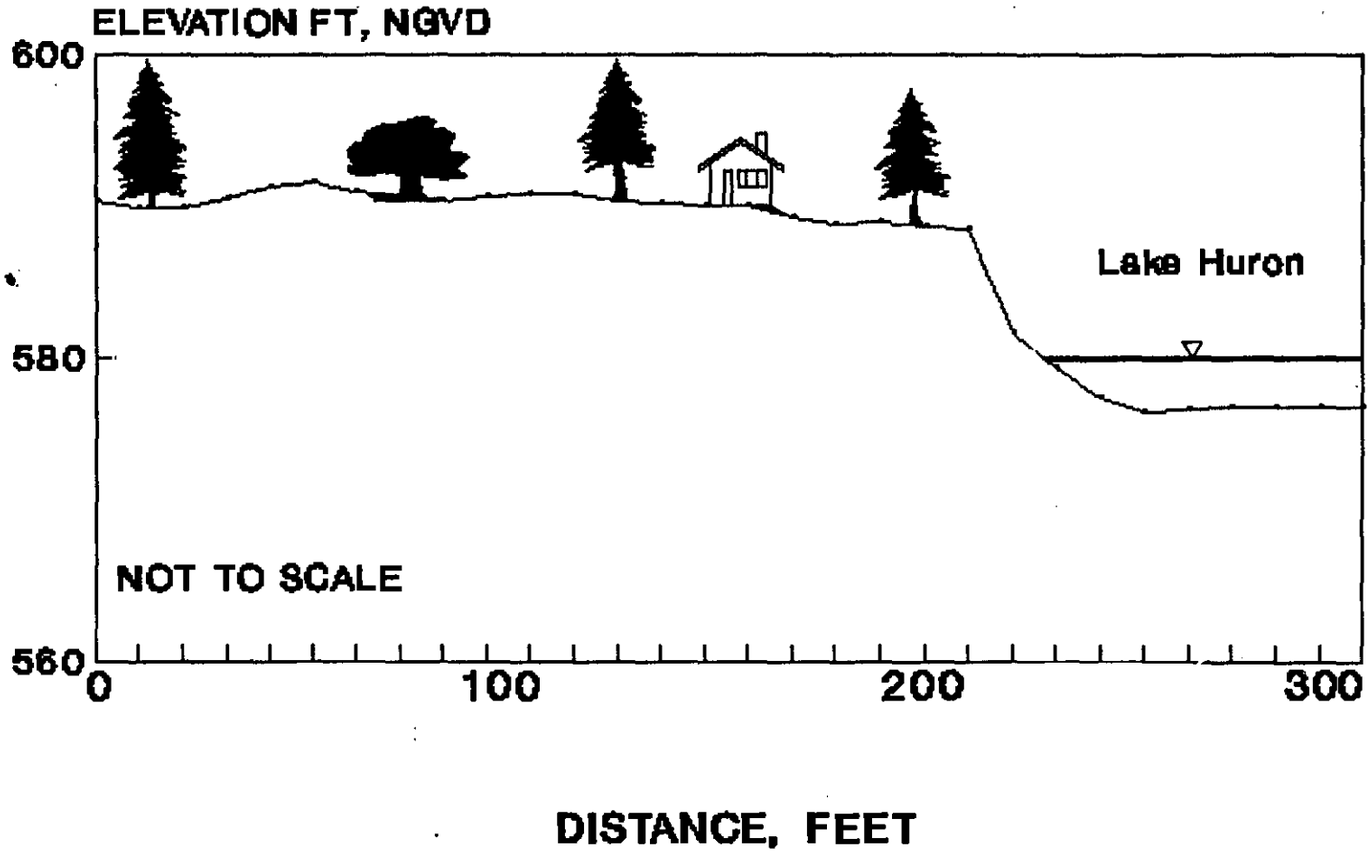

FIGURE B-7

FIS PROFILE
BALDWIN - 8

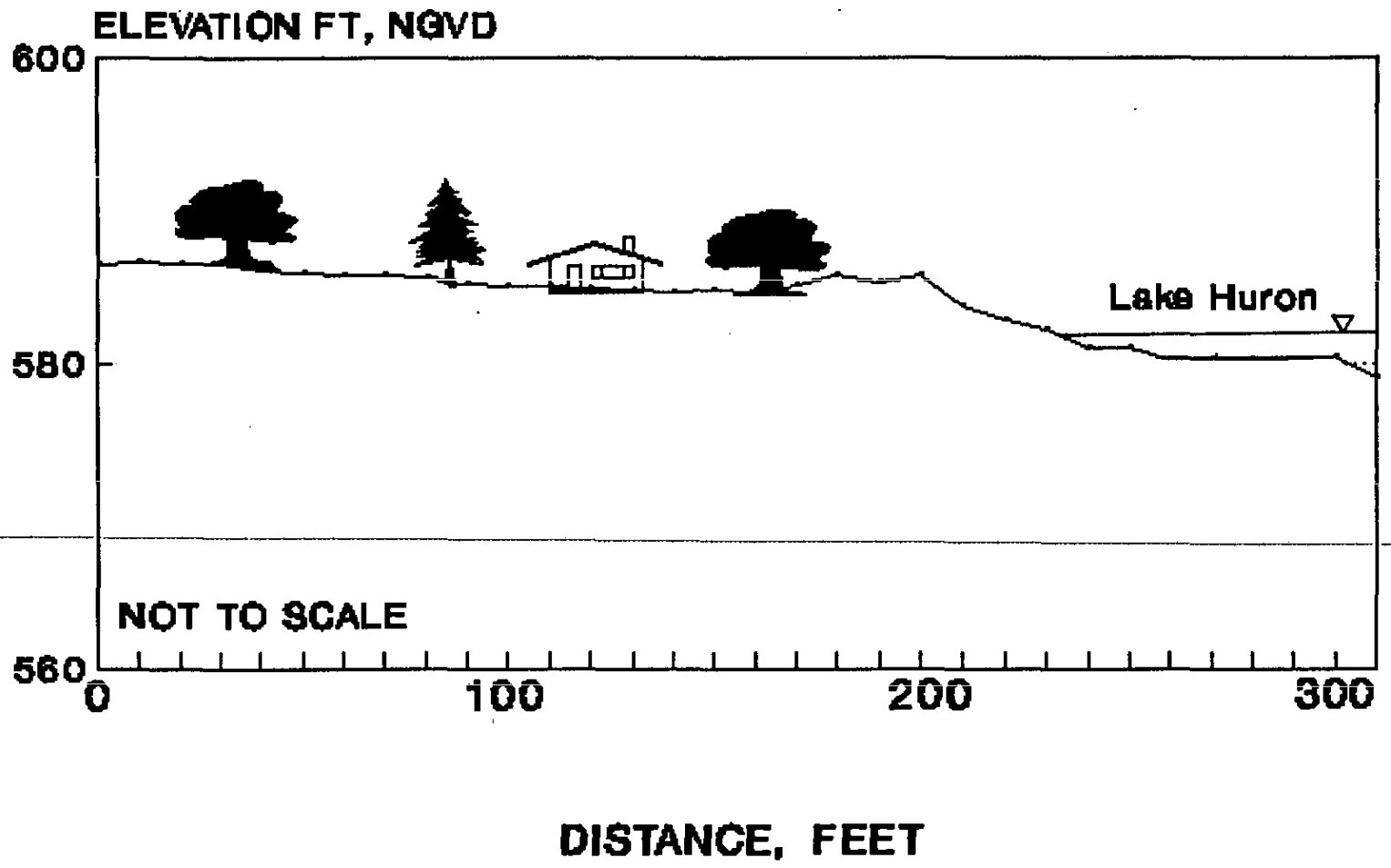

FIGURE B-8

FIS PROFILE
BALDWIN - 9

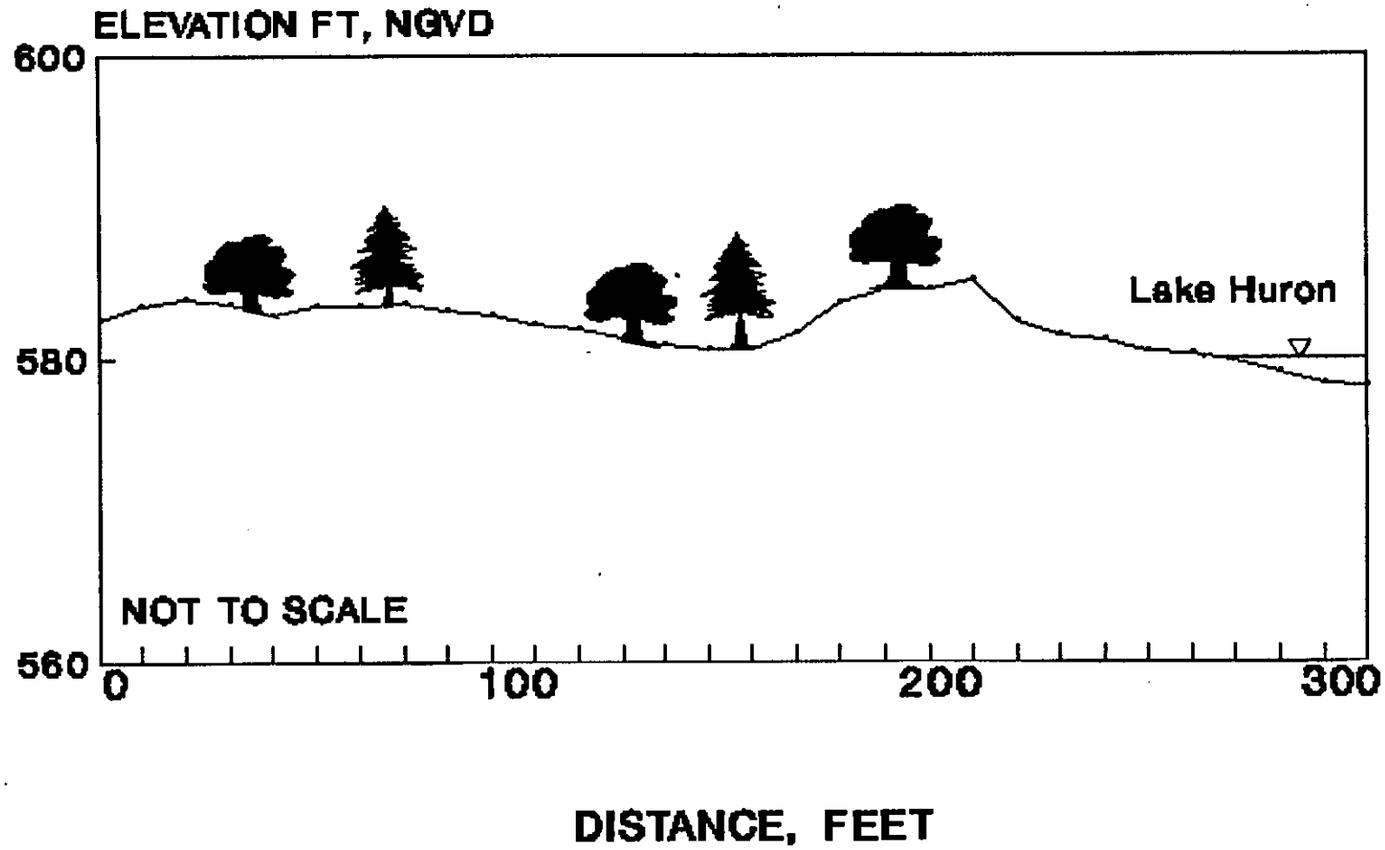

FIGURE B-9

FLOOD INSURANCE STUDY

TOWNSHIP OF BALDWIN, MICHIGAN
IOSCO COUNTY

REVISED
PRELIMINARY

REVISED:

Federal Emergency Management Agency

COMMUNITY NUMBER -260099

JUN 0 4 1992

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

TOWNSHIP OF BALDWIN,
IOSCO COUNTY,
MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Rate Map for the Township of Baldwin, Iosco County, Michigan (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Detroit District (the Study Contractor), for the Federal Emergency Management Agency (FEMA) under Interagency Agreement No. EMW-90-E-3263, Project Order No. 2. This study was completed in February 1991.

1.3 Coordination

On September 25, 1989, an initial coordination meeting was held with representatives of FEMA, the Michigan Department of Natural Resources (MDNR), the Township of Baldwin, and the Study Contractor. The technical results of this study were reviewed and approved by the MDNR, the State coordinating agency, and FEMA.

On , the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Township of Baldwin, Iosco County, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

A detailed coastal flooding analysis was performed on the entire coastline of the Township of Baldwin, where the flooding sources are Lake Huron, Tawas Bay, and Saginaw Bay.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Insurance Rate Map for the Township of Baldwin (Reference 1), and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through February 1996. The scope and methods of study were proposed to and agreed upon by FEMA and the community.

2.2 Community Description

The Township of Baldwin is located in the east-central portion of Iosco County, in the north-central part of Michigan's lower peninsula. The total land area contained within the township limits is 26.0 square miles. The community is bordered on the north by the Townships of Wilber and Au Sable, Michigan; on the west by the Township of Tawas, Michigan; on the southwest by the City of Tawas, Michigan; and on the east by Lake Huron. The 1980 population of the Township of Baldwin was reported to be 1,393 (Reference 2).

The climate of the Township of Baldwin is modified somewhat by Lake Huron. The lake provides a cooling effect during the summer months and a warming influence during the winter months. July is normally the warmest month, with a mean monthly temperature of 69.1 degrees Fahrenheit (^{o}F); whereas January is the coldest month, with a mean monthly temperature of 20.8^{o}F. The mean annual temperature from 1951 to 1975 was 45.6^{o}F. The record high for this period at the Township of Baldwin was 102°F on August 21, 1955; the record low was -37°F on January 30, 1951. Precipitation is distributed fairly equally throughout the year. The average annual precipitation is about 34.15 inches. August, with an average of 12.80 inches, is the wettest month, while February, with a 3.34-inch average, is the driest month (Reference 3).

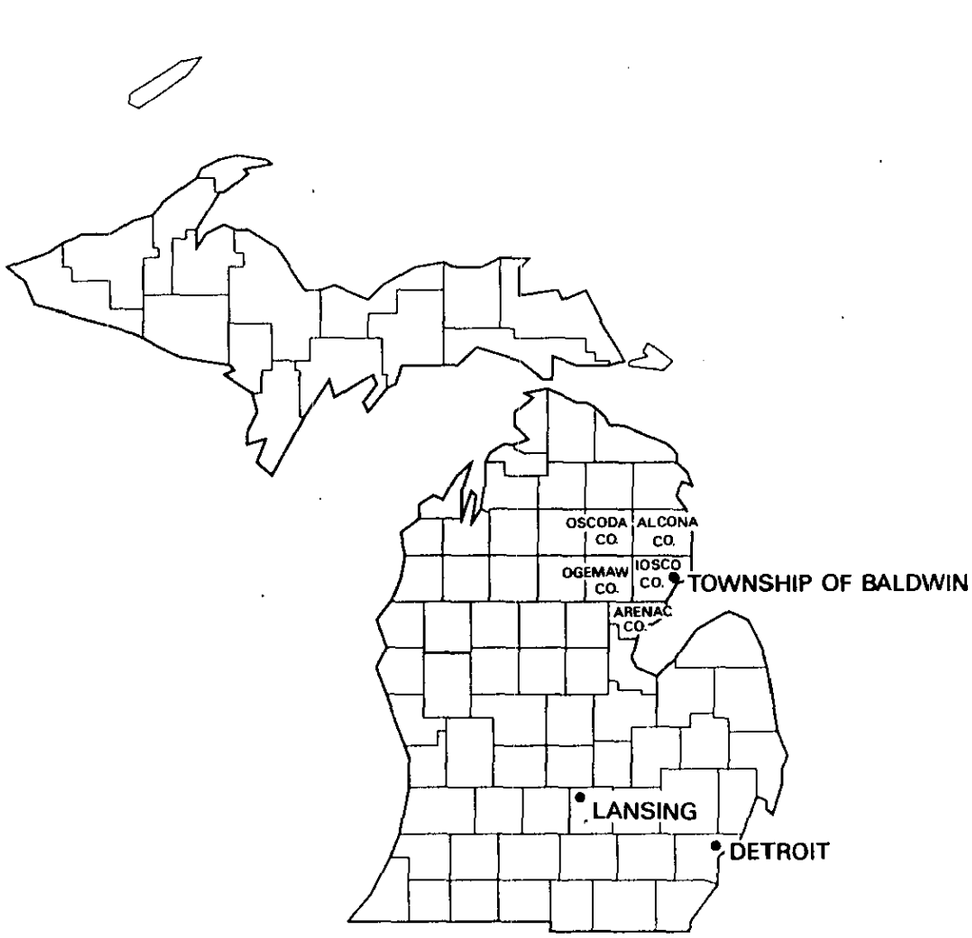

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

VICINITY MAP

Soil material in the Township of Baldwin varies greatly and ranges from clay to very coarse sand. Most of the soils of the community are poorly drained (Reference 4).

Bathymetry in Lake Huron and Tawas Bay varied from 30- to 50-foot depths offshore to less than 5 feet deep close to shore. In the Township of Baldwin, the Tawas Bay shoreline is protected to some extent from northeasterly and easterly storms by Tawas Point.

The majority of the shoreline of the township is exposed on the northeast to a fetch of about 180 miles. Ordinary fluctuations of water levels along this shoreline are of the same magnitude and frequency as generally apply to harbors on Lake Huron. The lowest lake stages usually prevail during the winter months and the highest during the summer months. Since 1900, the monthly mean water levels on Lake Huron have ranged from a minimum of 576.55 feet National Geodetic Vertical Datum of 1929 (NGVD) to a maximum of 582.82 feet NGVD.

Development in the floodplains of both Lake Huron and Tawas Bay has been relatively minor.

2.3 Principal Flood Problems

The shoreline of the Township of Baldwin is subject to severe wind and wave conditions during a large percentage of the time. When lake levels are high and storms occur from the northeast to southwest, shoreline communities located in the Township of Baldwin are usually subjected to extreme conditions.

Due to the relatively flat topography of the township along the shoreline of Lake Huron and Tawas Bay, substantial flooding has occurred, and will continue to occur, in this area during high bay stages.

Levels on Lake Huron are affected by three types of fluctuations: long-term, seasonal, and short-term. Long-term fluctuations are principally caused by persistent high or low water-supply conditions within the Great Lakes basin. Flooding can occur along the shoreline as a result of several consecutive years of above-average precipitation. This study is primarily concerned with long-term fluctuations combined with seasonal and short-term variations of the lake levels. Seasonal fluctuations are reflected by the occurrence of high lake levels in the spring, when runoff increases due to snowmelt, and because of low rates of evaporation from the lake and evapotranspiration from the land surface. However, because of the sluggish hydrologic response of the large bodies of water involved, peak seasonal levels usually do not occur until July. Short-term fluctuations in lake levels can be caused by strong winds and by sharp differences in barometric pressure. The winds drive surface water in great volumes toward the shore, thus raising the water level at one

side of the lake while lowering the water level at the other side. This phenomenon is termed a "seiche."

As a result of record high levels on Lake Huron in 1985-86, combined with periodic strong winds, portions of the shoreline of the Township of Baldwin frequently incurred flooding during this period. Additionally, the low-lying, floodprone areas along the shoreline, both on Lake Huron and Tawas Bay, were often inundated.

2.4 Flood Protection Measures

Shoreline protection structures exist in some areas along the shoreline of Lake Huron and Tawas Bay that provide the community with some degree of protection against flooding. However, it has been ascertained that these structures will not protect the community from rare events such as the 100-year flood. Structures that do not protect against the 100-year flood are not considered in the hydraulic analysis of the 100-year floodplain.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (one-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for each flooding source studied in detail affecting the community.

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the Saginaw Bay shoreline of the

Township of Baldwin from the COE flood levels report for Saginaw Bay (Reference 5), and are shown in Table 1, Summary of Stillwater Elevations.

The analyses reported in this study reflect the stillwater elevations due to wind-setup effects and include the contributions from wave action. The effects of wave action were also considered in the determination of flood hazard areas. Coastal structures located above stillwater flood elevations can still be severely damaged by wave runup, wave-induced erosion, and wave-borne debris. The extent of wave runup above stillwater levels depends greatly on the wave conditions, slope of the beach or structure, and local topography.

Wave heights and wave period can be found in the report entitled "Design Wave Information for the Great Lakes" (Reference 6), and computed from procedures described in "The TMA Shallow-Water Spectrum Description and Applications" (Reference 7). The wave-runup component was determined using the procedures developed in a Great Lakes wave-runup methodology study (Reference 8).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Hydraulic analyses for areas along the shoreline of Lake Huron and Tawas Bay were studied to estimate the wave-runup elevations associated with the 100-year flood level.

The wave-runup components and maximum wave-runup elevations for individual sites located on Tawas Bay and Lake Huron were determined using methodologies established in the technical letter report for the Township of Baldwin, Michigan (Reference 9).

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 2, Transect Location Map. The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering

FLOODING SOURCE AND TRANSECT	FLOOD INSURANCE RATE MAP PANEL	STILLWATER ELEVATION (FEET NGVD)				ZONE	BASE FLOOD ELEVATION[1] (FEET NGVD)
		10-YEAR	50-YEAR	100-YEAR	500-YEAR		
LAKE HURON/SAGINAW BAY/ TAWAS BAY							
1	0016	582.5	583.6	584.0	585.0	VE AE	584 584
2	0016	582.5	583.6	584.0	585.0	VE AE	584[2] 584
3	0008	582.5	583.6	584.0	585.0	VE	587[2]
4	0008	582.5	583.6	584.0	585.0	VE	587[2]
5	0008	582.5	583.6	584.0	585.0	VE	589[2]
6	0007	582.5	583.6	584.0	585.0	VE	589[2]
7	0007	582.5	583.6	584.0	585.0	VE	586[2]
8	0007	582.5	583.6	584.0	585.0	VE	586[2]
9	0007	582.5	583.6	584.0	585.0	VE AE	584 584

[1]ROUNDED TO THE NEAREST FOOT AND MAY INCLUDE EFFECT OF WAVE ACTION
BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS
[2]INCLUDES EFFECT OF WAVE RUNUP

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

SUMMARY OF STILLWATER ELEVATIONS

LAKE HURON/SAGINAW BAY/TAWAS BAY

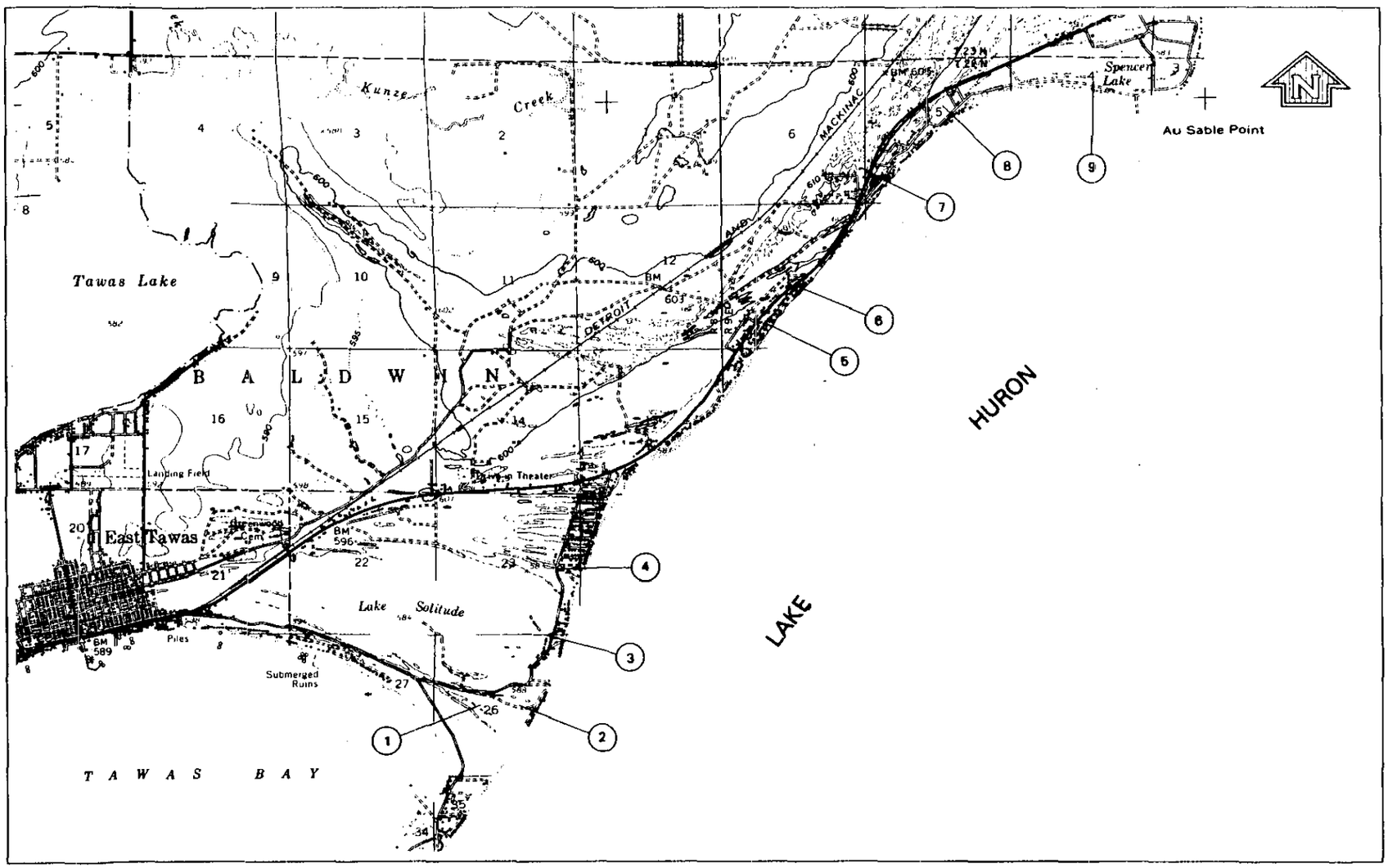

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWNSHIP OF BALDWIN, MI
(IOSCO CO.)

TRANSECT LOCATION MAP

the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the three-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was computed at each transect. The inland extent of the V-zone designation applies to all areas lakeward of a beach, dune, or bluff based on the limits of the runup elevation, or the four-foot stillwater depth when wave runup is not computed. Table 2 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave-runup elevations.

TABLE 2 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND WAVE RUNUP ELEVATIONS

TRANSECT	LOCATION	ELEVATIONS (FEET NGVD) 100-YEAR STILLWATER	WAVE RUNUP
1	From Tawas Bay shoreline, about 2,000 feet southeast of intersection of Baldwin Resort Road and Tawas Beach Road, extending northeast	584.0	N/A
2	From Lake Huron shoreline, about 4,600 feet east of intersection of Baldwin Resort Road and Tawas Beach Road, extending west	584.0	584.4
3	From Lake Huron shoreline, about 5,750 feet south of intersection of Baldwin Resort Road and U.S. 23, extending west	584.0	586.5
4	From Lake Huron shoreline, about 3,100 feet south of intersection of Baldwin Resort Road and U.S. 23, extending west	584.0	586.5
5	From Lake Huron shoreline, about 700 feet southwest of intersection of Scott Road and Forest Street, extending northwest	584.0	588.9

TABLE 2 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND WAVE RUNUP ELEVATIONS (Continued)

TRANSECT	LOCATION	ELEVATIONS (FEET NGVD) 100-YEAR STILLWATER	WAVE RUNUP
6	From Lake Huron shoreline about 1,000 feet northeast of intersection of Scott Road and Forest Street, extending northwest	584.0	588.9
7	From Lake Huron shoreline, about 300 feet southwest of intersection of U.S. 23 and Birchcrest Drive, extending northwest	584.0	585.7
8	From Lake Huron shoreline, about 3,550 feet northeast of intersection of Birchcrest Drive and U.S. 23, extending northwest	584.0	585.7
9	From Lake Huron shoreline, about 1,400 feet south of southern shoreline of Spencer Lake, extending north	584.0	N/A

Figure 3 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the A/V zone boundary.

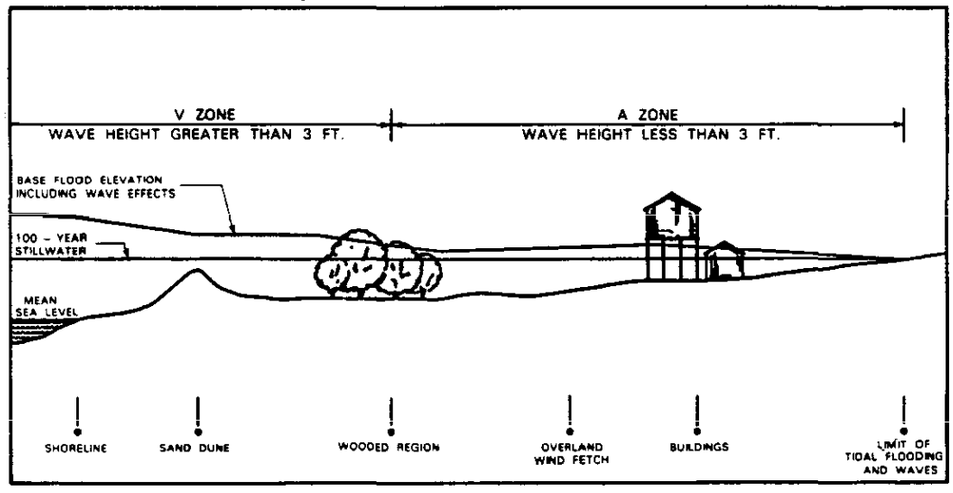

FIGURE 3 - Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (References 10-12), aerial photographs (Reference 13), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

All elevations are referenced to the NGVD. Elevation reference marks used in this study are shown on the maps.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the one-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each flooding source studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each transect cross section. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet and topographic maps at a scale of 1:24000 with a contour interval of 2 feet (References 10-12).

Floodplain boundaries are indicated on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, VE, and numbered A and V zones), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards (Zone B and Zone X). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For streams studied by approximate methods, only the 100-year floodplain boundaries are shown on the Flood Insurance Rate Map.

4.2 Floodways

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

Floodways have not been shown or computed for this community. Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause an increase in the base flood elevations greater than the state's allowable surcharge at any point within the community.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. Previously, the detailed data included the determination of reaches and Flood Hazard Factors (FHF) and numbered flood insurance zone designations. To the extent presented in this revised Flood Insurance Study, the reach determinations and FHFs are no longer applicable and zones are redesignated. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one foot and three feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated

with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than one foot, areas of 100-year flooding where the contributing drainage area is less than one square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, for 100-year floodplains studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Flood Insurance Studies published for the City of East Tawas, Michigan, and the Township of Au Sable, Michigan (References 14 and 15), agree with this study.

A revision in progress to the published Flood Insurance Study for the City of Tawas City, Michigan (Reference 16), agrees with this study.

This Flood Insurance Study supersedes the previously printed Flood Insurance Rate Map for the Township of Baldwin, Michigan (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604-2698.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To ensure that any user is aware of

all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 REFERENCES AND BIBLIOGRAPHY

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2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population and Housing, Michigan, Washington, D.C., September 1982.

3. National Oceanic and Atmospheric Administration, Climates of the States, Volume 1, 1980.

4. Federal Emergency Management Agency, Flood Insurance Study, Township of Alabaster, Iosco County, Michigan, February 1987.

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8. ----------, Detroit District, Great Lakes Wave Runup Methodology Study, June 1989.

9. ----------, Detroit District, Technical Letter Report for Baldwin Township, Michigan, January 1991.

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11. ----------, 7.5 Minute Series Topographic Map, Scale 1:24000, Contour Interval 10 feet: Spencer Lake, Michigan, 1989.

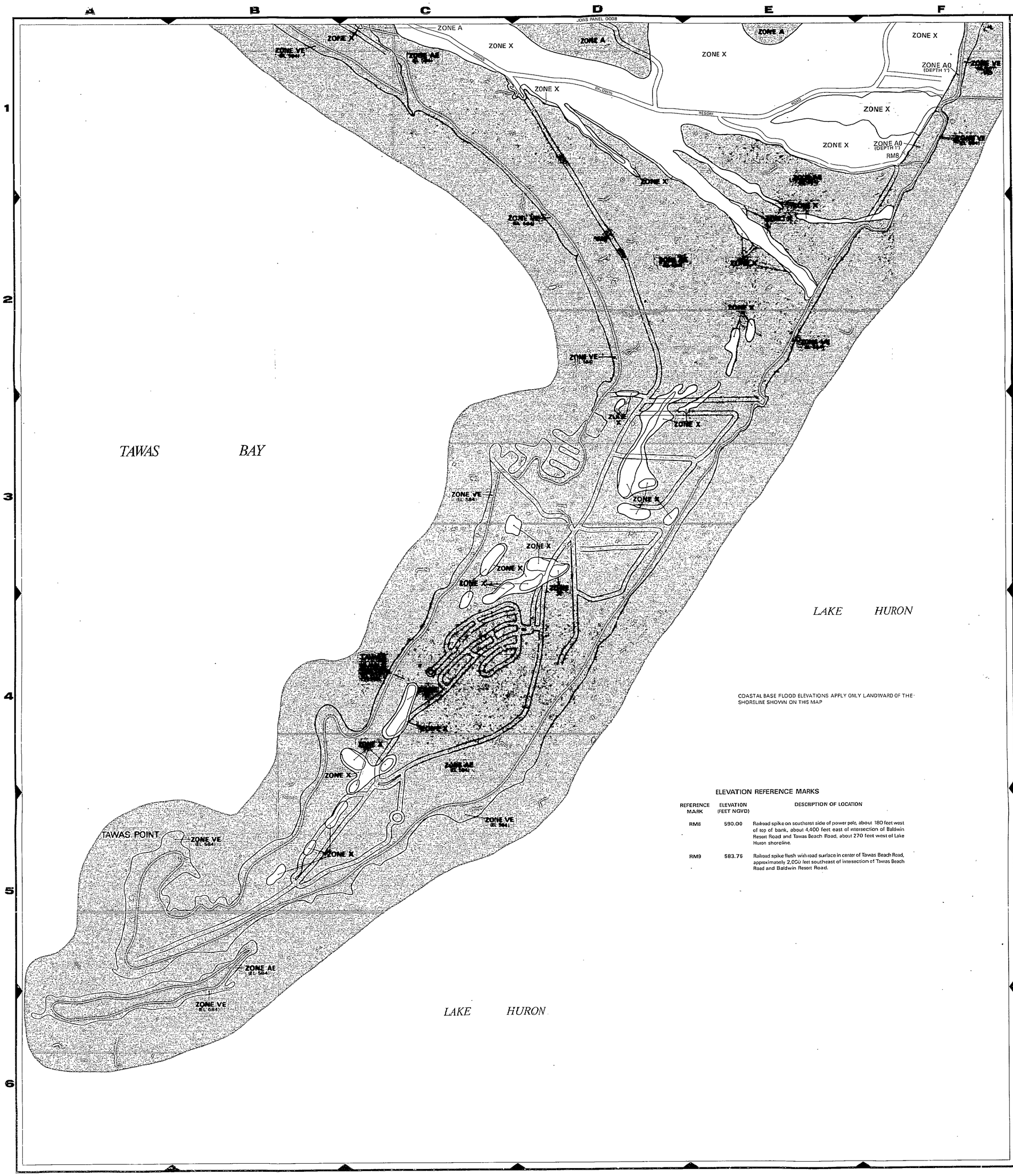
12. Abrams Aerial Survey Corporation, Topographic Map of Baldwin Township, Scale 1:2400, Contour Interval 2 feet.

13. Gourdie/Fraser and Associates, Aerial Photographs of the Baldwin Township Shoreline, Scale 1:6000, April 1990.

14. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of East Tawas, Michigan, September 1977.

15. Federal Emergency Management Agency, Flood Insurance Study, Township of Au Sable, Iosco County, Michigan, January 1988.

16. ----------, Flood Insurance Study, City of Tawas City, Iosco County, Michigan, revision in progress.



COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORELINE SHOWN ON THIS MAP

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM8	590.00	Railroad spike on southeast side of power pole, about 180 feet west of top of bank, about 4,400 feet east of intersection of Baldwin Resort Road and Tawas Beach Road, about 270 feet west of Lake Huron shoreline.
RM9	583.76	Railroad spike flush with road surface in center of Tawas Beach Road, approximately 2,000 feet southeast of intersection of Tawas Beach Road and Baldwin Resort Road.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of pondings); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain.
- **ZONE D** Areas in which flood hazards are undetermined

UNDEVELOPED COASTAL BARRIERS

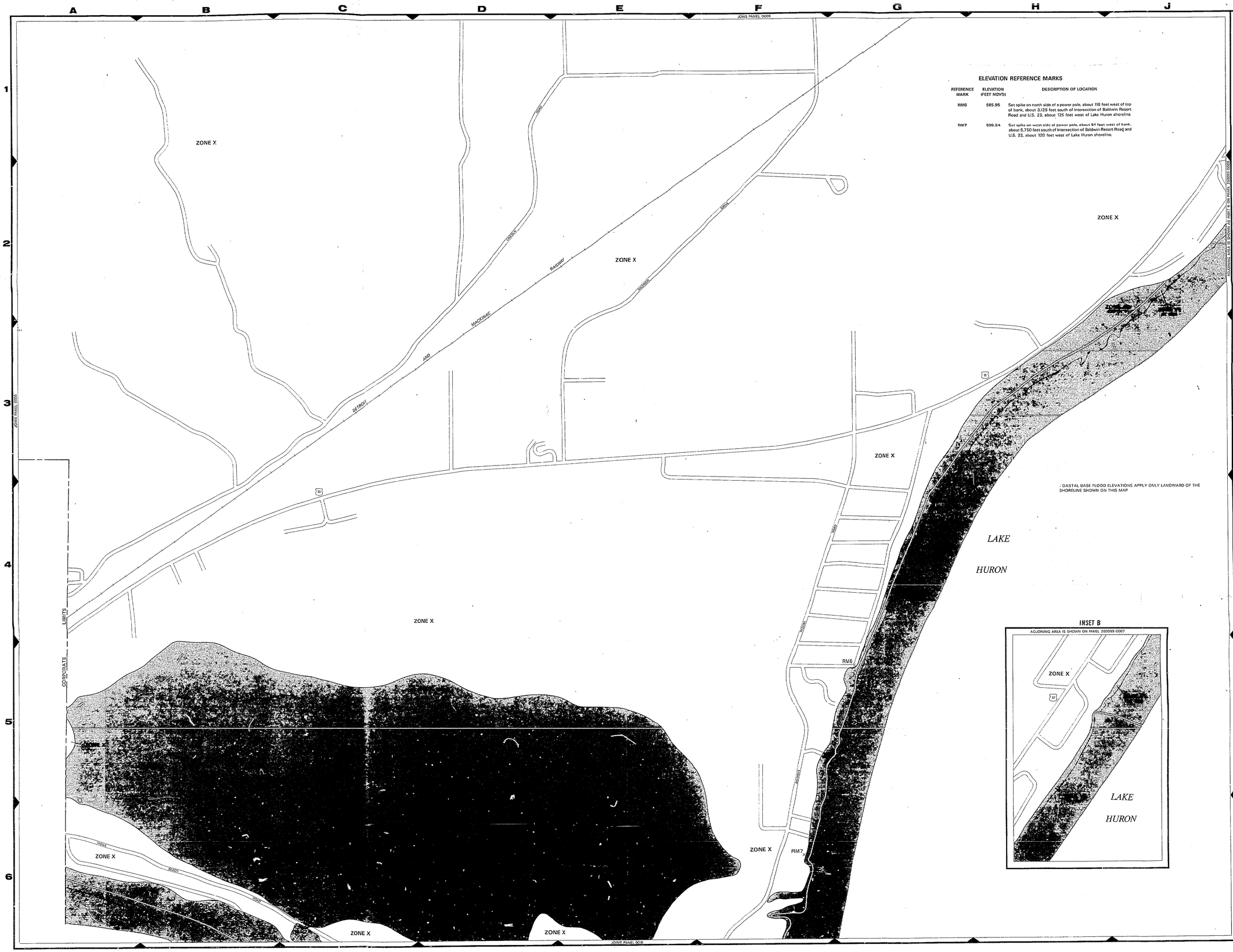
Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zone.

~~~ 567 ~~~ Base Flood Elevation Line; Elevation in Feet*

(A)—(A) Cross Section Line

(EL 19) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 × Elevation Reference Mark

M3.0 • Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all planimetric features outside Special Flood Hazard Area or all areas subject to flooding, particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year flood) include zones, A, AE, A1-A30, AH, AO, A99, V, V* and V1-V30

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of the shoreline.

This map incorporates approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (PL 97-348).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map

For adjoining panels, see separately printed Map Index

MAP REPOSITORY

INITIAL IDENTIFICATION:
JUNE 29, 1973

FLOOD HAZARD BOUNDARY MAP REVISION:
APRIL 12, 1974
JULY 9, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 1, 1988

FLOOD INSURANCE RATE MAP REVISIONS:
Map revised
to change special flood hazard areas, base flood elevations and zone designations.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620

N

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

PANEL 16 OF 16

COMMUNITY—PANEL NUMBER:
260099 0016 D
MAP REVISED:

PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA C FRAME 88/12 STANDARD MIP
~~~



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM6	585.95	Set spike on north side of a power pole, about 116 feet west of top of bank, about 3,125 feet south of intersection of Baldwin Resort Road and U.S. 23, about 125 feet west of Lake Huron shoreline.
RM7	590.24	Set spike on west side of power pole, about 64 feet west of bank, about 5,750 feet south of intersection of Baldwin Resort Road and U.S. 23, about 120 feet west of Lake Huron shoreline.

COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORELINE SHOWN ON THIS MAP

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

~~~567~~~ Base Flood Elevation Line; Elevation in Feet*

(A)———(A) Cross Section Line

(EL 19) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 Elevation Reference Mark

M3.0 Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all planimetric features outside Special Flood Hazard Area or all areas subject to flooding, particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year flood) include zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 100 inch.

Coastal base flood elevations apply only landward of the shoreline.

This map incorporates approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (PL 97-348).

Elevation reference marks are described in the Flood Insurance Study Report.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels, see separately printed Map Index.

MAP REPOSITORY

INITIAL IDENTIFICATION:
JUNE 29, 1973

FLOOD HAZARD BOUNDARY MAP REVISION:
APRIL 12, 1974
JULY 9, 1978

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 1, 1988

FLOOD INSURANCE RATE MAP REVISIONS:

Map revised
to change special flood hazard areas, base flood elevations and zone designations.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

PANEL 8 OF 16

COMMUNITY—PANEL NUMBER:
260099 0008 D

MAP REVISED:

REVISED
PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA E FRAME 88/12 STANDARD MIP
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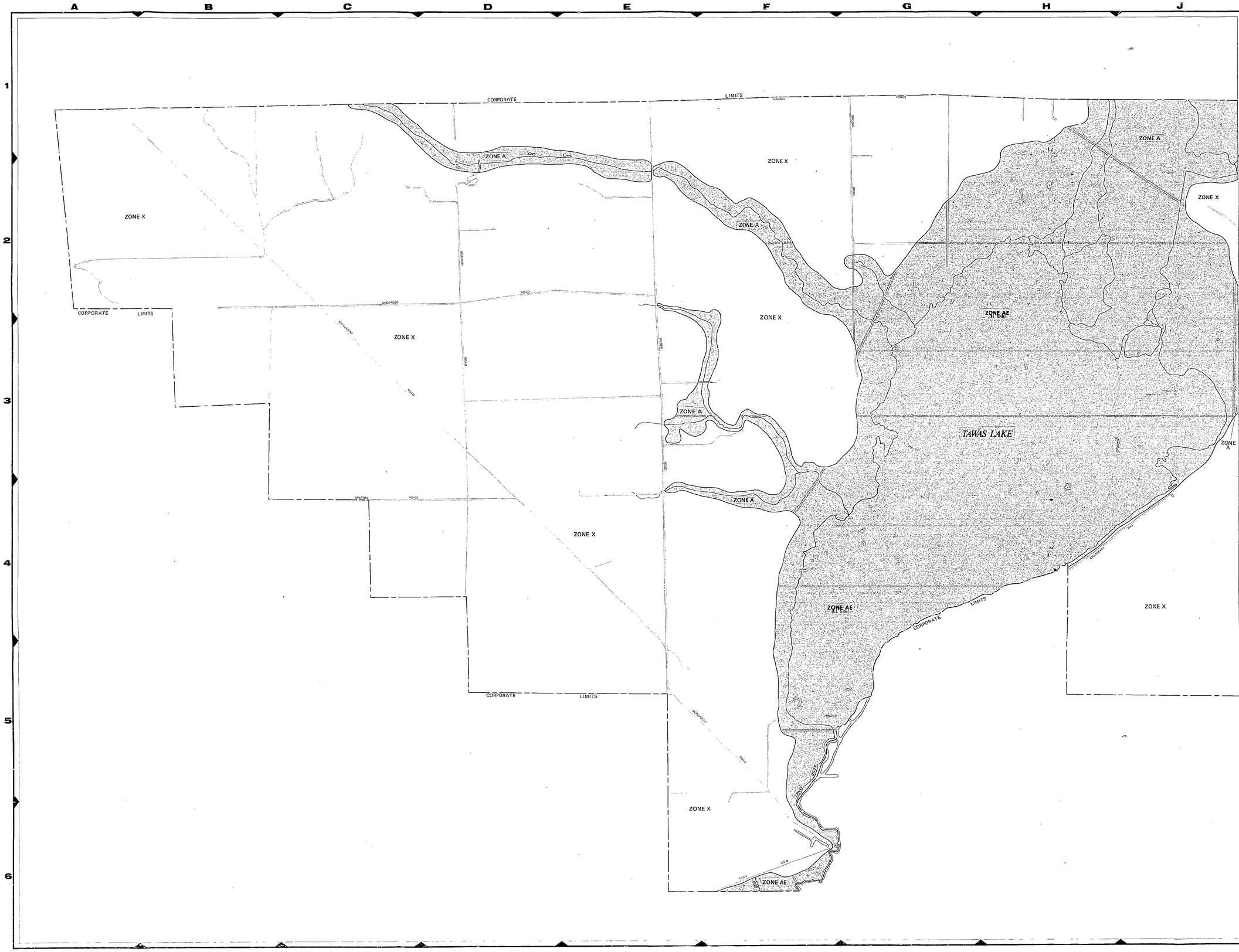


LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined; for areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zone.

987 — Base Flood Elevation Line; Elevation in Feet*

(A) — (A) Cross Section Line

(EL 19) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 Elevation Reference Mark

M3.0 Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all planimetric features outside Special Flood Hazard Areas or all areas subject to flooding, particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year flood) include zones A, AE, AH, AO, A1-A30, A99, V, VE, and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross-sections and interpolated between cross-sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of the shoreline.

This map incorporates approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (P.L. 97-348).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels see separately printed Map Index.

MAP REPOSITORY

INITIAL IDENTIFICATION:
JUNE 29, 1973

FLOOD HAZARD BOUNDARY MAP REVISION:
APRIL 12, 1974
JULY 9, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 1, 1988

FLOOD INSURANCE RATE MAP REVISIONS:

Map revised
to change special flood hazard areas, base flood elevations and zone designations.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

PANEL 5 OF 16

COMMUNITY–PANEL NUMBER:
260099 0005 D
MAP REVISED:

PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA E FRAME 88/12 STANDARD MIP

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zone

513 — Base Flood Elevation Line; Elevation in Feet*

(A) — (A) Cross Section Line

(EL 19) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 × Elevation Reference Mark

M3.0 • Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all planimetric features outside Special Flood Hazard Area or all areas subject to flooding, particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year floods) include zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of the shoreline.

This map incorporates approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (PL 97-348).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels, see separately printed Index Index.

MAP REPOSITORY

INITIAL IDENTIFICATION:
JUNE 29, 1973

FLOOD HAZARD BOUNDARY MAP REVISION:
APRIL 12, 1974
JULY 9, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 3, 1988

FLOOD INSURANCE RATE MAP REVISIONS:
Map revised
to change special flood hazard areas, base flood elevations and zone designations.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

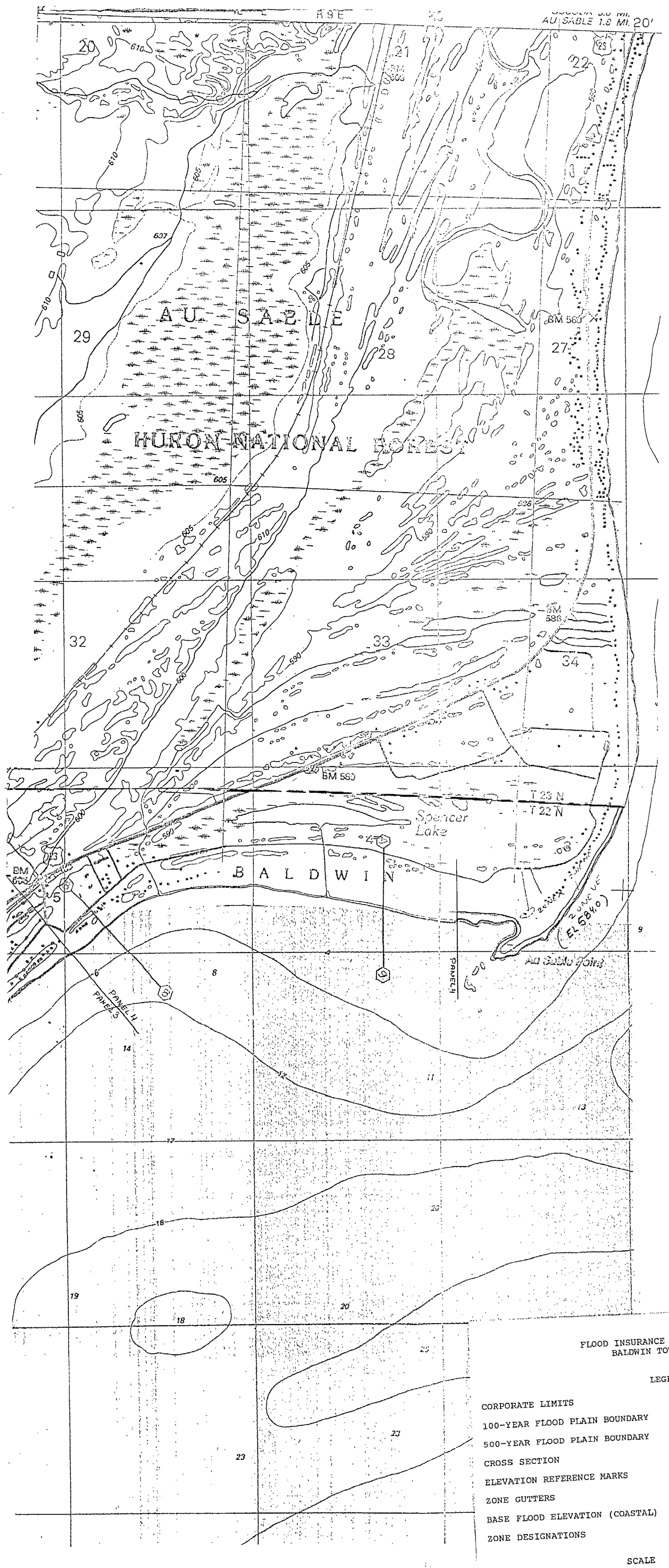
TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

PANEL 6 OF 16

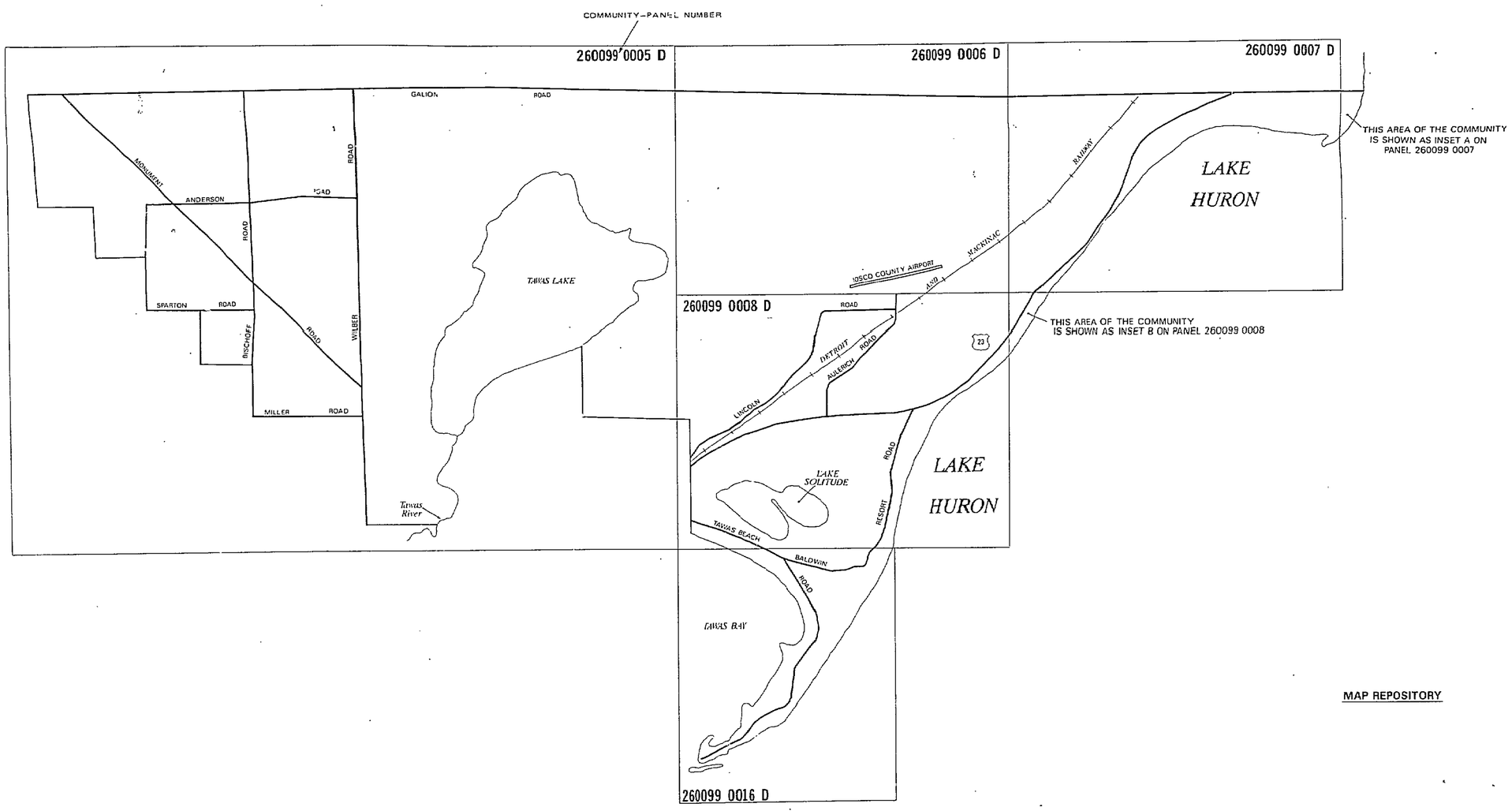
COMMUNITY–PANEL NUMBER:
260099 0006 D
MAP REVISED:

PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA E FRAME 88/12 STANDARD MIP


R 9 E
AU SABLE 1.8 MI. 20'
AU SABLE
HURON NATIONAL FOREST
BM 560
BM 586
BM 580
T 23 N
T 22 N
Spencer Lake
BALDWIN
PANEL 4
PANEL 3
PANEL 4
ZONE VE
(EL 584.0)
FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI
LEGEND
CORPORATE LIMITS
100-YEAR FLOOD PLAIN BOUNDARY
500-YEAR FLOOD PLAIN BOUNDARY
CROSS SECTION
ELEVATION REFERENCE MARKS
ZONE GUTTERS
BASE FLOOD ELEVATION (COASTAL)
ZONE DESIGNATIONS
RM3 X
(EL 587.0)
ZONE VE
SCALE 1" = 200'

PANEL 6



MAP REPOSITORY

N

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

MAP INDEX

PANELS PRINTED: 5, 6, 7, 8, 16

COMMUNITY-PANEL NUMBERS
260099 0005-0016

MAP REVISED:

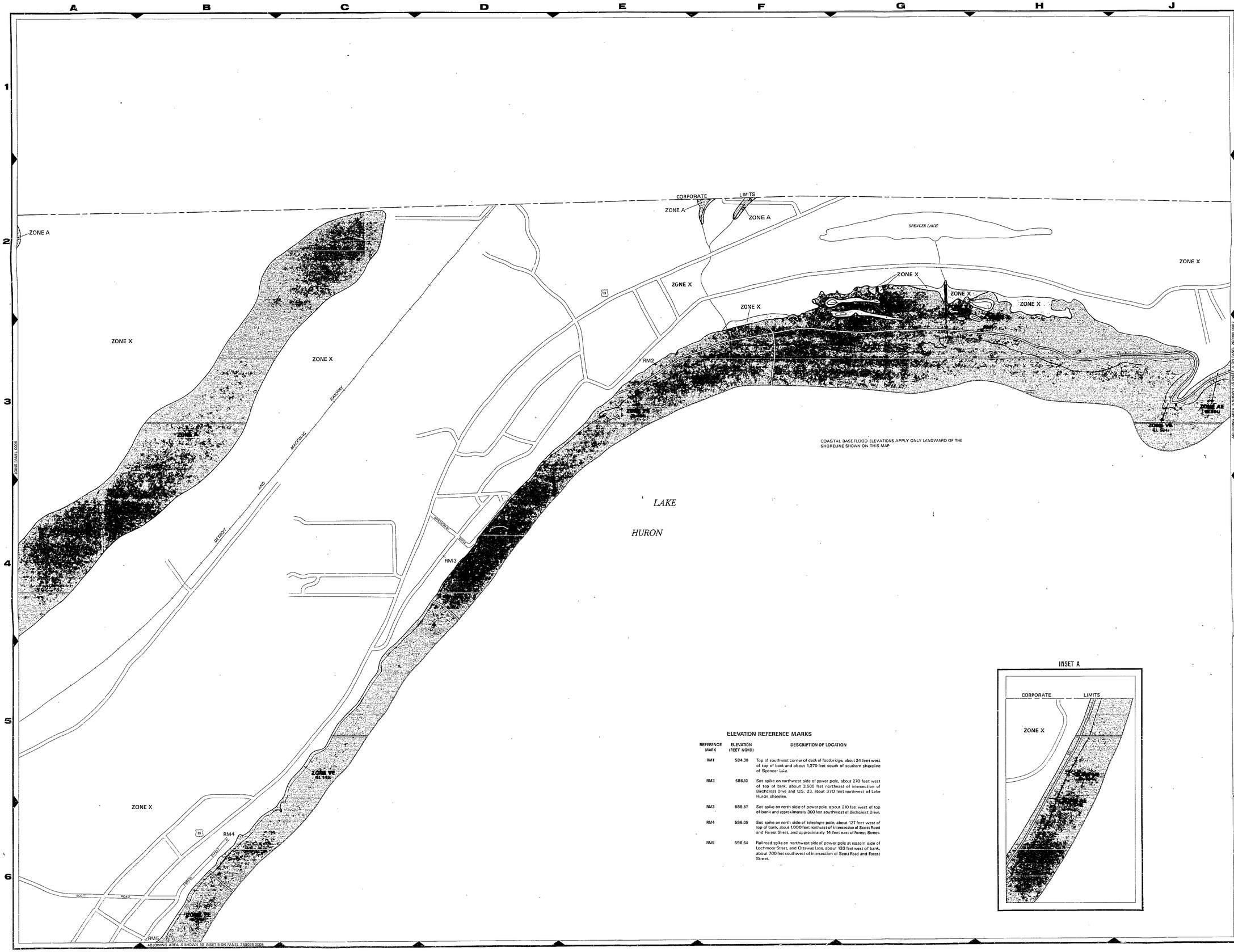
JUN 04 1992
REVISED

PRELIMINARY

Federal Emergency Management Agency

GREENHORNE & O'MARA B FRAME

FOLD TRIM FOLD FOLD FOLD



COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORELINE SHOWN ON THIS MAP

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM1	584.30	Top of southwest corner of deck of footbridge, about 24 feet west of top of bank and about 1,270 feet south of southern shoreline of Spencer Lake.
RM2	586.10	Set spike on northwest side of power pole, about 270 feet west of top of bank, about 3,500 feet northeast of intersection of Birchcrest Drive and U.S. 23, about 370 feet northwest of Lake Huron shoreline.
RM3	589.57	Set spike on north side of power pole, about 210 feet west of top of bank and approximately 300 feet southwest of Birchcrest Drive.
RM4	596.05	Set spike on north side of telephone pole, about 127 feet west of top of bank, about 1,000 feet northeast of intersection of Scott Road and Forest Street, and approximately 14 feet east of Forest Street.
RM5	596.64	Railroad spike on northwest side of power pole at eastern side of Lochmoor Street, and Ottawas Lane, about 133 feet west of bank, about 700 feet southwest of intersection of Scott Road and Forest Street.

INSET A

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zone.

56 — Base Flood Elevation Line; Elevation in Feet*

A — A Cross Section Line

(EL 19) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 Elevation Reference Mark

M3.0 Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all plan-metric features outside Special Flood Hazard Area or all areas subject to flooding, particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year flood) include zones, A, AE, A1–A30, AH, AO, A99, V, VE and V1-V30

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Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of the shoreline.

This map incorporates approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (P.L. 97–348).

Elevation reference marks are described in the Flood Insurance Study Report.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels, see separately printed Map Index.

MAP REPOSITORY

INITIAL IDENTIFICATION:
JUNE 28, 1973

FLOOD HAZARD BOUNDARY MAP REVISION:
APRIL 12, 1974
JULY 9, 1976

FLOOD INSURANCE RATE MAP EFFECTIVE:
FEBRUARY 1, 1988

FLOOD INSURANCE RATE MAP REVISIONS:

Map revised
to change special flood hazard areas, base flood elevations and zone designations.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWNSHIP OF
BALDWIN,
MICHIGAN
IOSCO COUNTY

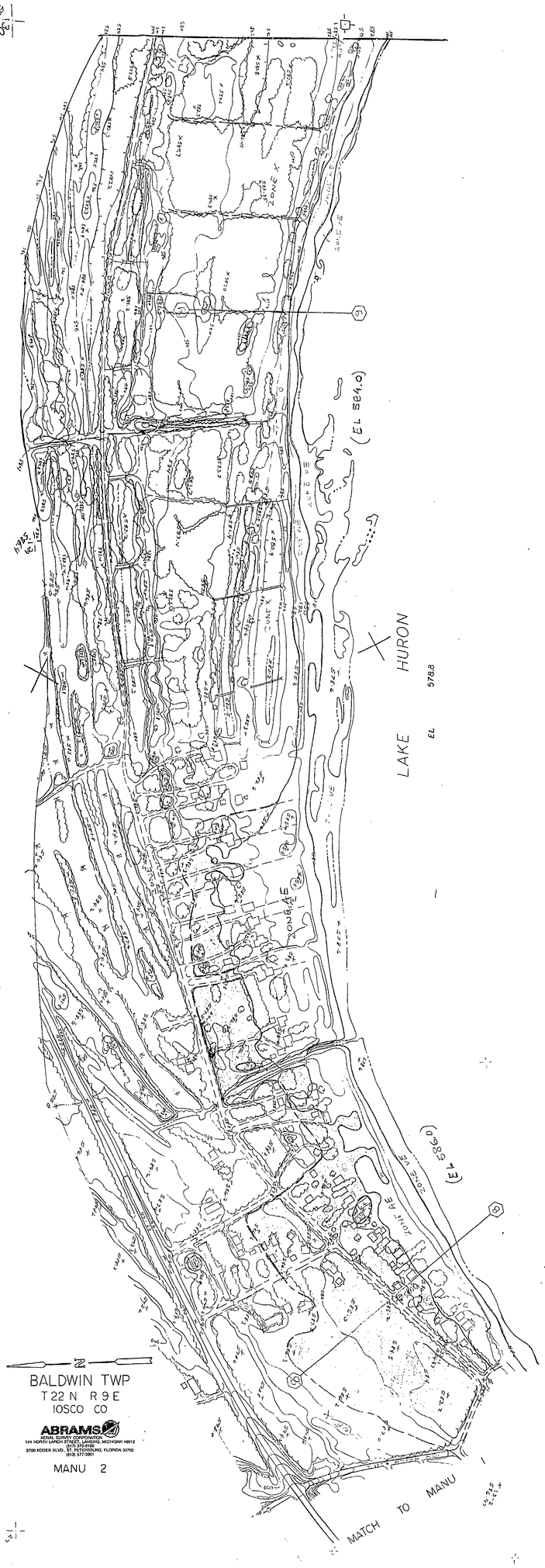
PANEL 7 OF 16

COMMUNITY–PANEL NUMBER:
260099 0007 D

MAP REVISED:

REVISED
PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA E FRAME 88/12 STANDARD MIP



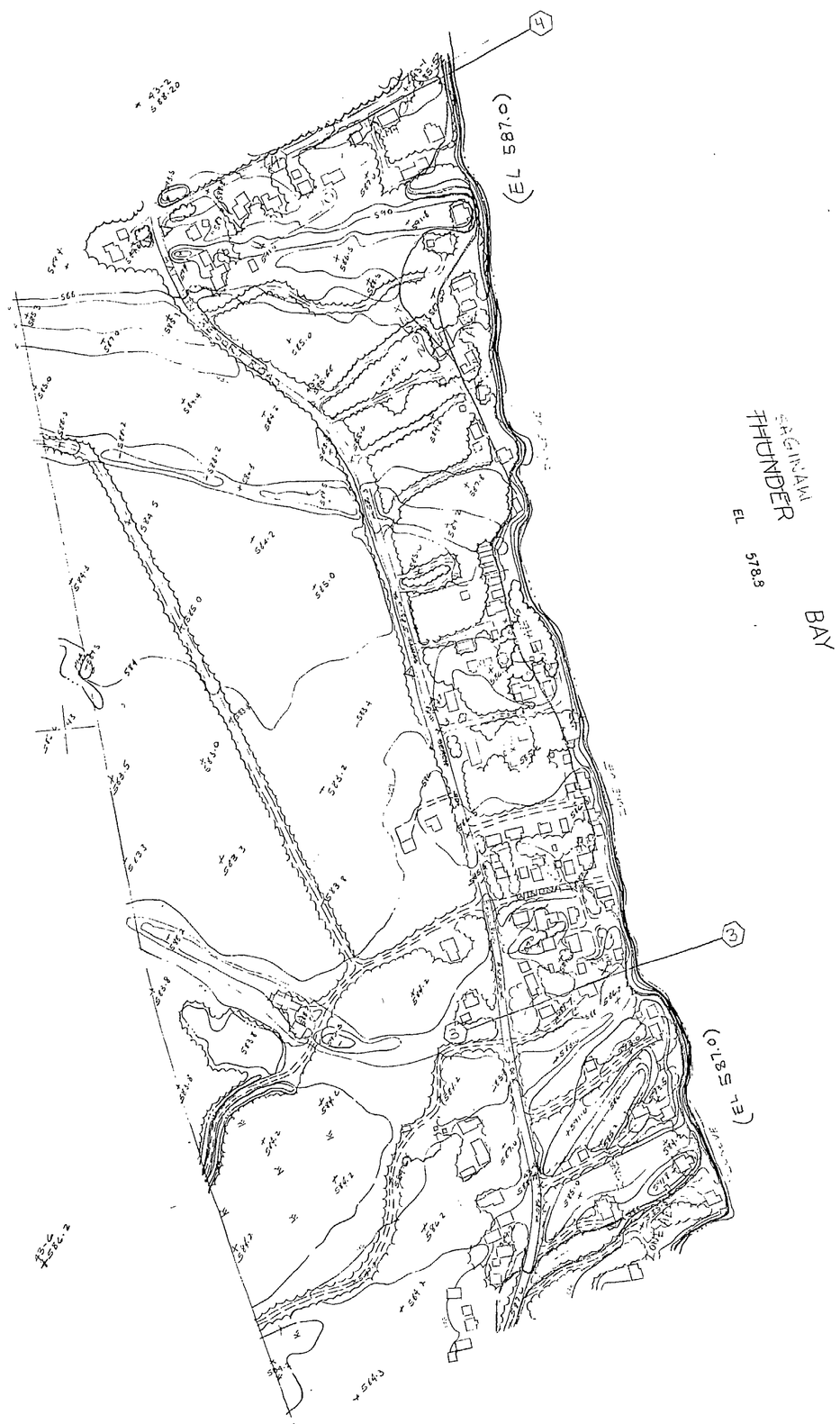
FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI

LEGEND

CORPORATE LIMITS	
100-YEAR FLOOD PLAIN BOUNDARY	
500-YEAR FLOOD PLAIN BOUNDARY	
CROSS SECTION	1 — 1
ELEVATION REFERENCE MARKS	RM3 X
ZONE GUTTERS	
BASE FLOOD ELEVATION (COASTAL)	(EL 587.0)
ZONE DESIGNATIONS	ZONE VE

SCALE 1" = 200'

PANEL 4



BALDWIN TWP
T22NR8E
IOSCO CO

ABRAMS
AERIAL SURVEY CORPORATION
124 NORTH LATCH STREET, LANSING, MICHIGAN 48912
(517) 372-8100
9700 KOGER BLVD., ST. PETERSBURG, FLORIDA 33702
(813) 577-3801

PANEL 2

FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI

LEGEND

CORPORATE LIMITS	
100-YEAR FLOOD PLAIN BOUNDARY	
500-YEAR FLOOD PLAIN BOUNDARY	
CROSS SECTION	1 — 1
ELEVATION REFERENCE MARKS	RM3 X
ZONE GUTTERS	
BASE FLOOD ELEVATION (COASTAL)	(EL 587.0)
ZONE DESIGNATIONS	ZONE VE

SCALE 1" = 200'

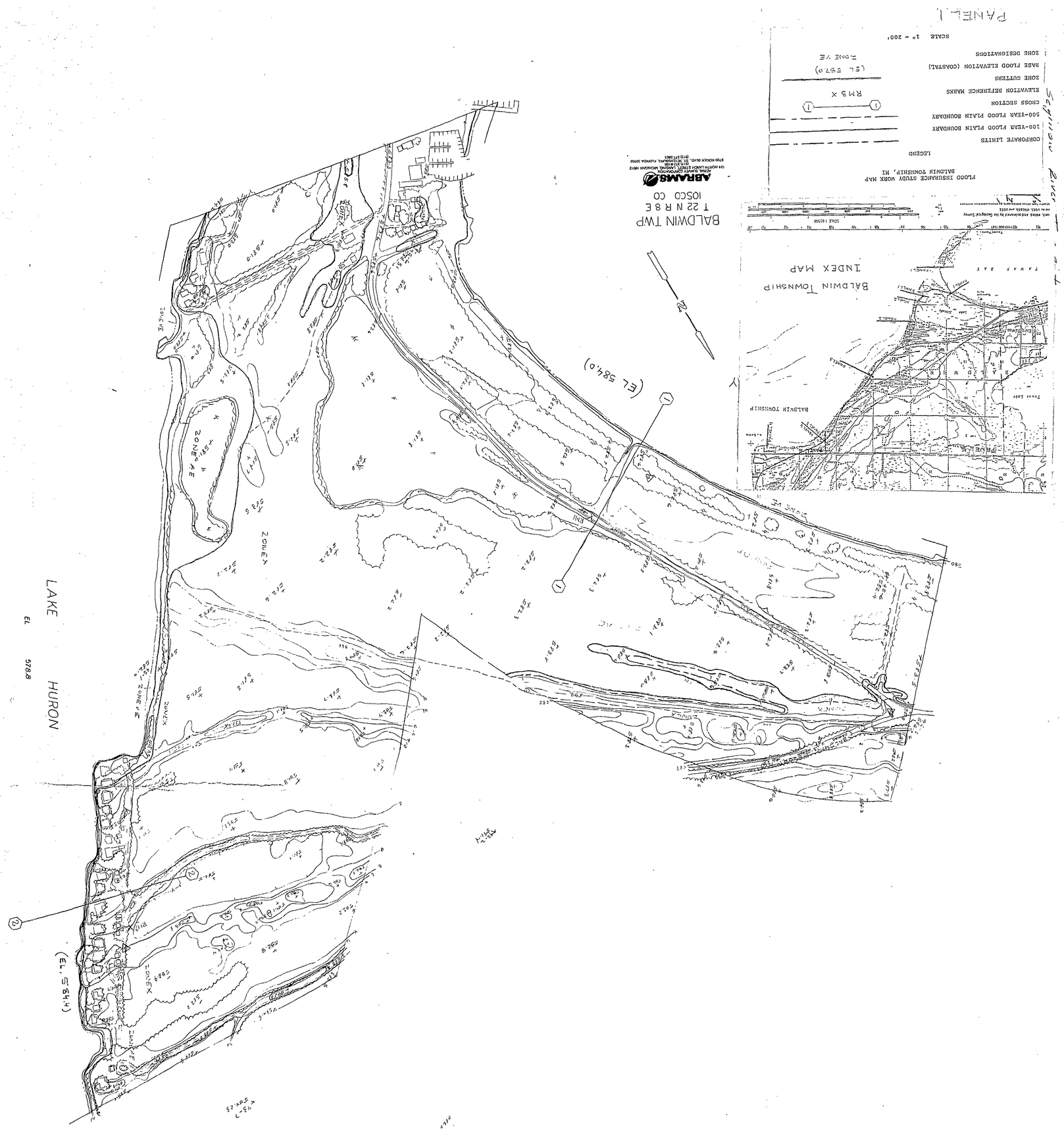
FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI

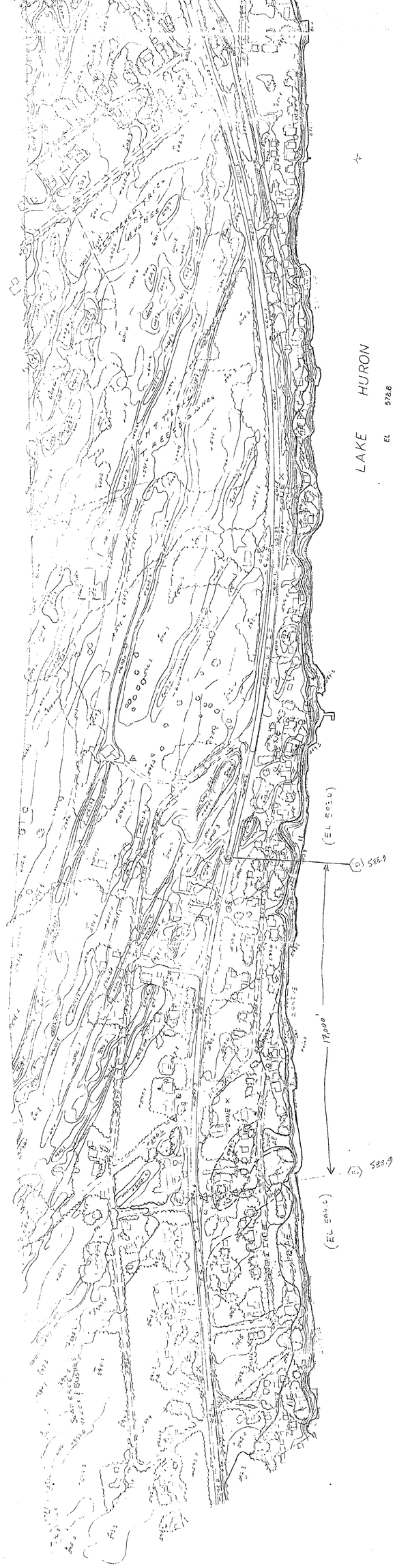
LEGEND

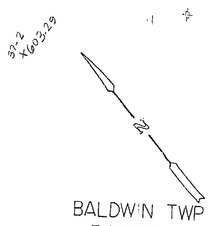
CORPORATE LIMITS	
100-YEAR FLOOD PLAIN BOUNDARY	
500-YEAR FLOOD PLAIN BOUNDARY	
CROSS SECTION	1 — 1
ELEVATION REFERENCE MARKS	RM3 X
ZONE GUTTERS	
BASE FLOOD ELEVATION (COASTAL)	(EL 587.0)
ZONE DESIGNATIONS	ZONE VE

SCALE 1" = 200'

PANEL 5


PANEL 1
SCALE 1" = 200'
FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI
LEGEND
CORPORATE LIMITS
100-YEAR FLOOD PLAIN BOUNDARY
500-YEAR FLOOD PLAIN BOUNDARY
CROSS SECTION
ELEVATION REFERENCE MARKS
ZONE CUTTERS
BASE FLOOD ELEVATION (COASTAL)
ZONE DESIGNATIONS
RM3 x
(EL 597.0)
ZONE VE
INDEX MAP
BALDWIN TOWNSHIP
TAWAS BAY
BALDWIN TWP
T 22 N R 8 E
IOSCO CO
ABRAMS
AERIAL SURVEY CORPORATION
124 NORTH LINDEN STREET, LANSING, MICHIGAN 48912
(517) 372-8100
8700 KOSKIA BLVD., ST. PETERSBURG, FLORIDA 33709
(813) 577-2601
(EL 584.0)
ZONE AE
ZONE X
ZONE VE
LAKE HURON
EL 578.8
(EL 584.4)
Baldwin





BALDWIN TWP
T 22 N R 9 E
IOSCO CO

AERIAL SURVEY CO. OF MICHIGAN
124 NORTH LARCH STREET
LANSING, MICHIGAN 48912
8100 NOURSE BLVD.
ST. PETERSBURG-KI, FLORIDA 33710
(813) 577-0181

MANU 1

FLOOD INSURANCE STUDY WORK MAP
BALDWIN TOWNSHIP, MI

LEGEND

CORPORATE LIMITS	
100-YEAR FLOOD PLAIN BOUNDARY	
500-YEAR FLOOD PLAIN BOUNDARY	
CROSS SECTION	1 — 1
ELEVATION REFERENCE MARKS	RM3 X
ZONE GUTTERS	
BASE FLOOD ELEVATION (COASTAL)	(EL 587.0)
ZONE DESIGNATIONS	ZONE VE

SCALE 1" = 200'

PANEL 3

Baldwin Twp.

1" = 200 L'ed
Gourdie/Fraser
Bagman "Liver
23055

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: East Tawas

3) WATERCOURSE: Lake Huron ~~Wave run-up~~

4) DOCUMENT TYPE: ~~Report~~ Wave run-up Report

00BREAK00

CENCE-PD-PF (1105)

21 MAR 1991

MEMORANDUM FOR Commander, North Central Division
ATTN: CENCD-PE-PD-FP (S. Tamulionis)
536 S. Clark St., Chicago, IL 60605

SUBJECT: City of East Tawas, Michigan, Limited Map Maintenance, Flood Insurance Study

1. Enclosed are draft copies of the required Technical Letter Report for the calculation of the wave run up component of the subject study, and appropriate work map. A copy of this report is also being transmitted to the Michigan Department of Natural Resources for concurrent review. This study is being conducted by the Detroit District, in accordance with Inter-Agency Agreement EMW-90-E-3286, Project Order No. 3.

2. Please return your comments on the draft report no later than two weeks after receipt. If you have any questions concerning the enclosed report, please contact Mr. Joe Wanielista, program manager, Flood Plain Management Services, at (313) 226-6773.

FOR THE COMMANDER:

Original Signed

Encls

WILLIAM W. WILLIS, P.E.
Chief, Planning Division

Copy Furnished (w/Encls):

Mr. Bruce Menerey, P.E.
Land and Water Management Division
Michigan Department of Natural Resources
P.O. Box 30023
Lansing, MI 48909

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MAR 22 1991

NATURAL RESOURCES
LAND & WATER MGMT.

TECHNICAL LETTER REPORT ON THE CITY OF EAST TAWAS, MICHIGAN

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
March 1991

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

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Appendix A - Flood Insurance Study Profiles and Wave Runup Computations

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This report describes the application of the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" to flood levels on Saginaw Bay in conjunction with the Limited Map Maintenance Program (LMMP), for the City of East Tawas, Michigan. The flood levels applicable to the City of East Tawas were developed in the September 1989 "Flood Levels Report for Saginaw Bay" report prepared by the U.S. Army Corps of Engineers, Detroit District (COE).

1.2 Coordination

The September 1989 "Flood Levels Report For Saginaw Bay" report, along with examples of the application of the methodology from the 1989 "Great Lakes Wave Runup Methodology Study", were presented to FEMA on 1 March 1990. The procedures outlined in the above references were approved at this meeting for application to all Saginaw Bay FIS and LMMP sites, including the City of East Tawas.

1.3 Authority and Acknowledgments

The objective of the LMMP is to provide funding for flood map updates. In the City of East Tawas, the LMMP will be used to revise the existing hydraulic analyses to include the wave runup component. The work was conducted under Inter-Agency Work Agreement, EMW-90-E-3286, Project Order No. 3A, between the COE and the Federal Emergency Management Agency (FEMA).

The "Great Lakes Wave Runup Methodology Study" was accomplished in 1989 by the COE for FEMA, for application to future coastal Flood Insurance Studies (FIS), and/or restudies of communities bordering the Great Lakes. The 100-year flood level from the September 1989 report referenced above was used to compute the maximum wave runup elevations required for updating the LMMP sites in the City of East Tawas on Saginaw Bay. Table 1 lists the profiles, and the 100-year and 500-year "base" flood levels at the two locations along the City of East Tawas shoreline. The two profiles were developed from data obtained from a June 1990 survey.

2.0 AREA STUDIED

2.1 Community Description

The City of East Tawas, Michigan, shown on Figure 1, is located in Iosco County along 2 miles of shoreline on Saginaw Bay. The city has a population of about 2,600. Its major industry is year-round tourism, based on the city's location on Saginaw Bay. The shoreline consists of a developed park area (East Tawas State Park), the Waterways Commission Dock, and small seasonal and year-round residential homes.

The City of East Tawas shoreline on Saginaw Bay is protected, to some extent, from northeasterly and easterly storms by Tawas Point. Bathymetry in Saginaw Bay along City of East Tawas shoreline varies from 30-foot depths

SHORELINE PROFILES
CITY OF EAST TAWAS, MICHIGAN

Profile Location	100-year Flood Level *	500-year Flood Level *
1. East Tawas-1	584.0	585.0
2. East Tawas-2	584.0	585.0

* NOTE: All elevations are in FT, NGVD and were obtained from the September 1989 "Flood Levels Report for Saginaw Bay"

TABLE 1

CITY OF EAST TAWAS
LOCATION MAP

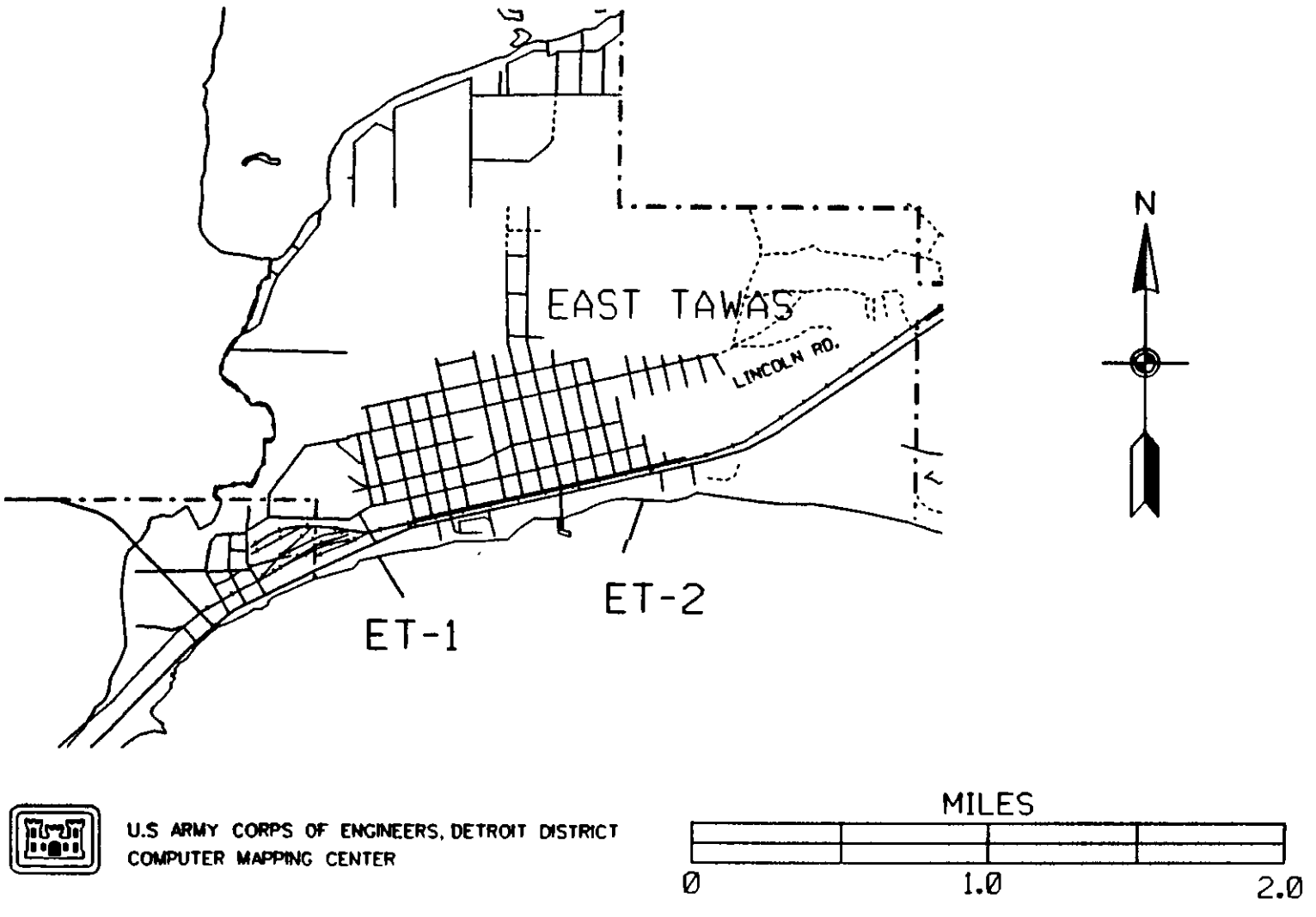


FIGURE 1

offshore to less than five feet deep near shore. The lowest seasonal lake stages usually prevail during the winter months and the highest during the summer months. During the past 13 years, fluctuations of monthly mean water levels on Saginaw Bay, as measured at the Essexville, Michigan water level gage, have ranged from a minimum of 578.14 feet NGVD to a maximum of 581.9 feet NGVD.

2.2 Principal Flood Problems

Short-term Saginaw Bay water level fluctuations are most often due to variations in wind and barometric pressure. Occasionally, a surge of considerable proportions takes place within a few hours, due to strong and persistent northerly or southerly winds.

When lake levels are high and storms occur from the south and east, the City of East Tawas shoreline is usually subjected to extreme conditions. Along this shoreline, substantial flooding has occurred because of the flat topography along Saginaw Bay.

3.0 ENGINEERING METHODS

The flood levels established in the U.S. Army Corps of Engineer's September 1989 "Flood Levels Report for Saginaw Bay" and the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" were used to analyze the flooding potential at the two City of East Tawas LMMP sites shown on Figure 1. The hydraulic analyses presented herein involved the determination of the wave runup components and maximum wave runup elevations for selected sites.

Input data used for flood calculations include site specific design wave, water depth at the toe of the structure, and wave period. Additional data such as nearshore profiles, high water marks, existing conditions, and bathymetry and topography, were also analyzed to determine the maximum wave runup elevation at each site. This technical letter report presents the wave runup application procedures for each of the two LMMP sites located in the City of East Tawas. Representative profiles and the wave runup computations for each site are included in Appendix A.

4.0 VE AND X-ZONE DELINEATIONS

Reaches of the City of East Tawas shoreline in the surf zone which are subject to significant wave attack are referred to by FEMA as Coastal High Hazard Zones or velocity ("VE") Zones. The VE-Zone (shown as the V-Zone on Figures 2 & 3) is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. An X-Zone is the flood insurance rate zone that corresponds to the areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees.

Two different flood conditions, as defined by FEMA, most closely represent the LMMP sites in the City of East Tawas. The first type of condition involves a beach/bluff system where wave runup does not overtop the existing beach/bluff and there are no obstructions on the lakeward side of the

beach/bluff. The VE/X-Zone demarcation line was established as the point of maximum wave runup. According to FEMA guidelines, the VE/X-Zone demarcation line is fixed at the point where the wave runup intersects the calculated post-storm profile (wave runup intersection point). Since the study assumed no bluff erosion, the VE/X-Zone demarcation line as determined from the point of maximum wave runup and the VE/X-Zone demarcation line as determined as the wave runup point are identical. This mapping is considered appropriate for profile East Tawas-1, and is shown on Figure 2.

The second type of condition involves a beach/bluff system where the structure is not flooded, damaged or overtopped by wave runup. In this case, the VE/X-Zone demarcation line is fixed at the most landward edge of the exposed portion of the structure. The landward side of the V-Zone is mapped as a X-Zone. This type of flooding condition is representative of profile East Tawas-2, and is shown on Figure 3.

The VE and X-Zones for these sites have been delineated according to FEMA's 1990 "Guidelines for Great Lakes Wave Runup Computation and Mapping" and are shown on the attached work maps.

The formal submittal of the City of East Tawas LMMP study will include original mylar copies showing sufficient detail for submittal to FEMA's technical review contractor.

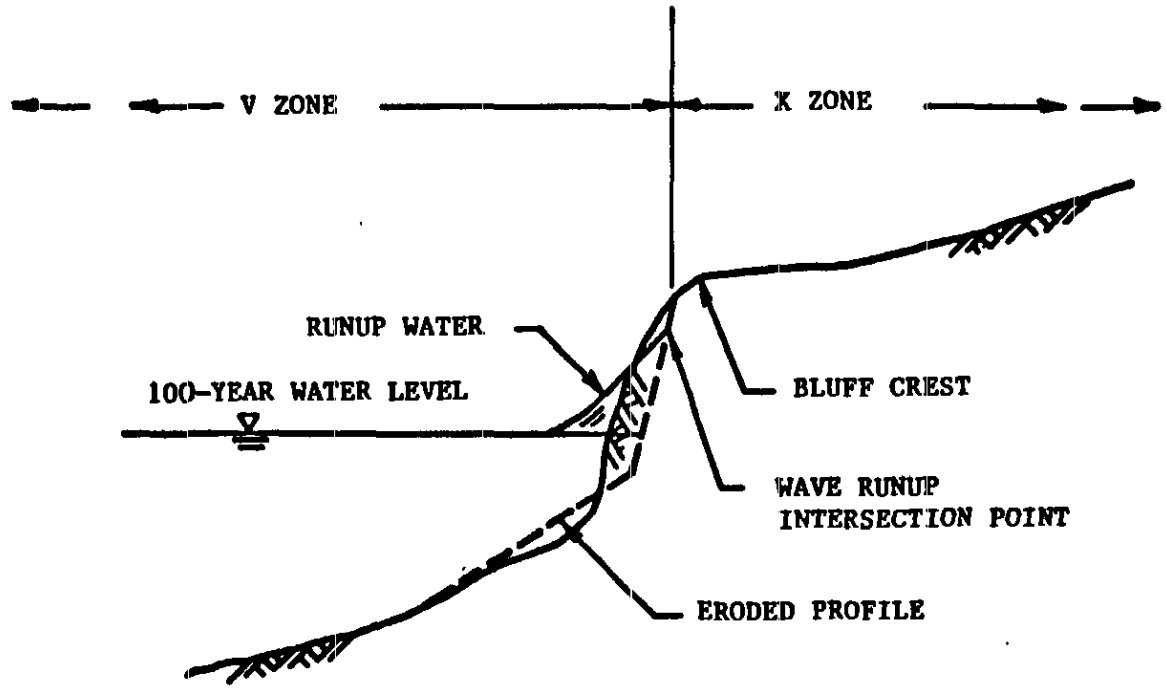
5.0 CONCLUSIONS

For each of the City of East Tawas sites where the 100-year flood level inundates the shoreline property, the inundated area will experience a minimal water depth shoreward of the shoreline protection. This water depth will generate a negligible wave across the property. Therefore, the 100-year flood level will be used to delineate the flood profiles at each site.

Accordingly, where structures protect against flooding, the 100-year VE and X-Zones, based on wave runup elevations, will be delineated on the work maps in the final LMMP for the site. Table 2 lists the 100-year computed wave runup components and the associated wave runup elevations for the two sites.

In conclusion, it is recommended that the delineated 100-year flood profiles for the two City of East Tawas sites included herein be used by FEMA for updating the LMMP sites.

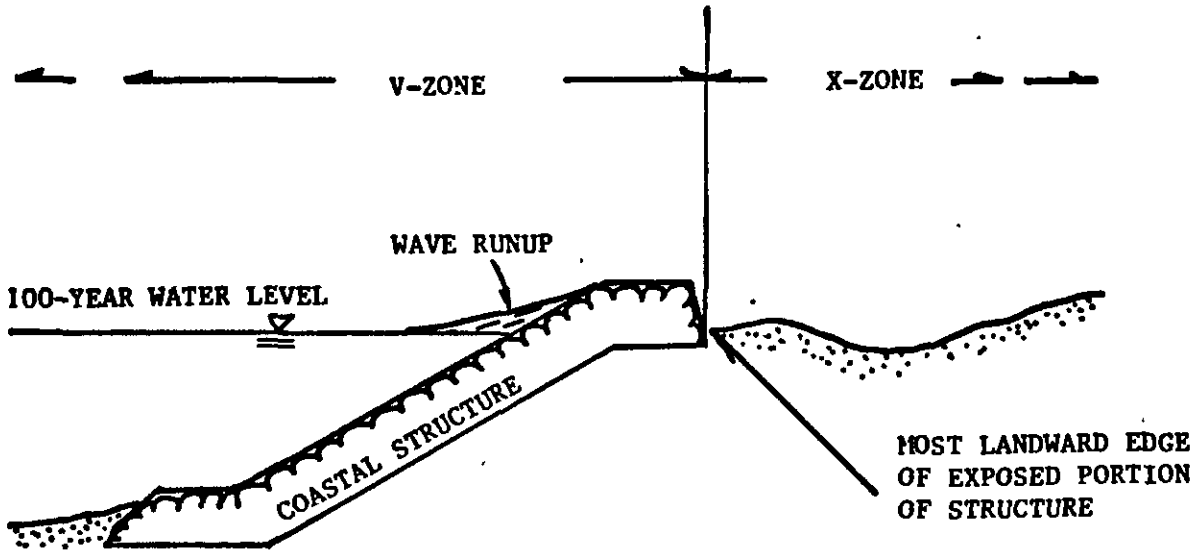
CITY OF EAST TAWAS V & X ZONE DELINEATIONS ON A BEACH SYSTEM



East Tawas-1

FIGURE 2

CITY OF EAST TAWAS V & X ZONE DELINEATIONS ON A STRUCTURE SYSTEM



East Tawas-2

FIGURE 3

Table 2

Wave Runup Elevations

East Tawas FIS Sites	100-year Computed Wave Runup(ft.)	100-year Wave Runup Elevation (ft., NGVD)
1. East Tawas-1	0.6	584.6
2. East Tawas-2	4.8	588.8

6.0 GLOSSARY

Annual Maximum Instantaneous Water Level: The highest water level that was recorded during a year by a gage with a sampling frequency of an hour or less.

Beach: The zone of sedimentary material that extends landward from the low water line to the place where there is a marked change in material or form, or to the line of permanent vegetation.

Bluff: A high, steep bank composed of erodible materials.

Floodplain: The area adjoining a river, stream, watercourse, ocean, lake or other body of standing water that has been or may be covered by floodwater.

National Geodetic Vertical Datum of 1929 (NGVD): The nationwide reference datum for land elevations throughout the United States. It was established by the National Geodetic Survey in 1929.

Runup: The rush of water up a beach or structure from the breaking of a wave. Also, the vertical height of uprush above the still-water level.

Still-water level: The elevation that the water surface would assume if all wave action were absent.

Storm-water level: The rise above the normal water level on the open-coast, due to wind stress on the water surface.

VE-Zone: The flood insurance rate zone that corresponds to the areas of 100-year coastal flood plains where average depths are more than 4 feet and have additional hazards associated with storm waves.

Wave height: The vertical distance between the wave crest and the preceding trough.

Wave setup: The superelevation of the water surface over normal surge elevation due to the onshore mass transport of the water by wave action alone.

Wind setup: The vertical rise in the still-water level on the leeward side of a body of water caused by wind stresses on the surface of the water.

X-Zone: The flood insurance rate zone that corresponds to the areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees.

7.0 REFERENCES

1. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Vicksburg, MS, Shore Protection Manual, Volumes I & II, 1984

2. U.S. Army Corps of Engineers, Detroit District, Phase I, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

3. U.S. Army Corps of Engineers, Detroit District, Phase II, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

4. U.S. Army Corps of Engineers, Detroit District, Appendices, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

5. U.S. Army Corps of Engineers, Coordinating Committee on Great Lakes Basin Hydraulic and Hydrologic Data, History of Water Level Gauges, Upper Great Lakes and the St. Clair - Detroit Rivers, January 1978

6. U.S. Army Corps of Engineers, North Central Division, Great Lakes Region Inventory Report National Shoreline Study, August 1978

7. U.S. Army Corps of Engineers, Detroit District, Flood Levels Report - Saginaw Bay, September 1989

8. U.S. Army Corps of Engineers, Detroit District, Flood Levels Report - Anchor Bay, September 1989

9. Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan, SCHWAB, D.J., and LYNN, E.W., Great Lakes Storm Surge Planning Program, 1987

10. U.S. Army Corps of Engineers, Detroit District, Phase II Report on Great Lakes Flood Levels - Little Bay De Noc, August 1981

11. U.S. Army Corps of Engineers, Detroit District, Phase II Report on Great Lakes Flood Levels - Big Bay De Noc, July 1981

12. FEMA, Guidelines for Great Lakes Wave Runup Computation and Mapping, 1990

13. U.S. Army Corps of Engineers, Detroit District, Section 22 Lake Superior Shoreline Wave Runup Study, June 1989

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

APPENDIX A

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
March 1991

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

SYNOPSIS

Appendix A outlines the procedures necessary to calculate the wave runup component and the maximum wave runup elevation associated with the 100-year flood level. These data, with the information provided from the profile surveys will enable the user to delineate the 100-year VE and X-Zones according to FEMA's 1990 "Guidelines for Great Lakes Wave Runup Computation and Mapping". The following list shows the two city of East Tawas sites and the 100-year wave runup flood profiles. Samples of these computations are included in Appendix A.

East Tawas FIS Sites	100-year Computed Wave Runup(ft.)	100-year Wave Runup Elevation (ft., NGVD)
1. East Tawas-1	0.6	584.5
2. East Tawas-2	4.8	586.8

```
                    RUNUP COMPUTATION
WAVE RUNUP FOR EAST TAWAS, MICHIGAN EAST TAWAS 1
runup on:  beach
100-year flood: 584.0 feet above IGLD, optional
water depth at toe:  26.0 feet          1st: significant wave computation
100-year wave period T:  11.4       (enter per Ref. 3)
                T':   5.7
                 L: 329.59
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                 K:   2.0
            alpha:   0.0110
              Hmo:  11.0
            d bar:   0.0062
          epsilon:   0.0083
           Hs/Hmo:   1.018     (enter per Ref. 4, Figure 10)
Hs in deep water:  11.2                (significant wave)
      beach slope:   0.00600  (tan 30H:1V = 0.03333)
beach (Greek ltr) xi:   0.046          2nd: wave runup computation
      beach runup:   0.5
   runup elevation: 584.5 feet above IGLD


A:\>NOTE:  ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD
```

```
                              RUNUP COMPUTATION
            WAVE RUNUP FOR EAST TAWAS, MICHIGAN EAST TAWAS 2
            runup on:  revetment
       100-year flood: 584.0 feet above IGLD, optional
    water depth at toe:   2.3 feet           1st: significant wave computation
  100-year wave period T:  11.4       (enter per Ref. 3)
                     T':   1.7
                      L:  98.03
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   6.8
                  alpha:   0.0200
                    Hmo:   1.4
                  d bar:   0.0006
               epsilon:   0.0036
                Hs/Hmo:   1.000     (enter per Ref. 4, Figure 10)
         H at structure:   1.4                 (significant wave)
             tan(theta):   0.60000  (tan 2H:1V = 0.50000   tan 3H:1V = 0.33333)
revetment (Greek ltr) xi:  13.1                 2nd: wave runup computation
        revetment runup:   2.8
        runup elevation: 586.8 feet above IGLD


