APPENDIX O
Benzie, Grand Traverse, and Leelanau County, Michigan
Discovery Report

Discovery Report

Great Lakes Coastal Flood Study

Lake Michigan
State of Michigan

Benzie County, Grand Traverse County, and Leelanau County
County-based Report

February 2013

FEMA

SUBMITTED BY:

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Submitted: February 2013

Project Area Community List

Benzie County	Grand Traverse County	Leelanau County
Benzonia, Township of	Acme, Township of	Bingham, Township of
Benzonia, Village of	Blair, Township of	Centerville, Township of
Beulah, Village of	East Bay, Township of	Cleveland, Township of
Blaine, Township of	Garfield, Township of	Elmwood, Township of
Crystal Lake, Township of	Peninsula, Township of	Empire, Township of
Elberta, Village of	Traverse City, City of	Empire, Village of
Frankfort, City of	White Water, Township of	Glen Arbor, Township of
Gilmore, Township of		Leelanau, Township of
Lake, Township of		Leland, Township of
Platte, Township of		Northport, Village of
		Solon, Township of
		Suttons Bay, Township of
		Suttons Bay, Village of

This list includes all communities within the Project Area covered by this report for the Great Lakes Coastal Study under consideration for new Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) products and datasets, which may include Flood Insurance Studies (FISs) and Flood Insurance Rate Maps (FIRMs). Not all communities will receive new/updated FEMA Risk MAP products and datasets or FISs and FIRMs.

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Acronyms and Abbreviations

AAL	Average Annualized Loss
CAV	Community Assistance Visit
CBRS	Coastal Barrier Resources System
CID	Community Identification Number
CIS	Community Information System
CMAG	Coastal Management Assistance Grant
C-MAN	Coastal Marine Automated Network
CNMS	Coordinated Needs Management Strategy
CO-OPS	Center for Operational Oceanographic Products and Services
CRS	Community Rating System
DFO	Department of Fisheries and Oceans
FEMA	Federal Emergency Management Agency
FIPS	Federal Information Processing Standards
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
GLCRG	Great Lakes Coastal Restoration Grant
HAZUS-MH	Multi-Hazard Risk Assessment and Loss Estimation Software Program
HWM	High Water Mark
HUC8	Hydrologic Unit Code 8
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision based on Fill
MLI	Midterm Levee Inventory
NDBC	National Data Buoy Center
NFIP	National Flood Insurance Program
NGDC	National Geophysical Data Center
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
Risk MAP	Risk Mapping, Assessment, and Planning
SFHA	Special Flood Hazard Area
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

I. Discovery Overview

The Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment, and Planning, or Risk MAP, program, helps communities identify, assess, and reduce their flood risk. Through Risk MAP, FEMA provides information to enhance local mitigation plans, improve community outreach, and increase local resilience to floods.

During the Discovery phase of Risk MAP project development, FEMA:

- Gathers information about local flood risk and flood hazards
- Reviews mitigation plans to understand local mitigation capabilities, hazard risk assessments, and current or future mitigation activities
- Supports communities within the coastal area to develop a vision for the future
- Collects information from communities about their flooding history, development plans, daily operations, and stormwater and floodplain management activities
- Uses all information gathered to determine which areas require mapping, risk assessment, or mitigation planning assistance through a Risk MAP project
- Develops Discovery Map and Report that summarize and display the Discovery findings

The Discovery process involves coordination with Great Lakes stakeholders, data collection and analysis, community interviews, a Discovery Meeting with stakeholders affected by the study, and development of recommendations based on an analysis of data and information gathered throughout the process

i. Great Lakes Coastal Flood Study

FEMA has initiated a coastal analysis and mapping study that may result in updated Flood Insurance Rate Maps (FIRMs) for coastal counties along the Great Lakes. The new coastal flood hazard analyses will utilize updated 1-percent-annual-chance (100-year) flood elevations obtained from a comprehensive storm surge study being developed by the U.S. Army Corps of Engineers (USACE).

The Great Lakes Coastal Flood Study (GLCFS) will incorporate modern analysis of historic storm and high water events and provide for updated flood risk information serving United States communities having shoreline along the Great Lakes. The storm surge study is one of the most extensive coastal storm surge analyses to date, encompassing coastal floodplains in the eight States with coastlines on the Great Lakes.

An updated coastal flood study is needed to obtain a better estimate of coastal flood hazards on the Great Lakes. The current, effective FIRMs are outdated primarily due to the age of data and the coastal methodologies used in producing them. Major changes in National Flood Insurance Program (NFIP) policies and methodologies have been implemented since the effective date of many flood insurance studies in the area, creating the need for an update that will reflect a more detailed and complete hazard determination.

The Great Lakes Coastal Flood Study includes a system-wide solution that provides a comprehensive analysis of storm and high water events within the Great Lakes Basin. This program is funded through the FEMA Risk MAP program. FEMA, USACE, Association of State Flood Plain Managers (ASFPM), State partners, and FEMA contractors will collaborate in updating the coastal methodology and flood maps, and create new flood risk products. FEMA manages the NFIP, which is the cornerstone of the national strategy for preparing communities for flood-related disasters.

ii. Purpose of Great Lakes Discovery

The Great Lakes Discovery process includes data collection, information exchange between all governmental levels of stakeholders, spatial data presentation, cooperative discussion with stakeholders to better understand the Great Lakes area, and a collaborative approach on the project planning in detail. The process allows FEMA to continue to vet the Great Lakes coastal study methodologies with a large stakeholder group, to discuss local priorities and data, to discuss mitigation strategies and coastal issues, and to move towards projects that will successfully identify the risks associated with Great Lakes flooding.

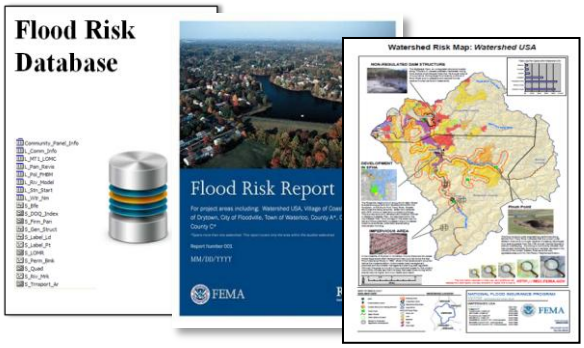
The Discovery process also helps FEMA better identify the types of datasets or products that are useful at the local level, especially as it relates to identifying new mitigation strategies and

actions and for use in local planning efforts. Products that may be available to communities as a result of this Great Lakes flood study include updated FIRMs, coastal flood risk products, calibrated models for storm surge and wave analysis on each of the lakes, and accurate depictions of water level and wave response on each lake occurring during hundreds of actual events. The type of product a community receives is dependant not only on the coastal flood study analysis results, but also on the type of data, local or nationally, that is available.

The following section describes the Coastal Flood Risk Products that a community may receive, as well as some products that are under development for the Great Lakes study areas.

iii. Coastal Flood Risk Products

As part of a Risk MAP project, FEMA will seek to provide State and community officials with three flood risk products to help them gain a better understanding of flood risk and its potential impact on communities and individuals. These products will also enable communities to move forward with informed mitigation actions to reduce identified risk. Delivery of the products discussed below will depend on available data, results of coastal analysis, local partnerships and needs, and fiscal year funding.



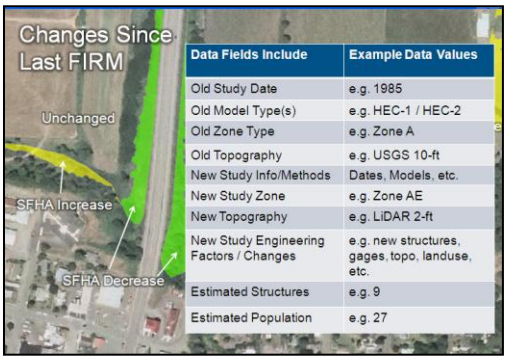
The three products are:

- Flood Risk Database
- Flood Risk Report
- Flood Risk Map

These products will summarize information captured in flood risk datasets that may be generated during a Risk MAP, or flood risk, study. The flood risk datasets could include regular and enhanced products. Standard flood risk datasets, also termed products, are listed below:

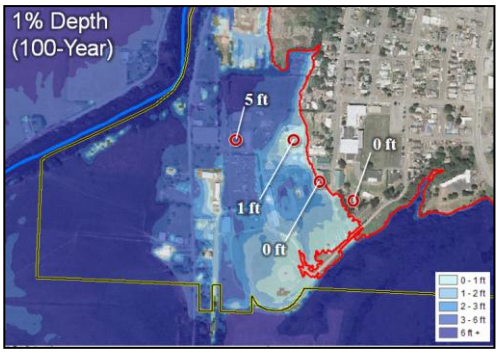
Changes Since Last FIRM (CSLF)

- Identify Areas and Types of Flood Zone Change:
    - Compares current effective (previous) with proposed (new) flood hazard mapping
- Flood zone changes are categorized and quantified



- Provide Study/Reach Level Rationale for Changes Including:
    - Methodology and assumptions
    - Changes of model inputs or parameters (also known as Contributing Engineering Factors).

Flood Depth and Analysis Grids (1-percent-annual-chance event only)



- Reflect total depth (i.e. stillwater and waves). Will be created for the 1% frequency event of the engineering studies performed and as appropriate for the data. Wave runup areas may not be applicable.
- Created using the regulatory mapping and associated zone breaks as input

Flood Risk Assessment (HAZUS-MH)

HAZUS MH
EARTHQUAKE • WIND • FLOOD

For more information about HAZUS and data inputs, visit http://www.fema.gov/plan/prevent/hazus/index.shtm or enter keywords "fema HAZUS" into an internet search engine.

- Hazard-United States Multi Hazard (HAZUS-MH) combines science, engineering and mathematical modeling with GIS technology to estimate losses of life and property—and shows those losses on a map
- HAZUS-MH estimates impacts to the physical, social, and economic vitality of a community from earthquakes, hurricane, winds, and floods
- Coastal flood risk assessments will be similar to riverine, but will use coastal depth grids as input for refined analysis.
- HAZUS-MH analysis and data can support adoption of high regulatory standards for structures in high loss areas
- HAZUS-MH results can help to provide justification to find mitigation projects to protect citizens and properties from losses during future coastal flood events

In addition, FEMA is looking into the possibility of developing some unique Great Lakes coastal flood risk products that utilize datasets that have recently been collected or will be collected as part of the GLCFS:

- Storm Response Erosion Data: Dataset is expected to contain the results from erosion analysis in response to the 1-percent-annual chance flood event

- Shoreline Feature Data: Dataset was developed by the USACE and contains primary and secondary land use tables, as well as coastline type, materials, and vegetation. The current dataset contains data at one-mile spacing. The dataset does not include field-based reconnaissance or sediment/subsurface soil collection.

The delivery of these standard flood risk products and the Great Lakes coastal flood risk datasets will be dependent on the location of the Risk MAP study and coastal analysis, data availability, and partnerships with local communities. Not all communities will receive flood risk products.

II. Stakeholder Communication and Coordination

Communication and coordination with Federal, State and local stakeholders is key to the success of the GLCFS. A large emphasis has been placed on identifying stakeholders early and often and working with those stakeholders continually throughout the study process, from Discovery all the way through flood map and flood risk product development. Through outreach, the goal is to increase understanding of the new coastal study methodologies and the tools and processes that will be available for risk-based community planning, and to increase flood hazard awareness within the Great Lakes Coastal Region.

i. Lake Michigan Discovery Stakeholder Coordination

Meetings, emails, telephone calls, and letters are essential to communicate effectively throughout the life of this Lake Michigan Coastal Flood Study project, which has begun with this Discovery process.

To kick-off this Discovery process, FEMA formed a group of core stakeholders, which included representatives from FEMA Region V, STARR (mapping partner to FEMA), USACE, National Oceanic and Atmospheric Administration (NOAA), ASFPM, State National Flood Insurance Program (NFIP) Coordinator, State Hazard Mitigation Officer (SHMO), and State Engineers. The core stakeholders reviewed the Discovery plan, objectives, and key outcomes for Lake Michigan Discovery with FEMA, provided suggestions for outreach and communication, and raised any concerns as it related to Lake Michigan and the coastal flood study process. Following this kick-off process, outreach, communication, and coordination with local stakeholders was initiated.

Discovery Meeting invitations were sent to local community and county stakeholders within the Benzie, Grand Traverse, and Leelanau Counties portions of the Lake Michigan Coastal Flood Study project. In addition, an email invitation was sent to a larger list of stakeholders, including but not limited to other federal agencies, universities, watershed groups, Great Lakes associations, technical stakeholders, and emergency management agencies.

Representatives from local governments, including cities, townships, and villages are considered fundamental stakeholders in this process because they have been elected or appointed to represent the interests of the residents of the Project Area. See Lake Michigan Basin-wide report for a complete list of the stakeholders invited to the Discovery Meeting.

Discovery Meeting invitations also included a Coastal Data Request Form (Attachment A). Communities were asked to provide information on data available at the local level that may be of use during the flood study update, and during the development of the coastal flood risk products discussed earlier in this report. The Coastal Data Request Form included data requests for:

- Base Map Data
- Coastal Data
- Historic Flood Data
- Risk Assessment
- Flood Mitigation Information
- Community Plans and Projects
- Other comments/concerns based on local knowledge

A compilation of responses to the coastal data request form can be found in Section IV, Summary of Data Analysis, of this report.

In addition to the hard copy letter invitations, and in order to improve communication and data sharing leading up to the Discovery Meeting, FEMA offered local communities an opportunity to attend pre-Discovery Meeting conference call, referred to as an Information Exchange Session. The conference call information was included in the Discovery Invitation letters mailed to local community officials, and an email reminder was sent out as well. The session's intent was to begin the process of learning about local data availability and what the critical issues are for the Great Lakes communities.

Stakeholder correspondence, invitations, meeting minutes, and presentations related to the information exchange session can be found in Attachment B, Benzie, Grand Traverse, and Leelanau Counties Pre-Meeting Correspondence.

III. Benzie, Grand Traverse, and Leelanau Counties Discovery Meeting

The Discovery Meeting for Benzie, Grand Traverse, and Leelanau Counties coastal communities was held on September 13, 2012 in Traverse City, MI. Communities potentially affected by

coastal flooding were invited to the Discovery Meeting. The purpose of this meeting was to facilitate discussion about study needs, mitigation project needs, desired compliance support, and local flood risk awareness efforts.

The objectives of the Discovery Meeting included:

- Continuation and expansion upon stakeholder engagement
- Discussion of data inputs from Federal, state and local stakeholders
- Identification of local coastal flood hazard needs and areas of concern
- Identification of flood risk products and datasets that best advance coastal mitigation action
- NFIP regulatory updates
- Discovery schedule and deliverables

The Discovery Meeting presentations included the following information:

- An overview of the GLCFS and schedule
- Review of the Discovery process and outcomes
- Discussion of coastal mapping and flood risk topics
- Discussion of how the study may affect communities, including compliance requirements
- Review of hazard mitigation opportunities and grant funding
- Encouragement and facilitation discussion regarding coastal study needs, mitigation project needs, desired compliance support, and local flood risk awareness efforts

Draft Discovery Maps for Benzie, Grand Traverse, and Leelanau Counties (Attachments C-E) were displayed and utilized during the meeting to stimulate discussion regarding areas of coastal flood risk concern and areas of hazard mitigation interest. The draft Discovery Map shown at the meeting included geospatial data that had been collected prior to the meeting:

Geospatial Data:

- Average Annualized Loss (AAL) data
- Coastal Barrier Resources System (CBRS)[1]

[1] CBRS consists of the undeveloped coastal barriers and other areas located on the coasts of the United States that are identified and generally depicted on a series of maps. CBRS areas are ineligible for most new Federal expenditures and financial assistance.

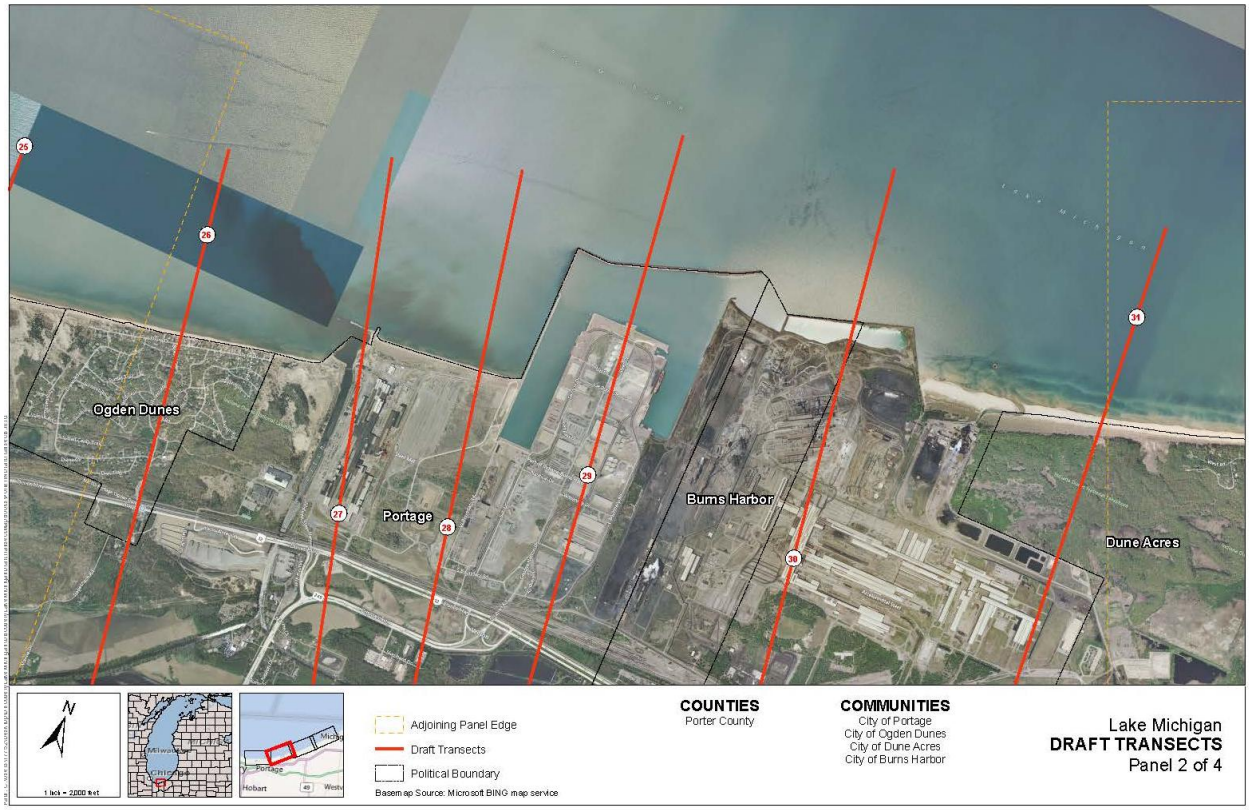
- Coordinated Needs Management Strategy (CNMS)[2] Data
- Proposed Coastal Transect Locations
- Effective Special Flood Hazard Areas (SFHAs)
- Jurisdictional Boundaries
- Letters of Map Change (LOMCs)
- Levees
- Shoreline
- Streams
- United States Geologic Survey (USGS) Gages
- Watershed Boundaries

Attendees were asked to cooperatively identify Areas of Concern and Areas of Mitigation Interest (AoMIs) within Benzie, Grand Traverse, and Leelanau Counties, Lake Michigan study area using the Discovery Map and through general discussion during the meeting.

In addition to the draft Discovery Map, figures showing the location of initially proposed coastal transects around Benzie, Grand Traverse, and Leelanau Counties were available for review and comment immediately following the meetings. Stakeholders were encouraged to review proposed transects and provide comments related to their location. Maps of proposed transect locations presented at the Discovery Meeting for Benzie, Grand Traverse, and Leelanau Counties can be found in Attachment E. A sample map is shown below as Figure 1:

[2] CNMS is a FEMA initiative to update the way FEMA organizes, stores, and analyzes flood hazard mapping needs information for communities. CNMS defines an approach and structure for the identification and management of flood hazard mapping needs that provides support to data-driven planning and the flood map update investment process in a geospatial environment. CNMS makes information related to mapping needs readily accessible and more usable. Currently, CNMS only captures riverine needs. It is expected coastal needs will be captured in this system in the future.

Figure 1: Sample Proposed Transect Figure



All comments provided during the Discovery Meeting on the draft Discovery Map and transect locations have been compiled into the Table 1 below.

Table 1: Stakeholder General and Transect Location Comments

State	County	Community	FIPS	CID	Comment	Type
Michigan	Benzie	Blaine Township	26019	260027	Relocate transect north.	Transect Comment
Michigan	Benzie	City of Frankfort	26019	260029	Wastewater treatment plant.	General Comment
Michigan	Benzie	City of Frankfort	26019	260029	Area on north side of lake close to OHWM.	General Comment
Michigan	Benzie	City of Frankfort	26019	260029	Area on south side of lake close to OHWM.	General Comment
Michigan	Benzie	City of Frankfort	26019	260029	Area inside Betsie Lake where 2 - 3 ft. swells occur and are refracted inside the interior zone.	General Comment

State	County	Community	FIPS	CID	Comment	Type
Michigan	Benzie	City of Frankfort	26019	260029	Reposition transect to pass through outlet.	Transect Comment
Michigan	Benzie	Lake Township	26019	260030	Shift transect so that it captures the County Lighthouse.	Transect Comment
Michigan	Benzie	Lake Township	26019	260030	Relocate transect to the north.	Transect Comment
Michigan	Benzie	Village of Elberta	26019		Reposition transect.	Transect Comment
Michigan	Grand Traverse	Acme Township	26055	260749	Mitigation action taken to remove structures to create Shoreline Park.	General Comment
Michigan	Grand Traverse	Acme Township	26055	260749	State Park	General Comment
Michigan	Grand Traverse	Acme Township	26055	260749	Township Park	General Comment
Michigan	Leelanau	Leelanau	26089		AAL is "incredible"	General Comment
Michigan	Leelanau	Village of Northport	26089	260580	Relocate transect to approach from the northeast.	Transect Comment

Discovery meeting minutes, sign in sheets, PowerPoint presentation, and correspondence have been included in the Attachment G, Benzie, Grand Traverse, and Leelanau Counties Discovery Meeting Documents.

IV. Summary of Data Analysis

During the Discovery phase of the Lake Michigan Coastal Flood Study project, a massive collection of tabular and spatial data was conducted for all communities from Federal and State sources. In addition, information was collected through phone conversations, information exchange session conference calls, and the Discovery Coastal Data Request forms. Section III above lists the types of data collected for the study area prior to the Discovery Meeting. The information that follows in Table 2 is divided into two sections: one section listing data that can be used for Risk MAP products and the other listing information that helped the study team form a better understanding of the Project Area, specifically as it may relate to mitigation and planning interests.

