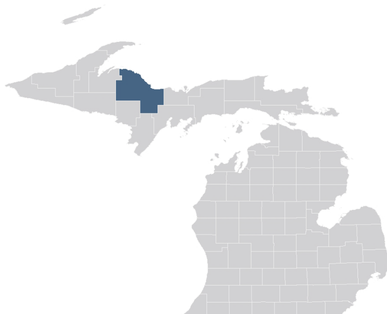
# FLOOD INSURANCE STUDY

## FEDERAL EMERGENCY MANAGEMENT AGENCY

**VOLUME 1 OF 1**



# MARQUETTE COUNTY, MICHIGAN

(ALL JURISDICTIONS)

| COMMUNITY NAME | NUMBER | COMMUNITY NAME | NUMBER |
|---|---|---|---|
| CHAMPION, TOWNSHIP OF | 261285 | NEGAUNEE, CITY OF | 261291 |
| CHOCOLAY, CHARTER TOWNSHIP OF | 260448 | NEGAUNEE, TOWNSHIP OF | 261225 |
| ELY, TOWNSHIP OF | 260449 | POWELL, TOWNSHIP OF | 260452 |
| EWING, TOWNSHIP OF* | 260957 | REPUBLIC, TOWNSHIP OF* | 260453 |
| FORSYTH, TOWNSHIP OF* | 260450 | RICHMOND, TOWNSHIP OF* | 261288 |
| HUMBOLDT, TOWNSHIP OF* | 261286 | SANDS, TOWNSHIP OF | 261284 |
| ISHPEMING, CITY OF | 260133 | SKANDIA, TOWNSHIP OF | 260987 |
| ISHPEMING, TOWNSHIP OF | 261390 | TILDEN, TOWNSHIP OF | 261287 |
| MARQUETTE, CHARTER TOWNSHIP OF | 260758 | TURIN, TOWNSHIP OF* | 261289 |
| MARQUETTE, CITY OF | 260716 | WELLS, TOWNSHIP OF* | 261290 |
| MICHIGAMME, TOWNSHIP OF* | 260451 | WEST BRANCH, TOWNSHIP OF | 260993 |

*No Special Flood Hazard Areas Identified

FEMA

REVISED PRELIMINARY

01/20/2023

REVISED:

**TO BE DETERMINED**

FLOOD INSURANCE STUDY NUMBER
26103CV000B
Version Number 2.5.3.6

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**Published Separately**

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**FLOOD INSURANCE STUDY REPORT**
**MARQUETTE COUNTY, MICHIGAN**

# SECTION 1.0 – INTRODUCTION

## 1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60, *Criteria for Land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

## 1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) Report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

## 1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Marquette County, Michigan.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC-8) sub-basins affecting each, are shown in Table 1. The FIRM panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

**Table 1: Listing of NFIP Jurisdictions**

| Community | CID | HUC-8 Sub - Basin(s) | Located on FIRM Panel(s) | If Not Included, Location of Flood Hazard Data |
|---|---|---|---|---|
| Champion, Township of | 261285 | 04020105, 04030107, 04030110 | 26103C0150E, 26103C0165E, 26103C0250D[2], 26103C0275E, 26103C0300D[2], 26103C0400D[2], 26103C0425E, 26103C0430E | |
| Chocolay, Charter Township of | 260448 | 04020201, 04020300 | 26103C0513E, 26103C0545E, 26103C0701E, 26103C0702E, 26103C0705D, 26103C0706E, 26103C0707E, 26103C0710D, 26103C0715D[2], 26103C0720D, 26103C0726E, 26103C0730E, 26103C0735E, 26103C0740D, 26103C0745D, 26103C0755E, 26103C0765E | |
| Ely, Township of | 260449 | 04020105, 04030110 | 26103C0425E, 26103C0430E, 26103C0440E, 26103C0625E, 26103C0626E, 26103C0638E, 26103C0650E[2], 26103C0850D, 26103C0875D[2], 26103C1075D, 26103C1100D[2] | |
| Ewing, Township of[1] | 260957 | 04030110, 04030111 | 26103C1150D[2], 26103C1175D[2], 26103C1200D[2], 26103C1275D[2], 26103C1300D[2], 26103C1325D[2], 26103C1400D[2], 26103C1425D[2] | |
| Forsyth, Township of[1] | 260450 | 04020201, 04030110, 04030111 | 26103C0900D[2], 26103C0925D[2], 26103C0950D[2], 26103C0975D[2], 26103C1125D[2], 26103C1150D[2], 26103C1175D[2], 26103C1200D[2] | |
| Humboldt, Township of[1] | 261286 | 04030107, 04030110 | 26103C0400D[2], 26103C0425E, 26103C0600D[2], 26103C0625E, 26103C0825D[2], 26103C0850D, 26103C1050D[2], 26103C1075D | |
| Ishpeming, City of | 260133 | 04020105, 04030110 | 26103C0440E, 26103C0445E, 26103C0627E, 26103C0631E, 26103C0650E[2] | |

[1] No Special Flood Hazard Areas Identified
[2] Panel Not Printed

## Table 1: Listing of NFIP Jurisdictions (continued)

| Community | CID | HUC-8 Sub - Basin(s) | Located on FIRM Panel(s) | If Not Included, Location of Flood Hazard Data |
|---|---|---|---|---|
| Ishpeming, Township of | 261390 | 04020105 | 26103C0165E, 26103C0170E, 26103C0300D[2], 26103C0315E[2], 26103C0430E, 26103C0435E, 26103C0440E, 26103C0445E, 26103C0455E, 26103C0626E, 26103C0627E | |
| Marquette, Charter Township of | 260758 | 04020105, 04020201, 04020300 | 26103C0315E[2], 26103C0320E, 26103C0340E, 26103C0455E, 26103C0460E, 26103C0480E, 26103C0485E, 26103C0490E, 26103C0495E, 26103C0700E | |
| Marquette, City of | 260716 | 04020105, 04020300 | 26103C0480E, 26103C0485E, 26103C0495E, 26103C0511E, 26103C0513E | |
| Michigamme, Township of[1] | 260451 | 04020105, 04030107, 04030110 | 26103C0100D[2], 26103C0125D[2], 26103C0150E, 26103C0225D[2], 26103C0250D[2], 26103C0275E, 26103C0375D[2], 26103C0400D[2] | |
| Negaunee, City of | 261291 | 04020105, 04030110 | 26103C0445E, 26103C0465E, 26103C0470E, 26103C0650E[2], 26103C0675E[2] | |
| Negaunee, Township of | 261225 | 04020105, 04030110 | 26103C0435E, 26103C0445E, 26103C0455E, 26103C0460E, 26103C0465E, 26103C0470E, 26103C0480E, 26103C0490E, 26103C0657E, 26103C0675E[2], 26103C0700E | |
| Powell, Township of | 260452 | 04020105, 04020300 | 26103C0020E, 26103C0025E[2], 26103C0040E, 26103C0045E, 26103C0050E[2], 26103C0065E, 26103C0070E, 26103C0100D[2], 26103C0125D[2], 26103C0135E, 26103C0150E, 26103C0155E, 26103C0160E, 26103C0165E, 26103C0170E, 26103C0190E, 26103C0300D[2], 26103C0305E, 26103C0310E, 26103C0315E[2], 26103C0320E | |

[1] No Special Flood Hazard Areas Identified
[2] Panel Not Printed

**Table 1: Listing of NFIP Jurisdictions (continued)**

| Community | CID | HUC-8 Sub - Basin(s) | Located on FIRM Panel(s) | If Not Included, Location of Flood Hazard Data |
|---|---|---|---|---|
| Republic, Township of[1] | 260453 | 04030107, 04030110 | 26103C0375D[2], 26103C0400D[2], 26103C0575D[2], 26103C0600D[2], 26103C0800D[2], 26103C0825D[2], 26103C1025D[2], 26103C1050D[2] | |
| Richmond, Township of[1] | 261288 | 04020105, 04020201, 04030110 | 26103C0657E, 26103C0675E[2], 26103C0700E, 26103C0900D[2], 26103C0925D[2] | |
| Sands, Township of | 261284 | 04020105, 04020201, 04020300, 04030110 | 26103C0490E, 26103C0495E, 26103C0513E, 26103C0700E, 26103C0701E, 26103C0705D, 26103C0715D[2], 26103C0925D[2], 26103C0950D[2] | |
| Skandia, Township of | 260987 | 04020201, 04030111 | 26103C0740D, 26103C0745D, 26103C0765E, 26103C0975D[2], 26103C1000D[2], 26103C1200D[2], 26103C1225D[2] | |
| Tilden, Township of | 261287 | 04020105, 04030110 | 26103C0625E, 26103C0626E, 26103C0627E, 26103C0638E, 26103C0650E[2], 26103C0675E[2], 26103C0875D[2], 26103C0900D[2], 26103C1100D[2], 26103C1125D[2] | |
| Turin, Township of[1] | 261289 | 04030110, 04030111 | 26103C1175D[2], 26103C1200D[2], 26103C1225D[2] | |
| Wells, Township of[1] | 261290 | 04030109, 04030110 | 26103C1125D[2], 26103C1150D[2], 26103C1250D[2], 26103C1275D[2], 26103C1300D[2], 26103C1350D[2], 26103C1375D[2], 26103C1400D[2] | |
| West Branch, Township of | 260993 | 04020201, 04030110 | 26103C0715D[2], 26103C0720D, 26103C0740D, 26103C0950D[2], 26103C0975D[2] | |

[1] No Special Flood Hazard Areas Identified
[2] Panel Not Printed

## 1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1-percent-annual-chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplains; and 1-percent-annual-chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 30, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

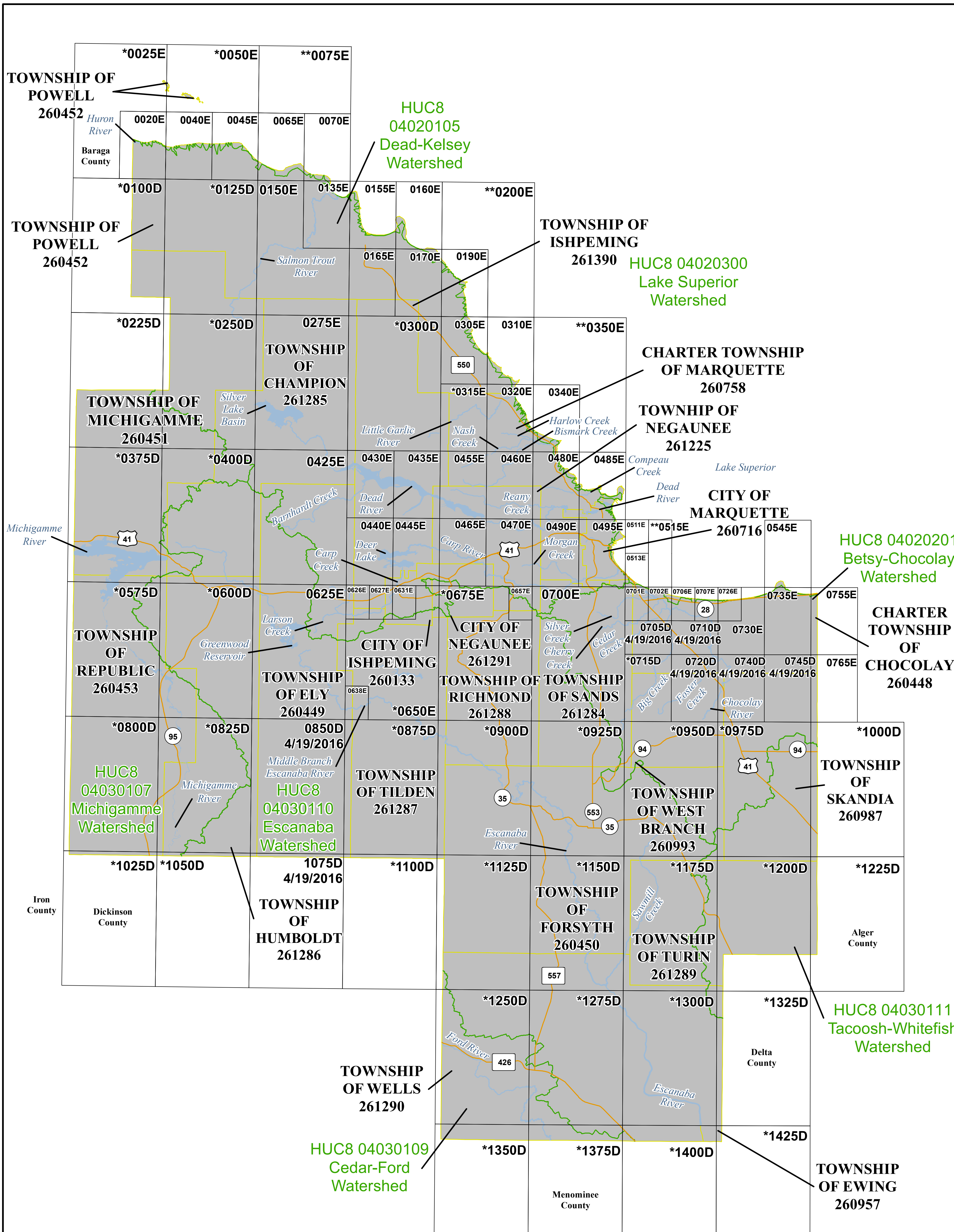
  The initial Countywide FIS Report for Marquette County became effective on April 19, 2016**.** Refer to Table 27 for information about subsequent revisions to the FIRMs.

  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at www.fema.gov/flood-insurance/rules-legislation/community-rating-system or contact your appropriate FEMA Regional Office for more information about this program.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at www.fema.gov/flood-maps/tutorials.

The FIRM Index in Figure 1 shows the overall FIRM panel layout within Marquette County, and also displays the panel number and effective date for each FIRM panel in the county. Other information shown on the FIRM Index includes community boundaries, flooding sources, watershed boundaries, and USGS HUC-8 codes.

## Figure 1: FIRM Index




**ATTENTION:** The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before TO BE DETERMINED.

N

1 inch = 32,500 feet 1:390,000

0 16,250 32,500 65,000 feet

Map Projection:
State Plane Michigan North FIPS 2111 Feet;
North American Datum 1983

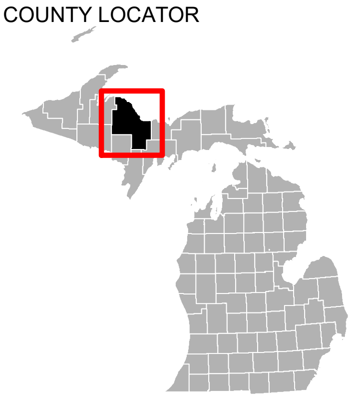
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

* PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS
** PANEL NOT PRINTED - AREA OUTSIDE OF COUNTY BOUNDARY

COUNTY LOCATOR



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

MARQUETTE COUNTY, MICHIGAN, USA All Jurisdictions

PANELS PRINTED:
0020, 0040, 0045, 0065, 0070, 0135, 0150, 0155, 0160, 0165, 0170, 0190, 0275, 0305, 0310, 0320, 0340, 0430, 0435, 0440, 0445, 0455, 0460, 0465, 0470, 0480, 0485, 0490, 0495, 0511, 0513, 0545, 0625, 0626, 0627, 0631, 0638, 0657, 0700, 0701, 0702, 0705, 0706, 0707, 0710, 0720, 0726, 0730, 0735, 0740, 0745, 0755, 0765, 0850, 1075

**REVISED PRELIMINARY**
**1/20/2023**

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

MAP NUMBER
26103CIND0B

MAP REVISED

Each FIRM panel may contain specific notes to the user that provide additional information regarding the flood hazard data shown on that map. However, the FIRM panel does not contain enough space to show all the notes that may be relevant in helping to better understand the information on the panel. Figure 2 contains the full list of these notes.

**Figure 2: FIRM Notes to Users**

# NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Mapping and Insurance eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Flood Map Service Center website or by calling the FEMA Mapping and Insurance eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 27 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Non-Coastal Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of the zero elevation referenced to Low Water Datum of Lake Superior, administratively established by the National Oceanic and Atmospheric Administration at 183.2 meters (601.1 feet) above zero point International Great Lakes Datum of 1985. This lake-wide elevation is approximately equal to an elevation of 601.0 feet North American Vertical Datum of 1988 (NAVD88). Coastal flood elevations are also provided in the Coastal Transect Parameters table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Coastal Transect Parameters table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

**Figure 2: FIRM Notes to Users (continued)**

FLOODWAY INFORMATION: 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 National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may have reduced flood hazards due to flood control structures. Refer to Section 4.3 "Dams and Other Flood Hazard Reduction Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was State Plane Michigan North FIPS 2111 Feet. The horizontal datum was the North American Datum of 1983 NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988**.** These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 30 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM panels dated **TO BE DETERMINED** was derived from multiple sources. County and municipality boundaries were provided by the Michigan Center for Geographic Information. Water lines, water areas, roads and railroads were provided by the Michigan Center for Shared Solutions and Technology Partnerships. Public Land Survey System information was provided by the Michigan Department of Natural Resources. Imagery was provided in digital format by the United States Department of Agriculture (USDA). This imagery information was derived from digital orthophotography in 2016 at a 2-foot resolution.

Base map information shown on the FIRM panels dated 04/19/2016 was derived from the National Agriculture Imagery Program at a scale of 1:12,000 from imagery dated 2010. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

**Figure 2: FIRM Notes to Users (continued)**

## NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Marquette County, MI, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 27 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before **TO BE DETERMINED**.

## SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Marquette County, MI, effective **TO BE DETERMINED**.

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS Report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluating mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Each FIRM panel contains an abbreviated legend for the features shown on the maps. However, the FIRM panel does not contain enough space to show the legend for all map features. Figure 3 shows the full legend of all map features. Note that not all of these features may appear on the FIRM panels in Marquette County**.**

**Figure 3: Map Legend for FIRM**

**SPECIAL FLOOD HAZARD AREAS:** The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.

| | |
|---|---|
| | Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE) |
| Zone A | The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone. |
| Zone AE | The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone. |
| Zone AH | The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone. |
| Zone AO | The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone. |
| Zone AR | The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| Zone A99 | The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone. |
| Zone V | The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone. |
| Zone VE | Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone. |
| | Regulatory Floodway determined in Zone AE. |

**Figure 3: Map Legend for FIRM (continued)**

| | |
|---|---|
| **OTHER AREAS OF FLOOD HAZARD** | |
| | Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile. |
| | Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone. |
| | Area with Reduced Flood Hazard due to Accredited or Provisionally Accredited Levee System: Area is shown as reduced flood hazard from the 1-percent-annual-chance or greater flood by a levee system. Overtopping or failure of any levee system is possible. |
| | Area with Undetermined Flood Hazard due to Non-Accredited Levee System: Analysis and mapping procedures for non-accredited levee systems were applied resulting in a flood insurance rate zone where flood hazards are undetermined, but possible. |
| **OTHER AREAS** | |
| | Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible. |
| NO SCREEN | Unshaded Zone X: Areas of minimal flood hazard. |
| **FLOOD HAZARD AND OTHER BOUNDARY LINES** | |
| (ortho) (vector) | Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping) |
| | Limit of Study |
| | Jurisdiction Boundary |
| | Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet |
| **GENERAL STRUCTURES** | |
| *Aqueduct Channel Culvert Storm Sewer* | Channel, Culvert, Aqueduct, or Storm Sewer |
| *Dam Jetty Weir* | Dam, Jetty, Weir |
| | Levee, Dike, or Floodwall |

### Figure 3: Map Legend for FIRM (continued)

| | |
|---|---|
| *Bridge* | Bridge |
| **REFERENCE MARKERS** | |
| 22.0 | River mile Markers |
| **CROSS SECTION & TRANSECT INFORMATION** | |
| B 20.2 | Lettered Cross Section with Regulatory Water Surface Elevation (BFE) |
| 5280 21.1 | Numbered Cross Section with Regulatory Water Surface Elevation (BFE) |
| 17.5 | Unlettered Cross Section with Regulatory Water Surface Elevation (BFE) |
| 8 | Coastal Transect |
| | Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation. |
| | Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping. |
| 513 | Base Flood Elevation Line |
| **ZONE AE (EL 16)** | Static Base Flood Elevation value (shown under zone label) |
| **ZONE AO (DEPTH 2)** | Zone designation with Depth |
| **ZONE AO (DEPTH 2) (VEL 15 FPS)** | Zone designation with Depth and Velocity |
| **BASE MAP FEATURES** | |
| *Missouri Creek* | River, Stream or Other Hydrographic Feature |
| 234 | Interstate Highway |
| 234 | U.S. Highway |
| 234 | State Highway |
| 234 | County Highway |

**Figure 3: Map Legend for FIRM (continued)**

| | |
|---|---|
| MAPLE LANE | Street, Road, Avenue Name, or Private Drive if shown on Flood Profile |
| RAILROAD | Railroad |
| | Horizontal Reference Grid Line |
| | Horizontal Reference Grid Ticks |
| + | Secondary Grid Crosshairs |
| Land Grant | Name of Land Grant |
| 7 | Section Number |
| R. 43 W. T. 22 N. | Range, Township Number |
| **$^{42}76^{000m}$E** | Horizontal Reference Grid Coordinates (UTM) |
| **365000 FT** | Horizontal Reference Grid Coordinates (State Plane) |
| **80° 16’ 52.5”** | Corner Coordinates (Latitude, Longitude) |

## SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

### 2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-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 hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Marquette County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1-percent-annual-chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 22), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1-percent and 0.2-percent-annual-chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1-percent-annual-chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1-percent and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary is shown on the FIRM. Figure 3, "Map Legend for FIRM", describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Marquette County, respectively.