A:\>NOTE:  ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD
```

City of East Tawas, Michigan
Limited Map Maintenance Program
Hydraulic Background Information

This study covers the entire East Tawas City shoreline on Saginaw Bay (about 2 miles). The study was performed to revise only the hydraulic analysis for East Tawas by incorporating the wave runup elevations associated with the 100-year flood level. Since completion of the City of East Tawas FIS in 1977, the "Flood Levels Report for Saginaw Bay" was prepared by the U.S. Army Corps of Engineers, Detroit District in September 1989. The stillwater elevations for the 100- and 500-year floods have been determined for the Saginaw Bay shoreline of East Tawas from this report and are shown in the table below. Table 1 also shows the wave runup elevation associated with the 100-year flood elevation.

TABLE 1
CITY OF EAST TAWAS, MICHIGAN
RECOMMENDED FLOOD LEVELS

TRANSECT #	STILLWATER[1] 100-YEAR (FT. NGVD)	WAVE RUNUP 100-YEAR (FT. NGVD)	STILLWATER[1] 500-YEAR (FT. NGVD)
1	584.0	584.~~0~~5	585.0
2	584.0	58~~8~~6.8	585.0

[1]Saginaw Bay

As part of this study, a field survey was made in September 1990. The survey included two transects, one located about 80 feet east of Church Road and another located about 30 feet west of Adams Road. Transects were located perpendicular to the shoreline and with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality.

Along each transect, the maximum wave runup elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical futures. The wave runup components were determined using the procedures developed in the June 1989 "Great Lakes Wave Runup Methodology Study" prepared by the U.S. Army Corps of Engineers, Detroit District. The 100-year flood level from the September 1989 report referenced above, was used to compute the maximum wave runup elevations required for updating the previous study for the City of East Tawas on Saginaw Bay.

FIS PROFILE
EAST TAWAS 1

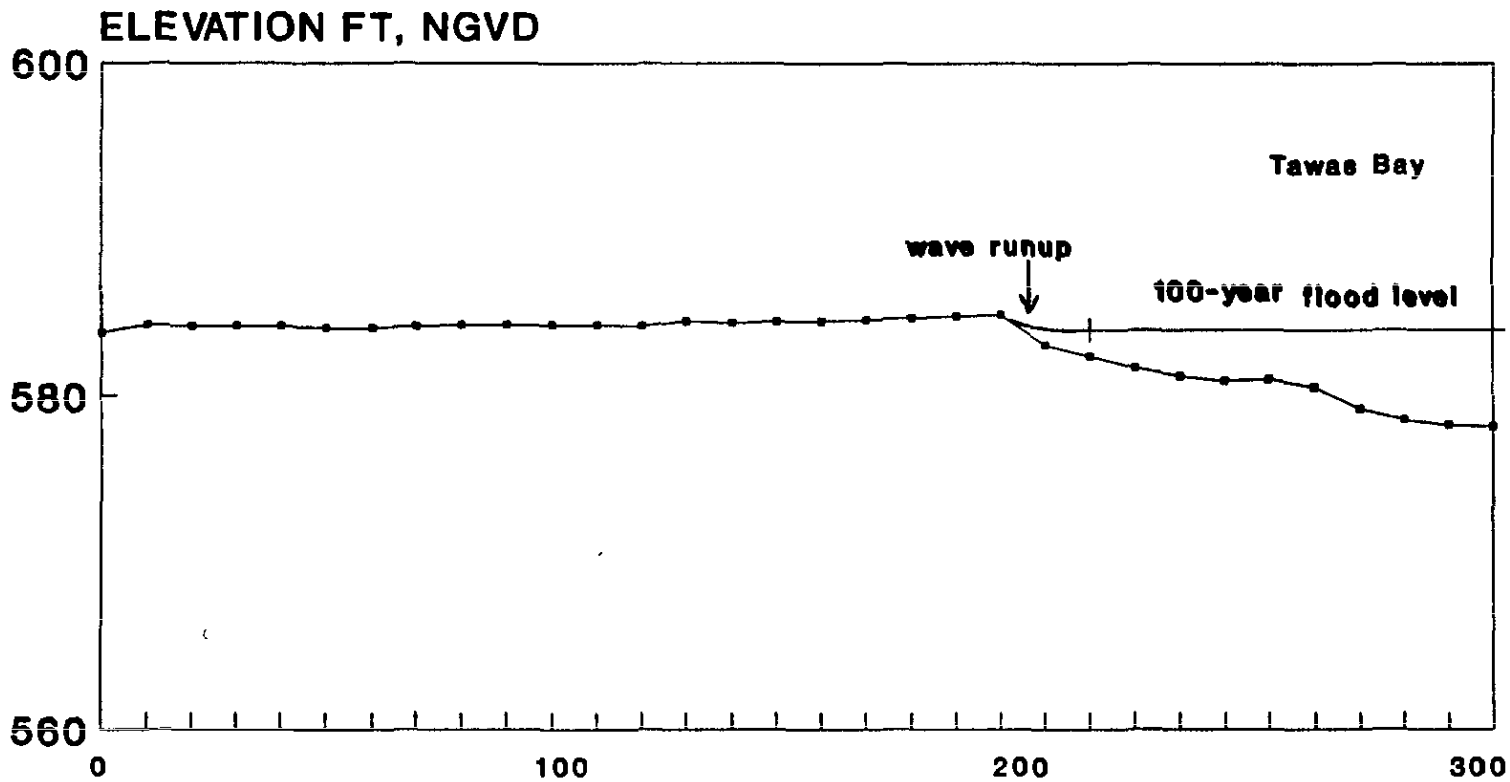


FIGURE ET-1

FIS PROFILE
EAST TAWAS-2

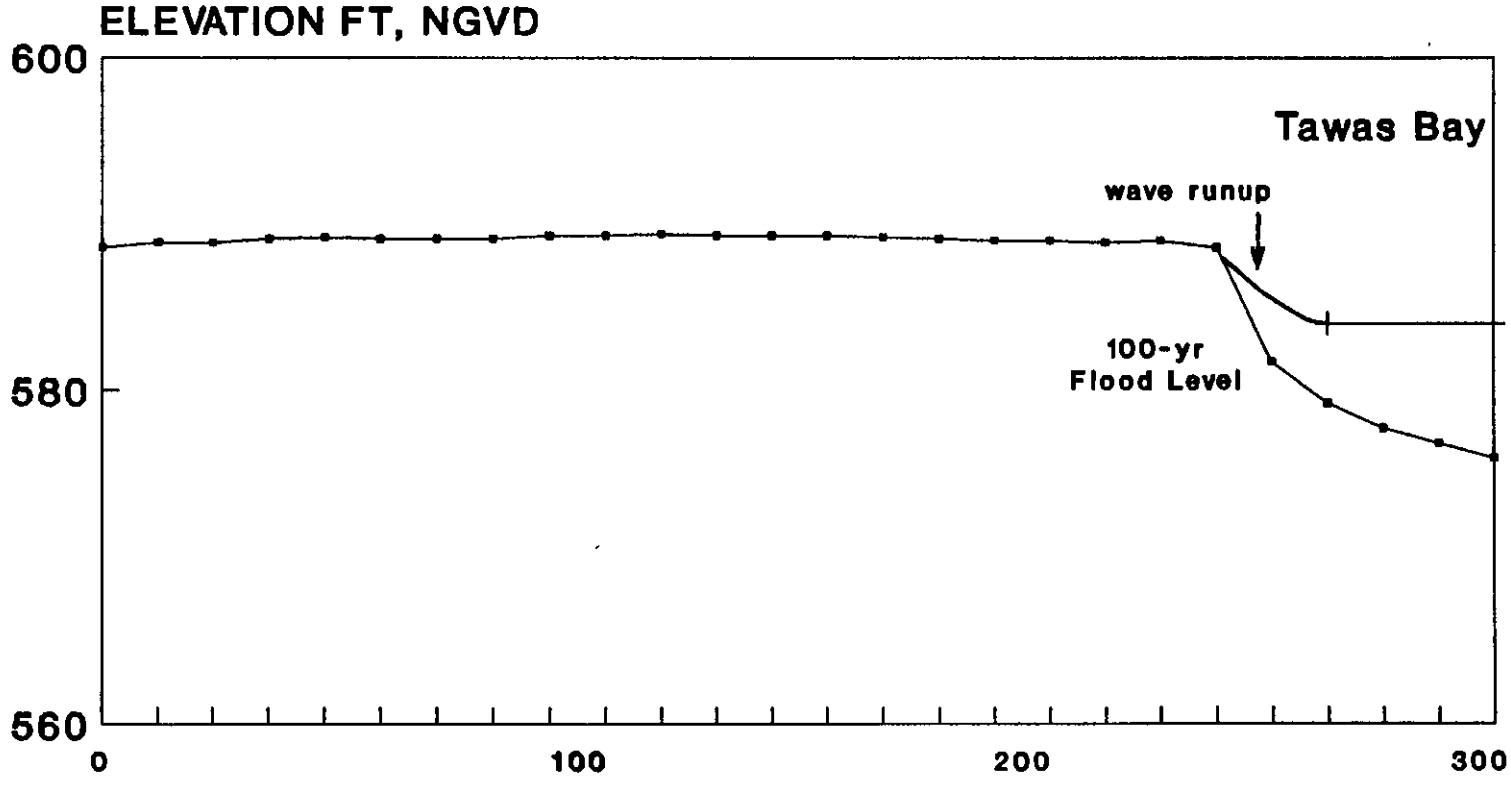


FIGURE ET-2

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: East Tawas

3) WATERCOURSE: Lake Huron ~~Wave run-up~~

4) DOCUMENT TYPE: ~~Report~~ Wave run-up Report

00BREAK00

21 MAR 1991

CENCE-PD-PF (1105)

MEMORANDUM FOR Commander, North Central Division
ATTN: CENCD-PE-PD-FP (S. Tamulionis)
536 S. Clark St., Chicago, IL 60605

SUBJECT: City of East Tawas, Michigan, Limited Map Maintenance, Flood Insurance Study

1. Enclosed are draft copies of the required Technical Letter Report for the calculation of the wave run up component of the subject study, and appropriate work map. A copy of this report is also being transmitted to the Michigan Department of Natural Resources for concurrent review. This study is being conducted by the Detroit District, in accordance with Inter-Agency Agreement EMW-90-E-3286, Project Order No. 3.

2. Please return your comments on the draft report no later than two weeks after receipt. If you have any questions concerning the enclosed report, please contact Mr. Joe Wanielista, program manager, Flood Plain Management Services, at (313) 226-6773.

FOR THE COMMANDER:

Original Signed

Encls

WILLIAM W. WILLIS, P.E.
Chief, Planning Division

Copy Furnished (w/Encls):

Mr. Bruce Menerey, P.E.
Land and Water Management Division
Michigan Department of Natural Resources
P.O. Box 30028
Lansing, MI 48909

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MAR 22 1991

NATURAL RESOURCES
LAND & WATER MGMT.

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
March 1991

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

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FIGURES

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1.0 INTRODUCTION

1.1 Purpose of Study

This report describes the application of the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" to flood levels on Saginaw Bay in conjunction with the Limited Map Maintenance Program (LMMP), for the City of East Tawas, Michigan. The flood levels applicable to the City of East Tawas were developed in the September 1989 "Flood Levels Report for Saginaw Bay" report prepared by the U.S. Army Corps of Engineers, Detroit District (COE).

1.2 Coordination

The September 1989 "Flood Levels Report For Saginaw Bay" report, along with examples of the application of the methodology from the 1989 "Great Lakes Wave Runup Methodology Study", were presented to FEMA on 1 March 1990. The procedures outlined in the above references were approved at this meeting for application to all Saginaw Bay FIS and LMMP sites, including the City of East Tawas.

1.3 Authority and Acknowledgments

The objective of the LMMP is to provide funding for flood map updates. In the City of East Tawas, the LMMP will be used to revise the existing hydraulic analyses to include the wave runup component. The work was conducted under Inter-Agency Work Agreement, EMW-90-E-3286, Project Order No. 3A, between the COE and the Federal Emergency Management Agency (FEMA).

The "Great Lakes Wave Runup Methodology Study" was accomplished in 1989 by the COE for FEMA, for application to future coastal Flood Insurance Studies (FIS), and/or restudies of communities bordering the Great Lakes. The 100-year flood level from the September 1989 report referenced above was used to compute the maximum wave runup elevations required for updating the LMMP sites in the City of East Tawas on Saginaw Bay. Table 1 lists the profiles, and the 100-year and 500-year "base" flood levels at the two locations along the City of East Tawas shoreline. The two profiles were developed from data obtained from a June 1990 survey.

2.0 AREA STUDIED

2.1 Community Description

The City of East Tawas, Michigan, shown on Figure 1, is located in Iosco County along 2 miles of shoreline on Saginaw Bay. The city has a population of about 2,600. Its major industry is year-round tourism, based on the city's location on Saginaw Bay. The shoreline consists of a developed park area (East Tawas State Park), the Waterways Commission Dock, and small seasonal and year-round residential homes.

The City of East Tawas shoreline on Saginaw Bay is protected, to some extent, from northeasterly and easterly storms by Tawas Point. Bathymetry in Saginaw Bay along City of East Tawas shoreline varies from 30-foot depths

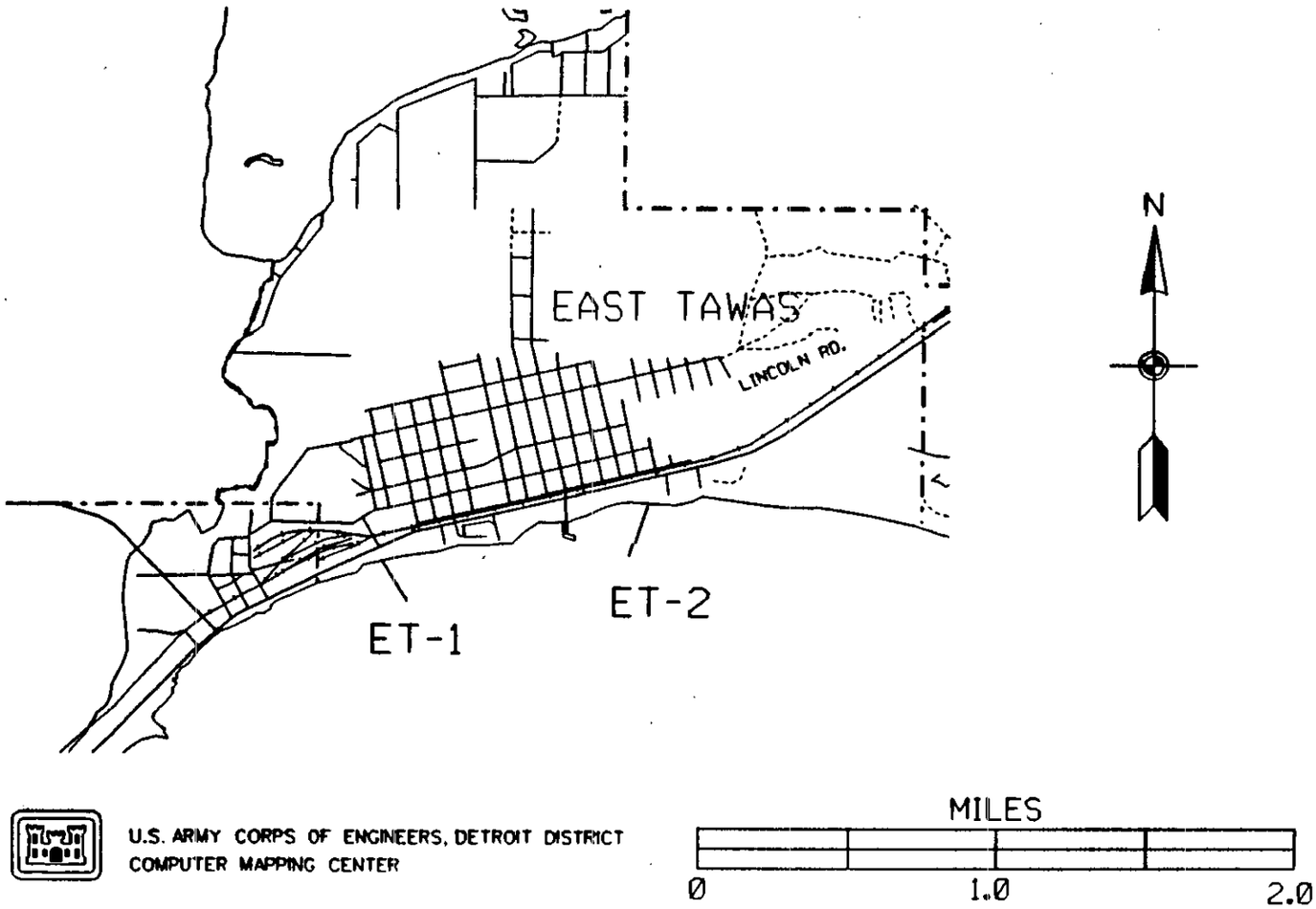
SHORELINE PROFILES
CITY OF EAST TAWAS, MICHIGAN

Profile Location	100-year Flood Level *	500-year Flood Level *
1. East Tawas-1	584.0	585.0
2. East Tawas-2	584.0	585.0

* NOTE: All elevations are in FT, NGVD and were obtained from the September 1989 "Flood Levels Report for Saginaw Bay"

TABLE 1

CITY OF EAST TAWAS
LOCATION MAP



U.S. ARMY CORPS OF ENGINEERS, DETROIT DISTRICT
COMPUTER MAPPING CENTER

FIGURE 1

offshore to less than five feet deep near shore. The lowest seasonal lake stages usually prevail during the winter months and the highest during the summer months. During the past 13 years, fluctuations of monthly mean water levels on Saginaw Bay, as measured at the Essexville, Michigan water level gage, have ranged from a minimum of 578.14 feet NGVD to a maximum of 581.9 feet NGVD.

2.2 Principal Flood Problems

Short-term Saginaw Bay water level fluctuations are most often due to variations in wind and barometric pressure. Occasionally, a surge of considerable proportions takes place within a few hours, due to strong and persistent northerly or southerly winds.

When lake levels are high and storms occur from the south and east, the City of East Tawas shoreline is usually subjected to extreme conditions. Along this shoreline, substantial flooding has occurred because of the flat topography along Saginaw Bay.

3.0 ENGINEERING METHODS

The flood levels established in the U.S. Army Corps of Engineer's September 1989 "Flood Levels Report for Saginaw Bay" and the procedures developed in the 1989 "Great Lakes Wave Runup Methodology Study" were used to analyze the flooding potential at the two City of East Tawas LMMP sites shown on Figure 1. The hydraulic analyses presented herein involved the determination of the wave runup components and maximum wave runup elevations for selected sites.

Input data used for flood calculations include site specific design wave, water depth at the toe of the structure, and wave period. Additional data such as nearshore profiles, high water marks, existing conditions, and bathymetry and topography, were also analyzed to determine the maximum wave runup elevation at each site. This technical letter report presents the wave runup application procedures for each of the two LMMP sites located in the City of East Tawas. Representative profiles and the wave runup computations for each site are included in Appendix A.

4.0 VE AND X-ZONE DELINEATIONS

Reaches of the City of East Tawas shoreline in the surf zone which are subject to significant wave attack are referred to by FEMA as Coastal High Hazard Zones or velocity ("VE") Zones. The VE-Zone (shown as the V-Zone on Figures 2 & 3) is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. An X-Zone is the flood insurance rate zone that corresponds to the areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees.

Two different flood conditions, as defined by FEMA, most closely represent the LMMP sites in the City of East Tawas. The first type of condition involves a beach/bluff system where wave runup does not overtop the existing beach/bluff and there are no obstructions on the lakeward side of the

beach/bluff. The VE/X-Zone demarcation line was established as the point of maximum wave runup. According to FEMA guidelines, the VE/X-Zone demarcation line is fixed at the point where the wave runup intersects the calculated post-storm profile (wave runup intersection point). Since the study assumed no bluff erosion, the VE/X-Zone demarcation line as determined from the point of maximum wave runup and the VE/X-Zone demarcation line as determined as the wave runup point are identical. This mapping is considered appropriate for profile East Tawas-1, and is shown on Figure 2.

The second type of condition involves a beach/bluff system where the structure is not flooded, damaged or overtopped by wave runup. In this case, the VE/X-Zone demarcation line is fixed at the most landward edge of the exposed portion of the structure. The landward side of the V-Zone is mapped as a X-Zone. This type of flooding condition is representative of profile East Tawas-2, and is shown on Figure 3.

The VE and X-Zones for these sites have been delineated according to FEMA's 1990 "Guidelines for Great Lakes Wave Runup Computation and Mapping" and are shown on the attached work maps.

The formal submittal of the City of East Tawas LMMP study will include original mylar copies showing sufficient detail for submittal to FEMA's technical review contractor.

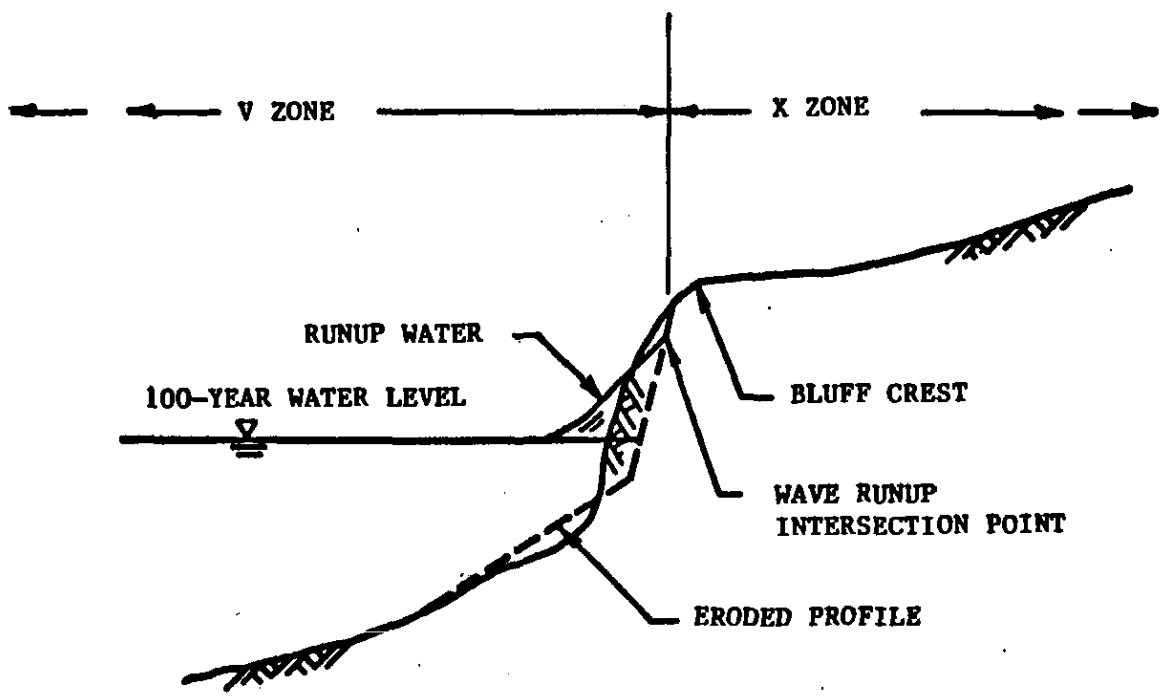
5.0 CONCLUSIONS

For each of the City of East Tawas sites where the 100-year flood level inundates the shoreline property, the inundated area will experience a minimal water depth shoreward of the shoreline protection. This water depth will generate a negligible wave across the property. Therefore, the 100-year flood level will be used to delineate the flood profiles at each site.

Accordingly, where structures protect against flooding, the 100-year VE and X-Zones, based on wave runup elevations, will be delineated on the work maps in the final LMMP for the site. Table 2 lists the 100-year computed wave runup components and the associated wave runup elevations for the two sites.

In conclusion, it is recommended that the delineated 100-year flood profiles for the two City of East Tawas sites included herein be used by FEMA for updating the LMMP sites.

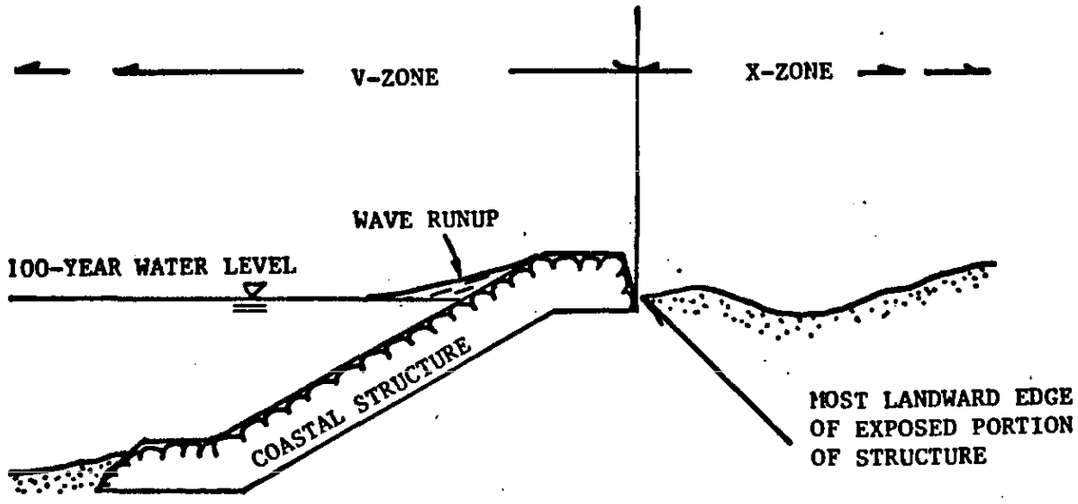
CITY OF EAST TAWAS V & X ZONE DELINEATIONS ON A BEACH SYSTEM



East Tawas-1

FIGURE 2

CITY OF EAST TAWAS V & X ZONE DELINEATIONS ON A STRUCTURE SYSTEM



East Tawas-2

FIGURE 3

Table 2

Wave Runup Elevations

East Tawas FIS Sites	100-year Computed Wave Runup(ft.)	100-year Wave Runup Elevation (ft., NGVD)
1. East Tawas-1	0.6	584.6
2. East Tawas-2	4.8	588.8

6.0 GLOSSARY

Annual Maximum Instantaneous Water Level: The highest water level that was recorded during a year by a gage with a sampling frequency of an hour or less.

Beach: The zone of sedimentary material that extends landward from the low water line to the place where there is a marked change in material or form, or to the line of permanent vegetation.

Bluff: A high, steep bank composed of erodible materials.

Floodplain: The area adjoining a river, stream, watercourse, ocean, lake or other body of standing water that has been or may be covered by floodwater.

National Geodetic Vertical Datum of 1929 (NGVD): The nationwide reference datum for land elevations throughout the United States. It was established by the National Geodetic Survey in 1929.

Runup: The rush of water up a beach or structure from the breaking of a wave. Also, the vertical height of uprush above the still-water level.

Still-water level: The elevation that the water surface would assume if all wave action were absent.

Storm-water level: The rise above the normal water level on the open-coast, due to wind stress on the water surface.

VE-Zone: The flood insurance rate zone that corresponds to the areas of 100-year coastal flood plains where average depths are more than 4 feet and have additional hazards associated with storm waves.

Wave height: The vertical distance between the wave crest and the preceding trough.

Wave setup: The superelevation of the water surface over normal surge elevation due to the onshore mass transport of the water by wave action alone.

Wind setup: The vertical rise in the still-water level on the leeward side of a body of water caused by wind stresses on the surface of the water.

X-Zone: The flood insurance rate zone that corresponds to the areas outside the 500-year flood plain, areas within the 500-year flood plain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees.

7.0 REFERENCES

1. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Vicksburg, MS, Shore Protection Manual, Volumes I & II, 1984

2. U.S. Army Corps of Engineers, Detroit District, Phase I, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

3. U.S. Army Corps of Engineers, Detroit District, Phase II, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

4. U.S. Army Corps of Engineers, Detroit District, Appendices, Revised Report on Great Lakes Open-Coast Flood Levels, April 1988

5. U.S. Army Corps of Engineers, Coordinating Committee on Great Lakes Basin Hydraulic and Hydrologic Data, History of Water Level Gauges, Upper Great Lakes and the St. Clair - Detroit Rivers, January 1978

6. U.S. Army Corps of Engineers, North Central Division, Great Lakes Region Inventory Report National Shoreline Study, August 1978

7. U.S. Army Corps of Engineers, Detroit District, Flood Levels Report - Saginaw Bay, September 1989

8. U.S. Army Corps of Engineers, Detroit District, Flood Levels Report - Anchor Bay, September 1989

9. Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan, SCHWAB, D.J., and LYNN, E.W., Great Lakes Storm Surge Planning Program, 1987

10. U.S. Army Corps of Engineers, Detroit District, Phase II Report on Great Lakes Flood Levels - Little Bay De Noc, August 1981

11. U.S. Army Corps of Engineers, Detroit District, Phase II Report on Great Lakes Flood Levels - Big Bay De Noc, July 1981

12. FEMA, Guidelines for Great Lakes Wave Runup Computation and Mapping, 1990

13. U.S. Army Corps of Engineers, Detroit District, Section 22 Lake Superior Shoreline Wave Runup Study, June 1989

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

APPENDIX A

Prepared by the U.S. Army Corps of Engineers
for the Federal Emergency Management Agency

Detroit, Michigan
March 1991

TECHNICAL LETTER REPORT ON
THE CITY OF EAST TAWAS, MICHIGAN

SYNOPSIS

Appendix A outlines the procedures necessary to calculate the wave runup component and the maximum wave runup elevation associated with the 100-year flood level. These data, with the information provided from the profile surveys will enable the user to delineate the 100-year VE and X-Zones according to FEMA's 1990 "Guidelines for Great Lakes Wave Runup Computation and Mapping". The following list shows the two city of East Tawas sites and the 100-year wave runup flood profiles. Samples of these computations are included in Appendix A.

East Tawas FIS Sites	100-year Computed Wave Runup(ft.)	100-year Wave Runup Elevation (ft., NGVD)
1. East Tawas-1	0.6	584.5
2. East Tawas-2	4.8	586.8

RUNUP COMPUTATION

WAVE RUNUP FOR EAST TAWAS, MICHIGAN EAST TAWAS 1

```
                runup on:  beach
       100-year flood: 584.0 feet above IGLD, optional
   water depth at toe:  26.0 feet            1st: significant wave computation
 100-year wave period T:  11.4       (enter per Ref. 3)
                    T':   5.7
                     L: 329.59
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                     K:   2.0
                 alpha:   0.0110
                   Hmo:  11.0
                 d bar:   0.0062
               epsilon:   0.0083
               Hs/Hmo:    1.018     (enter per Ref. 4, Figure 10)
     Hs in deep water:  11.2                (significant wave)
          beach slope:   0.00600  (tan 30H:1V = 0.03333)
 beach (Greek ltr) xi:   0.046              2nd: wave runup computation
          beach runup:   0.5
      runup elevation: 584.5 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

RUNUP COMPUTATION

WAVE RUNUP FOR EAST TAWAS, MICHIGAN EAST TAWAS 2

```
                runup on:  revetment
        100-year flood: 584.0 feet above IGLD, optional
     water depth at toe:   2.3 feet            1st: significant wave computation
  100-year wave period T:  11.4        (enter per Ref. 3)
                     T':   1.7
                      L:  98.03
100-yr deep water wave H:  24.9 feet  (enter per Ref. 3)
                      K:   6.8
                  alpha:   0.0200
                    Hmo:   1.4
                  d bar:   0.0006
                epsilon:   0.0036
                 Hs/Hmo:   1.000     (enter per Ref. 4, Figure 10)
         H at structure:   1.4                (significant wave)
            tan(theta):   0.60000  (tan 2H:1V = 0.50000   tan 3H:1V = 0.33333)
revetment (Greek ltr) xi:  13.1                2nd: wave runup computation
        revetment runup:   2.8
        runup elevation: 586.8 feet above IGLD
```

A:\>NOTE: ALL ELEVATIONS ABOVE ARE IN FEET ABOVE NGVD

City of East Tawas, Michigan
Limited Map Maintenance Program
Hydraulic Background Information

This study covers the entire East Tawas City shoreline on Saginaw Bay (about 2 miles). The study was performed to revise only the hydraulic analysis for East Tawas by incorporating the wave runup elevations associated with the 100-year flood level. Since completion of the City of East Tawas FIS in 1977, the "Flood Levels Report for Saginaw Bay" was prepared by the U.S. Army Corps of Engineers, Detroit District in September 1989. The stillwater elevations for the 100- and 500-year floods have been determined for the Saginaw Bay shoreline of East Tawas from this report and are shown in the table below. Table 1 also shows the wave runup elevation associated with the 100-year flood elevation.

TABLE 1
CITY OF EAST TAWAS, MICHIGAN
RECOMMENDED FLOOD LEVELS

TRANSECT #	STILLWATER[1] 100-YEAR (FT. NGVD)	WAVE RUNUP 100-YEAR (FT. NGVD)	STILLWATER[1] 500-YEAR (FT. NGVD)
1	584.0	584.~~8~~ 5	585.0
2	584.0	58~~8~~6.8	585.0

[1]Saginaw Bay

As part of this study, a field survey was made in September 1990. The survey included two transects, one located about 80 feet east of Church Road and another located about 30 feet west of Adams Road. Transects were located perpendicular to the shoreline and with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality.

Along each transect, the maximum wave runup elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical futures. The wave runup components were determined using the procedures developed in the June 1989 "Great Lakes Wave Runup Methodology Study" prepared by the U.S. Army Corps of Engineers, Detroit District. The 100-year flood level from the September 1989 report referenced above, was used to compute the maximum wave runup elevations required for updating the previous study for the City of East Tawas on Saginaw Bay.

FIS PROFILE
EAST TAWAS 1

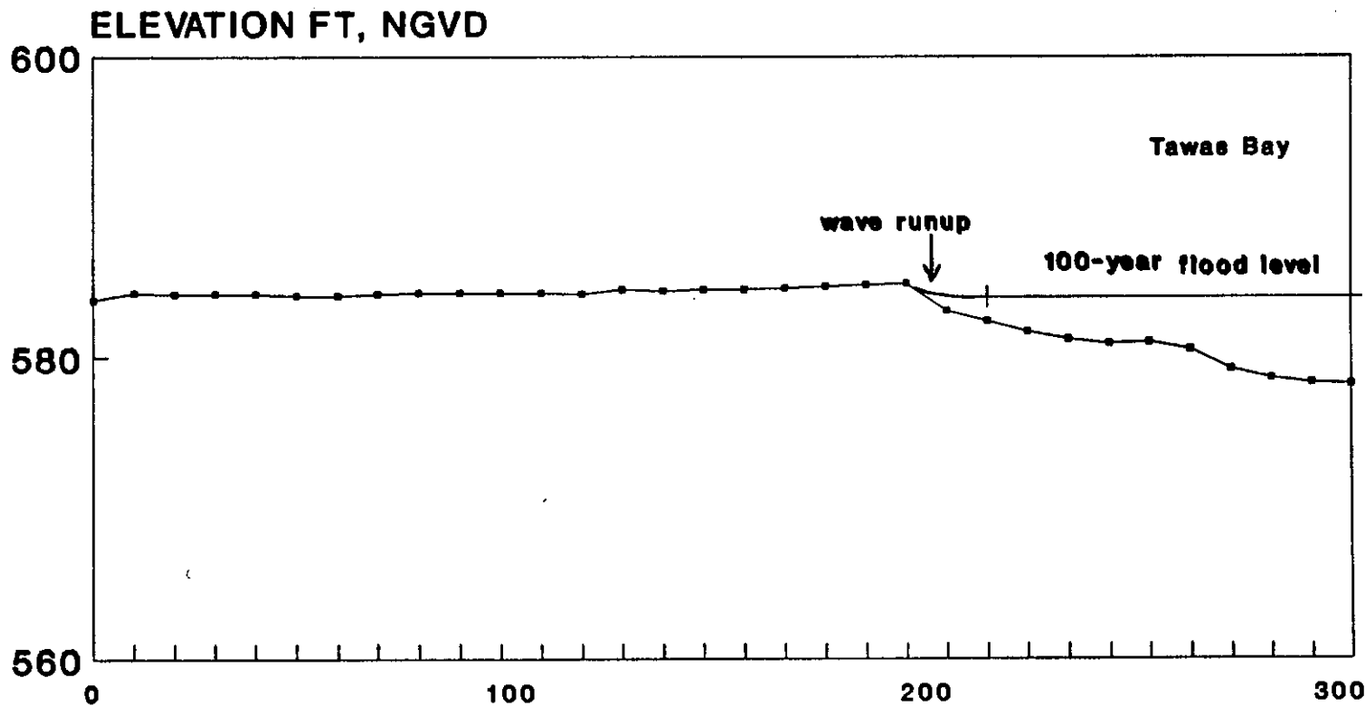


FIGURE ET-1

FIS PROFILE
EAST TAWAS-2

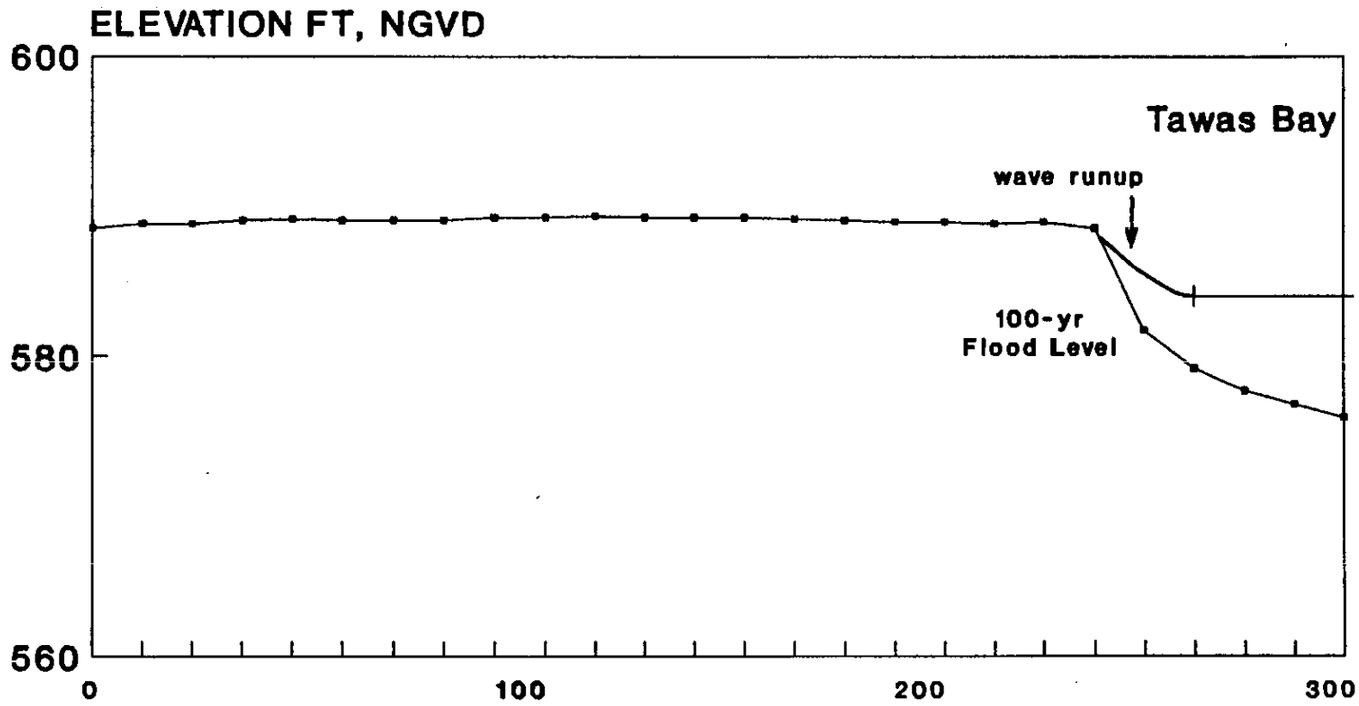
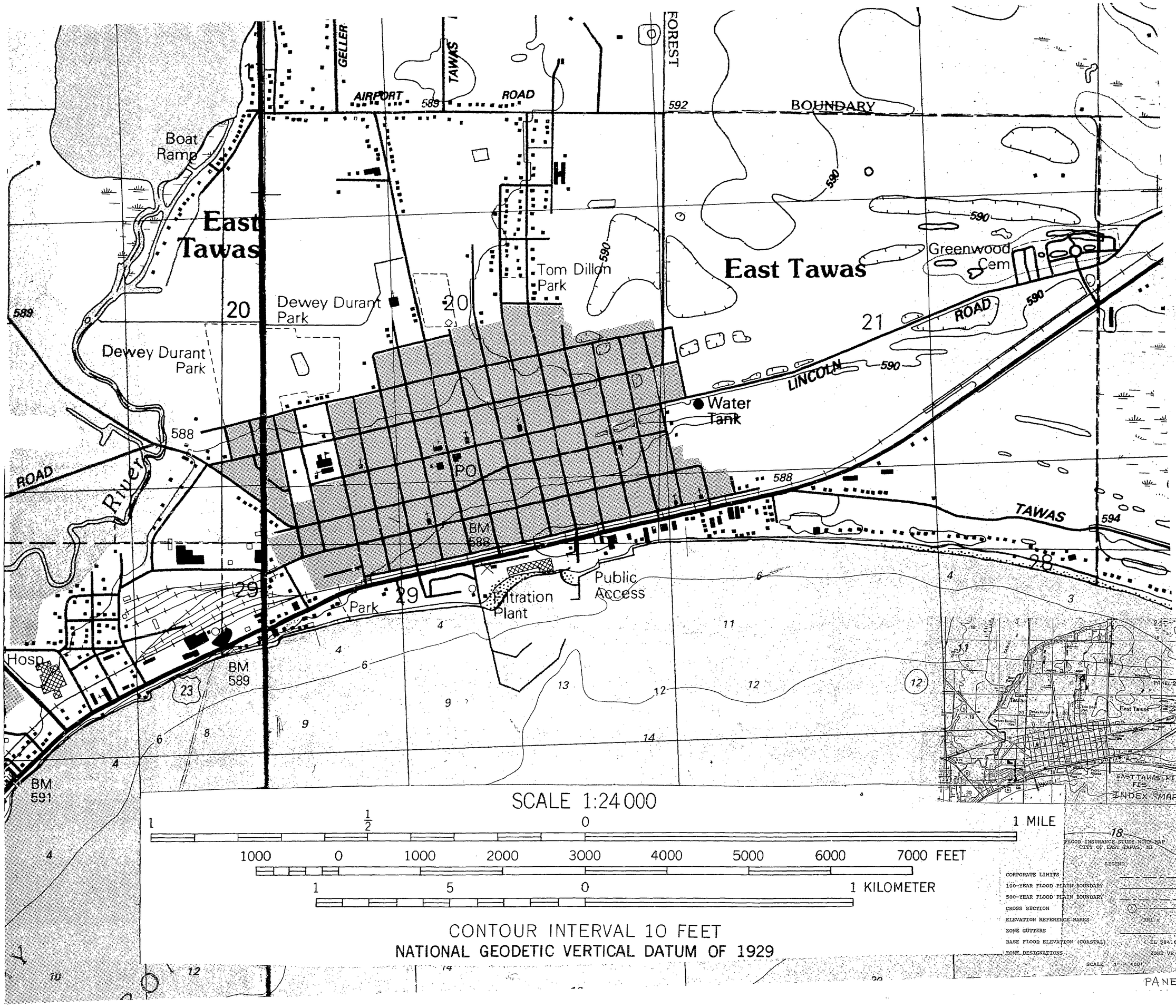


FIGURE ET-2



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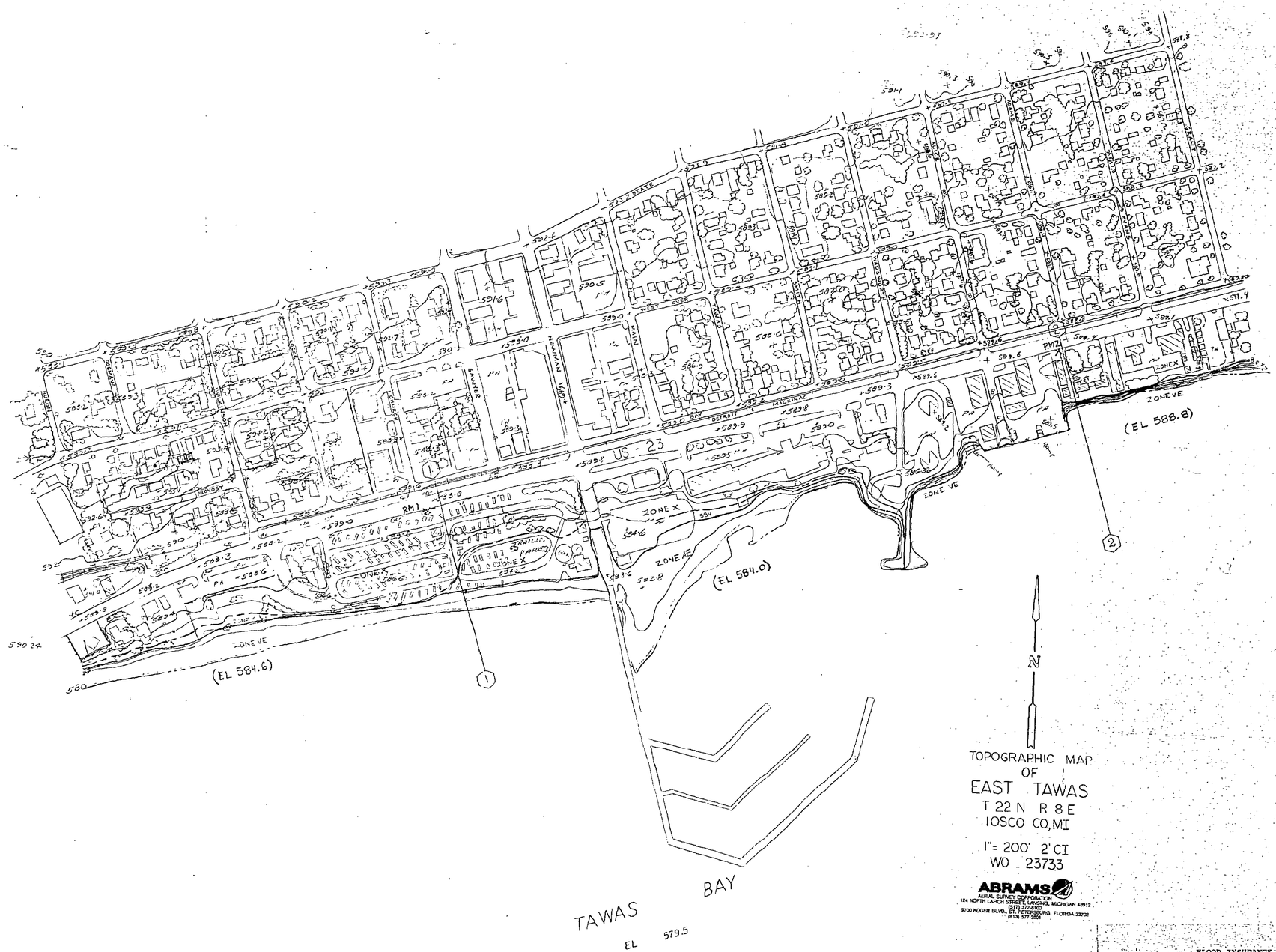
MAR 22 1991
NATURAL RESOURCES
LAND & WATER MGMT.



TOPOGRAPHIC MAP
OF
EAST TAWAS
T 22 N R 8 E
IOSCO CO, MI

1" = 200' 2' CI
WO 23733

ABRAMS
AERIAL SURVEY CORPORATION
124 NORTH LARCH STREET, LANSING, MICHIGAN 48912
(517) 372-8160
9700 ROGER BLVD., ST. PETERSBURG, FLORIDA 33702
(813) 577-3001

FLOOD INSURANCE STUDY WORK MAP
CITY OF EAST TAWAS, MI

LEGEND

CORPORATE LIMITS	
100-YEAR FLOOD PLAIN BOUNDARY	
500-YEAR FLOOD PLAIN BOUNDARY	
CROSS SECTION	1 — 1
ELEVATION REFERENCE MARKS	RM1 ×
ZONE GUTTERS	
BASE FLOOD ELEVATION (COASTAL)	(EL 584.6)
ZONE DESIGNATIONS	ZONE VE

SCALE 1" = 200'

PANEL 1

RECEIVED
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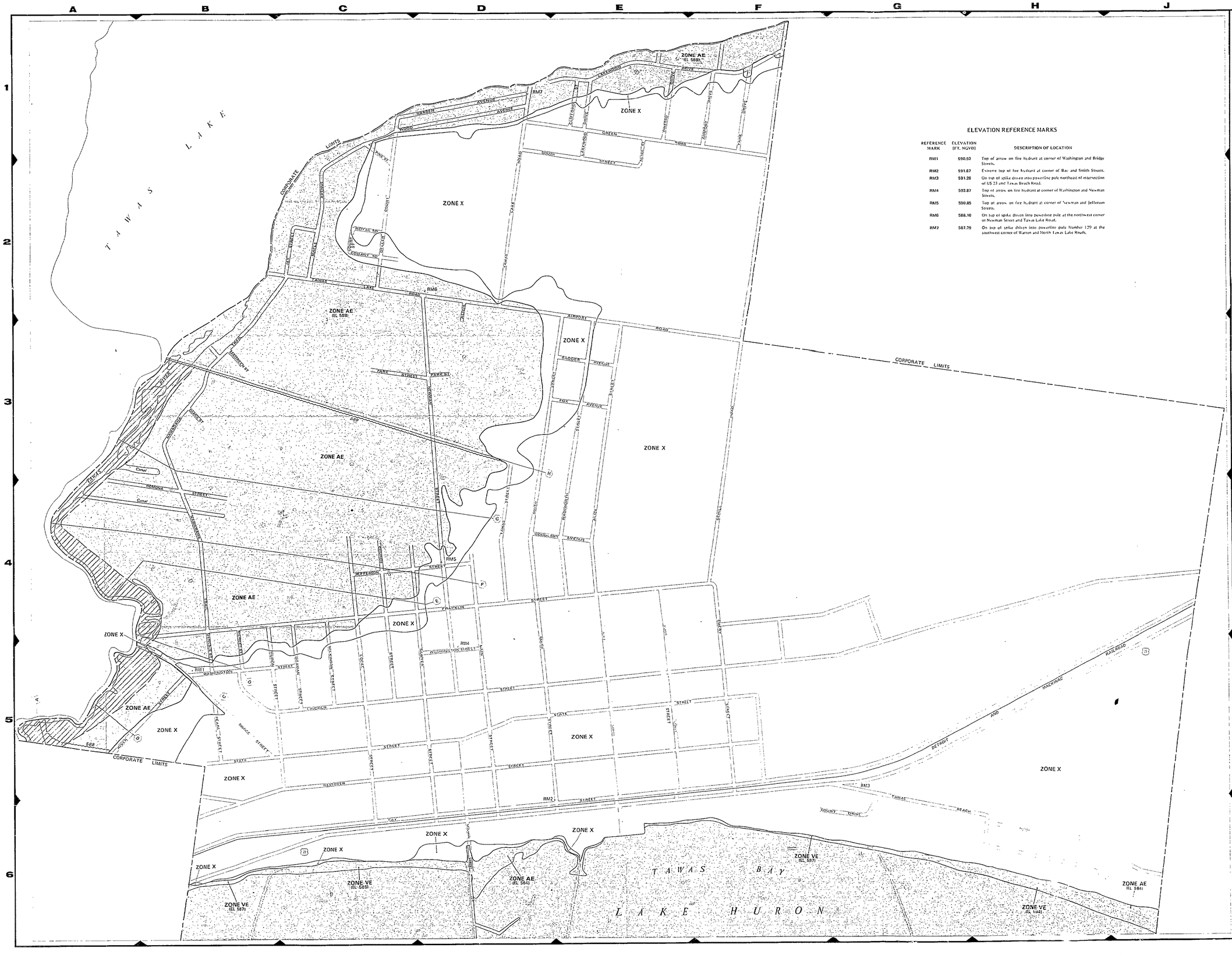
NATURAL RESOURCES
LAND & WATER MGMT.



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM1	590.53	Top of arrow on fire hydrant at corner of Washington and Bridge Streets.
RM2	591.67	Extreme top of fire hydrant at corner of Bay and Smith Streets.
RM3	591.28	On top of spike driven into powerline pole northeast of intersection of US 23 and Tawas Beach Road.
RM4	593.87	Top of arrow on fire hydrant at corner of Washington and Newman Streets.
RM5	590.85	Top of arrow on fire hydrant at corner of Newman and Jefferson Streets.
RM6	588.10	On top of spike driven into powerline pole at the northwest corner of Newman Street and Tawas Lake Road.
RM7	587.79	On top of spike driven into powerline pole Number 129 at the southwest corner of Warren and North Tawas Lake Roads.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined
- **ZONE AE** Base flood elevations determined
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year flood plain
- **ZONE D** Areas in which flood hazards are undetermined

UNDEVELOPED COASTAL BARRIERS

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zone

513 — Base Flood Elevation Line; Elevation in Feet*

(A)—(A) Cross Section Line

(EL 191) Base Flood Elevation in Feet Where Uniform Within Zone*

RM5 Elevation Reference Mark

M3.0 Mile Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all planimetric features outside Special Flood Hazard Areas or all areas subject to flooding particularly from local drainage sources of small size.

Areas of Special Flood Hazard (100-year flood) include zones A, AE, AH, AO, A1, A3, A99, V, VE and V1-V30.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown as 120 ft.

Coastal base flood elevations apply only landward of the shoreline.

This map represents approximate boundaries of coastal barriers established under the Coastal Barrier Resources Act (PL 97-348).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

MAP REPOSITORY

INITIAL IDENTIFICATION
MAY 24 1974

FLOOD HAZARD BOUNDARY MAP REVISION
MARCH 5 1976

FLOOD INSURANCE RATE MAP EFFECTIVE
SEPTEMBER 30, 1977

FLOOD INSURANCE RATE MAP REVISIONS
Map revised
to change special flood hazard areas, base flood elevations and zone designations, and to add cross sections and floodway.

To determine if flood insurance is available contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
400 0 400

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

CITY OF
EAST TAWAS,
MICHIGAN
IOSCO COUNTY

[ONLY PANEL PRINTED]

COMMUNITY—PANEL NUMBER:
260100 0001 C
MAP REVISED:

PRELIMINARY
Federal Emergency Management Agency

GREENHORNE & O'MARA E FRAME 88/12 STANDARD MIP

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Au Sable River

4) DOCUMENT TYPE: 100 yr encroached

00BREAK00

```
*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************


T1      OSCODA TOWNSHIP  JRA FILE NO. 5555-48-1 RONALD KOZALSKI,PROJECT MNGR.
T2      100 YEAR FLOOD
T3      AU SABLE RIVER

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

    -10.       4.       -0.       -0. -0.000000     -0.00     -0.0      -0.    580.600   -0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     3.000    -0.000    -1.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000

CCHV=     .300 CEHV=     .500
   SECNO     DEPTH     CWSEL     CRIWS     WSELR     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


                    SECTION THROUGH BREAKWATER OBTAINED FROM CORPS OF

                    ENGINEERS. SURVEYED IN JULY OF 1976.

     .00     14.20    580.60      0.00    580.60    580.73       .13      0.00      0.00    586.20
   6570.        0.     6570.        0.        0.     2250.        0.        0.        0.    586.10
    0.00      0.00      2.92      0.00      .070      .035      .060     0.000    566.40      0.00
 .000187        0.        0.        0.         0         0         1      0.00    186.41    186.41


                    SECTION THROUGH BREAKWATER OBTAINED FROM CORPS OF

                    ENGINEERS. SURVEYED IN JULY OF 1976.

     .21     15.02    580.82      0.00      0.00    581.00       .18       .24       .02    586.40
   6570.        0.     6570.        0.        0.     1945.        0.       53.        5.    586.20
     .09      0.00      3.38      0.00      .070      .035      .060      .035    565.80     13.80
 .000263     1100.     1100.     1100.         1         0         1      0.00    171.60    185.40


3470 ENCROACHMENT STATIONS=     1520.0     1720.0  TYPE=     1  TARGET=     200.000

                A       60FT. D.S. OF THE US-23 BRIDGE.

     .39     15.20    581.10      0.00      0.00    581.26       .17       .26      .00100000.00
   6570.        0.     6570.        0.        0.     2013.        0.       96.        9. 100000.00
     .17      0.00      3.26      0.00      .070      .035      .060      .035    565.90   1520.00
 .000290      950.      950.      950.         2         0         1      0.00    200.00   1720.00
```

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     .40     14.45    581.05      0.00      0.00    581.35       .30       .02       .07    604.80
   6570.        0.    6570.        0.        0.     1494.        0.       99.        9.    604.90
     .18      0.00      4.40      0.00      .050      .035      .050      .035    566.60   1527.50
 .000632       59.       59.       59.         2         0         1      0.00    174.04   1701.54

3265 DIVIDED FLOW

NORMAL BRIDGE.NRD=38 MIN ELTRD=  587.40 MAX ELLC=  601.30

                B        US-23 BRIDGE-NO BRIDGE SKE.