Table 2: Data Collected for Benzie, Grand Traverse, and Leelanau Counties, MI

Data Types	Deliverable/Product	Source	Date of Data Collection	Level
Average Anualized Loss Data (AAL)	Discovery Map	Federal Emergency Management Agency (FEMA)	June 2012	Nationwide
Census Blocks	Discovery Map	U.S. Census Bureau	June 2012	Countywide
Contacts	Discovery Report	Local Community Websites, State/FEMA updates	June 2012	Countywide
Community Assistance Visits (CAVs)	Discovery Report	FEMA Community Information System (CIS)	July 2012	Countywide
Community Rating System (CRS)	Discovery Report	FEMA's "Community Rating System Communities and Their Classes"	July 2012	Nationwide
Comprehensive Plans	Discovery Report	Local Community Websites	July 2012	Countywide
Coastal Barrier Resources System (CBRS)	Discovery Map	U.S. Fish and Wildlife Service	July 2012	Nationwide
Coastal Construction	To Be Collected	U.S. Army Corps of Engineers (USACE)	TBD	Nationwide
Coordinated Needs Management Strategy (CNMS)	Discovery Map	FEMA	July 2012	Countywide
Critically Erosion Beach Areas	To Be Collected	To Be Collected	TBD	Statewide
Critical Facilities	Discovery Report	Local Mitigation Plan	July 2012	Countywide
Dams	Discovery Report	USACE, National Inventory of Dams, Flood Insurance Rate Map (FIRM) Database	July 2012	Countywide
Declared Disasters	Discovery Report	FEMA's "Disaster Declarations Summary"	June 2012	Nationwide

Data Types	Deliverable/Product	Source	Date of Data Collection	Level
Demographics, Industry	Discovery Report	U.S. Census Bureau, Local Mitigation Plans	June 2012	Countywide
Effective Floodplains	Discovery Map	FEMA Map Service Center and Mapping Information Platform	June 2012	Countywide
Hazard Mitigation Plans and Status	Discovery Report	Local Mitigation Plans	July 2012	Countywide
Hazard Mitigation Assistance Program Grants Received	Discovery Report	FEMA's "Hazard Mitigation Program Summary" Community Input	June 2012	Nationwide
Hazard Mitigation Projects	Discovery Report	Local Mitigation Plans	July 2012	Countywide
High Water Marks	To Be Collected	To Be Collected	TBD	Countywide
Historical Flooding	Discovery Report	Effective Flood Insurance Study (FIS), Local Mitigation Plans	July 2012	Countywide
Historical Storm Events	Discovery Report	Effective FIS, Local Mitigation Plans	July 2012	Countywide
Individual/Public Assistance	Discovery Report	FEMA's "Public Assistance Subgrantee Summary"	June 2012	Nationwide
Insurance Policies	Discovery Report	FEMA CIS	July 2012	Nationwide
Letters of Map Change (LOMCs)	Discovery Map	FEMA's Mapping Information Platform	July 2012	Countywide
Meteorological Gages	Discovery Map	National Oceanic and Atmospheric Administration (NOAA) Great Lakes Environmental Research Laboratory	July 2012	Regionwide
Ordinance	Discovery Report	Local Community Websites	July 2012	Countywide
Repetitive Loss	Discovery Report	FEMA CIS	July 2012	Countywide

Data Types	Deliverable/Product	Source	Date of Data Collection	Level
Shoreline Classification	Discovery Map	USACE	July 2012	Regionwide
Stream Gages	Discovery Map	USGS	July 2012	Countywide
Water Level Gages	Discovery Map	NOAA Department of Fisheries and Oceans	July 2012	Regionwide
Wave Gages	Discovery Map	NOAA	July 2012	Regionwide

i. Data that can be used for future Coastal Flood Risk Products

I.IV.i.1 Average Annualized Loss (AAL) Data

The Average Annualized Loss (AAL) data provide a general understanding of the dollar losses associated with a certain flood frequency events and are used to get a relative comparison of flood risk. They are determined by FEMA's Multi-Hazard Risk Assessment and Loss Estimation Program, otherwise known as HAZUS-MH.

HAZUS-MH, a free risk assessment software application from FEMA, is the most widely used flood risk assessment tool available. HAZUS-MH can run multiple flood scenarios (riverine and coastal) to estimate hazard related damage. HAZUS-MH can also be used to evaluate flood damage based on new/proposed mitigation projects or future development patterns and practices, and it can run specialized risk assessments, such as those attributable to dam or levee failures.

HAZUS-MH includes national datasets that can be supplemented with local data. If local detailed data are available, users may utilize this data to perform more refined HAZUS analyses. Augmenting HAZUS-MH national data with local data can improve the accuracy and resolution of analysis results. Additional information about the HAZUS-MH process and tool can be found at http://www.fema.gov/protecting-our-communities/hazus.

The HAZUS-MH analysis data presented in this report is based on approximate flood boundaries and national datasets. The calculation is based on flood elevation estimates using a 10-meter Digital Elevation Model (DEM) on streams with drainage areas of at least 10 square miles. The results are shown in table 3 below. Information can also be obtained from the report titled FEMA *HAZUS AAL Usability Analysis*, dated April 13, 2011 (Federal Emergency Managment Agency, 2011). AAL data summarized at the census block level are shown on the draft Discovery Maps (Attachment C-E).

Table 3: HAZUS AAL Data for Benzie, Grand Traverse, and Leelanau Counties, MI

FIPS Code	County	Total (in thousands of $)	Building (in thousands of $)	Content (in thousands of $)
26019	Benzie	14,594	6,128	8,044
26055	Grand Traverse	49,956	16,822	28,704
26089	Leelanau	16,386	8,433	7,609

Source: FEMA
FIPS = Federal Information Processing Standards

I.IV.i.2 Coastal Recession

In Michigan, areas prone to erosion along the Lake Michigan shoreline are subject to special setback requirements established by the Michigan Department of Environmental Quality (DEQ).

From the DEQ's website, high risk erosion areas are those shorelands of the Great Lakes and connecting waters where recession of the zone of active erosion has been occurring at a long-term average rate of one foot or more per year. The erosion can be caused from one or several factors, including high water levels, storms, wind, ground water seepage, surface water runoff, and frost. The high risk erosion area regulations require setback distances to protect new structures from erosion for a period of 30 to 60 years, depending on the size, number of living units and type of construction.

Approximately 300 miles of shoreline are classified as high risk erosion area. Updates of the recession rate studies, which form the basis of the setbacks, are periodically conducted to reflect changing water levels and shore protection efforts.

Additional information can be found at the Department of Environmental Quality's High Risk Erosion Areas website http://www.michigan.gov/deq/0,1607,7-135-3313_3677_3700-10860--,00.html.

High risk erosion areas and critical dune areas are illustrated on maps available in the Appendix. For Benzie County, those maps include:

- Blaine Township
- Crystal Lake Township
- Gilmore Township
- Lake Township

For Leelanau County, maps are available for:

- Bingham Township
- Empire Township
- Glen Arbor Township
- Leelanau Township

- Leland Township
- Suttons Bay Township

For Grand Traverse County, maps are available for:

- Acme Township
- Garfield Township
- Peninsula Township

There are no high risk erosion areas for East Bay Township.

These high risk erosion area and critical dune area maps can be found at the Department of Environmental Quality's High Risk Erosion Areas website at http://michigan.gov/deq/0,1607,7-135-3313_3677_3700-107407--,00.html. We are currently working to collect additional coastal erosion data along the eastern coastline of Michigan for Lake Michigan. If you have any data that you would like to submit, please contact FEMA Region V.

I.IV.i.3 Federal Land

Federal lands data were obtained from the National Atlas at http://nationalatlas.gov/mld/fedlanp.html. This map layer shows those lands owned or administered by the Federal Government, including the Bureau of Land Management, the Bureau of Reclamation, the U.S. Department of Agriculture Forest Service, the Department of Defense, the U.S. Fish and Wildlife Service, the National Park Service, and other agencies. Only areas of 640 acres or more are included.

In Benzie and Leelanau counties, Sleeping Bear Dunes National Lakeshore is a federal land of the National Park Service. Sleeping Bear Dunes was created to preserve the outstanding natural features of this area including 71,000 acres of dunes, beaches, forests, inland lakes and rivers, and glacial phenomena. It also preserves cultural resources that reflect Great Lakes maritime and Michigan agricultural history. There are 35 miles of mainland beach within Sleeping Bear Dunes Park. South Manitou Island and North Manitou Island (Leelanau County) are also within Sleeping Bear Dunes. There are no federal lands in Grand Traverse County.

I.IV.i.4 Jurisdictional Boundaries

Jurisdictional boundaries were obtained for Benzie, Grand Traverse, and Leelanau Counties and Incorporated Areas from a derived set of TIGER line files available through the U.S. Census Bureau geography division. TIGER line files were last derived from the TIGER database in 1997. To learn more about TIGER line files and other Census TIGER database derived data sets visit http://www.census.gov/geo/www/tiger .

I.IV.i.5 Local Data

As part of the Discovery process, communities were asked to complete a Coastal Data Request Form (Attachment A) and identify data available at the local level that may be of use for the flood study update and development of the coastal flood risk products discussed earlier in this report. The Coastal Data Request Form included requests for base map data, coastal data, historic flood data, risk assessment information, mitigation information, and community plans and projects.

At the time this report was created, Acme Township (Grand Traverse county), Leelanau Township (Leelanau County) and the Village of Suttons Bay (Leelanau County) have returned information through use of the Coastal Data Request Form.

Appendix Q. Local Data from Stakeholders: Coastal Data Request Form Compilation compiles all the information collected from Lake Michigan communities from the completed Coastal Data Request Forms, during the Discovery Meeting, or through phone conversations and email.

I.IV.i.6 Publicly Owned Land

There were no publicly-owned lands found along the shoreline of Benzie, Grand Traverse, and Leelanau Counties within the study area at the time this report was created (FEMA 2011b).

I.IV.i.7 Shoreline Information

A shoreline feature dataset was generated by USACE Detroit District using 2012 oblique photographs. The dataset captures shoreline type, land use, coverage, and vegetation type along the entire Great Lakes shoreline, including Lake Michigan. The approximate shoreline along Benzie, Grand Traverse, and Leelanau Counties that is covered by this Great Lakes Coastal Flood Study is 259.45 miles. Tables 4 through 7 below summarize the shoreline features from the USACE dataset for the shoreline of Grand Traverse, Benzie, and Leelanau Counties.

Table 4: Summary of Shoreline Types

County	Total Shoreline (mile)	Artificial Shoreline (mile)	Boulders, Bedrock (mile)	Cohesive Clays and Silts (mile)	Sand (mile)	Shingles, Pebbles, Cobbles (Mile)
Benzie County	26.71	3.11	0	0	23.61	0
Grand Traverse County	67.41	6.84	0	0	43.2	43.2
Leelanau County	165.33	11.18	0	0	99.82	53.7

Source: USACE 2012, Lake Michigan Shoreline Classification

Table 5: Summary of Shoreline by Land Use

County	Total Shoreline (mile)	Commercial /Industrial (mile)	Forested (mile)	Low Density Residential (mile)	Moderate Density Residential (mile)	Park Land (mile)
Benzie County	26.71	0.62	4.35	9.45	0.62	11.67
Grand Traverse County	67.41	9.94	31.13	31.13	18.64	2.74
Leelanau County	165.33	11.83	60.33	60.33	19.88	69.29

Source: USACE 2012, Lake Michigan Shoreline Classification

Table 6: Summary of Shoreline Coverage

County	Total Shoreline (mile)	Bluff 2'-10' (mile)	Coastal Wetland (mile)	Dune 2'-10' (mile)	Flat Coast (mile)	High Bluff 10'+ (mile)	High Dune 10'+ (mile)	Other (mile)
Benzie County	26.71	0	0	1.86	0.62	12.56	11.68	0
Grand Traverse County	67.41	22.99	25.8	2.74	6.56	8.70	0	0
Leelanau County	165.33	0.62	11.18	71.09	46.25	3.73	31.83	0

Source: USACE 2012, Lake Michigan Shoreline Classification

Table 7: Summary of Shoreline Vegetation Types

County	Total Shoreline (mile)	High Density Shrubs /Trees (mile)	Low Density Shrubs/ Trees (mile)	Manicured Lawn (mile)	Moderate Density Shrubs/ Trees (mile)	None (mile)	Unmaintained Non-Woody Vegetation (mile)
Benzie County	26.71	10.56	13.53	.62	2.0	0	0
Grand Traverse County	67.41	23.32	1.24	32.04	10.2	0.62	0
Leelanau County	165.33	81.83	25.89	25.78	30.54	0	1.28

Source: USACE 2012, Lake Michigan Shoreline Classification

I.IV.i.8 Stream Lines/Hydrograph

Stream lines were obtained from USGS's National Hydrography Dataset (NHD). The NHD is a digital vector dataset for use by Geographic Information Systems (GIS). It contains features such as lakes, ponds, streams, rivers, canals, dams and stream gages. The datasets are designed to be used in general mapping and analysis of surface-water systems. Data can be downloaded from http://nhd.usgs.gov/data.html.

I.IV.i.9 Topography, Bathymetry, and Oblique Imagery

New Data Collected for Great Lakes Coastal Flood Study

As part of the Great Lakes Coastal Flood Study, LiDAR was collected to develop topographic and bathymetric data along the Lake Michigan shoreline. Topography is the configuration of natural and man-made features of a surface area and their relative position and elevations. Bathymetry is the underwater equivalent to topography.

The LiDAR data, collected and processed by USACE, is expected to become available in late 2012 or early 2013 for this study area. The transect-based coastal flood hazard analysis, as well as the mapping of the coastal flood risks, will utilize this new data. Existing high-resolution bathymetric and topographic data is available at http://csc.noaa.gov .

USACE has also collected oblique imagery for the entire Great Lakes coastline in 2012. Oblique imagery is captured at an angle, as compared to an overhead view provided by orthophotos, and allows users a 3-dimensional view of landscape, buildings, and other features. This dataset may be useful to communities during emergency response, planning, and management of assets, critical facilities, and public properties along the Lake Michigan shoreline. The oblique images can also be used to identify the shoreline types and identify obstructions to the coastal flood hazard analysis.

The oblique imagery for the entire Great Lakes can be viewed from http://greatlakes.usace.army.mil/.

Other Data Available:

The NOAA Coastal Services Center, Digital Coast, hosts a variety of digital coastal data, including bathymetric and topographic data, and is located at http://www.csc.noaa.gov/digitalcoast .

I.IV.i.10 Transportation

The Bing Map service has been used as a basemap layer on the Discovery Map, and includes a transportation layer. For more information on Bing Map services and how they can be used in GIS, please visit http://www.arcgis.com/home and search for “Bing Maps”.

I.IV.i.11 Watershed Boundaries

U.S. Geological Survey (USGS) Hydrologic Unit Code 8 (HUC8) watershed boundaries were obtained from the National Atlas 2011 “Raw Data Download” (http://nationalatlas.gov/atlasftp.html).

Benzie County contains portions of two HUC-8 watersheds, Grand Traverse County contains portions of three HUC-8 watersheds and Leelanau County contains portions of ## HUC-8 waterhsheds. The subbasin names and HUC-8 codes are listed below in Table 8:

Table 8: HUC-8 Watersheds in Benzie, Grand Traverse, and Leelanau Counties

County	Huc_8	Subbasin
Benzie County	4060104	Betsie-Platte
Benzie County	4060103	Manistee
Grand Traverse County	4060104	Betsie-Platte
Grand Traverse County	4060103	Manistee
Grand Traverse County	4060105	Boardman-Charlevoix
Leelanau County	4060104	Betsie-Platte
Leelanau County	4060105	Boardman-Charlevoix

ii. Other Data and Information

Benzie County is a county in the northwest of the Lower Peninsula of the State of Michigan, on the eastern shore of Lake Michigan. According to the 2010 census, it has a population of 17,525, which is an increase from 15,998 in 2000. The county has a total area of 859.64 square miles, of which 321.31 square miles is land and 538.32 square miles is water (U.S. Census Bureau, 2000). Additional information on Benzie County can be found at http://www.benzieco.net/

Leelanau County is a county in northern Michigan, specifically, the northwestern Lower Peninsula, on the shore of Lake Michigan. According to the 2010 census, it has a population of 21,708, which is a slight increase from 21,119 in 2000. The county has a total area of 2,532.38 square miles, of which 348.47 square miles is land and 2,183.91 square miles is water (U.S. Census Bureau, 2000). Lake Leelanau is the county's largest body of inland water, formed from the Leland River dam near Leland. A substantial portion of Sleeping Bear Dunes National Lakeshore lies with the county's borders, including North Manitou and South Manitou Islands. Additional information on Leelanau County can be found at http://www.leelanau.cc/

Grand Traverse County is a county in Northern Michigan, on the shore of Lake Michigan. According to the 2010 census, it has a population of 86,986, which is a significant increase from 77,654 in 2000. The county has a total area of 601.13 square miles, of which 465.07 square miles is land and 136.06 square miles is water (U.S. Census Bureau, 2000). Additional information on Grand Traverse County can be found at http://www.co.grand-traverse.mi.us/.

I.IV.ii.1 Coastal Barrier Resources Systems

The Coastal Barrier Resource System (CBRS) is a nationwide system of protected coastal areas that includes ocean-front land, the Great Lakes and Other Protected Areas (OPAs). The Coastal Barrier Resources Act (CBRA) of 1982 designated undeveloped coastal barrier lands and associated aquatic habitat as part of the Coastal Barrier Resources System (CBRS). This law does not regulate how people can develop land in the CBRS, but the Federal government does not encourage development of these areas. By electing to build in CBRS areas, owners are

responsible for the full cost and are ineligible for most federal expenditures and financial assistance programs.

Coastal barriers serve as important buffers between coastal storms and inland areas, often protecting properties on land from serious flood damage. Coastal barriers also provide protective habitat for aquatic plants and animals.

The CBRS boundaries around Lake Michigan were obtained from U.S. Fish and Wildlife Service (FWS) at http://www.fws.gov/CBRA/Maps/Data_Disclaimer_Shapefiles.html and are dated June 15, 2010. No coastal barrier units were found along Lake Michigan Shoreline in Benzie, Grand Traverse, and Leelanau Counties.

I.IV.ii.2 Coastal Zone Protection Structures

The USACE maintains a large infrastructure of over 900 coastal structures in the United States. These coastal structures protect harbors and shore-based infrastructure, provide beach and shoreline stability control, provide flood protection to varying degrees, and protect coastal communities, roadways and bridges, etc. These maintained coastal structures include seawalls, bulkheads, revetments, dikes and levees, breakwaters, groins, sills/perched beaches, and jetties and piers. The Enterprise Coastal Inventory Database (ECID) from the USACE Engineer Research and Development Center (ERDC) was obtained to identify these structures along Lake Michigan. This data is presented in tabular form in the lake-wide Lake Michigan Discovery Report.

I.IV.ii.3 Community Assisted Visits

Statewide Community Assistance Visits (CAVs) are part of the evaluation and review process used by FEMA and local officials to ensure that each community adequately enforces local floodplain management regulations to remain in compliance with NFIP requirements. Generally, a CAV consists of a tour of the floodplain, an inspection of community permit files, and meetings with local appointed and elected officials. During a CAV, observations and investigations focus on identifying issues in various areas, such as the community's floodplain management regulations (ordinance), community administration and enforcement procedures, engineering or other issues within the FIRMs, other problems in the community's floodplain management, and problems with the biennial report data. Any administrative problems or potential violations identified during a CAV are documented in the CAV findings report. The community is notified and given the opportunity to correct those administrative procedures and remedy the violations to the maximum extent possible within established deadlines.

The summary of CAV visits were extracted from the FEMA Community Information System (CIS) (https://portal.fema.gov/famsVuWeb/home) July 2012. Table 9 shows the summary of CAV dates by community within this study area.

Table 9: Summary of Community Assisted Visits in Benzie, Grand Traverse, and Leelanau

County	Community	CID	CAV Date	FIRM Date
Benzie County	Benzonia, Township of			
Benzie County	Benzonia, Village of			
Benzie County	Beulah, Village of			
Benzie County	Blaine, Township of	2600027	06/03/2010	11/20/2000
Benzie County	Crystal Lake, Township of	260028	06/03/2010	06/19/1989
Benzie County	Elberta, Village of		06/03/2010	01/01/1950
Benzie County	Frankfort, City of	260029	06/03/2010	03/18/1991
Benzie County	Gilmore, Township of			
Benzie County	Lake, Township of	260030	06/03/2010	06/05/1989
Benzie County	Platte, Township of			
Grand Traverse County	Acme, Township of	260749		01/01/1950
Grand Traverse County	Blair, Township of	260780		01/01/1950
Grand Traverse County	East Bay, Township of	260746		01/01/1950
Grand Traverse County	Garfield, Township of	260753		01/01/1950
Grand Traverse County	Peninsula, Township of	260747		01/01/1950
Grand Traverse County	Traverse City, City of	260082		
Grand Traverse County	White Water, Township of	260794	03/04/2004	09/30/1988
Leelanau County	Bingham, Township of	260772	01/12/2006	01/01/1950
Leelanau County	Centerville, Township of	260625	01/12/2006	02/01/1986
Leelanau County	Cleveland, Township of	260302		09/01/1986
Leelanau County	Elmwood, Township of	260113	09/27/2005	02/02/1983
Leelanau County	Empire, Township of	260765		01/01/1950
Leelanau County	Empire, Village of	260605		01/01/1950
Leelanau County	Glen Arbor, Township of	260604		09/01/1986
Leelanau County	Leelanau, Township of	260114	01/21/2003	04/02/1986
Leelanau County	Leland, Township of	260760		01/01/1950
Leelanau County	Northport, Village of	260580		03/02/1989
Leelanau County	Solon, Township of			
Leelanau County	Suttons Bay, Township of	260770	01/12/2006	01/01/1950
Leelanau County	Suttons Bay, Village of	260283	01/12/2006	06/01/1977

CAV = Community Assisted Visit

I.IV.ii.4 Community Rating System

The Community Rating System (CRS) is a voluntary incentive program to provide flood Insurance premium discounts to NFIP-participating communities that take extra measures to manage floodplains above the minimum requirements. A point system is used to determine a CRS rating. The more measures a community takes to minimize or eliminate exposure to floods, the more CRS points are awarded and the higher the discount on flood insurance premiums. The list of CRS communities is available on FEMA's Website site at http://www.fema.gov/library/viewRecord.do?id=3629.

No communities in Benzie, Grand Traverse, and Leelanau Counties participate in the CRS program.

I.IV.ii.5 Comprehensive Plans

A comprehensive plan is a land use document providing framework and policy direction for land use decisions. Comprehensive plans usually include chapters detailing policy direction affecting land use, transportation, housing capital facilities, utilities, coastal and rural areas. Comprehensive plans identify where and how growth needs will be met.

In Benzie County, a 2020 Comprehensive Plan exists to address land use and development. The plan's purpose is to provide policy and guide decision making for future land and infrastructure development decisions within Benzie County. Within the Plan, key planning issues are identified; community character is described; goals and policies are outlined; existing and future land uses are described and mapped; public facility standards are established; transportation improvements are identified and specific implementation measures are recommended. A copy of Benzie County's 2020 Comprehensive plan can be found at their website at http://www.benzieco.net/cmt_planning_commission.htm#master_plan.

The Grand Traverse County Comprehensive Plan was developed by the Grand Traverse County Planning Commission with the support and input of County Residents and local units of government. Its primary purpose is to foster and understanding of the fundamental challenges of our future as a community and to outline approaches to address them. The plan recognizes that the County will continue to grow and, without thoughtful and creative guidance, that growth threatens the quality of life that is the hallmark of the community. The purpose of the Plan is to describe current conditions in the County and the implications apparent in current trends. It also sets forth and alternative path to growth management, including a series of actions strategies to begin the process. A copy of the Grand Traverse County Comprehensive Plan can be found at their website at http://www.co.grand-traverse.mi.us/Assets/Departments/Planning/GTC+Master+Plan.pdf.

In Leelanau County, a General Plan was developed with the support and guidance of citizens and representatives of all local governments in Leelanau County to offer an overview with inner

consistency on the issues of future peninsular land use. It is founded on the principle that all land use and infrastructure decisions that do not involve issues of greater than local concern should be made at the local level. These decisions should be carefully coordinated with adjacent jurisdictions and appropriate county agencies. A copy of Leelanau County's General Plan can be found at their website http://www.leelanau.cc/generalplan.asp.