Table 2, "Flooding Sources Included in this FIS Report," lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 12. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1-percent-annual-chance floodplain corresponds to the SFHAs. The 0.2-percent-annual-chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

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. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

**Table 2: Flooding Sources Included in this FIS Report**

| Flooding Source | Community | Downstream Limit | Upstream Limit | HUC-8 Sub-Basin(s) | Length (mi) (streams or coastlines) | Area ($mi^2$) (estuaries or ponding) | Floodway (Y/N) | Zone shown on FIRM | Date of Analysis |
|---|---|---|---|---|---|---|---|---|---|
| All Other Zone A's excluding those individually listed | Champion, Township of; Chocolay, Charter Township of; Ely, Township of; Ishpeming, Township of; Marquette, City of; Powell, Township of; Sands, Township of; Skandia, Township of; Tilden, Township of; West Branch, Township of | Varies | Varies | 04020105, 04020201, 04030110 | 129 | N/A | N | A | July 2011 |
| Big Garlic River | Powell, Township of | Confluence with Lake Superior | Approximately 1.3 miles upstream of Loma Farms Road | 04020105, 04020300 | 2.8 | N/A | N | A | July 2011 |
| Carp Creek | Ely, Township of; Ishpeming, City of; Ishpeming, Township of; Tilden, Township of | Approximately 0.2 miles downstream of Deer Lake Road Bridge | Confluence of Larson Creek | 04020105 | 8.0 | N/A | N | A | February 2019 |
| Carp River | Marquette, City of | Confluence with Lake Superior | Approximately 0.2 miles upstream of South Front Street | 04020105 | 0.2 | N/A | N | AE | 1994 |

## Table 2: Flooding Sources Included in this FIS Report (continued)

| Flooding Source | Community | Downstream Limit | Upstream Limit | HUC-8 Sub-Basin(s) | Length (mi) (streams or coastlines) | Area ($mi^2$) (estuaries or ponding) | Floodway (Y/N) | Zone shown on FIRM | Date of Analysis |
|---|---|---|---|---|---|---|---|---|---|
| Carp River | Marquette, City of | Approximately 0.2 miles upstream of South Front Street | Approximately 0.6 miles downstream of County Road 553 | 04020105 | 1.7 | N/A | N | A | 1994 |
| Carp River | Ishpeming, Township of; Marquette, Charter Township of; Marquette, City of; Negaunee, City of; Negaunee, Township of; Sands, Township of | Approximately 0.6 miles downstream of County Road 553 | Deer Lake outlet | 04020105 | 21 | N/A | N | A | February 2019 |
| Chocolay River | Chocolay, Charter Township of | Confluence with Lake Superior | Approximately 3.5 miles upstream of State Highway 28 | 04020201 | 6.0 | N/A | Y | AE | August 1985 |
| Dead River | Marquette, Charter Township of; Marquette, City of | Confluence with Lake Superior | Forrestville Dam Lake | 04020105, 04020300 | 5.2 | N/A | N | A | July 2011 |
| Dead River | Marquette, Charter Township of; Negaunee, Township of | Forrestville Dam Lake | McClure Dam outlet | 04020105 | 7.6 | N/A | N | A | February 2019 |

### Table 2: Flooding Sources Included in this FIS Report (continued)

| Flooding Source | Community | Downstream Limit | Upstream Limit | HUC-8 Sub-Basin(s) | Length (mi) (streams or coastlines) | Area (mi$^2$) (estuaries or ponding) | Floodway (Y/N) | Zone shown on FIRM | Date of Analysis |
|---|---|---|---|---|---|---|---|---|---|
| Dead River | Negaunee, Township of | McClure Storage Basin inlet | Hoist Dam outlet | 04020105 | 2.1 | N/A | N | A | February 2019 |
| Dead River | Champion, Township of | Dead River Storage Basin | Silver Lake Basin outlet | 04020105 | 7.6 | N/A | N | A | February 2019 |
| Dead River Storage Basin | Champion, Township of; Ishpeming, Township of; Negaunee, Township of | Entire shoreline of Dead River Storage Basin | Entire shoreline of Dead River Storage Basin | 04020105 | N/A | 5.3 | N | A | February 2019 |
| Deer Lake | Ishpeming, Township of | Entire shoreline of Deer Lake | Entire shoreline of Deer Lake | 04020105 | N/A | 2.0 | N | A | February 2019 |
| East Branch Sand River | Skandia, Township of | Approximately 9,150 feet upstream from the confluence with Sand River | Approximately 450 feet downstream from Yalmer Road | 04020201 | 1.0 | N/A | N | A | 02/28/2017 |
| Huron River | Powell, Township of | Confluence with Lake Superior | Approximately 0.7 miles upstream of Lake Superior | 04020105, 04020300 | 0.7 | N/A | N | A | July 2011 |
| Iron River | Ishpeming, Township of; Powell, Township of | Confluence with Lake Superior | At Homeier Road | 04020105, 04020300 | 8.2 | N/A | N | A | July 2011 |

### Table 2: Flooding Sources Included in this FIS Report (continued)

| Flooding Source | Community | Downstream Limit | Upstream Limit | HUC-8 Sub-Basin(s) | Length (mi) (streams or coastlines) | Area ($mi^2$) (estuaries or ponding) | Floodway (Y/N) | Zone shown on FIRM | Date of Analysis |
|---|---|---|---|---|---|---|---|---|---|
| Lake Superior | Chocolay, Charter Township of; Marquette, Charter Township of; Marquette, City of; Powell, Township of; Sands, Township of | Entire Length of Marquette County Shoreline | Entire Length of Marquette County Shoreline | 04020105, 04020201, 04020300 | 72.6 | N/A | N | AE, VE | September 2018 |
| McClure Storage Basin | Negaunee, Township of | Entire shoreline of McClure Storage Basin | Entire shoreline of McClure Storage Basin | 04020105 | N/A | 0.1 | N | A | February 2019 |
| Salmon Trout River | Powell, Township of | Confluence with Lake Superior | Approximately 6 miles upstream of Huron Mountain Club Road | 04020105, 04020300 | 8.9 | N/A | N | A | July 2011 |
| Silver Creek | Chocolay, Charter Township of | Confluence with Chocolay River | Approximately 680 feet upstream of Willow Road | 04020201 | 1.7 | N/A | Y | AE | August 1985 |

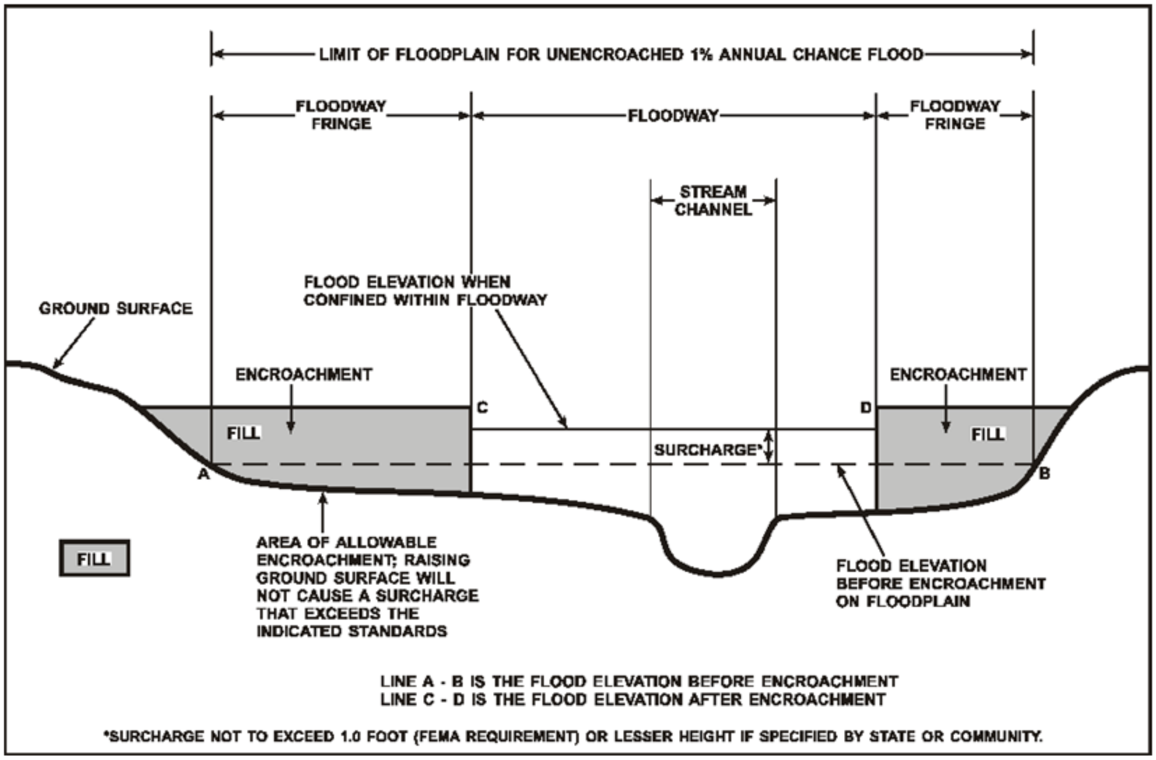
## 2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1-percent-annual-chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1-percent-annual-chance flood. The floodway fringe is the area between the floodway and the 1-percent-annual-chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1-percent-annual-chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. In Michigan, under the State's Floodplain Regulatory Authority, found in Part 31 of the Natural Resources and Environmental Protection Act, 1994 PA 451, encroachment in the floodplain is limited to that which will cause only insignificant increases in flood heights. At the time of this report the recommendation from Environment, Great Lakes & Energy (EGLE) (formerly MDEQ) is a floodway having no more than 0.1 foot surcharge (State of Michigan 1994). The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

**Figure 4: Floodway Schematic**




Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

## 2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The BFE is the elevation of the 1-percent-annual-chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

BFEs are primarily intended for flood insurance rating purposes. Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. For example, the user may use the FIRM to determine the stream station of a location of interest and then use the profile to determine the 1-percent annual chance elevation at that location. Because only selected cross sections may be shown on the FIRM for riverine areas, the profile should be used to obtain the flood elevation between mapped cross sections. Additionally, for riverine areas, whole-foot elevations shown on the FIRM may not exactly reflect the elevations derived from the hydraulic analyses; therefore, elevations obtained from the profile may more accurately reflect the results of the hydraulic analysis.

## 2.4 Non-Encroachment Zones

This section is not applicable to this Flood Risk Project.

## 2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1-percent-annual-chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

### 2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun. Tidal-induced fluctuations in the Great Lakes are small and their presence is masked by the normal fluctuations due to atmospheric forcing. The Great Lakes can be treated as if no tidal signal exists, and this contribution to water levels is neglected.

- *Storm surge, inclusive of wind setup and seiche-induced fluctuation,* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore. The most common cause of a large seiche in the Great Lakes is the oscillating water level after a storm that moves over the lake, with the downwind portion of the lake subject to wind setup as water piles up against the coast and the upwind portion subject to a decrease in water levels.

- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1-percent-annual-chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1-percent-annual-chance storm. The 1-percent-annual-chance storm surge can be determined from analyses of water level station records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the other effects of waves, such as wave runup and overland wave propagation.

- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the breaking of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1-percent-annual-chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since water level stations are often located in areas sheltered from wave action and do not capture wave height or wave setup information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to long-term erosion that occurs over time.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land, as shown in Figure 5a.
- *Wave overtopping* refers to the flooding that occurs when wave runup passes over the crest of a barrier, as shown in Figure 5b.

**Figure 5a: Wave Runup Transect Schematic**

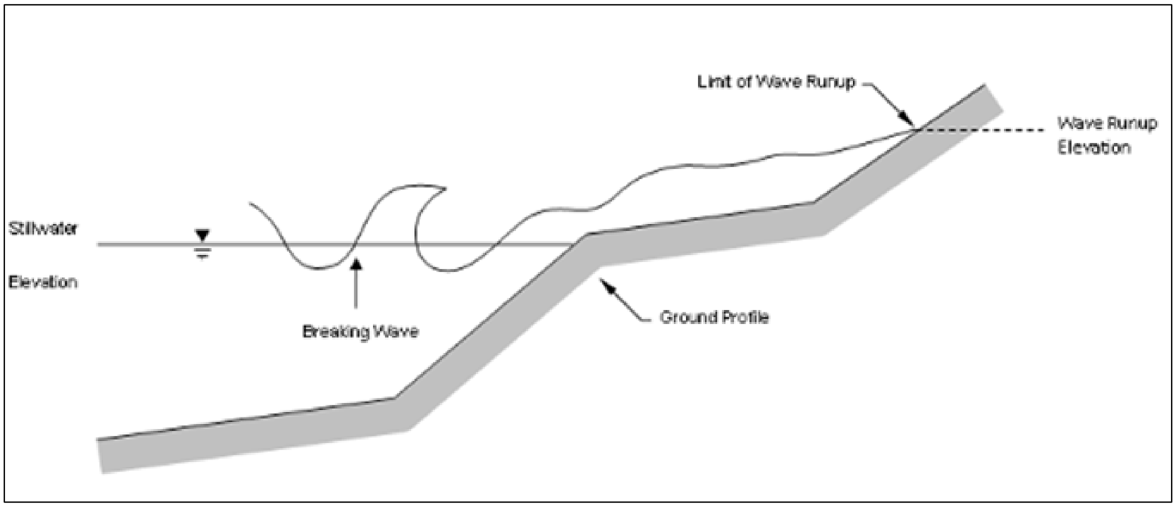
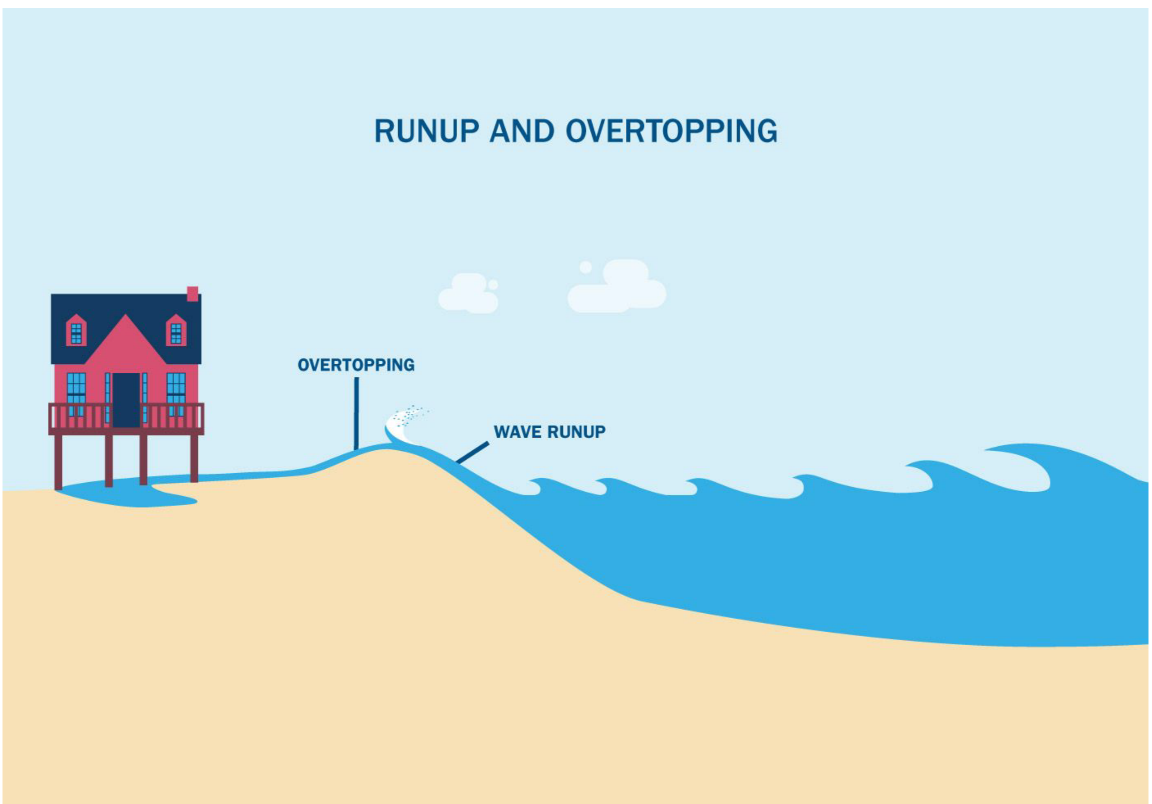



**Figure 5b: Wave Overtopping Schematic**




### 2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and in some cases extreme tides or lake level variations interact with factors such as topography, structures, and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by storm surge and waves, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

**Floodplain Boundaries**

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1-percent-annual-chance floodplain in these areas is derived from the stillwater elevation for the 1-percent-annual-chance storm. The methods used for calculation of stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report.

In areas dominated by overland wave propagation, the coastal BFEs represent the wave dissipation and generation as the wave propagates landward from the shoreline. The landward extent of the 1-percent-annual-chance floodplain is determined by the stillwater elevation with the addition of wave setup, where applicable. The methods used for calculation of wave setup and overland wave propagation are described in Section 5.3 of this FIS Report.

In some areas, the 1-percent-annual-chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1-percent-annual-chance storm surge. The Special Flood Hazard Area (SFHA) extent is determined based on the elevation of the land in relation to the wave runup elevation or the amount of wave overtopping. For areas dominated by wave runup, the coastal BFE can vary from reach to reach. Where wave runup exceeds the crest of a coastal feature, the SFHA extent is determined by the limit of the overtopping zone. The methods that were used for calculation of wave runup and overtopping hazards are described in Section 5.3 of this FIS Report.

Table 25 presents the types of coastal analyses that were used in mapping the 1-percent-annual-chance floodplain in coastal areas.

**Coastal BFEs**

Coastal BFEs are calculated as the stillwater elevation for the 1-percent-annual-chance storm plus the additional flood hazard from wave effects (storm-induced erosion, wave setup, overland wave propagation, wave runup, and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 16, "Coastal Transect Parameters." The locations of transects are shown in Figure 9, "Transect Location Map." More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

### 2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1-percent-annual-chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1-percent-annual-chance flood.

- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE.

No PFDs were identified within this county.

CHHAs are designated as “VE” zones (for “velocity wave zones”) and are subject to more stringent regulatory requirements and a different flood insurance rate structure. BFEs are assigned to Zones VE on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as “AE” zones on the FIRM.

Figure 6a, “Coastal Transect Schematic (Wave Runup and Overtopping),” illustrates the relationship between the base flood elevation, the 1-percent-annual-chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE/AO in areas subject to wave runup and overtopping.