     .40     14.45    581.05      0.00      0.00    581.36       .32       .00       .01    604.80
   6570.        0.    6570.        0.        0.     1454.        0.       99.        9.    604.90
     .18      0.00      4.52      0.00      .020      .030      .020      .035    566.60   1527.50
 .000648        1.        1.        1.         0         0         1      0.00    170.04   1701.54

3265 DIVIDED FLOW

   SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IOC       ICONT     CORAR     TOPWID      ENDST

NORMAL BRIDGE.NRD=38 MIN ELTRD=  587.40 MAX ELLC=  601.30

     .41     14.49    581.09      0.00      0.00    581.40       .31       .04       .00    604.80
   6570.        0.    6570.        0.        0.     1460.        0.      100.        9.    604.90
     .18      0.00      4.50      0.00      .020      .030      .020      .035    566.60   1527.50
 .000641       56.       56.       56.         0         0         1      0.00    170.28   1701.78

     .41     14.51    581.11      0.00      0.00    581.41       .30       .00       .01    604.80
   6570.        0.    6570.        0.        0.     1502.        0.      100.        9.    604.90
     .18      0.00      4.38      0.00      .050      .035      .050      .035    566.60   1527.50
 .000622        1.        1.        1.         1         0         1      0.00    174.34   1701.84

3470 ENCROACHMENT STATIONS=    1521.0    1723.0  TYPE=      1  TARGET=     202.000

                     REPEAT OF SECTION A

     .42     14.69    581.29      0.00      0.00    581.45       .16       .01       .04100000.00
   6570.        0.    6570.        0.        0.     2032.        0.      101.        9. 100000.00
     .18      0.00      3.23      0.00      .090      .035      .080      .035    566.60   1521.00
 .000284       15.       15.       15.         2         0         1      0.00    202.00   1723.00

                C        1315FT. U.S. FROM THE US-23 BRIDGE

     .66     11.35    581.75      0.00      0.00    581.90       .15       .45       .00    583.00
   6570.        0.    6570.        0.        0.     2090.        0.      162.       17.    582.40
     .29      0.00      3.16      0.00      .080      .035      .090      .035    570.40    802.08
 .000432     1300.     1300.     1300.         2         0         1      0.00    303.66   1105.74
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3470 ENCROACHMENT STATIONS=     955.5     1150.0  TYPE=     1  TARGET=     194.500

                D       100FT. D.S. FROM MILL STREET BRIDGE

      1.05     16.57    582.57      0.00      0.00    582.82       .25       .87       .05    583.00
     6570.        0.     6570.        0.        0.     1633.        0.      251.       27. 100000.00
       .44      0.00      4.02      0.00      .050      .035      .090      .035    566.00   1000.06
   .000406     2075.     2075.     2075.         2         0         1      0.00    149.50   1149.56


3470 ENCROACHMENT STATIONS=    1000.0     1150.0  TYPE=     1  TARGET=     150.000

                        REPEAT OF SECTION D

      1.07     16.61    582.61      0.00      0.00    582.86       .25       .04       .00    583.00
     6570.        0.     6570.        0.        0.     1638.        0.      254.       28. 100000.00
       .44      0.00      4.01      0.00      .050      .035      .090      .035    566.00   1000.05
   .000401       88.       88.       88.         0         0         1      0.00    149.53   1149.58


OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

      1.07     13.71    582.61      0.00      0.00    582.86       .25       .00       .00    592.40
     6570.        0.     6570.        0.        0.     1641.        0.      255.       28.    592.40
       .44      0.00      4.00      0.00      .050      .035      .090      .035    568.90    300.00
   .000401       11.       11.       11.         0         0         1      0.00    144.50    444.50


3265 DIVIDED FLOW

    SECNO      DEPTH     CWSEL     CRIWS     WSELK      EG        HV        HL       OLOSS   BANK ELEV
    Q          QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
    TIME       VLOB      VCH       VROB      XNL       XNCH      XNR       WTN      ELMIN      SSTA
    SLOPE      XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR    TOPWID     ENDST


NORMAL BRIDGE,NRD=14 MIN ELTRD=  583.80 MAX ELLC=  590.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

                E       MILL STREET BRIDGE NO BRIDGE SKEW

      1.07     13.70    582.60      0.00      0.00    582.87       .27       .00       .01    592.40
     6570.        0.     6570.        0.        0.     1573.        0.      255.       28.    592.40
       .44      0.00      4.18      0.00      .020      .030      .020      .035    568.90    300.00
   .000487        1.        1.        1.         0         0         1      0.00    139.50    444.50


3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=14 MIN ELTRD=  583.80 MAX ELLC=  590.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

      1.08     13.72    582.62      0.00      0.00    582.89       .27       .02       .00    592.40
     6570.        0.     6570.        0.        0.     1575.        0.      256.       28.    592.40
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 .000485      40.      40.      40.       0        0        1     0.00   139.50   444.50

OVERBANK AREA ASSUMED NON-EFFECTIVE.ELLEA=      592.40 ELREA=      592.40

    1.08    13.75   582.65     0.00     0.00   582.90      .25      .00      .01   592.40
  6570.       0.    6570.       0.       0.    1647.       0.     256.      28.   592.40
     .45     0.00     3.99     0.00     .050     .035     .090     .035   568.90   300.00
 .000396       1.       1.       1.        2        0        1     0.00   144.50   444.50

3470 ENCROACHMENT STATIONS=     1000.0    1150.0  TYPE=      1  TARGET=     150.000

                    REPEAT OF SECTION D

    1.08    13.74   582.64     0.00     0.00   582.91      .27      .00      .01   583.00
  6570.       0.    6570.       0.       0.    1579.       0.     256.      28. 100000.00
     .45     0.00     4.16     0.00     .050     .035     .090     .035   568.90  1000.05
 .000452       3.       3.       3.        1        0        1     0.00   149.56  1149.60

3470 ENCROACHMENT STATIONS=        .0     465.0  TYPE=      1  TARGET=     464.999

              F     233UFT. U.S. FROM MILL STREET BRIDGE - CROSS SECTION

                    ENCROACHED IN RIGHT OVERBANK TO RAISE WATER SURFACE LESS

                    THAN .1FT.

    1.52     9.87   583.77     0.00     0.00   583.92      .15      .97      .04   583.80
  6570.       0.    6570.       0.       0.    2146.       0.     356.      40. 100000.00
     .66     0.00     3.06     0.00     .090     .035     .070     .035   573.90   165.07
 .000383    2400.    2330.    1700.        2        0        1     0.00   299.93   465.00

  SECNO     DEPTH     CWSEL     CRIWS     WSELK      EG        HV        HL      QLOSS   BANK ELEV
  Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL      TWA    LEFT/RIGHT
  TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN      ELMIN      SSTA
  SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR    TOPWID     ENDST

3470 ENCROACHMENT STATIONS=      950.0    1215.0  TYPE=      1  TARGET=     268.000

              G     50FT. D.S. FROM WEST RIVER ROAD BRIDGE

    1.90    11.26   584.46     0.00     0.00   584.60      .14      .68      .00   584.20
  6570.       0.    6567.       3.       0.    2184.       7.     455.      53.   582.20
     .84     0.00     3.01      .49     .090     .035     .090     .035   573.20   950.00
 .000307    1800.    2000.    2200.        2        0        1     0.00   268.00  1218.00

OVERBANK AREA ASSUMED NON-EFFECTIVE.ELLEA=      590.60 ELREA=      592.00

    1.91    11.17   584.47     0.00     0.00   584.63      .16      .02      .01   590.60
  6570.       0.    6570.       0.       0.    2027.       0.     458.      53.   592.00
     .85     0.00     3.24     0.00     .090     .035     .090     .035   573.30   835.03
 .000349      49.      49.      49.        1        0        1     0.00   240.95  1075.98
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3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=41 MIN ELTRD=  587.60 MAX ELLC=  589.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

                H       WEST RIVER ROAD BRIDGE - BRIDGE AND BRIDGE PIERS ARE

                        SKEWED:  HWM 583.49,APRIL,1976: HWM 583.32, JULY 1, 1976

                        INTENSITY OF STORM-10YR.

     1.91     11.16    584.46     0.00     0.00    584.64      .18      .00      .01    590.60
    6570.        0.     6570.       0.       0.     1942.       0.     458.      53.    592.00
      .85     0.00      3.38     0.00     .020      .030     .020     .035   573.30    835.05
  .000475       1.        1.       1.        1         0        1     -.36   233.49   1075.97

3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=41 MIN ELTRD=  587.60 MAX ELLC=  589.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

     1.92     11.18    584.48     0.00     0.00    584.66      .18      .02      .00    590.60
    6570.        0.     6570.       0.       0.     1945.       0.     459.      53.    592.00
      .85     0.00      3.38     0.00     .020      .030     .020     .035   573.30    835.01
  .000473       35.       35.      35.        0         0        1     -.44   233.55   1076.00

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

     1.92     11.20    584.50     0.00     0.00    584.66      .16      .00      .00    590.60
    6570.        0.     6570.       0.       0.     2031.       0.     459.      53.    592.00
      .85     0.00      3.23     0.00     .080      .035     .090     .035   573.30    834.99
  .000347       1.        1.       1.        1         0        1     0.00   241.02   1076.02

   SECNO     DEPTH     CWSEL     CRIWS     WSELK      EG        HV       HL      QLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB       ACH       AROB     VOL     TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL        XNCH      XNR      WTN     ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL     IDC       ICONT    CORAR   TOPWID    ENDST

3470 ENCROACHMENT STATIONS=      950.0     1224.0  TYPE=      1  TARGET=      274.000

                        REPEAT OF SECTION G

     1.92     11.23    584.53     0.00     0.00    584.67      .14      .00      .01    584.20
    6570.        0.     6561.       9.       0.     2202.      19.     460.      54.    582.20
      .85     0.00      2.98      .47     .080      .035     .090     .035   573.30    950.00
  .000299       15.       15.      15.        2         0        1     0.00   274.00   1224.00
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3470 ENCROACHMENT STATIONS=     400.0     656.0  TYPE=     1  TARGET=     256.000

                I        515FT. U.S. FROM WEST RIVER ROAD BRIDGE

      2.02     11.48    584.68      0.00      0.00    584.83       .15       .15       .01    589.40
    6570.        0.     6570.        0.        0.     2119.        0.      485.       57. 100000.00
       .90      0.00      3.10      0.00      .100      .035      .090      .035    573.20    414.26
   .000299      500.      500.      500.         1         0         1      0.00    240.08    654.34


3470 ENCROACHMENT STATIONS=     210.0     648.0  TYPE=     1  TARGET=     438.000

                J        100FT. D.S. FROM THE MOUTH OF VAN ETTEN CREEK

                         RIGHT OVERBANK ENCROACHED TO ELIMINATE DIVIDED FLOW

                         CHANGE IN WATER SURFACE LESS THAN .1FT.

      2.51     13.21    585.41      0.00      0.00    585.48       .07       .63       .02    585.80
    6570.        0.     6570.        0.        0.     3019.        0.      638.       77. 100000.00
      1.23      0.00      2.18      0.00      .070      .035      .060      .035    572.20    210.44
   .000202     2600.     2600.     2700.         2         0         1      0.00    434.95    645.39


3470 ENCROACHMENT STATIONS=    1300.0    1481.0  TYPE=     1  TARGET=     181.000

                K        75FT. D.S. FROM THE D&M RAILROAD BRIDGE

      2.85     20.00    585.70      0.00      0.00    585.81       .11       .31       .02    587.40
    5750.        0.     5744.        6.        0.     2151.       21.      747.       90.    583.50
      1.42      0.00      2.67       .28      .060      .035      .100      .035    565.70   1300.91
   .000142     1850.     1825.     1650.         2         0         1      0.00    180.09   1481.00


      2.87     14.53    585.63      0.00      0.00    585.92       .29       .02       .09    595.80
    5750.        0.     5750.        0.        0.     1320.        0.      750.       90.    595.80
      1.42      0.00      4.36      0.00      .060      .035      .100      .035    571.10    300.00
   .000606       74.       74.       74.         2         0         1      0.00    143.50    443.50


NORMAL BRIDGE,NRD=10 MIN ELTRD=  595.20 MAX ELLC=  591.60

                L        D&M RAILROAD BRIDGE-NO BRIDGE SKEW

      2.87     14.53    585.63      0.00      0.00    585.92       .29       .00       .00    595.80
    5750.        0.     5750.        0.        0.     1320.        0.      750.       90.    595.80
      1.42      0.00      4.36      0.00      .045      .030      .045      .035    571.10    300.00
   .000446        1.        1.        1.         0         0         1      0.00    143.50    443.50


NORMAL BRIDGE,NRD=10 MIN ELTRD=  595.20 MAX ELLC=  591.60

      2.87     14.54    585.64      0.00      0.00    585.93       .29       .01       .00    595.80
    5750.        0.     5750.        0.        0.     1321.        0.      751.       90.    595.80
      1.42      0.00      4.35      0.00      .045      .030      .045      .035    571.10    300.00
   .000444       18.       18.       18.         0         0         1      0.00    143.50    443.50
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SECNO     DEPTH     WSEL      CRINS     WSELX     EG        HV        HL        VLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

    2.87     14.54    585.64      0.00      0.00    585.93       .29       .00       .00    595.80
   5750.        0.     5750.        0.        0.     1321.        0.      751.       90.    595.80
    1.42      0.00      4.35      0.00      .060      .040      .100      .035    571.10    300.00
 .000789        1.        1.        1.         0         0         1      0.00    143.50    443.50

3470 ENCROACHMENT STATIONS=     1300.0     1473.5  TYPE=      1  TARGET=     173.500

                    REPEAT OF SECTION K

    2.88     14.75    585.85      0.00      0.00    585.98       .14       .01       .05    587.40
   5750.        0.     5747.        3.        0.     1928.        8.      751.       90.    583.50
    1.43      0.00      2.98       .42      .060      .040      .100      .035    571.10   1300.83
 .000265       15.       15.       15.         2         0         1      0.00    172.67   1473.50

3470 ENCROACHMENT STATIONS=      766.0     1147.0  TYPE=      1  TARGET=     381.000
    3.20     12.20    586.40      0.00      0.00    566.51       .11       .52       .01    583.80
   5750.       19.     5731.        0.       46.     2103.        0.      831.       99. 100000.00
    1.60       .42      2.73      0.00      .080      .040      .100      .035    574.20    839.57
 .000359     1700.     1700.     1600.         2         0         1      0.00    307.43   1147.00

3470 ENCROACHMENT STATIONS=      875.0     1147.0  TYPE=      1  TARGET=     272.000
                M        ALONG NORTH-SOUTH POWER LINE-ENCROACHED AT STA. 1300

                         ON NATURAL RUN BECAUSE OF HIGH GROUND IN RIGHT OVERBANK

                         IMMEDIATELY UPSTREAM. ENCROACHED FURTHER TO RAISE WATER

                         SURFACE LESS THAN .1FT.

    3.27     11.63    586.53      0.00      0.00    586.65       .12       .14       .00    583.80
   5750.        0.     5750.        0.        0.     2079.        0.      849.      102. 100000.00
    1.64      0.00      2.77      0.00      .080      .040      .100      .035    574.90    875.00
 .000379      400.      370.      350.         1         0         1      0.00    272.00   1147.00

3470 ENCROACHMENT STATIONS=      200.0      550.0  TYPE=      1  TARGET=     350.000
                         MANUFACTURED SECTION-BASED ON SECTION N WITH ADJUST-

                         MENTS MADE TO INVERT OF CHANNEL AND CHANGES MADE TO LEFT

                         OVERBANK BASED ON TOPOGRAPHIC MAP-RIGHT OVERBANK

                         ENCROACHED TO RAISE WATER SURFACE LESS THAN .1FT

                                   0.00      0.00    587.51       .14       .84       .01    589.00
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   1.84      0.00      3.10       .91      .080      .040      .080      .036    575.10    203.77
 .000400    1600.     2200.     1500.         2        0.         1      0.00    346.23    550.00

3470 ENCROACHMENT STATIONS=      342.8      698.5  TYPE=      1  TARGET=      415.000
                N        ENCROACHED IN RIGHT OVERBANK TO RAISE WATER SURFACE

                         LESS THAN .1FT,CROSS SECTION SKEWED FROM ORIGINAL

                         LOCATION, SKEW FACTOR=.354

   3.79     12.39    587.59      0.00      0.00    587.75       .16       .24       .01    592.40
  5750.        0.     5072.      678.        0.     1476.      691.      981.      120.    583.10
   1.89      0.00      3.44       .98      .080      .040      .080      .036    575.20    349.04
 .000473     510.      550.      490.         2         0         1      0.00    349.41    698.45

3470 ENCROACHMENT STATIONS=     1250.0     1750.0  TYPE=      1  TARGET=      500.000
                         MANUFACTURED SECTION-BASED ON SECTIONS N&O WITH

                         INVERT ADJUSTMENT AND OVERBANK ADJUSTMENTS BASED ON

                         CONTOUR MAP

   4.13     13.33    588.33      0.00      0.00    588.47       .14       .71       .01    582.50
  5750.      139.     5611.        0.      226.     1851.        0.      1068.      133.    590.00
   2.06       .61      3.03      0.00      .090      .040      .070      .036    575.00   1272.33
 .000334    1450.     1800.     1800.         0         0         1      0.00    272.09   1544.42

3470 ENCROACHMENT STATIONS=      250.0      700.0  TYPE=      1  TARGET=      450.000
                         MANUFACTURED SECTION-BASED ON SECTIONS N&O WITH

                         INVERT ADJUSTMENT AND OVERBANK ADJUSTMENTS BASED ON

                         CONTOUR MAP. RIGHT OVERBANK ENCROACHED TO RAISE WATER

                         SURFACE LESS THAN .1FT

   4.37     13.84    588.74      0.00      0.00    588.83       .08       .34       .02    590.00
  5750.        0.     4847.      903.        0.     1958.     1177.     1143.      143.    583.10
   2.22      0.00      2.47       .77      .100      .040      .080      .037    574.90    252.51
 .000212    1120.     1300.     1150.         2         0         1      0.00    447.49    700.00

1490 NH CARD USED
   SECNO     DEPTH     CWSEL     CRIWS     WSELR        EG        HV        HL     QLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     TTRIAL    IDC       ICONT     CORAR     TOPWID      ENDST
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3470 ENCROACHMENT STATIONS=    1185.0     1620.0  TYPE=     1  TARGET=     435.000
                0        300FT. U.S. OF SECTION LINE BETWEEN SECTIONS 32&33

                         LEFT OVERBANK ENCROACHED TO ELIMINATE DIVIDED FLOW AND

                         TO RAISE WATER SURFACE LESS THAN .1FT

     4.62     14.29    588.99      0.00      0.00    589.07       .07       .24       .00    584.00
    5750.      669.     5581.        0.      859.     2195.        0.     1233.      156. 100000.00
     2.39       .77      2.31      0.00      .070      .040      .080      .037    574.70   1198.64
  .000165     1300.     1300.     1150.         2         0         1      0.00    421.36   1620.00


3470 ENCROACHMENT STATIONS=        .0      425.0  TYPE=     1  TARGET=     424.999
                         MANUFACTURED SECTION-BASED ON SECTION 0 WITH ADJUST-

                         MENTS TO INVERT AND OVERBANK ADJUSTMENTS BASED ON

                         CONTOUR MAP. RIGHT OVERBANK ENCROACHED TO RAISE WATER

                         SURFACE LESS THAN .1FT.

     4.95     12.90    589.30      0.00      0.00    589.39       .09       .32       .01    590.00
    5750.        0.     5370.      380.        0.     2199.      629.     1349.      170.    584.00
     2.60      0.00      2.44       .60      .070      .040      .100      .037    576.40     76.66
  .000202     1500.     1750.     1700.         0         0         1      0.00    348.34    425.00


3470 ENCROACHMENT STATIONS=    1000.0     1286.0  TYPE=     1  TARGET=     286.000
                P        LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE LESS

                         THAN .1FT.

     5.20     11.57    589.57      0.00      0.00    589.65       .08       .25       .00    590.00
    5750.        0.     5750.        0.        0.     2595.        0.     1429.      180. 100000.00
     2.76      0.00      2.22      0.00      .100      .040      .070      .037    578.00   1000.67
  .000190     1300.     1300.     1175.         2         0         1      0.00    284.01   1284.68
```

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: AuSable River

4) DOCUMENT TYPE: 100 yr natural

00BREAK00

```
CCHV=     .300 CEHV=     .500
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA      LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

                    SECTION THROUGH BREAKWATER OBTAINED FROM CORPS OF

                    ENGINEERS. SURVEYED IN JULY OF 1976.

     .00      14.20     580.60       0.00     580.60     580.73        .13       0.00       0.00     586.20
   6570.         0.      6570.         0.         0.      2250.         0.         0.         0.     586.10
    0.00       0.00       2.92       0.00       .070       .035       .060      0.000     566.40       0.00
 .000187         0.         0.         0.          0          0          1       0.00     186.41     186.41

                    SECTION THROUGH BREAKWATER OBTAINED FROM CORPS OF

                    ENGINEERS. SURVEYED IN JULY OF 1976.

     .21      15.02     580.82       0.00       0.00     581.00        .18        .24        .02     586.40
   6570.         0.      6570.         0.         0.      1945.         0.        53.         5.     586.20
     .09       0.00       3.38       0.00       .070       .035       .060       .035     565.80      13.80
 .000263      1100.      1100.      1100.          1          0          1       0.00     171.60     185.40

3470 ENCROACHMENT STATIONS=     1520.0     1720.0  TYPE=      1  TARGET=     200.000

                A        60FT. D.S. OF THE US-23 BRIDGE.

     .39      15.20     581.10       0.00       0.00     581.26        .17        .26       .00100000.00
   6570.         0.      6570.         0.         0.      2013.         0.        96.         9. 100000.00
     .17       0.00       3.26       0.00       .070       .035       .060       .035     565.90    1520.00
 .000290       950.       950.       950.          2          0          1       0.00     200.00    1720.00

     .40      14.45     581.05       0.00       0.00     581.35        .30        .02        .07     604.80
   6570.         0.      6570.         0.         0.      1494.         0.        99.         9.     604.90
     .18       0.00       4.40       0.00       .050       .035       .050       .035     566.60    1527.50
 .000632        59.        59.        59.          2          0          1       0.00     174.04    1701.54

3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=38 MIN ELTRD=  587.40 MAX ELLC=  601.30

                B        US-23 BRIDGE-NO BRIDGE SKEW

     .40      14.45     581.05       0.00       0.00     581.36        .32        .00        .01     604.80
   6570.         0.      6570.         0.         0.      1454.         0.        99.         9.     604.90
     .18       0.00       4.52       0.00       .020       .030       .020       .035     566.60    1527.50
 .000648         1.         1.         1.          0          0          1       0.00     170.04    1701.54
```

3265 DIVIDED FLOW

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

NORMAL BRIDGE,NRD=38 MIN ELTRD= 587.40 MAX ELLC= 601.30

.41	14.49	581.09	0.00	0.00	581.40	.31	.04	.00	604.80
6570.	0.	6570.	0.	0.	1460.	0.	100.	9.	604.90
.18	0.00	4.50	0.00	.020	.030	.020	.035	566.60	1527.50
.000641	56.	56.	56.	0	0	1	0.00	170.28	1701.78

.41	14.51	581.11	0.00	0.00	581.41	.30	.00	.01	604.80
6570.	0.	6570.	0.	0.	1502.	0.	100.	9.	604.90
.18	0.00	4.38	0.00	.050	.035	.050	.035	566.60	1527.50
.000622	1.	1.	1.	1	0	1	0.00	174.34	1701.84

3470 ENCROACHMENT STATIONS= 1521.0 1723.0 TYPE= 1 TARGET= 202.000

REPEAT OF SECTION A

.42	14.69	581.29	0.00	0.00	581.45	.16	.01	.04	100000.00
6570.	0.	6570.	0.	0.	2032.	0.	101.	9.	100000.00
.18	0.00	3.23	0.00	.090	.035	.080	.035	566.60	1521.00
.000284	15.	15.	15.	2	0	1	0.00	202.00	1723.00

C 1315FT. U.S. FROM THE US-23 BRIDGE

.66	11.35	581.75	0.00	0.00	581.90	.15	.45	.00	583.00
6570.	0.	6570.	0.	0.	2080.	0.	162.	17.	582.40
.29	0.00	3.16	0.00	.080	.035	.090	.035	570.40	802.08
.000432	1300.	1300.	1300.	2	0	1	0.00	303.66	1105.74

3470 ENCROACHMENT STATIONS= 955.5 1150.0 TYPE= 1 TARGET= 194.500

D 100FT. D.S. FROM MILL STREET BRIDGE

1.05	16.57	582.57	0.00	0.00	582.82	.25	.87	.05	583.00
6570.	0.	6570.	0.	0.	1633.	0.	251.	27.	100000.00
.44	0.00	4.02	0.00	.050	.035	.090	.035	566.00	1000.06
.000406	2075.	2075.	2075.	2	0	1	0.00	149.50	1149.56

3470 ENCROACHMENT STATIONS= 1000.0 1150.0 TYPE= 1 TARGET= 150.000

REPEAT OF SECTION D

1.07	16.61	582.61	0.00	0.00	582.86	.25	.04	.00	583.00
6570.	0.	6570.	0.	0.	1638.	0.	254.	28.	100000.00
.44	0.00	4.01	0.00	.050	.035	.090	.035	566.00	1000.05
.000401	88.	88.	88.	0	0	1	0.00	149.53	1149.58

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OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

     1.07     13.71    582.61      0.00      0.00    582.86       .25       .00       .00    592.40
    6570.        0.     6570.        0.        0.     1641.        0.      255.       28.    592.40
      .44      0.00      4.00      0.00      .050      .035      .090      .035    568.90    300.00
  .000401       11.       11.       11.         0         0         1      0.00    144.50    444.50

3265 DIVIDED FLOW

   SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

NORMAL BRIDGE,NRD=14 MIN ELTRD=  583.80 MAX ELLC=  590.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

                E        MILL STREET BRIDGE NO BRIDGE SKEW

     1.07     13.70    582.60      0.00      0.00    582.87       .27       .00       .01    592.40
    6570.        0.     6570.        0.        0.     1573.        0.      255.       28.    592.40
      .44      0.00      4.18      0.00      .020      .030      .020      .035    568.90    300.00
  .000487        1.        1.        1.         0         0         1      0.00    139.50    444.50

3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=14 MIN ELTRD=  583.80 MAX ELLC=  590.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

     1.08     13.72    582.62      0.00      0.00    582.89       .27       .02       .00    592.40
    6570.        0.     6570.        0.        0.     1575.        0.      256.       28.    592.40
      .45      0.00      4.17      0.00      .020      .030      .020      .035    568.90    300.00
  .000485       40.       40.       40.         0         0         1      0.00    139.50    444.50

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      592.40 ELREA=      592.40

     1.08     13.75    582.65      0.00      0.00    582.90       .25       .00       .01    592.40
    6570.        0.     6570.        0.        0.     1647.        0.      256.       28.    592.40
      .45      0.00      3.99      0.00      .050      .035      .090      .035    568.90    300.00
  .000396        1.        1.        1.         2         0         1      0.00    144.50    444.50

3470 ENCROACHMENT STATIONS=    1000.0    1150.0  TYPE=      1  TARGET=     150.000

                    REPEAT OF SECTION D

     1.08     13.74    582.64      0.00      0.00    582.91       .27       .00       .01    583.00
    6570.        0.     6570.        0.        0.     1579.        0.      256.       28. 100000.00
      .45      0.00      4.16      0.00      .050      .035      .090      .035    568.90   1000.05
  .000452         3         3         3         1         0         1      0.00    149.56   1149.60
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3470 ENCROACHMENT STATIONS=        .0      675.0  TYPE=      1  TARGET=      674.999

                F        2330FT. U.S. FROM MILL STREET BRIDGE --CROSS SECTION

                         ENCROACHED IN RIGHT OVERBANK TO RAISE WATER SURFACE LESS

                         THAN .1FT.

     1.52      9.86    583.76      0.00      0.00    583.91       .14       .95       .04    583.80
    6570.        0.     6499.       71.        0.     2144.      173.      359.       44.    582.40
      .66      0.00      3.03       .41      .090      .035      .070      .035    573.90    165.09
  .000374     2400.     2330.     1700.         2         0         1      0.00    491.79    656.88

   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN      SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID     ENDST

3470 ENCROACHMENT STATIONS=      950.0     1218.0  TYPE=      1  TARGET=      268.000

                G        50FT. D.S. FROM WEST RIVER ROAD BRIDGE

     1.90     11.24    584.44      0.00      0.00    584.59       .14       .68       .00    584.20
    6570.        0.     6567.        3.        0.     2179.        7.      463.       62.    582.20
      .85      0.00      3.01       .49      .090      .035      .090      .035    573.20    950.00
  .000310     1800.     2000.     2200.         2         0         1      0.00    268.00   1218.00

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

     1.91     11.15    584.45      0.00      0.00    584.61       .16       .02       .01    590.60
    6570.        0.     6570.        0.        0.     2023.        0.      465.       62.    592.00
      .85      0.00      3.25      0.00      .090      .035      .090      .035    573.30    835.08
  .000351       49.       49.       49.         1         0         1      0.00    240.87   1075.95

3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=41 MIN ELTRD=  587.60 MAX ELLC=  589.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

                H        WEST RIVER ROAD BRIDGE - BRIDGE AND BRIDGE PIERS ARE

                         SKEWED:  HWM 583.49,APRIL,1976; HWM 583.32, JULY 1, 1976

                         INTENSITY OF STORM-10YR.

     1.91     11.14    584.44      0.00      0.00    584.62       .18       .00       .01    590.60
    6570.        0.     6570.        0.        0.     1938.        0.      465.       62.    592.00
      .85      0.00      3.39      0.00      .020      .030      .020      .035    573.30    835.10
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.000478      1.      1.      1.      1      0      1     -.26   233.40  1075.93

3265 DIVIDED FLOW

NORMAL BRIDGE,NRD=41 MIN ELTRD=  587.60 MAX ELLC=  589.60

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

    1.92    11.16   584.46     0.00     0.00   584.64      .18      .02      .00   590.60
   6570.       0.   6570.       0.       0.    1941.       0.     467.      62.   592.00
     .85     0.00     3.38     0.00     .020     .030     .020     .035   573.30   835.06
 .000476      35.      35.      35.        0        0        1     -.33   233.46  1075.96

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      590.60 ELREA=      592.00

    1.92    11.18   584.48     0.00     0.00   584.64      .16      .00      .00   590.60
   6570.       0.   6570.       0.       0.    2026.       0.     467.      62.   592.00
     .85     0.00     3.24     0.00     .080     .035     .090     .035   573.30   835.04
 .000349       1.       1.       1.        1        0        1     0.00   240.94  1075.98

  SECNO    DEPTH    CWSEL    CRIWS    WSELK      EG       HV       HL    OLOSS   BANK ELEV
  Q        QLOB     QCH      QROB     ALOB       ACH      AROB     VOL   TWA     LEFT/RIGHT
  TIME     VLOB     VCH      VROB     XNL        XNCH     XNR      WTN   ELMIN   SSTA
  SLOPE    XLOBL    XLCH     XLOBR    ITRIAL     IDC      ICONT    CORAR TOPWID  ENDST

3470 ENCROACHMENT STATIONS=      950.0     1224.0  TYPE=      1  TARGET=      274.000

                    REPEAT OF SECTION G

    1.92    11.22   584.52     0.00     0.00   584.65      .14      .00      .01   584.20
   6570.       0.   6561.       9.       0.    2197.      19.     468.      62.   582.20
     .86     0.00     2.99      .47     .080     .035     .090     .035   573.30   950.00
 .000301      15.      15.      15.        2        0        1     0.00   274.00  1224.00

3470 ENCROACHMENT STATIONS=      400.0      656.0  TYPE=      1  TARGET=      256.000

                I        515FT. U.S. FROM WEST RIVER ROAD BRIDGE

    2.02    11.46   584.66     0.00     0.00   584.81      .15      .15      .01   589.40
   6570.       0.   6570.       0.       0.    2115.       0.     492.      65. 100000.00
     .90     0.00     3.11     0.00     .100     .035     .090     .035   573.20   414.32
 .000301     500.     500.     500.        1        0        1     0.00   240.02   654.33

3265 DIVIDED FLOW

                J        100FT. D.S. FROM THE MOUTH OF VAN ETTEN CREEK

                         RIGHT OVERBANK ENCROACHED TO ELIMINATE DIVIDED FLOW

                         CHANGE IN WATER SURFACE LESS THAN .1FT
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     2.51      13.19     585.39      0.00      0.00    585.47       .07       .63       .02    585.80
    6570.         0.      6543.       27.        0.     3013.       97.      649.       90.    587.30
     1.23      0.00       2.17       .28      .070      .035      .060      .035    572.20    210.46
  .000201     2600.      2600.     2700.         2         0         1      0.00    590.97    860.33

3470 ENCROACHMENT STATIONS=     1300.0     1481.0  TYPE=      1  TARGET=     181.000

                K        75FT. D.S. FROM THE D&M RAILROAD BRIDGE

     2.85      19.99     585.69      0.00      0.00    585.80       .11       .31       .02    587.40
    5750.         0.      5744.        6.        0.     2148.       21.      759.      106.    583.50
     1.42      0.00       2.67       .28      .060      .035      .100      .035    565.70   1300.92
  .000143     1850.      1825.     1650.         2         0         1      0.00    180.08   1481.00

     2.87      14.51     585.61      0.00      0.00    585.91       .30       .02       .09    595.80
    5750.         0.      5750.        0.        0.     1318.        0.      762.      106.    595.80
     1.43      0.00       4.36      0.00      .060      .035      .100      .035    571.10    300.00
  .000610       74.        74.       74.         2         0         1      0.00    143.50    443.50

NORMAL BRIDGE,NRD=10 MIN ELTRD=  595.20 MAX ELLC=  591.60

                L        D&M RAILROAD BRIDGE-NO BRIDGE SKEW

     2.87      14.51     585.61      0.00      0.00    585.91       .30       .00       .00    595.80
    5750.         0.      5750.        0.        0.     1318.        0.      762.      106.    595.80
     1.43      0.00       4.36      0.00      .045      .030      .045      .035    571.10    300.00
  .000448        1.         1.        1.         0         0         1      0.00    143.50    443.50

NORMAL BRIDGE,NRD=10 MIN ELTRD=  595.20 MAX ELLC=  591.60

     2.87      14.52     585.62      0.00      0.00    585.92       .30       .01       .00    595.80
    5750.         0.      5750.        0.        0.     1319.        0.      762.      106.    595.80
     1.43      0.00       4.36      0.00      .045      .030      .045      .035    571.10    300.00
  .000446       18.        18.       18.         0         0         1      0.00    143.50    443.50

   SECNO      DEPTH      CWSEL      CRIWS      WSELK       EG        HV        HL      OLOSS   BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH       AROB       VOL       TWA   LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH      XNR        WTN       ELMIN     SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC       ICONT      CORAR     TOPWID    ENDST

     2.87      14.52     585.62      0.00      0.00    585.92       .30       .00       .00    595.80
    5750.         0.      5750.        0.        0.     1319.        0.      762.      106.    595.80
     1.43      0.00       4.36      0.00      .060      .040      .100      .035    571.10    300.00
  .000793        1.         1.        1.         0         0         1      0.00    143.50    443.50

3470 ENCROACHMENT STATIONS=     1300.0     1473.5  TYPE=      1  TARGET=     173.500

                      REPEAT OF SECTION K

     2.88      14.73     585.83      0.00      0.00    585.97       .14       .01       .05    587.40
    5750.         0.      5747.        3.        0.     1925.        8.      763.      106.    583.50
     1.43      0.00       2.98       .42      .060      .040      .100      .035    571.10   1300.84
  .000266        15         15        15         2         0         1      0.00    172.66   1473.50
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3470 ENCROACHMENT STATIONS=      766.0     1700.0  TYPE=      1  TARGET=      934.000
     3.20     12.18    586.38      0.00      0.00    586.49       .10       .51       .01    583.80
    5750.       18.    5517.       215.       46.     2099.      567.      853.      122.    586.30
     1.62       .40      2.63       .38      .080      .040      .100      .035    574.20    839.77
  .000335     1700.     1700.     1600.         2         0         1      0.00    677.76   1517.53


3470 ENCROACHMENT STATIONS=      765.0     1300.0  TYPE=      1  TARGET=      534.000
                M        ALONG NORTH-SOUTH POWER LINE-ENCROACHED AT STA. 1300

                         ON NATURAL RUN BECAUSE OF HIGH GROUND IN RIGHT OVERBANK

                         IMMEDIATELY UPSTREAM. ENCROACHED FURTHER TO RAISE WATER

                         SURFACE LESS THAN .1FT.

     3.27     11.61    586.51      0.00      0.00    586.62       .11       .13       .01    583.80
    5750.       22.    5650.        79.       50.     2073.      207.      874.      127.    586.30
     1.66       .43      2.72       .38      .080      .040      .100      .036    574.90    838.16
  .000365      400.      370.       350.         1         0         1      0.00    461.84   1300.00


                         MANUFACTURED SECTION-BASED ON SECTION N WITH ADJUST-

                         MENTS MADE TO INVERT OF CHANNEL AND CHANGES MADE TO LEFT

                         OVERBANK BASED ON TOPOGRAPHIC MAP-RIGHT OVERBANK

                         ENCROACHED TO RAISE WATER SURFACE LESS THAN .1FT

     3.68     12.20    587.30      0.00      0.00    587.43       .12       .80       .01    589.00
    5750.        0.    5054.       696.        0.     1678.      914.      989.      149.    583.10
     1.87       0.00      3.01       .76      .080      .040      .080      .036    575.10    203.91
  .000382     1600.     2200.     1500.         2         0         1      0.00    576.50    780.41


                N        ENCROACHED IN RIGHT OVERBANK TO RAISE WATER SURFACE

                         LESS THAN .1FT,CROSS SECTION SKEWED FROM ORIGINAL

                         LOCATION, SKEW FACTOR=.854

     3.79     12.32    587.52      0.00      0.00    587.68       .16       .23       .02    592.40
    5750.        0.    5006.       744.        0.     1463.      851.     1019.      155.    583.10
     1.92       0.00      3.42       .87      .080      .040      .080      .036    575.20    349.15
  .000475      510.      550.       490.         1         0         1      0.00    507.92    857.07


3470 ENCROACHMENT STATIONS=     1250.0     1750.0  TYPE=      1  TARGET=      500.000
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MANUFACTURED SECTION-BASED ON SECTIONS N&O WITH

INVERT ADJUSTMENT AND OVERBANK ADJUSTMENTS BASED ON

CONTOUR MAP

```
     4.13      13.26     588.26      0.00      0.00    588.40       .14       .72       .01    582.50
    5750.       136.      5614.        0.      221.     1838.        0.      1108.      171.    590.00
     2.09        .62       3.05      0.00      .090      .040      .070      .037    575.00   1273.21
 .000342      1450.      1800.     1800.         2         0        1      0.00    270.99   1544.20
```

MANUFACTURED SECTION-BASED ON SECTIONS N&O WITH

INVERT ADJUSTMENT AND OVERBANK ADJUSTMENTS BASED ON

CONTOUR MAP. RIGHT OVERBANK ENCROACHED TO RAISE WATER

SURFACE LESS THAN .1FT

```
     4.37      13.78     588.68      0.00      0.00    588.75       .08       .33       .02    590.00
    5750.         0.      4728.     1022.        0.     1945.     1585.      1186.      185.    583.10
     2.26       0.00       2.43       .64      .100      .040      .080      .037    574.90    252.65
 .000206      1120.      1300.     1000.         2         0        1      0.00    809.05   1061.70
```

1490 NH CARD USED

3265 DIVIDED FLOW

```
   SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
   Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
   TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
   SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST
```

3470 ENCROACHMENT STATIONS= .0 1800.0 TYPE= 1 TARGET= 1799.999

0 300FT. U.S. OF SECTION LINE BETWEEN SECTIONS 32&33

LEFT OVERBANK ENCROACHED TO ELIMINATE DIVIDED FLOW AND

TO RAISE WATER SURFACE LESS THAN .1FT

```
     4.62      14.21     588.91      0.00      0.00    588.99       .07       .23       .00    584.00
    5750.       710.      5040.        0.     1125.     2178.        1.      1279.      204.    588.80
     2.42        .63       2.31       .04      .072      .040      .070      .037    574.70    840.26
 .000167      1150.      1300.      950.         2         0        1      0.00    706.83   1632.90
```

MANUFACTURED SECTION-BASED ON SECTION 0 WITH ADJUST-

MENTS TO INVERT AND OVERBANK ADJUSTMENTS BASED ON

CONTOUR MAP. RIGHT OVERBANK ENCROACHED TO RAISE WATER

SURFACE LESS THAN .1FT.

```
     4.95     12.82    589.22      0.00      0.00    589.30       .08       .31       .00    590.00
    5750.        0.     5254.       496.        0.     2180.      993.     1401.      227.    584.00
     2.63      0.00      2.41       .50      .070      .040      .100      .037    576.40     76.86
  .000199     1375.     1750.     1425.         2         0         1      0.00    635.76    712.62
```

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 720.0 1286.0 TYPE= 1 TARGET= 566.000

P LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE LESS

THAN .1FT.

```
     5.20     11.48    589.48      0.00      0.00    589.55       .07       .25       .00    590.00
    5750.      148.     5602.        0.      445.     2569.        0.     1468.      243. 100000.00
     2.80       .33      2.18      0.00      .100      .040      .070      .037    578.00    733.60
  .000187     1150.     1300.      900.         2         0         1      0.00    526.53   1284.60
```

```
*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,53
*****************************************
```

```
**** 7000 SCOPE 2.1 LVL  221  02/05/77  12.00.12  02/18/77      77049

SYS DEVICES 819/ 4/PF FLS=200K FLL=764K MXS=160K MXL=457K MXB=457B

HH.MM.SS CPU SECOND ORIGIN
          13.57.20.MFA. ::     20PPU CB273 B+W LYN ECS-2CPUS R.D 08.12
13.57.41 00000.012 MFZ.      -OSCJ048,T10,CP70.   TWP OF OSCODA
13.57.41 00000.013 JOB.      -CHARGE,810-0037-45-78-5548,JANDA,001,D,JANDA.
13.58.13 00000.055 JOB.      -ATTACH(HEC2,HEC2PROD,ID=MULLAN)
13.58.16 00000.060 MFZ.        PF254 - CYCLE    1 ATTACHED FROM SN=SYSTEM
13.58.16 00000.061 LOD.      -HEC2(PL=99999).
13.58.23 00000.474 MFZ.        LD610 - FLS REQUIRED TO LOAD - 0025222 OU.COG
13.58.23 00000.485 MFZ.        LD603 - EXECUTION INITIATED OS.EXP
13.58.23 00000.485 USR.      FORTRAN LIBRARY 217=MODIFIED 03/16/76
14.12.20 00001.411 USR.          STOP
14.12.20 00001.411 USR.            .925 CP SECONDS EXECUTION TIME
14.12.20 00001.414 MFZ.        RM770 - MAXIMUM ACTIVE FILES                3
14.12.20 00001.414 MFZ.        RM771 - OPEN/CLOSE CALLS                   16
14.12.20 00001.414 MFZ.        RM772 - DATA TRANSFER CALLS             2,472
14.12.20 00001.414 MFZ.        RM773 - CONTROL/POSITIONING CALLS          12
14.12.20 00001.415 MFZ.        RM774 - BM DATA TRANSFER CALLS            316
14.12.20 00001.415 MFZ.        RM775 - BM CONTROL/POSITIONING CALLS       53
14.12.20 00001.415 MFZ.        RM776 - QUEUE MANAGER CALLS                67
14.12.20 00001.415 MFZ.        RM777 - RECALL CALLS                       49
14.12.20 00001.415 MFZ.        BWMSG - NUMBER OF TAPES MOUNTED
14.12.20 00001.416 MFZ.        SRU                   1.675  SRU
14.12.20 00001.416 MFZ.        SCM                  54.281  KWS
14.12.20 00001.416 MFZ.        I/O                   0.032  MW
14.12.20 00001.417 MFZ.        RMS                   0.023  MWS
14.12.20 00001.417 MFZ.        USER                  0.731  SEC
14.12.20 00001.417 MFZ.        JOB                   1.419  SEC
14.12.20 00001.417 MFZ.        SC050 - 000020 SC/LC SWAPS
14.12.20 00001.417 MFZ.      OSCJ011   OSCJ011
```

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Au Sable River

4) DOCUMENT TYPE: Input data 100 yr encroached

00BREAK00

```
*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************
```

```
C
1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       10 YEAR FLOOD
T3       AU SABLE RIVER

J1   ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      -0.       2.        -0.       -0. -0.000000     -0.00     -0.0      -0.     580.600   -0.000

J2   NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     -0.000    -0.000    -1.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000

J3      1.000    10.000    11.000    12.000    14.000     8.000     4.000    -0.000    -0.000    -0.000
NC       .070      .060      .035      .300      .500    -0.000    -0.000    -0.000    -0.000    -0.000
OT      4.000  5070.000  6100.000  6570.000  7770.000    -0.000    -0.000    -0.000    -0.000    -0.000

X1       .001    21.000     0.000   190.000     0.000     0.000     0.000    -0.000    -0.000    -0.000
GR    586.200     0.000   574.200     0.000   574.400    10.000   572.500    20.000   567.600    30.000
GR    566.700    40.000   566.500    50.000   566.500    60.000   566.400    70.000   566.800    80.000
GR    566.900    90.000   566.800   100.000   566.600   110.000   566.600   120.000   567.000   130.000
GR    567.300   140.000   568.100   150.000   569.200   160.000   570.500   170.000   570.800   180.000
GR    586.100   190.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000

X1       .208    19.000     0.000   190.000  1100.000  1100.000  1100.000    -0.000    -0.000    -0.000
GR    586.400     0.000   578.300    20.000   577.100    30.000   571.100    40.000   566.600    50.000
GR    566.500    60.000   565.800    70.000   566.400    80.000   566.800    90.000   566.700   100.000
GR    566.600   110.000   566.500   120.000   566.200   130.000   566.700   140.000   567.400   150.000
GR    570.500   160.000   573.700   170.000   574.500   180.000   586.200   190.000    -0.000    -0.000

X1       .388    51.000  1500.000  1751.000   950.000   950.000   950.000    -0.000    -0.000    -0.000
X3     -0.000    -0.000    -0.000  1520.000    -0.000  1720.000    -0.000    -0.000    -0.000    -0.000
GR    586.900     0.000   586.800   100.000   587.100   200.000   584.600   300.000   585.000   400.000
GR    584.200   500.000   584.100   600.000   585.400   700.000   589.800   759.000   590.000   800.000
GR    585.100   836.000   584.400   900.000   584.600  1000.000   586.100  1100.000   587.100  1200.000
GR    586.400  1300.000   586.600  1400.000   585.700  1500.000   581.100  1505.000   579.500  1520.000
GR    577.300  1540.000   575.300  1550.000   572.500  1560.000   567.800  1580.000   571.700  1600.000
GR    571.800  1620.000   570.500  1640.000   567.500  1660.000   565.900  1680.000   565.900  1700.000
GR    572.500  1710.000   578.800  1720.000   581.400  1740.000   586.400  1751.000   586.700  1800.000
GR    585.900  1900.000   585.500  2000.000   584.500  2100.000   583.000  2200.000   583.000  2300.000
GR    583.600  2400.000   586.700  2450.000   586.800  2473.000   582.300  2500.000   583.000  2600.000
GR    583.300  2700.000   583.700  2800.000   583.500  2900.000   583.600  3000.000   584.000  3100.000
GR    584.700  3200.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000
NC       .050      .050      .035    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000

X1       .399    62.000  1500.000  1730.000    59.000    59.000    59.000    -0.000    -0.000    -0.000
GR    587.600     0.000   587.600   100.000   587.700   200.000   587.600   300.000   587.400   400.000
GR    587.400   500.000   587.500   600.000   588.100   700.000   589.000   800.000   590.700   900.000
GR    592.700  1000.000   595.500  1100.000   598.100  1200.000   600.500  1300.000   602.800  1400.000
GR    604.800  1500.000   605.400  1500.000   598.200  1500.000   598.100  1506.000   590.800  1522.500
GR    590.800  1527.500   579.600  1527.500   579.500  1530.000   576.300  1550.000   573.000  1570.000
GR    572.600  1572.500   572.600  1572.500   572.300  1574.500   572.300  1574.500   570.100  1590.000
GR    568.900  1610.000   566.600  1630.000   569.200  1650.000   569.600  1655.500   569.600  1655.500
      [illegible]  1657.500   569.800  1657.500   570.800  1670.000   575.400  1680.000   579.300  1690.000
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GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000	
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000	
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000	
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000	
GR	569.800	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000	
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	569.600	1655.500	
GR	572.600	1572.500	572.600	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000	
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000	
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500	
GR	592.700	1000.000	595.500	1100.000	599.100	1200.000	600.500	1300.000	602.800	1400.000	
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000	
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000	
X1	.412	62.000	1500.000	1730.000	1.000	1.000	1.000	-0.000	-0.000	-0.000	
NC	.050	.050	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000	
X1	.411	-0.000	-0.000	56.000	56.000	56.000	-0.000	-0.000	-0.000	-0.000	
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000	
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000	
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000	
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000	
GR	601.300	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000	
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	601.300	1655.500	
GR	572.600	1572.500	601.300	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000	
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000	
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500	
GR	592.700	1000.000	595.500	1100.000	599.100	1200.000	600.500	1300.000	602.800	1400.000	
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000	
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000	
X1	.412	62.000	1500.000	1730.000	1.000	1.000	1.000	-0.000	-0.000	-0.000	
NC	.090	.080	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000	
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000	
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000	
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000	
GR	569.800	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000	
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	569.600	1655.500	
GR	572.600	1572.500	572.600	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000	
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000	
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500	
GR	592.700	1000.000	595.500	1100.000	599.100	1200.000	600.500	1300.000	602.800	1400.000	
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000	
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000	
X1	.415	51.000	1500.000	1751.000	15.000	15.000	15.000	-0.000	-0.000	-0.000	
X3	-0.000	-0.000	-0.000	1521.000	-0.000	1723.000	-0.000	-0.000	-0.000	-0.000	
GR	586.900	0.000	586.800	100.000	587.100	200.000	584.600	300.000	585.000	400.000	
GR	584.200	500.000	584.100	500.000	585.400	700.000	589.800	759.000	590.000	800.000	
GR	585.100	836.000	584.400	900.000	584.600	1000.000	586.100	1100.000	587.100	1200.000	
GR	586.400	1300.000	586.600	1400.000	585.700	1500.000	581.100	1505.000	579.500	1520.000	
GR	577.300	1540.000	575.300	1550.000	572.500	1560.000	567.800	1580.000	571.700	1600.000	
GR	571.800	1620.000	570.500	1640.000	567.500	1660.000	566.600	1680.000	566.600	1700.000	
GR	572.500	1710.000	578.800	1720.000	581.400	1740.000	586.400	1751.000	586.700	1800.000	
GR	585.900	1900.000	585.500	2000.000	584.500	2100.000	583.000	2200.000	583.000	2300.000	
GR	583.600	2400.000	586.700	2450.000	586.800	2473.000	582.300	2500.000	583.000	2600.000	
			583.700	2800.000	593.500	2900.000	583.600	3000.000	584.000	3100.000	
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000	
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000	
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000	
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000	
GR	601.300	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000	
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	601.300	1655.500	
GR	572.600	1572.500	601.300	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000	
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000	
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500	
GR	592.700	1000.000	595.500	1100.000	599.100	1200.000	600.500	1300.000	602.800	1400.000	
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000	
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000	
X1	.400	62.000	1500.000	1730.000	1.000	1.000	1.000	-0.000	-0.000	-0.000	
BT	38.000	0.000	587.600	0.000	100.000	587.600	200.000	587.700	0.000		
BT	587.500	0.000	700.000	588.100	0.000	300.000	589.000	0.000	900.000	590.700	
BT	0.000	1000.000	592.700	0.000	1100.000	595.500	0.000	1200.000	598.100	0.000	
BT	1300.000	600.500	0.000	1400.000	602.800	0.000	1500.000	604.800	0.000	1500.000	
BT	605.400	600.600	1572.500	606.100	601.300	1574.500	606.100	601.300	1655.500	606.100	
BT	601.300	1657.500	606.100	601.300	1730.000	605.400	600.600	1730.000	604.900	0.000	
BT	1800.000	603.200	0.000	1900.000	601.100	0.000	2000.000	598.400	0.000	2100.000	
BT	595.700	0.000	2200.000	593.100	0.000	2300.000	591.100	0.000	2400.000	589.600	
BT	0.000	2500.000	588.500	0.000	2600.000	588.000	0.000	2700.000	587.800	0.000	
BT	2800.000	587.600	0.000	2900.000	587.600	0.000	3000.000	587.400	0.000	3100.000	
BT	587.500	0.000	3200.000	587.500	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000	
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000	
GR	592.700	1000.000	595.500	1100.000	599.100	1200.000	600.500	1300.000	602.800	1400.000	
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500	
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000	
GR	572.600	1572.500	572.600	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000	
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	569.600	1655.500	
GR	569.800	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000	
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000	
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000	
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000	
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000	
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	