I.IV.ii.6 Coordinated Needs Management Strategy (CNMS) and NFIP Mapping Needs

During FEMA's Flood Map Modernization program from 2003 to 2008, FEMA adhered to Procedure Memorandum No. 56 which states that, "Section 575 of the National Flood Insurance Program Reform Act of 1994 mandates that at least once every five years FEMA assess the need to review and update all floodplain areas and flood risk zones identified, delineated, or established under Section 1360 of the National Flood Insurance Act, as amended." This requirement was fulfilled through the Mapping Needs Assessment process. Other mechanisms such as the Mapping Needs Update Support System (MNUSS) and scoping reports were used to capture information describing conditions on the FIRMs and the potential for a map update. FEMA's Coordinated Needs Management Strategy (CNMS) was initiated through FEMA's Risk MAP program in 2009.

CNMS is a FEMA initiative to update the way FEMA organizes, stores, and analyzes flood hazard mapping needs information for communities. CNMS defines an approach and structure for the identification and management of flood hazard mapping needs that provides support to data-driven planning and the flood map update investment process in a geospatial environment. The goal is to identify areas where existing flood maps are not up to FEMA's mapping standards. More information about the CNMS can be found at http://www.fema.gov/library/viewRecord.do?id=4628 .

There are three classifications within the CNMS: "Valid," "Unverified," and "Unknown." New and updated studies (those with new hydrologic and hydraulic models) performed during the Map Modernization program were automatically determined to be "Valid". The remaining studies went through a 17-element validation process with seven critical and 10 secondary elements. Validation elements apply physical, climatological, and environmental factors to stream studies to determine validity. A stream study has to pass all of the critical elements and at least seven secondary elements to be classified as "Valid." The remaining streams are classified as "Unverified" or "Unknown". Studies for which flood hazard data are identified as having critical or significant secondary change characteristics are classified as "Unverified." Streams with a status of "Unknown" are those that have a study underway, will be evaluated in the future, or do not have sufficient information to determine whether they are "Valid" or "Unverified" (FEMA 2012a).

Table 10 below summarizes the results of the validation analysis obtained from CNMS in June 2012.

Table 10: CNMS Status for Benzie, Grand Traverse, and Leelanau Counties, MI

County	FIPS	Unknown (stream miles)	Unverified (stream miles)	Valid (stream miles)	Total (stream miles)
Benzie County, MI	26019	--	--	--	--
Grand Traverse County, MI	26055	9.87	0.00	112.58	122.45
Leelanau County	26089	23.84	0.00	21.25	45.09

I.IV.ii.7 Critical Facilities

Critical facilities are the facilities that can impact the delivery of vital services, cause greater damages to other sectors of a community, or put special populations at risk.

Hospitals, roads, schools, and shelters are all examples of critical facilities that play a central role in disaster response and recovery. Understanding which facilities are exposed, and the degree of that exposure, can help reduce or eliminate service interruptions and costly redevelopment. Incorporating this information into development planning helps communities get back on their feet faster.

Location of critical facilities with a county or community can be viewed from the NOAA Coastal Services Center, Critical Facilities Flood Exposure Tool at http://www.csc.noaa.gov/criticalfacilities/.

I.IV.ii.8 Critically Eroded Beaches and Beach Nourishment/Dune Replacement Projects

Critically eroded beaches and beach nourishment/dune replacement projects were not identified in Benzie, Grand Traverse, and Leelanau Counties through this Discovery process.

I.IV.ii.9 Dams

The National Inventory of Dams (NID) is a congressionally authorized database that documents dams in the United States and its territories. The current NID, published in 2010, includes information on 84,000 dams that are more than 25 feet high, hold more than 50 acre-feet of water, or are considered a significant hazard if they fail. The NID is maintained and published by the USACE, in cooperation with the Association of State Dam Safety Officials, States and territories, and Federal dam-regulating agencies. The database contains information about the

dams' locations, sizes, purposes, types, last inspections, regulatory facts, and other technical data. The information contained in the NID is updated approximately every 2 years.

Table 11 below is a summary of documented dams by county in Grand Traverse, Benzie, and Leelanau. The NID is available at the USACE Website https://nid.usace.army.mil/.

Table 11: Documented Dams for Benzie, Leelanau, and Grand Traverse Counties, MI

County	Name	Primary Purpose	Dam Type	River
Benzie	Homestead Dam	Other	Other	Betsie River
Benzie	Little Platte Lake Control Dam	Recreation	Other	North Branch Platte River
Benzie	Crystal Lake Level Control Dam	Recreation	Gravity	Crystal Lake Outlet
Benzie	Thompsonville Dam	Other	-	Betsie River
Benzie	Grass Lake Dam	Recreation	Gravity	Betsie River
Grand Traverse	Mayfield Electric Light Plant Dam	Recreation	-	Swainston Creek
Grand Traverse	Lake Dubonnet Dam	Recreation	Earth	Platte River
Grand Traverse	Bissell Pond Dam	Other	-	Williamsburg Creek
Grand Traverse	Petobego Dam	Recreation	Earth	Tobeco Creek
Grand Traverse	General Growth Dam	Flood Control	Earth	Tributary to Kids Creek
Grand Traverse	Brown Bridge Dam	Other	-	Boardman River
Grand Traverse	Union Street Dam	Recreation	-	Boardman River
Grand Traverse	Boardman Dam	Other	-	Boardman River
Grand Traverse	Sabin Dam	Other	-	Boardman River
Grand Traverse	Headquarters Lake Dam	Recreation	-	Fife Lake Outlet
Grand Traverse	Wysong Dam	Recreation	Earth	Tributary to Lake Michigan
Grand Traverse	Gerhard Dam	Recreation	Earth	Tributary to Mitchell Creek
Leelanau	Meeuwenberg Dam	Recreation	Earth	Tributary to Cedar Lake

County	Name	Primary Purpose	Dam Type	River
Leelanau	Leland Dam	Other	-	Tributary to Lake Michigan
Leelanau	Cedar Lake Dam	Recreation	Earth	Cedar Lake Outlet
Leelanau	Belanger Dam	Other	Gravity	Belangers Creek

I.IV.ii.10 Levees

The table below presents levee information from the National Levee Database (NLD), developed by the U.S. Army Corps of Engineers (USACE). The NLD does not contain all levees located in the United States. The database contains information to facilitate and link activities, such as flood risk communication, levee system evaluation for the NFIP, levee system inspections, floodplain management, and risk assessments. The NLD continues to be a dynamic database with ongoing efforts to add levee data from federal agencies, states, and tribes. There were no levees identified in Grand Traverse, Benzie, or Leelanau Counties at the time of this report.

In addition, FEMA developed a Midterm Levee Inventory (MLI) report which compiled a database of structures designed to provide at least the minimum level of protection from the base flood level (1- percent-annual-chance flood), as this standard is the minimum level of protection recognized by the NFIP for accreditation. FEMA also maintains a Mid-term Levee Inventory (MLI), updated in November 2011, which can be accessed through FEMA's Regional Service Centers (RSCs). RCS contact information is listed on https://hazards.fema.gov/femaportal/docs/RSC%20Contact%20Information.pdf.

I.IV.ii.11 Declared Disasters

The FEMA Disaster Declarations Summary is a dataset describing all federally declared disasters. This information begins with the first disaster declaration in 1953 and features all three disaster declaration types: major disaster, emergency, and fire management assistance. The dataset includes declared recovery programs and geographic areas (County data not available before 1964; fire management records are considered partial because of the historical nature of the dataset).

The list of FEMA's disaster declarations is available on the FEMA Website at http://www.fema.gov/data-feeds.

At the time of this report, there were no declared disasters identified for Benzie, Grand Traverse, and Leelanau Counties.

I.IV.ii.12 Flood Insurance Policies

A community's agreement to adopt and enforce floodplain management ordinances, particularly with respect to new construction, is an important element in making flood insurance available to home and business owners. For this Discovery project, data on flood insurance policies were also gathered.

Table 12 below summarizes the numbers and premiums of insurance policies, the total coverage, and the numbers and dollar amounts of paid losses in communities of Benzie, Grand Traverse, and Leelanau Counties. The data were based on Community Summary Reports extracted from FEMA's CIS website (https://portal.fema.gov/famsVuWeb/home) in July 2012.

Table 12: Summary of Flood Insurance Policies and Claims for Benzie, Grand Traverse, and Leelanau Counties

County	CID	No. Policies	Total Premium	Total Coverage	Number of claims since 1978	Dollar ($) paid for claims since 1978
Benzie	26019	50	$41,460	$9,693,600	4	$20,147
Grand Traverse	26055	59	$45,656	$14,809,700	21	$49,393
Leelanau	26089	88	$79,248	$20,534,800	24	$34,728

I.IV.ii.13 Gage Data

The NOAA Coastal Services Center, Digital Coast, hosts a variety of digital coastal data, including gage data, and is located at http://www.csc.noaa.gov/digitalcoast .

Meteorological Stations

The National Data Buoy Center (NDBC) is a part of the NOAA National Weather Service (NWS). NDBC designs, develops, operates, and maintains a network of data collecting buoys and coastal stations. NDBC provides hourly observations from a network of about 90 buoys and 60 Coastal Marine Automated Network (C-MAN) stations. All stations measure wind speed, direction, and gust; atmospheric pressure; and air temperature. Water level is measured at selected stations. The historical and current data are available at the NDBC Website http://www.ndbc.noaa.gov/.

Table 13 shows the meteorological station identification number and location for the gages for Lake Michigan located in Grand Traverse County. There were no gages identified in Lake Michigan for Benzie and Leelanau Counties.

Table 13: Meteorological Stations in Lake Michigan, Grand Traverse County, MI

County	Station ID	Location	Owner	Data	Years of Historical Data
Grand Traverse County	GTLM4	Grand Traverse, MI	National Weather	Wind, atmospheric	2006 - present

In addition, the Great Lakes Environmental Research Laboratory is a part of NOAA focused on the Great Lakes. It maintains multiple datasets, including a collection of meteorological data for both the United States and Canada. The datasets can be found online at http://www.glerl.noaa.gov .

Stream Gages

The USGS National Water Information System Web Interface (http://waterdata.usgs.gov/nwis, provides real-time data for any given stream gage location. Table 14 below shows the gage identification numbers and locations for the gages in Benzie, Grand Traverse, and Leelanau Counties. USGS stream gage locations are also shown on the Discovery Map.

Table 14: Stream Gage Stations in Benzie, Grand Traverse, and Leelanau Counties, MI

County	Gage ID	Begin Date	End Date	Gage Location
Benzie County	04126740	10/1/1989	9/30/2011	Platte River at Honor, MI
Grand Traverse County	04126970	10/1/1997	9/30/2011	Boardman R above Brown Bridge Road near Mayfield, MI
Grand Traverse County	04127000	10/1/1952	9/30/1989	Boardman River near Mayfield, MI
Leelanau County	04126802	12/5/2003	9/30/2006	Crystal River at County Hwy 675 NR Glen Arbor, MI

Water Level Station

Great Lakes water levels constitute one of the longest, high quality hydrometeorological data sets in North America with reference gage records beginning around 1860 with sporadic records back to the early 1800's. NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) maintains several water level stations along Lake Michigan. CO-OPS' primary motivation is the collection and dissemination of high quality and accurate measurements of lake level for scientific studies. The station information and water level data are available at NOAA CO-OPS Website: http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Great Lakes Water Level Data&state=LakeMichigan.

The monthly high and low water level data from the year 1918 to 2011 for Lake Michigan are available at the USACE Website: http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/.

The Great Lakes Water Levels Report provides daily mean water levels of Lake Michigan for the past three months. The data are available at the USACE Website: http://www.lre.usace.army.mil/greatlakes/hh/greatlakeswaterlevels/currentconditions/great lakes waterlevels/.

Wave Gage/Buoy Stations

As mentioned above, the NDBC provides hourly observations from a network of about 90 buoys and 60 C-MAN stations. In addition to standard meteorological observation, all buoy stations and some C MAN stations measure sea surface temperature, wave height and period. Conductivity and water current are measured at selected stations. The historical and current data are available at NDBC Website http://www.ndbc.noaa.gov/.

I.IV.ii.14 Hazard Mitigation Plans

Hazard Mitigation Plans (HMPs) are prepared to assist communities to reduce their risk to natural hazard events. The plans are used to develop strategies for risk reduction and to serve as a guide for all mitigation activities in the given county or community.

A local hazard mitigation plan is a long-term strategic/guidance document used by an entity to reduce future risk to life, property, and the economy in a community. A hazard mitigation plan has the following elements:

- A public participation process for bringing together diverse stakeholders in the jurisdiction(s) to provide an array of input into the plan
- A risk assessment to identify the hazards, determine the people and property subject to those hazards, and estimate vulnerability
- A mitigation strategy that contains goals, objectives, and an action plan to implement priority mitigation actions that reduce risk
- A maintenance process to ensure the plan is reviewed and updated
- An adoption requirement to ensure the support from participating jurisdictions

Local mitigation plans are required to be updated every 5 years to maintain eligibility for FEMA Hazard Mitigation Assistance grant programs. The status of current hazard mitigation plans for Grand Traverse, Benzie and Leelanau counties is shown in the Table 15. The data was obtained from FEMA's Plan Approval Status Report based on Regional reports for the end of June 2012 (FEMA 2012b).

Table 15: Hazard Mitigation Plan Status for Benzie, Grand Traverse, and Leelanau Counties, MI

Jurisdiction	Approval Date	Expiration Date
Benzie County	11/5/2007	11/5/2012
Grand Traverse County	7/9/2008	7/9/2013
Leelanau County	11/5/2007	11/5/2012

The State of Michigan has issued a comprehensive document listing Hazard Mitigation Success Stories. The document was prepared by the Emergency Management and Homeland Security Division, Michigan Department of State Police and Michigan Citizen- Community Emergency Response Coordinating Council (MCCERCC) and was issued in 2011. Michigan Hazard Mitigation Success Stories can be downloaded at http://www.michigan.gov/documents/msp/Michigan_Hazard_Mitigation_Success_Stories_May_2011_Final_Edition_web_355580_7.pdf

I.IV.ii.15 Hazard Mitigation Grant Program

Hazard mitigation initiatives are intended to actively reduce a community's vulnerability to hazards and are developed to accurately reflect a community's need. A variety of hazard mitigation projects have been submitted to FEMA's Hazard Mitigation Grant Program. A list of projects that have been closed, approved, withdrawn, or denied is included in the Appendices.

I.IV.ii.16 Historical Flooding & High Water Marks

In the analysis of a flood event, often the high watermark is identified to determine the maximum elevation of floodwaters. If a high watermark on a tree, building or other fixed object can be identified and measured following a flood event, the floodwater elevation and therefore the extent of flooding can be determined. Such high watermark information combined with storm data, lake level and river stage data can be useful when modeling the extent of flooding associated with specified flood events.

The high watermark should not be confused with the term 'Ordinary High Watermark' (OHW). The OHW is the line along the Lake Michigan shoreline that defines the boundary between uplands and submerged lands and designates a line of regulatory jurisdiction. The line is often used to define the boundary between public and private lands.

No High Water Mark (HWM) data was found for Benzie, Grand Traverse, and Leelanau Counties associated with historical flooding of Lake Michigan. If local stakeholders have available HWM data or historic photographs, they are encouraged to submit them to FEMA Region V, Mitigation Division.

I.IV.ii.17 Letters of Map Change

A Letter of Map Change (LOMC) is a letter that reflects an official revision to an effective NFIP map. LOMCs are issued in place of the physical revision and republication of the effective FIRM. LOMCs include completed cases of Letters of Map Amendment (LOMAs) and Letters of Map Revision (LOMRs), including LOMRs based on fill (LOMR-Fs), and conditional LOMRs.

Table 16 below lists the number of LOMCs in Benzie, Grand Traverse, and Leelanau Counties. No Conditional LOMAs or Conditional LOMR-Fs were included. The LOMCs are shown on the Discovery Maps. Clusters of LOMCs indicate a need for updated maps. The list of LOMC cases were obtained from the FEMA Mapping Information Platform Website (https://hazards.fema.gov/femaportal/wps/portal).

Table 16: Summary of LOMC cases in Benzie, Grand Traverse, and Leelanau Counties, MI

County	Number of Letters of Map Amendments	Number of Letters of Map Revisions – Based on Fill	Number of Letters of Map Revisions – Floodway Removal	Number of Letters of Map Revisions
Benzie County	44	1	0	0
Grand Traverse County	108	1	1	1
Leelanau County	83	1	0	0

I.IV.ii.18 Locally Identified Mitigation Projects

The potential mitigation actions and strategies, as pulled from each of the County level Hazard Mitigation Plans (Benzie, Grand Traverse, and Leelanau Counties), are available in Attachment H.

I.IV.ii.19 Ordinances

For States that have demonstrated a commitment to, and experience in, the application of NFIP minimum floodplain management criteria, 44 CFR §60.25(d) allows FEMA to consider State approval or certification of community floodplain management ordinances as meeting NFIP requirements. This provision provides Regional Offices with the latitude to approve floodplain management regulations based on their review and approval by the State. However, the Regional Office must still formally approve the regulations in the Community Information System (CIS).

The requirements that apply to a community are referred to by the NFIP and appear in CIS as the community's "Level of Regulations." The Level of Regulations, determined by the most detailed

data that FEMA has provided the community, is designated as (a), (b), (c), (d), (e), or (f), or (d) and (e) for communities with both floodways and V zones.

County regulations regarding development within known flood hazard areas can range from ordinances with minimum NFIP requirements to strong, pro-active ordinances. Stronger ordinances not only regulate and protect new and improved development in existing Special Flood Hazard Areas (SFHAs), but also seek to mitigate the growth of SFHAs. Increase of SFHA can be caused by increased runoff from developed areas and the degradation of natural flood control areas, such as wetlands and forests. No ordinance information was available at the time of this report for Benzie, Grand Traverse, or Leelanau Counties.

I.IV.ii.20 Proposed Transects

Transects are shore perpendicular profiles along which coastal flooding analysis is performed. Transects are used to transform offshore conditions onshore and are used to define coastal flood risks inland of the shoreline. They are spaced to define representative segments of a shoreline reach. The transect layout for coastal hazard analysis and subsequent floodplain delineation is determined by physical factors such as changes in topography, bathymetry, shoreline orientation, and land cover data, in addition to societal factors such as variations in development and density. Base maps were reviewed to determine the proposed transect locations for hazard modeling along the Lake Michigan shoreline.

The proposed transect layout is shown on the draft Discovery Map for Benzie, Grand Traverse, and Leelanau Counties (Attachment C-E) and includes an identification number for each transect.

Stakeholders were provided with the proposed transect shapefiles (GIS digital data) upon request, and the proposed transects were also reviewed during Discovery Meetings. Input from local officials was requested regarding the placement and the number of transects. Comments regarding placement of transects in Benzie, Grand Traverse, and Leelanau Counties, Michigan are shown in Table 17.

Table 17: Stakeholder General and Transect Comments

State	County	Community	FIPS	CID	Comment	Type
Michigan	Benzie	Blaine Township	26019	260027	Relocate transect north.	Transect Comment
Michigan	Benzie	City of Frankfort	26019	260029	Reposition transect to pass through outlet.	Transect Comment

State	County	Community	FIPS	CID	Comment	Type
Michigan	Benzie	Lake Township	26019	260030	Shift transect so that it captures the County Lighthouse.	Transect Comment
Michigan	Benzie	Lake Township	26019	260030	Relocate transect to the north.	Transect Comment
Michigan	Benzie	Village of Elberta	26019		Reposition transect.	Transect Comment
Michigan	Leelanau	Village of Northport	26089	260580	Relocate transect to approach from the northeast.	Transect Comment

I.IV.ii.21 Pre-Disaster Mitigation (PDM) Program

The Pre-Disaster Mitigation (PDM) program is a nation-wide competitive grant program that was created to assist State and local governments, including Indian Tribe governments, with the funding to implement cost-effective hazard mitigation activities prior to disasters. The intent of this program is to reduce overall risk to people and property, while also minimizing the cost of disaster recovery.

Grants awarded during past fiscal years can be downloaded from the Pre-Disaster Mitigation Archives at http://www.fema.gov/pre-disaster-mitigation-grant-program/pre-disaster-mitigation-archives

I.IV.ii.22 Great Lakes Coastal Restoration Grants

The Great Lakes received $475 million for restoration efforts in 2010, as part of the Great Lakes Restoration Initiative, or GLRI. Michigan Sea Grant was awarded more than $1.5 million to help restore particular areas in the region and is leading two projects while assisting on five others. The projects focus on endangered fish, invasive species, beach contamination, water pollution and sound boating and marina operations. Additional information can be found at Michigan Sea Grant website http://www.miseagrant.umich.edu/explore/restoration/.

I.IV.ii.23 Public Assistance Projects

The mission of FEMA's Public Assistance (PA) Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from declared disasters or emergencies. Through the PA Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from

future events by providing assistance for hazard mitigation measures during the recovery process. A list of Public Assistance-funded projects is available at FEMA data feeds website (http://www.fema.gov/data-feeds , accessed July 2012). There are no Public Assistance Projects for Grand Traverse, Benzie, and Leelanau Counties.

I.IV.ii.24 Regulatory Mapping

A FIRM is a regulatory map created by the NFIP for floodplain management and insurance purposes. The FIRM shows a community's base-flood elevations (BFE), flood zones and floodplain boundaries. FIRM maps with effective dates and NFIP Program participation status for Benzie, Grand Traverse, and Leelanau Counties are listed below by community. Benzie, Grand Traverse, and Leelanau, Counties have not yet been modernized to digital mapping. Effective FIRMs and FISs can be downloaded from FEMA's Map Service Center (MSC) at https://msc.fema.gov .

Table 18: Effective Status of Benzie, Grand Traverse, and Leelanau Counties, MI

County	Community	CID	Effective Date
Benzie	Benzonia, Township of		
Benzie	Benzonia, Village of		
Benzie	Beulah, Village of		
Benzie	Blaine, Township of	2600027	
Benzie	Crystal Lake, Township of	260028	
Benzie	Elberta, Village of		
Benzie	Frankfort, City of	260029	
Benzie	Gilmore, Township of		
Benzie	Lake, Township of	260030	
Benzie	Platte, Township of		
Grand Traverse	Acme, Township of	260749	
Grand Traverse	Blair, Township of	260780	
Grand Traverse	East Bay, Township of	260746	
Grand Traverse	Garfield, Township of	260753	
Grand Traverse	Peninsula, Township of	260747	
Grand Traverse	Traverse City, City of	260082	
Grand Traverse	White Water, Township of	260794	
Leelanau	Bingham, Township of	260772	
Leelanau	Centerville, Township of	260625	
Leelanau	Cleveland, Township of	260302	
Leelanau	Elmwood, Township of	260113	
Leelanau	Empire, Township of	260765	
Leelanau	Empire, Village of	260605	
Leelanau	Glen Arbor, Township of	260604	
Leelanau	Leelanau, Township of	260114	

County	Community	CID	Effective Date
Leelanau	Leland, Township of	260760	
Leelanau	Northport, Village of	260580	
Leelanau	Solon, Township of		
Leelanau	Suttons Bay, Township of	260770	
Leelanau	Suttons Bay, Village of	260283	

I.IV.ii.25 Repetitive Loss/Severe Repetitive Loss

If a claimant receives two or more claim payments of more than $1,000 from the National Flood Insurance Program within any rolling 10-year period for their home or business, their property is considered a Repetitive Loss (RL) structure. More information can be obtained at http://www.fema.gov/repetitive-flood-claims-program. No repetitive loss or severe repetitive loss data were found for the communities in Benzie, Grand Traverse, and Leelanau Counties.