**Figure 6a: Coastal Transect Schematic (Wave Runup and Overtopping)**

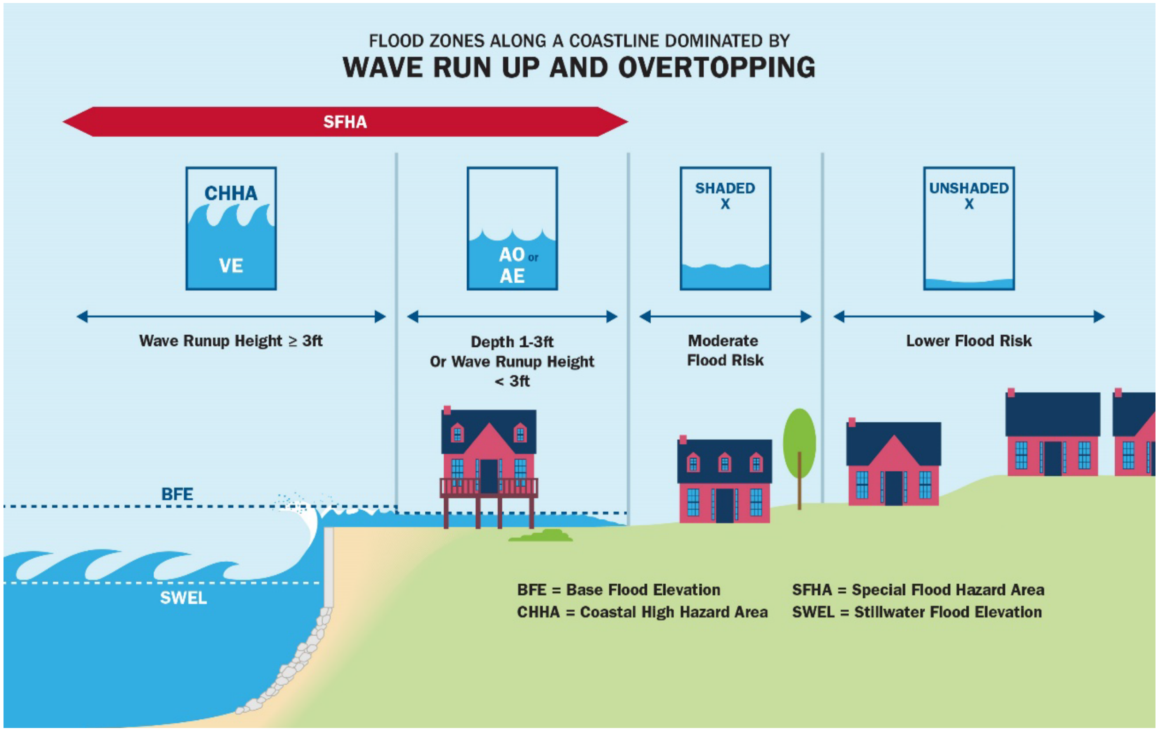
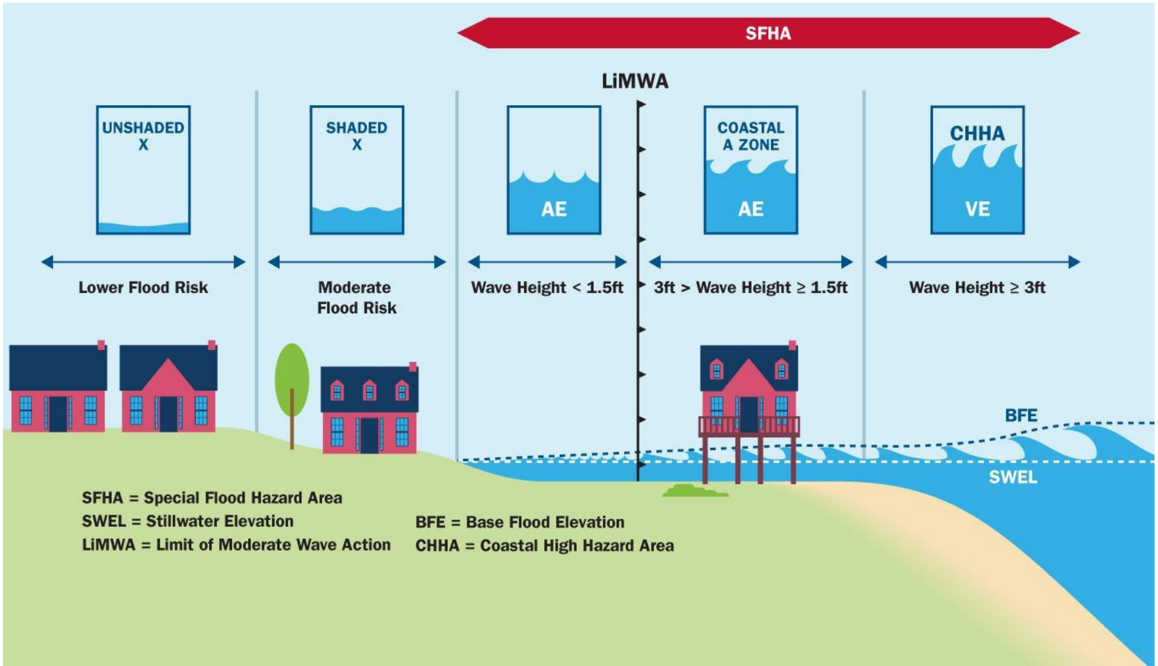



Figure 6b, "Coastal Transect Schematic (Overland Wave Propagation)," illustrates the relationship between the base flood elevation, the 1-percent-annual-chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE in areas subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

**Figure 6b: Coastal Transect Schematic (Overland Wave Propagation)**




Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." The BFE mapped on the FIRM at the shoreline is determined by the 1-percent-annual-chance total water elevation, which includes the stillwater elevation plus wave effects. The 1-percent-annual-chance total water elevations are included in Table 16, along with the statistical stillwater elevations. If the BFE on the FIRM is higher than the stillwater elevations shown in Table 16 due to the presence of wave effects, the higher elevation should be used for construction and/or floodplain management purposes.

### 2.5.4 Limit of Moderate Wave Action

Laboratory tests and field investigations have shown that wave heights as little as 1.5 feet can cause damage to and failure of typical Zone AE building construction. Wood-frame, light gage steel, and masonry walls on shallow footings or slabs are subject to damage when exposed to waves less than 3 feet in height. Other flood hazards associated with coastal waves (floating debris, high velocity flow, erosion, and scour) can also damage Zone AE construction.

Therefore, a LiMWA boundary may be shown on the FIRM as an informational layer to assist coastal communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The location of the LiMWA relative to Zone VE and Zone AE is shown in Figure 6b.

The effects of wave hazards in Zone AE between Zone VE (or the shoreline where Zone VE is not identified) and the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot or greater breaking waves are projected to occur during the 1-

percent-annual-chance flooding event. Communities are therefore encouraged to adopt and enforce more stringent floodplain management requirements than the minimum NFIP requirements in areas lakeward of the LiMWA. The NFIP Community Rating System provides credits for these actions.

In areas where wave runup elevations dominate over wave crest elevations (Figure 6a), the LiMWA should not be shown on the FIRM. Examples of runup dominated areas include shorelines with steeply sloped beaches, bluffs, or flood protection structures that lie parallel to the shore. Similarly, in areas where the Zone VE designation is based on the presence of a PFD or wave overtopping, the LiMWA is not shown on the FIRM.

The LiMWA was not applicable for any transects within this county.

## SECTION 3.0 – INSURANCE APPLICATIONS

### 3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in Marquette County.

**Table 3: Flood Zone Designations by Community**

| Community | Flood Zone(s) |
|---|---|
| Champion, Township of | A, X |
| Chocolay, Charter Township of | A, AE, AO, VE, X |
| Ely, Township of | A, X |
| Ewing, Township of | X |
| Forsyth, Township of | X |
| Humboldt, Township of | X |
| Ishpeming, City of | A, X |
| Ishpeming, Township of | A, X |
| Marquette, Charter Township of | A, AE, AO, VE, X |
| Marquette, City of | A, AE, AO, VE, X |
| Michigamme, Township of | X |
| Negaunee, City of | A, X |
| Negaunee, Township of | A, X |
| Powell, Township of | A, AE, AO, VE, X |
| Republic, Township of | X |

**Table 3: Flood Zone Designations by Community (continued)**

| Community | Flood Zone(s) |
|---|---|
| Richmond, Township of | X |
| Sands, Township of | A, VE, X |
| Skandia, Township of | A, X |
| Tilden, Township of | A, X |
| Turin, Township of | X |
| Wells, Township of | X |
| West Branch, Township of | A, X |

## SECTION 4.0 – AREA STUDIED

### 4.1 Basin Description

Table 4 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

**Table 4: Basin Characteristics**

| HUC-8 Sub-Basin Name | HUC-8 Sub - Basin Number | Primary Flooding Source | Description of Affected Area | Drainage Area (Square Miles) |
|---|---|---|---|---|
| Betsy-Chocolay | 04020201 | Chocolay River | Second largest watershed in Marquette County, covers the eastern portion of Marquette County, includes Chocolay River, Silver Creek and tributaries | 1,150 |
| Cedar-Ford | 04030109 | Ford River | Covers the southern portion of Marquette County, includes Fork River, Cedar River and tributaries | 1,019 |
| Dead-Kelsey | 04020105 | Dead River | Covers the northeast portion of Marquette County, includes Dead River, Carp River and Carp Creek | 909 |
| Escanaba | 04030110 | Escanaba River | Covers the central and southern portion of Marquette County, includes the Escanaba River and tributaries | 927 |
| Lake Superior | 04020300 | Lake Superior | Watershed covering the shoreline of Marquette County to the north | 31,673 |
| Michigamme | 04030107 | Michigamme River | Covers the western portion of Marquette County, includes the Michigamme River and tributaries | 724 |
| Tacoosh-Whitefish | 04030111 | Whitefish River | Covers the southeast portion of Marquette County, includes the Tacoosh River, Whitefish River and tributaries | 642 |

## 4.2 Principal Flood Problems

Table 5 contains a description of the principal flood problems that have been noted for Marquette County by flooding source.

**Table 5: Principal Flood Problems**

| Flooding Source | Description of Flood Problems |
|---|---|
| Carp River | Carp River provides one of the greatest risk of property damage due to riverine flooding. Ice and debris from beaver dams can cause riverine flooding due to Carp River as the blockage generated could cause back-up water. This back-up water has the potential to damage U.S. 41/M-28 Highway and disable the City of Marquette's wastewater treatment facility (Marquette N.D.). |
| Chocolay River | The Chocolay River can flood from excess rainfall or increased runoff from snowmelt. The record flood event in April 1985 occurred due to a dam break at Lake LeVasseur resulting in flood conditions between the 1 and 0.2 % annual chance flood events (between 2,350 cubic feet per second and 3,550 cubic feet per second) (FEMA 2016). |
| Dead River | Dead River can flood from excess rainfall and snowmelt, as well as experience backwater from Lake Superior at the downstream end of the river near the City of Marquette. In 2003, excess rainfall and snowmelt caused the earthen dike at Silver Lake Basin to fail. Nine billion gallons of water were released causing mass flooding, as well as the destruction of existing bridges, roadways, and railways. The floodwaters crested Hoist Dam, McClure Dam, and Forrestville Road Dam. The floodplains and the outlet into Lake Superior were littered with sediment deposit and the floodplains and channels were massively altered. An upper reach of Dead River was restored between 2003-2009 which altered the floodplains (McEwen N.D.). |
| Silver Creek | Silver Creek flooding is often caused by backwater from Chocolay River. Sudden rainfall can cause Silver Creek to flood independently of Chocolay River at times (FEMA 2016). |

Table 6 contains information about historic flood elevations in the communities within Marquette County.

**Table 6: Historic Flooding Elevations**

**[Not applicable to this Flood Risk Project.]**

## 4.3 Dams and Other Flood Hazard Reduction Measures

Table 7 contains information about non-levee flood hazard reduction measures within Marquette County such as dams or jetties. Levee systems are addressed in Section 4.4 of this FIS Report.

**Table 7: Dams and Other Flood Hazard Reduction Measures**

**[Not applicable to this Flood Risk Project.]**

### 4.4 Levee Systems

This section is not applicable to the Flood Risk Project.

**Table 8: Levee Systems**

**[Not applicable to this Flood Risk Project.]**

## SECTION 5.0 – ENGINEERING METHODS

For the flooding sources 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 are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 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-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2-percent-annual-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 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); 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.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 26, “Incorporated Letters of Map Change”, which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, “FIRM Revisions.”

### 5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 12. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 9. Discharges for flooding sources designated as Zone A on the FIRM are not shown in Table 9 of this FIS Report, however, discharge values are included in the FIRM database in the S_NODES and L_SUMMARY_DISCHARGES feature classes. Stream gage information is provided in Table 11.

**Table 9: Summary of Discharges**

| Flooding Source | Location | Drainage Area (Square Miles) | Peak Discharge (CFS) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance | 0.2% Annual Chance |
| Carp River | Unknown | * | * | * | * | * | * |
| Chocolay River | At confluence with Lake Superior | 159 | 2,900 | * | 4,100 | 4,600 | 5,900 |
| Silver Creek | At confluence with Chocolay River | 10 | 200 | * | 410 | 510 | 780 |

*Not calculated for this Flood Risk Project

**Figure 7: Frequency Discharge-Drainage Area Curves**

**[Not applicable to this Flood Risk Project.]**

**Table 10: Summary of Non-Coastal Stillwater Elevations**

**[Not applicable to this Flood Risk Project.]**

**Table 11: Stream Gage Information used to Determine Discharges**

| Flooding Source | Gage Identifier | Agency that Maintains Gage | Site Name | Drainage Area (Square Miles) | Period of Record | |
|---|---|---|---|---|---|---|
| | | | | | From | To |
| Carp River | 4044400 | United States Geological Survey | Carp River at US-HWY 41 near Negaunee, MI | 51.4 | 7/1/1961 | 11/30/1986 |

## 5.2 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. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed in Table 23, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 12. Roughness coefficients are provided in Table 13. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

**Table 12: Summary of Hydrologic and Hydraulic Analyses**

| Flooding Source | Study Limits Downstream Limit | Study Limits Upstream Limit | Hydrologic Model or Method Used | Hydraulic Model or Method Used | Date Analyses Completed | Flood Zone on FIRM | Special Considerations |
|---|---|---|---|---|---|---|---|
| All Other Zone A's excluding those individually listed | Varies | Varies | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Peak discharges were derived from USGS stream gage data, USGS regression equations (USGS 1984) and the Michigan Department of Environmental Quality SCS Procedures (Sorrell 2008) |
| Big Garlic River | Confluence with Lake Superior | Approximately 1.3 miles upstream of Loma Farms Road | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Approximately 200 feet of flood hazards upstream of Lake Superior were modified to tie-into the new coastal flood hazards in 2021. |
| Carp Creek | Approximately 0.2 miles downstream of Deer Lake Road Bridge | Confluence of Larson Creek | HEC-HMS 4.2.1 (USACE 2018) | HEC-RAS 5.0.3 (USACE 2016b) | February 2019 | A | |
| Carp River | Confluence with Lake Superior | Approximately 0.2 miles upstream of South Front Street | * | * | 1994 | AE | Analysis from LOMR 04-05-0761P. Approximately 1,400 feet of flood hazards upstream of Lake Superior were redelineated to tie-into the new coastal flood hazards in 2021. |
| Carp River | Approximately 0.2 miles upstream of South Front Street | Approximately 0.6 miles downstream of County Road 553 | * | * | 1994 | A | Analysis from LOMR 04-05-0761P. |

*Data not available

**Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)**

| Flooding Source | Study Limits Downstream Limit | Study Limits Upstream Limit | Hydrologic Model or Method Used | Hydraulic Model or Method Used | Date Analyses Completed | Flood Zone on FIRM | Special Considerations |
|---|---|---|---|---|---|---|---|
| Carp River | Approximately 0.6 miles downstream of County Road 553 | Deer Lake outlet | Gage Analysis (USDI 1982) and HEC-HMS 4.2.1 (USACE 2018) | HEC-RAS 5.0.3 (USACE 2016b) | February 2019 | A | Gage analysis was performed using USGS Gage No. 04044400 and HEC-SSP Version 2.1.1 (USACE 2017) and Bulletin 17B (USDI 1982). This reach was still modeled in HEC-HMS 4.2.1 for comparison (STARRII 2018). |
| Chocolay River | Confluence with Lake Superior | Approximately 3.5 miles upstream of State Highway 28 | USGS Regression Equations (USGS 1984) | HEC-2 (USACE 1982) | August 1985 | AE w/ Floodway | Redelineated in 2016 (FEMA 2016). Approximately 595 feet of AE flood hazards upstream of Lake Superior were modified to tie-into the new coastal flood hazards in 2021. |
| Dead River | Confluence with Lake Superior | Forrestville Dam Lake | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Approximately 450 feet of flood hazards upstream of Lake Superior were redelineated to tie-into the new coastal flood hazards in 2021. |
| Dead River | Forrestville Dam Lake | McClure Dam outlet | HEC-HMS 4.2.1 (USACE 2018) | HEC-RAS 5.0.3 (USACE 2016b) | February 2019 | A | |
| Dead River | McClure Storage Basin inlet | Hoist Dam outlet | HEC-HMS 4.2.1 (USACE 2018) | HEC-RAS 5.0.3 (USACE 2016b) | February 2019 | A | |
| Dead River | Dead River Storage Basin | Silver Lake Basin outlet | HEC-HMS 4.2.1 (USACE 2018) | HEC-RAS 5.0.3 (USACE 2016b) | February 2019 | A | Reservoir storage and outflow structures on Silver Lake were modeled in HEC HMS. |

**Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)**

| Flooding Source | Study Limits Downstream Limit | Study Limits Upstream Limit | Hydrologic Model or Method Used | Hydraulic Model or Method Used | Date Analyses Completed | Flood Zone on FIRM | Special Considerations |
|---|---|---|---|---|---|---|---|
| Dead River Storage Basin | Entire shoreline of Dead River Storage Basin | Entire shoreline of Dead River Storage Basin | HEC-HMS 4.2.1 (USACE 2018) | N/A | February 2019 | A | The 1 percent annual chance floodplain elevation was estimated to be 1,348.1 feet (NAVD88) by MDEQ. |
| Deer Lake | Entire shoreline of Deer Lake | Entire shoreline of Deer Lake | HEC-HMS 4.2.1 (USACE 2018) | N/A | February 2019 | A | The 1 percent annual chance floodplain elevation was estimated to be 1,390.1 feet (NAVD88) by MDEQ. |
| East Branch Sand River | Approximately 9,150 feet upstream from the confluence with Sand River | Approximately 450 feet downstream from Yalmer Road | USGS Regression Equations (USGS 1984) | HEC RAS 5.0 (USACE 2016a) | 02/28/2017 | A | Approximately 650 feet of flood hazards downstream of the model were modified to tie-into the existing Zone A East Branch Sand River. |
| Huron River | Confluence with Lake Superior | Approximately 0.7 miles upstream of Lake Superior | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Approximately 350 feet of flood hazards upstream of Lake Superior were modified to tie-into the new coastal flood hazards in 2021. |
| Iron River | Confluence with Lake Superior | At Homeier Road | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Approximately 0.8 mile of flood hazards upstream of Lake Superior were redelineated to tie-into the new coastal flood hazards in 2021 |
| McClure Storage Basin | Entire shoreline of McClure Storage Basin | Entire shoreline of McClure Storage Basin | HEC-HMS 4.2.1 (USACE 2018) | N/A | February 2019 | A | The 1 percent annual chance floodplain elevation was estimated to be 1,250.1 feet (NAVD88) by MDEQ. |

**Table 12: Summary of Hydrologic and Hydraulic Analyses (continued)**

| Flooding Source | Study Limits Downstream Limit | Study Limits Upstream Limit | Hydrologic Model or Method Used | Hydraulic Model or Method Used | Date Analyses Completed | Flood Zone on FIRM | Special Considerations |
|---|---|---|---|---|---|---|---|
| Salmon Trout River | Confluence with Lake Superior | Approximately 6 miles upstream of Huron Mountain Club Road | USGS Regression Equations (USGS 1984) | HEC RAS 4.1 (USACE 2010) | July 2011 | A | Approximately 1.8 mile of flood hazards upstream of Lake Superior were redelineated to tie-into the new coastal flood hazards in 2021. |
| Silver Creek | Confluence with Chocolay River | Approximately 680 feet upstream of Willow Road | TR-20 (SCS 1965) | HEC-2 (USACE 1982) | August 1985 | AE w/ Floodway | Redelineated in 2016 (FEMA 2016). |

**Table 13: Roughness Coefficients**

| Flooding Source | Channel “n” | Overbank “n” |
|---|---|---|
| Carp Creek | 0.035-0.040 | 0.060-0.150 |
| Carp River | 0.040-0.050 | 0.060-0.150 |
| Carp River (Zone AE) | 0.040-0.050 | 0.060-0.150 |
| Chocolay River | 0.035-0.045 | 0.060-0.150 |
| Dead River | 0.040-0.050 | 0.060-0.150 |
| Silver Creek | 0.035-0.060 | 0.060-0.120 |

## 5.3 Coastal Analyses

For the areas of Marquette County that are impacted by coastal flooding processes, coastal flood hazard analyses were performed to provide estimates of coastal BFEs. Coastal BFEs reflect the increase in water levels during a flood event due to storm surge as well as overland wave effects.

The following subsections provide summaries of how each coastal process was considered for this FIS Report. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation (STARR, 2018). Table 14 summarizes the methods and/or models used for the coastal analyses. Refer to Section 2.5.1 for descriptions of the terms used in this section.