GR	1204.700	2200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.080	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.659	42.000	800.000	1108.000	1300.000	1300.000	1300.000	-0.000	-0.000	-0.000
GR	587.400	0.000	584.900	100.000	584.000	200.000	583.500	300.000	583.200	400.000
GR	583.600	500.000	583.800	600.000	583.400	700.000	583.000	800.000	581.200	803.000
GR	576.300	810.000	575.300	820.000	576.000	840.000	575.200	860.000	574.800	880.000
GR	574.400	900.000	574.400	920.000	574.800	940.000	574.700	960.000	575.100	980.000
GR	574.600	1000.000	574.800	1020.000	574.000	1040.000	572.000	1060.000	570.400	1070.000
GR	571.700	1077.000	577.400	1090.000	580.100	1100.000	582.400	1108.000	583.400	1152.000
GR	586.900	1165.000	587.400	1200.000	588.300	1230.000	588.300	1300.000	587.700	1400.000
GR	587.100	1500.000	587.200	1600.000	587.600	1700.000	588.000	1800.000	589.400	1900.000
GR	591.000	2000.000	593.500	2100.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.050	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.052	27.000	1000.000	1150.000	2075.000	2075.000	2075.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	955.500	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
GR	586.500	0.000	587.200	100.000	585.900	200.000	584.900	300.000	584.300	400.000
GR	584.000	500.000	583.600	600.000	583.800	700.000	586.500	785.000	586.900	800.000
GR	583.700	900.000	583.000	1000.000	575.600	1001.000	571.500	1010.000	569.600	1020.000
GR	570.200	1040.000	568.500	1060.000	566.000	1080.000	571.000	1100.000	572.900	1120.000
GR	578.400	1130.000	581.000	1140.000	581.500	1149.000	583.400	1150.000	585.400	1190.000
GR	589.100	1210.000	592.400	1272.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.069	-0.000	-0.000	-0.000	88.000	88.000	88.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1000.000	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
X1	1.071	35.000	300.000	444.500	11.000	11.000	11.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	568.900	345.500	568.900	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	568.900	396.000	568.900	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000
GR	581.900	444.500	592.400	444.500	592.100	500.000	593.500	600.000	595.700	700.000
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.072	35.000	300.000	444.500	1.000	1.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
BT	14.000	0.000	583.800	0.000	100.000	586.700	0.000	200.000	588.800	0.000
BT	300.000	592.400	0.000	300.000	593.100	590.000	345.500	593.600	590.600	348.000
BT	593.600	590.600	396.000	593.600	590.500	398.500	593.600	590.500	444.500	593.100
BT	590.100	444.500	592.400	0.000	500.000	592.100	0.000	600.000	593.500	0.000
BT	700.000	595.700	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	590.600	345.500	590.600	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	590.500	396.000	590.500	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000
GR	581.900	444.500	592.400	444.500	592.100	500.000	593.500	600.000	595.700	700.000
X1	1.080	-0.000	-0.000	-0.000	40.000	40.000	40.000	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
NC	.050	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.081	35.000	300.000	444.500	1.000	1.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	568.900	345.500	568.900	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	568.900	396.000	568.900	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000

X1	1.082	27.000	1000.000	1150.000	3.000	3.000	3.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1000.000	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
GR	586.500	0.000	587.200	100.000	585.900	200.000	584.900	300.000	584.300	400.000
GR	584.000	500.000	583.600	600.000	583.800	700.000	586.500	785.000	586.900	800.000
GR	583.700	900.000	583.000	1000.000	575.600	1001.000	571.500	1010.000	569.600	1020.000
GR	570.200	1040.000	568.900	1060.000	568.900	1080.000	571.000	1100.000	572.900	1120.000
GR	578.400	1130.000	581.000	1140.000	581.500	1149.000	583.400	1150.000	585.400	1190.000
GR	589.100	1210.000	592.400	1272.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.090	.070	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.522	45.000	165.000	465.000	2400.000	1700.000	2330.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	-0.000	-0.000	465.000	-0.000	-0.000	-0.000	-0.000
GR	595.500	0.000	593.000	40.000	591.700	59.000	590.700	75.000	589.300	76.000
GR	588.200	85.000	587.000	95.000	587.700	105.000	588.200	115.000	586.700	135.000
GR	583.800	165.000	580.000	175.000	578.700	195.000	577.900	215.000	577.700	235.000
GR	577.100	255.000	576.600	275.000	576.200	295.000	576.300	315.000	575.400	335.000
GR	575.100	355.000	575.100	375.000	575.100	395.000	573.900	415.000	574.200	435.000
GR	575.300	445.000	578.800	455.000	581.400	463.000	582.400	465.000	582.500	475.000
GR	582.700	575.000	584.000	675.000	583.000	775.000	585.200	875.000	586.200	975.000
GR	588.200	1075.000	589.900	1185.000	588.200	1275.000	588.800	1375.000	590.000	1475.000
GR	590.100	1575.000	589.800	1675.000	589.600	1775.000	589.900	1875.000	589.900	1975.000
NC	.090	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.900	37.000	950.000	1215.000	1800.000	2200.000	2000.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	950.000	-0.000	1218.000	-0.000	-0.000	-0.000	-0.000
GR	592.500	0.000	590.000	50.000	587.700	150.000	586.900	250.000	587.300	350.000
GR	588.400	450.000	588.700	550.000	588.300	650.000	588.300	698.000	584.100	720.000
GR	583.600	750.000	584.500	850.000	584.200	950.000	581.600	951.000	580.800	960.000
GR	579.500	970.000	576.900	980.000	576.900	990.000	575.600	1000.000	575.300	1010.000
GR	575.500	1030.000	575.900	1050.000	576.500	1070.000	576.100	1090.000	575.600	1110.000
GR	575.400	1130.000	574.700	1150.000	574.200	1170.000	573.200	1180.000	574.200	1190.000
GR	577.300	1200.000	581.100	1212.000	582.200	1215.000	583.900	1250.000	586.000	1350.000
GR	588.600	1370.000	592.800	1390.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.909	41.000	950.000	1245.100	49.000	49.000	49.000	.875	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
GR	592.100	0.000	590.200	50.000	589.300	150.000	588.900	250.000	587.600	350.000
GR	588.300	450.000	591.000	550.000	589.300	650.000	590.000	750.000	590.800	850.000
GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.200	992.000	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000
GR	575.200	1035.000	576.900	1050.000	575.800	1070.000	576.000	1090.000	575.300	1110.000
GR	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.500	1170.000	574.000	1180.000
GR	573.900	1190.000	574.200	1200.000	576.000	1210.000	577.100	1217.000	582.400	1225.000
GR	587.700	1237.000	588.300	1245.100	592.000	1245.100	592.000	1250.000	592.900	1350.000
GR	595.300	1450.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.910	73.000	950.000	1245.100	1.000	1.000	1.000	.875	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	.875	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
BT	41.000	0.000	592.100	0.000	50.000	590.200	0.000	150.000	589.300	0.000
BT	250.000	588.900	0.000	350.000	587.600	0.000	450.000	588.300	0.000	550.000
BT	591.000	0.000	650.000	589.500	0.000	750.000	590.000	0.000	850.000	590.800
BT	0.000	950.000	590.600	0.000	950.000	591.400	588.200	990.000	591.700	588.500
BT	990.000	591.700	584.400	992.500	591.700	584.400	992.500	591.700	588.500	1032.500
BT	591.900	588.700	1032.500	591.900	584.600	1035.000	591.900	584.600	1035.000	591.900
BT	588.700	1075.000	592.000	588.800	1075.000	592.000	584.700	1077.500	592.000	584.700
BT	1077.500	592.000	588.800	1117.500	592.300	589.100	1117.500	592.300	585.000	1120.000
BT	592.300	585.000	1120.000	592.300	589.100	1160.000	592.700	589.500	1160.000	592.700
BT	585.400	1162.500	592.700	585.400	1162.500	592.700	589.500	1202.500	592.800	589.600
BT	1202.500	592.800	585.500	1205.000	592.800	585.500	1205.000	592.800	589.600	1245.100
BT	592.800	589.600	1245.100	592.000	0.000	1250.000	592.000	0.000	1350.000	592.900
BT	0.000	1450.000	595.300	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
[illegible]	[illegible]	[illegible]	[illegible]	50.000	589.300	150.000	588.900	250.000	587.600	350.000

GR	588.200	450.000	591.000	550.000	589.300	650.000	590.000	750.000	590.800	850.000
GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.300	990.400	584.400	990.400	584.400	992.100	576.200	992.100	576.200	992.500
GR	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000	575.200	1032.500
GR	575.200	1032.900	584.600	1032.900	584.600	1034.600	575.200	1034.600	575.200	1035.000
GR	576.900	1050.000	575.800	1070.000	575.800	1075.000	575.800	1075.400	584.700	1075.400
GR	584.700	1077.100	575.900	1077.100	575.900	1077.500	576.000	1090.000	575.300	1110.000
GR	575.400	1117.500	575.400	1117.900	585.000	1117.900	585.000	1119.600	575.500	1119.600
GR	575.500	1120.000	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.300	1160.400
GR	585.400	1160.400	585.400	1162.100	573.300	1162.100	573.300	1162.500	573.500	1170.000
GR	574.000	1180.000	573.900	1190.000	574.200	1200.000	574.600	1202.500	574.600	1202.900
GR	585.500	1202.900	585.500	1204.600	575.100	1204.600	575.100	1205.000	576.000	1210.000
GR	577.100	1217.000	582.400	1225.000	587.700	1237.000	588.300	1245.100	592.000	1245.100
GR	592.000	1250.000	592.900	1350.000	595.300	1450.000	-0.000	-0.000	-0.000	-0.000
X1	1.917	-0.000	-0.000	-0.000	34.500	34.500	34.500	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
NC	.080	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.918	41.000	950.000	1245.100	1.000	1.000	1.000	.875	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
GR	592.100	0.000	590.200	50.000	589.300	150.000	588.900	250.000	587.600	350.000
GR	588.300	450.000	591.000	550.000	589.300	650.000	590.000	750.000	590.800	850.000
GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.200	992.000	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000
GR	575.200	1035.000	576.900	1050.000	575.800	1070.000	576.000	1090.000	575.300	1110.000
GR	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.500	1170.000	574.000	1180.000
GR	573.900	1190.000	574.200	1200.000	576.000	1210.000	577.100	1217.000	582.400	1225.000
GR	587.700	1237.000	588.300	1245.100	592.000	1245.100	592.000	1250.000	592.900	1350.000
GR	595.300	1450.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.921	37.000	950.000	1215.000	15.000	15.000	15.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	950.000	-0.000	1224.000	-0.000	-0.000	-0.000	-0.000
GR	592.500	0.000	590.000	50.000	587.700	150.000	586.900	250.000	587.300	350.000
GR	588.400	450.000	588.700	550.000	588.300	650.000	588.300	698.000	584.100	720.000
GR	583.600	750.000	584.500	850.000	584.200	950.000	581.600	951.000	580.800	960.000
GR	579.500	970.000	576.900	980.000	576.900	990.000	575.600	1000.000	575.300	1010.000
GR	575.500	1030.000	575.900	1050.000	576.500	1070.000	576.100	1090.000	575.600	1110.000
GR	575.400	1130.000	574.700	1150.000	574.200	1170.000	573.300	1180.000	574.200	1190.000
GR	577.300	1200.000	581.100	1212.000	582.200	1215.000	583.900	1250.000	586.000	1350.000
GR	588.600	1370.000	592.800	1390.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.100	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.015	29.000	400.000	656.000	500.000	500.000	500.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	400.000	-0.000	656.000	-0.000	-0.000	-0.000	-0.000
GR	592.000	0.000	591.800	100.000	590.800	200.000	589.400	300.000	589.400	400.000
GR	581.800	423.000	580.500	430.000	578.800	440.000	577.600	450.000	576.300	460.000
GR	574.700	470.000	574.400	480.000	573.600	500.000	574.100	520.000	574.600	540.000
GR	573.400	560.000	573.500	580.000	573.200	600.000	574.300	610.000	575.400	620.000
GR	577.700	630.000	580.300	640.000	581.800	650.000	581.600	653.000	588.500	656.000
GR	589.100	700.000	585.400	726.000	589.600	760.000	593.600	767.000	-0.000	-0.000
NC	.070	.060	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.507	44.000	210.000	648.000	2600.000	2700.000	2600.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	210.000	-0.000	648.000	-0.000	-0.000	-0.000	-0.000
GR	596.000	0.000	589.700	35.000	586.600	110.000	585.800	210.000	581.400	215.000
GR	578.100	230.000	577.600	250.000	577.900	270.000	578.500	290.000	578.000	310.000
GR	579.200	330.000	580.200	350.000	579.900	370.000	580.100	390.000	579.900	410.000
GR	579.900	430.000	579.700	450.000	579.400	470.000	579.100	490.000	578.500	510.000
GR	578.200	530.000	577.500	550.000	576.900	570.000	575.300	590.000	573.600	600.000
GR	572.200	610.000	573.300	620.000	578.400	630.000	581.500	640.000	587.300	648.000
GR	585.200	710.000	584.600	810.000	584.000	840.000	588.800	910.000	590.500	940.000
GR	589.800	1010.000	589.100	1110.000	589.200	1210.000	589.500	1310.000	589.400	1410.000
GR	589.300	1510.000	590.100	1600.000	587.800	1610.000	595.300	1630.000	-0.000	-0.000
NC	.060	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

	4.000	1440.000	1340.000	1750.000	1600.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.853	46.000	1300.000	1470.000	1850.000	1650.000	1825.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1300.000	-0.000	1481.000	-0.000	-0.000	-0.000	-0.000
GR	591.900	0.000	591.100	100.000	590.300	200.000	587.100	300.000	588.000	400.000
GR	589.800	500.000	587.700	600.000	588.300	700.000	588.700	800.000	588.100	900.000
GR	588.000	1000.000	586.900	1100.000	586.900	1200.000	587.400	1300.000	581.800	1303.000
GR	580.900	1305.000	576.100	1310.000	575.500	1320.000	574.900	1340.000	569.000	1350.000
GR	566.400	1360.000	565.700	1370.000	567.700	1380.000	567.700	1390.000	567.900	1400.000
GR	568.900	1410.000	570.700	1420.000	574.900	1430.000	576.500	1440.000	578.400	1450.000
GR	581.800	1460.000	583.500	1470.000	584.900	1500.000	586.200	1600.000	586.300	1700.000
GR	589.600	1800.000	590.100	1900.000	589.200	2000.000	588.700	2100.000	588.900	2200.000
GR	588.200	2300.000	588.700	2400.000	588.500	2500.000	588.300	2600.000	588.400	2700.000
GR	587.800	2800.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.867	26.000	300.000	443.500	74.000	74.000	74.000	-0.000	-0.000	-0.000
GR	595.200	0.000	595.500	100.000	595.600	200.000	595.800	300.000	578.800	300.000
GR	574.700	310.000	571.300	320.000	571.300	322.500	571.100	330.000	572.300	340.000
GR	572.500	347.300	572.500	350.000	573.300	360.000	573.300	370.000	575.800	380.000
GR	578.500	390.000	578.700	400.000	580.200	410.000	581.600	420.000	583.300	430.000
GR	583.200	440.000	583.300	443.500	595.800	443.500	595.700	500.000	595.400	600.000
GR	595.200	700.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.045	.045	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.868	-0.000	-0.000	-0.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
BT	10.000	0.000	595.200	0.000	100.000	595.500	0.000	200.000	595.600	0.000
BT	300.000	595.800	591.400	322.500	595.800	591.500	347.300	595.900	591.600	443.500
BT	595.800	591.600	500.000	595.700	0.000	600.000	595.400	0.000	700.000	595.200
BT	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.871	-0.000	-0.000	-0.000	17.700	17.700	17.700	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
NC	.060	.100	.040	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.872	-0.000	-0.000	-0.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
X1	2.875	41.000	1300.000	1470.000	15.000	15.000	15.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1300.000	-0.000	1473.500	-0.000	-0.000	-0.000	-0.000
GR	591.900	0.000	591.100	100.000	590.300	200.000	587.100	300.000	588.000	400.000
GR	589.800	500.000	587.700	600.000	588.300	700.000	588.700	800.000	588.100	900.000
GR	588.000	1000.000	586.900	1100.000	586.900	1200.000	587.400	1300.000	581.800	1303.000
GR	580.900	1305.000	576.100	1310.000	575.500	1320.000	574.900	1340.000	571.100	1350.000
GR	571.100	1410.000	571.100	1420.000	574.900	1430.000	576.500	1440.000	578.400	1450.000
GR	581.800	1460.000	583.500	1470.000	584.900	1500.000	586.200	1600.000	586.300	1700.000
GR	589.600	1800.000	590.100	1900.000	589.200	2000.000	588.700	2100.000	588.900	2200.000
GR	588.200	2300.000	588.700	2400.000	588.500	2500.000	588.300	2600.000	588.400	2700.000
GR	587.800	2800.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.080	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.197	43.000	875.000	1147.000	1700.000	1600.000	1700.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	766.000	-0.000	1147.000	-0.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.400	100.000	590.000	200.000	589.400	300.000	590.500	400.000
GR	589.400	500.000	589.100	600.000	589.100	700.000	590.700	767.000	589.300	800.000
GR	583.800	875.000	581.800	900.000	581.400	910.000	580.300	920.000	580.400	940.000
GR	580.400	960.000	580.100	980.000	579.500	1000.000	578.400	1020.000	577.500	1040.000
GR	575.500	1060.000	574.900	1080.000	574.200	1090.000	574.800	1100.000	575.000	1110.000
GR	574.300	1120.000	575.000	1130.000	579.800	1135.000	582.300	1140.000	586.300	1147.000
GR	585.500	1200.000	584.000	1300.000	585.200	1400.000	584.000	1500.000	587.400	1525.000
GR	587.500	1600.000	589.700	1700.000	588.000	1800.000	587.000	1900.000	586.400	2000.000
GR	587.400	2100.000	590.700	2200.000	595.100	2300.000	-0.000	-0.000	-0.000	-0.000
X1	3.266	43.000	875.000	1147.000	400.000	350.000	370.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	875.000	-0.000	1147.000	-0.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.400	100.000	590.000	200.000	589.400	300.000	590.500	400.000
GR	589.400	500.000	589.100	600.000	589.100	700.000	590.700	767.000	589.300	800.000
GR	583.800	875.000	581.800	900.000	581.400	910.000	580.300	920.000	580.400	940.000

GR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
GR	576.200	1060.000	575.600	1080.000	574.900	1090.000	575.500	1100.000	575.700	1110.000
GR	575.000	1120.000	575.700	1130.000	579.800	1135.000	582.300	1140.000	586.300	1147.000
GR	585.500	1200.000	584.000	1300.000	585.200	1400.000	584.000	1500.000	587.400	1525.000
GR	587.500	1600.000	589.700	1700.000	588.000	1800.000	587.000	1900.000	586.400	2000.000
GR	587.400	2100.000	590.700	2200.000	595.100	2300.000	-0.000	-0.000	-0.000	-0.000
NC	.080	.080	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.683	26.000	200.000	400.000	1600.000	1500.000	2200.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	200.000	-0.000	550.000	-0.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.000	200.000	582.500	215.000	579.700	220.000	578.200	230.000
GR	577.100	240.000	576.100	250.000	575.500	260.000	575.300	270.000	575.100	280.000
GR	575.500	290.000	576.000	300.000	576.800	310.000	577.500	320.000	578.200	330.000
GR	579.300	340.000	579.900	350.000	580.800	360.000	581.800	370.000	582.500	385.000
GR	583.100	400.000	583.700	500.000	584.600	600.000	586.500	700.000	587.500	800.000
GR	590.900	940.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.787	30.000	400.000	600.000	510.000	490.000	550.000	.857	-0.000	-0.000
X3	-0.000	-0.000	-0.000	400.000	-0.000	815.000	-0.000	-0.000	-0.000	-0.000
GR	592.900	0.000	594.000	100.000	593.300	200.000	593.700	300.000	592.400	400.000
GR	582.500	415.000	579.700	420.000	578.200	430.000	577.100	440.000	576.100	450.000
GR	575.500	460.000	575.300	470.000	575.200	480.000	575.500	490.000	576.000	500.000
GR	576.800	510.000	577.500	520.000	578.200	530.000	579.300	540.000	579.900	550.000
GR	580.800	560.000	581.800	570.000	582.500	585.000	583.100	600.000	583.700	700.000
GR	584.600	800.000	586.500	900.000	587.500	1000.000	590.900	1040.000	589.500	1100.000
NC	.090	.070	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.128	27.000	1350.000	1550.000	1450.000	1800.000	1800.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1250.000	-0.000	1750.000	-0.000	-0.000	-0.000	-0.000
GR	593.300	0.000	590.000	550.000	589.000	750.000	590.000	950.000	589.000	1050.000
GR	590.000	1150.000	590.000	1250.000	582.500	1350.000	581.800	1365.000	580.800	1375.000
GR	579.900	1385.000	579.300	1395.000	578.200	1405.000	577.500	1415.000	576.800	1425.000
GR	576.000	1435.000	575.500	1445.000	575.000	1455.000	575.300	1465.000	575.500	1475.000
GR	576.100	1485.000	577.100	1495.000	578.200	1505.000	579.700	1515.000	582.500	1525.000
GR	590.000	1550.000	595.500	1750.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.100	.080	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.374	27.000	250.000	450.000	1120.000	1150.000	1300.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	250.000	-0.000	700.000	-0.000	-0.000	-0.000	-0.000
GR	593.700	0.000	590.000	250.000	582.500	265.000	579.700	270.000	578.200	280.000
GR	577.100	290.000	576.100	300.000	575.500	310.000	575.300	320.000	574.900	330.000
GR	575.500	340.000	576.000	350.000	576.800	360.000	577.500	370.000	578.200	380.000
GR	579.300	390.000	579.900	400.000	580.800	410.000	581.800	420.000	582.500	435.000
GR	583.100	450.000	583.700	550.000	584.600	650.000	586.500	750.000	587.500	850.000
GR	590.000	1300.000	592.100	2150.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NH	4.000	.100	1185.000	.070	1400.000	.040	1620.000	.070	2600.000	-0.000
X1	4.620	36.000	1400.000	1620.000	1300.000	1150.000	1300.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1185.000	-0.000	1620.000	-0.000	-0.000	-0.000	-0.000
GR	600.000	0.000	590.000	800.000	587.300	900.000	587.600	1000.000	588.700	1100.000
GR	590.000	1185.000	585.200	1250.000	583.300	1300.000	584.000	1400.000	582.100	1410.000
GR	581.100	1420.000	581.100	1430.000	581.000	1440.000	579.700	1460.000	578.100	1480.000
GR	578.100	1500.000	576.800	1520.000	576.000	1530.000	575.500	1540.000	575.200	1550.000
GR	574.700	1560.000	575.200	1570.000	577.300	1580.000	578.400	1590.000	581.600	1600.000
GR	588.800	1620.000	589.500	1700.000	589.700	1800.000	589.200	1900.000	589.600	2000.000
GR	590.600	2100.000	590.700	2200.000	591.300	2300.000	591.200	2400.000	591.000	2500.000
GR	592.100	2600.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.070	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.951	23.000	75.000	295.000	1500.000	1700.000	1750.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	-0.000	-0.000	425.000	-0.000	-0.000	-0.000	-0.000
GR	600.000	0.000	590.000	75.000	581.600	95.000	578.400	105.000	577.300	115.000
GR	576.400	125.000	576.400	165.000	576.800	175.000	578.100	195.000	578.100	215.000
GR	579.700	235.000	581.000	255.000	581.100	265.000	581.100	275.000	582.100	285.000
GR	584.000	295.000	585.000	435.000	586.000	450.000	587.000	480.000	588.000	540.000
			[illegible]	[illegible]	[illegible]	1350.000	-0.000	-0.000	-0.000	-0.000

NC	.100	.079	.340	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	5.197	34.000	1000.000	1286.000	1300.000	1175.000	1300.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1000.000	-0.000	1286.000	-0.000	-0.000	-0.000	-0.000
GR	591.600	0.000	591.200	100.000	590.700	200.000	590.100	300.000	590.700	400.000
GR	590.900	500.000	590.800	600.000	591.100	700.000	592.200	720.000	588.200	740.000
GR	586.300	800.000	587.800	900.000	590.000	1000.000	583.600	1010.000	582.200	1020.000
GR	581.500	1040.000	580.800	1060.000	580.800	1080.000	580.100	1100.000	580.800	1120.000
GR	579.800	1140.000	579.000	1160.000	578.600	1180.000	579.000	1200.000	578.300	1220.000
GR	578.000	1240.000	578.800	1250.000	579.900	1260.000	582.400	1270.000	584.500	1280.000
GR	591.000	1286.000	590.500	1400.000	594.000	1455.000	593.300	1500.000	-0.000	-0.000
EJ	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Au Sable River

4) DOCUMENT TYPE: Input data 100yr natural

00BREAK00

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*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************
C
1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       100 YEAR FLOOD
T3       AU SABLE RIVER

J1  ICHECK     INQ        NINV       IDIR       STRT       METRIC     HVINS      Q          WSEL       FQ
      -0.        4.        -0.        -0. -0.000000      -0.00       -0.0       -0.    580.600    -0.000

J2  NPROF      IPLOT      PRFVS      XSECV      XSECH      FN         ALLDC      IBW        CHNIM      ITRACE
    -0.000     -0.000     -1.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000

J3      1.000     10.000     11.000     12.000     14.000      8.000      4.000     -0.000     -0.000     -0.000
NC       .070       .060       .035       .300       .500     -0.000     -0.000     -0.000     -0.000     -0.000
QT      4.000   5070.000   6100.000   6570.000   7770.000     -0.000     -0.000     -0.000     -0.000     -0.000

X1       .001     21.000      0.000    190.000      0.000      0.000      0.000     -0.000     -0.000     -0.000
GR    586.200      0.000    574.200      0.000    574.400     10.000    572.500     20.000    567.600     30.000
GR    566.700     40.000    566.500     50.000    566.500     60.000    566.400     70.000    566.800     80.000
GR    566.900     90.000    566.800    100.000    566.600    110.000    566.600    120.000    567.000    130.000
GR    567.300    140.000    568.100    150.000    569.200    160.000    570.500    170.000    570.800    180.000
GR    586.100    190.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000

X1       .208     19.000      0.000    190.000   1100.000   1100.000   1100.000     -0.000     -0.000     -0.000
GR    586.400      0.000    578.300     20.000    577.100     30.000    571.100     40.000    566.600     50.000
GR    566.500     60.000    565.800     70.000    566.400     80.000    566.800     90.000    566.700    100.000
GR    566.600    110.000    566.500    120.000    566.200    130.000    566.700    140.000    567.400    150.000
GR    570.500    160.000    573.700    170.000    574.500    180.000    586.200    190.000     -0.000     -0.000

X1       .388     51.000   1500.000   1751.000    950.000    950.000    950.000     -0.000     -0.000     -0.000
X3      -0.000     -0.000     -0.000   1520.000     -0.000   1720.000     -0.000     -0.000     -0.000     -0.000
GR    586.900      0.000    586.800    100.000    587.100    200.000    584.600    300.000    585.000    400.000
GR    584.200    500.000    584.100    600.000    585.400    700.000    589.800    759.000    590.000    800.000
GR    585.100    836.000    584.400    900.000    584.600   1000.000    586.100   1100.000    587.100   1200.000
GR    586.400   1300.000    586.600   1400.000    585.700   1500.000    581.100   1505.000    579.500   1520.000
GR    577.300   1540.000    575.300   1550.000    572.500   1560.000    567.800   1580.000    571.700   1600.000
GR    571.800   1620.000    570.500   1640.000    567.500   1660.000    565.900   1680.000    565.900   1700.000
GR    572.500   1710.000    578.800   1720.000    581.400   1740.000    586.400   1751.000    586.700   1800.000
GR    585.900   1900.000    585.500   2000.000    584.500   2100.000    583.000   2200.000    583.000   2300.000
GR    583.600   2400.000    586.700   2450.000    586.800   2473.000    582.300   2500.000    583.000   2600.000
GR    583.300   2700.000    583.700   2800.000    583.500   2900.000    583.600   3000.000    584.000   3100.000
GR    584.700   3200.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000
NC       .050       .050       .035     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000     -0.000

X1       .399     62.000   1500.000   1730.000     59.000     59.000     59.000     -0.000     -0.000     -0.000
GR    587.600      0.000    587.600    100.000    587.700    200.000    587.600    300.000    587.400    400.000
GR    587.400    500.000    587.500    600.000    588.100    700.000    589.000    800.000    590.700    900.000
GR    592.700   1000.000    595.500   1100.000    598.100   1200.000    600.500   1300.000    602.800   1400.000
GR    604.800   1500.000    605.400   1500.000    598.200   1500.000    598.100   1506.000    590.800   1522.500
GR    590.800   1527.500    579.600   1527.500    579.500   1530.000    576.300   1550.000    573.000   1570.000
GR    572.600   1572.500    572.600   1572.500    572.300   1574.500    572.300   1574.500    570.100   1590.000
GR    568.900   1610.000    566.600   1630.000    569.200   1650.000    569.600   1655.500    569.600   1655.500
GR    569.800   1657.500    569.800   1657.500    570.800   1670.000    575.400   1680.000    579.300   1690.000
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GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.400	62.000	1500.000	1730.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
BT	38.000	0.000	587.600	0.000	100.000	587.600	0.000	200.000	587.700	0.000
BT	300.000	587.600	0.000	400.000	587.400	0.000	500.000	587.400	0.000	600.000
BT	587.500	0.000	700.000	538.100	0.000	800.000	589.000	0.000	900.000	590.700
BT	0.000	1000.000	592.700	0.000	1100.000	595.500	0.000	1200.000	598.100	0.000
BT	1300.000	600.500	0.000	1400.000	602.300	0.000	1500.000	604.800	0.000	1500.000
BT	605.400	600.600	1572.500	606.100	601.300	1574.500	606.100	601.300	1655.500	606.100
BT	601.300	1657.500	606.100	601.300	1730.000	605.400	600.600	1730.000	604.900	0.000
BT	1800.000	603.200	0.000	1900.000	601.100	0.000	2000.000	598.400	0.000	2100.000
BT	595.700	0.000	2200.000	593.100	0.000	2300.000	591.100	0.000	2400.000	589.600
BT	0.000	2500.000	588.500	0.000	2600.000	588.000	0.000	2700.000	587.800	0.000
BT	2800.000	587.600	0.000	2900.000	587.600	0.000	3000.000	587.400	0.000	3100.000
BT	587.500	0.000	3200.000	587.500	0.000	-0.000	-0.000	-0.000	-0.000	-0.000
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000
GR	592.700	1000.000	595.500	1100.000	598.100	1200.000	600.500	1300.000	602.800	1400.000
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000
GR	572.600	1572.500	601.300	1572.500	601.300	1574.500	572.300	1574.500	570.100	1590.000
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	601.300	1655.500
GR	601.300	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.411	-0.000	-0.000	-0.000	56.000	56.000	56.000	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
NC	.050	.050	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.412	62.000	1500.000	1730.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
GR	587.600	0.000	587.600	100.000	587.700	200.000	587.600	300.000	587.400	400.000
GR	587.400	500.000	587.500	600.000	588.100	700.000	589.000	800.000	590.700	900.000
GR	592.700	1000.000	595.500	1100.000	598.100	1200.000	600.500	1300.000	602.800	1400.000
GR	604.800	1500.000	605.400	1500.000	598.200	1500.000	598.100	1506.000	590.800	1522.500
GR	590.800	1527.500	579.600	1527.500	579.500	1530.000	576.300	1550.000	573.000	1570.000
GR	572.600	1572.500	572.600	1572.500	572.300	1574.500	572.300	1574.500	570.100	1590.000
GR	568.900	1610.000	566.600	1630.000	569.200	1650.000	569.600	1655.500	569.600	1655.500
GR	569.800	1657.500	569.800	1657.500	570.800	1670.000	575.400	1680.000	579.300	1690.000
GR	581.200	1702.500	590.800	1702.500	590.800	1707.500	598.100	1724.000	598.200	1730.000
GR	605.400	1730.000	604.900	1730.000	603.200	1800.000	601.100	1900.000	598.400	2000.000
GR	595.700	2100.000	593.100	2200.000	591.100	2300.000	589.600	2400.000	588.500	2500.000
GR	588.000	2600.000	587.800	2700.000	587.600	2800.000	587.600	2900.000	587.400	3000.000
GR	587.500	3100.000	587.500	3200.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.090	.080	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.415	51.000	1500.000	1751.000	15.000	15.000	15.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1521.000	-0.000	1723.000	-0.000	-0.000	-0.000	-0.000
GR	586.900	0.000	586.800	100.000	587.100	200.000	584.600	300.000	585.000	400.000
GR	584.200	500.000	584.100	600.000	585.400	700.000	589.800	759.000	590.000	800.000
GR	585.100	836.000	584.400	900.000	584.600	1000.000	586.100	1100.000	587.100	1200.000
GR	586.400	1300.000	586.600	1400.000	585.700	1500.000	581.100	1505.000	579.500	1520.000
GR	577.300	1540.000	575.300	1550.000	572.500	1560.000	567.800	1580.000	571.700	1600.000
GR	571.800	1620.000	570.500	1640.000	567.500	1660.000	566.600	1680.000	566.600	1700.000
GR	572.500	1710.000	578.800	1720.000	581.400	1740.000	586.400	1751.000	586.700	1800.000
GR	585.900	1900.000	585.500	2000.000	584.500	2100.000	583.000	2200.000	583.000	2300.000
GR	583.600	2400.000	586.700	2450.000	586.800	2473.000	582.300	2500.000	583.000	2600.000
GR	583.300	2700.000	583.700	2800.000	583.500	2900.000	583.600	3000.000	584.000	3100.000

NC	.080	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	.659	42.000	800.000	1108.000	1300.000	1300.000	1300.000	-0.000	-0.000	-0.000
GR	587.400	0.000	584.900	100.000	584.000	200.000	583.500	300.000	583.200	400.000
GR	583.600	500.000	583.800	600.000	583.400	700.000	583.000	800.000	581.200	803.000
GR	576.300	810.000	575.300	820.000	576.000	840.000	575.200	860.000	574.800	880.000
GR	574.400	900.000	574.400	920.000	574.800	940.000	574.700	960.000	575.100	980.000
GR	574.600	1000.000	574.800	1020.000	574.000	1040.000	572.000	1060.000	570.400	1070.000
GR	571.700	1077.000	577.400	1090.000	580.100	1100.000	582.400	1108.000	583.400	1152.000
GR	586.900	1165.000	587.400	1200.000	588.300	1230.000	588.300	1300.000	587.700	1400.000
GR	587.100	1500.000	587.200	1600.000	587.600	1700.000	588.000	1800.000	589.400	1900.000
GR	591.000	2000.000	593.500	2100.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.050	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.052	27.000	1000.000	1150.000	2075.000	2075.000	2075.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	955.500	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
GR	586.500	0.000	587.200	100.000	585.900	200.000	584.900	300.000	584.300	400.000
GR	584.000	500.000	583.600	600.000	583.800	700.000	586.500	785.000	586.900	800.000
GR	583.700	900.000	583.000	1000.000	575.600	1001.000	571.500	1010.000	569.600	1020.000
GR	570.200	1040.000	568.500	1060.000	566.000	1080.000	571.000	1100.000	572.900	1120.000
GR	578.400	1130.000	581.000	1140.000	581.500	1149.000	583.400	1150.000	585.400	1190.000
GR	589.100	1210.000	592.400	1272.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.069	-0.000	-0.000	-0.000	88.000	88.000	88.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1000.000	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
X1	1.071	35.000	300.000	444.500	11.000	11.000	11.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	568.900	345.500	568.900	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	568.900	396.000	568.900	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000
GR	581.900	444.500	592.400	444.500	592.100	500.000	593.500	600.000	595.700	700.000
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.072	35.000	300.000	444.500	1.000	1.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
BT	14.000	0.000	583.800	0.000	100.000	586.700	0.000	200.000	588.800	0.000
BT	300.000	592.400	0.000	300.000	593.100	590.000	345.500	593.600	590.600	348.000
BT	593.600	590.600	396.000	593.600	590.500	398.500	593.600	590.500	444.500	593.100
BT	590.100	444.500	592.400	0.000	500.000	592.100	0.000	600.000	593.500	0.000
BT	700.000	595.700	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	590.600	345.500	590.600	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	590.500	396.000	590.500	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000
GR	581.900	444.500	592.400	444.500	592.100	500.000	593.500	600.000	595.700	700.000
X1	1.080	-0.000	-0.000	-0.000	40.000	40.000	40.000	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
NC	.050	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.081	35.000	300.000	444.500	1.000	1.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	592.400	592.400	-0.000
GR	583.800	0.000	586.700	100.000	588.800	200.000	592.400	300.000	582.000	300.000
GR	582.500	305.000	576.900	305.100	575.300	310.000	570.500	320.000	569.100	330.000
GR	568.900	340.000	568.900	345.500	568.900	345.500	568.900	348.000	568.900	348.000
GR	568.900	350.000	569.500	360.000	570.200	370.000	569.600	380.000	569.300	390.000
GR	568.900	396.000	568.900	396.000	568.900	398.500	568.900	398.500	568.900	400.000
GR	570.100	410.000	571.500	420.000	572.600	430.000	575.100	440.900	582.400	441.000

X1	1.082	27.000	1000.000	1150.000	3.000	3.000	3.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1000.000	-0.000	1150.000	-0.000	-0.000	-0.000	-0.000
GR	586.500	0.000	587.200	100.000	585.900	200.000	584.900	300.000	584.300	400.000
GR	584.000	500.000	583.600	600.000	583.800	700.000	586.500	785.000	586.900	800.000
GR	583.700	900.000	583.000	1000.000	575.600	1001.000	571.500	1010.000	569.600	1020.000
GR	570.200	1040.000	568.900	1060.000	568.900	1080.000	571.000	1100.000	572.900	1120.000
GR	578.400	1130.000	581.000	1140.000	581.500	1149.000	583.400	1150.000	585.400	1190.000
GR	589.100	1210.000	592.400	1272.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.090	.070	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.522	45.000	165.000	465.000	2400.000	1700.000	2330.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	-0.000	-0.000	675.000	-0.000	-0.000	-0.000	-0.000
GR	595.500	0.000	593.000	40.000	591.700	59.000	590.700	75.000	589.300	76.000
GR	588.200	85.000	587.000	95.000	587.700	105.000	588.200	115.000	586.700	135.000
GR	583.800	165.000	580.000	175.000	578.700	195.000	577.900	215.000	577.700	235.000
GR	577.100	255.000	576.600	275.000	576.200	295.000	576.300	315.000	575.400	335.000
GR	575.100	355.000	575.100	375.000	575.100	395.000	573.900	415.000	574.200	435.000
GR	575.300	445.000	578.800	455.000	581.400	463.000	582.400	465.000	582.500	475.000
GR	582.700	575.000	584.000	675.000	583.000	775.000	585.200	875.000	586.200	975.000
GR	588.200	1075.000	589.900	1185.000	588.200	1275.000	588.800	1375.000	590.000	1475.000
GR	590.100	1575.000	589.800	1675.000	589.600	1775.000	589.900	1875.000	589.900	1975.000
NC	.090	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.900	37.000	950.000	1215.000	1800.000	2200.000	2000.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	950.000	-0.000	1218.000	-0.000	-0.000	-0.000	-0.000
GR	592.500	0.000	590.000	50.000	587.700	150.000	586.900	250.000	587.300	350.000
GR	588.400	450.000	588.700	550.000	588.300	650.000	588.300	698.000	584.100	720.000
GR	583.600	750.000	584.500	850.000	584.200	950.000	581.600	951.000	580.800	960.000
GR	579.500	970.000	576.900	980.000	576.900	990.000	575.600	1000.000	575.300	1010.000
GR	575.500	1030.000	575.900	1050.000	576.500	1070.000	576.100	1090.000	575.600	1110.000
GR	575.400	1130.000	574.700	1150.000	574.200	1170.000	573.200	1180.000	574.200	1190.000
GR	577.300	1200.000	581.100	1212.000	582.200	1215.000	583.900	1250.000	586.000	1350.000
GR	588.600	1370.000	592.800	1390.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.909	41.000	950.000	1245.100	49.000	49.000	49.000	.875	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
GR	592.100	0.000	590.200	50.000	589.300	150.000	588.900	250.000	587.600	350.000
GR	588.300	450.000	591.000	550.000	589.300	650.000	590.000	750.000	590.800	850.000
GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.200	992.000	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000
GR	575.200	1035.000	576.900	1050.000	575.800	1070.000	576.000	1090.000	575.300	1110.000
GR	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.500	1170.000	574.000	1180.000
GR	573.900	1190.000	574.200	1200.000	576.000	1210.000	577.100	1217.000	582.400	1225.000
GR	587.700	1237.000	588.300	1245.100	592.000	1245.100	592.000	1250.000	592.900	1350.000
GR	595.300	1450.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.020	.020	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.910	73.000	950.000	1245.100	1.000	1.000	1.000	.875	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	.875	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
BT	41.000	0.000	592.100	0.000	50.000	590.200	0.000	150.000	589.300	0.000
BT	250.000	588.900	0.000	350.000	587.600	0.000	450.000	588.300	0.000	550.000
BT	591.000	0.000	650.000	589.300	0.000	750.000	590.000	0.000	850.000	590.800
BT	0.000	950.000	590.600	0.000	950.000	591.400	588.200	990.000	591.700	588.500
BT	990.000	591.700	584.400	992.500	591.700	584.400	992.500	591.700	588.500	1032.500
BT	591.900	588.700	1032.500	591.900	584.600	1035.000	591.900	584.600	1035.000	591.900
BT	588.700	1075.000	592.000	588.800	1075.000	592.000	584.700	1077.500	592.000	584.700
BT	1077.500	592.000	588.800	1117.500	592.300	589.100	1117.500	592.300	585.000	1120.000
BT	592.300	585.000	1120.000	592.300	589.100	1160.000	592.700	589.500	1160.000	592.700
BT	585.400	1162.500	592.700	585.400	1162.500	592.700	589.500	1202.500	592.800	589.600
BT	1202.500	592.800	585.500	1205.000	592.800	585.500	1205.000	592.800	589.600	1245.100
BT	592.800	589.600	1245.100	592.000	0.000	1250.000	592.000	0.000	1350.000	592.900
BT	0.000	1450.000	595.300	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
GR	592.100	0.000	590.200	50.000	589.300	150.000	588.900	250.000	587.600	350.000

GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.300	990.400	584.400	990.400	584.400	992.100	576.200	992.100	576.200	992.500
GR	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000	575.200	1032.500
GR	575.200	1032.900	584.600	1032.900	584.600	1034.600	575.200	1034.600	575.200	1035.000
GR	576.900	1050.000	575.800	1070.000	575.800	1075.000	575.800	1075.400	584.700	1075.400
GR	584.700	1077.100	575.900	1077.100	575.900	1077.500	576.000	1090.000	575.300	1110.000
GR	575.400	1117.500	575.400	1117.900	585.000	1117.900	585.000	1119.600	575.500	1119.600
GR	575.500	1120.000	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.300	1160.400
GR	585.400	1160.400	585.400	1162.100	573.300	1162.100	573.300	1162.500	573.500	1170.000
GR	574.000	1180.000	573.900	1190.000	574.200	1200.000	574.600	1202.500	574.600	1202.900
GR	585.500	1202.900	585.500	1204.600	575.100	1204.600	575.100	1205.000	576.000	1210.000
GR	577.100	1217.000	582.400	1225.000	587.700	1237.000	588.300	1245.100	592.000	1245.100
GR	592.000	1250.000	592.900	1350.000	595.300	1450.000	-0.000	-0.000	-0.000	-0.000
X1	1.917	-0.000	-0.000	-0.000	34.500	34.500	34.500	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
NC	.080	.090	.035	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.918	41.000	950.000	1245.100	1.000	1.000	1.000	.875	-0.000	-0.000
X3	10.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	590.600	592.000	-0.000
GR	592.100	0.000	590.200	50.000	589.300	150.000	588.900	250.000	587.600	350.000
GR	588.300	450.000	591.000	550.000	589.300	650.000	590.000	750.000	590.800	850.000
GR	590.600	950.000	586.000	950.000	580.000	967.000	577.300	980.000	576.300	990.000
GR	576.200	992.000	574.400	1000.000	575.300	1010.000	575.800	1020.000	575.200	1031.000
GR	575.200	1035.000	576.900	1050.000	575.800	1070.000	576.000	1090.000	575.300	1110.000
GR	575.800	1138.000	574.400	1150.000	573.300	1160.000	573.500	1170.000	574.000	1180.000
GR	573.900	1190.000	574.200	1200.000	576.000	1210.000	577.100	1217.000	582.400	1225.000
GR	587.700	1237.000	588.300	1245.100	592.000	1245.100	592.000	1250.000	592.900	1350.000
GR	595.300	1450.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	1.921	37.000	950.000	1215.000	15.000	15.000	15.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	950.000	-0.000	1224.000	-0.000	-0.000	-0.000	-0.000
GR	592.500	0.000	590.000	50.000	587.700	150.000	586.900	250.000	587.300	350.000
GR	588.400	450.000	588.700	550.000	588.300	650.000	588.300	698.000	584.100	720.000
GR	583.600	750.000	584.500	850.000	584.200	950.000	581.600	951.000	580.800	960.000
GR	579.500	970.000	576.900	980.000	576.900	990.000	575.600	1000.000	575.300	1010.000
GR	575.500	1030.000	575.900	1050.000	576.500	1070.000	576.100	1090.000	575.600	1110.000
GR	575.400	1130.000	574.700	1150.000	574.200	1170.000	573.300	1180.000	574.200	1190.000
GR	577.300	1200.000	581.100	1212.000	582.200	1215.000	583.900	1250.000	586.000	1350.000
GR	588.600	1370.000	592.800	1390.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.100	.090	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.015	29.000	400.000	656.000	500.000	500.000	500.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	400.000	-0.000	656.000	-0.000	-0.000	-0.000	-0.000
GR	592.000	0.000	591.800	100.000	590.800	200.000	589.400	300.000	589.400	400.000
GR	581.800	423.000	580.500	430.000	578.800	440.000	577.600	450.000	576.300	460.000
GR	574.700	470.000	574.400	480.000	573.600	500.000	574.100	520.000	574.600	540.000
GR	573.400	560.000	573.500	580.000	573.200	600.000	574.300	610.000	575.400	620.000
GR	577.700	630.000	580.300	640.000	581.800	650.000	581.600	653.000	588.500	656.000
GR	589.100	700.000	585.400	726.000	589.600	760.000	593.600	767.000	-0.000	-0.000
NC	.070	.060	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.507	44.000	210.000	648.000	2600.000	2700.000	2600.000	-0.000	-0.000	-0.000
GR	596.000	0.000	589.700	35.000	586.600	110.000	585.800	210.000	581.400	215.000
GR	578.100	230.000	577.600	250.000	577.900	270.000	578.500	290.000	578.000	310.000
GR	579.200	330.000	580.200	350.000	579.900	370.000	580.100	390.000	579.900	410.000
GR	579.900	430.000	579.700	450.000	579.400	470.000	579.100	490.000	578.500	510.000
GR	578.200	530.000	577.500	550.000	576.900	570.000	575.300	590.000	573.600	600.000
GR	572.200	610.000	573.300	620.000	578.400	630.000	581.500	640.000	587.300	648.000
GR	585.200	710.000	584.600	810.000	584.000	840.000	588.800	910.000	590.500	940.000
GR	589.800	1010.000	589.100	1110.000	589.200	1210.000	589.500	1310.000	589.400	1410.000
GR	589.300	1510.000	590.100	1600.000	587.800	1610.000	595.300	1630.000	-0.000	-0.000
NC	.060	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
OT	4.000	4440.000	5340.000	5750.000	6800.000	-0.000	-0.000	-0.000	-0.000	-0.000

X1	2.853	46.000	1300.000	1470.000	1850.000	1650.000	1825.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1300.000	-0.000	1481.000	-0.000	-0.000	-0.000	-0.000
GR	591.900	0.000	591.100	100.000	590.300	200.000	587.100	300.000	588.000	400.000
GR	589.800	500.000	587.700	600.000	588.300	700.000	588.700	800.000	588.100	900.000
GR	588.000	1000.000	586.900	1100.000	586.900	1200.000	587.400	1300.000	581.800	1303.000
GR	580.900	1305.000	576.100	1310.000	575.500	1320.000	574.900	1340.000	569.000	1350.000
GR	566.400	1360.000	565.700	1370.000	567.700	1380.000	567.700	1390.000	567.900	1400.000
GR	568.900	1410.000	570.700	1420.000	574.900	1430.000	576.500	1440.000	578.400	1450.000
GR	581.800	1460.000	583.500	1470.000	584.900	1500.000	586.200	1600.000	586.300	1700.000
GR	589.600	1800.000	590.100	1900.000	589.200	2000.000	588.700	2100.000	588.900	2200.000
GR	588.200	2300.000	588.700	2400.000	588.500	2500.000	588.300	2600.000	588.400	2700.000
GR	587.800	2800.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.867	26.000	300.000	443.500	74.000	74.000	74.000	-0.000	-0.000	-0.000
GR	595.200	0.000	595.500	100.000	595.600	200.000	595.800	300.000	578.800	300.000
GR	574.700	310.000	571.300	320.000	571.300	322.500	571.100	330.000	572.300	340.000
GR	572.500	347.300	572.500	350.000	573.300	360.000	573.300	370.000	575.800	380.000
GR	578.500	390.000	578.700	400.000	580.200	410.000	581.600	420.000	583.300	430.000
GR	583.200	440.000	583.300	443.500	595.800	443.500	595.700	500.000	595.400	600.000
GR	595.200	700.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.045	.045	.030	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.868	-0.000	-0.000	-0.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
BT	10.000	0.000	595.200	0.000	100.000	595.500	0.000	200.000	595.600	0.000
BT	300.000	595.300	591.400	322.500	595.800	591.500	347.300	595.900	591.600	443.500
BT	595.800	591.600	500.000	595.700	0.000	600.000	595.400	0.000	700.000	595.200
BT	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.871	-0.000	-0.000	-0.000	17.700	17.700	17.700	-0.000	-0.000	-0.000
X2	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	1.000	-0.000	-0.000	-0.000
NC	.060	.100	.040	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	2.872	-0.000	-0.000	-0.000	1.000	1.000	1.000	-0.000	-0.000	-0.000
X1	2.875	41.000	1300.000	1470.000	15.000	15.000	15.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1300.000	-0.000	1473.500	-0.000	-0.000	-0.000	-0.000
GR	591.900	0.000	591.100	100.000	590.300	200.000	587.100	300.000	588.000	400.000
GR	589.800	500.000	587.700	600.000	588.300	700.000	588.700	800.000	588.100	900.000
GR	588.000	1000.000	586.900	1100.000	586.900	1200.000	587.400	1300.000	581.800	1303.000
GR	580.900	1305.000	576.100	1310.000	575.500	1320.000	574.900	1340.000	571.100	1350.000
GR	571.100	1410.000	571.100	1420.000	574.900	1430.000	576.500	1440.000	578.400	1450.000
GR	581.800	1460.000	583.500	1470.000	584.900	1500.000	586.200	1600.000	586.300	1700.000
GR	589.600	1800.000	590.100	1900.000	589.200	2000.000	588.700	2100.000	588.900	2200.000
GR	588.200	2300.000	588.700	2400.000	588.500	2500.000	588.300	2600.000	588.400	2700.000
GR	587.800	2800.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.080	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.197	43.000	875.000	1147.000	1700.000	1600.000	1700.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	766.000	-0.000	1700.000	-0.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.400	100.000	590.000	200.000	589.400	300.000	590.500	400.000
GR	589.400	500.000	589.100	600.000	589.100	700.000	590.700	767.000	589.300	800.000
GR	583.800	875.000	581.800	900.000	581.400	910.000	580.300	920.000	580.400	940.000
GR	580.400	960.000	580.100	980.000	579.500	1000.000	578.400	1020.000	577.500	1040.000
GR	575.500	1060.000	574.900	1080.000	574.200	1090.000	574.800	1100.000	575.000	1110.000
GR	574.300	1120.000	575.000	1130.000	579.800	1135.000	582.300	1140.000	586.300	1147.000
GR	585.500	1200.000	584.000	1300.000	585.200	1400.000	584.000	1500.000	587.400	1525.000
GR	587.500	1600.000	589.700	1700.000	588.000	1800.000	587.000	1900.000	586.400	2000.000
GR	587.400	2100.000	590.700	2200.000	595.100	2300.000	-0.000	-0.000	-0.000	-0.000
X1	3.266	43.000	875.000	1147.000	400.000	350.000	370.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	766.000	-0.000	1300.000	-0.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.400	100.000	590.000	200.000	589.400	300.000	590.500	400.000
GR	589.400	500.000	589.100	600.000	589.100	700.000	590.700	767.000	589.300	800.000
GR	583.800	875.000	581.800	900.000	581.400	910.000	580.300	920.000	580.400	940.000
GR	580.400	960.000	580.100	980.000	579.500	1000.000	578.400	1020.000	577.500	1040.000