I.IV.ii.26 Socio-Economic Analysis

The 2010 American Community Survey 1-year estimate indicates the median income for a household in Grand Traverse County was $47,389 and the median income for a family was $57,887. Males had a median income of $45,854 versus $29,337 for females. The per capita income for the county was $28,606. About 8.5% of families and 12.7% of the population were below the poverty line, including 15.0% of those under the age 18 and 6.6% of those age 65 or over.

In Benzie County, the median income for a household in the county was $44,718 and the median income for a family was $53,250. Males had a median income of $37,704 versus $31,272 for females. The per capita income for the county was $23,649. About 6.5% of families and 11.1% of the population were below the poverty line, including 17.1% of those under the age 18 and 5.1% of those age 65 or over.

In Leelanau County, the median income for a household in the county was $54,498 and the median income for a family was $65,962. Males had a median income of $46,823 versus $33,446 for females. The per capita income for the county was $30,787. About 6.3% of families and 9.4% of the population were below the poverty line, including 8.5% of those under the age 18 and 4.9% of those age 65 or over.

Additional information on demographics and socioeconomic trends can be found at the U.S. Census Bureau.

I.IV.ii.27 State-level Datasets, Programs, and Information

USGS Studies

Michigan Coastal Zone Enhancement Program Assessment and Strategy (2011-2016): Every five years, the Coastal Zone Management Act encourages states and territories to conduct self-evaluations of their coastal management programs to assess significant changes in the state's coastal resources and management practices, identify critical needs, and prioritize areas for enhancement under the Coastal Zone Enhancement Program. More information on this program can be found at http://coastalmanagement.noaa.gov/enhanc.html. The Coastal Zone Enhancement Program Assessment and Strategy can be downloaded at http://coastalmanagement.noaa.gov/mystate/docs/mi3092011.pdf .

The Michigan Coastal Management Program website, located at www.mi.gov/coastalmanagementprovides information on the Program including information on its permitting, coastal planning and technical assistance programs. Michigan's Coastal Management Program was developed under the federal Coastal Zone Management Act and approved in 1978. Since then, the Program has assisted organizations in protecting and enhancing their coastal areas, funded studies related to coastal management, and helped to increase recreational opportunities in Michigan's Great Lakes coastal area.

Coastal Zone Boundary maps can be downloaded at http://www.michigan.gov/deq/0,4561,7-135-3313_3677_3696-90802--,00.html

A list of previously awarded coastal management grants can be found here: http://www.michigan.gov/deq/0,4561,7-135-3313_3677_3696-171451--,00.html

V. Risk MAP Projects and Needs

This section provides information about the planned next steps for the Lake Michigan Great Lakes Coastal Flood Study (GLCFS), including information about the upcoming coastal study, potential for mitigation technical assistance within the project area, changes in compliance as a result of the coastal flood study, future communications, and how unmet needs will be addressed.

i. Future Coastal Study

Information and data collected as part of this Benzie, Grand Traverse, and Leelanau Counties Discovery effort and provided in this report will be utilized in the upcoming GLCFS for Lake Michigan.

A summary of the GLCFS project can be found at http://www.greatlakescoast.org/ under Great Lakes Coastal Analysis & Mapping.

The following is a summary of the work expected to be performed for Lake Michigan as part of the GLCFS. The scope of work described in this section is subject to change.

All engineering and mapping analysis performed as part of this study will follow guidance provided within FEMA's Draft Guidelines and Specifications for Coastal Studies Along the Great Lakes, issued on May 8, 2012 (Federal Emergency Management Agency, 2012).

Engineering & Mapping:

Coastal flood hazard analyses and mapping for all communities of the United States located along the Lake Michigan shoreline will be performed. This analysis will include the creation of bathymetric and topographic map data inventory, base map acquisition, and coastal flood hazard analysis.

National Flood Insurance Program Integration:

Regulatory Digital Flood Insurance Rate Map (DFIRM) files will be updated through the FEMA's Physical Map Revision (PMR) process, using the results from the work performed in the Engineering and Mapping task described above.

Coastal flood maps (or workmaps) will be produced for the study area and reviewed with local community officials. The workmap will include the 1%- and 0.2%-annual chance Special Flood Hazard Area (SFHA), Coastal High Hazard Zone (VE Zone) and Coastal A Zone (AE Zone), Base Flood Elevations (BFEs) and Limit of Moderate Wave Action (LiMWA).

Not all communities will receive regulatory DFIRM panels as a result of this study. Distribution of updated regulatory DFIRM panels will be based upon the results of the coastal analysis and stakeholder discussions with FEMA.

Coastal Flood Risk Assessment Products:

Coastal flood risk products were introduced in section 1 iii of this report. Depending on available data, results of coastal analysis, fiscal year funding, and community partnerships with FEMA, coastal flood risk products may be generated for identified coastal communities in Benzie, Grand Traverse, and Leelanau Counties as summarized in Table 19.

Table 19: Potential Flood Risk Products

County	State	Flood Risk Map and Flood Risk Report	Changes Since Last FIRM	Flood Depth and Analysis Grids	Optional Flood Risk Assessment Products
Benzie	MI	X		X	TBD
Grand Traverse	MI	X	X	X	TBD
Leelanau	MI	X	X	X	TBD

A Flood Risk Map, Flood Risk Report and Flood Risk Database may also be developed as part of this process, in conjunction with the above described products, and is also dependant on results of coastal analysis, data available, fiscal year funding, and partnerships with local communities.

ii. Potential Mitigation Projects

Mitigation Planning Technical Assistance (MPTA) is available to help communities plan for and reduce risks by providing communities with specialized assistance. MPTA is a part of the Risk MAP program and includes risk assessment, mitigation planning, and traditional hazard identification (flood mapping) activities. MPTA is one available part of the Risk MAP process, as it can help communities increase awareness and take action to reduce risk. Technical assistance can be performed at any time during the hazard mitigation planning process.

Unfortunately, not every community will receive MPTA as part of a Risk MAP project. Forming a partnership between FEMA and a local community is an essential part of initiating a MPTA project. Assistance will be prioritized after all data and information is collected and assessed by FEMA in coordination with the local communities to determine where MPTA resources would be beneficial. Communities should alert FEMA of any resources that are available at the local level, and of actions they are interested in implementing in partnership with FEMA.

Technical assistance is available through Risk MAP to assist communitites in identifiying, selecting, and implementing activities to support mitigation planning and risk reduction. Technical assistance activities should be based on the needs of the community and assist with already established capabilities.

Such activities could include (but are not limited to):

- Advising in the creation of initial Hazard Mitigation Plans
- Advising in the update of existing Hazard Mitigation Plans
- Training to improve a community's capabilities for reducing risk

- Assistance in incorporating flood risk datasets and products into potential and effective community legislation, guidance, regulations, procedures, etc.
- Assistance with the creation, acquisition and incorporation of GIS data into potential and effective maps, planning mechanisms, emergency management procedures, etc.
- Facilitating the identification of data gaps and interpret technical data to identify risk reduction definiencies that should be corrected.

At the time of this report, specific potential future mitigation projects were not identified during the Discovery Meeting or Discovery process for communities in Benzie, Grand Traverse, and Leelanau Counties. Continued discussion regarding FEMA partnership with local communities to assist in developing new mitigation actions and moving those actions forward will be essential as this coastal project moves forwards.

iii. Compliance

FEMA uses a number of key tools to determine a community's compliance with the minimum regulations of the NFIP. Among them are Community Assistance Visits (CAVs), the Letter of Map Change (LOMC) process, and Submit-for-Rates. These tools help assess a community's implementation of their flood damage reduction regulations and identify any floodplain management deficiencies and violations.

The CAV is a visit to a community by a FEMA staff member, or staff of a state agency on behalf of FEMA, that serves the dual purpose of providing technical assistance to the community and assuring that the community is adequately enforcing its floodplain management regulations. Potential violations may be identified during the CAV visit as a result of touring the floodplain, inspecting community permit files, and meeting with local appointed and elected officials. Open CAVs can be indicative of unresolved violations.

Violations can also be discovered when LOMR-F applications depict a non-compliant structure based on elevation data; or can be found through Submit-for-Rate requests, which occur when a structure applies for flood insurance but has been identified as being two or more feet below Base Flood Elevation (BFE). Elevation comparisons identified through LOMR-F applications and Submit-for-Rates imply structures were not built compliantly.

If administrative problems or potential violations are identified, the community will be notified and given the opportunity to correct those administrative procedures and remedy the violations to the maximum extent possible within established deadlines. FEMA or the state will work with the community to help them bring their program into compliance with NFIP requirements. In extreme cases where the community does not take action to bring itself into compliance FEMA may initiate an enforcement action against the community.

During this Discovery process, stakeholders were provided with information regarding NFIP requirements that are associated with coastal hazard zones, as well as information about new FEMA guidance related to moderate wave action. These topics, including coastal SFHAs, building requirements in VE Zones, and the LiMWA, are discussed in detail at http://www.greatlakescoast.org and can also be found in the basinwide Lake Michigan Discovery Report (Federal Emergency Managment Agency, 2012).

iv. Communication

Throughout this Discovery process, community representatives and local stakeholders indicated the need to be kept informed about the results of Discovery, the upcoming coastal flood study, and opportunities for public input throughout the study process.

Ongoing communication and coordination will be an essential part of this Lake Michigan Coastal Flood Study for Benzie, Grand Traverse, and Leelanau Counties. Throughout this study process, Federal, State, and local stakeholders for Benzie, Grand Traverse, and Leelanau Counties will be kept informed via email, phone calls, letters, newsletters, and meetings.

The Great Lakes Coastal Flood Study website http://www.greatlakescoast.org is an excellent resource where stakeholders can obtain the most update-to-date information about the status of the Great Lakes Coastal Flood Study, data collection, upcoming meetings, new technical reports, the latest methodologies, factsheets, and much more.

FEMA encourages stakeholders to remain involved throughout the study process and will seek to identify partnership opportunities during the study process.

v. Unmet Needs

During the Discovery Meetings and throughout the Discovery process, Lake Michigan stakeholders identified concerns with proceeding with a new coastal flood risk study. Many stakeholders were concerned about what to expect in terms of extent of new SFHA boundaries. EMA acknowledged this concern and noted that upcoming engineering and production will include the distribution of draft workmaps and other flood risk products designed to give local stakeholders an opportunity to review and comment on flood risk data before the data is carried into NFIP FIRM maps.

In addition, comments related to the proposed transects were raised during the Discovery Meeting by State and County representatives. These comments were noted and will be considered as the study continues to move forward. It should be noted that transects proposed in this report remain subject to change.

VI. Close

Federal, State and local stakeholders were interested in the Discovery processes and in ensuring that local existing information and data that may assist in the upcoming Lake Michigan flood study was provided to FEMA so that it may be considered for use as the study progresses. Many stakeholders were interested in learning more about the new methodologies being used as part of the Great Lakes Coastal Flood studies, and how their community would be specifically affected by the flood study.

The information gathered in this Discovery process for Benzie, Grand Traverse, and Leelanau Counties will provide invaluable information as the Lake Michigan Coastal Flood Study proceeds.

VII. References

Federal Emergency Management Agency. 2011a. *HAZUS Flood Average Annualized Loss Usability Analysis*. April 13, 2011.

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Federal Emergency Management Agency, 2012a, Coordinated Needs Management System, http://cnms.riskmapcds.com/HelpCNMS.html, accessed July 2012.

Federal Emergency Management Agency, 2012b, Mitigation Planning Report with Transmittal Memo, May 2012.

U.S. Army Corps of Engineers, Great Lakes Hydraulics and Hydrology Branch, 1977. *Report on Great Lakes Open-Coast Flood Levels*.

U.S. Army Corps of Engineers, Detroit District, 2012, Lake Michigan Shoreline Classification obtained on July 3, 2012.

U.S. Census Bureau, 2010, State and County Quick Facts, http://quickfacts.census.gov/, accessed on July 30, 2012.

VIII. Attachments

The Discovery Report and appendices are stored digitally under their respective folders on the FEMA Mapping Information Platform (MIP) at:

LakeMichigan\Discovery\Project_Discovery_Initiation\Discovery_Report\

This Discovery Report and attachments are also available for download from the following website: http://www.greatlakescoast.org/

Expiration Date: TBD

A. Coastal Data Request Form
B. Benzie, Grand Traverse, and Leelanau Counties Pre-Meeting Correspondence
C. Benzie County Draft Discovery Map
D. Grand Traverse County Draft Discovery Map
E. Leelanau County Draft Discovery Map
F. Benzie, Grand Traverse, and Leelanau Counties Proposed Transects
G. Benzie, Grand Traverse, and Leelanau Counties Discovery Meeting Documents
H. Locally Identified Mitigation Projects

Attachment A.

Coastal Data Request Form

U.S. Department of Homeland Security
536 S. Clark St. 6th Floor
Chicago, IL 60605
FEMA

Community Discovery Coastal Data Request Form

Thank you for taking the time to complete this questionnaire. We are interested in obtaining coastal-specific data for your community. It will provide important information to help FEMA understand coastal flood risk issues in your community and to work with you in increasing your community's resilience to coastal flooding through implementation of the Risk MAP program. In addition, this form can be used as a way to prepare for the upcoming Discovery Meeting, as the topics on this form will be discussed throughout the meeting.

Once you have completed the questionnaire, please return the form:

Via e-mail: GreatLakesFloodStudy@starr-team.com
By mail: Holly Davis
Atkins/STARR
7406 Fullerton Street, Suite 350
Jacksonville, Florida 32256

Please provide as much information as possible. If you have any questions about the Discovery process or about completing this questionnaire, please contact:

Holly Davis, holly.davis@starr-team.com, (904) 363-8451

Contact Information	
Community/Organization	
Name:	
Title:	
Address:	
E-mail:	
Phone:	
Contact Preference	☐ Email ☐ Phone ☐ Mail

U.S. Department of Homeland Security
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Chicago, IL 60605
FEMA

Base Map Data		*Please select available data type*	
	Topography (e.g., LiDAR or contour data)	☐ *Hard copy*	☐ *Digital*
	Property information (e.g., Building footprints, parcel data, tax assessor's data)	☐ *Hard copy*	☐ *Digital*
Coastal Data			
	Coastal structures (e.g., seawalls, levees, jetties, groins, etc.)	☐ *Hard copy*	☐ *Digital*
	Coastal features (i.e., dunes and bluffs)	☐ *Hard copy*	☐ *Digital*
	Shoreline change data	☐ *Hard copy*	☐ *Digital*
	Locations of beach nourishment or dune restoration projects	☐ *Hard copy*	☐ *Digital*
	Areas of significant beach or dune erosion	☐ *Hard copy*	☐ *Digital*
	Mean high water	☐ *Hard copy*	☐ *Digital*
	Mean lake level	☐ *Hard copy*	☐ *Digital*
Other Data			
	Hydraulic structures (e.g., bridges, culverts, levees, dams) with inspection status, if available	☐ *Hard copy*	☐ *Digital*
	Elevated roads	☐ *Hard copy*	☐ *Digital*
	Critical facilities	☐ *Hard copy*	☐ *Digital*
	Other known hazards with geographical boundaries, i.e., landslide hazard areas, storm surge inundation zones, wildfire hazard areas, etc.	☐ *Hard copy*	☐ *Digital*
	Other relevant data	☐ *Hard copy*	☐ *Digital*

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Please provide the following information about the community:

Historical Flood Data		
Are you aware of any coastal flooding issues not represented on effective FIRMs:	☐ yes ☐ no	If yes, please explain and provide inundation areas of historic flooding events if available.
Risk Assessment		
Does your community have HAZUS-based loss estimates from average annualized loss?	☐ yes ☐ no	If yes, please describe:
Does your community have other risk assessment data?	☐ yes ☐ no	If yes, please describe:

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Flood Mitigation Information		
Does your community have a hazard mitigation plan?	☐ yes ☐ no	If yes, what is the status of the hazard mitigation plan? ☐ being reviewed ☐ it has been adopted ☐ it is currently being updated ☐ it is planned for updates
Does the plan reflect any coastal flood hazards?	☐ yes ☐ no	If yes, please explain:
Does the hazard mitigation plan indicate any data deficiencies for flood hazards that could be addressed through a flood study, especially near coastal zones?	☐ yes ☐ no	If yes, please explain:
Does your community have on-going mitigation projects, such as acquisition, elevation, flood control, soil stabilization, natural systems restoration, floodproofing, etc.	☐ yes ☐ no	If yes, please describe the projects and their locations:

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Any specific coastal mitigation projects?	☐ yes ☐ no	If yes, please explain:
Does your community have experience with coastal flood disasters and flood disaster recovery?	☐ yes ☐ no	If yes, please explain:
Does your community coordinate floodplain management programs with programs for the management and planning of open space? If possible, any coastal specific?	☐ yes ☐ no	If yes, please explain:

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Have you had any prior proactive mitigation actions and planning efforts that resulted in reduced losses? If possible, any coastal specific?	☐ yes ☐ no	If yes, please describe:
Has your community applied and granted Individual Assistance/Public Assistance grants for declared disasters?	☐ yes ☐ no	If yes, please describe and provide the locations of these grants projects:
Has your community applied for FEMA Hazard Mitigation Grants program or other mitigation funds (USACE, NRCS, USGS, state Hazard Mitigation officer, etc.) in the past?	☐ yes ☐ no	If yes, please describe and provide the locations of on-going/planned/finished grants projects/structures:

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How would you rank the community's ability to implement mitigation actions and to communicate flood risk to citizens?		☐ high ☐ medium ☐ low
Community Plans and Projects		
Does your community have a comprehensive plan?	☐ yes ☐ no	If you answered yes and you have a hazard mitigation plan, was your hazard mitigation plan coordinated with the comprehensive plan? ☐ yes ☐ no
Does your community's comprehensive plan have a special consideration for coastal areas?	☐ yes ☐ no	If yes, please explain elements/regulations that affect coastal area development.
Does your community have a coastal zone management plan?	☐ yes ☐ no	If yes, please provide a digital or hard copy of the plan.
Does your community have planning staff or a planning/zoning commission and other measures, such as ordinances, administrative plans, or other programs contributing to effective administration of floodplain zoning, building codes, open space preservation, and coastal zone management?	☐ yes ☐ no	If yes, please explain this group's role in floodplain management and provide examples of the types of programs in place:

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Chicago, IL 60605
FEMA

Does your community have areas of recent or planned development/re-development and areas of high growth or other natural land changes (e.g., wildfires or landslides):	☐ yes ☐ no	If yes, please describe:
Are there any locations of other ongoing studies or projects and studied areas that have been modified since the effective map and require an updated study (e.g., highway improvement, seawall improvement, etc.)	☐ yes ☐ no	If yes, please describe:
Any other comments/concerns based on local knowledge:		

Attachment B.

Benzie, Grand Traverse, and Leelanau Counties Pre-Meeting Correspondence

Davis, Holly A

Subject: FEMA's Great Lakes Coastal Flood Study: Discovery Information Exchange Session for Grand Traverse, Benzie and Leelanau County, MI
Location: Call in number: 1-877-537-6647 Participant Code: 31578 and WebEx

Start: Wed 8/8/2012 1:00 PM
End: Wed 8/8/2012 2:00 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Davis, Holly A

Required Attendees:

Optional Attendees:

Good Morning,

You are receiving this meeting invitation because you have been identified as a ***Lake Michigan*** local community stakeholder. You should have recently received an invitation in the mail from the Federal Emergency Management Agency (FEMA), regarding the ***Great Lakes Coastal Flood Study*** effort, inviting you to attend a Discovery Meeting in September, as well as this information exchange session, scheduled for **Wednesday, August 8, 2012 at 1pm ET**. More information about the ***Great Lakes Coastal Flood Study*** may be found at http://www.greatlakescoast.org.

While the WebEx and call-in information was provided in the letter, I wanted to also provide this information to you via email to serve as a reminder. Below is the call-in and WebEx information:

Date:	Wednesday, August 8, 2012
Time:	1:00pm – 2:00pm ET
Link to WebEx:	https://www.webex.com/login/attend-a-meeting
Meeting No:	652 352 734
Call in number:	877-537-6647
Participant Code:	31578

This informal session will begin the process of learning about your available local coastal data, hazard mitigation strategies, and what the critical flooding issues are in your community so that we can then work with you to determine how to best utilize that information during FEMA's Great Lakes study. A data request form is attached to help facilitate the discussion. We encourage open discussions throughout this meeting and will use the information to better cater our upcoming Discovery Meetings as well. Attendees of this conference call, as well as the Discovery Meetings, may include, but certainly are not limited to, community leaders, emergency managers, GIS specialists, engineers, outreach specialists, and local planners.

We look forward to speaking with you on Wednesday, and appreciate your participation in this process. If you have any questions, or are not able to attend this session but would like to learn more, please do not hesitate to contact me directly. My information can be found below.

Thanks,
Holly

Holly A. Davis
STARR Team
Tel: (904) 363-8451 | Fax: (904) 363 8811 | Cell: (904) 476 9840 |

Great Lakes Coastal Flood Study
Information Exchange WebEx Meeting
Grand Traverse, Benzie and Leelanau Counties, Michigan
August 8, 2012 1:00pm ET

Attendance:
John Travis – Traverse City, Grand Traverse County
Jack Kelly – Elmwood Charter Township, Leelanau County
Wayne Kladder – Acme Township, Grand Traverse County
Sharon Vreeland – Manager, Acme Township, Grand Traverse County
Stacey Roberts, STARR
Holly Davis, STARR

Discussion:

- **Jack Kelly –**
    - Familiar with hazard mitigation plans from previous work. In the Township, there is not much flooding concern. The Town experiences snowstorm, windstorm and rainstorm events, but there are no flood risks even though the Township is on the Bay and two lakes (Lake Leelanau and Cedar Lake).
    - Last year submitted information to the NFIP, is this a continuation of that project? If not, would be able to send STARR the same info submitted last year that would be helpful toward this effort.
    - Also the Township recently completed a storm water management strategy.
    - Shoreline park in planning stage.
- **Wayne Kladder –**
    - Not much flood risk or problems or flood hazard areas
    - Have a 50-foot setback requirement from MHW which may help
    - In the process of creating a shoreline park (approx. 1 mile), for which the Township purchased 3 hotels and tore down. Have purchased two additional hotels and one building that will also be torn down for the park lands.
    - The only flood issue is a small road house with a dam that was once a sawmill. The pond has been re-established and since some rain events cause flooding over the road.
- **John Travis -**
    - **Two issues:**
        - Have installed new culverts by the bay to address storm water runoff. The Township does not have dedicated 'storm water' budget, and they do the best they can in engineering, natural resources and other departments.
        - There is an ongoing project on Boardman River that involved removal of dams that have been there for many years. One primary dam will remain, but the rest are being removed and it has locals concerned. DEQ is involved, but don't

know of a single 'authority' for this project. John sent the links below for more information:

- http://www.theboardman.org/
- http://www.ci.traverse-city.mi.us/BrownBridge/RFQ-Brown_Bridge_Dam_Removal_and_Restoration.pdf
- http://www.ci.traverse-city.mi.us/BrownBridge/120418%20RFQ%20Addendum%202%20110027.pdf
- http://www.ci.traverse-city.mi.us/departments/engineering/GTAREAWaterSystemsMasterPlan2010REVISEDFINALREPORTwithbookmarks.pdf#pagemode=bookmarks
- http://www.ci.traverse-city.mi.us/community-projects/boardman-river-dams-implementation-team

Q&A

Wayne Kladder

Recent ruling in Michigan that allows property owners to remove vegetation and perhaps even till their coastal shoreline. The Town is proactive in the removal of exotics and maintaining native vegetation. Is vegetation important? *Yes, particularly as it relates to coastal analysis and any information on vegetation is useful.*

John Travis -

Northport Village and Leelanau Township might want to consider additional transects in their areas. Surprised they are not in attendance.