**Table 14: Summary of Coastal Analyses**

| Flooding Source | Study Limits From | Study Limits To | Hazard Evaluated | Model or Method Used | Date Analysis was Completed |
|---|---|---|---|---|---|
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Lake-wide Storm Surge | Advanced Circulation Model (ADCIRC) | 10/31/2016 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Lake-wide Wave Generation | Simulating Waves Nearshore Model (SWAN) | 10/31/2016 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Event-Based Erosion | Cross-Shore Numerical Model (CSHORE) | 09/30/2018 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Overland Wave Propagation | Joint Probability Method (JPM); WHAFIS | 09/30/2018 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Statistical Analyses | GPD with Q-Q Optimization | 09/30/2018 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Wave Setup | Direct Integration Method (DIM) | 09/30/2018 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Wave Runup | Stockdon, Van Gent, and Shore Protection Manual (SPM)[1] | 09/30/2018 |
| Lake Superior | Entire coastline of Marquette County, MI | Entire coastline of Marquette County, MI | Wave Overtopping | EurOtop Manual; Plateau Method | 09/30/2018 |

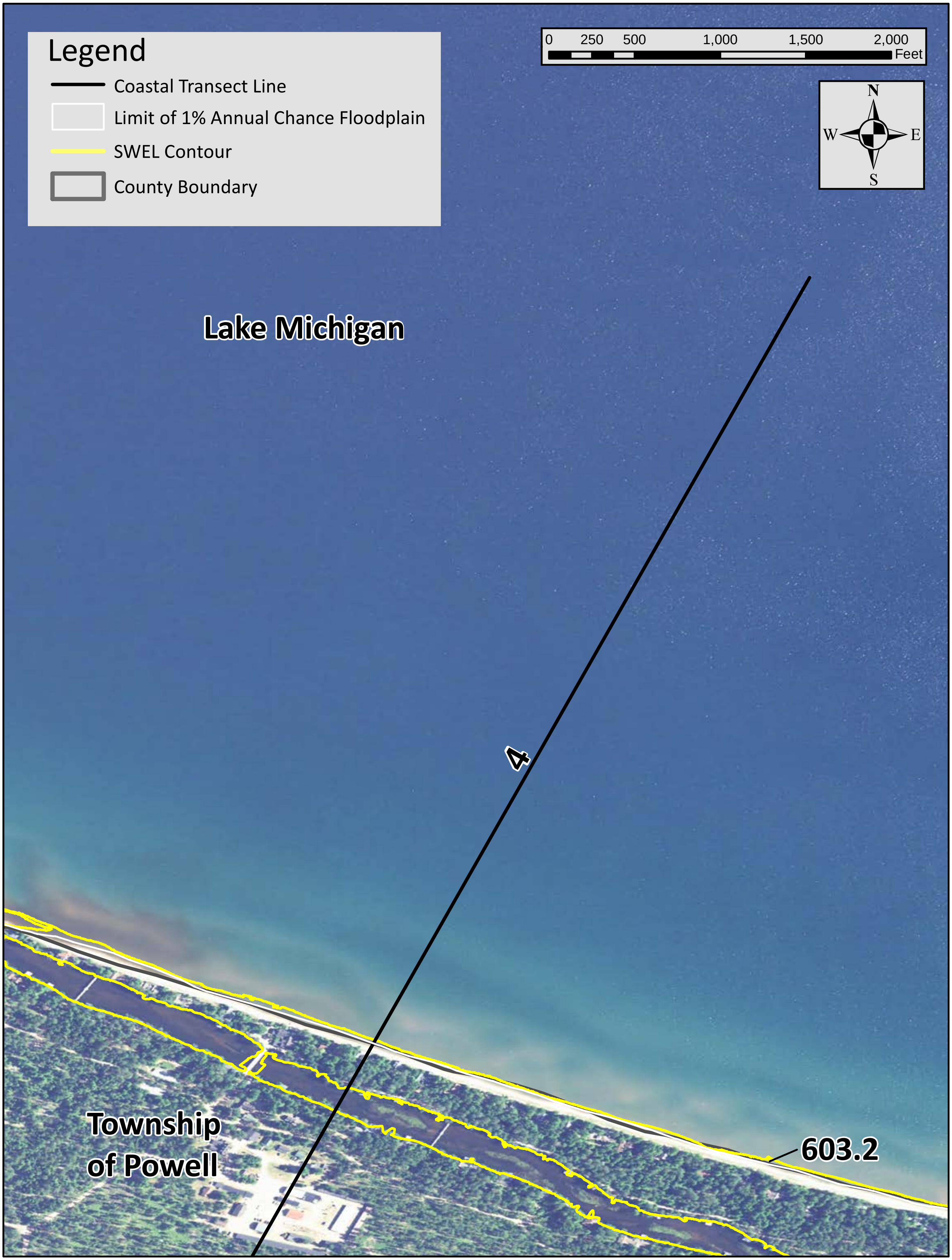
[1] U.S. Army Corps of Engineers (USACE) Shore Protection Manual (SPM). (USACE, 1984)

### 5.3.1 Total Stillwater Elevations

The stillwater elevations for the 1-percent-annual-chance flood were determined for areas subject to coastal flooding. The models and methods that were used to determine storm surge and wave setup are listed in Table 14. The stillwater elevation that was used for each transect in the coastal analyses is shown in Table 16, “Coastal Transect Parameters.” Figure 8 shows an example of the stillwater elevations for the 1-percent-annual-chance flood that was determined for this coastal analysis; wave setup is computed at each transect location and added to the stillwater elevation to determine a total stillwater elevation.

Stillwater elevations and starting wave conditions for Marquette County were determined from the lake-wide wave and storm surge study conducted for Lake Superior by FEMA and Strategic Alliance for Risk Reduction (STARR, 2016a). The study was performed using the coupled SWAN + ADCIRC hydrodynamic and wave model on a mesh of 713,159 nodes and validated using water levels and waves for six historical storms. The model was then used to simulate 150 selected historic storms based on historic peak water levels and peak wave heights. When available, ice coverage was accounted for in validation and production events. The modeled data were used to create a history of water elevation and wave height records from which the 10-, 2-, 1-, and 0.2-percent-annual-chance of exceedance elevations were calculated.

**Figure 8: 1% Annual Chance Total Stillwater Elevations for Coastal Areas**



### Storm Surge Statistics

Storm surge is modeled based on characteristics of actual storms responsible for significant coastal flooding. The characteristics of these storms are typically determined by statistical study of the regional historical record of storms or by statistical study of water level stations.

When historic records are used to calculate storm surge, characteristics such as the strength, size, track, etc., of storms are identified by site. Storm data was used in conjunction with numerical hydrodynamic models to determine the corresponding storm surge levels. An extreme value analysis was performed on the storm surge modeling results to determine a stillwater elevation for the 1-percent-annual-chance event.

In an oceanic environment, water level stations can be used instead of historic records of storms when the available station record for the area represents both the astronomical tide component and the storm surge component. Great Lakes studies rely on water level stations to identify the highest water level storm events from the historic record. The selected storms are then used to simulate storm surge and wave heights across the study area. Table 15 provides the water level station name, managing agency, station type, station identifier, start date, end date, and statistical methodology applied to each station to determine the stillwater elevations.

**Table 15: Water Level Station Analysis Specifics**

| Station Name | Managing Agency of Station | Station Type | Start Date | End Date[1] | Statistical Methodology |
|---|---|---|---|---|---|
| Duluth, MN (9099064) | National Oceanic and Atmospheric Administration (NOAA) | Water Level | 1970 | 2009 | N/A |
| Grand Marais, MN (9099090) | NOAA | Water Level | 1970 | 2009 | N/A |
| Gros Cap, Canada (10920) | Department of Fisheries and Oceans Canada (DFO) | Water Level | 1961 | 2009 | N/A |
| Marquette C.G., MI (9099018) | NOAA | Water Level | 1980 | 2009 | N/A |
| Michipicoten Harbour, Canada (10750) | DFO | Water Level | 1962 | 2009 | N/A |
| Ontonagon, MI (9099044) | NOAA | Water Level | 1970 | 2009 | N/A |
| Point Iroquois, MI (9099004) | NOAA | Water Level | 1970 | 2009 | N/A |
| Rossport, Canada (10220) | DFO | Water Level | 1967 | 2009 | N/A |
| Thunder Bay, Canada (10050) | DFO | Water Level | 1907 | 2009 | N/A |

[1]Available data within study period of record (1960-2009).

For each return period, the stillwater elevation at each node was used to create a raster surface using ArcInfo geoprocessing tools. The storm surge modeling was performed with elevation data referenced to the long term low water datum. At the time of this study, the low water datum for Lake Superior was 601.0 feet NAVD88 or 601.1 feet IGLD85. The node or point data was converted to the vertical datum of NAVD88 (from IGLD85).

### 5.3.2 Waves

Starting wave heights and wave periods for Marquette County were determined from the lake-wide wave and storm surge study conducted for Lake Michigan by FEMA and STARR as described in Section 5.3.1. The modeled data were used to create a history of wave height and wave period records which was used to determine starting wave conditions for the transect analysis.

**Wave Setup Analysis**

Wave setup was computed based on the wave and water level modeling results through the methods and models listed in Table 14. To adequately capture the complex hydrodynamics of wave-breaking across the surf zone, wave setup was calculated at each transect using the Direct Integration Method (DIM).

### 5.3.3 Coastal Erosion

A single storm episode can cause extensive erosion in coastal areas. Storm-induced erosion was evaluated using the methods listed in Table 14 to determine the modification to existing topography that is expected to be associated with coastal flooding events. The post-event eroded profile was used for the subsequent transect-based onshore wave hazard analyses.

### 5.3.4 Wave Hazard Analyses

Overland wave hazards were evaluated to determine the combined effects of ground elevation, vegetation, and physical features on overland wave propagation and wave runup. These analyses were performed at representative transects where waves are expected to be present during the floods of the selected recurrence intervals. The results of these analyses were used to determine elevations for the 1-percent-annual-chance flood. The transect analysis was performed with elevations in the vertical datum of IGLD85 and ultimately converted to NAVD88 for mapping.

Transect locations were chosen with consideration given to the physical land characteristics as well as development type and density so that they would closely represent conditions in their locality. Additional consideration was given to changes in the total stillwater elevation. Transects were spaced close together in areas of complex topography and dense development or where total stillwater elevations varied. In areas having more uniform characteristics, transects were spaced at larger intervals. Transects shown in Figure 9, “Transect Location Map,” are also depicted on the FIRM. Table 16 provides the location, stillwater elevations, and total water elevations for all coastal analysis transects. Starting wave conditions are also provided for each transect evaluated for overland wave hazards. In this table, “starting” indicates the parameter value at the beginning of the transect.

## Wave Height Analysis

Wave height analyses were performed to determine wave heights and corresponding wave crest elevations for the areas inundated by coastal flooding and subject to overland wave propagation hazards. Refer to Figure 6b for a schematic of a coastal transect evaluated for overland wave propagation hazards.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (NAS). This method is based on three major concepts. First, depth-limited waves in shallow water reach maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures prescribed in the NAS Report. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Along each transect, wave heights and wave crest elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The joint probability method (JPM) is used to compute five theoretical combinations of wave and water level conditions that have a joint 1-percent-annual-chance probability of occurrence. These theoretical combinations were simulated to determine the water levels, which include wave setup, and wave conditions at the shoreline. Wave heights and wave crest elevations were modeled using the methods and models listed in Table 14.

## Wave Runup and Overtopping Analysis

Wave runup is the uprush of water caused by wave action on a shore barrier exceeding the total stillwater level. As part of the coastal study, an evaluation of wave runup is conducted to determine the total water elevation due to storm surge, wave setup, and wave runup, and whether that total water elevation is the dominant coastal flood hazard for an area. Wave runup is evaluated for areas having dune barrier systems, coastal bluffs, as well as sloped and vertical structures.

Wave runup elevations were calculated for each coastal transect using the methods and models listed in Table 14, which follow the FEMA Guidelines and Specifications. For gently sloping shorelines (slopes less than 1:10), the Stockdon equations were applied (Stockdon et al., 2006). For steeper (but non-vertical) sloping shorelines, the van Gent method was performed (van Gent, 2001). For vertical structures, runup elevations were determined using the guidance in Figure D-14 of the FEMA Guidelines and Specifications obtained from the SPM (USACE, 1984). The SPM results in a mean wave runup value, which was multiplied by 2.2 to obtain the 2-percent runup height.

Wave overtopping occurs when the potential wave runup elevation is greater than the topographic feature crest elevation. The overtopping rate will depend on the incident water level and wave conditions, the barrier geometry and roughness characteristics, and the upland slope. Overtopping rates were calculated using the methods and models listed in

Table 14, which follow the FEMA Guidelines and Specifications.

Wave overtopping behavior is determined based on the slope landward of the barrier crest. Where the shoreline geometry is characterized by a low-crested bluff or structure backed by a positively-sloping, nearly level upland, the Plateau Method was applied to calculate an adjusted runup elevation and the inland extent of runup. Where the shoreline geometry is characterized by a negative slope landward of the barrier crest, the overtopping water will result in sheet flow on the negative slope and may propagate until it reaches another flooding source or ponding area.

There were no overtopping transects present within this county.

**Table 16: Coastal Transect Parameters**

| Flooding Source | Coastal Transect | Starting Wave Conditions for the 1% Annual Chance[1,2] | | Starting Stillwater Elevations (ft NAVD88) | | | | | 1% Annual Chance Total Water Elevation[4] (ft NAVD88) |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant Wave Height $H_s$ (ft) | Peak Wave Period $T_p$ (sec) | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance[3] | 0.2% Annual Chance | |
| Lake Superior | 1 | 10.6 | 8.7 | 602.9 | 603.1 | 603.2 | 603.2 | 603.3 | 606.5 |
| Lake Superior | 2 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.2 | 603.3 | 610.1 |
| Lake Superior | 3 | N/A | N/A | 602.8 | 603.0 | 603.1 | 603.2 | 603.3 | 613.7 |
| Lake Superior | 4 | N/A | N/A | 602.8 | 603.0 | 603.1 | 603.2 | 603.3 | 607.2 |
| Lake Superior | 5 | N/A | N/A | 602.9 | 603.0 | 603.1 | 603.2 | 603.3 | 644.6 |
| Lake Superior | 6 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 607.2 |
| Lake Superior | 7 | 11.9 | 8.4 | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 607.1 |
| Lake Superior | 8 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.2 | 603.3 | 638.5 |

[1]Wave data are provided for WHAFIS-based transects only. The 1% starting wave parameters are not applicable for runup transects since a response-based approach is utilized.
[2]Wave data correspond to the 1-percent-annual-chance floodplain but may not be directly associated with the 1-percent-annual-chance SWEL.
[3]Statistical 1-percent-annual-chance starting Stillwater elevation may be different than that used in WHAFIS wave analysis as a result of the Joint Probability approach.
[4]Includes wave action representative of 1% Total Water Level (for wave runup and overtopping) or 1% Wave Crest Elevation (for overland wave propagation).
[*]Runup dominant at shoreface and WHAFIS dominant offshore.

## Table 16: Coastal Transect Parameters (continued)

| Flooding Source | Coastal Transect | Starting Wave Conditions for the 1% Annual Chance[1,2] | | Starting Stillwater Elevations (ft NAVD88) | | | | | 1% Annual Chance Total Water Elevation[4] (ft NAVD88) |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant Wave Height $H_s$ (ft) | Peak Wave Period $T_p$ (sec) | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance[3] | 0.2% Annual Chance | |
| Lake Superior | 9 | N/A | N/A | 602.9 | 603.0 | 603.2 | 603.2 | 603.4 | 607.0 |
| Lake Superior | 10 | N/A | N/A | 602.8 | 603.0 | 603.1 | 603.2 | 603.3 | 626.2 |
| Lake Superior | 11 | 14.9 | 9.6 | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 607.4 |
| Lake Superior | 12 | 11.5 | 8.6 | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 606.7 |
| Lake Superior | 13 | N/A | N/A | 602.8 | 603.0 | 603.1 | 603.2 | 603.3 | 607.6 |
| Lake Superior | 14 | N/A | N/A | 602.8 | 603.0 | 603.1 | 603.2 | 603.3 | 642.3 |
| Lake Superior | 15 | N/A | N/A | 602.9 | 603.2 | 603.3 | 603.4 | 603.5 | 608.4 |
| Lake Superior | 16 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 607.1 |
| Lake Superior | 17 | N/A | N/A | 602.8 | 603.0 | 603.2 | 603.2 | 603.4 | 610.4 |

[1]Wave data are provided for WHAFIS-based transects only. The 1% starting wave parameters are not applicable for runup transects since a response-based approach is utilized.
[2]Wave data correspond to the 1-percent-annual-chance floodplain but may not be directly associated with the 1-percent-annual-chance SWEL.
[3]Statistical 1-percent-annual-chance starting Stillwater elevation may be different than that used in WHAFIS wave analysis as a result of the Joint Probability approach.
[4]Includes wave action representative of 1% Total Water Level (for wave runup and overtopping) or 1% Wave Crest Elevation (for overland wave propagation).
[*]Runup dominant at shoreface and WHAFIS dominant offshore.

## Table 16: Coastal Transect Parameters (continued)

| Flooding Source | Coastal Transect | Starting Wave Conditions for the 1% Annual Chance[1,2] | | Starting Stillwater Elevations (ft NAVD88) | | | | | 1% Annual Chance Total Water Elevation[4] (ft NAVD88) |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant Wave Height $H_s$ (ft) | Peak Wave Period $T_p$ (sec) | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance[3] | 0.2% Annual Chance | |
| Lake Superior | 18 | N/A | N/A | 602.9 | 603.0 | 603.2 | 603.2 | 603.4 | 643.3 |
| Lake Superior | 19 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 609.1 |
| Lake Superior | 20 | N/A | N/A | 602.8 | 603.0 | 603.2 | 603.3 | 603.4 | 608.0 |
| Lake Superior | 21 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 633.9 |
| Lake Superior | 22 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 612.1 |
| Lake Superior | 23 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 607.8 |
| Lake Superior | 24 | N/A | N/A | 602.9 | 603.1 | 603.3 | 603.4 | 603.6 | 607.3 |
| Lake Superior | 25 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 610.4 |
| Lake Superior | 26 | 11.7 | 9.7 | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 605.1* |

[1]Wave data are provided for WHAFIS-based transects only. The 1% starting wave parameters are not applicable for runup transects since a response-based approach is utilized.

[2]Wave data correspond to the 1-percent-annual-chance floodplain but may not be directly associated with the 1-percent-annual-chance SWEL.

[3]Statistical 1-percent-annual-chance starting Stillwater elevation may be different than that used in WHAFIS wave analysis as a result of the Joint Probability approach.

[4]Includes wave action representative of 1% Total Water Level (for wave runup and overtopping) or 1% Wave Crest Elevation (for overland wave propagation).

*Runup dominant at shoreface and WHAFIS dominant offshore.

## Table 16: Coastal Transect Parameters (continued)

| Flooding Source | Coastal Transect | Starting Wave Conditions for the 1% Annual Chance[1,2] | | Starting Stillwater Elevations (ft NAVD88) | | | | | 1% Annual Chance Total Water Elevation[4] (ft NAVD88) |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant Wave Height $H_s$ (ft) | Peak Wave Period $T_p$ (sec) | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance[3] | 0.2% Annual Chance | |
| Lake Superior | 27 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.4 | 612.8 |
| Lake Superior | 28 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 608.7 |
| Lake Superior | 29 | 9.5 | 9.7 | 602.8 | 603.0 | 603.2 | 603.3 | 603.5 | 604.1* |
| Lake Superior | 30 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 607.0 |
| Lake Superior | 31 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 609.5 |
| Lake Superior | 32 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 608.0 |
| Lake Superior | 33 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 608.0 |
| Lake Superior | 34 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 608.6 |
| Lake Superior | 35 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 608.3 |

[1]Wave data are provided for WHAFIS-based transects only. The 1% starting wave parameters are not applicable for runup transects since a response-based approach is utilized.
[2]Wave data correspond to the 1-percent-annual-chance floodplain but may not be directly associated with the 1-percent-annual-chance SWEL.
[3]Statistical 1-percent-annual-chance starting Stillwater elevation may be different than that used in WHAFIS wave analysis as a result of the Joint Probability approach.
[4]Includes wave action representative of 1% Total Water Level (for wave runup and overtopping) or 1% Wave Crest Elevation (for overland wave propagation).
*Runup dominant at shoreface and WHAFIS dominant offshore.