GR	575.000	1120.000	575.700	1130.000	579.800	1135.000	582.300	1140.000	586.300	1147.000
GR	585.500	1200.000	584.000	1300.000	585.200	1400.000	584.000	1500.000	587.400	1525.000
GR	587.500	1600.000	589.700	1700.000	588.000	1800.000	587.000	1900.000	586.400	2000.000
GR	587.400	2100.000	590.700	2200.000	595.100	2300.000	-0.000	-0.000	-0.000	-0.000
NC	.080	.080	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.683	26.000	200.000	400.000	1600.000	1500.000	2200.000	-0.000	-0.000	-0.000
GR	590.000	0.000	589.000	200.000	582.500	215.000	579.700	220.000	578.200	230.000
GR	577.100	240.000	576.100	250.000	575.500	260.000	575.300	270.000	575.100	280.000
GR	575.500	290.000	576.000	300.000	576.800	310.000	577.500	320.000	578.200	330.000
GR	579.300	340.000	579.900	350.000	580.800	360.000	581.800	370.000	582.500	385.000
GR	583.100	400.000	583.700	500.000	584.600	600.000	586.500	700.000	587.500	800.000
GR	590.900	940.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	3.787	30.000	400.000	600.000	510.000	490.000	550.000	.857	-0.000	-0.000
GR	592.900	0.000	594.000	100.000	593.300	200.000	593.700	300.000	592.400	400.000
GR	582.500	415.000	579.700	420.000	578.200	430.000	577.100	440.000	576.100	450.000
GR	575.500	460.000	575.300	470.000	575.200	480.000	575.500	490.000	576.000	500.000
GR	576.800	510.000	577.500	520.000	578.200	530.000	579.300	540.000	579.900	550.000
GR	580.800	560.000	581.800	570.000	582.500	585.000	583.100	600.000	583.700	700.000
GR	584.600	800.000	586.500	900.000	587.500	1000.000	590.900	1040.000	589.500	1100.000
NC	.090	.070	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.128	27.000	1350.000	1550.000	1450.000	1900.000	1800.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	1250.000	-0.000	1750.000	-0.000	-0.000	-0.000	-0.000
GR	593.300	0.000	590.000	550.000	589.000	750.000	590.000	950.000	589.000	1050.000
GR	590.000	1150.000	590.000	1250.000	582.500	1350.000	581.800	1365.000	580.800	1375.000
GR	579.900	1385.000	579.300	1395.000	578.200	1405.000	577.500	1415.000	576.800	1425.000
GR	576.000	1435.000	575.500	1445.000	575.000	1455.000	575.300	1465.000	575.500	1475.000
GR	576.100	1485.000	577.100	1495.000	578.200	1505.000	579.700	1515.000	582.500	1525.000
GR	590.000	1550.000	595.500	1750.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.100	.080	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.374	27.000	250.000	450.000	1120.000	1000.000	1300.000	-0.000	-0.000	-0.000
GR	593.700	0.000	590.000	250.000	582.500	265.000	579.700	270.000	578.200	280.000
GR	577.100	290.000	576.100	300.000	575.500	310.000	575.300	320.000	574.900	330.000
GR	575.500	340.000	576.000	350.000	576.800	360.000	577.500	370.000	578.200	380.000
GR	579.300	390.000	579.900	400.000	580.800	410.000	581.800	420.000	582.500	435.000
GR	583.100	450.000	583.700	550.000	584.600	650.000	586.500	750.000	587.500	850.000
GR	590.000	1300.000	592.100	2150.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NH	4.000	.100	1185.000	.070	1400.000	.040	1620.000	.070	2600.000	-0.000
X1	4.620	36.000	1400.000	1620.000	1150.000	950.000	1300.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	-0.000	-0.000	1800.000	-0.000	-0.000	-0.000	-0.000
GR	600.000	0.000	590.000	800.000	587.300	900.000	587.600	1000.000	588.700	1100.000
GR	590.000	1185.000	585.200	1250.000	583.300	1300.000	584.000	1400.000	582.100	1410.000
GR	581.100	1420.000	581.100	1430.000	581.000	1440.000	579.700	1460.000	578.100	1480.000
GR	578.100	1500.000	576.800	1520.000	576.000	1530.000	575.500	1540.000	575.200	1550.000
GR	574.700	1560.000	575.200	1570.000	577.300	1580.000	578.400	1590.000	581.600	1600.000
GR	588.800	1620.000	589.500	1700.000	589.700	1800.000	589.200	1900.000	589.600	2000.000
GR	590.600	2100.000	590.700	2200.000	591.300	2300.000	591.200	2400.000	591.000	2500.000
GR	592.100	2600.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
NC	.070	.100	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	4.951	23.000	75.000	295.000	1375.000	1425.000	1750.000	-0.000	-0.000	-0.000
GR	600.000	0.000	590.000	75.000	581.600	95.000	578.400	105.000	577.300	115.000
GR	576.400	125.000	576.400	165.000	576.800	175.000	578.100	195.000	578.100	215.000
GR	579.700	235.000	581.000	255.000	581.100	265.000	581.100	275.000	582.100	285.000
GR	584.000	295.000	585.000	435.000	586.000	450.000	587.000	480.000	588.000	540.000
GR	589.000	660.000	590.000	900.000	594.000	1350.000	-0.000	-0.000	-0.000	-0.000
NC	.100	.070	.040	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
X1	5.197	34.000	1000.000	1286.000	1150.000	900.000	1300.000	-0.000	-0.000	-0.000
X3	-0.000	-0.000	-0.000	720.000	-0.000	1286.000	-0.000	-0.000	-0.000	-0.000
GR	591.600	0.000	591.200	100.000	590.700	200.000	590.100	300.000	590.700	400.000

GR	586.300	800.000	587.800	900.000	590.000	1000.000	583.600	1010.000	582.200	1020.000
GR	581.500	1040.000	580.800	1060.000	580.800	1080.000	580.100	1100.000	580.800	1120.000
GR	579.800	1140.000	579.000	1160.000	578.600	1180.000	579.000	1200.000	578.300	1220.000
GR	578.000	1240.000	578.800	1250.000	579.900	1260.000	582.400	1270.000	584.500	1280.000
GR	591.000	1286.000	590.500	1400.000	594.000	1455.000	593.300	1500.000	-0.000	-0.000
EJ	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Au Sable River

4) DOCUMENT TYPE: Summary

00BREAK00

SUMMARY PRINTOUT FOR MULTIPLE PROFILES

AU SABLE RIVER

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
.00	0.00	0.00	0.00	566.40	5070.00	580.60	.08	0.00	0.00	5070.00	14.20	186.41
.00	0.00	0.00	0.00	566.40	6100.00	580.60	.11	0.00	0.00	6100.00	14.20	186.41
.00	0.00	0.00	0.00	566.40	6570.00	580.60	.13	0.00	0.00	6570.00	14.20	186.41
.00	0.00	0.00	0.00	566.40	7770.00	580.60	.19	0.00	0.00	7770.00	14.20	186.41
.21	1100.00	0.00	0.00	565.80	5070.00	580.73	.11	.15	.01	5070.00	14.93	171.30
.21	1100.00	0.00	0.00	565.80	6100.00	580.79	.15	.21	.02	6100.00	14.99	171.50
.21	1100.00	0.00	0.00	565.80	6570.00	580.82	.18	.24	.02	6570.00	15.02	171.60
.21	1100.00	0.00	0.00	565.80	7770.00	580.91	.24	.34	.03	7770.00	15.11	171.88
A .39	950.00	0.00	0.00	565.90	5070.00	580.90	.10	.16	.00	5070.00	15.00	200.00
.39	950.00	0.00	0.00	565.90	6100.00	581.03	.14	.23	.00	6100.00	15.13	200.00
.39	950.00	0.00	0.00	565.90	6570.00	581.10	.17	.26	.00	6570.00	15.20	200.00
.39	950.00	0.00	0.00	565.90	7770.00	581.28	.22	.35	.01	7770.00	15.38	200.00
B .40	59.00	0.00	0.00	566.60	5070.00	580.87	.19	.02	.04	5070.00	14.27	172.85
.40	59.00	0.00	0.00	566.60	6100.00	580.99	.26	.02	.06	6100.00	14.39	173.64
.40	59.00	0.00	0.00	566.60	6570.00	581.05	.30	.02	.07	6570.00	14.45	174.04
.40	59.00	0.00	0.00	566.60	7770.00	581.23	.40	.03	.09	7770.00	14.63	175.00
.40	1.00	587.40	601.30	566.60	5070.00	580.87	.20	.00	.01	5070.00	14.27	168.86
.40	1.00	587.40	601.30	566.60	6100.00	580.99	.28	.00	.01	6100.00	14.39	169.64
.40	1.00	587.40	601.30	566.60	6570.00	581.05	.32	.00	.01	6570.00	14.45	170.04
.40	1.00	587.40	601.30	566.60	7770.00	581.22	.43	.00	.01	7770.00	14.62	171.00
.41	56.00	587.40	601.30	566.60	5070.00	580.89	.20	.02	.00	5070.00	14.29	169.00
.41	56.00	587.40	601.30	566.60	6100.00	581.02	.28	.03	.00	6100.00	14.42	169.85
.41	56.00	587.40	601.30	566.60	6570.00	581.09	.31	.04	.00	6570.00	14.49	170.28
.41	56.00	587.40	601.30	566.60	7770.00	581.27	.42	.05	.00	7770.00	14.67	171.00
.41	1.00	0.00	0.00	566.60	5070.00	580.91	.19	.00	.00	5070.00	14.31	173.01
.41	1.00	0.00	0.00	566.60	6100.00	581.04	.26	.00	.00	6100.00	14.44	173.90
.41	1.00	0.00	0.00	566.60	6570.00	581.11	.30	.00	.01	6570.00	14.51	174.34
.41	1.00	0.00	0.00	566.60	7770.00	581.30	.40	.00	.01	7770.00	14.70	175.00
.42	15.00	0.00	0.00	566.60	5070.00	581.02	.10	.00	.03	5070.00	14.42	202.00
.42	15.00	0.00	0.00	566.60	6100.00	581.20	.14	.01	.04	6100.00	14.60	202.00
.42	15.00	0.00	0.00	566.60	6570.00	581.29	.16	.01	.04	6570.00	14.69	202.00
.42	15.00	0.00	0.00	566.60	7770.00	581.55	.22	.01	.05	7770.00	14.95	202.00
C .66	1300.00	0.00	0.00	570.40	5070.00	581.33	.10	.31	.00	5070.00	10.93	301.47
.66	1300.00	0.00	0.00	570.40	6100.00	581.61	.14	.41	.00	6100.00	11.21	302.93
.66	1300.00	0.00	0.00	570.40	6570.00	581.75	.15	.45	.00	6570.00	11.35	303.66
.66	1300.00	0.00	0.00	570.40	7770.00	582.13	.19	.56	.01	7770.00	11.73	305.62
1.05	2075.00	0.00	0.00	566.00	5070.00	581.92	.17	.63	.03	5070.00	15.92	149.08
1.05	2075.00	0.00	0.00	566.00	6100.00	582.36	.23	.80	.04	6100.00	16.36	149.37
1.05	2075.00	0.00	0.00	566.00	6570.00	582.57	.25	.87	.05	6570.00	16.57	149.50
1.05	2075.00	0.00	0.00	566.00	7770.00	583.10	.32	1.03	.06	7769.93	17.10	164.65

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
1.07	88.00	0.00	0.00	566.00	5070.00	581.95	.17	.03	.00	5070.00	15.95	149.10
1.07	88.00	0.00	0.00	566.00	6100.00	582.40	.22	.03	.00	6100.00	16.40	149.39
1.07	88.00	0.00	0.00	566.00	6570.00	582.61	.25	.04	.00	6570.00	16.61	149.53
1.07	88.00	0.00	0.00	566.00	7770.00	583.15	.32	.04	.00	7770.00	17.15	149.87
1.07	11.00	0.00	0.00	568.90	5070.00	581.96	.17	.00	.00	5070.00	13.06	136.36
1.07	11.00	0.00	0.00	568.90	6100.00	582.40	.22	.00	.00	6100.00	13.50	143.52
1.07	11.00	0.00	0.00	568.90	6570.00	582.61	.25	.00	.00	6570.00	13.71	144.50
1.07	11.00	0.00	0.00	568.90	7770.00	583.15	.32	.01	.00	7770.00	14.25	144.50
1.07	1.00	583.80	590.60	568.90	5070.00	581.95	.18	.00	.01	5070.00	13.05	131.36
1.07	1.00	583.80	590.60	568.90	6100.00	582.39	.24	.00	.01	6100.00	13.49	138.52
1.07	1.00	583.80	590.60	568.90	6570.00	582.60	.27	.00	.01	6570.00	13.70	139.50
1.07	1.00	583.80	590.60	568.90	7770.00	583.14	.35	.00	.01	7770.00	14.24	139.50
1.08	40.00	583.80	590.60	568.90	5070.00	581.96	.18	.01	.00	5070.00	13.06	131.44
1.08	40.00	583.80	590.60	568.90	6100.00	582.41	.24	.02	.00	6100.00	13.51	138.68
1.08	40.00	583.80	590.60	568.90	6570.00	582.62	.27	.02	.00	6570.00	13.72	139.50
1.08	40.00	583.80	590.60	568.90	7770.00	583.17	.34	.02	.00	7770.00	14.27	139.50
1.08	1.00	0.00	0.00	568.90	5070.00	581.98	.17	.00	.00	5070.00	13.08	136.50
1.08	1.00	0.00	0.00	568.90	6100.00	582.44	.22	.00	.01	6100.00	13.54	143.90
1.08	1.00	0.00	0.00	568.90	6570.00	582.65	.25	.00	.01	6570.00	13.75	144.50
1.08	1.00	0.00	0.00	568.90	7770.00	583.21	.31	.00	.01	7770.00	14.31	144.50
1.08	3.00	0.00	0.00	568.90	5070.00	581.97	.18	.00	.01	5070.00	13.07	149.11
1.08	3.00	0.00	0.00	568.90	6100.00	582.43	.24	.00	.01	6100.00	13.53	149.42
1.08	3.00	0.00	0.00	568.90	6570.00	582.64	.27	.00	.01	6570.00	13.74	149.56
1.08	3.00	0.00	0.00	568.90	7770.00	583.19	.34	.00	.01	7770.00	14.29	149.89
1.52	2330.00	0.00	0.00	573.90	5070.00	582.86	.11	.80	.02	5070.00	8.96	297.53
1.52	2330.00	0.00	0.00	573.90	6100.00	583.49	.14	.92	.03	6100.00	9.59	299.18
1.52	2330.00	0.00	0.00	573.90	6570.00	583.77	.15	.97	.04	6570.00	9.87	299.93
1.52	2330.00	0.00	0.00	573.90	7770.00	584.48	.17	1.06	.05	7769.62	10.58	307.05
1.90	2000.00	0.00	0.00	573.20	5070.00	583.49	.11	.62	.00	5068.85	10.29	267.73
1.90	2000.00	0.00	0.00	573.20	6100.00	584.16	.13	.67	.00	6097.52	10.96	267.99
1.90	2000.00	0.00	0.00	573.20	6570.00	584.46	.14	.68	.00	6566.79	11.26	268.00
1.90	2000.00	0.00	0.00	573.20	7770.00	585.20	.17	.71	.00	7764.67	12.00	268.00
1.91	49.00	0.00	0.00	573.30	5070.00	583.50	.12	.01	.01	5070.00	10.20	236.64
1.91	49.00	0.00	0.00	573.30	6100.00	584.17	.15	.02	.01	6100.00	10.87	239.62
1.91	49.00	0.00	0.00	573.30	6570.00	584.47	.16	.02	.01	6570.00	11.17	240.95
1.91	49.00	0.00	0.00	573.30	7770.00	585.20	.19	.02	.01	7770.00	11.90	244.22
1.91	1.00	587.60	589.60	573.30	5070.00	583.49	.13	.00	.01	5070.00	10.19	227.68
1.91	1.00	587.60	589.60	573.30	6100.00	584.16	.16	.00	.01	6100.00	10.86	230.67
1.91	1.00	587.60	589.60	573.30	6570.00	584.46	.18	.00	.01	6570.00	11.16	233.49
1.91	1.00	587.60	589.60	573.30	7770.00	585.19	.21	.00	.01	7770.00	11.89	241.21

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
1.92	34.50	587.60	589.60	573.30	5070.00	583.51	.13	.01	.00	5070.00	10.21	227.74
1.92	34.50	587.60	589.60	573.30	6100.00	584.18	.16	.02	.00	6100.00	10.88	230.73
1.92	34.50	587.60	589.60	573.30	6570.00	584.48	.18	.02	.00	6570.00	11.18	233.55
1.92	34.50	587.60	589.60	573.30	7770.00	585.21	.21	.02	.00	7770.00	11.91	241.28
1.92	1.00	0.00	0.00	573.30	5070.00	583.52	.12	.00	.00	5070.00	10.22	236.66
1.92	1.00	0.00	0.00	573.30	6100.00	584.20	.15	.00	.00	6100.00	10.90	239.69
1.92	1.00	0.00	0.00	573.30	6570.00	584.50	.16	.00	.00	6570.00	11.20	241.02
1.92	1.00	0.00	0.00	573.30	7770.00	585.24	.19	.00	.01	7770.00	11.94	244.36
1.92	15.00	0.00	0.00	573.30	5070.00	583.55	.11	.00	.01	5067.01	10.25	273.75
1.92	15.00	0.00	0.00	573.30	6100.00	584.23	.13	.00	.01	6093.17	10.93	274.00
1.92	15.00	0.00	0.00	573.30	6570.00	584.53	.14	.00	.01	6561.05	11.23	274.00
1.92	15.00	0.00	0.00	573.30	7770.00	585.28	.16	.01	.01	7754.81	11.98	274.00
2.02	500.00	0.00	0.00	573.20	5070.00	583.68	.11	.13	.00	5070.00	10.48	236.61
2.02	500.00	0.00	0.00	573.20	6100.00	584.37	.14	.14	.01	6100.00	11.17	239.02
2.02	500.00	0.00	0.00	573.20	6570.00	584.68	.15	.15	.01	6570.00	11.48	240.08
2.02	500.00	0.00	0.00	573.20	7770.00	585.43	.18	.16	.01	7770.00	12.23	242.70
2.51	2600.00	0.00	0.00	572.20	5070.00	584.34	.06	.60	.02	5070.00	12.14	432.27
2.51	2600.00	0.00	0.00	572.20	6100.00	585.08	.07	.62	.02	6100.00	12.88	434.13
2.51	2600.00	0.00	0.00	572.20	6570.00	585.41	.07	.63	.02	6570.00	13.21	434.95
2.51	2600.00	0.00	0.00	572.20	7770.00	586.20	.08	.65	.03	7770.00	14.00	436.49
2.85	1825.00	0.00	0.00	565.70	4440.00	584.61	.08	.28	.01	4438.65	18.91	179.51
2.85	1825.00	0.00	0.00	565.70	5340.00	585.37	.10	.30	.02	5335.81	19.67	179.91
2.85	1825.00	0.00	0.00	565.70	5750.00	585.70	.11	.31	.02	5744.10	20.00	180.09
2.85	1825.00	0.00	0.00	565.70	6800.00	586.51	.14	.33	.03	6788.74	20.81	180.52
2.87	74.00	0.00	0.00	571.10	4440.00	584.56	.23	.02	.07	4440.00	13.46	143.50
2.87	74.00	0.00	0.00	571.10	5340.00	585.30	.27	.02	.09	5340.00	14.20	143.50
2.87	74.00	0.00	0.00	571.10	5750.00	585.63	.29	.02	.09	5750.00	14.53	143.50
2.87	74.00	0.00	0.00	571.10	6800.00	586.42	.35	.02	.11	6800.00	15.32	143.50
2.87	1.00	595.20	591.60	571.10	4440.00	584.56	.23	.00	.00	4440.00	13.46	143.50
2.87	1.00	595.20	591.60	571.10	5340.00	585.30	.27	.00	.00	5340.00	14.20	143.50
2.87	1.00	595.20	591.60	571.10	5750.00	585.63	.29	.00	.00	5750.00	14.53	143.50
2.87	1.00	595.20	591.60	571.10	6800.00	586.42	.35	.00	.00	6800.00	15.32	143.50
2.87	17.70	595.20	591.60	571.10	4440.00	584.56	.22	.01	.00	4440.00	13.46	143.50
2.87	17.70	595.20	591.60	571.10	5340.00	585.31	.27	.01	.00	5340.00	14.21	143.50
2.87	17.70	595.20	591.60	571.10	5750.00	585.64	.29	.01	.00	5750.00	14.54	143.50
2.87	17.70	595.20	591.60	571.10	6800.00	586.43	.35	.01	.00	6800.00	15.33	143.50
2.87	1.00	0.00	0.00	571.10	4440.00	584.57	.22	.00	.00	4440.00	13.47	143.50
2.87	1.00	0.00	0.00	571.10	5340.00	585.31	.27	.00	.00	5340.00	14.21	143.50
2.87	1.00	0.00	0.00	571.10	5750.00	585.64	.29	.00	.00	5750.00	14.54	143.50
2.87	1.00	0.00	0.00	571.10	6800.00	586.43	.35	.00	.00	6800.00	15.33	143.50

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
2.88	15.00	0.00	0.00	571.10	4440.00	584.73	.10	.01	.04	4439.03	13.63	172.07
2.88	15.00	0.00	0.00	571.10	5340.00	585.51	.13	.01	.04	5337.54	14.41	172.49
2.88	15.00	0.00	0.00	571.10	5750.00	585.85	.14	.01	.05	5746.69	14.75	172.67
2.88	15.00	0.00	0.00	571.10	6800.00	586.67	.17	.01	.05	6794.14	15.57	173.11
3.20	1700.00	0.00	0.00	574.20	4440.00	585.22	.10	.48	.00	4436.14	11.02	289.40
3.20	1700.00	0.00	0.00	574.20	5340.00	586.04	.11	.51	.01	5326.98	11.84	302.08
3.20	1700.00	0.00	0.00	574.20	5750.00	586.40	.11	.52	.01	5730.75	12.20	307.43
3.20	1700.00	0.00	0.00	574.20	6800.00	587.27	.13	.55	.01	6758.81	13.07	319.32
3.27	370.00	0.00	0.00	574.90	4440.00	585.35	.10	.14	.00	4440.00	10.45	270.34
3.27	370.00	0.00	0.00	574.90	5340.00	586.18	.11	.14	.00	5340.00	11.28	271.78
3.27	370.00	0.00	0.00	574.90	5750.00	586.53	.12	.14	.00	5750.00	11.63	272.00
3.27	370.00	0.00	0.00	574.90	6800.00	587.40	.13	.13	.00	6800.00	12.50	272.00
3.68	2200.00	0.00	0.00	575.10	4440.00	586.20	.12	.86	.01	4159.86	11.10	343.54
3.68	2200.00	0.00	0.00	575.10	5340.00	587.01	.13	.85	.01	4901.80	11.91	345.42
3.68	2200.00	0.00	0.00	575.10	5750.00	587.37	.14	.84	.01	5234.84	12.27	346.23
3.68	2200.00	0.00	0.00	575.10	6800.00	588.23	.15	.83	.01	6078.57	13.13	348.21
3.79	550.00	0.00	0.00	575.20	4440.00	586.43	.14	.24	.01	4070.63	11.23	347.90
3.79	550.00	0.00	0.00	575.20	5340.00	587.24	.16	.24	.01	4762.80	12.04	348.95
3.79	550.00	0.00	0.00	575.20	5750.00	587.59	.16	.24	.01	5071.74	12.39	349.41
3.79	550.00	0.00	0.00	575.20	6800.00	588.45	.16	.23	.01	5851.08	13.25	350.52
4.13	1800.00	0.00	0.00	575.00	4440.00	587.14	.11	.67	.01	4367.20	12.14	252.57
4.13	1800.00	0.00	0.00	575.00	5340.00	587.97	.13	.70	.01	5223.78	12.97	266.24
4.13	1800.00	0.00	0.00	575.00	5750.00	588.33	.14	.71	.01	5611.01	13.33	272.09
4.13	1800.00	0.00	0.00	575.00	6800.00	589.19	.16	.73	.00	6593.98	14.19	286.42
4.37	1300.00	0.00	0.00	574.90	4440.00	587.52	.07	.32	.01	3894.35	12.62	445.03
4.37	1300.00	0.00	0.00	574.90	5340.00	588.37	.08	.33	.02	4552.06	13.47	446.75
4.37	1300.00	0.00	0.00	574.90	5750.00	588.74	.08	.34	.02	4846.53	13.84	447.49
4.37	1300.00	0.00	0.00	574.90	6800.00	589.63	.09	.35	.02	5590.93	14.73	449.27
4.62	1300.00	0.00	0.00	574.70	4440.00	587.76	.06	.23	.00	4038.42	13.06	401.77
4.62	1300.00	0.00	0.00	574.70	5340.00	588.62	.07	.24	.00	4758.54	13.92	415.84
4.62	1300.00	0.00	0.00	574.70	5750.00	588.99	.07	.24	.00	5081.31	14.29	421.36
4.62	1300.00	0.00	0.00	574.70	6800.00	589.89	.08	.24	.00	5896.34	15.19	433.47
4.95	1750.00	0.00	0.00	576.40	4440.00	588.05	.07	.30	.00	4215.94	11.65	345.38
4.95	1750.00	0.00	0.00	576.40	5340.00	588.93	.08	.31	.01	5010.62	12.53	347.45
4.95	1750.00	0.00	0.00	576.40	5750.00	589.30	.09	.32	.01	5369.89	12.90	348.34
4.95	1750.00	0.00	0.00	576.40	6800.00	590.20	.10	.33	.01	6285.03	13.80	351.53
5.20	1300.00	0.00	0.00	578.00	4440.00	588.31	.06	.24	.00	4440.00	10.31	280.87
5.20	1300.00	0.00	0.00	578.00	5340.00	589.19	.07	.25	.00	5340.00	11.19	283.06
5.20	1300.00	0.00	0.00	578.00	5750.00	589.57	.08	.25	.00	5750.00	11.57	284.01
5.20	1300.00	0.00	0.00	578.00	6800.00	590.48	.09	.26	.00	6800.00	12.48	285.52

SECTION NUMBER	DISCHARGE CFS	CWSEL	CWSEL DIFF EACH Q	CWSEL DIFF EACH SECTION	CWSEL-WSELK	TOPWID	T.W. DIFF	LENGTH
.001	5070.000	580.600	0.000	0.000	0.000	186.405	0.000	0.000
.001	6100.000	580.600	0.000	0.000	0.000	186.405	0.000	0.000
.001	6570.000	580.600	0.000	0.000	0.000	186.405	0.000	0.000
.001	7770.000	580.600	0.000	0.000	0.000	186.405	0.000	0.000
.208	5070.000	580.732	0.000	.132	0.000	171.300	0.000	1100.000
.208	6100.000	580.790	.058	.190	0.000	171.503	-.203	1100.000
.208	6570.000	580.820	.030	.220	0.000	171.600	-.300	1100.000
.208	7770.000	580.906	.086	.306	0.000	171.879	-.579	1100.000

.388	5070.000	580.900	0.000	.169	0.000	199.999	0.000	950.000
.388	6100.000	581.030	.130	.241	0.000	199.999	-.000	950.000
.388	6570.000	581.097	.066	.277	0.000	199.999	-.000	950.000
.388	7770.000	581.285	.188	.379	0.000	199.999	-.000	950.000
.399	5070.000	580.874	0.000	-.027	0.000	172.854	0.000	59.000
.399	6100.000	580.993	.119	-.038	0.000	173.636	-.782	59.000
.399	6570.000	581.054	.061	-.043	0.000	174.037	-1.183	59.000
.399	7770.000	581.227	.173	-.058	0.000	175.000	-2.146	59.000
.400	5070.000	580.869	0.000	-.005	0.000	168.856	0.000	1.000
.400	6100.000	580.986	.117	-.007	0.000	169.639	-.783	1.000
.400	6570.000	581.046	.060	-.008	0.000	170.040	-1.184	1.000
.400	7770.000	581.216	.170	-.011	0.000	171.000	-2.144	1.000
.411	5070.000	580.893	0.000	.024	0.000	169.005	0.000	56.000
.411	6100.000	581.020	.127	.034	0.000	169.846	-.841	56.000
.411	6570.000	581.085	.065	.040	0.000	170.276	-1.271	56.000
.411	7770.000	581.270	.184	.054	0.000	171.000	-1.995	56.000
.412	5070.000	580.907	0.000	.014	0.000	173.007	0.000	1.000
.412	6100.000	581.040	.133	.020	0.000	173.898	-.891	1.000
.412	6570.000	581.108	.068	.023	0.000	174.336	-1.329	1.000
.412	7770.000	581.303	.195	.034	0.000	175.000	-1.993	1.000
.415	5070.000	581.020	0.000	.112	0.000	201.999	0.000	15.000
.415	6100.000	581.199	.179	.158	0.000	201.999	-.000	15.000
.415	6570.000	581.290	.091	.182	0.000	201.999	-.000	15.000
.415	7770.000	581.546	.256	.243	0.000	201.999	-.000	15.000
.659	5070.000	581.326	0.000	.306	0.000	301.474	0.000	1300.000
.659	6100.000	581.609	.283	.411	0.000	302.933	-1.458	1300.000
.659	6570.000	581.750	.140	.460	0.000	303.655	-2.181	1300.000
.659	7770.000	582.132	.382	.585	0.000	305.621	-4.146	1300.000
1.052	5070.000	581.924	0.000	.598	0.000	149.077	0.000	2075.000
1.052	6100.000	582.364	.440	.755	0.000	149.368	-.291	2075.000
1.052	6570.000	582.571	.207	.821	0.000	149.505	-.428	2075.000
1.052	7770.000	583.104	.533	.972	0.000	164.646	-15.568	2075.000
1.069	5070.000	581.951	0.000	.027	0.000	149.095	0.000	88.000
1.069	6100.000	582.398	.448	.034	0.000	149.391	-.296	88.000
1.069	6570.000	582.608	.210	.038	0.000	149.529	-.434	88.000
1.069	7770.000	583.150	.541	.046	0.000	149.866	-.771	88.000
1.071	5070.000	581.956	0.000	.005	0.000	136.360	0.000	11.000
1.071	6100.000	582.404	.448	.005	0.000	143.517	-7.157	11.000
1.071	6570.000	582.614	.210	.006	0.000	144.500	-8.140	11.000
1.071	7770.000	583.155	.541	.005	0.000	144.500	-8.140	11.000
1.072	5070.000	581.949	0.000	-.007	0.000	131.362	0.000	1.000
1.072	6100.000	582.394	.446	-.010	0.000	138.521	-7.159	1.000
1.072	6570.000	582.603	.209	-.011	0.000	139.500	-8.138	1.000
1.072	7770.000	583.141	.538	-.014	0.000	139.500	-8.138	1.000
1.080	5070.000	581.962	0.000	.013	0.000	131.445	0.000	40.000
1.080	6100.000	582.413	.451	.018	0.000	138.682	-7.237	40.000
1.080	6570.000	582.624	.211	.021	0.000	139.500	-8.055	40.000
1.080	7770.000	583.167	.543	.025	0.000	139.500	-8.055	40.000
1.081	5070.000	581.982	0.000	.020	0.000	136.502	0.000	1.000
1.081	6100.000	582.440	.458	.027	0.000	143.899	-7.397	1.000
1.081	6570.000	582.654	.214	.031	0.000	144.500	-7.998	1.000
1.081	7770.000	583.206	.552	.039	0.000	144.500	-7.998	1.000

1.082	5070.000	581.973	0.000	-.008	0.000	149.111	0.000	3.000
1.082	6100.000	582.431	.456	-.009	0.000	149.416	-.305	3.000
1.082	6570.000	582.645	.214	-.010	0.000	149.557	-.446	3.000
1.082	7770.000	583.195	.550	-.011	0.000	149.895	-.783	3.000
1.522	5070.000	582.861	0.000	.886	0.000	297.527	0.000	2330.000
1.522	6100.000	583.489	.627	1.058	0.000	299.178	-1.651	2330.000
1.522	6570.000	583.773	.284	1.128	0.000	299.926	-2.399	2330.000
1.522	7770.000	584.482	.709	1.287	0.000	307.047	-9.521	2330.000
1.900	5070.000	583.492	0.000	.631	0.000	267.727	0.000	2000.000
1.900	6100.000	584.165	.673	.676	0.000	267.985	-.259	2000.000
1.900	6570.000	584.464	.299	.691	0.000	267.999	-.272	2000.000
1.900	7770.000	585.198	.734	.716	0.000	267.999	-.272	2000.000
1.909	5070.000	583.498	0.000	.006	0.000	236.639	0.000	49.000
1.909	6100.000	584.170	.672	.005	0.000	239.620	-2.980	49.000
1.909	6570.000	584.468	.298	.005	0.000	240.952	-4.313	49.000
1.909	7770.000	585.201	.733	.003	0.000	244.225	-7.586	49.000
1.910	5070.000	583.493	0.000	-.005	0.000	227.683	0.000	1.000
1.910	6100.000	584.163	.671	-.006	0.000	230.669	-2.986	1.000
1.910	6570.000	584.461	.298	-.007	0.000	233.487	-5.804	1.000
1.910	7770.000	585.192	.730	-.009	0.000	241.214	-13.532	1.000
1.917	5070.000	583.507	0.000	.014	0.000	227.736	0.000	34.500
1.917	6100.000	584.180	.673	.016	0.000	230.729	-2.993	34.500
1.917	6570.000	584.478	.299	.017	0.000	233.550	-5.814	34.500
1.917	7770.000	585.211	.733	.019	0.000	241.285	-13.549	34.500
1.918	5070.000	583.522	0.000	.015	0.000	236.663	0.000	1.000
1.918	6100.000	584.198	.676	.018	0.000	239.686	-3.023	1.000
1.918	6570.000	584.498	.300	.019	0.000	241.022	-4.359	1.000
1.918	7770.000	585.238	.740	.027	0.000	244.357	-7.694	1.000
1.921	5070.000	583.549	0.000	.027	0.000	273.749	0.000	15.000
1.921	6100.000	584.232	.683	.034	0.000	273.999	-.250	15.000
1.921	6570.000	584.535	.303	.037	0.000	273.999	-.250	15.000
1.921	7770.000	585.281	.747	.044	0.000	273.999	-.250	15.000
2.015	5070.000	583.677	0.000	.129	0.000	236.610	0.000	500.000
2.015	6100.000	584.371	.694	.140	0.000	239.015	-2.405	500.000
2.015	6570.000	584.678	.307	.144	0.000	240.080	-3.470	500.000
2.015	7770.000	585.433	.755	.152	0.000	242.695	-6.086	500.000
2.507	5070.000	584.344	0.000	.667	0.000	432.268	0.000	2600.000
2.507	6100.000	585.084	.740	.713	0.000	434.129	-1.861	2600.000
2.507	6570.000	585.409	.325	.730	0.000	434.946	-2.678	2600.000
2.507	7770.000	586.203	.794	.770	0.000	436.486	-4.217	2600.000
2.853	4440.000	584.614	0.000	.270	0.000	179.506	0.000	1825.000
2.853	5340.000	585.370	.757	.286	0.000	179.912	-.405	1825.000
2.853	5750.000	585.701	.330	.292	0.000	180.089	-.582	1825.000
2.853	6800.000	586.505	.804	.302	0.000	180.520	-1.013	1825.000
2.867	4440.000	584.557	0.000	-.057	0.000	143.500	0.000	74.000
2.867	5340.000	585.302	.746	-.068	0.000	143.500	0.000	74.000
2.867	5750.000	585.628	.326	-.073	0.000	143.500	0.000	74.000
2.867	6800.000	586.420	.792	-.085	0.000	143.500	0.000	74.000
2.868	4440.000	584.557	0.000	.000	0.000	143.500	0.000	1.000
2.868	5340.000	585.303	.746	.001	0.000	143.500	0.000	1.000
2.868	5750.000	585.628	.326	.001	0.000	143.500	0.000	1.000
2.868	6800.000	586.421	.792	.001	0.000	143.500	0.000	1.000
2.871	4440.000	584.565	0.000	.008	0.000	143.500	0.000	17.700

2.871	5340.000	585.311	.747	.008	0.000	143.500	0.000	17.700
2.871	5750.000	585.637	.326	.009	0.000	143.500	0.000	17.700
2.871	6800.000	586.430	.793	.009	0.000	143.500	0.000	17.700
2.872	4440.000	584.565	0.000	.001	0.000	143.500	0.000	1.000
2.872	5340.000	585.312	.747	.001	0.000	143.500	0.000	1.000
2.872	5750.000	585.638	.326	.001	0.000	143.500	0.000	1.000
2.872	6800.000	586.431	.793	.001	0.000	143.500	0.000	1.000
2.875	4440.000	584.731	0.000	.166	0.000	172.069	0.000	15.000
2.875	5340.000	585.508	.777	.196	0.000	172.485	-.416	15.000
2.875	5750.000	585.847	.339	.209	0.000	172.667	-.598	15.000
2.875	6800.000	586.673	.826	.243	0.000	173.110	-1.041	15.000
3.197	4440.000	585.215	0.000	.484	0.000	289.395	0.000	1700.000
3.197	5340.000	586.040	.825	.532	0.000	302.084	-12.688	1700.000
3.197	5750.000	586.398	.359	.551	0.000	307.428	-18.033	1700.000
3.197	6800.000	587.270	.872	.597	0.000	319.318	-29.922	1700.000
3.266	4440.000	585.354	0.000	.139	0.000	270.343	0.000	370.000
3.266	5340.000	586.176	.822	.136	0.000	271.781	-1.438	370.000
3.266	5750.000	586.533	.357	.135	0.000	271.999	-1.656	370.000
3.266	6800.000	587.402	.869	.131	0.000	271.999	-1.656	370.000
3.683	4440.000	586.201	0.000	.848	0.000	343.540	0.000	2200.000
3.683	5340.000	587.014	.813	.839	0.000	345.416	-1.876	2200.000
3.683	5750.000	587.368	.354	.835	0.000	346.233	-2.694	2200.000
3.683	6800.000	588.227	.858	.825	0.000	348.214	-4.674	2200.000
3.787	4440.000	586.426	0.000	.225	0.000	347.898	0.000	550.000
3.787	5340.000	587.238	.811	.224	0.000	348.951	-1.054	550.000
3.787	5750.000	587.591	.353	.223	0.000	349.410	-1.512	550.000
3.787	6800.000	588.447	.856	.220	0.000	350.521	-2.624	550.000
4.128	4440.000	587.145	0.000	.718	0.000	252.567	0.000	1800.000
4.128	5340.000	587.973	.828	.735	0.000	266.240	-13.672	1800.000
4.128	5750.000	588.331	.358	.739	0.000	272.088	-19.521	1800.000
4.128	6800.000	589.194	.863	.747	0.000	286.422	-33.855	1800.000
4.374	4440.000	587.517	0.000	.373	0.000	445.033	0.000	1300.000
4.374	5340.000	588.374	.857	.401	0.000	446.747	-1.713	1300.000
4.374	5750.000	588.744	.370	.413	0.000	447.486	-2.453	1300.000
4.374	6800.000	589.634	.890	.440	0.000	449.267	-4.234	1300.000
4.620	4440.000	587.760	0.000	.242	0.000	401.771	0.000	1300.000
4.620	5340.000	588.622	.862	.248	0.000	415.838	-14.067	1300.000
4.620	5750.000	588.993	.371	.249	0.000	421.363	-19.592	1300.000
4.620	6800.000	589.887	.894	.253	0.000	433.467	-31.696	1300.000
4.951	4440.000	588.054	0.000	.294	0.000	345.381	0.000	1750.000
4.951	5340.000	588.927	.873	.306	0.000	347.452	-2.071	1750.000
4.951	5750.000	589.303	.375	.310	0.000	348.343	-2.961	1750.000
4.951	6800.000	590.205	.902	.318	0.000	351.528	-6.146	1750.000
5.197	4440.000	588.307	0.000	.253	0.000	280.868	0.000	1300.000
5.197	5340.000	589.191	.864	.264	0.000	283.065	-2.197	1300.000
5.197	5750.000	589.570	.380	.268	0.000	284.009	-3.141	1300.000
5.197	6800.000	590.482	.911	.277	0.000	285.521	-4.653	1300.000

DATA FOR LAST CROSS SECTION

PROFILE	TYPE ENC	TARGET	TOP WIDTH AREA-ACRES	TOP WIDTH AREA-DIFF
1	0.000	285.000	176.986	0.000
2	0.000	286.000	178.835	1.849
[illegible]	[illegible]	285.000	179.602	2.615

```
*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************
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00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Van Etten Creek

4) DOCUMENT TYPE: 100 yr encroached

00BREAK00

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*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************


T1      OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2      100 YEAR FLOOD
T3      VAN ETTEN CREEK

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
     -10.      4.      -0.      -0.     .000900   -0.00    -0.0     -0.     -0.000   -0.000
J2  NPROF    IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     3.000    1.000   -1.000   -0.000   -0.000   -0.000   -0.000   -0.000   -0.000   -0.000

CCHV=     .300 CEHV=     .500
2096 WSEL NOT GIVEN,AVG OF MAX,MIN USED
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


3470 ENCROACHMENT STATIONS=        .0      350.0  TYPE=     1  TARGET=     349.999
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could be low

```
                A        100' D.S. OF THE MOUTH OF THE VAN ETTEN CREEK

     .00      5.43    583.03      0.00     -0.00    583.21      .18      0.00      0.00    585.80
   2050.        0.     2050.        0.        0.     607.        0.        0.        0. 100000.00
    0.00      0.00      3.37      0.00      .070      .035      .060     0.000    577.60    213.15
 .000899       -0.       -0.       -0.         0         0        19      0.00    136.85    350.00


3470 ENCROACHMENT STATIONS=     1190.0     1302.0  TYPE=     1  TARGET=     112.000

                B        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER

                         SURFACE WITHIN ALLOWABLE LIMIT OF .1FT

     .30      6.96    584.46      0.00      0.00    584.68      .22      1.45       .02    589.30
   2050.        0.     2050.        0.        0.     548.        0.       21.        4. 100000.00
     .12      0.00      3.74      0.00      .090      .035      .090      .035    577.50   1195.80
 .000912     1600.     1600.     1600.         1         0         1      0.00    106.19   1302.00


3470 ENCROACHMENT STATIONS=      720.0      823.0  TYPE=     1  TARGET=     103.000

                C        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER

                         SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
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slope area run

100 year stage from available flow data

585.77 since in step above slope in step the error would probably be limited to the just two sections.

.51	8.09	585.39	0.00	0.00	585.59	.20	.90	.01	584.50
2050.	0.	2050.	0.	0.	577.	0.	35.	7.	100000.00
.20	0.00	3.55	0.00	.090	.035	.090	.035	577.30	720.00
.000744	1100.	1100.	1100.	2	0	1	0.00	103.00	823.00

3470 ENCROACHMENT STATIONS= 255.0 335.0 TYPE= 1 TARGET= 80.000

MANUFACTURED SECTION-CHANNEL BASED ON SECTION D WITH

ADJUSTMENT TO INVERT: OVERBANKS MADE UP BASED ON

CONTOUR MAP

.89	10.49	586.99	0.00	0.00	587.21	.23	1.61	.02	586.20
2050.	0.	2050.	0.	0.	536.	0.	61.	11.	100000.00
.35	0.00	3.83	0.00	.090	.040	.070	.037	576.50	255.00
.000874	2100.	2000.	1550.	2	0	1	0.00	76.35	331.35

3470 ENCROACHMENT STATIONS= 255.0 335.0 TYPE= 1 TARGET= 80.000

D ENCROACHED TO STA.200 TO CUT OFF LOW SPOT IN LEFT OVER-

BANK AND THEN ENCROACHED FURTHER TO RAISE WATER SURFACE

WITHIN THE ALLOWABLE LIMIT OF .1FT.-HWM AT AUSABLE GOLF

CLUB 587.83, DATE UNKNOWN, DISCHARGE UNKNOWN

HWM 585.15 JULY, 1976 DISCHARGE UNKNOWN

1.06	11.71	587.71	0.00	0.00	587.89	.18	.66	.01	586.20
2050.	0.	2050.	0.	0.	597.	0.	73.	13.	100000.00
.42	0.00	3.44	0.00	.090	.040	.090	.038	576.00	255.00
.000629	900.	900.	900.	0	0	1	0.00	77.01	332.01

3470 ENCROACHMENT STATIONS= 875.0 984.4 TYPE= 1 TARGET= 109.400

50FT. D.S. FROM F-41 BRIDGE-DUPLICATE OF SECTION F

ENCROACHED FOR EXPANSION OF FLOW THROUGH BRIDGE

1.30	11.06	588.46	0.00	0.00	588.63	.17	.74	.00	586.30
2050.	20.	2012.	18.	27.	609.	25.	91.	15.	587.00
.53	.74	3.31	.72	.070	.040	.070	.038	577.40	875.00
.000553	1200.	1250.	1300.	2	0	1	0.00	109.40	984.40

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

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OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.30    11.00   588.50     0.00     0.00   588.66      .16      .03      .00   594.40
    2050.       0.    2050.       0.       0.     645.       0.      91.      16.   594.40
      .53     0.00     3.18     0.00     .070     .040     .070     .038   577.50  1000.00
  .000572      49.      49.      49.        1        0        1     0.00    84.40  1084.40

NORMAL BRIDGE,NRD=49 MIN ELTRD=  591.80 MAX ELLC=  591.20

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

                E      F-41 (M-171) BRIDGE-NO BRIDGE SKEW

     1.31    11.00   588.50     0.00     0.00   588.66      .16      .00      .00   594.40
    2050.       0.    2050.       0.       0.     641.       0.      91.      16.   594.40
      .53     0.00     3.20     0.00     .025     .030     .025     .038   577.50  1000.00
  .000342       1.       1.       1.        0        0        1    -3.90    84.40  1084.40

NORMAL BRIDGE,NRD=49 MIN ELTRD=  591.80 MAX ELLC=  591.20

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.31    11.01   588.51     0.00     0.00   588.67      .16      .01      .00   594.40
    2050.       0.    2050.       0.       0.     642.       0.      92.      16.   594.40
      .54     0.00     3.19     0.00     .025     .030     .025     .038   577.50  1000.00
  .000354      28.      28.      28.        0        0        1    -3.97    84.40  1084.40

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.31    11.02   588.52     0.00     0.00   588.67      .16      .00      .00   594.40
    2050.       0.    2050.       0.       0.     646.       0.      92.      16.   594.40
      .54     0.00     3.17     0.00     .050     .040     .050     .038   577.50  1000.00
  .000569       1.       1.       1.        0        0        1     0.00    84.40  1084.40

3470 ENCROACHMENT STATIONS=     871.8     988.2  TYPE=     1  TARGET=     116.400

                    DUPLICATE OF SECTION F-ENCROACHED FOR CONTRACTION OF

                    FLOW THROUGH BRIDGE

     1.31    11.22   588.52     0.00     0.00   588.69      .16      .01      .00   586.30
    2050.      19.    2012.      19.      33.     614.      33.      92.      16.   587.00
      .54      .57     3.28      .58     .100     .045     .100     .038   577.30   871.80
  .000680      15.      15.      15.        0        0        1     0.00   116.40   988.20

  SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS  BANK ELEV
  Q         QLOB      QCH       QROB      ALOB       ACH      AROB       VOL       TWA  LEFT/RIGHT
  TIME      VLOB      VCH       VROB       XNL      XNCH       XNR       WTN    ELMIN      SSTA
  SLOPE     XLOBL     XLCH      XLOBR    ITRIAL       IDC    ICONT     CORAR   TOPWID      ENDST
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3470 ENCROACHMENT STATIONS=      837.8     1022.2  TYPE=     1  TARGET=     184.400
                F        50FT. U.S. OF THE F-41 BRIDGE

      1.32     11.26    588.56      0.00      0.00    588.71       .15       .02       .00    586.30
     2050.       22.     1956.       72.       55.      618.      114.       93.       16.    587.00
       .54       .40      3.17       .63      .100      .045      .100      .038    577.30    841.81
   .000630       34.       34.       34.         2         0         1      0.00    180.38   1022.20


3470 ENCROACHMENT STATIONS=      305.0      388.0  TYPE=     1  TARGET=      83.000
                         MANUFACTURED SECTION-CHANNEL BASED ON SECTION G WITH

                         ADJUSTMENT TO INVERT;    OVERBANKS MADE UP BASED ON

                         CONTOUR MAP-ENCROACHED AT BANK STATIONS TO RAISE

                         WATER SURFACE WITHIN ALLOWABLE LIMIT OF .1FT.

      1.60     11.11    589.71      0.00      0.00    589.91       .20      1.17       .03    588.80
     2050.        0.     2050.        0.        0.      573.        0.      116.       20.  100000.00
       .66      0.00      3.58      0.00      .100      .045      .100      .039    578.60    305.00
   .000997     1500.     1500.     1500.         2         0         1      0.00     83.00    388.00


3470 ENCROACHMENT STATIONS=          .0      145.0  TYPE=     1  TARGET=     144.999
                G        SECTION ENCROACHED TO RAISE WATER SURFACE WITHIN

                         ALLOWABLE LIMIT OF .1FT.