Sharon Vreeland

Have you invited the Grand Traverse Band of Ottawa and Chippewa Indians to these meetings? *FEMA to coordinate direct outreach to Indian communities.*

John Travis

Will the floodplain change? *Too soon to tell, but will be discovered during studies*.

Will the new maps include benchmarks? *Topography for studies will be lidar, so no new ground surveys to be taken or benchmarks established.*

Previous maps (some) contained local benchmarks (i.e. USGS), this is useful to the local communities, particularly where benchmarks are far and few between. Will the new maps contain benchmarks? *We will ask the question and follow up with you.*

Will maps be available digitally? *Yes, FEMA is making data and maps available digitally*.

Wrap-up and Adjourn

- Holly Davis, STARR, will send follow-up email, including a copy of the presentation, data request form and draft transects, to the entire group of invitees.

FEMA

Information Exchange Session for Lake Michigan Discovery

Grand Traverse, Benzie and Leelanau Counties, Michigan
August 8, 2012
1pm – 2pm ET

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

Purpose of Information Exchange

- Introduction to Risk MAP
- Introduction to Great Lakes Flood Study and Discovery
- Learn more about your areas of concern, coastal flood risk, and coastal mitigation
- Bring the right people to the table early
- Identify data gaps

Risk MAP (Mapping, Assessment, and Planning) Vision

FEMA

Goals

1. Address gaps in flood hazard data
2. Increase risk awareness to encourage risk reduction
3. Risk-based Mitigation Planning resulting in risk reduction actions
4. Enhanced digital platform to improve communication and sharing of risk data
5. Align programs and develop synergies

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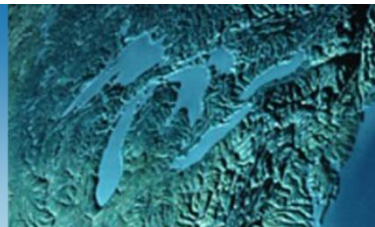
greatlakescoast.org



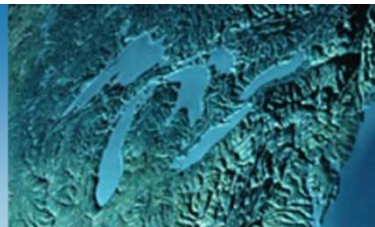
Overview of Great Lakes Coastal Flood Study

FEMA

- Latest models, data, and technology
- Deliver updated flood maps and flood risk datasets
- Equip Federal Agencies, eight States and hundreds of coastal communities with data and planning tools to facilitate actions to enhance resiliency of the Great Lakes ecosystem

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org



Hazard Mitigation Resources, Strategies & Actions

FEMA

- **Recent community hazard mitigation experiences?**
  - *Public Works*
  - *Building Standards*
  - *Community Planning and Hazard Mitigation Plan Update*
  - *Communication Processes, GIS, etc.*
- **New option to document ideas and actions through the FEMA Mitigation Action Form**

Land Use Ordinances	Local Building Codes	Mitigation Projects	Community Identified Mitigation Programs	Management Best Practices
Zoning, Setbacks, Floodplain Management, etc.	IBC, IRC, Local Regulations, etc.	Acquisition, Elevation, Floodproofing, etc.		Integration of natural hazards into other planning mechanisms

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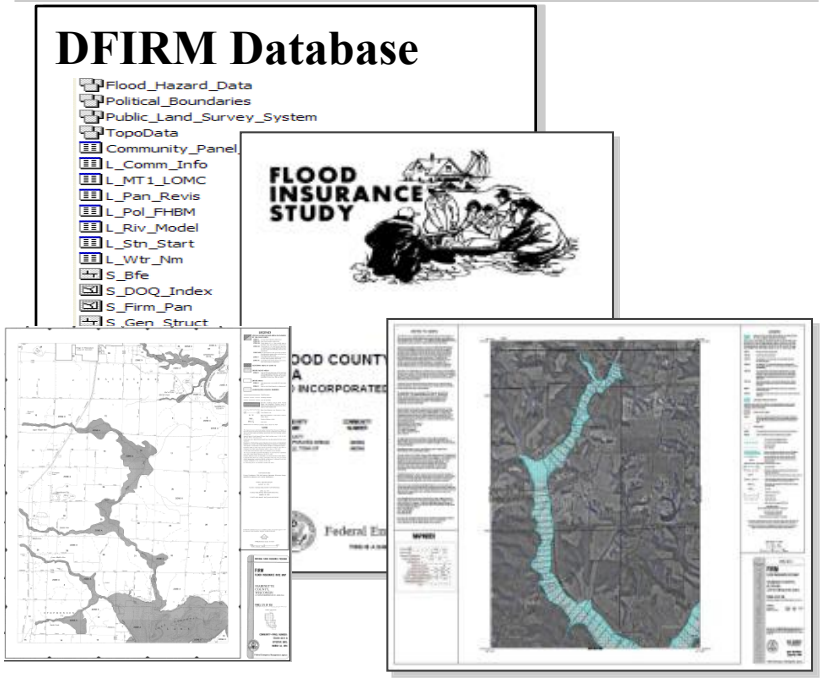
Products and Datasets: Regulatory and Non-regulatory

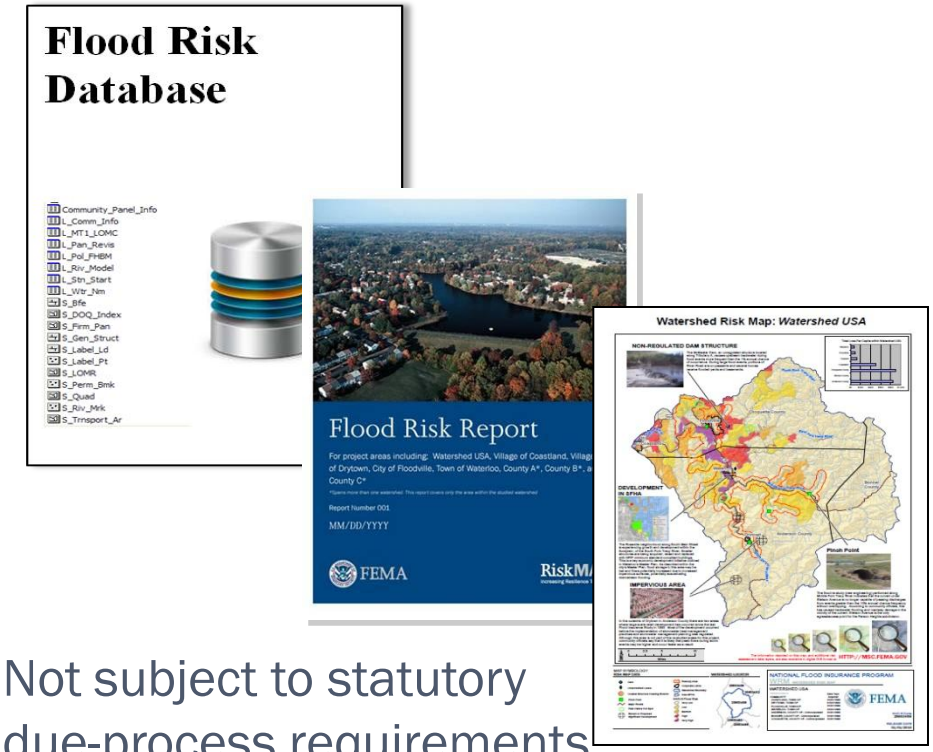
FEMA

Traditional Regulatory Products



Subject to statutory due-process requirements

Non-Regulatory Products



Not subject to statutory due-process requirements

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Products and Datasets: Coastal Products in Development

FEMA

Erosion

Red Lantern Restaurant, Lake Michigan, IN

Lake Levels

Lake Michigan Shoreline
Reference

Shoreline Feature

Upper Peninsula Shoreline
Reference

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Risk MAP Overview: Shoreline Features Database

FEMA

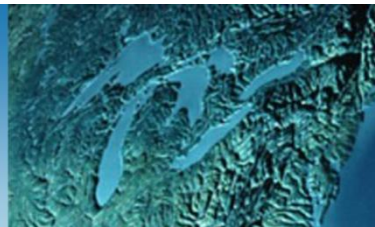
Shoreline Material
Sand
Cohesive
Cobble
Diamicton*
Shingle
Bedrock
Artificial

Primary Land Use
High Density Residential
Moderate Density Residential
Low Density Residential
Commercial/Industrial
Park Land
Farm Land
Forested

Primary Coast Type
High Dune, 10'+
Dune, 2' - 10'
High Bluff, 10'+
Bluff, 2' - 10'
Coastal Wetland
Flat Coast

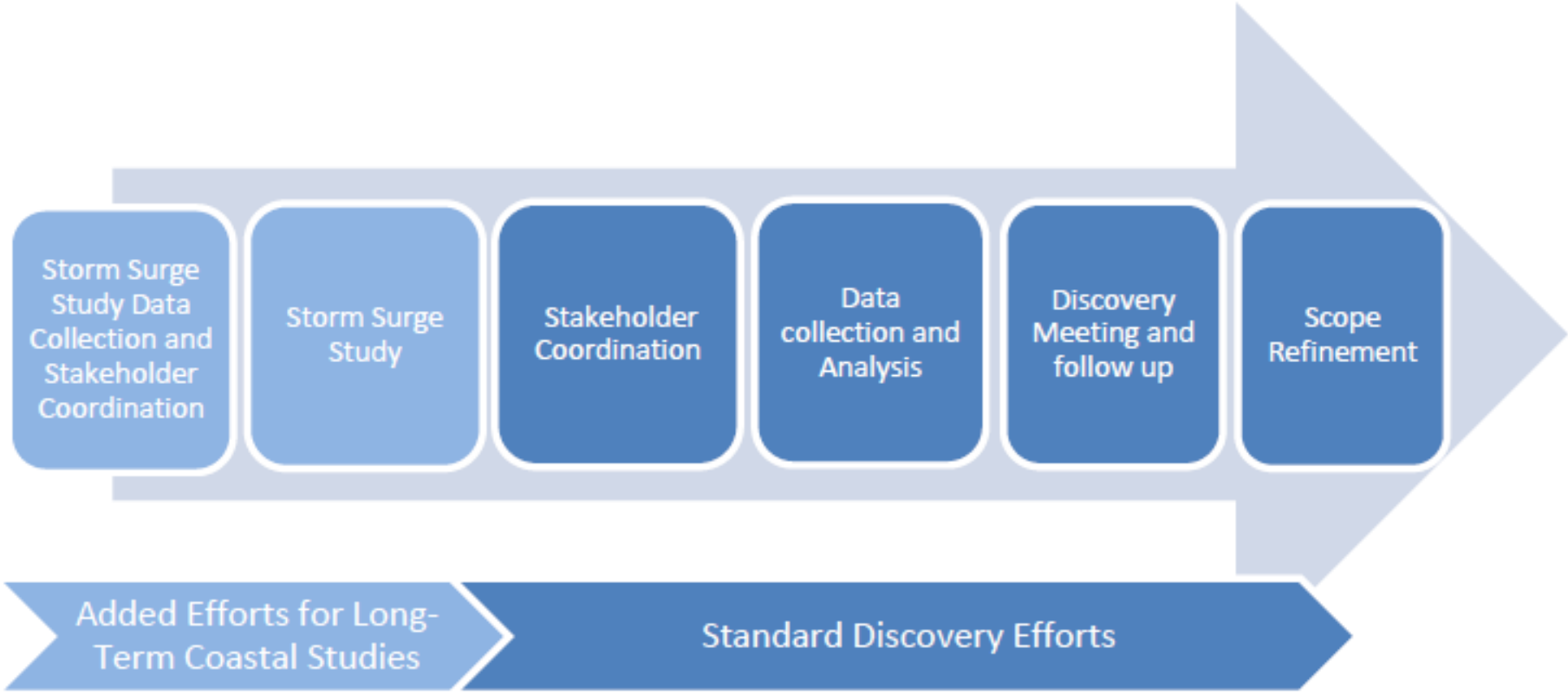
Primary Vegetation
None
High Density Shrubs/Trees
Moderate Density Shrubs/Trees
Low Density Shrubs/Trees
Manicured Lawn
Native Vegetation

- Contains primary and secondary Land Use tables – same for coast type and vegetation.
- Current project collects data at one-mile spacing, for scoping and cost
- Current project does not include field-based reconnaissance or sediment/subsurface soils collection



Great Lakes Coastal Flood Study
Discovery Process Overview

FEMA



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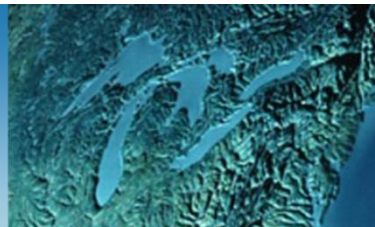
Great Lakes Coastal Flood Study
greatlakescoast.org



Great Lakes Coastal Flood Study
Discovery Meeting

Discovery Meeting Venue	Discovery Meeting Address	Discovery Meeting Date, Time
County Training Room at the Governmental Center	400 Boardman Avenue Traverse City, Michigan 49684	Thursday 09/13/2012; 1:00 - 3:00 PM ET

Draft Discovery Meeting Agenda

- Why are we here?
- Coastal mapping and flood risk topics to be aware of
- How does this apply to my community?
  - NFIP compliance, hazard mitigation opportunities, and grant funding
- Interactive Session
  - Utilization of Coastal Flood Risk Products for Planning and Mitigation, Identification of Existing Local Coastal Data, View and Discuss Local Coastal Areas of Concern Using the Discovery Map, Discuss Mitigation Action Opportunities and Introduce the Mitigation Action Form
- Wrap Up

Draft Transect Map Station: Talk to technical staff about draft transects and view draft transects in GIS

Mitigation Resources, Strategies, and Actions Station: Talk with FEMA and State staff about areas of concern and potential mitigation actions to help reduce risk. Fill out Mitigation Action Form.

Great Lakes Coastal Flood Study
Discovery Products

- **Final Discovery Report**
  - Single, comprehensive report for all of Lake Michigan, with appendices for each coastal community by county
  - Includes pre-discovery data, meeting agenda, sign-in sheets, discussion topics, decisions made, etc.
- **Final Discovery Maps**
  - Including feedback from participants
  - Visual representation of meeting outcomes

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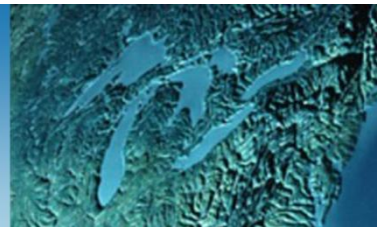
Great Lakes Coastal Flood Study
greatlakescoast.org

Who Should Attend the Discovery Meeting?

- **Community Officials**
  - CEO and Floodplain Administrators (FPAs)
  - Planners, GIS Specialists, Engineers, Outreach Specialists, Emergency Managers, and Community Leaders
- **State Representatives**
  - State Hazard Mitigation Officer (SHMO), National Flood Insurance Program (NFIP) Coordinators, Cooperating Technical Partners (CTPs)
- **Other Federal Agencies (NOAA, USACE, USGS)**
- **Regional Planning Agencies**
- **Great Lakes Organizations**



Great Lakes Coastal Flood Study
Discovery Study Area

FEMA

Lake Michigan coastal communities in Benzie, Grand Traverse, and Leelanau Counties, MI

Grand Traverse County

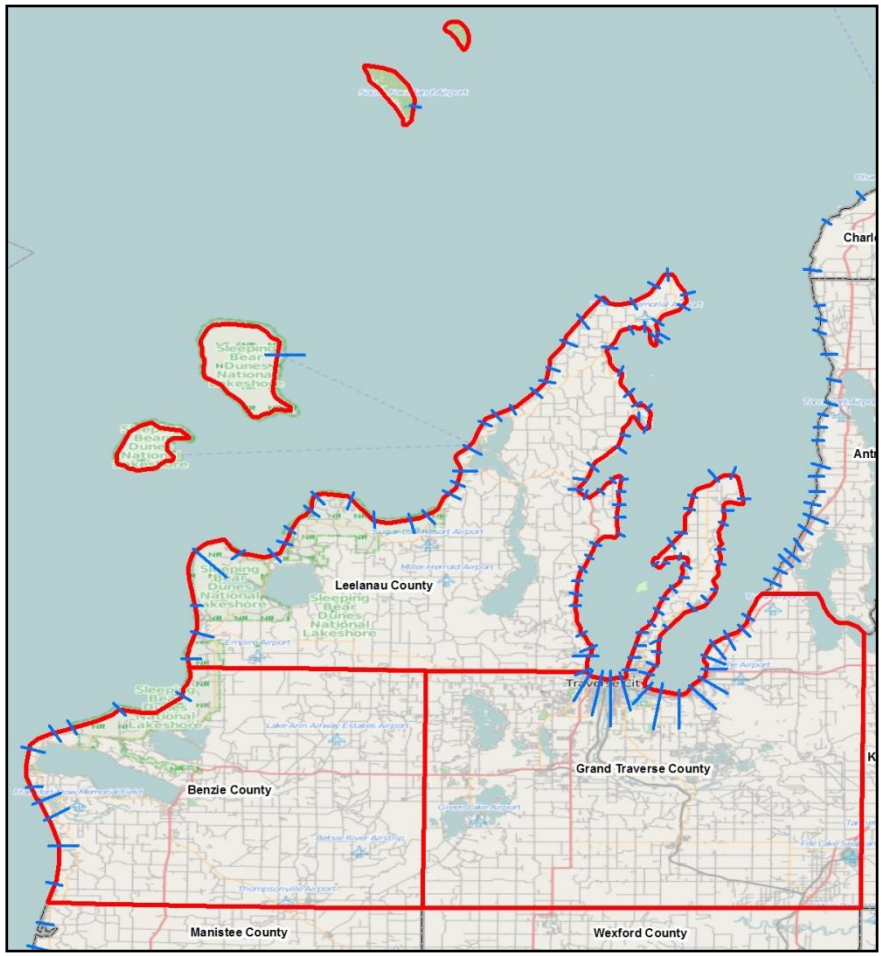
Acme Township
Blair Township
East Bay Township
Garfield Township
Peninsula Township
Traverse City
White Water Township

Benzie County

Benzonia Township
Benzonia Village
Beulah Village
Blaine Township
Crystal Lake Township
Elberta Village
City of Frankfort
Gilmore Township
Lake Township
Platte Township

Leelanau County

Bingham Township
Centerville Township
Cleveland Township
Elmwood Township
Empire Township
Empire Village
Glen Arbor Township
Leelanau Township
Leland Township
Northport Village
Solon Township
Suttons Bay Twp
Suttons Bay Village



RiskMAP
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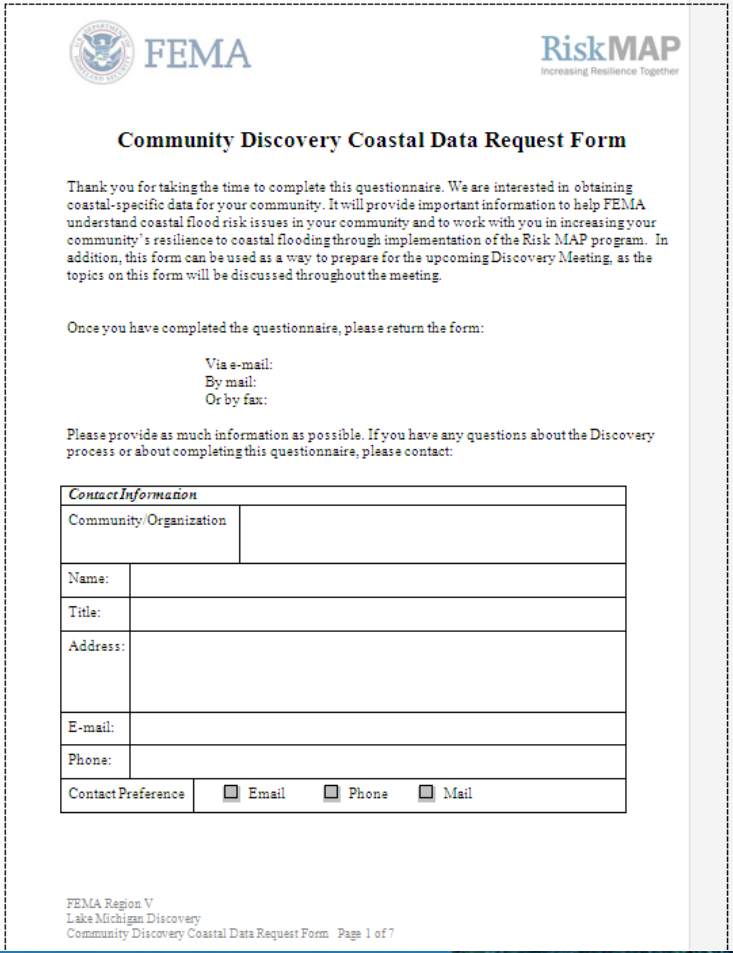
Great Lakes Coastal Flood Study
greatlakescoast.org

Data Request Form Overview

- Contact Information
- Base Map Data
- Coastal Data
- Other Data
- Historic Flood Data
- Risk Assessment
- Flood Mitigation Information
- Community Plans and Projects
- Any Other Comments/ Concerns Based on Local Knowledge



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Community Discovery Coastal Data Request Form

Thank you for taking the time to complete this questionnaire. We are interested in obtaining coastal-specific data for your community. It will provide important information to help FEMA understand coastal flood risk issues in your community and to work with you in increasing your community's resilience to coastal flooding through implementation of the Risk MAP program. In addition, this form can be used as a way to prepare for the upcoming Discovery Meeting, as the topics on this form will be discussed throughout the meeting.

Once you have completed the questionnaire, please return the form:

Via e-mail:
By mail:
Or by fax:

Please provide as much information as possible. If you have any questions about the Discovery process or about completing this questionnaire, please contact:

Contact Information	
Community/Organization	
Name:	
Title:	
Address:	
E-mail:	
Phone:	
Contact Preference	☐ Email ☐ Phone ☐ Mail

FEMA Region V
Lake Michigan Discovery
Community Discovery Coastal Data Request Form Page 1 of 7

RiskMAP
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Great Lakes Coastal Flood Study
greatlakescoast.org

Review of Data Collected To Date

- Draft Transects
- Shoreline Classification Dataset
- Hazard Mitigation Plans
- Hazard Mitigation Grants Program (HMGP) projects
- Pre-Disaster Mitigation Program projects
- Declared Disasters
- Repetitive loss claims by community

Next Steps and Opportunity to Get Involved

- **Assessment of data and information provided**
- **Identification of best practices:**
  - Do you have an example of a local coastal mitigation best practice?
- **Discovery meeting involvement:**
  - Are you be interested in participating in Discovery Meeting facilitation?

THANK YOU FOR YOUR PARTICIPATION!

Who to Contact

- **For more information:** http://www.greatlakescoast.org/
- **Send completed questionnaires to:**
  - GreatLakesFloodStudy@starr-team.com
- **FEMA Region V**
  - Ken Hinterlong @ ken.hinterlong@fema.dhs.gov
  - Erin Maloney @ erin.maloney@fema.dhs.gov
- **STARR**
  - Holly Davis@ holly.davis@starr-team.com
  - Stacey Roberts @ stacey.roberts@starr-team.com

Questions?