### Table 16: Coastal Transect Parameters (continued)

| Flooding Source | Coastal Transect | Starting Wave Conditions for the 1% Annual Chance[1,2] | | Starting Stillwater Elevations (ft NAVD88) | | | | | 1% Annual Chance Total Water Elevation[4] (ft NAVD88) |
|---|---|---|---|---|---|---|---|---|---|
| | | Significant Wave Height $H_s$ (ft) | Peak Wave Period $T_p$ (sec) | 10% Annual Chance | 4% Annual Chance | 2% Annual Chance | 1% Annual Chance[3] | 0.2% Annual Chance | |
| Lake Superior | 36 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.3 | 603.5 | 607.4 |
| Lake Superior | 37 | 14.9 | 10.0 | 603.1 | 603.4 | 603.6 | 603.7 | 603.9 | 606.0* |
| Lake Superior | 38 | N/A | N/A | 602.9 | 603.1 | 603.2 | 603.4 | 603.6 | 611.3 |

[1]Wave data are provided for WHAFIS-based transects only. The 1% starting wave parameters are not applicable for runup transects since a response-based approach is utilized.

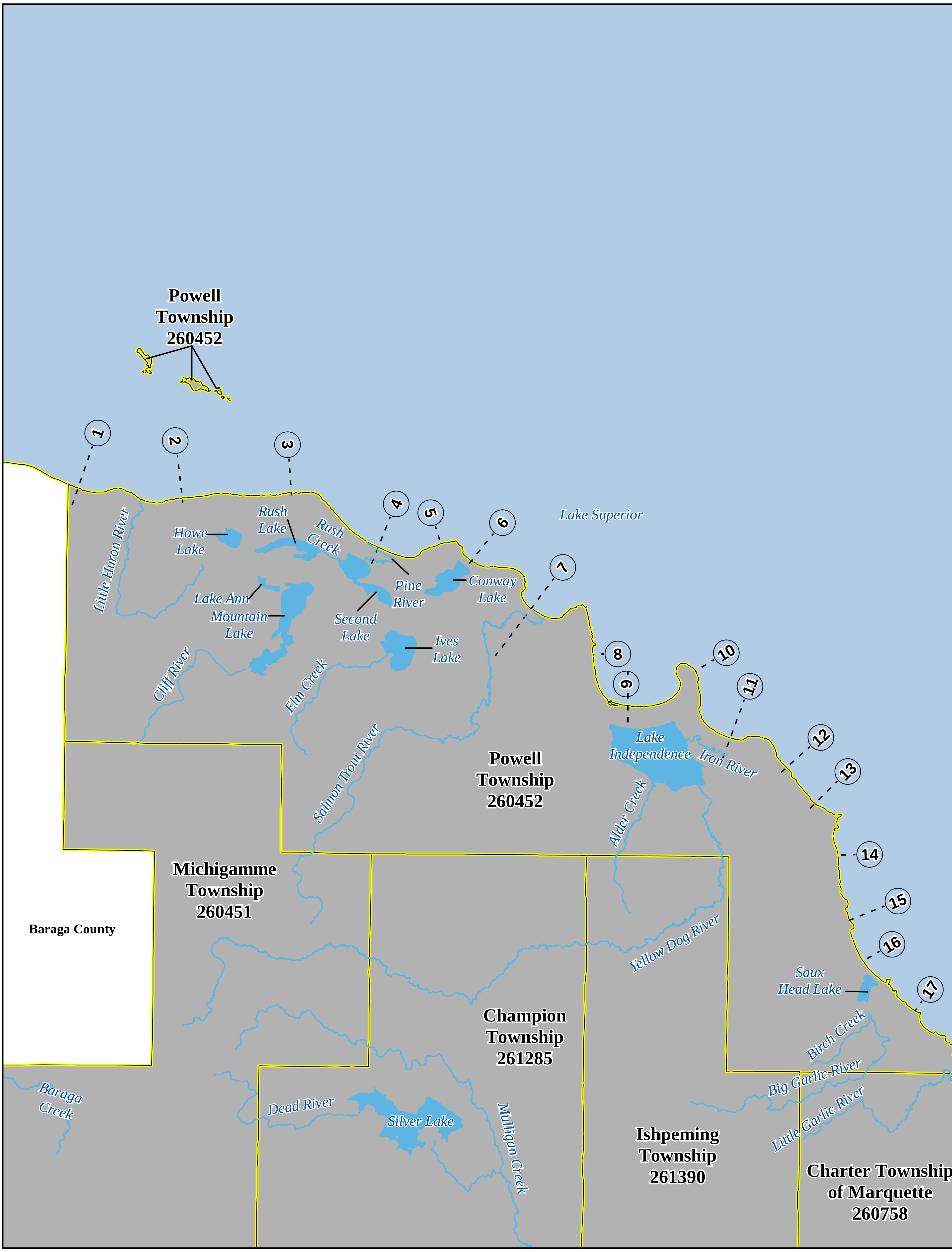
[2]Wave data correspond to the 1-percent-annual-chance floodplain but may not be directly associated with the 1-percent-annual-chance SWEL.

[3]Statistical 1-percent-annual-chance starting Stillwater elevation may be different than that used in WHAFIS wave analysis as a result of the Joint Probability approach.

[4]Includes wave action representative of 1% Total Water Level (for wave runup and overtopping) or 1% Wave Crest Elevation (for overland wave propagation).

*Runup dominant at shoreface and WHAFIS dominant offshore.

**Figure 9: Transect Location Map**

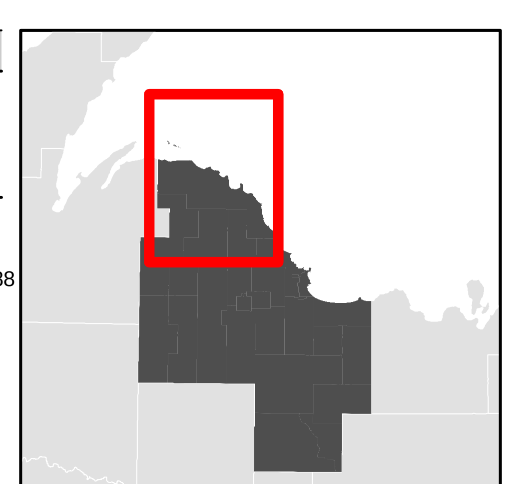



1 inch = 14,000 feet

0 3,500 7,000 14,000 21,000 Feet

N

Map Projection:
Michigan State Plane Zone 2111; North American Datum 1983; North American Vertical Datum of 1988



**NATIONAL FLOOD INSURANCE PROGRAM**

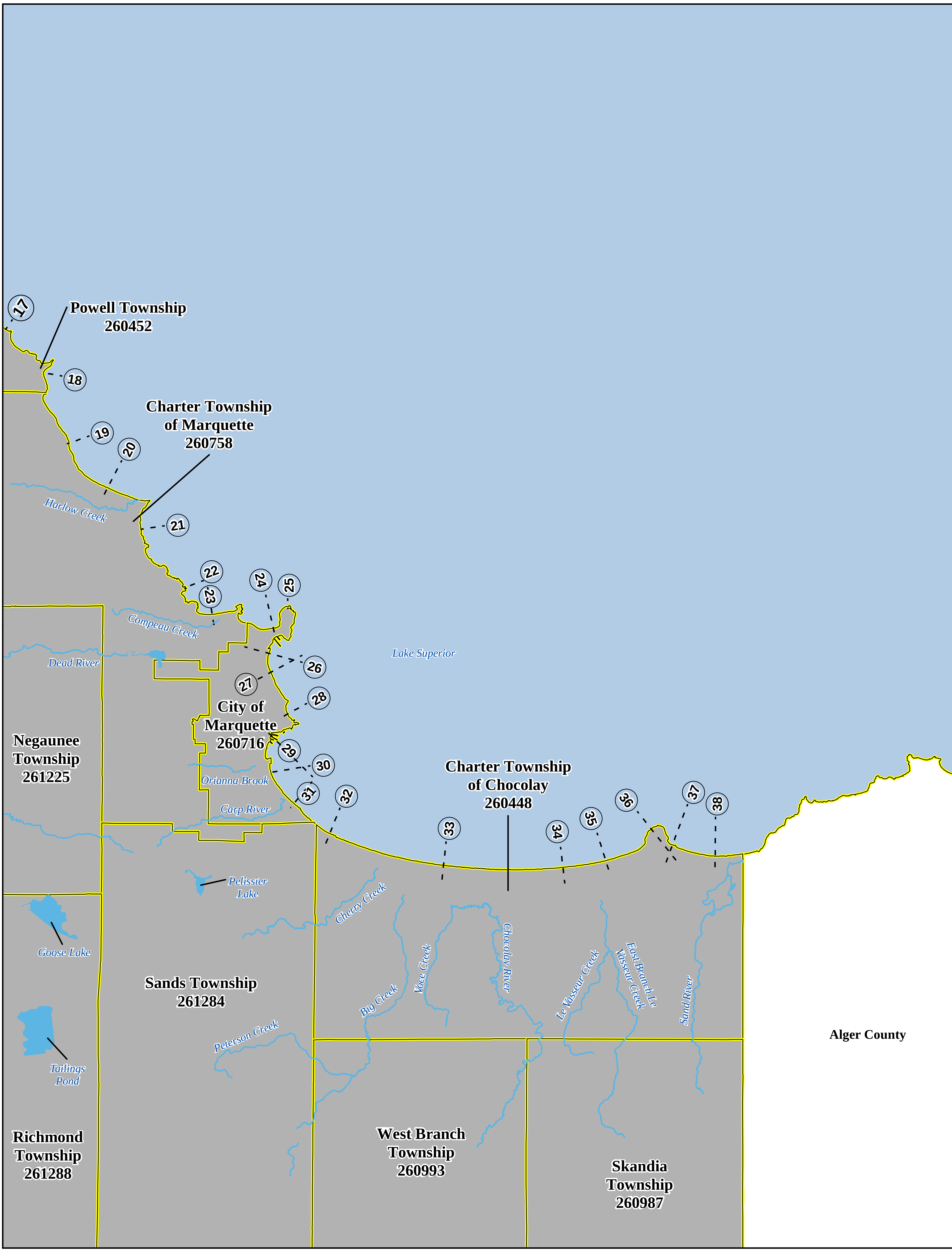
Transect Locator Map

PANELS WITH TRANSECTS:
0025, 0050, 0075, 0150, 0200, 0325, 0350, 0485, 0495, 0511, 0513, 0545, 0701, 0706, 0726, 0730, 0735

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

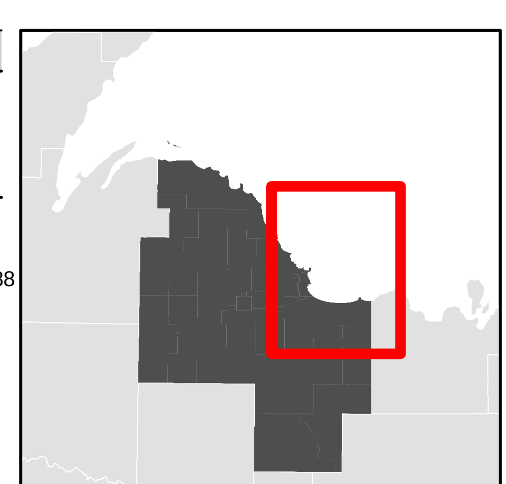
**Figure 9: Transect Location Map (continued)**




1 inch = 14,000 feet

0 3,500 7,000 14,000 21,000 Feet

Map Projection:
Michigan State Plane Zone 2111; North American Datum 1983; North American Vertical Datum of 1988



**NATIONAL FLOOD INSURANCE PROGRAM**

Transect Locator Map

PANELS WITH TRANSECTS:
0025, 0050, 0075, 0150, 0200, 0325, 0350, 0485, 0495, 0511, 0513, 0545, 0701, 0706, 0726, 0730, 0735

FEMA

## 5.4 Alluvial Fan Analyses

This section is not applicable to this Flood Risk Project.

**Table 17: Summary of Alluvial Fan Analyses**

**[Not applicable to this Flood Risk Project.]**

**Table 18: Results of Alluvial Fan Analyses**

**[Not applicable to this Flood Risk Project.]**

# SECTION 6.0 – MAPPING METHODS

## 6.1 Vertical and Horizontal Control

All FIS Reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS Reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the North American Vertical Datum of 1988 (NAVD88), many FIS Reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

Flood elevations shown in this FIS Report and on the FIRMs are referenced to NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between NGVD29 and NAVD88 or other datum conversion, visit the National Geodetic Survey website at www.ngs.noaa.gov.

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the archived project documentation associated with the FIS Report and the FIRMs for this community. Interested individuals may contact FEMA to access these data.

To obtain current elevation, description, and/or location information for benchmarks in the area, please visit the NGS website at www.ngs.noaa.gov.

The datum conversion locations and values that were calculated for Marquette County are provided in Table 19.

**Table 19: Countywide Vertical Datum Conversion**

**[Not applicable to this Flood Risk Project.]**

A countywide conversion factor could not be generated for Marquette County because the maximum variance from average exceeds 0.25 feet. Calculations for the vertical offsets on a stream by stream basis are depicted in Table 20.

**Table 20: Stream-Based Vertical Datum Conversion**

| Flooding Source | Average Vertical Datum Conversion Factor (feet) |
|---|---|
| Carp River | 0.104 |
| Chocolay River | 0.090 |
| Dead River Storage Basin | 0.131 |
| Deer Lake | 0.117 |
| Lake Superior | 0.103 |
| McClure Storage Basin | 0.122 |
| Silver Creek | 0.098 |

## 6.2 Base Map

The FIRMs and FIS Report for this project have been produced in a digital format. The flood hazard information was converted to a Geographic Information System (GIS) format that meets FEMA's FIRM Database specifications and geographic information standards. This information is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community. The FIRM Database includes most of the tabular information contained in the FIS Report in such a way that the data can be associated with pertinent spatial features. For example, the information contained in the Floodway Data table and Flood Profiles can be linked to the cross sections that are shown on the FIRMs. Additional information about the FIRM Database and its contents can be found in FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping*, www.fema.gov/flood-maps/guidance-partners/guidelines-standards.

Base map information shown on the FIRM was derived from the sources described in Table 21.

**Table 21: Base Map Sources**

| Data Type | Data Provider | Data Date | Data Scale | Data Description |
|---|---|---|---|---|
| 1-Meter Resolution Aerial Imagery | National Agriculture Imagery Program | 2005 | N/A | Aerial Imagery for FIRM panels dated TBD (NAIP 2005). |
| Aerial Imagery for Marquette County, Michigan | United States Department of Agriculture | 2016 | 1:24,000 | Orthoimagery was provided for Marquette County for FIRM panels dated TBD (USDA 2016). |
| Aerial Photo Index and Transportation Features | Michigan Department of Natural Resources | 2016 | N/A | Spatial and attribute information for base index and transportation features for FIRM panels dated 4/19/2016 (MDNRa 2016). |

**Table 21: Base Map Sources (continued)**

| Data Type | Data Provider | Data Date | Data Scale | Data Description |
|---|---|---|---|---|
| Aerial Topography of Portions of Chocolay Township | Marquette County Planning Commission | 1955 | N/A | Topography imagery for Chocolay Township for FIRM panels dated TBD (MCPC 1955). |
| FIRM Panel Index | U.S. Geological Survey | 2016 | N/A | Spatial and attribute information for FIRM panels dated 4/19/2016 (USGS 2016). |
| Michigan All Roads, Hydrography Lines, Hydrography Polygons | Center for Shared Solutions and Technology Partnerships | 2014 | 1:24,000 | Spatial and attribute information for water areas, water lines, and transportation features for FIRM panels dated TBD (CSSTP 2014). |
| Michigan Minor Civil Divisions | Michigan Center for Geographic Information | 2013 | 1:24,000 | Municipal and county boundaries for FIRM panels dated TBD (MCGI 2013). |
| Michigan Railroads | Center for Shared Solutions and Technology Partnerships | 2013 | 1:24,000 | Railroads in Marquette County for FIRM panels dated 4/19/2016 (CSSTP 2013). |
| Public Land Survey Sections | Michigan Department of Natural Resources | 2014 | 1:24,000 | PLSS data for Marquette County for FIRM panels dated TBD (MDNR 2014). |
| Public Land Survey System Arcs | Michigan Department of Natural Resources | 1998 | N/A | Spatial and attribute information for PLSS areas for FIRM panels dated 4/19/2016 (MDNR 1998). |
| Water Lines | Michigan Department of Natural Resources | 2016 | N/A | Spatial and attribute information for water lines for FIRM panels dated 4/19/2016 (MDNRb 2016). |
| Water Polygons | Michigan Department of Natural Resources | 2016 | N/A | Spatial and attribute information for water areas for FIRM panels dated 4/19/2016 (MDNRc 2016). |

### 6.3 Floodplain and Floodway Delineation

The FIRM shows tints, screens, and symbols to indicate floodplains and floodways as well as the locations of selected cross sections used in the hydraulic analyses and floodway computations.

For riverine flooding sources, the mapped floodplain boundaries shown on the FIRM have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using the topographic elevation data described in Table 22. For each coastal flooding source studied as part of this FIS Report, the mapped floodplain boundaries on the FIRM have been delineated using the flood and wave elevations determined at each transect; between transects, boundaries were delineated using land use and land cover data, the topographic elevation data described in Table 22, and knowledge of coastal flood processes. In ponding areas, flood elevations were determined at each junction of the model; between junctions, boundaries were interpolated using the topographic elevation data described in Table 22.

The floodplain boundaries for some flooding sources, or portions of flooding sources, have been redelineated as part of this Flood Risk Project. Redelineation is the method of mapping effective engineering analyses using new topographic data, resulting in updated floodplain boundaries. Table 12 and Table 22 include information pertaining to the flooding sources redelineated as part of this Flood Risk Project

In cases where the 1-percent and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance 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.

The floodway widths presented in this FIS Report and on the FIRM were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. Table 2 indicates the flooding sources for which floodways have been determined. The results of the floodway computations for those flooding sources have been tabulated for selected cross sections and are shown in Table 23, "Floodway Data."

**Table 22: Summary of Topographic Elevation Data used in Mapping**

| Community | Flooding Source | Source for Topographic Elevation Data | | | |
|---|---|---|---|---|---|
| | | Description | Vertical Accuracy | Horizontal Accuracy | Citation |
| Champion, Township of; Ely, Township of; Ishpeming, City of; Ishpeming, Township of; Marquette, Charter Township of; Marquette, City of; Negaunee, City of; Negaunee, Township of; Sands, Township of; Tilden, Township of | Carp Creek, Carp River[1], Dead River | Michigan Department of Natural Resources | 0.087m RMSE, or 0.175m FVA @ 95 percent Confidence Level | Not Provided | STARR 2018b |
| Champion, Township of; Chocolay, Charter Township of; Ely, Township of; Ishpeming, Township of; Marquette, Charter Township of; Marquette, City of; Negaunee, Township of; Powell, Township of; Sands, Township of; Skandia, Township of; West Branch, Township of | All Zone A's from 2011 study | 1/3 Arc Second National Elevation Dataset | 10 meters | Not Provided | USGS 2005 |
| Chocolay, Charter Township of; Marquette, Charter Township of; Marquette, City of; Powell, Township of; Sands, Township of | Big Garlic River[1], Carp River[1], Chocolay River[1], Dead River[1], Huron River[1], Iron River[1], Lake Superior, Salmon Trout River[1] | Joint Airborne Lidar Bathymetry Technical Center of eXpertise (JALBTCX) Seamless Bathymetry and Terrain for Lake Superior | 15cm RMSE V. | Not Provided | JALBTCX 2011 |
| Chocolay, Charter Township of | Chocolay River, Silver Creek | 15 Minute Series Topographic Maps, quadrangles of Gwinn, Michigan; Skandia, Michigan | 20 foot contours | Not Provided | USGS 1952, USGS 1958, USGS 1975 |
| Marquette, City of | Carp River[1] | Redelineated using 2 foot contours | 2 foot contours | Not Provided | Ayres 2002 |
| Skandia, Township of | East Branch Sand River | Northern Michigan – Alger LiDAR – Michigan 2015 | 2 foot contours | Not Provided | MI 2015 |

[1]See Table 12, "Special Considerations" column for Limits

BFEs shown at cross sections on the FIRM represent the 1-percent-annual-chance water surface elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report**.** Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations.