      1.87     11.63    590.93      0.00      0.00    591.08       .15      1.16       .01100000.00
     2050.        0.     1999.       51.        0.      637.       89.      137.       24.    588.80
       .78      0.00      3.14       .57      .070      .045      .100      .040    579.30      6.13
   .000694     1400.     1400.     1400.         2         0         1      0.00    138.87    145.00


3470 ENCROACHMENT STATIONS=         6.0      118.0  TYPE=     1  TARGET=     112.000
                H        50FT. D.S. OF THE D&M RAILROAD BRIDGE-ENCROACHED

                         FOR THE EXPANSION OF FLOW THROUGH BRIDGE

      2.25     10.55    592.05      0.00      0.00    592.16       .11      1.07       .01100000.00
     2050.        0.     2049.        1.        0.      775.        7.      172.       30.    591.70
       .99      0.00      2.64       .17      .100      .045      .100      .041    581.50      6.97
   .000422     2000.     2000.     2000.         2         0         1      0.00    111.03    118.00


3470 ENCROACHMENT STATIONS=         6.0      101.0  TYPE=     1  TARGET=      95.000
                         REPEAT OF SECTION H-ENCROACHED FOR THE EXPANSION OF

                         FLOW THROUGH BRIDGE
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     2.25     10.57    592.07      0.00      0.00    592.17       .11       .01       .00100000.00
    2050.        0.     2050.        0.        0.      777.        0.      172.       30. 100000.00
     1.00      0.00      2.64      0.00      .100      .045      .100      .041    581.50      6.93
  .000421       33.       33.       33.         0         0         1      0.00     94.07    101.00

                 I        D&M RAILROAD BRIDGE-NO BRIDGE SKEW

     2.26     11.57    592.07      0.00      0.00    592.19       .12       .01       .00    603.00
    2050.        0.     2050.        0.        0.      747.        0.      172.       30.    603.00
     1.00      0.00      2.74      0.00      .100      .045      .100      .041    580.50    100.00
  .000459       16.       16.       16.         0         0         1      0.00     87.00    187.00

 NORMAL BRIDGE,NRD=10 MIN ELTRD=  603.00 MAX ELLC=  603.00

     2.26     11.57    592.07      0.00      0.00    592.19       .12       .00       .00    603.00
    2050.        0.     2050.        0.        0.      747.        0.      172.       30.    603.00
     1.00      0.00      2.74      0.00      .045      .030      .045      .041    580.50    100.00
  .000204        1.        1.        1.         0         0         1      0.00     87.00    187.00

 NORMAL BRIDGE,NRD=10 MIN ELTRD=  603.00 MAX ELLC=  603.00

     2.26     11.57    592.07      0.00      0.00    592.19       .12       .00       .00    603.00
    2050.        0.     2050.        0.        0.      748.        0.      173.       30.    603.00
     1.00      0.00      2.74      0.00      .045      .030      .045      .041    580.50    100.00
  .000203       18.       18.       18.         0         0         1      0.00     87.00    187.00

     SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS   BANK ELEV
     Q         QLOB      QCH       QROB      ALOB       ACH      AROB       VOL       TWA   LEFT/RIGHT
     TIME      VLOB      VCH       VROB      XNL        XNCH     XNR        WTN       ELMIN      SSTA
     SLOPE     XLOBL     XLCH      XLOBR     ITRIAL     IDC      ICONT      CORAR     TOPWID     ENDST

     2.26     11.57    592.07      0.00      0.00    592.19       .12       .00       .00    603.00
    2050.        0.     2050.        0.        0.      748.        0.      173.       30.    603.00
     1.00      0.00      2.74      0.00      .100      .045      .100      .041    580.50    100.00
  .000458        1.        1.        1.         0         0         1      0.00     87.00    187.00

 3470 ENCROACHMENT STATIONS=        6.0      101.0  TYPE=      1  TARGET=      95.000

                 REPEAT OF SECTION H-ENCROACHED FOR CONTRACTION OF FLOW

                 THROUGH BRIDGE

     2.26     11.59    592.09      0.00      0.00    592.19       .11       .00       .00100000.00
    2050.        0.     2050.        0.        0.      786.        0.      173.       30. 100000.00
     1.00      0.00      2.61      0.00      .100      .045      .100      .041    580.50      6.89
  .000406        4.        4.        4.         0         0         1      0.00     94.11    101.00

 3470 ENCROACHMENT STATIONS=      200.0      450.0  TYPE=      1  TARGET=     250.000

                 MANUFACTURED SECTION-CHANNEL BASED ON SECTION J WITH

                 INVERT ADJUSTMENT;     OVERBANKS BASED ON CONTOUR MAP.
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LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE WITHIN

ALLOWABLE .1FT LIMIT

2.56	12.66	592.66	0.00	0.00	592.74	.08	.54	.01	588.80
2050.	174.	1826.	50.	327.	767.	113.	209.	36.	587.90
1.21	.53	2.38	.44	.100	.045	.100	.041	580.00	200.00
.000282	1600.	1600.	1600.	2	0	1	0.00	235.61	435.61

3470 ENCROACHMENT STATIONS= 40.0 165.0 TYPE= 1 TARGET= 125.000

J 100FT. D.S. OF THE VAN ETTEN LAKE DAM-ENCROACHED FOR

THE EXPANSION OF FLOW THROUGH OUTLET OF DAM

2.75	13.65	592.85	0.00	0.00	592.88	.03	.12	.02	100000.00
2050.	0.	2050.	0.	0.	1538.	0.	240.	40.	100000.00
1.41	0.00	1.33	0.00	.100	.045	.100	.042	579.20	40.00
.000069	750.	1000.	1150.	2	0	1	0.00	125.00	165.00

K VAN ETTEN LAKE DAM-HWM, 592.85, SPRING, 1950, DISCHARGE

UNKNOWN;HWM 589.87, D.S. SIDE OF DAM, JULY, 1976

DISCHARGE UNKNOWN

I do not like a stage for the 100 yr below the HW unless it is proven to be a heavy low fog event.

2.78	10.15	592.75	0.00	0.00	593.01	.25	.02	.11	600.80
2050.	0.	2050.	0.	0.	508.	0.	243.	40.	600.80
1.42	0.00	4.04	0.00	.025	.020	.025	.041	582.60	50.50
.000212	185.	135.	85.	2	0	1	0.00	50.00	100.50

3265 DIVIDED FLOW

2.78	10.15	592.75	0.00	0.00	593.02	.27	.00	.01	600.80
2050.	0.	2050.	0.	0.	487.	0.	244.	40.	600.80
1.42	0.00	4.21	0.00	.025	.020	.025	.041	582.60	50.50
.000330	10.	10.	10.	0	0	1	0.00	48.00	100.50

3265 DIVIDED FLOW

2.78	10.15	592.75	0.00	0.00	593.02	.27	.00	.00	600.80
2050.	0.	2050.	0.	0.	487.	0.	244.	40.	600.80
1.42	0.00	4.21	0.00	.025	.020	.025	.041	582.60	50.50
.000330	4.	4.	4.	0	0	1	0.00	48.00	100.50

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.05	1.51	3.00	-0.00	50.00	2.00	504.00	-0.00	582.60	582.60

3265 DIVIDED FLOW

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

CLASS A LOW FLOW

BRIDGE W.S.= 592.72 BRIDGE VELOCITY= 4.22 OK

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	ELLC	ELTRD	CLASS
0.00	593.04	.02	0.	2050.	504.	593.10	600.80	1.00

2.78	10.16	592.76	0.00	0.00	593.04	.27	.02	0.00	600.80
2050.	0.	2050.	0.	0.	488.	0.	244.	40.	600.80
1.42	0.00	4.20	0.00	.025	.020	.025	.041	582.60	50.50
.000329	7.	7.	7.	0	0	1	0.00	48.00	100.50

3470 ENCROACHMENT STATIONS= 28.0 128.0 TYPE= 1 TARGET= 100.000

2.78	10.30	592.90	0.00	0.00	593.07	.17	.00	.03	588.90
2050.	29.	1909.	112.	29.	562.	76.	244.	40.	588.90
1.43	1.02	3.40	1.47	.025	.020	.025	.041	582.60	36.16
.000123	25.	25.	25.	2	0	1	0.00	91.84	128.00

2.80	10.89	593.09	0.00	0.00	593.12	.03	.01	.04	590.00
2050.	4.	2042.	5.	19.	1370.	24.	246.	40.	590.00
1.44	.19	1.49	.19	.090	.035	.090	.041	582.20	67.64
.000077	100.	100.	100.	2	0	1	0.00	197.81	265.45

$Q = A\sqrt{\frac{2gH}{K}}$

$Q = A\left(\frac{V^2}{2g}\right) XKOR = HW$

$\frac{Q}{A} = \left[\frac{\left(\frac{2050}{504}\right)^2}{2g}\right]^{0.26}$ (1.51) = HW

0.388 = HW

592.75
0.39
593.14

$\left(\frac{2050}{488}\right)^2 / 2g = .274$

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Van Etten Creek

4) DOCUMENT TYPE: 100 yr natural

00BREAK00

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*****************************************
HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
*****************************************

C
1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI•PROJECT MNGR.
T2       100 YEAR FLOOD
T3       VAN ETTEN CREEK

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      EQ
     -10.       4.       -0.       -0.    .000900    -0.00     -0.0      -0.      -0.000    -0.000

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE
    -1.000    -0.000    -1.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000    -0.000

CCHV=     .300 CEHV=     .500
.2096 WSEL NOT GIVEN,AVG OF MAX,MIN USED
    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3470 ENCROACHMENT STATIONS=        .0      350.0  TYPE=     1  TARGET=     349.999
                A        100' D.S. OF THE MOUTH OF THE VAN ETTEN CREEK

      .00      5.43    583.03      0.00     -0.00    583.21      .18      0.00      0.00    585.80
    2050.        0.     2050.        0.        0.     607.        0.        0.        0. 100000.00
     0.00      0.00      3.37      0.00      .070      .035      .060     0.000    577.60    213.15
  .000899      -0.       -0.       -0.         0         0        19      0.00    136.85    350.00

3470 ENCROACHMENT STATIONS=     1190.0     1340.0  TYPE=     1  TARGET=     150.000
                B        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER

                         SURFACE WITHIN ALLOWABLE LIMIT OF .1FT

      .30      6.95    584.45      0.00      0.00    584.66      .22      1.43       .02    589.30
    2050.        0.     2044.        6.        0.     547.       15.       21.        5.    582.80
      .12      0.00      3.73       .43      .090      .035      .090      .035    577.50   1195.81
  .000893     1600.     1600.     1600.         1         0         1      0.00    124.14   1319.96

3470 ENCROACHMENT STATIONS=      670.0      920.0  TYPE=     1  TARGET=     250.000
                C        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER

                         SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
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      .51      8.06    585.36      0.00      0.00    585.56       .20       .89       .01    584.50
     2050.       2.      2047.       1.        7.      575.        5.        36.        8.    584.90
      .21       .26      3.56       .17      .090      .035      .090      .035    577.30    704.58
  .000742     1100.     1100.     1100.         2         0         1      0.00    140.89    845.47

                    MANUFACTURED SECTION-CHANNEL BASED ON SECTION D WITH

                    ADJUSTMENT TO INVERT:    OVERBANKS MADE UP BASED ON

                    CONTOUR MAP

      .89     10.45    586.95      0.00      0.00    587.18       .23      1.61       .02    586.20
     2050.       1.      2049.       0.        4.      534.        0.        62.       13.    591.00
      .35       .25      3.84      0.00      .090      .040      .070      .037    576.50    244.07
  .000874     2100.     2000.     1550.         2         0         1      0.00     87.25    331.32

3470 ENCROACHMENT STATIONS=      200.0      335.0  TYPE=      -1  TARGET=      135.000
                D       ENCROACHED TO STA.200 TO CUT OFF LOW SPOT IN LEFT OVER-

                        BANK AND THEN ENCROACHED FURTHER TO RAISE WATER SURFACE

                        WITHIN THE ALLOWABLE LIMIT OF .1FT.-HWM AT AUSABLE GOLF

                        CLUB 587.83, DATE UNKNOWN, DISCHARGE UNKNOWN

                        HWM 585.15 JULY, 1976 DISCHARGE UNKNOWN

      1.06     11.67    587.67      0.00      0.00    587.85       .18       .65       .02    586.20
     2050.       33.      2017.       0.        69.      594.        0.        74.       16. 100000.00
      .42       .47      3.40      0.00      .090      .040      .090      .038    576.00    200.00
  .000604      900.      900.      900.         1         0         1      0.00    131.98    331.98

3470 ENCROACHMENT STATIONS=      875.0      984.4  TYPE=       1  TARGET=      109.400
                        50FT. D.S. FROM F-41 BRIDGE-DUPLICATE OF SECTION F

                        ENCROACHED FOR EXPANSION OF FLOW THROUGH BRIDGE

      1.30     11.01    588.41      0.00      0.00    588.58       .17       .73       .00    586.30
     2050.       19.      2014.      17.        26.      605.       24.        93.       19.    587.00
      .53       .74      3.33       .71      .070      .040      .070      .038    577.40    875.00
  .000567     1200.     1250.     1300.         2         0         1      0.00    109.40    984.40

    SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS   BANK ELEV
    Q         QLOB      QCH       QROB      ALOB       ACH      AROB       VOL       TWA   LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL        XNCH     XNR        WTN       ELMIN      SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL     IDC      ICONT      CORAR     TOPWID     ENDST
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OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.30    10.95   588.45     0.00     0.00   588.61      .16      .03      .00   594.40
    2050.       0.   2050.       0.       0.     641.       0.      94.      19.   594.40
      .53     0.00     3.20     0.00     .070     .040     .070     .038   577.50  1000.00
  .000585      49.      49.      49.        1        0        1     0.00    84.40  1084.40


NORMAL BRIDGE,NRD=49 MIN ELTRD=  591.80 MAX ELLC=  591.20

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

                E        F-41 (M-171) BRIDGE-NO BRIDGE SKEW

     1.31    10.95   588.45     0.00     0.00   588.61      .16      .00      .00   594.40
    2050.       0.   2050.       0.       0.     637.       0.      94.      19.   594.40
      .53     0.00     3.22     0.00     .025     .030     .025     .038   577.50  1000.00
  .000349       1.       1.       1.        0        0        1    -3.74    84.40  1084.40


NORMAL BRIDGE,NRD=49 MIN ELTRD=  591.80 MAX ELLC=  591.20

OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.31    10.96   588.46     0.00     0.00   588.62      .16      .01      .00   594.40
    2050.       0.   2050.       0.       0.     638.       0.      94.      19.   594.40
      .54     0.00     3.21     0.00     .025     .030     .025     .038   577.50  1000.00
  .000348      28.      28.      28.        0        0        1    -3.78    84.40  1084.40


OVERBANK AREA ASSUMED NON-EFFECTIVE,ELLEA=      594.40 ELREA=      594.40

     1.31    10.97   588.47     0.00     0.00   588.62      .16      .00      .00   594.40
    2050.       0.   2050.       0.       0.     642.       0.      94.      19.   594.40
      .54     0.00     3.19     0.00     .050     .040     .050     .038   577.50  1000.00
  .000581       1.       1.       1.        0        0        1     0.00    84.40  1084.40


3470 ENCROACHMENT STATIONS=      871.8      988.2  TYPE=      1  TARGET=      116.400

                    DUPLICATE OF SECTION F-ENCROACHED FOR CONTRACTION OF


                    FLOW THROUGH BRIDGE

     1.31    11.17   588.47     0.00     0.00   588.64      .17      .01      .00   586.30
    2050.      18.   2013.      19.      32.     610.      33.      94.      19.   587.00
      .54      .57     3.30      .58     .100     .045     .100     .038   577.30   871.80
  .000696      15.      15.      15.        0        0        1     0.00   116.40   988.20

   SECNO     DEPTH     CWSEL     CRIWS     WSELK      EG        HV        HL     OLOSS   BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL      TWA   LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN      ELMIN      SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR    TOPWID     ENDST


3470 ENCROACHMENT STATIONS=      837.8     1022.2  TYPE=      1  TARGET=      184.000
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          F        50FT. U.S. OF THE F-41 BRIDGE

     1.32    11.21   588.51     0.00     0.00   588.67      .15      .02      .00   586.30
    2050.      21.     1959.      70.      52.     614.     112.      95.      19.   587.00
      .54      .40     3.19      .63     .100     .045     .100     .038   577.30   842.89
  .000646      34.      34.      34.        2        0        1     0.00   179.31  1022.20

                   MANUFACTURED SECTION-CHANNEL BASED ON SECTION G WITH

                   ADJUSTMENT TO INVERT:    OVERBANKS MADE UP BASED ON

                   CONTOUR MAP-ENCROACHED AT BANK STATIONS TO RAISE

                   WATER SURFACE WITHIN ALLOWABLE LIMIT OF .1FT.

     1.60    11.06   589.66     0.00     0.00   589.86      .20     1.17      .02   588.80
    2050.       7.     2036.       8.      26.     568.      15.     119.      25.   587.20
      .66      .26     3.58      .52     .100     .045     .100     .039   578.60   244.86
  .000958    1500.    1500.    1500.        2        0        1     0.00   155.05   399.91

          G        SECTION ENCROACHED TO RAISE WATER SURFACE WITHIN

                   ALLOWABLE LIMIT OF .1FT.

     1.87    11.57   590.87     0.00     0.00   591.01      .15     1.14      .01   594.10
    2050.       0.     1984.      66.       0.     631.     144.     141.      31.   588.80
      .79     0.00     3.14      .46     .070     .045     .100     .040   579.30     6.26
  .000704    1400.    1400.    1400.        2        0        1     0.00   215.52   221.77

 3470 ENCROACHMENT STATIONS=        6.0      118.0  TYPE=      1  TARGET=      112.000

          H        50FT. D.S. OF THE D&M RAILROAD BRIDGE-ENCROACHED

                   FOR THE EXPANSION OF FLOW THROUGH BRIDGE

     2.25    10.50   592.00     0.00     0.00   592.11      .11     1.08      .01100000.00
    2050.       0.     2049.       1.       0.     770.       6.     177.      39.   591.70
      .99     0.00     2.66      .16     .100     .045     .100     .041   581.50     7.08
  .000430    2000.    2000.    2000.        2        0        1     0.00   110.92   118.00

 3470 ENCROACHMENT STATIONS=        6.0      101.0  TYPE=      1  TARGET=       95.000

                   REPEAT OF SECTION H-ENCROACHED FOR THE EXPANSION OF

                   FLOW THROUGH BRIDGE

     2.25    10.51   592.01     0.00     0.00   592.12      .11      .01      .00100000.00
    2050.       0.     2050.       0.       0.     772.       0.     177.      39. 100000.00
     1.00     0.00     2.65     0.00     .100     .045     .100     .041   581.50     7.04
  .000429      33.      33.      33.        0        0        1     0.00    93.96   101.00
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                I        D&M RAILROAD BRIDGE-NO BRIDGE SKEW

      2.26     11.52    592.02      0.00      0.00    592.14      .12       .01       .00    603.00
     2050.        0.     2050.        0.        0.      743.       0.      178.       39.    603.00
      1.00      0.00      2.76      0.00      .100      .045      .100      .041    580.50    100.00
   .000467       16.       16.       16.         0         0         1      0.00     87.00    187.00

NORMAL BRIDGE,NRD=10 MIN ELTRD=  603.00 MAX ELLC=  603.00

      2.26     11.52    592.02      0.00      0.00    592.14      .12       .00       .00    603.00
     2050.        0.     2050.        0.        0.      743.       0.      178.       39.    603.00
      1.00      0.00      2.76      0.00      .045      .030      .045      .041    580.50    100.00
   .000208        1.        1.        1.         0         0         1      0.00     87.00    187.00

NORMAL BRIDGE,NRD=10 MIN ELTRD=  603.00 MAX ELLC=  603.00

      2.26     11.52    592.02      0.00      0.00    592.14      .12       .00       .00    603.00
     2050.        0.     2050.        0.        0.      743.       0.      178.       39.    603.00
      1.00      0.00      2.76      0.00      .045      .030      .045      .041    580.50    100.00
   .000207       18.       18.       18.         0         0         1      0.00     87.00    187.00

    SECNO     DEPTH     CWSEL     CRIWS     WSELK        EG        HV        HL     OLOSS   BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

      2.26     11.52    592.02      0.00      0.00    592.14      .12       .00       .00    603.00
     2050.        0.     2050.        0.        0.      743.       0.      178.       39.    603.00
      1.00      0.00      2.76      0.00      .100      .045      .100      .041    580.50    100.00
   .000466        1.        1.        1.         0         0         1      0.00     87.00    187.00

3470 ENCROACHMENT STATIONS=        6.0      101.0  TYPE=      1  TARGET=      95.000

                    REPEAT OF SECTION H-ENCROACHED FOR CONTRACTION OF FLOW

                    THROUGH BRIDGE

      2.26     11.54    592.04      0.00      0.00    592.15      .11       .00       .00100000.00
     2050.        0.     2050.        0.        0.      782.       0.      178.       39. 100000.00
      1.00      0.00      2.62      0.00      .100      .045      .100      .041    580.50      7.01
   .000414        4.        4.        4.         0         0         1      0.00     93.99    101.00

                    MANUFACTURED SECTION-CHANNEL BASED ON SECTION J WITH

                    INVERT ADJUSTMENT:    OVERBANKS BASED ON CONTOUR MAP.

                    LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE WITHIN

                    ALLOWABLE .1FT LIMIT
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2.56	12.62	592.62	0.00	0.00	592.69	.08	.54	.01	588.80
2050.	197.	1804.	49.	425.	763.	111.	216.	46.	587.90
1.21	.46	2.36	.44	.100	.045	.100	.041	580.00	110.87
.000280	1600.	1600.	1600.	2	0	1	0.00	324.30	435.17

3470 ENCROACHMENT STATIONS= 40.0 165.0 TYPE= 1 TARGET= 125.000

Samples from elev 580.5

J 100FT. D.S. OF THE VAN ETTEN LAKE DAM-ENCROACHED FOR

THE EXPANSION OF FLOW THROUGH OUTLET OF DAM

2.75	13.60	592.80	0.00	0.00	592.83	.03	.12	.01	100000.00
2050.	0.	2050.	0.	0.	1532.	0.	248.	51.	100000.00
1.42	0.00	1.34	0.00	.100	.045	.100	.042	579.20	40.00
.000070	750.	1000.	1150.	2	0	1	0.00	125.00	165.00

K VAN ETTEN LAKE DAM-HWM, 592.85, SPRING, 1950, DISCHARGE

UNKNOWN;HWM 589.87, D.S. SIDE OF DAM, JULY, 1976

DISCHARGE UNKNOWN

2.78	10.11	592.71	0.00	0.00	592.96	.26	.02	.11	600.80
2050.	0.	2050.	0.	0.	505.	0.	251.	51.	600.80
1.43	0.00	4.06	0.00	.025	.020	.025	.041	582.60	50.50
.000215	185.	135.	85.	2	0	1	0.00	50.00	100.50

3265 DIVIDED FLOW

2.78	10.10	592.70	0.00	0.00	592.97	.28	.00	.01	600.80
2050.	0.	2050.	0.	0.	485.	0.	251.	51.	600.80
1.43	0.00	4.23	0.00	.025	.020	.025	.041	582.60	50.50
.000334	10.	10.	10.	0	0	1	0.00	48.00	100.50

Sheet N35A-2

580.5

3265 DIVIDED FLOW

2.78	10.10	592.70	0.00	0.00	592.98	.28	.00	.00	600.80
2050.	0.	2050.	0.	0.	485.	0.	251.	51.	600.80
1.43	0.00	4.23	0.00	.025	.020	.025	.041	582.60	50.50
.000334	4.	4.	4.	0	0	1	0.00	48.00	100.50

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	1.05	1.51	3.00	-0.00	50.00	2.00	504.00	-0.00	582.60	582.60

3265 DIVIDED FLOW

583.0

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	LEFT/RIGHT
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA

CLASS A LOW FLOW

BRIDGE W.S.= 592.68 BRIDGE VELOCITY= 4.24

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	ELLC	ELTRD	CLASS
0.00	592.99	.02	0.	2050.	504.	593.10	600.80	1.00

2.78	10.12	592.72	0.00	0.00	592.99	.28	.02	0.00	600.80
2050.	0.	2050.	0.	0.	486.	0.	251.	51.	600.80
1.43	0.00	4.22	0.00	.025	.020	.025	.041	582.60	50.50
.000333	7.	7.	7.	0	0	1	0.00	48.00	100.50

3470 ENCROACHMENT STATIONS= 29.0 128.0 TYPE= 1 TARGET= 100.000

2.78	10.26	592.86	0.00	0.00	593.03	.17	.00	.03	588.90
2050.	29.	1911.	110.	28.	559.	75.	251.	51.	588.90
1.43	1.02	3.42	1.47	.025	.020	.025	.041	582.60	36.32
.000125	25.	25.	25.	2	0	1	0.00	91.68	128.00

2.80	10.85	593.05 *	0.00	0.00	593.08	.03	.01	.04	590.00
2050.	4.	2042.	4.	19.	1363.	23.	254.	52.	590.00
1.45	.19	1.50	.19	.090	.035	.090	.041	582.20	67.82
.000079	100.	100.	100.	2	0	1	0.00	197.41	265.23

580 datum
13.9
593.9

* March 28, 1950 High Water
593.9
4.7 ft above legal level >
than CWSEL

* The 1955 dam regulation plan may eliminate the very high floodstages. However, I suggest not having a flood plain below the past highwater marks!

SUMMARY PRINTOUT FOR MULTIPLE PROFILES

VAN ETTEN CREEK

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
.00	0.00	0.00	0.00	577.60	2050.00	583.03	.18	0.00	0.00	2050.00	5.43	136.85
.30	1600.00	0.00	0.00	577.50	2050.00	584.45	.22	1.43	.02	2043.56	6.95	124.14
.51	1100.00	0.00	0.00	577.30	2050.00	585.36	.20	.89	.01	2047.41	8.06	140.89
.89	2000.00	0.00	0.00	576.50	2050.00	586.95	.23	1.61	.02	2048.95	10.45	87.25
1.06	900.00	0.00	0.00	576.00	2050.00	587.67	.18	.65	.02	2017.35	11.67	131.98
1.30	1250.00	0.00	0.00	577.40	2050.00	588.41	.17	.73	.00	2013.59	11.01	109.40
1.30	49.00	0.00	0.00	577.50	2050.00	588.45	.16	.03	.00	2050.00	10.95	84.40
1.31	1.00	591.80	591.20	577.50	2050.00	588.45	.16	.00	.00	2050.00	10.95	84.40
1.31	28.00	591.80	591.20	577.50	2050.00	588.46	.16	.01	.00	2050.00	10.96	84.40
1.31	1.00	0.00	0.00	577.50	2050.00	588.47	.16	.00	.00	2050.00	10.97	84.40
1.31	15.00	0.00	0.00	577.30	2050.00	588.47	.17	.01	.00	2013.29	11.17	116.40
1.32	34.00	0.00	0.00	577.30	2050.00	588.51	.15	.02	.00	1958.52	11.21	179.31
1.60	1500.00	0.00	0.00	578.60	2050.00	589.66	.20	1.17	.02	2035.61	11.06	155.05
1.87	1400.00	0.00	0.00	579.30	2050.00	590.87	.15	1.14	.01	1983.53	11.57	215.52
2.25	2000.00	0.00	0.00	581.50	2050.00	592.00	.11	1.08	.01	2048.97	10.50	110.92
2.25	33.00	0.00	0.00	581.50	2050.00	592.01	.11	.01	.00	2050.00	10.51	93.96
2.26	16.00	0.00	0.00	580.50	2050.00	592.02	.12	.01	.00	2050.00	11.52	87.00
2.26	1.00	603.00	603.00	580.50	2050.00	592.02	.12	.00	.00	2050.00	11.52	87.00
2.26	18.00	603.00	603.00	580.50	2050.00	592.02	.12	.00	.00	2050.00	11.52	87.00
2.26	1.00	0.00	0.00	580.50	2050.00	592.02	.12	.00	.00	2050.00	11.52	87.00
2.26	4.00	0.00	0.00	580.50	2050.00	592.04	.11	.00	.00	2050.00	11.54	93.99
2.56	1600.00	0.00	0.00	580.00	2050.00	592.62	.08	.54	.01	1803.70	12.62	324.30
2.75	1000.00	0.00	0.00	579.20	2050.00	592.80	.03	.12	.01	2050.00	13.60	125.00
2.78	135.00	0.00	0.00	582.60	2050.00	592.71	.26	.02	.11	2050.00	10.11	50.00
2.78	10.00	0.00	0.00	582.60	2050.00	592.70	.28	.00	.01	2050.00	10.10	48.00
2.78	4.00	0.00	0.00	582.60	2050.00	592.70	.28	.00	.00	2050.00	10.10	48.00
2.78	7.00	600.80	593.10	582.60	2050.00	592.72	.28	.02	0.00	2050.00	10.12	48.00
2.78	25.00	0.00	0.00	582.60	2050.00	592.86	[illegible]	.00	[illegible]	[illegible]	[illegible]	[illegible]

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
2.80	100.00	0.00	0.00	582.20	2050.00	593.05	.03	.01	.04	2042.03	10.85	197.41

SECTION NUMBER	DISCHARGE CFS	CWSEL	CWSEL DIFF EACH Q	CWSEL DIFF EACH SECTION	CWSEL-WSELK	TOPWID	T.W. DIFF	LENGTH
.001	2050.000	583.031	0.000	0.000	0.000	136.852	0.000	-0.000
.303	2050.000	584.445	0.000	1.415	0.000	124.145	0.000	1600.000
.511	2050.000	585.363	0.000	.918	0.000	140.887	0.000	1100.000
.889	2050.000	586.955	0.000	1.591	0.000	87.248	0.000	2000.000
1.059	2050.000	587.671	0.000	.717	0.000	131.978	0.000	900.000
1.295	2050.000	588.412	0.000	.740	0.000	109.399	0.000	1250.000
1.304	2050.000	588.453	0.000	.042	0.000	84.400	0.000	49.000
1.305	2050.000	588.453	0.000	-.000	0.000	84.400	0.000	1.000
1.310	2050.000	588.463	0.000	.010	0.000	84.400	0.000	28.000
1.311	2050.000	588.466	0.000	.003	0.000	84.400	0.000	1.000
1.314	2050.000	588.472	0.000	.006	0.000	116.399	0.000	15.000
1.319	2050.000	588.514	0.000	.042	0.000	179.307	0.000	34.000
1.603	2050.000	589.659	0.000	1.145	0.000	155.047	0.000	1500.000
1.868	2050.000	590.866	0.000	1.207	0.000	215.515	0.000	1400.000
2.246	2050.000	592.000	0.000	1.134	0.000	110.919	0.000	2000.000
2.252	2050.000	592.015	0.000	.015	0.000	93.960	0.000	33.000
2.255	2050.000	592.018	0.000	.003	0.000	87.000	0.000	16.000
2.256	2050.000	592.018	0.000	.000	0.000	87.000	0.000	1.000
2.259	2050.000	592.022	0.000	.004	0.000	87.000	0.000	18.000
2.260	2050.000	592.022	0.000	.000	0.000	87.000	0.000	1.000
2.261	2050.000	592.039	0.000	.016	0.000	93.993	0.000	4.000
2.558	2050.000	592.617	0.000	.579	0.000	324.302	0.000	1600.000
2.749	2050.000	592.804	0.000	.187	0.000	124.999	0.000	1000.000
2.775	2050.000	592.706	0.000	-.099	0.000	50.000	0.000	135.000
2.777	2050.000	592.698	0.000	-.008	0.000	48.000	0.000	10.000
2.778	2050.000	592.699	0.000	.001	0.000	48.000	0.000	4.000
2.779	2050.000	592.716	0.000	.017	0.000	48.000	0.000	7.000
2.784	2050.000	592.858	0.000	.142	0.000	91.675	0.000	25.000
2.803	2050.000	593.045	0.000	.187	0.000	197.407	0.000	[illegible]

DATA FOR LAST CROSS SECTION

PROFILE	TYPE ENC	TARGET	TOP WIDTH AREA-ACRES	TOP WIDTH AREA-DIFF
1	0.000	0.000	51.699	0.000

00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Van Etten Creek

4) DOCUMENT TYPE: Input data 100 yr encroached

00BREAK00

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C
C     41
C    .001        A        100' D.S. OF THE MOUTH OF THE VAN ETTEN CREEK
C    .303        B        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER
C    .303                 SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
C    .511        C        SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER
C    .511                 SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
C    .889                 MANUFACTURED SECTION-CHANNEL BASED ON SECTION D WITH
C    .889                 ADJUSTMENT TO INVERT;    OVERBANKS MADE UP BASED ON
C    .889                 CONTOUR MAP
C   1.059        D        ENCROACHED TO STA.200 TO CUT OFF LOW SPOT IN LEFT OVER-
C   1.059                 BANK AND THEN ENCROACHED FURTHER TO RAISE WATER SURFACE
C   1.059                 WITHIN THE ALLOWABLE LIMIT OF .1FT.-HWM AT AUSABLE GOLF
C   1.059                 CLUB 587.83, DATE UNKNOWN, DISCHARGE UNKNOWN
C   1.059                 HWM 585.15 JULY, 1976 DISCHARGE UNKNOWN
C   1.295                 50FT. D.S. FROM F-41 BRIDGE-DUPLICATE OF SECTION F
C   1.295                 ENCROACHED FOR EXPANSION OF FLOW THROUGH BRIDGE
C   1.305        E        F-41 (M-171) BRIDGE-NO BRIDGE SKEW
C   1.314                 DUPLICATE OF SECTION F-ENCROACHED FOR CONTRACTION OF
C   1.314                 FLOW THROUGH BRIDGE
C   1.319        F        50FT. U.S. OF THE F-41 BRIDGE
C   1.603                 MANUFACTURED SECTION-CHANNEL BASED ON SECTION G WITH
C   1.603                 ADJUSTMENT TO INVERT;    OVERBANKS MADE UP BASED ON
C   1.603                 CONTOUR MAP-ENCROACHED AT BANK STATIONS TO RAISE
C   1.603                 WATER SURFACE WITHIN ALLOWABLE LIMIT OF .1FT.
C   1.868        G        SECTION ENCROACHED TO RAISE WATER SURFACE WITHIN
C   1.868                 ALLOWABLE LIMIT OF .1FT.
C   2.246        H        50FT. D.S. OF THE D&M RAILROAD BRIDGE-ENCROACHED
C   2.246                 FOR THE EXPANSION OF FLOW THROUGH BRIDGE
C   2.252                 REPEAT OF SECTION H-ENCROACHED FOR THE EXPANSION OF
C   2.252                 FLOW THROUGH BRIDGE
C   2.255        I        D&M RAILROAD BRIDGE-NO BRIDGE SKEW
C   2.261                 REPEAT OF SECTION H-ENCROACHED FOR CONTRACTION OF FLOW
C   2.261                 THROUGH BRIDGE
C   2.558                 MANUFACTURED SECTION-CHANNEL BASED ON SECTION J WITH
C   2.558                 INVERT ADJUSTMENT;    OVERBANKS BASED ON CONTOUR MAP.
C   2.558                 LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE WITHIN
C   2.558                 ALLOWABLE .1FT LIMIT
C   2.749        J        100FT. D.S. OF THE VAN ETTEN LAKE DAM-ENCROACHED FOR
C   2.749                 THE EXPANSION OF FLOW THROUGH OUTLET OF DAM
C   2.775        K        VAN ETTEN LAKE DAM-HWM, 592.85, SPRING, 1950, DISCHARGE
C   2.775                 UNKNOWN;HWM 589.87, D.S. SIDE OF DAM, JULY, 1976
C   2.775                 DISCHARGE UNKNOWN
T1        OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2        10 YEAR FLOOD
T3        VAN ETTEN CREEK
J1   -10     2                     .0009
J2     1              -1
J3     1     10       11      12      14       8       4
NC   .07    .06     .035      .3      .5
QT     4   1290     1770    2050    2450
X1  .001     44      210     648
X3                             0                350
GR 596.0      0    589.7      35   586.6     110   585.8     210   581.4     215
GR 578.1    230    577.6     250   577.9     270   578.5     290   578.0     310
GR 579.2    330    580.2     350   579.9     370   580.1     390   579.9     410
GR 579.9    430    579.7     450   579.4     470   579.1     490   578.5     510
GR 578.2    530    577.5     550   576.9     570   575.3     590   573.6     600
GR 572.2    610    573.3     620   578.4     630   581.5     640   587.3     648
GR 585.2    710    584.6     810   584.0     840   588.8     910   590.5     940
GR 589.8   1010    589.1    1110   589.2    1210   589.5    1310   589.4    1410
GR 589.3   1510    590.1    1600   587.8    1610   595.3    1630
NC   .09    .09     .035
X1  .303     44     1190    1302    1600    1600    1600
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X3                      1190            1302
GR 595.6      0   587.5   24   586.2   90   586.8   190   588.8   290
GR 589.6    390   591.1  490   591.3  590   589.8   690   589.8   790
GR 591.1    890   591.5  990   587.2 1050   587.5  1090   589.3  1190
GR 581.8   1199   579.9 1205   578.7 1210   577.5  1220   577.9  1230
GR 578.4   1240   578.7 1250   579.1 1260   579.8  1270   580.1  1280
GR 579.8   1290   579.9 1295   581.8 1301   582.8  1302   586.3  1340
GR 583.8   1390   583.9 1490   587.6 1590   589.1  1690   586.7  1790
GR 589.4   1890   589.0 1990   587.9 2090   588.2  2190   589.5  2290
GR 590.4   2390   590.4 2490   590.0 2590   589.6  2690
X1  .511     33     720  823    1100 1100   1100
X3                      720             823
GR 593.9      0   587.7   33   586.4  120   587.6   220   588.4   320
GR 588.3    420   588.2  520   586.4  620   587.3   670   584.5   720
GR 580.3    724   578.8  730   577.3  740   577.7   750   578.6   760
GR 579.9    770   580.0  780   580.7  790   580.5   800   580.6   810
GR 581.9    818   584.9  823   586.9  920   585.1  1020   584.7  1120
GR 584.2   1220   584.3 1320   585.6 1420   587.2  1520   586.4  1620
GR 586.4   1720   587.6 1820   591.3 1920
NC  .09     .07     .04
X1  .889     13     255  335    2100 1550   2000
X3                      255             335
GR 600.0      0   590.0  200   586.2  255   582.0   260   581.4   265
GR 580.6    275   579.9  285   578.6  295   576.5   305   577.4   315
GR 580.0    320   581.1  326   591.0  335
NC  .09     .09
X1 1.059     28     255  335     900  900    900
X3                      255             335
GR 590.7      0   587.3   15   587.8   55   587.0   155   586.2   255
GR 582.0    260   581.4  265   580.6  275   579.9   285   578.6   295
GR 576.0    305   577.4  315   580.0  320   581.1   326   591.0   335
GR 591.0    355   588.5  455   591.1  535   587.9   555   587.4   655
GR 589.3    720   585.0  745   583.7  755   584.2   775   586.7   785
GR 587.0    855   588.2  955   590.7 1055
NC  .07     .07
X1 1.295     30     890  970    1200 1300   1250
X3                      875            984.4
GR 596.8      0   588.5   27   588.5   90   587.7   190   588.6   290
GR 589.4    390   590.8  490   591.2  590   589.5   690   591.0   790
GR 586.3    890   582.9  898   581.7  900   579.2   910   578.3   920
GR 577.4    930   578.2  940   580.8  950   582.9   955   587.0   970
GR 586.3    990   586.0 1040   589.0 1090   589.6  1190   593.6  1260
GR 593.0   1290   594.0 1390   594.8 1490   593.8  1555   599.9  1578
X1 1.304     48    1000 1084.4    49   49     49
X3     10
GR 598.3      0   596.0  100   593.7  200   592.5   300   592.2   400
GR 591.8    500   592.0  600   592.3  700   593.3   800   593.8   900
GR 594.4   1000   585.7 1000   585.7 1001   585.7  1002   585.7  1004
GR 585.6   1006   585.6 1008   585.6 1010   585.2 1012.5   584.9 1014.4
GR 584.0   1020   582.4 1024.4 580.3 1030   580.0 1034.4   579.6  1040
GR 579.3 1044.4   579.0 1050   578.3 1054.4 577.5  1060    577.6 1064.4
GR 577.7   1070   578.2 1071.9 578.9 1074.4 579.4 1076.4   580.0 1078.4
GR 580.4 1080.0   580.5 1080.4 581.1 1082.4 581.4 1083.4   581.7 1084.4
GR 594.4 1084.4   594.3 1100   594.1 1200   593.9  1300    594.8  1400
GR 597.0   1500   599.0 1600   599.8 171.3
NC  .025   .025    .03
X1 1.305                          1     1     1
X3     10                                     594.4   594.4
BT     49     0.0   598.3    0.0  100.0  596.0    0.0   200.0   593.7    0.0
BT  300.0   592.5     0.0  400.0  592.2    0.0  500.0   591.8     0.0  600.0
BT  592.0     0.0   700.0  592.3    0.0  800.0  593.3     0.0   900.0  593.8
BT    0.0  1000.0   594.4    0.0 1000.0  598.5  586.2  1001.0   598.6  587.7
BT 1002.0   598.7   588.5 1004.0  599.0  589.4 1006.0   599.4   590.0 1008.0
BT  599.8   590.4  1010.0  600.2  590.6 1012.5  600.8   590.7  1012.5  600.8
BT  591.2  1014.4   601.4  591.2 1020.0  602.4  591.2  1024.4   603.4  591.2
BT 1030.0   604.4   591.2 1034.4  605.0  591.2 1040.0   605.4   591.2 1044.4
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BT 605.4   591.2  1050.0   605.0   591.2  1054.4   604.4   591.2  1060.0   603.4
BT 591.2  1064.4   602.4   591.2  1070.0   601.4   591.2  1071.9   600.8   591.2
BT1071.9   600.8   590.7  1074.4   600.2   590.6  1076.4   599.8   590.4  1078.4
BT 599.4   590.0  1080.4   599.0   589.4  1082.4   598.7   588.5  1083.4   598.6
BT 587.7  1084.4   598.5   586.2  1084.4   594.4     0.0  1100.0   594.3     0.0
BT1200.0   594.1     0.0  1300.0   593.9     0.0  1400.0   594.8     0.0  1500.0
BT 597.0     0.0  1600.0   599.0     0.0  1713.0   599.8     0.0
X1 1.310                        28      28      28
X2                                                1
X3    10                                        594.4   594.4
NC   .05     .05     .04
X1 1.311                         1       1       1
X3    10
NC    .1     .1     .045
X1 1.314     30     890     970      15      15      15
X3                         871.8           988.2
GR 596.8      0   588.5      27   588.5      90   587.7     190   588.6     290
GR 589.4    390   590.8     490   591.2     590   589.5     690   591.0     790
GR 586.3    890   582.9     898   581.7     900   579.2     910   578.3     920
GR 577.3    930   578.2     940   580.8     950   582.9     955   587.0     970
GR 586.3    990   586.0    1040   589.0    1090   589.6    1190   593.6    1260
GR 593.0   1290   594.0    1390   594.8    1490   593.8    1555   599.9    1578
X1 1.319                         34      34      34
X3                         837.8          1022.2
X1 1.603     14     305     388    1500    1500    1500
X3                           305     388
GR 595.0      0   592.9     100   590.3     200   588.8     305   582.3     313
GR 581.8    315   580.4     320   578.6     325   579.1     330   581.1     340
GR 582.8    350   584.5     375   587.2     388   600.0     450
NC   .07     .1     .045
X1 1.868     16       0      95    1400    1400    1400
X3                             0     145
GR 594.1      0   587.9      12   585.2      25   583.5      50   581.8      60
GR 579.8     70   579.3      75   580.4      80   581.8      85   582.3      87
GR 588.8     95   590.3     200   592.9     300   595.0     400   597.5     500
GR 599.5    600
NC    .1     .1
X1 2.246     16       0     101    2000    2000    2000
X3                             6     118
GR 595.2      0   584.8      23   581.9      25   582.8      33   582.4      43
GR 582.7     53   581.9      63   581.8      73   581.5      83   582.0      89
GR 582.8     91   591.7     101   591.5     123   590.5     223   592.4     323
GR 595.5    423
X1 2.252                         33      33      33
X3                               6     101
X1 2.255     18     100     187      16      16      16
GR 603.0      0   603.0    96.5   603.0    96.5   603.0     100   584.7     100
GR 582.7    110   582.1     120   581.4     130   580.5     140   581.4     150
GR 582.5    160   585.0     170   590.2     180   590.6     187   603.0     187
GR 603.0  190.5   603.0   190.5   603.0     300
NC  .045   .045     .03
X1 2.256                         1       1       1
BT    10      0   603.0     0.0    96.5   603.0     0.0    96.5   608.7   603.0
BT   100  608.7   603.0     100   608.7   599.9     187   608.7   599.9     187
BT 608.7  603.0   190.5   608.7   603.0   190.5   603.0     0.0     300   603.0
BT   0.0
X1 2.259                         18      18      18
X2                                                1
NC    .1     .1     .045
X1 2.260                         1       1       1
X1 2.261     16               101       4       4       4
X3                               6     101
GR 595.2      0   584.8      23   581.9      25   582.8      33   582.4      43
GR 582.7     53   581.9      63   581.8      73   580.5      83   582.0      89
GR 582.8     91   591.7     101   591.5     123   590.5     223   592.4     323
GR 595.5    423
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X1 2.558      15     305     388    1600    1600    1600
X3                           200             450
GR 595.0       0    592.9    100    590.3     200    588.8     305    582.3     313
GR 581.8     315    580.4    320    580.0     325    580.0     330    581.8     340
GR 583.5     350    585.2    375    587.9     388    594.1     450    600.0     500
X1 2.749      19      30     173     750    1150    1000
X3                            40             165
GR 596.3       0    589.1     30    585.8      35    581.5      42    582.3      50
GR 579.6      60    579.2     70    579.4      80    579.3      90    579.3     100
GR 579.3     110    579.6    120    580.1     130    581.0     140    582.5     150
GR 586.5     173    588.8    178    589.3     209    600.3     239
NC   .025   .025     .02
X1 2.775      16     50.5   100.5     185      85     135
GR 603.0       0    595.1     49    600.8      49    600.8    50.5    582.6    50.5
GR 582.6    74.5    582.6   74.5    582.6    76.5    582.6    76.5    582.6   100.5
GR 600.8   100.5    600.8    102    594.5     102    596.3     179    596.7     200
GR 602.4     266
X1 2.777      16     50.5   100.5      10      10      10
GR 603.0       0    595.1     49    600.8      49    600.8    50.5    582.6    50.5
GR 582.6    74.5    599.3   74.5    599.3    76.5    582.6    76.5    582.6   100.5
GR 600.8   100.5    600.8    102    594.5     102    596.3     179    596.7     200
GR 602.4     266
X1 2.778                                 4       4       4
SB  1.05    1.51      3.0                50       2     504              582.6   582.6
X1 2.779                                 7       7       7
X2                      1   593.1   600.8
BT    10     0.0    603.0     0.0    49.0   595.1     0.0    49.0    600.8     0.0
BT  50.5   600.8    593.1   100.5   600.8   593.1   102.0   600.8     0.0   102.0
BT 594.5     0.0    179.0   596.3     0.0   200.0   596.7     0.0    266.0   602.4
BT   0.0
X1 2.784       8     50.5     105      25      25      25
X3                            28             128
GR 603.0       0    588.9    50.5   582.6    50.5   582.6     105    588.9     105
GR 593.3     179    596.7     200   602.4     266
NC    .09    .09     .035
X1 2.803      20      80     250     100     100     100
GR 610.0       0    600.0      40   590.0      80    588.6      90    584.5      97
GR 585.3     105    582.6     115   582.2     125    582.4     135    582.3     145
GR 582.3     155    582.3     160   582.3     165    582.6     175    583.1     185
GR 584.0     195    585.5     205   588.6     220    590.0     250    600.0     300
EJ
T1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       50 YEAR FLOOD
T3       VAN ETTEN CREEK
J1   -10       3                      .0009
J2     2                 -1
T1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       100 YEAR FLOOD
T3       VAN ETTEN CREEK
J1   -10       4                      .0009
J2     3       1         -1
T1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       500 YEAR FLOOD
T3       VAN ETTEN CREEK
J1   -10       5                      .0009
J2    15                 -1
ER
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00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Van Etten Creek

4) DOCUMENT TYPE: Input data 100yr natural

00BREAK00

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C
C     41
C   .001        A     100' D.S. OF THE MOUTH OF THE VAN ETTEN CREEK
C   .303        B     SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER
C   .303              SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
C   .511        C     SECTION ENCROACHED TO BANK STATIONS TO RAISE WATER
C   .511              SURFACE WITHIN ALLOWABLE LIMIT OF .1FT
C   .889              MANUFACTURED SECTION-CHANNEL BASED ON SECTION D WITH
C   .889              ADJUSTMENT TO INVERT:    OVERBANKS MADE UP BASED ON
C   .889              CONTOUR MAP
C  1.059        D     ENCROACHED TO STA.200 TO CUT OFF LOW SPOT IN LEFT OVER-
C  1.059              BANK AND THEN ENCROACHED FURTHER TO RAISE WATER SURFACE
C  1.059              WITHIN THE ALLOWABLE LIMIT OF .1FT.-HWM AT AUSABLE GOLF
C  1.059              CLUB 587.83, DATE UNKNOWN, DISCHARGE UNKNOWN
C  1.059              HWM 585.15 JULY, 1976 DISCHARGE UNKNOWN
C  1.295              50FT. D.S. FROM F-41 BRIDGE-DUPLICATE OF SECTION F
C  1.295              ENCROACHED FOR EXPANSION OF FLOW THROUGH BRIDGE
C  1.305        E     F-41 (M-171) BRIDGE-NO BRIDGE SKEW
C  1.314              DUPLICATE OF SECTION F-ENCROACHED FOR CONTRACTION OF
C  1.314              FLOW THROUGH BRIDGE
C  1.319        F     50FT. U.S. OF THE F-41 BRIDGE
C  1.603              MANUFACTURED SECTION-CHANNEL BASED ON SECTION G WITH
C  1.603              ADJUSTMENT TO INVERT:    OVERBANKS MADE UP BASED ON
C  1.603              CONTOUR MAP-ENCROACHED AT BANK STATIONS TO RAISE
C  1.603              WATER SURFACE WITHIN ALLOWABLE LIMIT OF .1FT.
C  1.868        G     SECTION ENCROACHED TO RAISE WATER SURFACE WITHIN
C  1.868              ALLOWABLE LIMIT OF .1FT.
C  2.246        H     50FT. D.S. OF THE D&M RAILROAD BRIDGE-ENCROACHED
C  2.246              FOR THE EXPANSION OF FLOW THROUGH BRIDGE
C  2.252              REPEAT OF SECTION H-ENCROACHED FOR THE EXPANSION OF
C  2.252              FLOW THROUGH BRIDGE
C  2.255        I     D&M RAILROAD BRIDGE-NO BRIDGE SKEW
C  2.261              REPEAT OF SECTION H-ENCROACHED FOR CONTRACTION OF FLOW
C  2.261              THROUGH BRIDGE
C  2.558              MANUFACTURED SECTION-CHANNEL BASED ON SECTION J WITH
C  2.558              INVERT ADJUSTMENT:    OVERBANKS BASED ON CONTOUR MAP.
C  2.558              LEFT OVERBANK ENCROACHED TO RAISE WATER SURFACE WITHIN
C  2.558              ALLOWABLE .1FT LIMIT
C  2.749        J     100FT. D.S. OF THE VAN ETTEN LAKE DAM-ENCROACHED FOR
C  2.749              THE EXPANSION OF FLOW THROUGH OUTLET OF DAM
C  2.775        K     VAN ETTEN LAKE DAM-HWM, 592.85, SPRING, 1950, DISCHARGE
C  2.775              UNKNOWN;HWM 589.87, D.S. SIDE OF DAM, JULY, 1976
C  2.775              DISCHARGE UNKNOWN
T1       OSCODA TOWNSHIP  J&A FILE NO. 5555-48-1 RONALD KOWALSKI,PROJECT MNGR.
T2       100 YEAR FLOOD
T3       VAN ETTEN CREEK
J1   -10      4                  .0009
J2    -1                -1
J3     1     10     11     12     14      8      4
NC   .07    .06   .035     .3     .5
QT     4   1290   1770   2050   2450
X1  .001     44    210    648
X3                          0            350
GR 596.0      0  589.7     35  586.6    110  585.8    210  581.4    215
GR 578.1    230  577.6    250  577.9    270  578.5    290  578.0    310
GR 579.2    330  580.2    350  579.9    370  580.1    390  579.9    410
GR 579.9    430  579.7    450  579.4    470  579.1    490  578.5    510
GR 578.2    530  577.5    550  576.9    570  575.3    590  573.6    600
GR 572.2    610  573.3    620  578.4    630  581.5    640  587.3    648
GR 585.2    710  584.6    810  584.0    840  588.8    910  590.5    940
GR 589.8   1010  589.1   1110  589.2   1210  589.5   1310  589.4   1410
GR 589.3   1510  590.1   1600  587.8   1610  595.3   1630
NC   .09    .09   .035
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Natural Run ?