Attachment C.

Benzie County Draft Discovery Map

BEN10
BEN09
BEN08
BEN07
BEN06
BEN05
BEN04
BEN03
BEN02
BEN01
Empire Township
Leelanau County
Platte Township
Lake Township
Crystal Lake Township
Benzonia Township
Benzie County
City of Frankfort
Village of Elberta
Gilmore Township
Blaine Township
Manistee County
Arcadia Township
Pleasanton Township
Crystal Downs Country Club
Pilgrim
Matheson
Watervale
Crystal Lake Cemetery
Frankfort Dow Memorial Field
Pinewood Golf Course
Champion Hill Golf Club
Crystal Lake Golf Club
Peacroft Golf Plantation
N
0 0.5 1 2 Miles

MAP SYMBOLOGY

LEGEND

- Ports
- Dams
- USGS Gages
- Wave Gages
- Draft Transects
- Stream/River
- Watershed
- Waterbody
- Federal Lands
- Municipal Boundary
- County Boundary

AAL DATA/ Total Average Annualized Losses per Census Block

- $1,000 - $100,000
- $100,001 - $250,000
- $250,001 - $750,000
- $750,001 - $2,000,000
- $2,000,000+

Coordinated Needs Management Strategy (CNMS) - Status

- UNVERIFIED
- UNKNOWN
- VALID

COASTAL STUDY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM
Discovery Map

LAKE MICHIGAN COASTAL STUDY

BENZIE COUNTY, MICHIGAN COASTAL STUDY COMMUNITIES

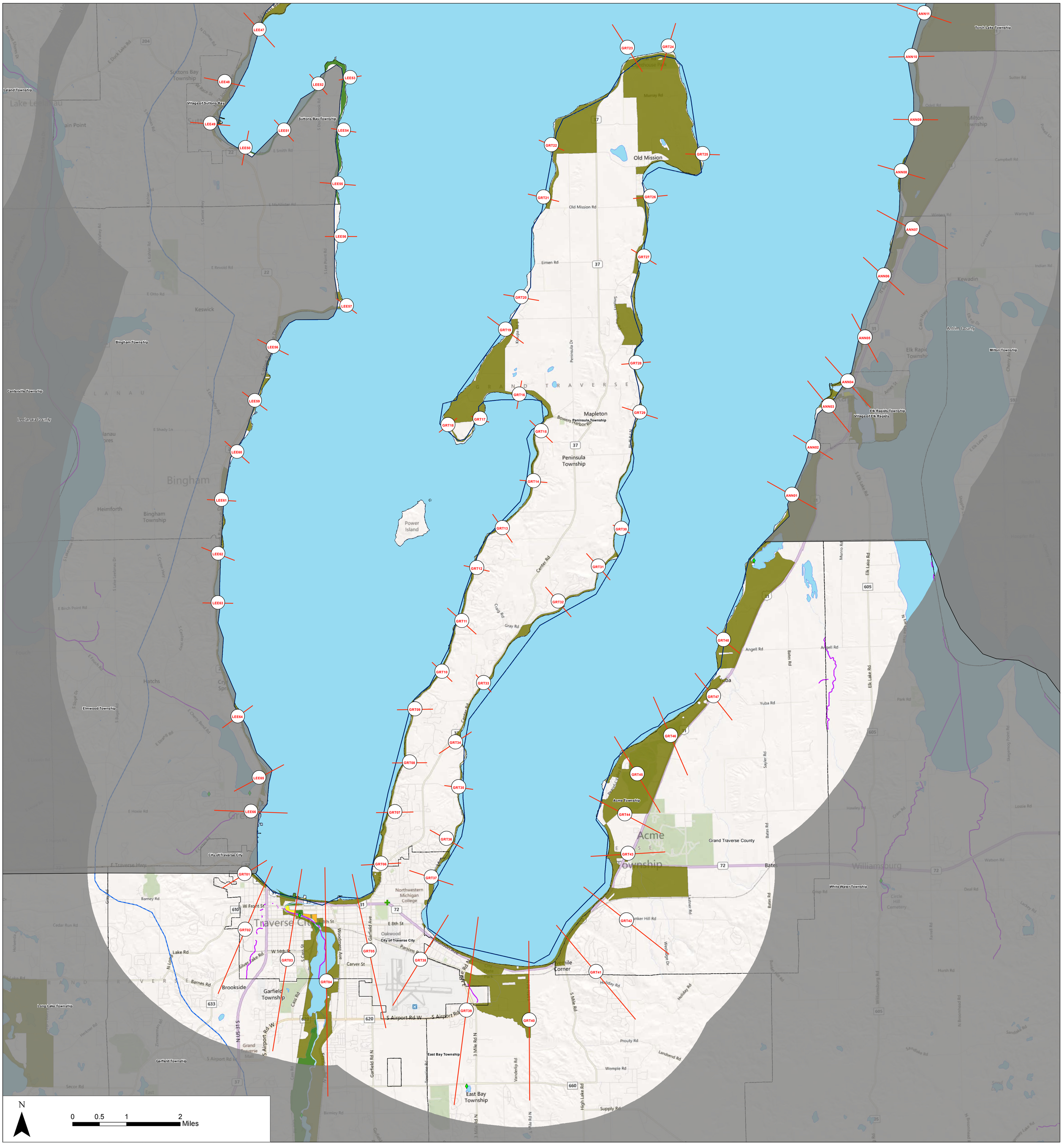
Township of Benzonia	Village of Elberta
Village of Benzonia	City of Frankfort
Village of Beulah	Township of Gilmore
Township of Blaine	Township of Lake
Township of Crystal Lake	Township of Platte

STARR

FEMA

Attachment D.

Grand Traverse County Draft Discovery Map



MAP SYMBOLOGY

LEGEND

- Ports
- Dams
- USGS Gages
- Wave Gages
- Draft Transects
- Stream/River
- Watershed
- Waterbody
- Federal Lands
- Municipal Boundary
- County Boundary

AAL DATA/ Total Average Annualized Losses per Census Block

- $1,000 - $100,000
- $100,001 - $250,000
- $250,001 - $750,000
- $750,001 - $2,000,000
- $2,000,000+

Coordinated Needs Management Strategy (CNMS) - Status

- UNVERIFIED
- UNKNOWN
- VALID

COASTAL STUDY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

LAKE MICHIGAN COASTAL STUDY

GRAND TRAVERSE COUNTY, MICHIGAN COASTAL STUDY COMMUNITIES

Town of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

STARR

FEMA

Attachment D.

Leelanau County Draft Discovery Map

MAP SYMBOLOGY

LEGEND

- Ports
- Dams
- USGS Gages
- Wave Gages
- Draft Transects
- Stream/River
- Watershed
- Waterbody
- Federal Lands
- Municipal Boundary
- County Boundary

AAL DATA/ Total Average Annualized Losses per Census Block

- $1,000 - $100,000
- $100,001 - $250,000
- $250,001 - $750,000
- $750,001 - $2,000,000
- $2,000,000+

Coordinated Needs Management Strategy (CNMS) - Status

- UNVERIFIED
- UNKNOWN
- VALID

COASTAL STUDY LOCATOR

NATIONAL FLOOD INSURANCE PROGRAM

Discovery Map

LAKE MICHIGAN COASTAL STUDY

LEELANAU COUNTY, MICHIGAN COASTAL STUDY COMMUNITIES

- Township of Bingham
- Township of Centerville
- Township of Cleveland
- Township of Elmwood
- Township of Empire
- Village of Empire
- Township of Glen Arbor
- Township of Leelanau
- Township of Leeland
- Village of Northport
- Township of Solon
- Township of Suttons Bay
- Village of Suttons Bay

STARR

FEMA

Attachment F.

Benzie, Grand Traverse, and Leelanau Counties Proposed Transects

MAN15

Manistee County
Arcadia Township

Blaine Township
Benzie County

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 1 of 10

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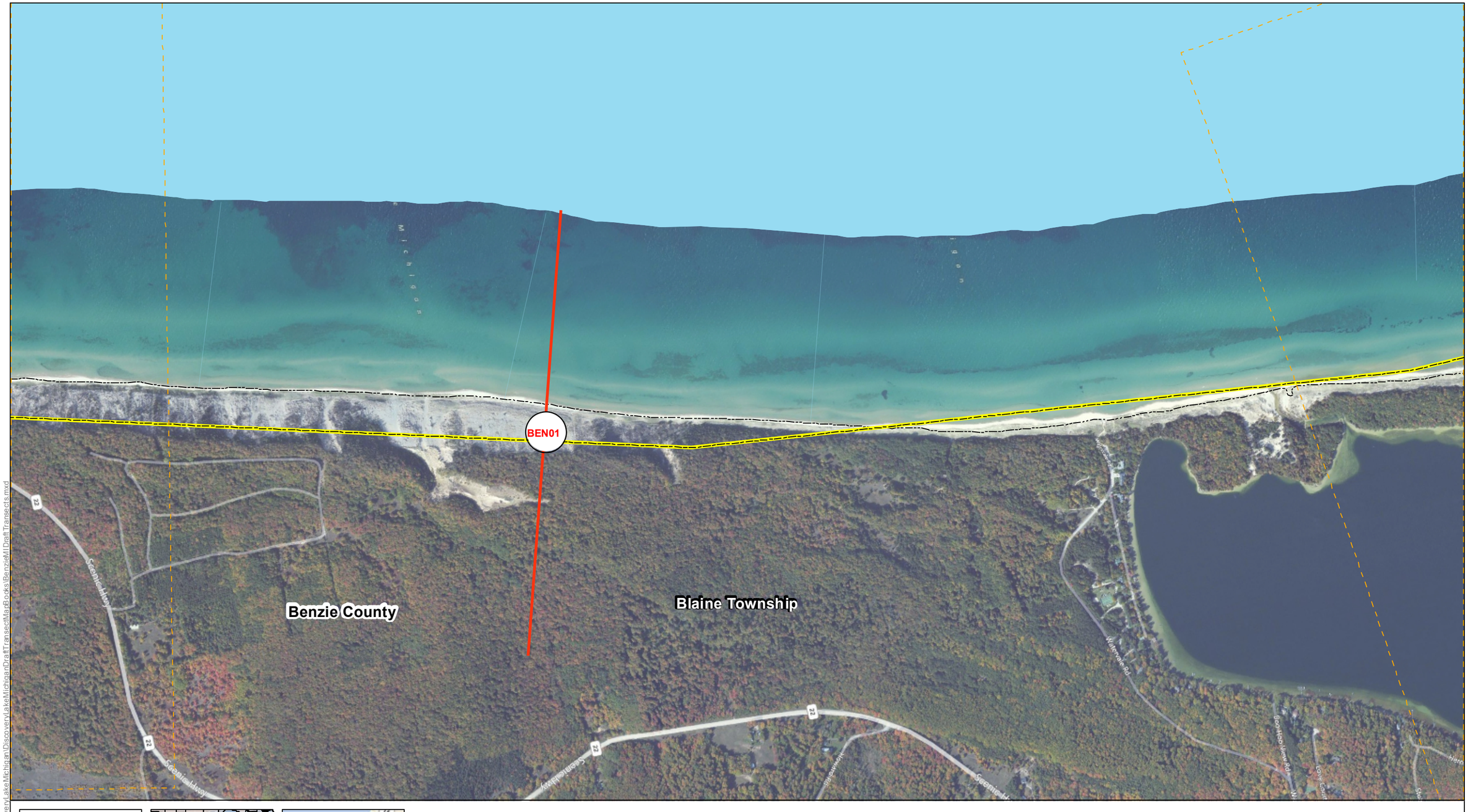

1 inch = 1,001 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 2 of 10

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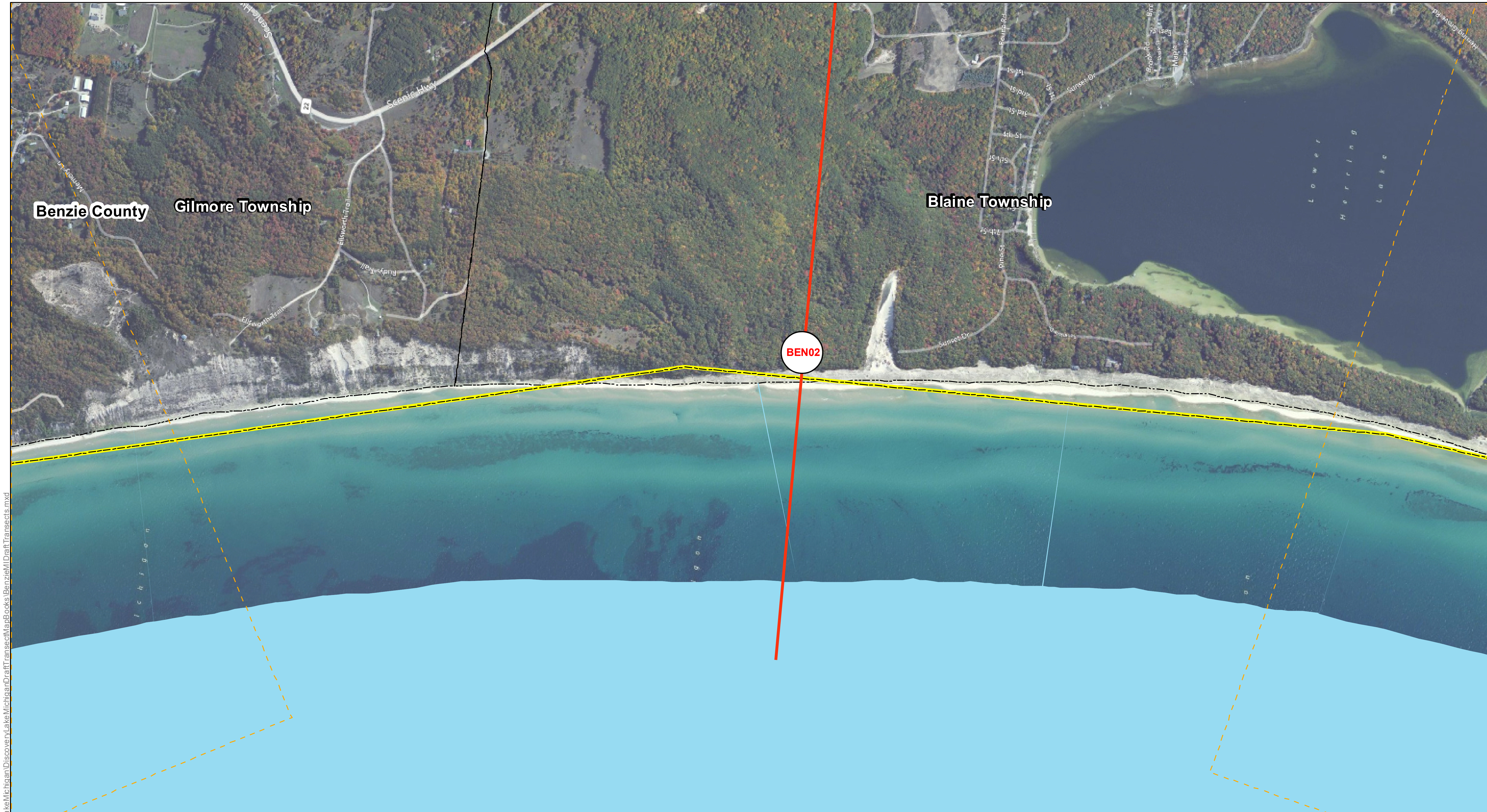

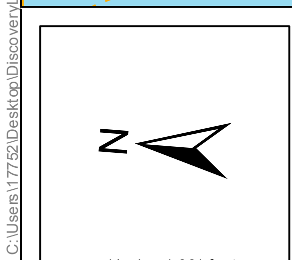

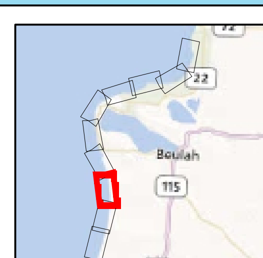

- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia	Village of Elberta
Village of Benzonia	City of Frankfurt
Village of Beulah	Township of Gilmore
Township of Blaine	Township of Lake
Township of Crystal Lake	Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 3 of 10

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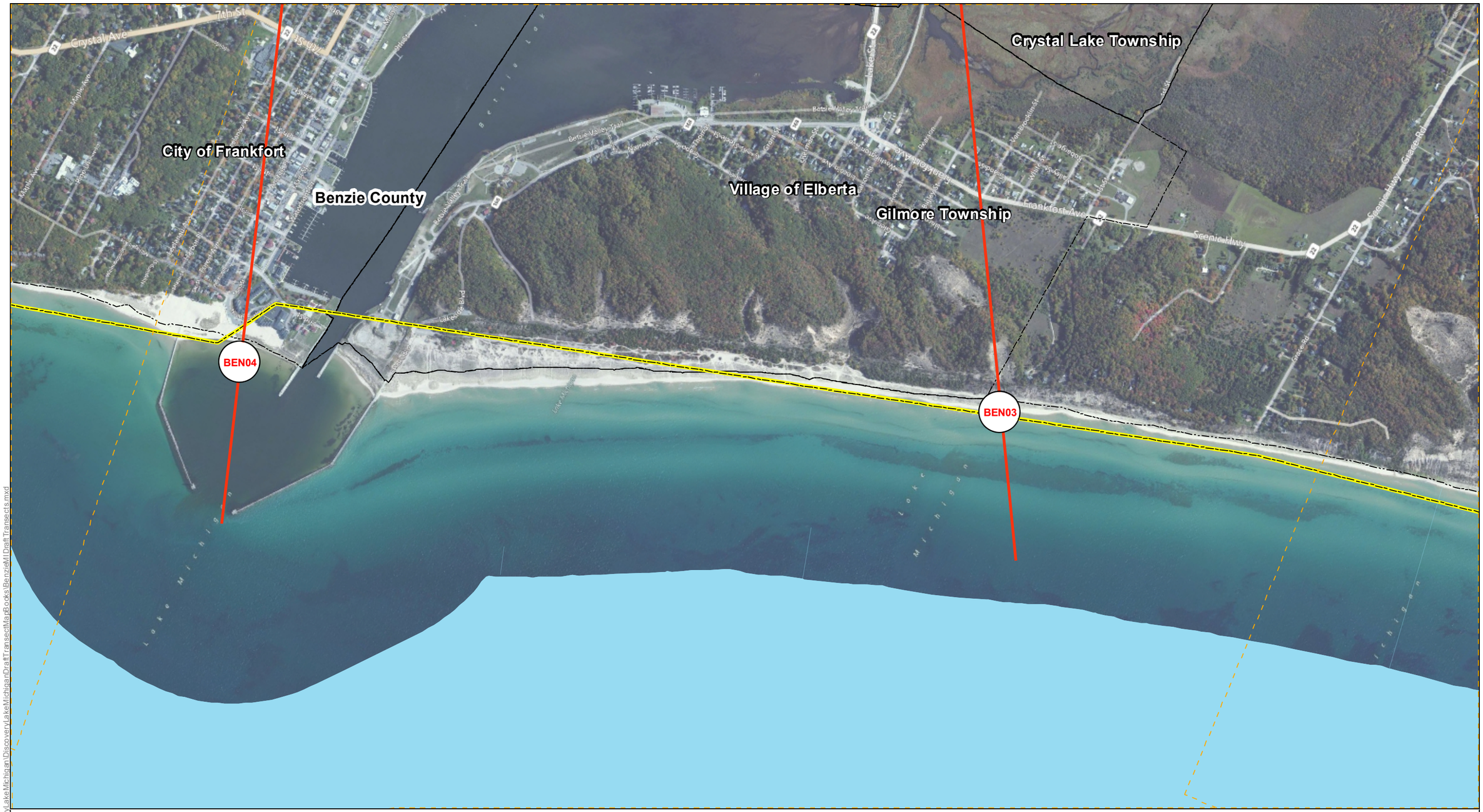

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia	Village of Elberta
Village of Benzonia	City of Frankfurt
Village of Beulah	Township of Gilmore
Township of Blaine	Township of Lake
Township of Crystal Lake	Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 4 of 10

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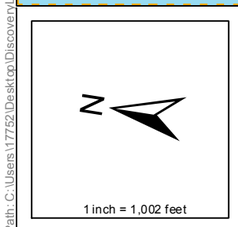

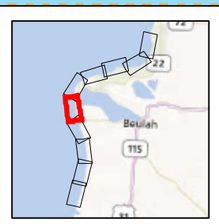

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 5 of 10

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\BenzieMI\Draft Transects.mxd

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1 inch = 1,002 feet

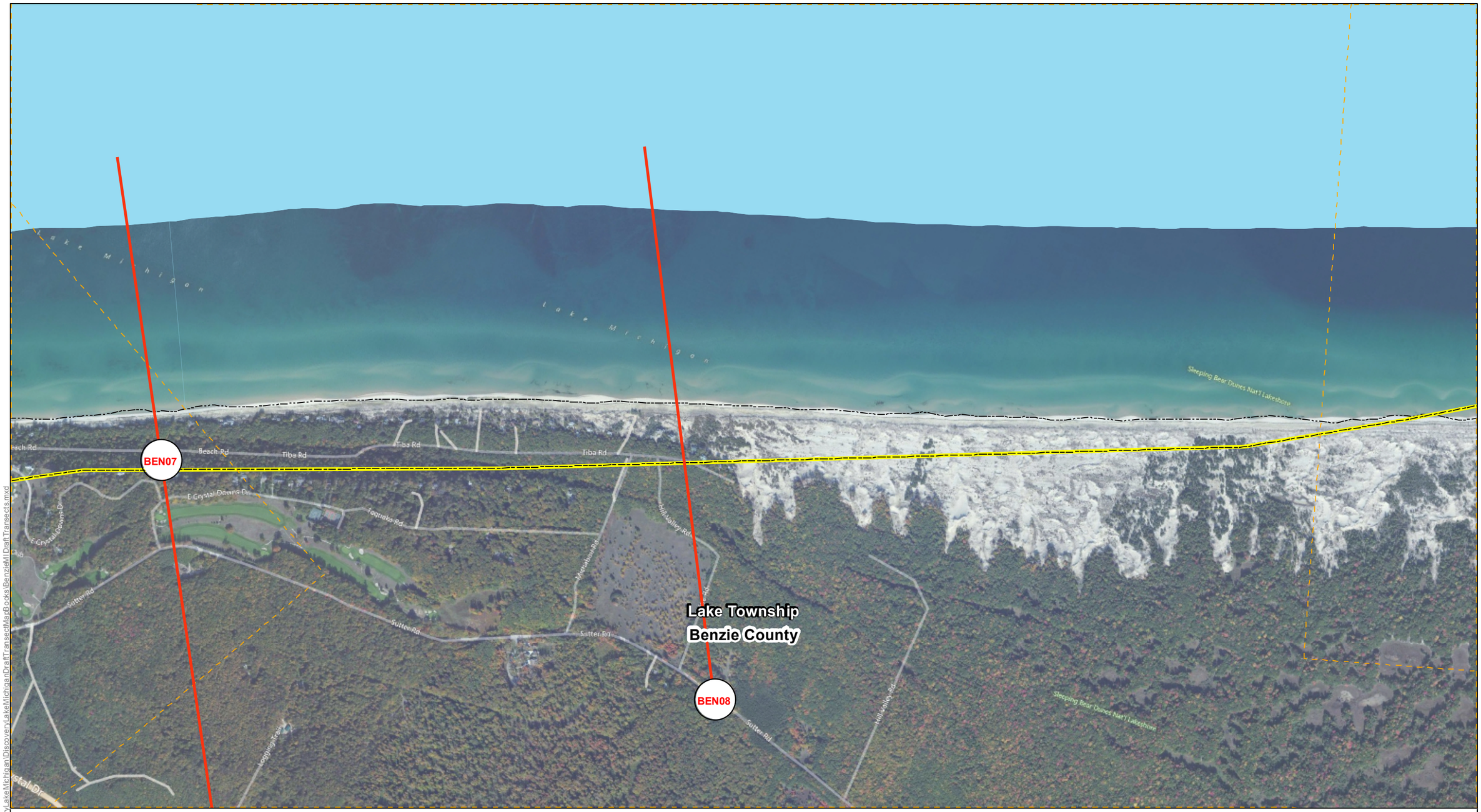
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 6 of 10