## Table 23: Floodway Data

| LOCATION | | FLOODWAY | | | | 1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88) | | | |
|---|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/ SECOND) | WIDTH REDUCED FROM PRIOR STUDY (FEET) | REGULATORY (FEET NAVD) | WITHOUT FLOODWAY (FEET NAVD) | WITH FLOODWAY (FEET NAVD) | INCREASE (FEET) |
| A | 580 | 130 | 817 | 5.6 | | 606.9 | 606.9 | 606.9 | 0.0 |
| B | 840 | 96 | 675 | 6.8 | | 607.1 | 607.1 | 607.2 | 0.1 |
| C | 1,270 | 286 | 1,968 | 2.3 | | 608.0 | 608.0 | 608.0 | 0.0 |
| D | 2,260 | 507 | 2,324 | 2.0 | | 608.3 | 608.3 | 608.3 | 0.0 |
| E | 3,010 | 99 | 929 | 5.0 | | 608.5 | 608.5 | 608.5 | 0.0 |
| F | 5,070 | 496 | 1,991 | 2.3 | | 609.0 | 609.0 | 609.0 | 0.0 |
| G | 6,530 | 323 | 1,636 | 2.8 | | 609.4 | 609.4 | 609.4 | 0.0 |
| H | 8,450 | 363 | 1,985 | 2.3 | | 610.2 | 610.2 | 610.2 | 0.0 |
| I | 10,050 | 577 | 2,835 | 1.6 | | 611.1 | 611.1 | 611.1 | 0.0 |
| J | 13,080 | 280 | 1,466 | 3.1 | | 612.0 | 612.0 | 612.0 | 0.0 |
| K | 15,400 | 725 | 4,544 | 1.0 | | 612.9 | 612.9 | 612.9 | 0.0 |
| L | 16,940 | 681 | 5,540 | 0.8 | | 613.2 | 613.2 | 613.2 | 0.0 |
| M | 18,090 | 794 | 4,040 | 1.1 | | 613.3 | 613.3 | 613.3 | 0.0 |
| N | 19,430 | 733 | 4,391 | 1.0 | | 613.7 | 613.7 | 613.7 | 0.0 |
| O | 20,900 | 495 | 2,061 | 2.2 | | 614.1 | 614.1 | 614.1 | 0.0 |
| P | 21,650 | 1,013 | 4,386 | 1.0 | | 614.6 | 614.6 | 614.6 | 0.0 |
| Q | 22,900 | 963 | 3,597 | 1.2 | | 614.9 | 614.9 | 614.9 | 0.0 |
| R | 23,880 | 1,268 | 5,534 | 0.8 | | 615.2 | 615.2 | 615.3 | 0.1 |
| S | 25,260 | 1,125 | 5,719 | 0.8 | | 615.6 | 615.6 | 615.7 | 0.1 |
| T | 26,250 | 1,034 | 4,717 | 0.9 | | 615.8 | 615.8 | 615.9 | 0.1 |
| U | 27,920 | 1,730 | 8,237 | 0.5 | | 616.3 | 616.3 | 616.4 | 0.1 |
| V | 29,670 | 1,448 | 7,072 | 0.6 | | 616.5 | 616.5 | 616.6 | 0.1 |
| W | 30,820 | 1,408 | 6,721 | 0.6 | | 616.8 | 616.8 | 616.9 | 0.1 |

[1] Feet above confluence with Lake Superior

TABLE 23

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MARQUETTE COUNTY, MI**

**(ALL JURISDICTIONS)**

**FLOODWAY DATA**

**CHOCOLAY RIVER**

**Table 23: Floodway Data (continued)**

| LOCATION | | FLOODWAY | | | | 1% ANNUAL CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD88) | | | |
|---|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FEET) | SECTION AREA (SQ. FEET) | MEAN VELOCITY (FEET/ SECOND) | WIDTH REDUCED FROM PRIOR STUDY (FEET) | REGULATORY (FEET NAVD) | WITHOUT FLOODWAY (FEET NAVD) | WITH FLOODWAY (FEET NAVD) | INCREASE (FEET) |
| A | 510 | 94 | 216 | 2.4 | | 611.6 | 609.6[2] | 609.7 | 0.1 |
| B | 1,240 | 31 | 82 | 6.2 | | 613.0 | 613.0 | 613.0 | 0.0 |
| C | 1,610 | 45 | 110 | 4.6 | | 614.4 | 614.4 | 614.5 | 0.1 |
| D | 2,390 | 110 | 313 | 1.6 | | 617.4 | 617.4 | 617.4 | 0.0 |
| E | 3,350 | 155 | 434 | 1.2 | | 618.0 | 618.0 | 618.1 | 0.1 |
| F | 4,550 | 66 | 178 | 2.9 | | 629.5 | 629.5 | 629.6 | 0.1 |
| G | 4,980 | 215 | 512 | 1.0 | | 630.8 | 630.8 | 630.9 | 0.1 |
| H | 5,400 | 175 | 193 | 2.6 | 25.0 | 633.0 | 633.0 | 633.0 | 0.0 |
| I | 6,050 | 383 | 1,223 | 0.4 | | 639.0 | 639.0 | 639.0 | 0.0 |
| J | 7,160 | 191 | 481 | 1.1 | | 642.2 | 642.2 | 642.3 | 0.1 |
| K | 7,460 | 95 | 190 | 2.7 | | 643.2 | 643.2 | 643.3 | 0.1 |
| L | 8,140 | 76 | 110 | 4.7 | | 649.4 | 649.4 | 649.4 | 0.0 |
| M | 8,650 | 154 | 254 | 2.0 | | 652.5 | 652.5 | 652.6 | 0.1 |

[1] Feet above confluence with Chocolay River

[2] Elevation computed without consideration of backwater effects from Chocolay River

TABLE 23

FEDERAL EMERGENCY MANAGEMENT AGENCY

**MARQUETTE COUNTY, MI**

**(ALL JURISDICTIONS)**

**FLOODWAY DATA**

**SILVER CREEK**

**Table 24: Flood Hazard and Non-Encroachment Data for Selected Streams**
**[Not applicable for this Flood Risk Project.]**

## 6.4 Coastal Flood Hazard Mapping

Flood insurance zones and BFEs including the wave effects were identified on each transect based on the results from the onshore wave hazard analyses. Between transects, elevations were interpolated using topographic maps, land-use and land-cover data, and knowledge of coastal flood processes to determine the extent of flooding. Sources for topographic data are shown in Table 22.

Zone VE is subdivided into elevation zones and BFEs are provided on the FIRM.

The limit of Zone VE shown on the FIRM is defined as the farthest inland extent of any of the following criteria (determined for the 1-percent-annual-chance flood condition):

- The *primary frontal dune* is defined in 44 CFR Section 59.1 of the NFIP regulations. “The primary frontal dune represents a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes that occur immediately landward and adjacent to the beach. The primary frontal dune zone is subject to erosion and overtopping from high tides and waves during major coastal storms. The inland limit of the primary frontal dune zone occurs at the point where there is a distinct change from a relatively steep slope to a relatively mild slope.”

- The *wave runup Zone VE* occurs where the (eroded) ground profile is 3.0 feet or more below the 2-percent wave runup elevation.

- The *wave overtopping splash Zone VE* is the area landward of the crest of an overtopped barrier, in cases where the potential 2-percent wave runup exceeds the barrier crest elevation.

- The *breaking wave height Zone VE* occurs where 3-foot or greater wave heights could occur.

- The *high-velocity flow Zone VE* is landward of the overtopping splash zone (or area on a sloping beach or other shore type), where the product of depth of flow times the flow velocity squared ($hv^2$) is greater than or equal to 200 $ft^3/sec^2$.

The SFHA boundary indicates the landward extent of the coastal SFHAs shown on the FIRM as Zones VE, AE, AO, AH, or A.

Table 25 indicates the coastal analyses used for floodplain mapping and the criteria used to determine the inland limit of the open-coast Zone VE and the SFHA boundary at each transect.

**Table 25: Summary of Coastal Transect Mapping Considerations**

| Coastal Transect | Primary Frontal Dune (PFD) Identified | Wave Runup Analysis | Wave Height Analysis | Zone VE Limit | SFHA Boundary |
|---|---|---|---|---|---|
| | | Zone Designation and BFE (ft NAVD88) | Zone Designation and BFE (ft NAVD88) | | |
| 1 | No | VE607<br>AE607 | AE605 | Runup | SWEL |
| 2 | No | VE610 | N/A | Runup | Runup |
| 3 | No | VE614 | N/A | Runup | Runup |
| 4 | No | VE607<br>AE607 | N/A | Runup | Runup |
| 5 | No | VE645 | N/A | Runup | Runup |
| 6 | No | VE607<br>AE607 | N/A | Runup | Runup |
| 7 | No | VE607<br>AE607 | AE603 | Runup | SWEL |
| 8 | No | VE639 | N/A | Runup | Runup |
| 9 | No | VE607<br>AE607 | N/A | Runup | Runup |
| 10 | No | VE626 | N/A | Runup | Runup |
| 11 | No | VE607<br>AE607 | AE606 – 605<br>AE 603 | Runup | SWEL |
| 12 | No | VE607 | N/A | Runup | Runup |
| 13 | No | VE608<br>AE608 | N/A | Runup | Runup |
| 14 | No | VE642 | N/A | Runup | Runup |
| 15 | No | VE608 | N/A | Runup | Runup |
| 16 | No | VE607<br>AE607 | N/A | Runup | Runup |
| 17 | No | VE610 | N/A | Runup | Runup |
| 18 | No | VE643 | N/A | Runup | Runup |
| 19 | No | VE609 | N/A | Runup | Runup |
| 20 | No | VE608 | N/A | Runup | Runup |
| 21 | No | VE634 | N/A | Runup | Runup |

**Table 25: Summary of Coastal Transect Mapping Considerations (continued)**

| Coastal Transect | Primary Frontal Dune (PFD) Identified | Wave Runup Analysis<br>Zone Designation and BFE (ft NAVD88) | Wave Height Analysis<br>Zone Designation and BFE (ft NAVD88) | Zone VE Limit | SFHA Boundary |
|---|---|---|---|---|---|
| 22 | No | VE612 | N/A | Runup | Runup |
| 23 | No | VE608 | N/A | Runup | Runup |
| 24 | No | VE607 | N/A | Runup | Runup |
| 25 | No | VE610 | N/A | Runup | Runup |
| 26 | No | AE605 | VE607<br>AE606 – 605<br>AE603 | Overland Wave Propagation | SWEL |
| 27 | No | VE609 | N/A | Wave Overtopping Splash Zone | Wave Overtopping Splash Zone |
| 28 | No | VE609<br>AE609 | N/A | Runup | Runup |
| 29 | No | AE604 | AE606 | N/A | Runup |
| 30 | No | VE607<br>AE607 | N/A | Runup | Runup |
| 31 | No | VE610 | N/A | Runup | Runup |
| 32 | No | VE608 | N/A | Runup | Runup |
| 33 | No | VE608 | N/A | Runup | Runup |
| 34 | No | VE609 | N/A | Runup | Runup |
| 35 | No | VE608 | N/A | Runup | Runup |
| 36 | No | VE607 | N/A | Runup | Runup |
| 37 | No | VE606 | VE607 | Runup | Runup |
| 38 | No | VE611 | N/A | Runup | Runup |

A LiMWA boundary has also been added in coastal areas subject to overland wave propagation for use by local communities in safe rebuilding practices. The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave.

The LiMWA was not mapped at any locations within this county.

## 6.5 FIRM Revisions

This FIS Report and the FIRM are based on the most up-to-date information available to FEMA at the time of its publication; however, flood hazard conditions change over time. Communities or private parties may request flood map revisions at any time. Certain types of requests require submission of supporting data. FEMA may also initiate a revision. Revisions may take several forms, including Letters of Map Amendment (LOMAs), Letters of Map Revision Based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs) (referred to collectively as Letters of Map Change (LOMCs)), Physical Map Revisions (PMRs), and FEMA-contracted restudies. These types of revisions are further described below. Some of these types of revisions do not result in the republishing of the FIS Report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood-hazard data (shown in Table 30, "Map Repositories").

### 6.5.1 Letters of Map Amendment

A LOMA is an official revision by letter to an effective NFIP map. A LOMA results from an administrative process that involves the review of scientific or technical data submitted by the owner or lessee of property who believes the property has incorrectly been included in a designated SFHA. A LOMA amends the currently effective FEMA map and establishes that a specific property is not located in a SFHA.

To obtain an application for a LOMA, visit www.fema.gov/flood-maps/change-your-flood-zone and download the form "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill". Visit the "Flood Map-Related Fees" section to determine the cost, if any, of applying for a LOMA.

FEMA offers a tutorial on how to apply for a LOMA. The LOMA Tutorial Series can be accessed at www.fema.gov/flood-maps/tutorials.

For more information about how to apply for a LOMA, call the FEMA Mapping and Insurance eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627).

### 6.5.2 Letters of Map Revision Based on Fill

A LOMR-F is an official revision by letter to an effective NFIP map. A LOMR-F states FEMA's determination concerning whether a structure or parcel has been elevated on fill above the base flood elevation and is, therefore, excluded from the SFHA.

Information about obtaining an application for a LOMR-F can be obtained in the same manner as that for a LOMA, by visiting www.fema.gov/flood-maps/change-your-flood-zone for the "MT-1 Application Forms and Instructions for Conditional and Final Letters of Map Amendment and Letters of Map Revision Based on Fill" or by calling the FEMA Mapping and Insurance eXchange, toll free, at 1-877-FEMA MAP (1-877-336-2627). Fees for applying for a LOMR-F, if any, are listed in the "Flood Map-Related Fees" section.

A tutorial for LOMR-F is available at www.fema.gov/flood-maps/tutorials.

### 6.5.3 Letters of Map Revision

A LOMR is an official revision to the currently effective FEMA map. It is used to change flood zones, floodplain and floodway delineations, flood elevations and planimetric features. All requests for LOMRs should be made to FEMA through the chief executive officer of the community, since it is the community that must adopt any changes and revisions to the map. If the request for a LOMR is not submitted through the chief executive officer of the community, evidence must be submitted that the community has been notified of the request.

To obtain an application for a LOMR, visit www.fema.gov/flood-maps/change-your-flood-zone and download the form “MT-2 Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision”. Visit the “Flood Map-Related Fees” section to determine the cost of applying for a LOMR. For more information about how to apply for a LOMR, call the FEMA Mapping and Insurance eXchange; toll free, at 1-877-FEMA MAP (1-877-336-2627) to speak to a Map Specialist.

Previously issued mappable LOMCs (including LOMRs) that have been incorporated into the Marquette County FIRM are listed in Table 26. Please note that this table only includes LOMCs that have been issued on the FIRM panels updated by this map revision. For all other areas within this county, users should be aware that revisions to the FIS Report made by prior LOMRs may not be reflected herein and users will need to continue to use the previously issued LOMRs to obtain the most current data.

**Table 26: Incorporated Letters of Map Change**

| Case Number | Effective Date | Flooding Source | FIRM Panel(s) |
|---|---|---|---|
| 19-05-1622P | 2/15/2019 | Lake Superior | 26103C0135E, 26103C0155E, 26103C0160E, 26103C0170E, 26103C0305E, 26103C0310E, 26103C0320E |

### 6.5.4 Physical Map Revisions

A Physical Map Revisions (PMR) is an official republication of a community’s NFIP map to effect changes to base flood elevations, floodplain boundary delineations, regulatory floodways and planimetric features. These changes typically occur as a result of structural works or improvements, annexations resulting in additional flood hazard areas or correction to base flood elevations or SFHAs.

The community’s chief executive officer must submit scientific and technical data to FEMA to support the request for a PMR. The data will be analyzed and the map will be revised if warranted. The community is provided with copies of the revised information and is afforded a review period. When the base flood elevations are changed, a 90-day appeal period is provided. A 6-month adoption period for formal approval of the revised map(s) is also provided.

For more information about the PMR process, please visit www.fema.gov and visit the Floods & Maps “Change Your Flood Zone Designation” section.

### 6.5.5 Contracted Restudies

The NFIP provides for a periodic review and restudy of flood hazards within a given community. FEMA accomplishes this through a national watershed-based mapping needs assessment strategy, known as the Coordinated Needs Management Strategy (CNMS). The CNMS is used by FEMA to assign priorities and allocate funding for new flood hazard analyses used to update the FIS Report and FIRM. The goal of CNMS is to define the validity of the engineering study data within a mapped inventory. The CNMS is used to track the assessment process, document engineering gaps and their resolution, and aid in prioritization for using flood risk as a key factor for areas identified for flood map updates. Visit www.fema.gov to learn more about the CNMS or contact the FEMA Regional Office listed in Section 8 of this FIS Report.

### 6.5.6 Community Map History

The current FIRM presents flooding information for the entire geographic area of Marquette County**.** Previously, separate FIRMs, Flood Hazard Boundary Maps (FHBMs) and/or Flood Boundary and Floodway Maps (FBFMs) may have been prepared for the incorporated communities and the unincorporated areas in the county that had identified SFHAs. Current and historical data relating to the maps prepared for the project area are presented in Table 27, "Community Map History." A description of each of the column headings and the source of the date is also listed below.

- *Community Name* includes communities falling within the geographic area shown on the FIRM, including those that fall on the boundary line, nonparticipating communities, and communities with maps that have been rescinded. Communities with No Special Flood Hazards are indicated by a footnote. If all maps (FHBM, FBFM, and FIRM) were rescinded for a community, it is not listed in this table unless SFHAs have been identified in this community.

- *Initial Identification Date (First NFIP Map Published)* is the date of the first NFIP map that identified flood hazards in the community. If the FHBM has been converted to a FIRM, the initial FHBM date is shown. If the community has never been mapped, the upcoming effective date or "pending" (for Preliminary FIS Reports) is shown. If the community is listed in Table 27 but not identified on the map, the community is treated as if it were unmapped.

- *Initial FHBM Effective Date* is the effective date of the first FHBM. This date may be the same date as the Initial NFIP Map Date.

- *FHBM Revision Date(s)* is the date(s) that the FHBM was revised, if applicable.

- *Initial FIRM Effective Date* is the date of the first effective FIRM for the community.

- *FIRM Revision Date(s)* is the date(s) the FIRM was revised, if applicable. This is the revised date that is shown on the FIRM panel, if applicable. As countywide studies are completed or revised, each community listed should have its FIRM dates updated accordingly to reflect the date of the countywide study. Once the FIRMs exist in countywide format, as PMRs of FIRM panels within the county are completed, the FIRM Revision Dates in the table for each community affected by the PMR are updated with the date of the PMR, even if the PMR did not revise all the panels within that community.

The initial effective date for the Marquette County FIRMs in countywide format was 04/19/2016.

**Table 27: Community Map History**

| Community Name | Initial Identification Date | Initial FHBM Effective Date | FHBM Revision Date(s) | Initial FIRM Effective Date | FIRM Revision Date(s) |
|---|---|---|---|---|---|
| Champion, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Chocolay, Charter Township of | 10/24/1975 | 10/24/1975 | 1/5/1979 | 5/4/1987 | TBD<br>4/19/2016 |
| Ely, Township of | 5/20/1977 | 5/20/1977 | 2/13/1981 | 9/1/1988 | TBD<br>4/19/2016 |
| Ewing, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |
| Forsyth, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |
| Humboldt, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Ishpeming, City of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Ishpeming, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Marquette, Charter Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Marquette, City of | 9/30/1988 | N/A | N/A | 9/30/1988 | TBD<br>4/19/2016<br>12/2/1994 |
| Michigamme, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Negaunee, City of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Negaunee, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Powell, Township of | 11/20/2000 | N/A | N/A | 11/20/2000 | TBD<br>4/19/2016 |
| Republic, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |
| Richmond, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Sands, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Skandia, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Tilden, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | TBD |
| Turin, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |
| Wells, Township of[1,2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |
| West Branch, Township of[2] | 4/19/2016 | N/A | N/A | 4/19/2016 | N/A |

[1] No Special Flood Hazard Areas Identified
[2]This Community did not have a FIRM prior to the first countywide FIRM for Marquette County

## SECTION 7.0 – CONTRACTED STUDIES AND COMMUNITY COORDINATION

### 7.1 Contracted Studies

Table 28 provides a summary of the contracted studies, by flooding source, that are included in this FIS Report.