Flow encroached to channel

X3				1190		1340				
GR	595.6	0	587.5	24	586.2	90	586.8	190	588.8	290
GR	589.6	390	591.1	490	591.3	590	589.8	690	589.8	790
GR	591.1	890	591.5	990	587.2	1050	587.5	1090	589.3	1190
GR	581.8	1199	579.9	1205	578.7	1210	577.5	1220	577.9	1230
GR	578.4	1240	578.7	1250	579.1	1260	579.8	1270	580.1	1280
GR	579.8	1290	579.9	1295	581.8	1301	582.8	1302	586.3	1340
GR	583.8	1390	583.9	1490	587.6	1590	589.1	1690	586.7	1790
GR	589.4	1890	589.0	1990	587.9	2090	588.2	2190	589.5	2290
GR	590.4	2390	590.4	2490	590.0	2590	589.6	2690		
X1	.511	33	720	823	1100	1100	1100			
X3				670		920				
GR	593.9	0	587.7	33	586.4	120	587.6	220	588.4	320
GR	588.3	420	588.2	520	586.4	620	587.3	670	584.5	720
GR	580.3	724	578.8	730	577.3	740	577.7	750	578.6	760
GR	579.9	770	580.0	780	580.7	790	580.5	800	580.6	810
GR	581.9	818	584.9	823	586.9	920	585.1	1020	584.7	1120
GR	584.2	1220	584.3	1320	585.6	1420	587.2	1520	586.4	1620
GR	586.4	1720	587.6	1820	591.3	1920				
NC	.09	.07	.04							
X1	.889	13	255	335	2100	1550	2000			
GR	600.0	0	590.0	200	586.2	255	582.0	260	581.4	265
GR	580.6	275	579.9	285	578.6	295	576.5	305	577.4	315
GR	580.0	320	581.1	326	591.0	335				
NC	.09	.09								
X1	1.059	28	255	335	900	900	900			
X3				200		335				
GR	590.7	0	587.3	15	587.8	55	587.0	155	586.2	255
GR	582.0	260	581.4	265	580.6	275	579.9	285	578.6	295
GR	576.0	305	577.4	315	580.0	320	581.1	326	591.0	335
GR	591.0	355	588.5	455	591.1	535	587.9	555	587.4	655
GR	589.3	720	585.0	745	583.7	755	584.2	775	586.7	785
GR	587.0	855	588.2	955	590.7	1055				
NC	.07	.07								
X1	1.295	30	890	970	1200	1300	1250			
X3				875		984.4				
GR	596.8	0	588.5	27	588.5	90	587.7	190	588.6	290
GR	589.4	390	590.8	490	591.2	590	589.5	690	591.0	790
GR	586.3	890	582.9	898	581.7	900	579.2	910	578.3	920
GR	577.4	930	578.2	940	580.8	950	582.9	955	587.0	970
GR	586.3	990	586.0	1040	589.0	1090	589.6	1190	593.6	1260
GR	593.0	1290	594.0	1390	594.8	1490	593.8	1555	599.9	1578
X1	1.304	48	1000	1084.4	49	49	49			
X3	10									
GR	598.3	0	596.0	100	593.7	200	592.5	300	592.2	400
GR	591.8	500	592.0	600	592.3	700	593.3	800	593.8	900
GR	594.4	1000	585.7	1000	585.7	1001	585.7	1002	585.7	1004
GR	585.6	1006	585.6	1008	585.6	1010	585.2	1012.5	584.9	1014.4
GR	584.0	1020	582.4	1024.4	580.3	1030	580.0	1034.4	579.6	1040
GR	579.3	1044.4	579.0	1050	578.3	1054.4	577.5	1060	577.6	1064.4
GR	577.7	1070	578.2	1071.9	578.9	1074.4	579.4	1076.4	580.0	1078.4
GR	580.4	1080.0	580.5	1080.4	581.1	1082.4	581.4	1083.4	581.7	1084.4
GR	594.4	1084.4	594.3	1100	594.1	1200	593.9	1300	594.8	1400
GR	597.0	1500	599.0	1600	599.8	1713				
NC	.025	.025	.03							
X1	1.305				1	1	1			
X3	10							594.4	594.4	
BT	49	0.0	598.3	0.0	100.0	596.0	0.0	200.0	593.7	0.0
BT	300.0	592.5	0.0	400.0	592.2	0.0	500.0	591.8	0.0	600.0
BT	592.0	0.0	700.0	592.3	0.0	800.0	593.3	0.0	900.0	593.8
BT	0.0	1000.0	594.4	0.0	1000.0	598.5	586.2	1001.0	598.6	587.7
BT	1002.0	598.7	588.5	1004.0	599.0	589.4	1006.0	599.4	590.0	1008.0
BT	599.8	590.4	1010.0	600.2	590.6	1012.5	600.8	590.7	1012.5	600.8
BT	591.2	1014.4	601.4	591.2	1020.0	602.4	591.2	1024.4	603.4	591.2
BT	1030.0	604.4	591.2	1034.4	605.0	591.2	1040.0	605.4	591.2	1044.4

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BT 591.2  1064.4   602.4   591.2  1070.0   601.4   591.2  1071.9   600.8   591.2
BT1071.9   600.8   590.7  1074.4   600.2   590.6  1076.4   599.8   590.4  1078.4
BT 599.4   590.0  1080.4   599.0   589.4  1082.4   598.7   588.5  1083.4   598.6
BT 587.7  1084.4   598.5   586.2  1084.4   594.4     0.0  1100.0   594.3     0.0
BT1200.0   594.1     0.0  1300.0   593.9     0.0  1400.0   594.8     0.0  1500.0
BT 597.0     0.0  1600.0   599.0     0.0  1713.0   599.8     0.0
X1 1.310                            28      28      28
X2                                                   1
X3    10                                                   594.4   594.4
NC   .05     .05     .04
X1 1.311                             1       1       1
X3    10
NC    .1      .1    .045
X1 1.314      30     890     970     15      15      15
X3                         871.8           988.2
GR 596.8       0   588.5      27  588.5      90   587.7     190   588.6     290
GR 589.4     390   590.8     490  591.2     590   589.5     690   591.0     790
GR 586.3     890   582.9     898  581.7     900   579.2     910   578.3     920
GR 577.3     930   578.2     940  580.8     950   582.9     955   587.0     970
GR 586.3     990   586.0    1040  589.0    1090   589.6    1190   593.6    1260
GR 593.0    1290   594.0    1390  594.8    1490   593.8    1555   599.9    1578
X1 1.319                            34      34      34
X3                         837.8          1022.2
X1 1.603      14     305     388    1500    1500    1500
GR 595.0       0   592.9     100  590.3     200   588.8     305   582.3     313
GR 581.8     315   580.4     320  578.6     325   579.1     330   581.1     340
GR 582.8     350   584.5     375  587.2     388   600.0     450
NC   .07      .1    .045
X1 1.868      16       0      95    1400    1400    1400
GR 594.1       0   587.9      12  585.2      25   583.5      50   581.8      60
GR 579.8      70   579.3      75  580.4      80   581.8      85   582.3      87
GR 588.8      95   590.3     200  592.9     300   595.0     400   597.5     500
GR 599.5     600
NC    .1      .1
X1 2.246      16       0     101    2000    2000    2000
X3                           6             118
GR 595.2       0   584.8      23  581.9      25   582.8      33   582.4      43
GR 582.7      53   581.9      63  581.8      73   581.5      83   582.0      89
GR 582.8      91   591.7     101  591.5     123   590.5     223   592.4     323
GR 595.5     423
X1 2.252                            33      33      33
X3                           6             101
X1 2.255      18     100     187     16      16      16
GR 603.0       0   603.0    96.5  603.0    96.5   603.0     100   584.7     100
GR 582.7     110   582.1     120  581.4     130   580.5     140   581.4     150
GR 582.5     160   585.0     170  590.2     180   590.6     187   603.0     187
GR 603.0   190.5   603.0   190.5  603.0     300
NC  .045    .045     .03
X1 2.256                             1       1       1
BT    10       0   603.0     0.0   96.5   603.0     0.0    96.5   608.7   603.0
BT   100   608.7   603.0     100  608.7   599.9     187   608.7   599.9     187
BT 608.7   603.0   190.5   608.7  603.0   190.5   603.0     0.0     300   603.0
BT   0.0
X1 2.259                            18      18      18
X2                                                   1
NC    .1      .1    .045
X1 2.260                             1       1       1
X1 2.261      16             101       4       4       4
X3                           6             101
GR 595.2       0   584.8      23  581.9      25   582.8      33   582.4      43
GR 582.7      53   581.9      63  581.8      73   580.5      83   582.0      89
GR 582.8      91   591.7     101  591.5     123   590.5     223   592.4     323
GR 595.5     423
X1 2.558      15     305     388    1600    1600    1600
GR 595.0       0   592.9     100  590.3     200   588.8     305   582.3     313
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GR 583.5     350   585.2     375   587.9     388   594.1     450   600.0     500
X1 2.749      19      30     173     750    1150    1000
X3                           40             165
GR 596.3       0   589.1      30   585.8      35   581.5      42   582.3      50
GR 579.6      60   579.2      70   579.4      80   579.3      90   579.3     100
GR 579.3     110   579.6     120   580.1     130   581.0     140   582.5     150
GR 586.5     173   588.8     178   589.3     209   600.3     239
NC  .025    .025     .02
X1 2.775      16    50.5   100.5     185      85     135
GR 603.0       0   595.1      49   600.8      49   600.8    50.5   582.6    50.5
GR 582.6    74.5   582.6    74.5   582.6    76.5   582.6    76.5   582.6   100.5
GR 600.8   100.5   600.8     102   594.5     102   596.3     179   596.7     200
GR 602.4     266
X1 2.777      16    50.5   100.5      10      10      10
GR 603.0       0   595.1      49   600.8      49   600.8    50.5   582.6    50.5
GR 582.6    74.5   599.3    74.5   599.3    76.5   582.6    76.5   582.6   100.5
GR 600.8   100.5   600.8     102   594.5     102   596.3     179   596.7     200
GR 602.4     266
X1 2.778                        4       4       4
SB  1.05    1.51     3.0       50       2     504            582.6   582.6
X1 2.779                        7       7       7
X2                     1   593.1   600.8
BT    10     0.0   603.0     0.0    49.0   595.1     0.0    49.0   600.8     0.0
BT  50.5   600.8   593.1   100.5   600.8   593.1   102.0   600.8     0.0   102.0
BT 594.5     0.0   179.0   596.3     0.0   200.0   596.7     0.0   266.0   602.4
BT   0.0
X1 2.784       8    50.5     105      25      25      25
X3                           28             128
GR 603.0       0   588.9    50.5   582.6    50.5   582.6     105   588.9     105
GR 593.3     179   596.7     200   602.4     266
NC   .09     .09    .035
X1 2.803      20      80     250     100     100     100
GR 610.0       0   600.0      40   590.0      80   588.6      90   584.5      97
GR 585.3     105   582.6     115   582.2     125   582.4     135   582.3     145
GR 582.3     155   582.3     160   582.3     165   582.6     175   583.1     185
GR 584.0     195   585.5     205   588.6     220   590.0     250   600.0     300
EJ

ER
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00BREAK00

1) COUNTY: Iosco

2) STUDY NAME: Oscoda

3) WATERCOURSE: Van Etten Creek

4) DOCUMENT TYPE: Summary

00BREAK00

SUMMARY PRINTOUT FOR MULTIPLE PROFILES

VAN ETTEN CREEK

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
.00	0.00	0.00	0.00	577.60	1290.00	581.93	.12	0.00	0.00	1290.00	4.33	135.60
.00	0.00	0.00	0.00	577.60	1770.00	582.65	.16	0.00	0.00	1770.00	5.05	136.41
.00	0.00	0.00	0.00	577.60	2050.00	583.03	.18	0.00	0.00	2050.00	5.43	136.85
.00	0.00	0.00	0.00	577.60	2450.00	583.55	.20	0.00	0.00	2450.00	5.95	137.44
.30	1600.00	0.00	0.00	577.50	1290.00	583.29	.14	1.37	.01	1290.00	5.79	104.78
.30	1600.00	0.00	0.00	577.50	1770.00	584.05	.19	1.43	.02	1770.00	6.55	105.70
.30	1600.00	0.00	0.00	577.50	2050.00	584.46	.22	1.45	.02	2050.00	6.96	106.19
.30	1600.00	0.00	0.00	577.50	2450.00	585.00	.25	1.48	.03	2450.00	7.50	106.84
.51	1100.00	0.00	0.00	577.30	1290.00	584.11	.13	.81	.00	1290.00	6.81	101.32
.51	1100.00	0.00	0.00	577.30	1770.00	584.95	.17	.87	.01	1770.00	7.65	103.00
.51	1100.00	0.00	0.00	577.30	2050.00	585.39	.20	.90	.01	2050.00	8.09	103.00
.51	1100.00	0.00	0.00	577.30	2450.00	585.98	.23	.94	.01	2450.00	8.68	103.00
.89	2000.00	0.00	0.00	576.50	1290.00	585.49	.14	1.38	.01	1290.00	8.99	74.14
.89	2000.00	0.00	0.00	576.50	1770.00	586.48	.20	1.54	.01	1770.00	9.98	75.88
.89	2000.00	0.00	0.00	576.50	2050.00	586.99	.23	1.61	.02	2050.00	10.49	76.35
.89	2000.00	0.00	0.00	576.50	2450.00	587.66	.27	1.70	.02	2450.00	11.16	76.96
1.06	900.00	0.00	0.00	576.00	1290.00	586.06	.12	.54	.01	1290.00	10.06	75.35
1.06	900.00	0.00	0.00	576.00	1770.00	587.15	.16	.62	.01	1770.00	11.15	76.51
1.06	900.00	0.00	0.00	576.00	2050.00	587.71	.18	.66	.01	2050.00	11.71	77.01
1.06	900.00	0.00	0.00	576.00	2450.00	588.45	.22	.72	.02	2450.00	12.45	77.67
1.30	1250.00	0.00	0.00	577.40	1290.00	586.72	.12	.65	.00	1289.60	9.32	94.16
1.30	1250.00	0.00	0.00	577.40	1770.00	587.87	.15	.71	.00	1750.94	10.47	109.40
1.30	1250.00	0.00	0.00	577.40	2050.00	588.46	.17	.74	.00	2012.18	11.06	109.40
1.30	1250.00	0.00	0.00	577.40	2450.00	589.25	.19	.77	.01	2379.76	11.85	109.40
1.30	49.00	0.00	0.00	577.50	1290.00	586.76	.10	.03	.00	1290.00	9.26	84.40
1.30	49.00	0.00	0.00	577.50	1770.00	587.91	.14	.03	.00	1770.00	10.41	84.40
1.30	49.00	0.00	0.00	577.50	2050.00	588.50	.16	.03	.00	2050.00	11.00	84.40
1.30	49.00	0.00	0.00	577.50	2450.00	589.29	.18	.03	.00	2450.00	11.79	84.40
1.31	1.00	591.80	591.20	577.50	1290.00	586.76	.10	.00	.00	1290.00	9.26	84.40
1.31	1.00	591.80	591.20	577.50	1770.00	587.91	.14	.00	.00	1770.00	10.41	84.40
1.31	1.00	591.80	591.20	577.50	2050.00	588.50	.16	.00	.00	2050.00	11.00	84.40
1.31	1.00	591.80	591.20	577.50	2450.00	589.29	.19	.00	.00	2450.00	11.79	84.40
1.31	28.00	591.80	591.20	577.50	1290.00	586.77	.10	.01	.00	1290.00	9.27	84.40
1.31	28.00	591.80	591.20	577.50	1770.00	587.92	.14	.01	.00	1770.00	10.42	84.40
1.31	28.00	591.80	591.20	577.50	2050.00	588.51	.16	.01	.00	2050.00	11.01	84.40
1.31	28.00	591.80	591.20	577.50	2450.00	589.30	.19	.01	.00	2450.00	11.80	84.40
1.31	1.00	0.00	0.00	577.50	1290.00	586.77	.10	.00	.00	1290.00	9.27	84.40
1.31	1.00	0.00	0.00	577.50	1770.00	587.93	.14	.00	.00	1770.00	10.43	84.40
1.31	1.00	0.00	0.00	577.50	2050.00	588.52	.16	.00	.00	2050.00	11.02	84.40
1.31	1.00	0.00	0.00	577.50	2450.00	589.30	.18	.00	.00	2450.00	11.80	84.40

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
1.31	15.00	0.00	0.00	577.30	1290.00	586.77	.11	.01	.01	1289.35	9.47	100.76
1.31	15.00	0.00	0.00	577.30	1770.00	587.93	.15	.01	.00	1750.42	10.63	116.40
1.31	15.00	0.00	0.00	577.30	2050.00	588.52	.16	.01	.00	2011.94	11.22	116.40
1.31	15.00	0.00	0.00	577.30	2450.00	589.31	.19	.01	.00	2380.28	12.01	116.40
1.32	34.00	0.00	0.00	577.30	1290.00	586.80	.11	.02	.00	1284.16	9.50	135.82
1.32	34.00	0.00	0.00	577.30	1770.00	587.96	.14	.02	.00	1717.85	10.66	167.42
1.32	34.00	0.00	0.00	577.30	2050.00	588.56	.15	.02	.00	1955.61	11.26	180.38
1.32	34.00	0.00	0.00	577.30	2450.00	589.37	.16	.02	.01	2277.08	12.07	184.40
1.60	1500.00	0.00	0.00	578.60	1290.00	587.96	.14	1.18	.01	1290.00	9.36	81.96
1.60	1500.00	0.00	0.00	578.60	1770.00	589.12	.18	1.18	.02	1770.00	10.52	83.00
1.60	1500.00	0.00	0.00	578.60	2050.00	589.71	.20	1.17	.03	2050.00	11.11	83.00
1.60	1500.00	0.00	0.00	578.60	2450.00	590.50	.23	1.17	.03	2450.00	11.90	83.00
1.87	1400.00	0.00	0.00	579.30	1290.00	589.15	.11	1.15	.01	1289.48	9.85	109.74
1.87	1400.00	0.00	0.00	579.30	1770.00	590.32	.14	1.15	.01	1744.66	11.02	137.69
1.87	1400.00	0.00	0.00	579.30	2050.00	590.93	.15	1.16	.01	1999.03	11.63	138.87
1.87	1400.00	0.00	0.00	579.30	2450.00	591.74	.16	1.16	.02	2354.91	12.44	140.44
2.25	2000.00	0.00	0.00	581.50	1290.00	590.16	.07	.96	.01	1290.00	8.66	88.11
2.25	2000.00	0.00	0.00	581.50	1770.00	591.41	.09	1.04	.01	1770.00	9.91	92.30
2.25	2000.00	0.00	0.00	581.50	2050.00	592.05	.11	1.07	.01	2048.74	10.55	111.03
2.25	2000.00	0.00	0.00	581.50	2450.00	592.88	.13	1.09	.01	2442.20	11.38	112.00
2.25	33.00	0.00	0.00	581.50	1290.00	590.17	.07	.01	.00	1290.00	8.67	88.17
2.25	33.00	0.00	0.00	581.50	1770.00	591.43	.09	.01	.00	1770.00	9.93	92.36
2.25	33.00	0.00	0.00	581.50	2050.00	592.07	.11	.01	.00	2050.00	10.57	94.07
2.25	33.00	0.00	0.00	581.50	2450.00	592.90	.13	.01	.00	2450.00	11.40	95.00
2.26	16.00	0.00	0.00	580.50	1290.00	590.18	.08	.01	.00	1290.00	9.68	79.96
2.26	16.00	0.00	0.00	580.50	1770.00	591.43	.10	.01	.00	1770.00	10.93	87.00
2.26	16.00	0.00	0.00	580.50	2050.00	592.07	.12	.01	.00	2050.00	11.57	87.00
2.26	16.00	0.00	0.00	580.50	2450.00	592.90	.14	.01	.01	2450.00	12.40	87.00
2.26	1.00	603.00	603.00	580.50	1290.00	590.18	.08	.00	.00	1290.00	9.68	79.96
2.26	1.00	603.00	603.00	580.50	1770.00	591.43	.10	.00	.00	1770.00	10.93	87.00
2.26	1.00	603.00	603.00	580.50	2050.00	592.07	.12	.00	.00	2050.00	11.57	87.00
2.26	1.00	603.00	603.00	580.50	2450.00	592.90	.14	.00	.00	2450.00	12.40	87.00
2.26	18.00	603.00	603.00	580.50	1290.00	590.18	.08	.00	.00	1290.00	9.68	79.97
2.26	18.00	603.00	603.00	580.50	1770.00	591.43	.10	.00	.00	1770.00	10.93	87.00
2.26	18.00	603.00	603.00	580.50	2050.00	592.07	.12	.00	.00	2050.00	11.57	87.00
2.26	18.00	603.00	603.00	580.50	2450.00	592.91	.14	.00	.00	2450.00	12.41	87.00
2.26	1.00	0.00	0.00	580.50	1290.00	590.18	.08	.00	.00	1290.00	9.68	79.97
2.26	1.00	0.00	0.00	580.50	1770.00	591.43	.10	.00	.00	1770.00	10.93	87.00
2.26	1.00	0.00	0.00	580.50	2050.00	592.07	.12	.00	.00	2050.00	11.57	87.00
2.26	1.00	0.00	0.00	580.50	2450.00	592.91	.14	.00	.00	2450.00	12.41	87.00

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	HV	HL	OLOSS	QCH	DEPTH	TOPWID
2.26	4.00	0.00	0.00	580.50	1290.00	590.19	.07	.00	.00	1290.00	9.69	88.21
2.26	4.00	0.00	0.00	580.50	1770.00	591.45	.09	.00	.00	1770.00	10.95	92.41
2.26	4.00	0.00	0.00	580.50	2050.00	592.09	.11	.00	.00	2050.00	11.59	94.11
2.26	4.00	0.00	0.00	580.50	2450.00	592.93	.12	.00	.00	2450.00	12.43	95.00
2.56	1600.00	0.00	0.00	580.00	1290.00	590.70	.06	.50	.00	1244.25	10.70	215.95
2.56	1600.00	0.00	0.00	580.00	1770.00	592.00	.07	.53	.01	1619.11	12.00	228.97
2.56	1600.00	0.00	0.00	580.00	2050.00	592.66	.08	.54	.01	1825.79	12.66	235.61
2.56	1600.00	0.00	0.00	580.00	2450.00	593.53	.09	.55	.01	2111.03	13.53	244.28
2.75	1000.00	0.00	0.00	579.20	1290.00	590.85	.02	.10	.01	1290.00	11.65	125.00
2.75	1000.00	0.00	0.00	579.20	1770.00	592.18	.02	.11	.02	1770.00	12.98	125.00
2.75	1000.00	0.00	0.00	579.20	2050.00	592.85	.03	.12	.02	2050.00	13.65	125.00
2.75	1000.00	0.00	0.00	579.20	2450.00	593.73	.03	.13	.02	2450.00	14.53	125.00
2.78	135.00	0.00	0.00	582.60	1290.00	590.80	.15	.01	.07	1290.00	8.20	50.00
2.78	135.00	0.00	0.00	582.60	1770.00	592.09	.22	.01	.10	1770.00	9.49	50.00
2.78	135.00	0.00	0.00	582.60	2050.00	592.75	.25	.02	.11	2050.00	10.15	50.00
2.78	135.00	0.00	0.00	582.60	2450.00	593.61	.31	.02	.14	2450.00	11.01	50.00
2.78	10.00	0.00	0.00	582.60	1290.00	590.79	.17	.00	.01	1290.00	8.19	48.00
2.78	10.00	0.00	0.00	582.60	1770.00	592.09	.23	.00	.01	1770.00	9.49	48.00
2.78	10.00	0.00	0.00	582.60	2050.00	592.75	.27	.00	.01	2050.00	10.15	48.00
2.78	10.00	0.00	0.00	582.60	2450.00	593.60	.33	.00	.01	2450.00	11.00	48.00
2.78	4.00	0.00	0.00	582.60	1290.00	590.79	.17	.00	.00	1290.00	8.19	48.00
2.78	4.00	0.00	0.00	582.60	1770.00	592.09	.23	.00	.00	1770.00	9.49	48.00
2.78	4.00	0.00	0.00	582.60	2050.00	592.75	.27	.00	.00	2050.00	10.15	48.00
2.78	4.00	0.00	0.00	582.60	2450.00	593.60	.33	.00	.00	2450.00	11.00	48.00
2.78	7.00	600.80	593.10	582.60	1290.00	590.80	.17	.01	0.00	1290.00	8.20	48.00
2.78	7.00	600.80	593.10	582.60	1770.00	592.10	.23	.01	0.00	1770.00	9.50	48.00
2.78	7.00	600.80	593.10	582.60	2050.00	592.76	.27	.02	0.00	2050.00	10.16	48.00
2.78	7.00	600.80	593.10	582.60	2450.00	593.83	.32	.22	0.00	2450.00	11.23	48.00
2.78	25.00	0.00	0.00	582.60	1290.00	590.87	.12	.00	.01	1263.85	8.27	84.54
2.78	25.00	0.00	0.00	582.60	1770.00	592.21	.15	.00	.02	1677.62	9.61	89.37
2.78	25.00	0.00	0.00	582.60	2050.00	592.90	.17	.00	.03	1908.65	10.30	91.84
2.78	25.00	0.00	0.00	582.60	2450.00	594.02	.18	.00	.04	2217.15	11.42	95.83
2.80	100.00	0.00	0.00	582.20	1290.00	591.00	.03	.01	.03	1289.58	8.80	179.00
2.80	100.00	0.00	0.00	582.20	1770.00	592.38	.03	.01	.04	1765.87	10.18	191.42
2.80	100.00	0.00	0.00	582.20	2050.00	593.09	.03	.01	.04	2041.79	10.89	197.81
2.80	100.00	0.00	0.00	582.20	2450.00	594.22	.04	.01	.04	2431.99	12.02	207.95

SECTION NUMBER	DISCHARGE CFS	CWSEL	CWSEL DIFF EACH Q	CWSEL DIFF EACH SECTION	CWSEL-WSELK	TOPWID	T.W. DIFF	LENGTH
.001	1290.000	581.926	0.000	0.000	0.000	135.597	0.000	-0.000
.001	1770.000	582.645	.719	0.000	0.000	136.414	-.818	-0.000
.001	2050.000	583.031	.385	0.000	0.000	136.852	-1.255	-0.000
.001	2450.000	583.548	.517	0.000	0.000	137.440	-1.843	-0.000
.303	1290.000	583.286	0.000	1.360	0.000	104.782	0.000	1600.000
.303	1770.000	584.055	.768	1.409	0.000	105.704	-.922	1600.000
.303	2050.000	584.460	.405	1.429	0.000	106.195	-1.413	1600.000
.303	2450.000	585.003	.544	1.455	0.000	106.836	-2.053	1600.000
.511	1290.000	584.114	0.000	.828	0.000	101.322	0.000	1100.000
.511	1770.000	584.954	.840	.899	0.000	102.999	-1.677	1100.000
.511	2050.000	585.391	.437	.932	0.000	102.999	-1.677	1100.000
.511	2450.000	585.979	.587	.975	0.000	102.999	-1.677	1100.000

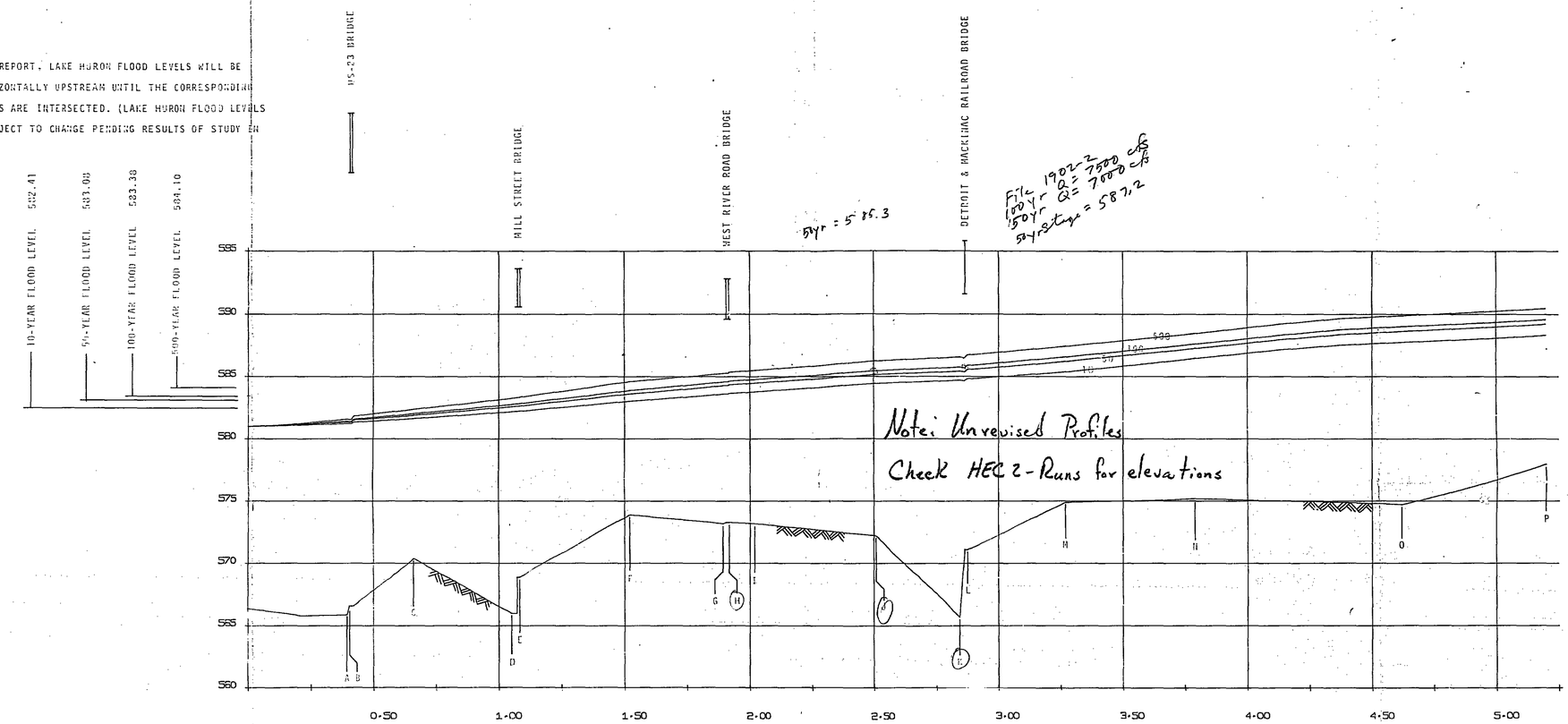
.889	1290.000	585.485	0.000	1.371	0.000	74.136	0.000	2000.000
.889	1770.000	586.478	.992	1.524	0.000	75.883	-1.747	2000.000
.889	2050.000	586.986	.508	1.594	0.000	76.350	-2.214	2000.000
.889	2450.000	587.661	.675	1.682	0.000	76.964	-2.828	2000.000
1.059	1290.000	586.064	0.000	.579	0.000	75.351	0.000	900.000
1.059	1770.000	587.149	1.085	.672	0.000	76.506	-1.155	900.000
1.059	2050.000	587.706	.556	.720	0.000	77.012	-1.661	900.000
1.059	2450.000	588.445	.739	.784	0.000	77.671	-2.320	900.000
1.295	1290.000	586.718	0.000	.654	0.000	94.161	0.000	1250.000
1.295	1770.000	587.871	1.154	.722	0.000	109.399	-15.238	1250.000
1.295	2050.000	588.464	.593	.758	0.000	109.399	-15.238	1250.000
1.295	2450.000	589.253	.789	.807	0.000	109.399	-15.238	1250.000
1.304	1290.000	586.760	0.000	.043	0.000	84.400	0.000	49.000
1.304	1770.000	587.914	1.154	.043	0.000	84.400	0.000	49.000
1.304	2050.000	588.505	.590	.041	0.000	84.400	0.000	49.000
1.304	2450.000	589.288	.784	.036	0.000	84.400	0.000	49.000
1.305	1290.000	586.761	0.000	.000	0.000	84.400	0.000	1.000
1.305	1770.000	587.914	1.154	-.000	0.000	84.400	0.000	1.000
1.305	2050.000	588.504	.590	-.001	0.000	84.400	0.000	1.000
1.305	2450.000	589.286	.782	-.002	0.000	84.400	0.000	1.000
1.310	1290.000	586.769	0.000	.009	0.000	84.400	0.000	28.000
1.310	1770.000	587.924	1.155	.010	0.000	84.400	0.000	28.000
1.310	2050.000	588.514	.591	.010	0.000	84.400	0.000	28.000
1.310	2450.000	589.298	.783	.011	0.000	84.400	0.000	28.000
1.311	1290.000	586.770	0.000	.001	0.000	84.400	0.000	1.000
1.311	1770.000	587.926	1.156	.002	0.000	84.400	0.000	1.000
1.311	2050.000	588.517	.592	.003	0.000	84.400	0.000	1.000
1.311	2450.000	589.304	.787	.006	0.000	84.400	0.000	1.000
1.314	1290.000	586.773	0.000	.003	0.000	100.762	0.000	15.000
1.314	1770.000	587.930	1.157	.004	0.000	116.399	-15.637	15.000
1.314	2050.000	588.523	.593	.006	0.000	116.399	-15.637	15.000
1.314	2450.000	589.312	.789	.008	0.000	116.399	-15.637	15.000
1.319	1290.000	586.798	0.000	.025	0.000	135.817	0.000	34.000
1.319	1770.000	587.964	1.166	.034	0.000	167.416	-31.599	34.000
1.319	2050.000	588.565	.601	.042	0.000	180.384	-44.567	34.000
1.319	2450.000	589.367	.802	.055	0.000	184.399	-48.582	34.000
1.603	1290.000	587.960	0.000	1.162	0.000	81.965	0.000	1500.000
1.603	1770.000	589.120	1.160	1.156	0.000	82.999	-1.034	1500.000
1.603	2050.000	589.713	.592	1.148	0.000	82.999	-1.034	1500.000
1.603	2450.000	590.500	.787	1.133	0.000	82.999	-1.034	1500.000
1.868	1290.000	589.148	0.000	1.187	0.000	109.741	0.000	1400.000
1.868	1770.000	590.324	1.176	1.203	0.000	137.690	-27.949	1400.000
1.868	2050.000	590.933	.609	1.220	0.000	138.869	-29.128	1400.000
1.868	2450.000	591.744	.812	1.244	0.000	140.440	-30.698	1400.000
2.246	1290.000	590.161	0.000	1.014	0.000	88.112	0.000	2000.000
2.246	1770.000	591.414	1.253	1.090	0.000	92.304	-4.192	2000.000
2.246	2050.000	592.052	.638	1.119	0.000	111.033	-22.921	2000.000
2.246	2450.000	592.885	.833	1.140	0.000	111.999	-23.887	2000.000
2.252	1290.000	590.173	0.000	.012	0.000	88.168	0.000	33.000
2.252	1770.000	591.427	1.254	.014	0.000	92.363	-4.195	33.000
2.252	2050.000	592.066	.638	.014	0.000	94.074	-5.905	33.000
2.252	2450.000	592.899	.833	.014	0.000	94.999	-6.831	33.000

2.255	1290.000	590.176	0.000	.003	0.000	79.960	0.000	16.000
2.255	1770.000	591.431	1.254	.003	0.000	87.000	-7.040	16.000
2.255	2050.000	592.069	.638	.003	0.000	87.000	-7.040	16.000
2.255	2450.000	592.901	.832	.002	0.000	87.000	-7.040	16.000
2.256	1290.000	590.177	0.000	.000	0.000	79.961	0.000	1.000
2.256	1770.000	591.431	1.254	.000	0.000	87.000	-7.039	1.000
2.256	2050.000	592.069	.638	.000	0.000	87.000	-7.039	1.000
2.256	2450.000	592.901	.832	.000	0.000	87.000	-7.039	1.000
2.259	1290.000	590.180	0.000	.003	0.000	79.970	0.000	18.000
2.259	1770.000	591.434	1.255	.004	0.000	87.000	-7.030	18.000
2.259	2050.000	592.073	.638	.004	0.000	87.000	-7.030	18.000
2.259	2450.000	592.905	.832	.004	0.000	87.000	-7.030	18.000
2.260	1290.000	590.180	0.000	.000	0.000	79.970	0.000	1.000
2.260	1770.000	591.435	1.255	.000	0.000	87.000	-7.030	1.000
2.260	2050.000	592.073	.638	.000	0.000	87.000	-7.030	1.000
2.260	2450.000	592.906	.832	.000	0.000	87.000	-7.030	1.000
2.261	1290.000	590.190	0.000	.010	0.000	88.208	0.000	4.000
2.261	1770.000	591.449	1.258	.014	0.000	92.409	-4.202	4.000
2.261	2050.000	592.089	.641	.016	0.000	94.106	-5.898	4.000
2.261	2450.000	592.926	.836	.020	0.000	94.999	-6.791	4.000
2.558	1290.000	590.696	0.000	.505	0.000	215.954	0.000	1600.000
2.558	1770.000	591.997	1.302	.549	0.000	228.972	-13.018	1600.000
2.558	2050.000	592.662	.664	.572	0.000	235.614	-19.660	1600.000
2.558	2450.000	593.528	.866	.602	0.000	244.275	-28.321	1600.000
2.749	1290.000	590.855	0.000	.159	0.000	124.999	0.000	1000.000
2.749	1770.000	592.177	1.323	.180	0.000	124.999	-.000	1000.000
2.749	2050.000	592.851	.674	.190	0.000	124.999	-.000	1000.000
2.749	2450.000	593.729	.877	.201	0.000	124.999	-.000	1000.000
2.775	1290.000	590.796	0.000	-.058	0.000	50.000	0.000	135.000
2.775	1770.000	592.094	1.298	-.083	0.000	50.000	0.000	135.000
2.775	2050.000	592.753	.659	-.098	0.000	50.000	0.000	135.000
2.775	2450.000	593.609	.856	-.119	0.000	50.000	0.000	135.000
2.777	1290.000	590.792	0.000	-.005	0.000	48.000	0.000	10.000
2.777	1770.000	592.088	1.296	-.007	0.000	48.000	0.000	10.000
2.777	2050.000	592.745	.658	-.008	0.000	48.000	0.000	10.000
2.777	2450.000	593.599	.854	-.010	0.000	48.000	0.000	10.000
2.778	1290.000	590.793	0.000	.001	0.000	48.000	0.000	4.000
2.778	1770.000	592.089	1.296	.001	0.000	48.000	0.000	4.000
2.778	2050.000	592.747	.658	.001	0.000	48.000	0.000	4.000
2.778	2450.000	593.601	.854	.002	0.000	48.000	0.000	4.000
2.779	1290.000	590.802	0.000	.009	0.000	48.000	0.000	7.000
2.779	1770.000	592.103	1.301	.014	0.000	48.000	0.000	7.000
2.779	2050.000	592.763	.661	.017	0.000	48.000	0.000	7.000
2.779	2450.000	593.834	1.071	.234	0.000	48.000	0.000	7.000
2.784	1290.000	590.867	0.000	.065	0.000	84.542	0.000	25.000
2.784	1770.000	592.213	1.347	.111	0.000	89.367	-4.824	25.000
2.784	2050.000	592.905	.691	.141	0.000	91.843	-7.301	25.000
2.784	2450.000	594.019	1.114	.185	0.000	95.833	-11.290	25.000
2.803	1290.000	590.999	0.000	.133	0.000	178.996	0.000	100.000
2.803	1770.000	592.380	1.381	.167	0.000	191.425	-12.429	100.000
2.803	2050.000	593.090	.709	.185	0.000	197.807	-18.811	100.000
2.803	2450.000	594.216	1.126	.197	0.000	207.945	-28.949	100.000

DATA FOR LAST CROSS SECTION

PROFILE	TYPE ENC	TARGET	TOP WIDTH AREA-ACRES	TOP WIDTH AREA-DIFF.
1	0.000	0.000	36.699	0.000
2	0.000	0.000	39.422	2.723
3	0.000	0.000	40.437	3.739
4	0.000	0.000	40.967	4.268

NOTE: IN THE FINAL REPORT, LAKE HURON FLOOD LEVELS WILL BE EXTENDED HORIZONTALLY UPSTREAM UNTIL THE CORRESPONDING RIVER PROFILES ARE INTERSECTED. (LAKE HURON FLOOD LEVELS SHOWN ARE SUBJECT TO CHANGE PENDING RESULTS OF STUDY IN PROGRESS.)



DRAWN:
DESIGN:
CHECKED:
DATE COMPLETED:
FINAL:
PRELIMINARY:

VERT. 1" = 5'
SCALE:
HORIZ. 1" = .25 MI

REVISIONS	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE

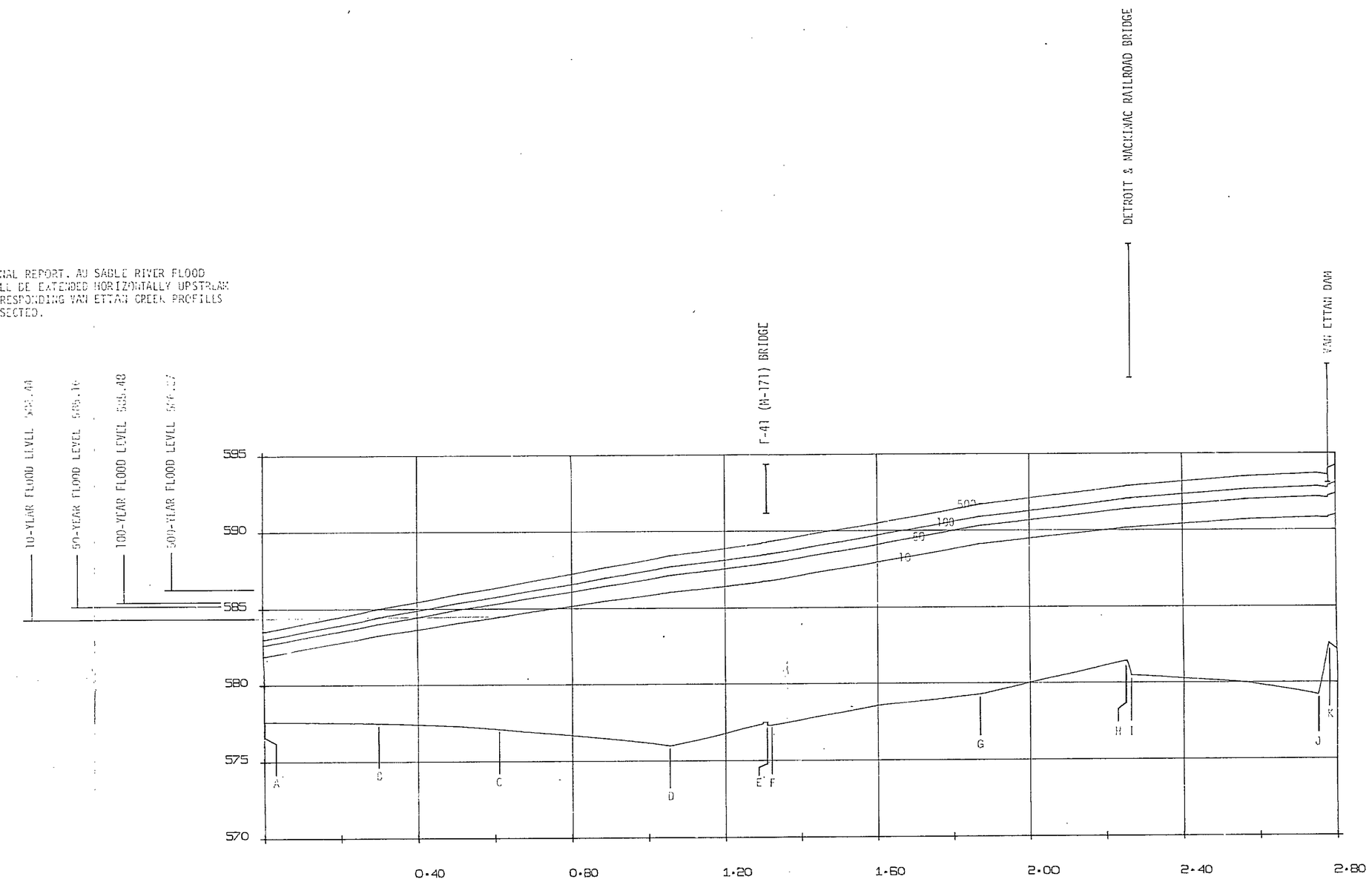
JOHNSON & ANDERSON, INC.
CONSULTING ENGINEERS
PONTIAC, MICHIGAN

OSCODA TOWNSHIP, MI, FIS

AU SABLE RIVER

JOB NO. 5555-48-1
DATE ISSUED
SHEET NO. 1 OF 1

NOTE: IN THE FINAL REPORT, AU SABLE RIVER FLOOD LEVELS WILL BE EXTENDED HORIZONTALLY UPSTREAM UNTIL CORRESPONDING VAN ETTAN CREEK PROFILES ARE INTERSECTED.



Job No.	Contr. No.	Cont. Tab No.	Type of Job No.	Sheet No. of No. of Sheets	As Built	Section	Civ No. in County	Twp. No. in County	Village No. in County	County No. or State	State	Construction Contract	Job Calc. No.
1 3 4 5 6	7 8 9	10 11 12	13 14	15 16 17 18 19 20 21 22 23	24	25 26	27 28 29	30 31 32	33 34 35	36 37 38	39 40 41	42 43 44	45 46 47 48 49	50	51 52 53	54 55 56

DRAWN:
DESIGN:
CHECKED:

FINAL:
DATE COMPLETED:
PRELIMINARY:

SCALE: VERT. 1" = 5'
HORIZ. 1" = .2 MI

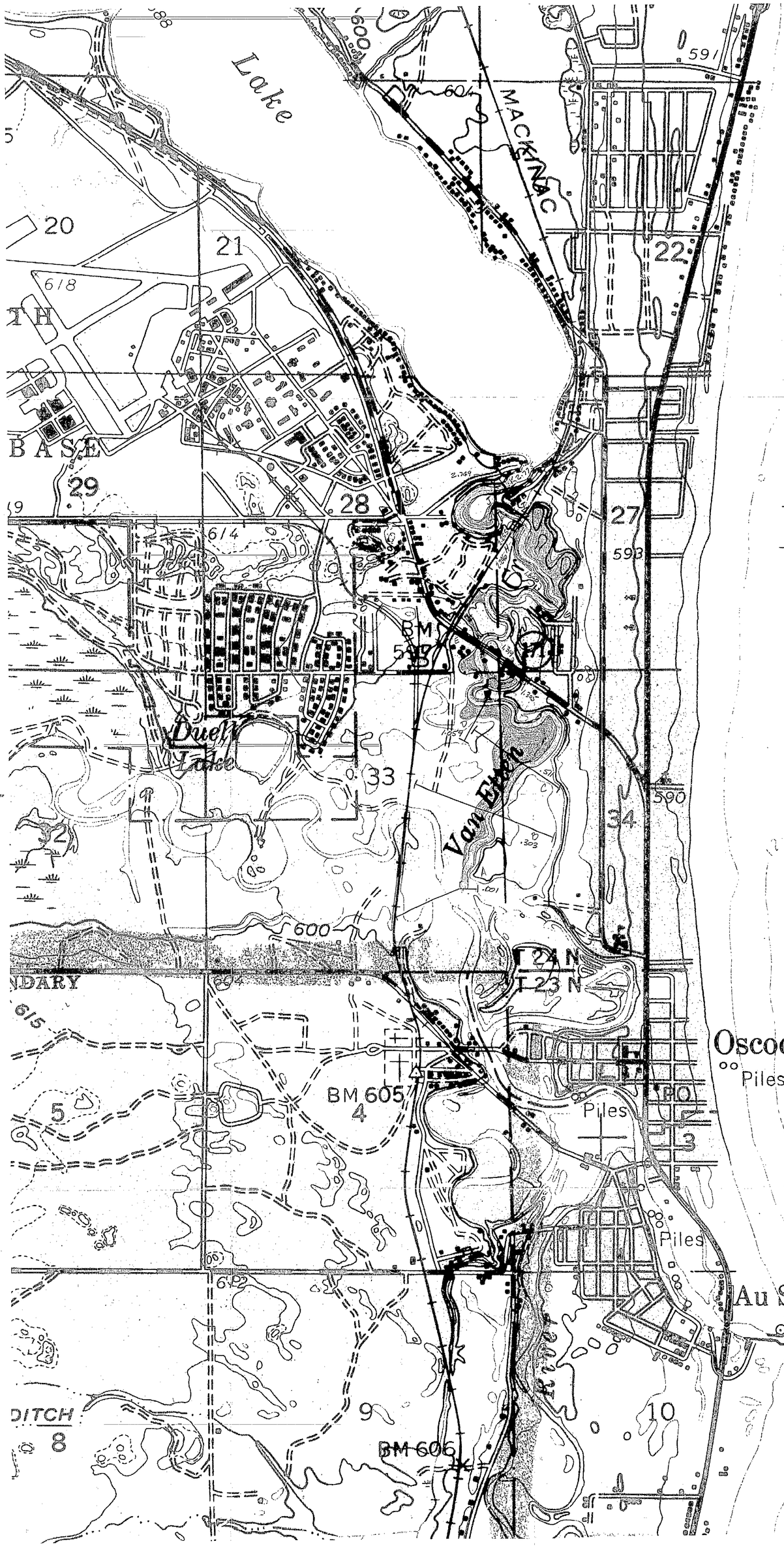
REVISIONS	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE	MARK	BULLETIN	DATE

JOHNSON & ANDERSON, INC.
CONSULTING ENGINEERS
PONTIAC, MICHIGAN

OSCODA TOWNSHIP, MI, FIS

VAN ETTAN CREEK

JOB NO. 5555-48-1
DATE ISSUED
SHEET NO. 1 OF 1



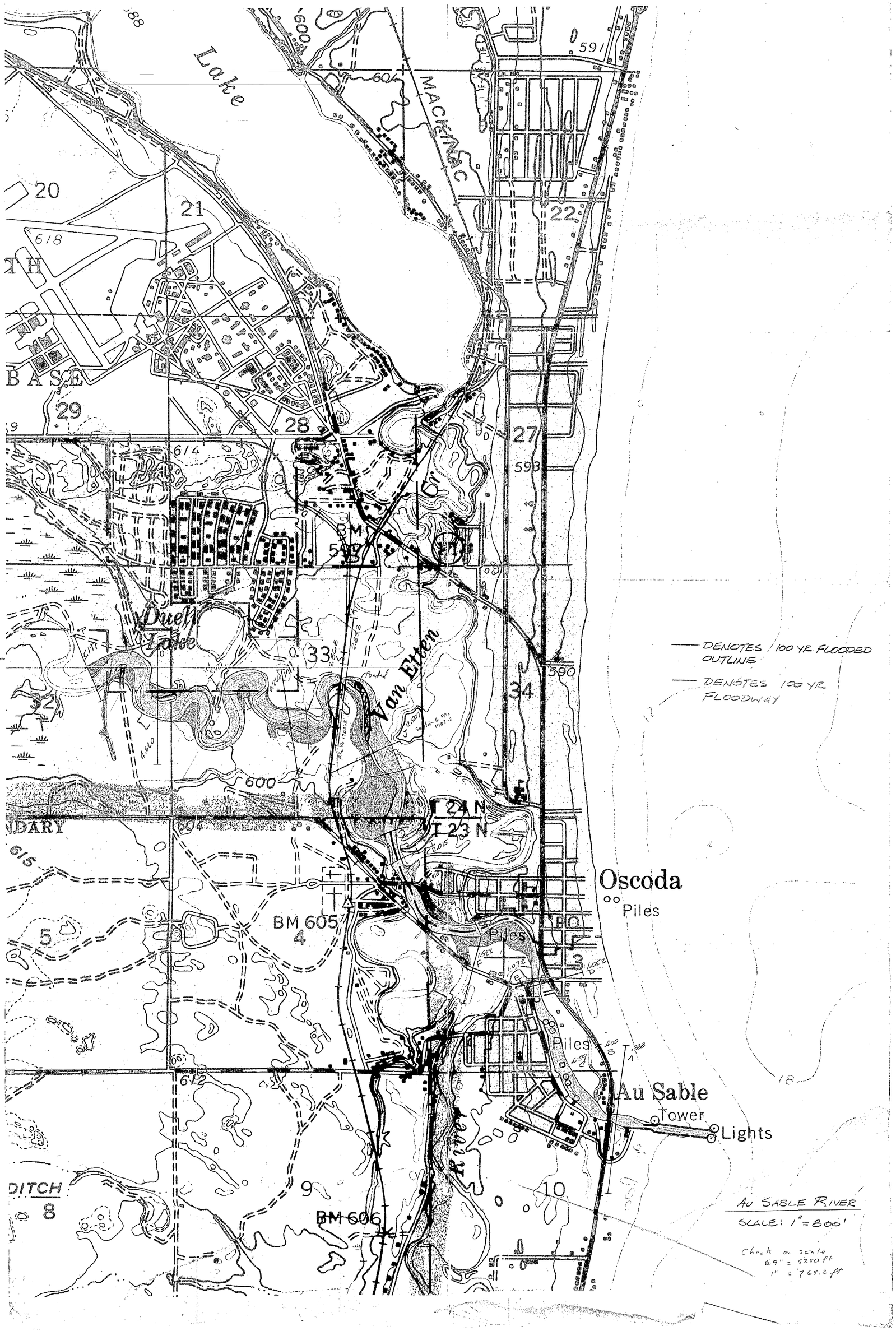
— DENOTES 100 YR. FLOODED OUTLINE

— DENOTES 100 YR. FLOODWAY

VAN ETTEN CREEK

SCALE: 1" = 800'

Check on scale
6.8" = 5280'
1" = 776.47 ft.


Lake
MACKINAC
BASE
Duell
Lake
Van Etten
Dr.
River
Oscoda
Piles
Piles
Piles
Au Sable
Tower
Lights
BM 605
BM 606
T 24 N
T 23 N
DITCH
BOUNDARY
DENOTES 100 YR FLOODED OUTLINE
DENOTES 100 YR FLOODWAY
AU SABLE RIVER
SCALE: 1" = 800'
Check on scale
6.9" = 5250 ft
1" = 765.2 ft