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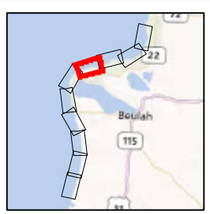

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 7 of 10

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\BenzieMI\DraftTransects.mxd

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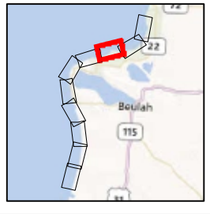
1 inch = 1,003 feet



Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 8 of 10

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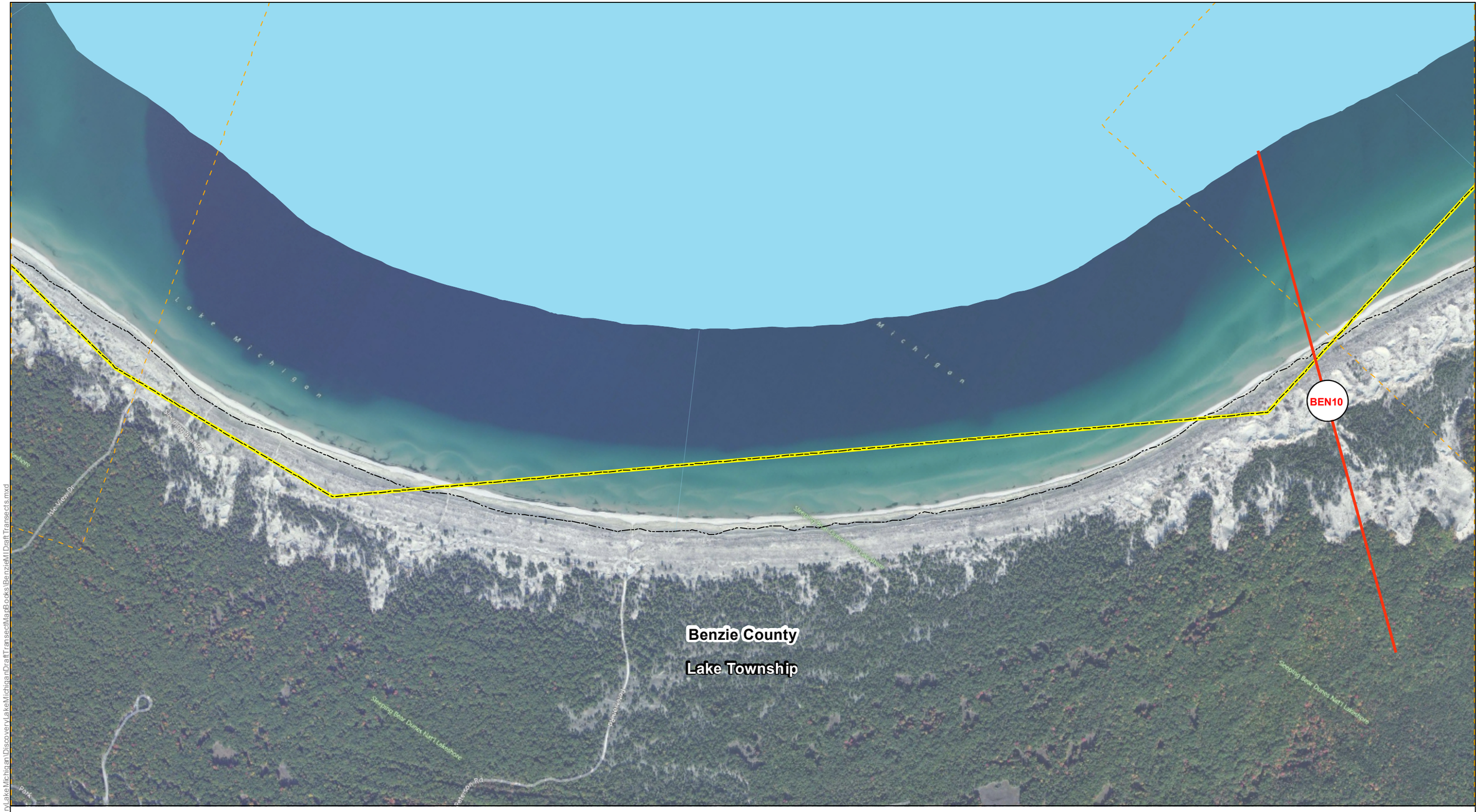

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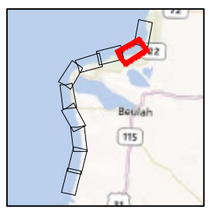
1 inch = 1,001 feet



Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan
DRAFT TRANSECTS
Panel 9 of 10

BEN10

LEE01

Benzie County

Lake Township

Leelanau County

Empire Township

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\BenzieMI\DraftTransects.mxd

1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

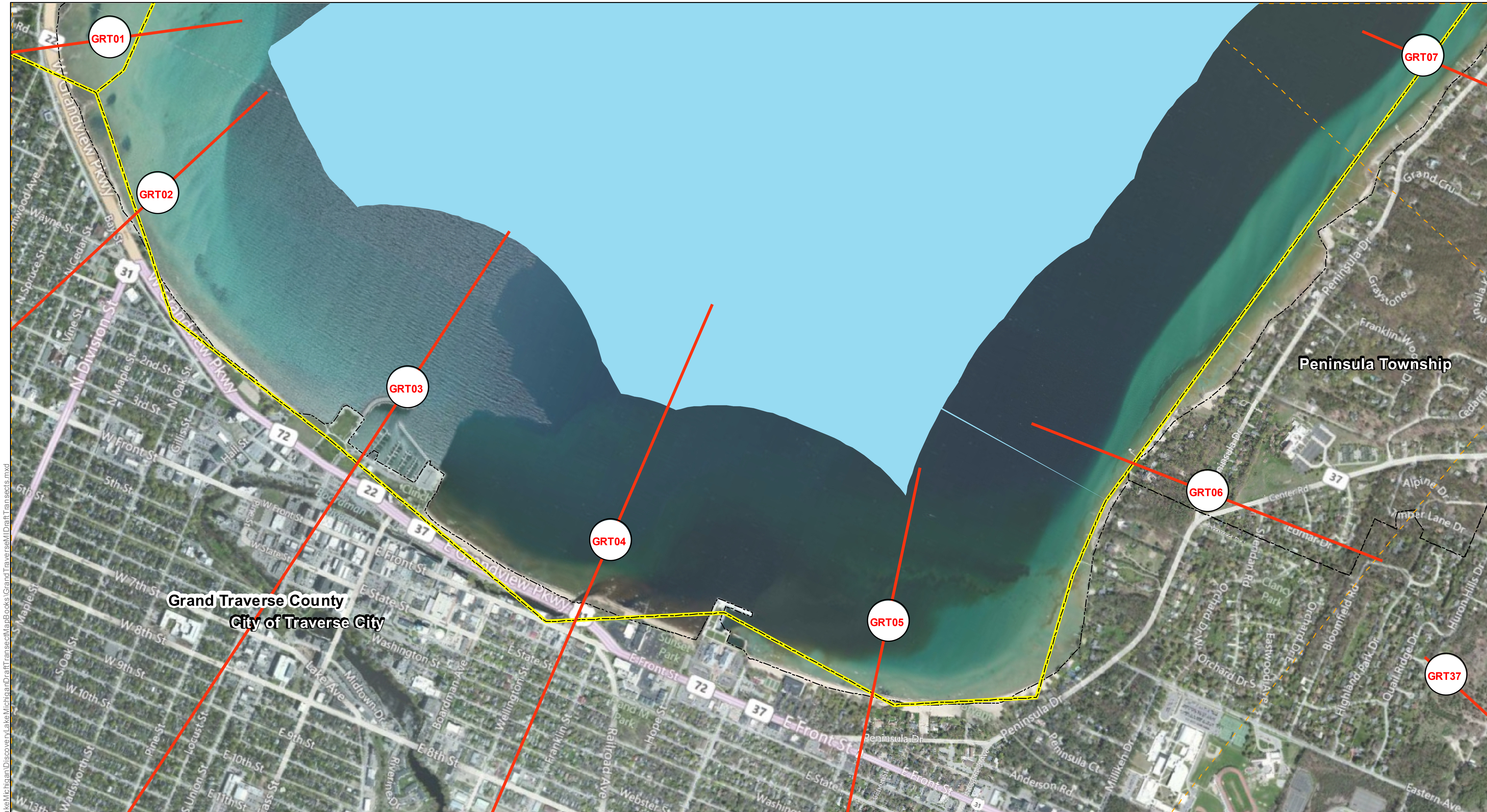
STUDY COMMUNITIES

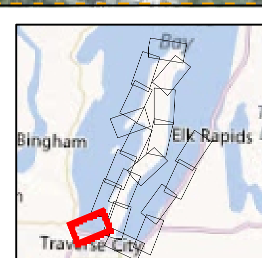
Township of Benzonia
Village of Benzonia
Village of Beulah
Township of Blaine
Township of Crystal Lake
Village of Elberta
City of Frankfurt
Township of Gilmore
Township of Lake
Township of Platte

Benzie County, Michigan

DRAFT TRANSECTS

Panel 10 of 10





- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 1 of 19

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 2 of 19

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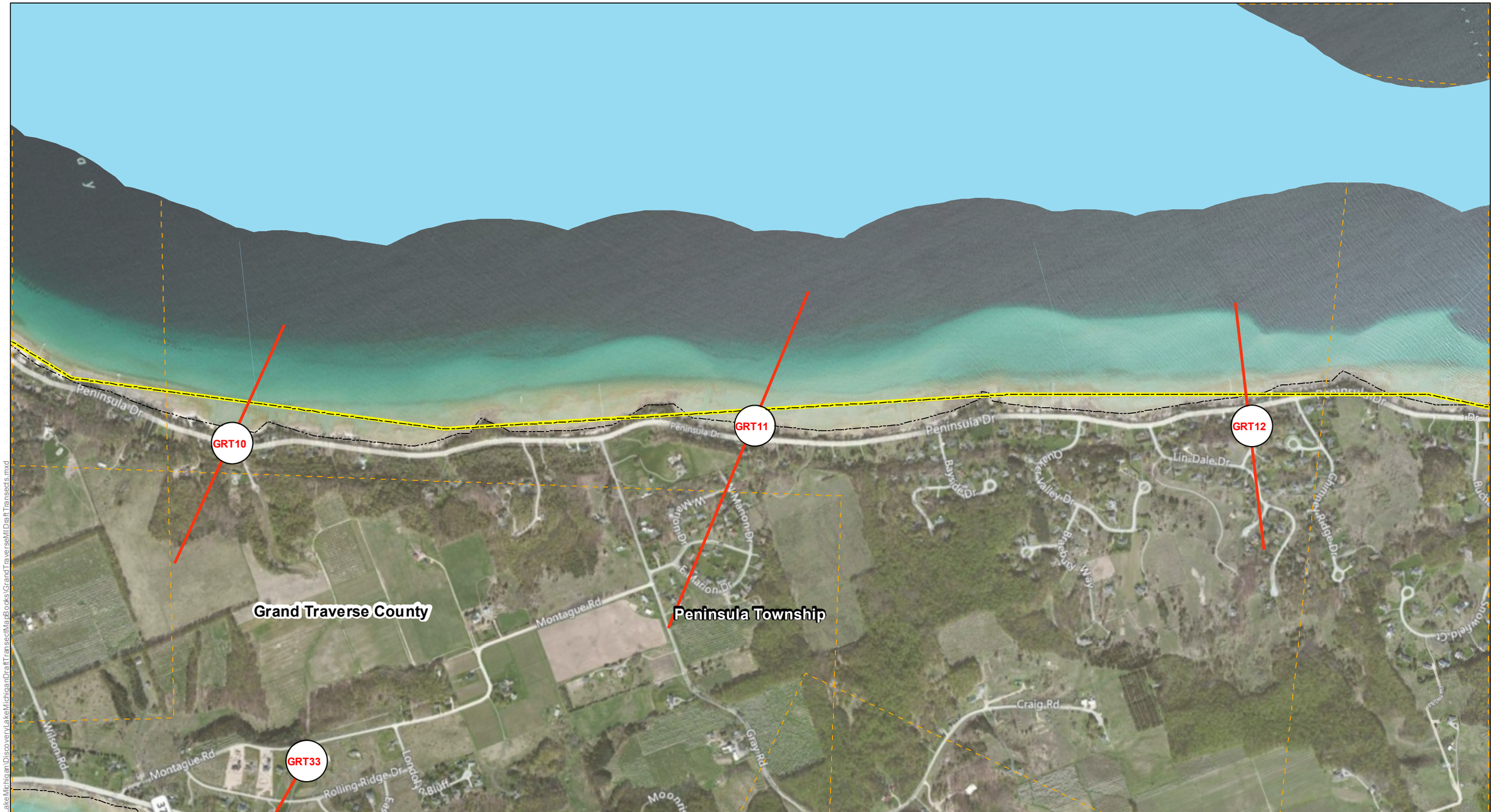
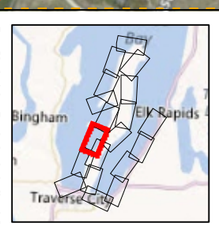


1 inch = 1,003 feet



Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 3 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

GRT13

GRT14

GRT15

Grand Traverse County

Peninsula Township

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

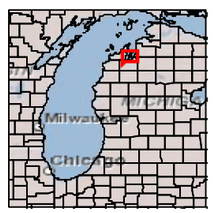
Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

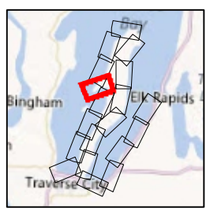
Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 4 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

N

1 inch = 1,001 feet





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

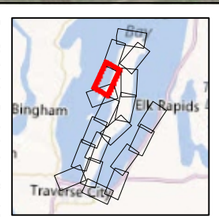
STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 5 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

1 inch = 1,001 feet



Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

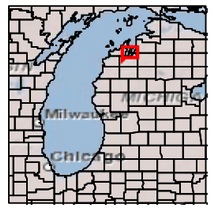
STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 6 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

1 inch = 1,001 feet



Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 7 of 19

Path: C:\Users\17752\Desktop\Discovery Lake Michigan\Discovery Lake Michigan Draft Transect Map Books\Grand Traverse MI Draft Transects.mxd

GRT23

GRT24

Lighthouse Park

Center Rd

Grand Traverse County

Peninsula Township

Shorewood

Gelert Rd

Eagle Point Rd

Brinkman Rd

N

1 inch = 1,002 feet

Milwaukee

Chicago

Bingham

Elk Rapids

Traverse City

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 8 of 19

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransect\MapBooks\GrandTraverseMI\DraftTransects.mxd

Grand Traverse County

Peninsula Township

GRT26

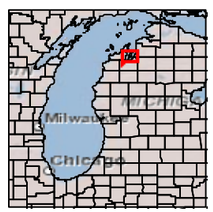
GRT27

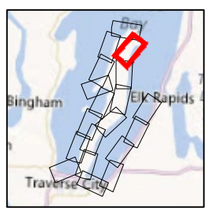
GRT25

Center Rd
Smokey Hollow Rd
Mission Rd
Kitty Ln
Brinkman Rd
Woodland Rd
Traverse St
Bay St
Old Mission
Eastern Rd
Ridgewood Rd
Bagley Lake
Forest Ave

Grand Traverse Bay

1 inch = 1,002 feet





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 9 of 19

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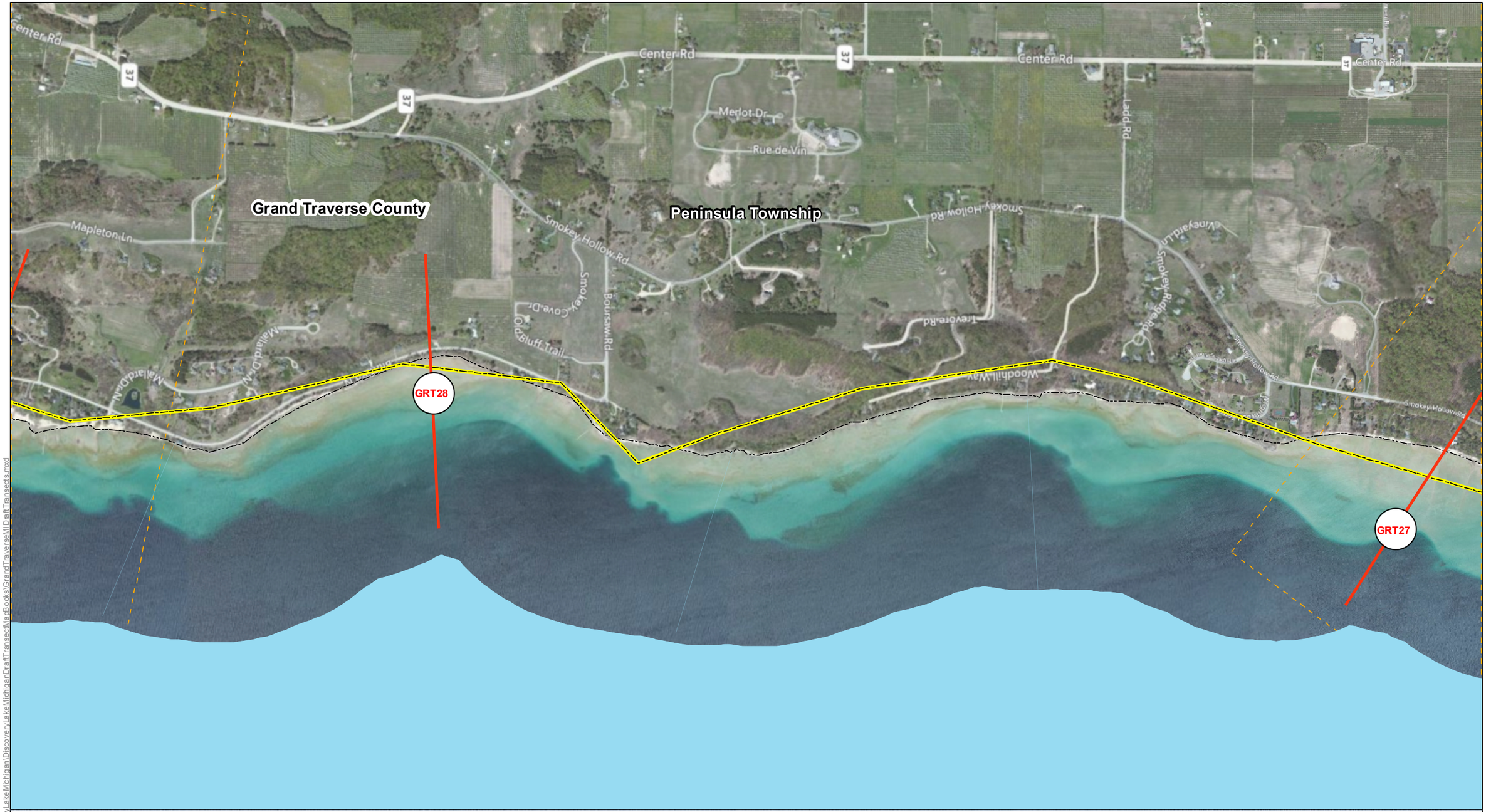


STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 10 of 19

Grand Traverse County

Peninsula Township

Nelson Rd

Center Rd

37

Cherry Hill Rd

Blue Water Rd

Mapleton

Mapleton Ln

Blue Ridge Dr

Bluff Rd N

Blue Shore Dr

GRT30

GRT29

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan

DRAFT TRANSECTS

Panel 11 of 19

Path: C:\Users\17752\Desktop\Discovery Lake Michigan\Discovery Lake Michigan Draft Transect Map Books\Grand Traverse MI Draft Transects.mxd

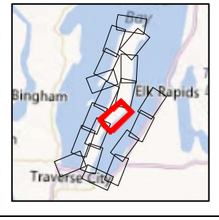
Peninsula Township

Grand Traverse County

GRT32

GRT31

1 inch = 1,001 feet



Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan

DRAFT TRANSECTS

Panel 12 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

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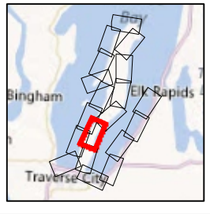
1 inch = 1,002 feet



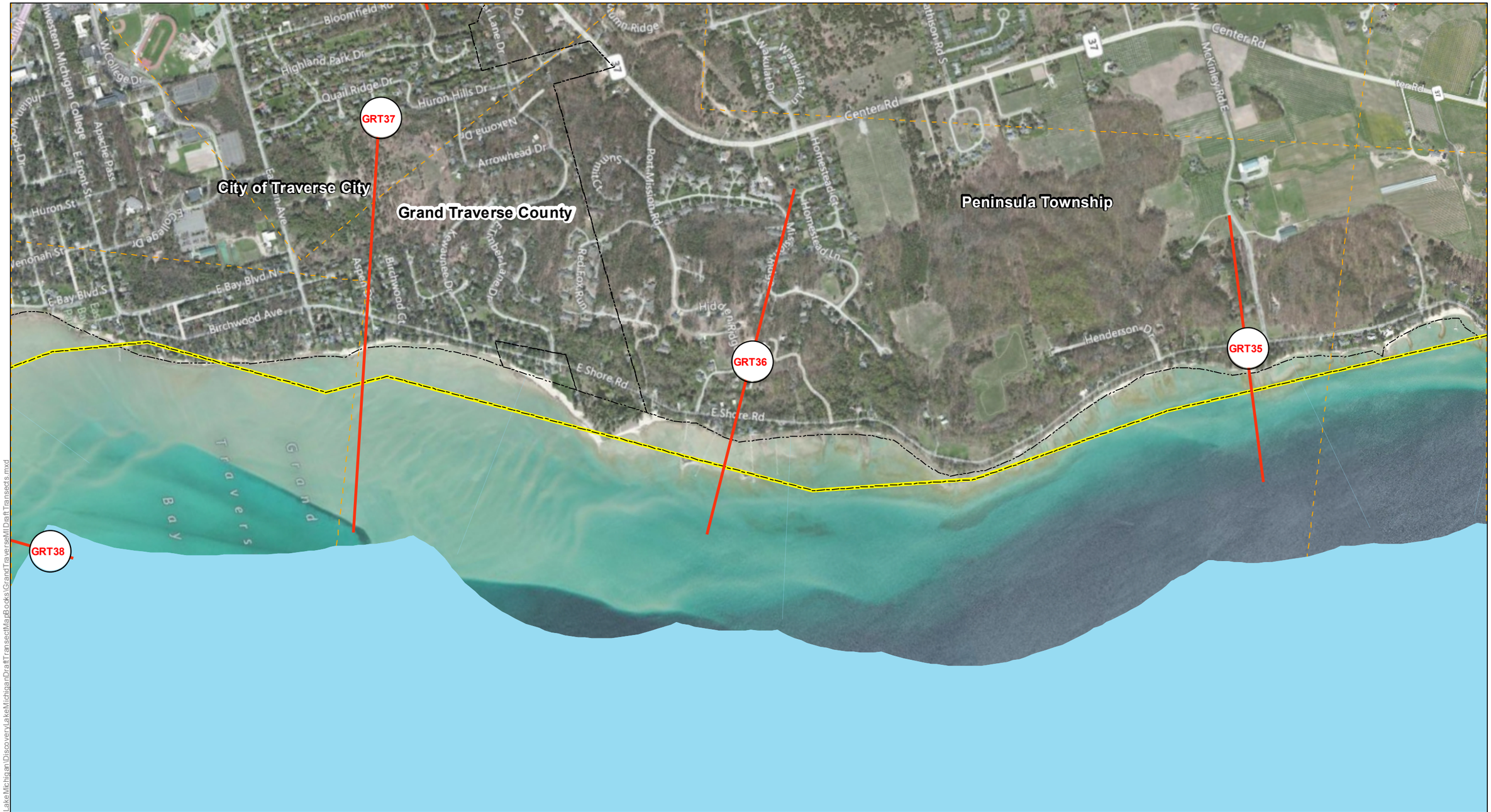
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 13 of 19