**Table 28: Summary of Contracted Studies Included in this FIS Report**

| Flooding Source | FIS Report Dated | Contractor | Number | Work Completed Date | Affected Communities |
|---|---|---|---|---|---|
| All Other Zone A's excluding those individually listed | 4/19/2016 | Atkins | HSFE05-05-D-0023 | July 2011 | Champion, Township of; Chocolay, Charter Township of; Ely, Township of; Ishpeming, Township of; Marquette, City of; Powell, Township of; Sands, Township of; Skandia, Township of; Tilden, Township of; West Branch, Township of |
| Carp Creek, Dead River Storage Basin, Deer Lake, McClure Storage Basin | TBD | STARR II | HSFE60-15-D-0005 | February 2019 | Champion, Township of; Ely, Township of; Ishpeming, City of; Ishpeming, Township of; Negaunee, Township of; Tilden, Township of |
| Carp River (Approximately 0.6 miles downstream of County Road 553) | 4/19/2016 | N/A | N/A | 1994 | Marquette, City of |
| Carp River (Approximately 0.6 miles upstream of County Road 553) | TBD | STARR II | HSFE60-15-D-0005 | February 2019 | Champion, Township of; Ishpeming, Township of; Marquette, Charter Township of; Marquette, City of; Negaunee, City of; Negaunee, Township of; Sands, Township of |
| Chocolay River, Silver Creek | 4/19/2016 | STS Consultants, Inc. | EMW-83-C-1169 | August 1985 | Chocolay, Charter Township of |
| Dead River (downstream of Forrestville Dam) | 4/19/2016 | Atkins | HSFE05-05-D-0023 | July 2011 | Marquette, Charter Township of; Marquette, City of |
| Dead River (upstream of Forrestville Dam) | TBD | STARR II | HSFE60-15-D-0005 | February 2019 | Champion, Township of; Marquette, Charter Township of; Negaunee, Township of |
| East Branch Sand River | TBD | STARR | HSFEHQ-09-D-0370 | February 28, 2017 | Skandia, Township of |
| Lake Superior | TBD | STARR | HSFEHQ-09D-0370 | September 2018 | Chocolay, Charter Township of; Marquette, Charter Township of; Marquette, City of; Powell, Township of; Sands, Township of |

## 7.2 Community Meetings

The dates of the community meetings held for this Flood Risk Project and previous Flood Risk Projects are shown in Table 29. These meetings may have previously been referred to by a variety of names (Community Coordination Officer (CCO), Scoping, Discovery, etc.), but all meetings represent opportunities for FEMA, community officials, study contractors, and other invited guests to discuss the planning for and results of the project.

**Table 29: Community Meetings**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Champion, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Chocolay, Charter Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Ely, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Ewing, Township of | 4/19/2016 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |
| Forsyth, Township of | 4/19/2016 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Humboldt, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Ishpeming, City of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Ishpeming, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Marquette, Charter Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Marquette, City of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Michigamme, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Negaunee, City of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Negaunee, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Powell, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Republic, Township of | 4/16/2019 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Richmond, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Sands, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

### Table 29: Community Meetings (continued)

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Skandia, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |
| Tilden, Township of | TBD | 11/5/2015 | Project Discovery | Representatives of Arvon Township, Baraga Township, Charter Township of Chocolay, Charter Township of Marquette, Chassell Township, City of Ishpeming, City of Marquette, Marquette County, Michigan Dept. of Environmental Quality, Risk Analysis FEMA Region V, STARR, Township of Ely, Township of Michigamme, Township of Sands, Village of L'Anse |
| | | 7/7/2016 | Project Discovery | Representatives of Charter Township of Chocolay, Charter Township of Marquette, FEMA Region V, Keweenaw Bay Indian Community, Marquette County, Michigan Dept. of Env. Quality, STARR, Township of Sands, Village of Baraga, Village of L'Anse |
| | | 7/10/2018 | Flood Risk Review | Representatives of Cambensy Engineering & Survey, Charter Township of Chocolay, Charter Township of Marquette, City of Marquette, Marquette County, Michigan Dept. Of Environmental Quality, Van Neste Survey |
| | | 5/1/2019 | Flood Risk Review | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, Department of Environmental Quality, FEMA, Marquette County, Stantec/STARR II, STARR II, Township of Ishpeming, Township of Negaunee |
| | | 11/02/2021 | CCO Meeting | Representatives of Charter Township of Marquette, City of Ishpeming, City of Marquette, FEMA, Marquette County, Michigan Dept. Of Environmental Quality, STARR II, Township of Ely, Township of Ishpeming, Township of Negaunee |

**Table 29: Community Meetings (continued)**

| Community | FIS Report Dated | Date of Meeting | Meeting Type | Attended By |
|---|---|---|---|---|
| Turin, Township of | 4/19/2016 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |
| Wells, Township of | 4/19/2016 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |
| West Branch, Township of | 4/19/2016 | 5/29/2008 | Initial CCO | Representatives of Atkins, FEMA, Marquette County, Michigan Department of Natural Resources |
| | | 3/21/2013 | Final CCO | Representatives of Atkins, FEMA, Michigan Department of Natural Resources |

## SECTION 8.0 – ADDITIONAL INFORMATION

Information concerning the pertinent data used in the preparation of this FIS Report can be obtained by submitting an order with any required payment to the FEMA Engineering Library. For more information on this process, see www.fema.gov.

The additional data that was used for this project includes the User's Manual for Wave Height Analysis (FEMA 1981), the WHAFIS Program Version 3.0 (FEMA 1988), the guidance for Coastal Flooding Analyses and Mapping (FEMA 2002), the Coastal Flood Hazards Flood Analysis and Mapping Focused Study Report (FEMA 2005), Appendix D.3 of the FEMA Great Lakes Coastal Guidelines (FEMA 2014), North American Datum Conversion Utility (NGS 2009), the Journal of Waterway (OE 2001), Mathcad Version 14.0 (PTC 2007), the Great Lakes Storm Surge Analysis Lake Superior, FEMA Region V (STARR 2012), the Coastal Scoping Report (STARR 2015), ADCIRC+SWAN Modeling Lake Superior (STARR 2016a) and Lake Superior Modeling, IDS2: ADCIRC+SWAN Production Runs (STARR 2016b), the Hydraulic Deliverable for the Betsy-Chocolay Watershed Study (STARR 2017), Wave Runup Prediction for Flood Hazard Assessment (USACE 2012a), and America Fact Finder (USCB 2010).

Table 30 is a list of the locations where FIRMs for Marquette County can be viewed. Please note that the maps at these locations are for reference only and are not for distribution. Also, please note that only the maps for the community listed in the table are available at that particular repository. A user may need to visit another repository to view maps from an adjacent community.

**Table 30: Map Repositories**

| Community | Address | City | State | Zip Code |
|---|---|---|---|---|
| Champion, Township of | Township Hall<br>5317 US Highway 41 West | Champion | MI | 49814 |
| Chocolay, Charter Township of | Chocolay Charter Township Hall<br>5010 US Highway 41 South | Marquette | MI | 49855 |
| Ely, Township of | Ely Township Hall<br>1555 County Road 496 | Ishpeming | MI | 49849 |
| Ewing, Township of[1] | Ewing Township Hall<br>2500 West Maple Ridge 37th Road | Rock | MI | 49880 |
| Forsyth, Township of[1] | Forsyth Township Hall<br>186 West Flint Street | Gwinn | MI | 49841 |
| Humboldt, Township of[1] | Humboldt Township Hall<br>244 County Road FAF | Champion | MI | 49814 |

[1] No Special Flood Hazard Areas Identified

**Table 30: Map Repositories (continued)**

| Community | Address | City | State | Zip Code |
|---|---|---|---|---|
| Ishpeming, City of | City Hall<br>100 East Division Street | Ishpeming | MI | 49849 |
| Ishpeming, Township of | Township Hall<br>1575 US Highway 41 West | Ishpeming | MI | 49849 |
| Marquette, Charter Township of | Charter Township Hall<br>1000 Commerce Drive | Marquette | MI | 49855 |
| Marquette, City of | City Hall<br>300 West Baraga Avenue | Marquette | MI | 49855 |
| Michigamme, Township of[1] | Township Hall<br>202 West Main Street | Michigamme | MI | 49861 |
| Negaunee, City of | City Hall<br>319 West Case Street | Negaunee | MI | 49866 |
| Negaunee, Township of | Township Hall<br>42 State Highway M35 | Negaunee | MI | 49866 |
| Powell, Township of | Powell Township Hall<br>101 Bensinger Street | Big Bay | MI | 49808 |
| Republic, Township of[1] | Township Office<br>279 Kloman Avenue | Republic | MI | 49879 |
| Richmond, Township of[1] | Richmond Township Hall<br>100 Smith Street | Palmer | MI | 49871 |
| Sands, Township of | Sands Township<br>Office Complex<br>987 State Highway M-553 | Gwinn | MI | 49841 |
| Skandia, Township of | Township Hall<br>224 Kreiger Drive | Skandia | MI | 49885 |
| Tilden, Township of | Tilden Township Hall<br>3145 County Road PG | Ishpeming | MI | 49849 |
| Turin, Township of[1] | Turin Township Hall<br>17506 Michigan Route 35 | Rock | MI | 49880 |
| Wells, Township of[1] | Wells Township Hall<br>38295 County Road 426 | Arnold | MI | 49819 |
| West Branch, Township of | West Branch Township Hall<br>1016 County Road 545<br>North | Skandia | MI | 49885 |

[1] No Special Flood Hazard Areas Identified

The National Flood Hazard Layer (NFHL) dataset is a compilation of effective FIRM Databases and LOMCs. Together they create a GIS data layer for a State or Territory. The NFHL is updated as studies become effective and extracts are made available to the public monthly. NFHL data can be viewed or ordered from the website shown in Table 31. Table 31 contains useful contact information regarding the FIS Report, the FIRM, and other relevant flood hazard and GIS data. In addition, information about the State NFIP Coordinator and GIS Coordinator is shown in this table. At the request of FEMA, each Governor has designated an agency of State or territorial government to coordinate that State's or territory's NFIP activities. These agencies often assist communities in developing and adopting necessary floodplain management measures. State GIS Coordinators are knowledgeable about the availability and location of State and local GIS data in their state.

**Table 31: Additional Information**

| FEMA and the NFIP | |
|---|---|
| FEMA and FEMA Engineering Library website | www.fema.gov/flood-maps/products-tools/know-your-risk/engineers-surveyors-architects |
| NFIP website | www.fema.gov/flood-insurance |
| NFHL Dataset | msc.fema.gov |
| FEMA Region V | Federal Emergency Management Agency<br>536 South Clark Street, 6th Floor<br>Chicago, IL 60605<br>(312) 408-5500 |
| Other Federal Agencies | |
| USGS website | www.usgs.gov |
| Hydraulic Engineering Center website | www.hec.usace.army.mil |
| State Agencies and Organizations | |
| State NFIP Coordinator | Matt Occhipinti, NFIP Coorindator<br>EGLE, WRD<br>350 Ottawa Ave, NW<br>Grand Rapids, MI 49503<br>(616) 204-1708<br>occhipintim@michigan.gov |
| State GIS Coordinator | Mark Holmes, GISP<br>Statewide GeoSpatial Services Manager<br>111 S. Capitol Ave<br>Romney Building 10th Floor<br>P.O. Box 30026<br>Lansing, MI 48933<br>Phone: (517) 241-6469<br>holmesm3@michigan.gov |

## SECTION 9.0 – BIBLIOGRAPHY AND REFERENCES

Table 32 includes sources used in the preparation of and cited in this FIS Report as well as additional studies that have been conducted in the study area.

**Table 32: Bibliography and References**

| Citation in this FIS | Publisher/Issuer | Publication Title, "Article," Volume, Number, etc. | Author/Editor | Place of Publication | Publication Date/Date of Issuance | Link |
|---|---|---|---|---|---|---|
| Ayres 2002 | City of Marquette | Digital Orthophotography Project | Ayres Associates | Marquette, MI | April 2002 | |
| CSSTP 2013 | Center for Shared Solutions and Technology Partnerships | Michigan Railroads | Center for Shared Solutions and Technology Partnerships | Lansing, MI | January 2013 | http://gis-michigan.opendata.arcgis.com/ |
| CSSTP 2014 | Center for Shared Solutions and Technology Partnerships | Michigan All Roads, Hydrography Lines, Hydrography Polygons | Center for Shared Solutions and Technology Partnerships | Lansing, MI | June 2014 | http://gis-michigan.opendata.arcgis.com/ |
| FEMA 1981 | Federal Emergency Management Agency | User's Manual for Wave Height Analysis | Federal Emergency Management Agency | Washington, D.C. | February 1981 | |
| FEMA 1988 | Federal Emergency Management Agency | Technical Documentation for WHAFIS Program Version 3.0 | Federal Emergency Management Agency | Washington, D.C. | September 1988 | |
| FEMA 2002 | Federal Emergency Management Agency | Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix D: Guidance for Coastal Flooding Analyses and Mapping | Federal Emergency Management Agency | Washington, D.C. | February 2002 | |

**Table 32: Bibliography and References (continued)**

| Citation in this FIS | Publisher/Issuer | Publication Title, "Article," Volume, Number, etc. | Author/Editor | Place of Publication | Publication Date/Date of Issuance | Link |
|---|---|---|---|---|---|---|
| FEMA 2005 | Federal Emergency Management Agency | FEMA Coastal Flood Hazard Analysis and Mapping Guidelines Focused Study Report | Jones et. al | | February 2005 | https://www.fema.gov/sites/default/files/2020-03/frm_psum.pdf |
| FEMA 2007 | Federal Emergency Management Agency | Supplementary WHAFIS Documentation, WHAFIS 4.0, A Revision of FEMA's WHAFIS 3.0 Program | Divoky, D. | Washington, D.C. | 8/10/2007 | |
| FEMA 2014 | Federal Emergency Management Agency | FEMA Great Lakes Coastal Guidelines, Appendix D.3 Update | Federal Emergency Management Agency | Washington, D.C. | January 2014 | |
| FEMA 2016 | Federal Emergency Management Agency | Flood Insurance Study, Marquette County, Michigan | Atkins | Washington, D.C. | 4/19/2016 | https://www.fema.gov/ |
| JALBTCX 2011 | Joint Airborne LiDAR Bathymetry Technical Center of eXpertise | U.S. Army Corps of Engineers (USACE), JALBTCX (Joint Airborne Lidar Bathymetry Technical Center of eXpertise) Seamless Bathymetry and Terrain for Lake Superior | Joint Airborne LiDAR Bathymetry Technical Center of eXpertise | Washington, D.C. | 2011 | |
| Marquette N.D. | Marquette County | Chapter 3 Flooding | Marquette County | | N.D. | https://www.co.marquette.mi.us/departments/planning/docs/Hazard_Mitigation_Plan/Chapter_3_Flooding.pdf |

**Table 32: Bibliography and References (continued)**

| Citation in this FIS | Publisher/Issuer | Publication Title, "Article," Volume, Number, etc. | Author/Editor | Place of Publication | Publication Date/Date of Issuance | Link |
|---|---|---|---|---|---|---|
| McEwen N.D. | Freshwater Future | Dam Failure Causes Major Flooding | Scott McEwen | | N.D. | https://freshwaterfuture.org |
| MCGI 2013 | Michigan Center for Geographic Information | Michigan Minor Civil Divisions | Michigan Center for Geographic Information | Lansing, MI | January 2013 | http://gis-michigan.opendata.arcgis.com/ |
| MCPC 1955 | Marquette County Planning Commission | Aerial Topography of Portions of Chocolay Township | Chocolay Township | | 1955 | |
| MDNR 1998 | Michigan Department of Natural Resources | Public Land Survey System Arcs | Michigan Department of Natural Resources | Lansing, Michigan | 11/30/1998 | |
| MDNR 2014 | Michigan Department of Natural Resources | Public Land Survey Sections | Michigan Department of Natural Resources | Lansing, MI | 9/17/2014 | http://gis-michigan.opendata.arcgis.com/ |
| MDNRa 2016 | Michigan Department of Natural Resources | Aerial Photo Index and Transportation Features | Michigan Department of Natural Resources | Lansing, Michigan | 4/19/2016 | |
| MDNRb 2016 | Michigan Department of Natural Resources | Water Lines | Michigan Department of Natural Resources | Lansing, Michigan | 4/19/2016 | |
| MDNRc 2016 | Michigan Department of Natural Resources | Water Polygons | Michigan Department of Natural Resources | Lansing, Michigan | 4/19/2016 | |
| MI 2015 | State of Michigan | Northern Michigan - Alger LiDAR - Michigan 2015 | State of Michigan | | 2015 | |

**Table 32: Bibliography and References (continued)**

| Citation in this FIS | Publisher/Issuer | Publication Title, "Article," Volume, Number, etc. | Author/Editor | Place of Publication | Publication Date/Date of Issuance | Link |
|---|---|---|---|---|---|---|
| NAIP 2005 | National Agriculture Imagery Program | 1-Meter Resolution Aerial Imagery | National Agriculture Imagery Program | | 2005 | |
| NGS 2009 | National Geodetic Survey | VERTCON - North American Vertical Datum Conversion Utility | National Geodetic Survery | | 6/25/2009 | https://www.ngs.noaa.gov/ |
| NID 2019 | U.S. Army Corps of Engineers | National Inventory of Dams | U.S. Army Corps of Engineers | | 2019 | https://nid.sec.usace.army.mil/ords/f?p=105:22:14968767807727::NO::: |
| OE 2001 | Journal of Waterway, Port, Coastal, Ocean Engineering | Wave runup on dikes with shallow foreshores. Journal of Waterway, Port, Coastal, Ocean Engineering, Vol. 127, pp. 254 to 262 | Van Gent, M.R.A. | | 2001 | - |
| PBSJ 2010 | PBS and J | Flooding Polygons | PBS and J | Beltsville, MD | 2010 | |
| PTC 2007 | Parametric Technology Corporation | Mathcad Version 14.0 | Parametric Technology Corporation | | 2007 | - |
| SCS 1965 | Soil Conservation Service | Computer Program for Project Formulation, Hydrology, Technical Release No. 20 | U.S. Department of Agriculture | | May 1965 | |
| Sorrell 2008 | Michigan Department of Environmental Equality, Land and Water Management Division | Computing Flood Discharges for Small Ungaged Watersheds | Richard C. Sorrell | | June 2008 | https://www.michigan.gov/ |

**Table 32: Bibliography and References (continued)**

| Citation in this FIS | Publisher/Issuer | Publication Title, "Article," Volume, Number, etc. | Author/Editor | Place of Publication | Publication Date/Date of Issuance | Link |
|---|---|---|---|---|---|---|
| STARR 2012 | Strategic Alliance for Risk Reduction | Great Lakes Storm Surge Analysis Lake Superior, FEMA Region V | Strategic Alliance for Risk Reduction | Washington, D.C. | December 2012 | |
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**Table 32: Bibliography and References (continued)**

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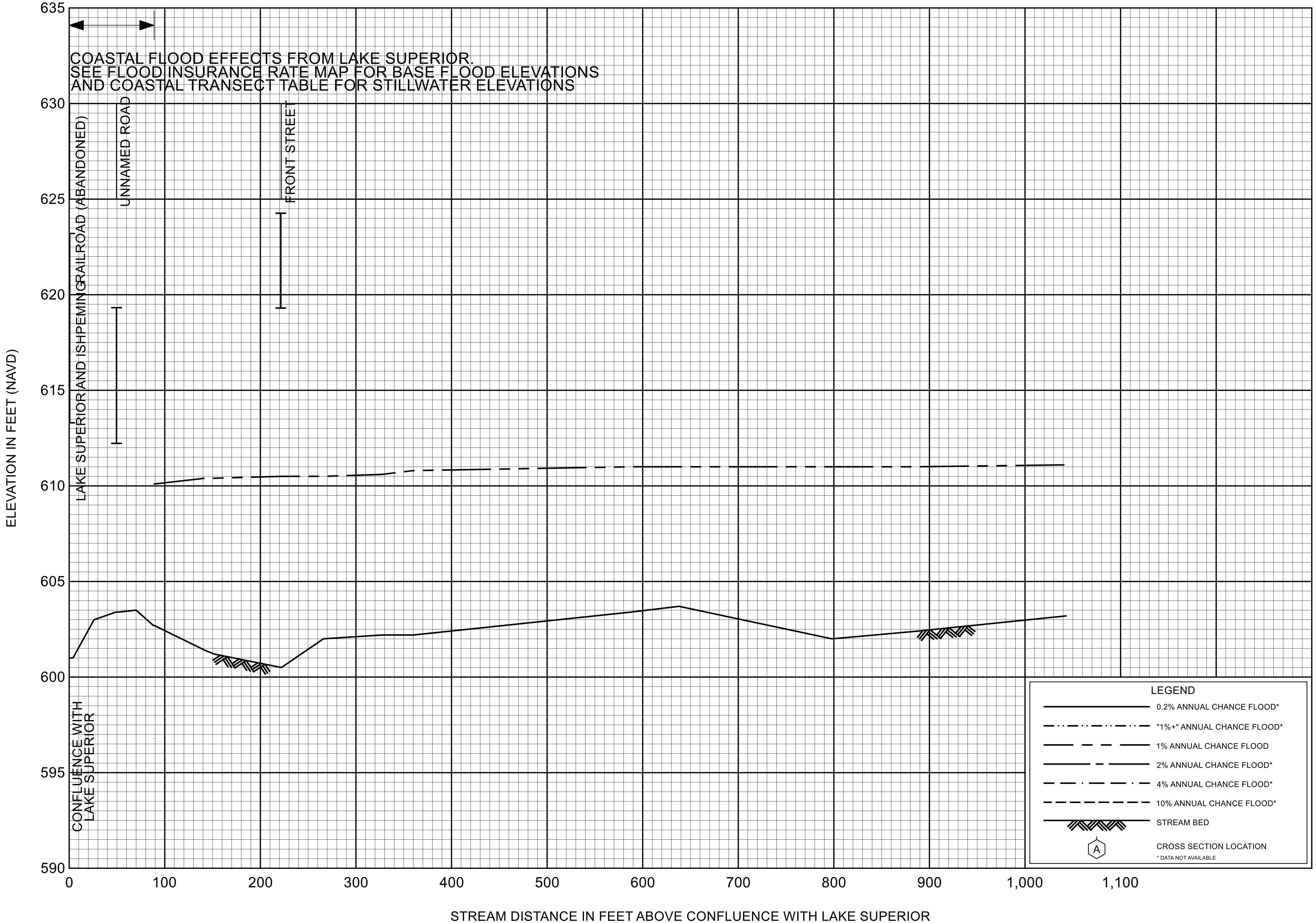


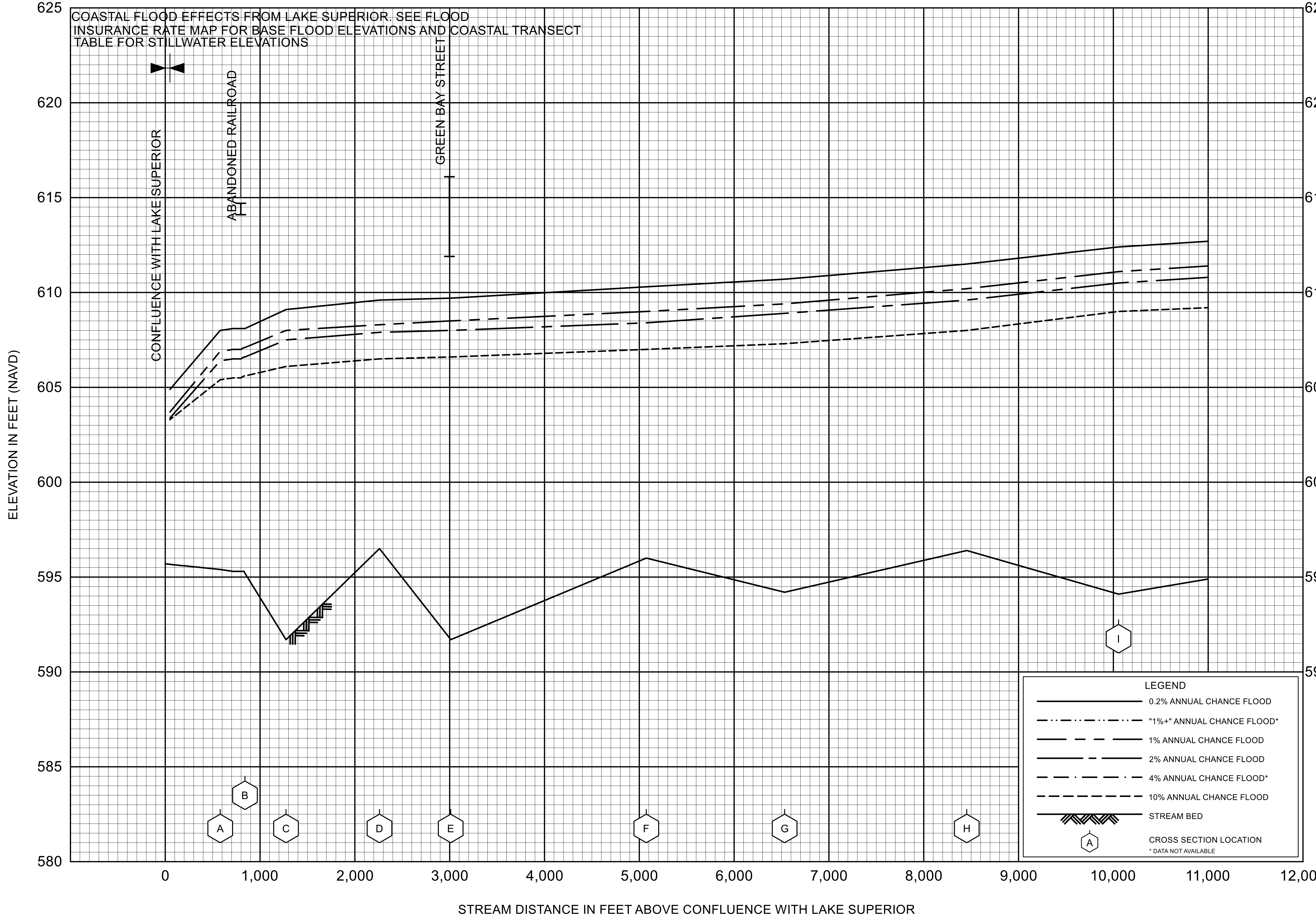

FLOOD PROFILES

CARP RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARQUETTE COUNTY, MI

(ALL JURISDICTIONS)



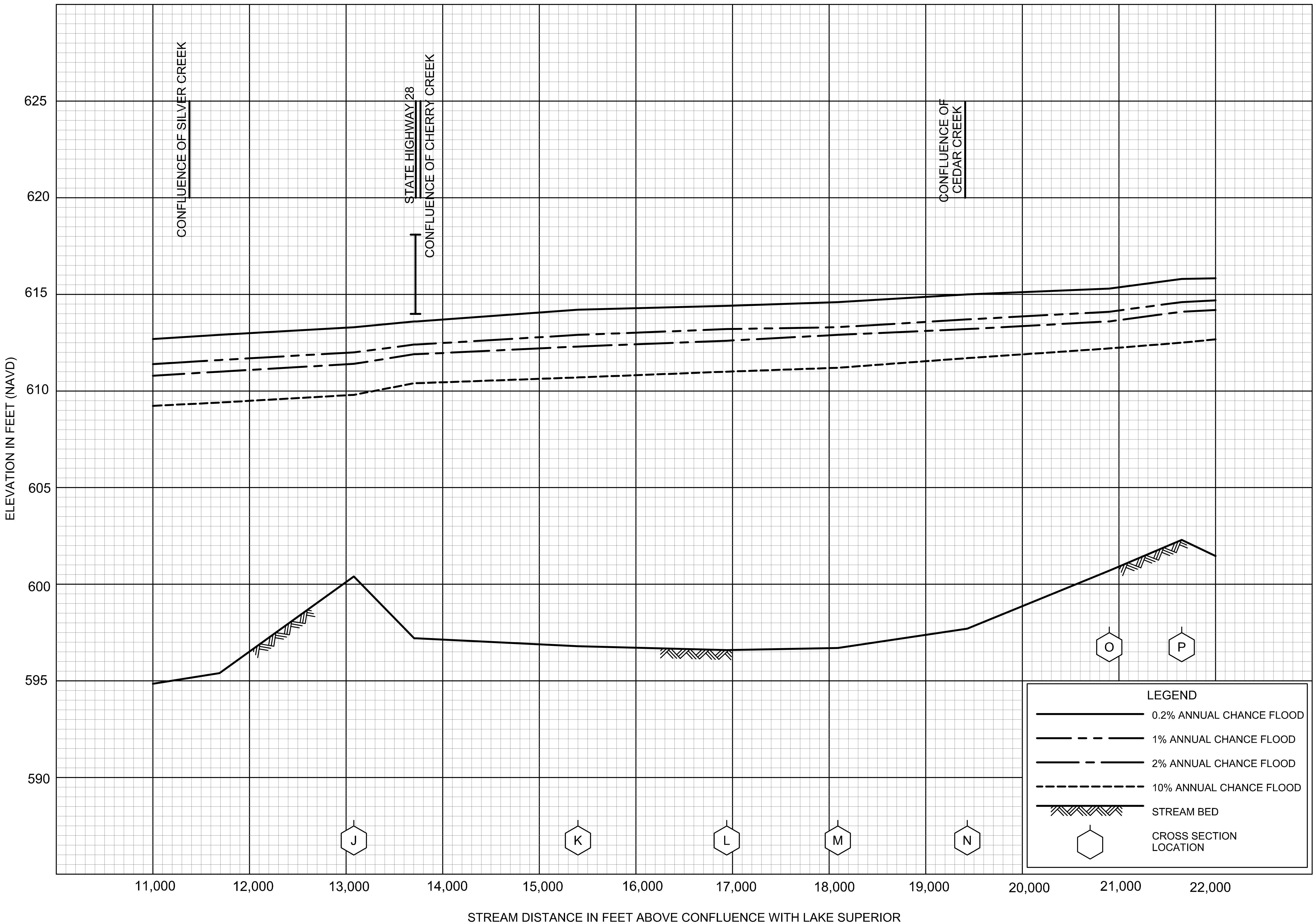

FLOOD PROFILES

CHOCOLAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARQUETTE COUNTY, MI

(ALL JURISDICTIONS)

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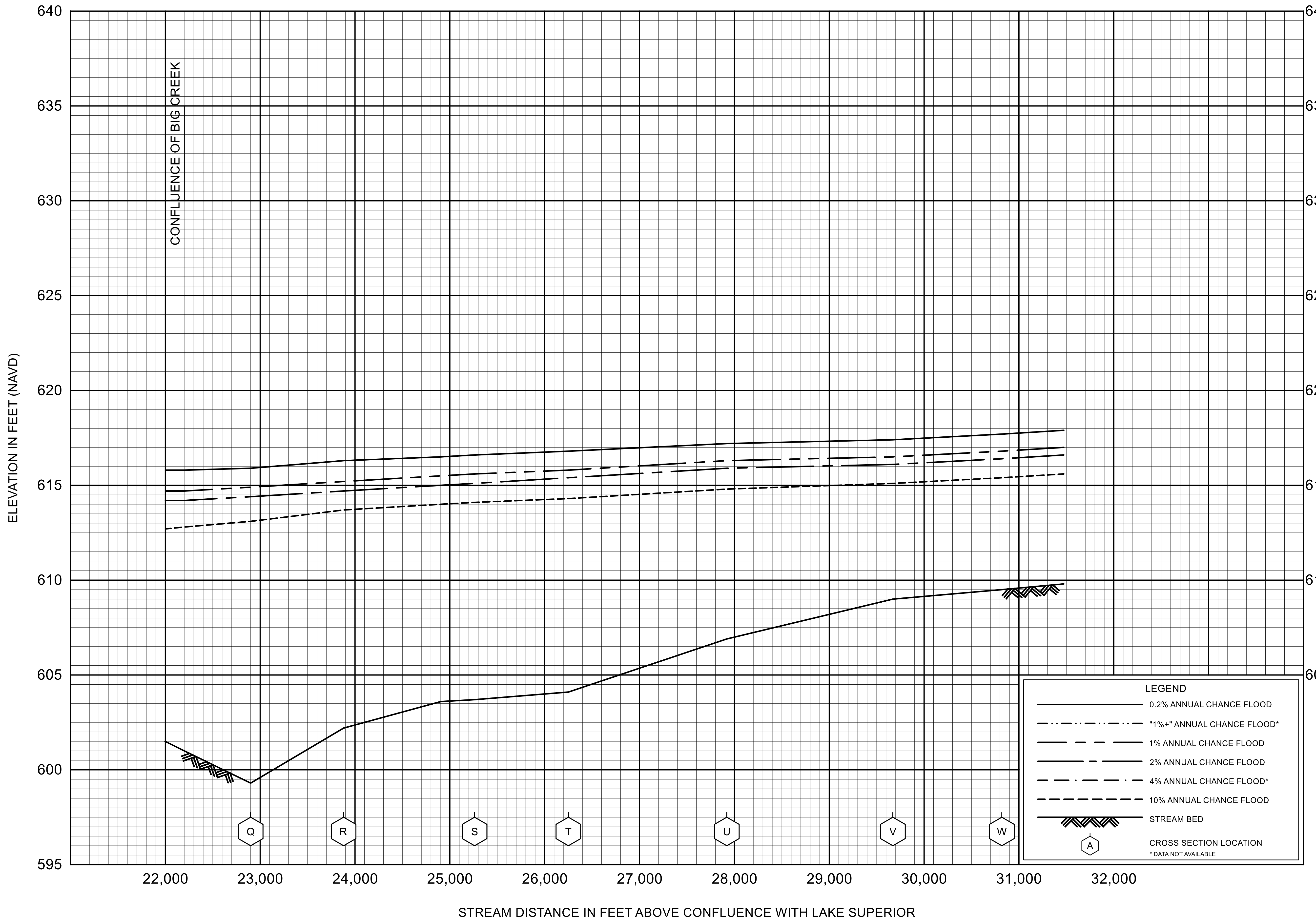


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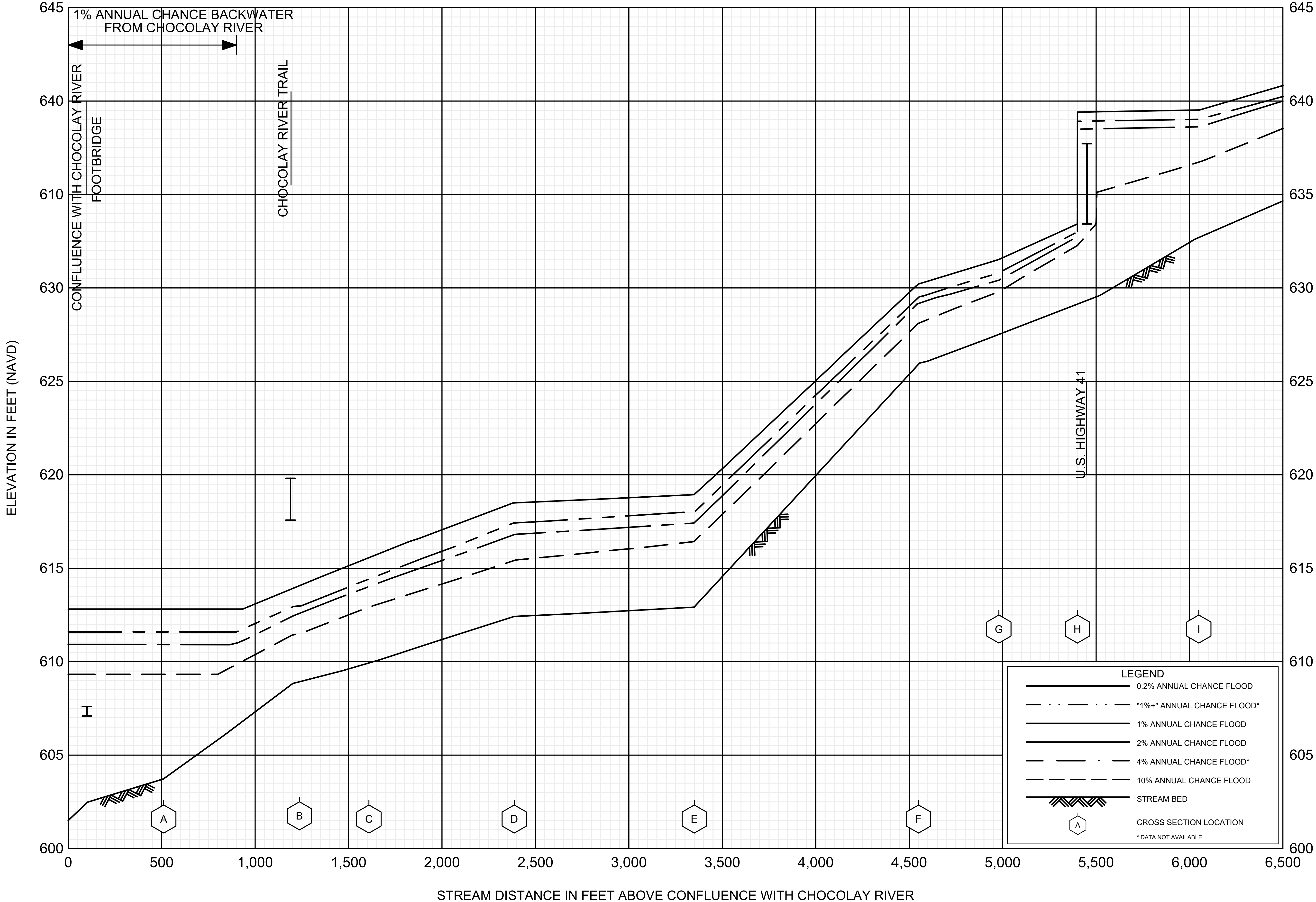


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SILVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARQUETTE COUNTY, MI

(ALL JURISDICTIONS)

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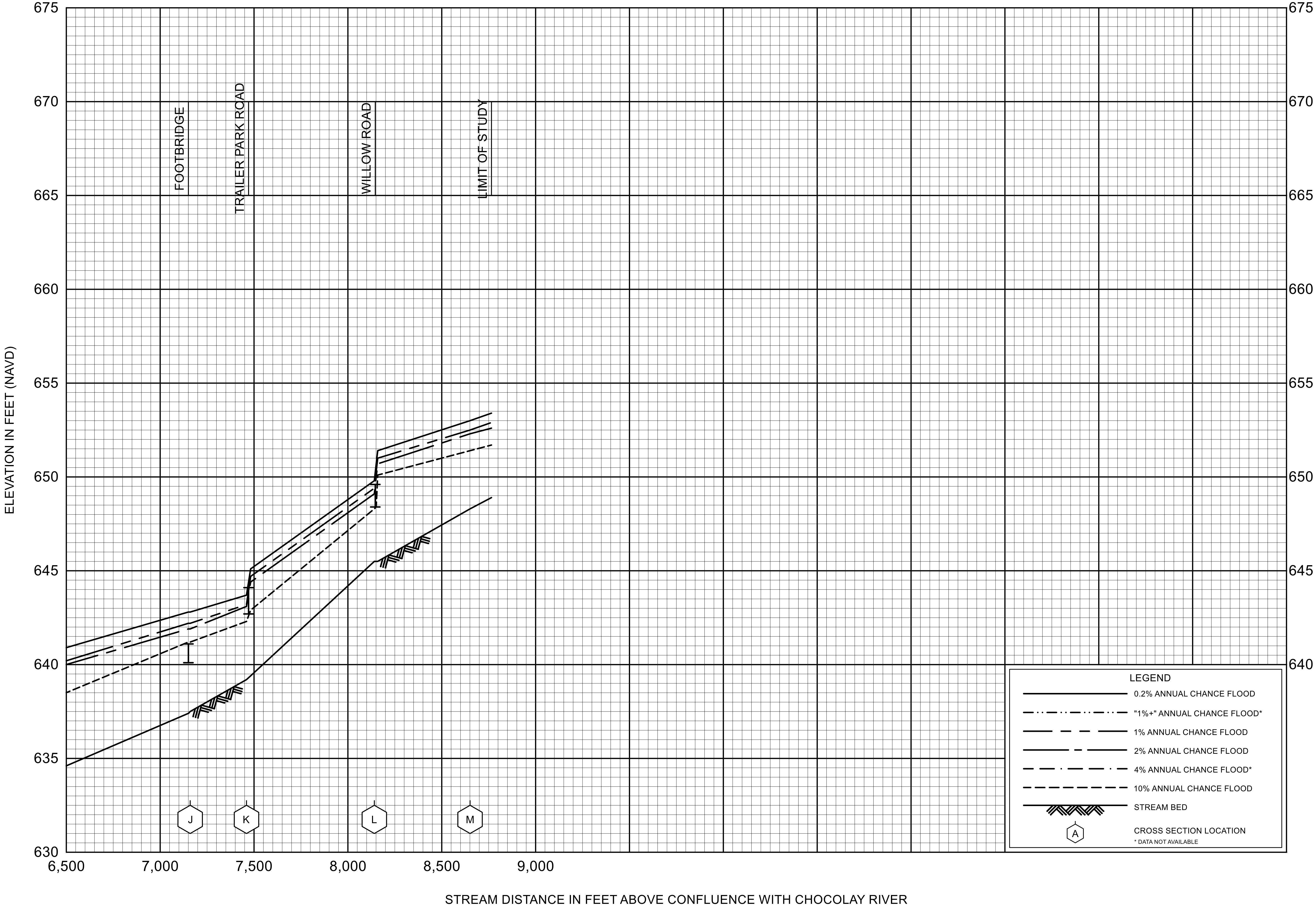


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SILVER CREEK

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MARQUETTE COUNTY, MI
(ALL JURISDICTIONS)