1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 14 of 19

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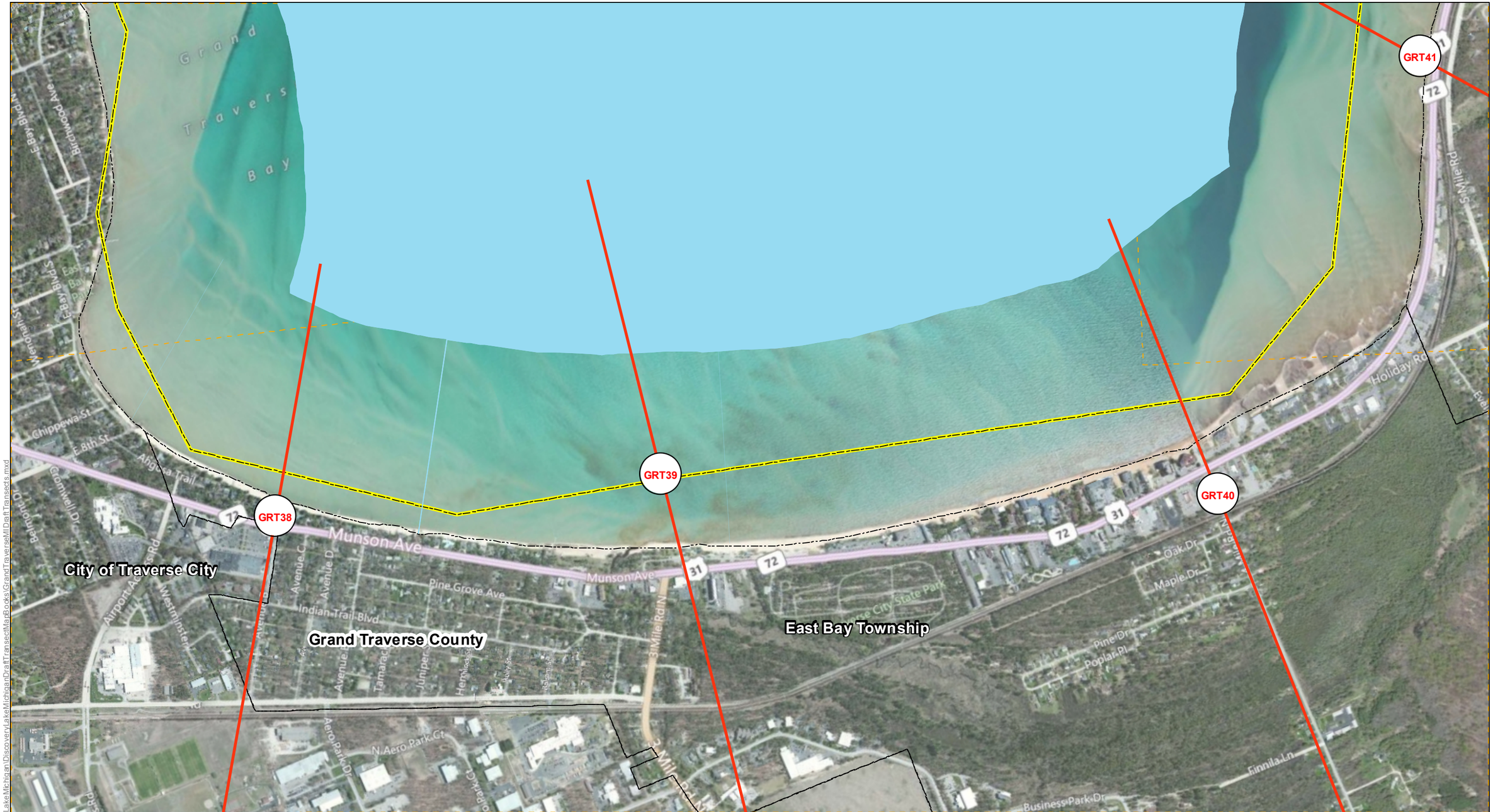

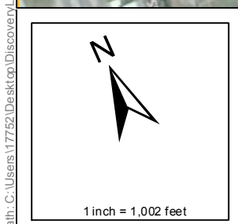

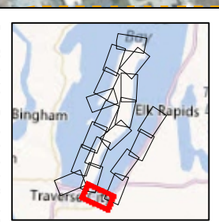

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 15 of 19

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

GRT41

GRT42

GRT43

Grand Traverse County

Acme Township

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 16 of 19

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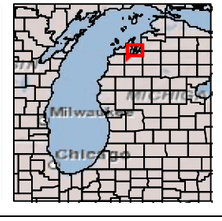
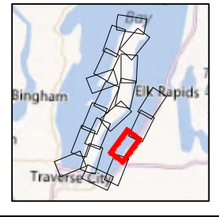
1 inch = 1,002 feet





- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 17 of 19

Path: C:\Users\17752\Desktop\DiscoveryLake\Michigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

GRT46

GRT47

GRT48

Grand Traverse County

Acme Township

Grand Traverse Bay

Bayridge Dr

Shaw Rd

Winter Rd

Yuba Park Rd

Yuba

Yuba Creek

Yuba Rd

Kay Ray Rd

Plum Dr

Bates Rd

31

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan
DRAFT TRANSECTS
Panel 18 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd

Grand Traverse County

Acme Township

Antrim County

Elk Rapids Township

ANN01

Lake

Sunset Shore Dr

Cabana Shores Rd

Petobego Pond

Grand Traverse Bay

31

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

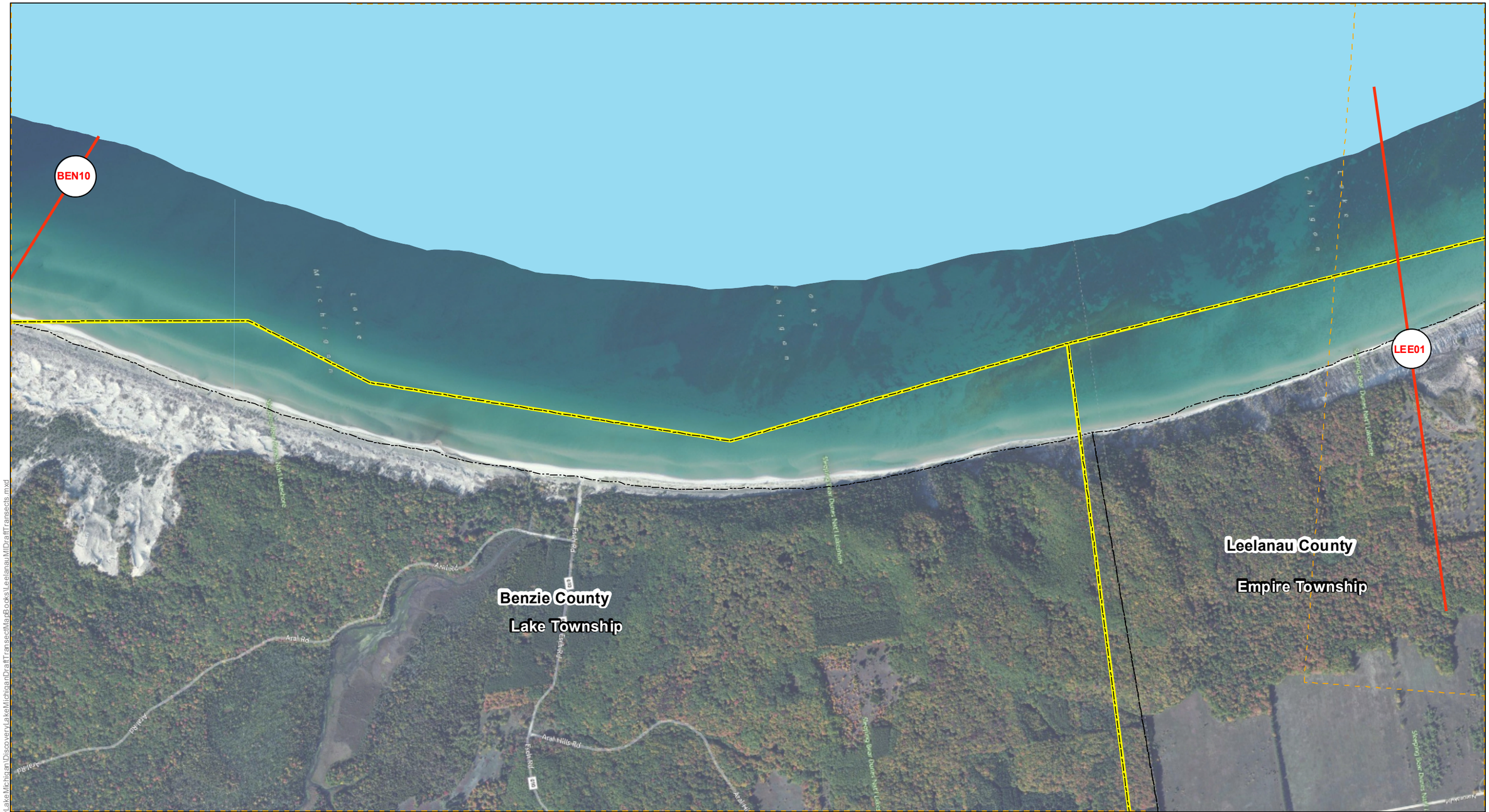
Township of Acme
Township of Blair
Township of East Bay
Township of Garfield
Township of Peninsula
City of Traverse City
Township of White Water

Grand Traverse County, Michigan

DRAFT TRANSECTS

Panel 19 of 19

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\GrandTraverseMIDraftTransects.mxd



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1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 1 of 52

LEE01

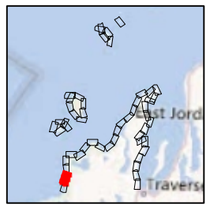
LEE02

Empire Township

Leelanau County

Village of Empire

1 inch = 1,001 feet



Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 2 of 52

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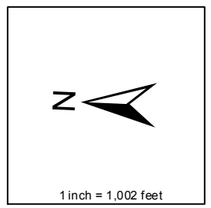
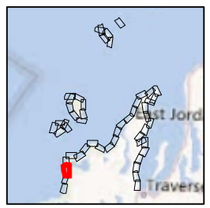




Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 3 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBook\LeelanauMIDraftTransects.mxd

Leelanau County

Glen Arbor Township

LEE04

Path: C:\Users\17752\Desktop\Discovery Lake Michigan\Discovery Lake Michigan Draft Transect Map Books\Leelanau MI\Draft Transects.mxd

1 inch = 1,002 feet

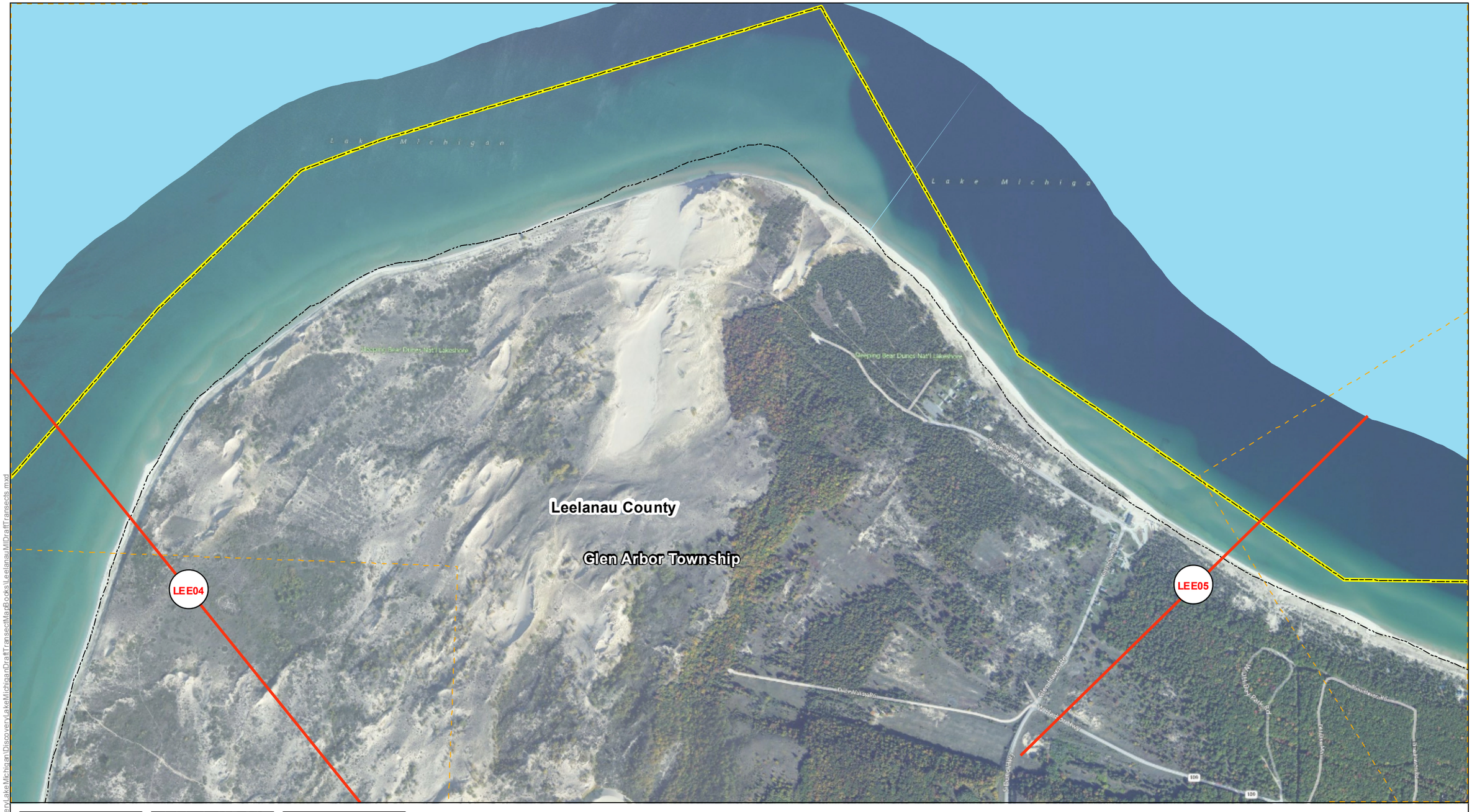
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

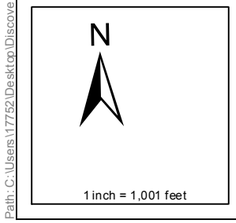
Basemap Source: Microsoft BING map service

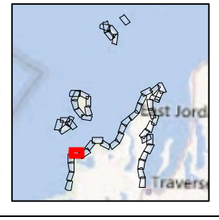
STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 4 of 52







Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

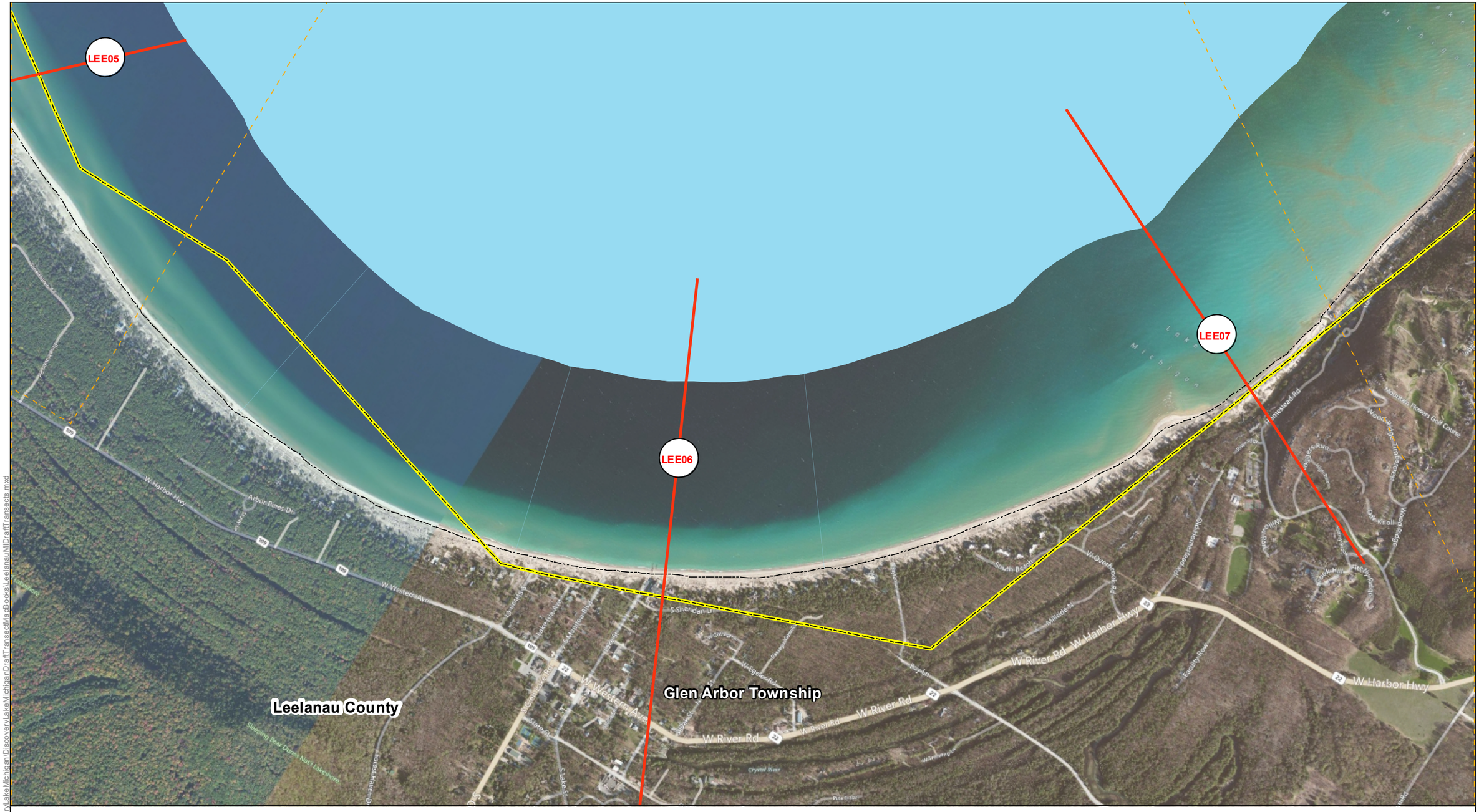
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 5 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



1 inch = 1,001 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 6 of 52

LEE08

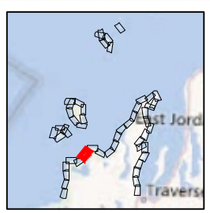
LEE09

Leelanau County

Glen Arbor Township

Cleveland Township

1 inch = 1,001 feet



Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 7 of 52

Path: C:\Users\17752\Desktop\DiscoveryLake\Michigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

N

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

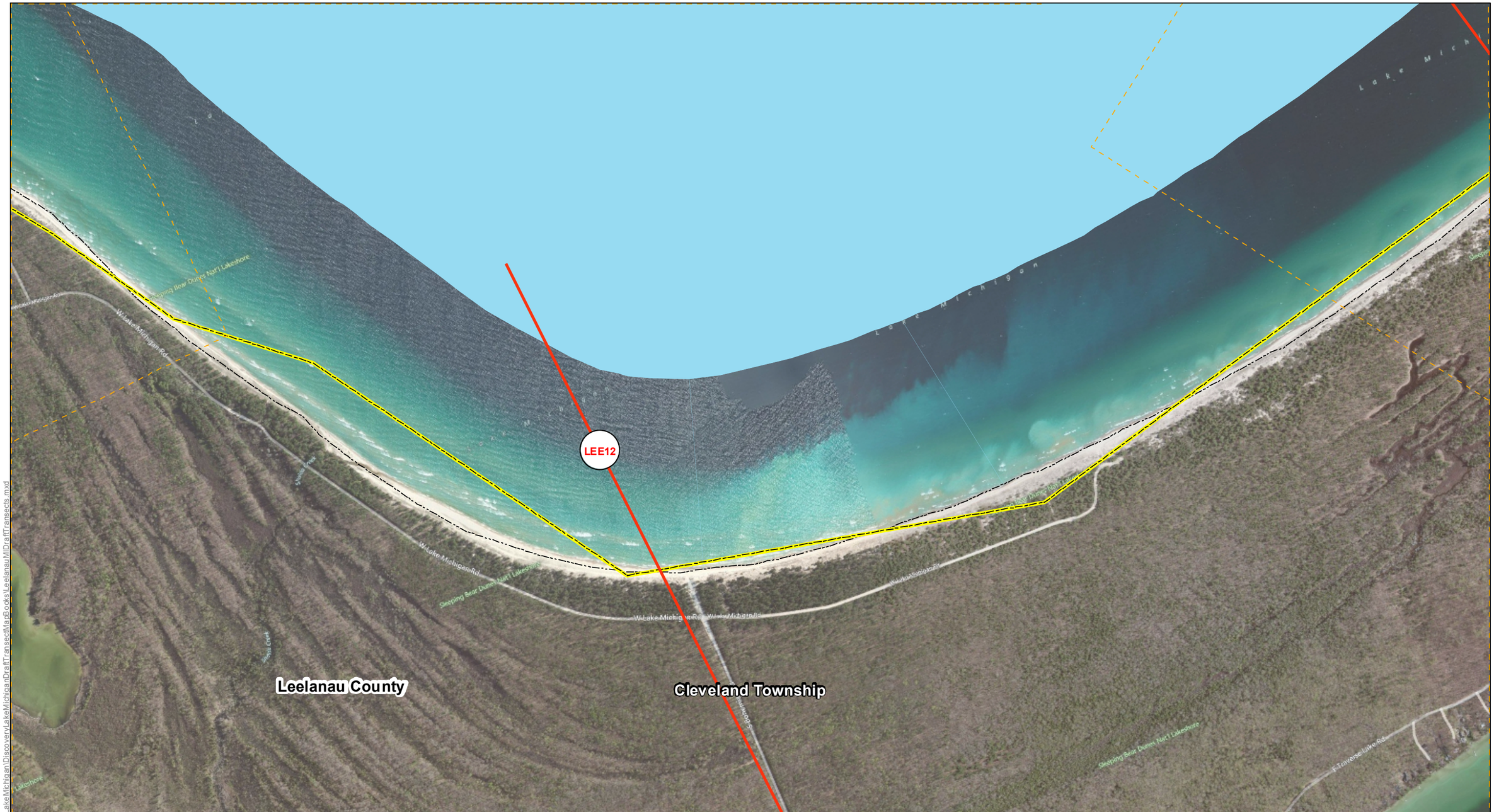
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 8 of 52

Path: C:\Users\177752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

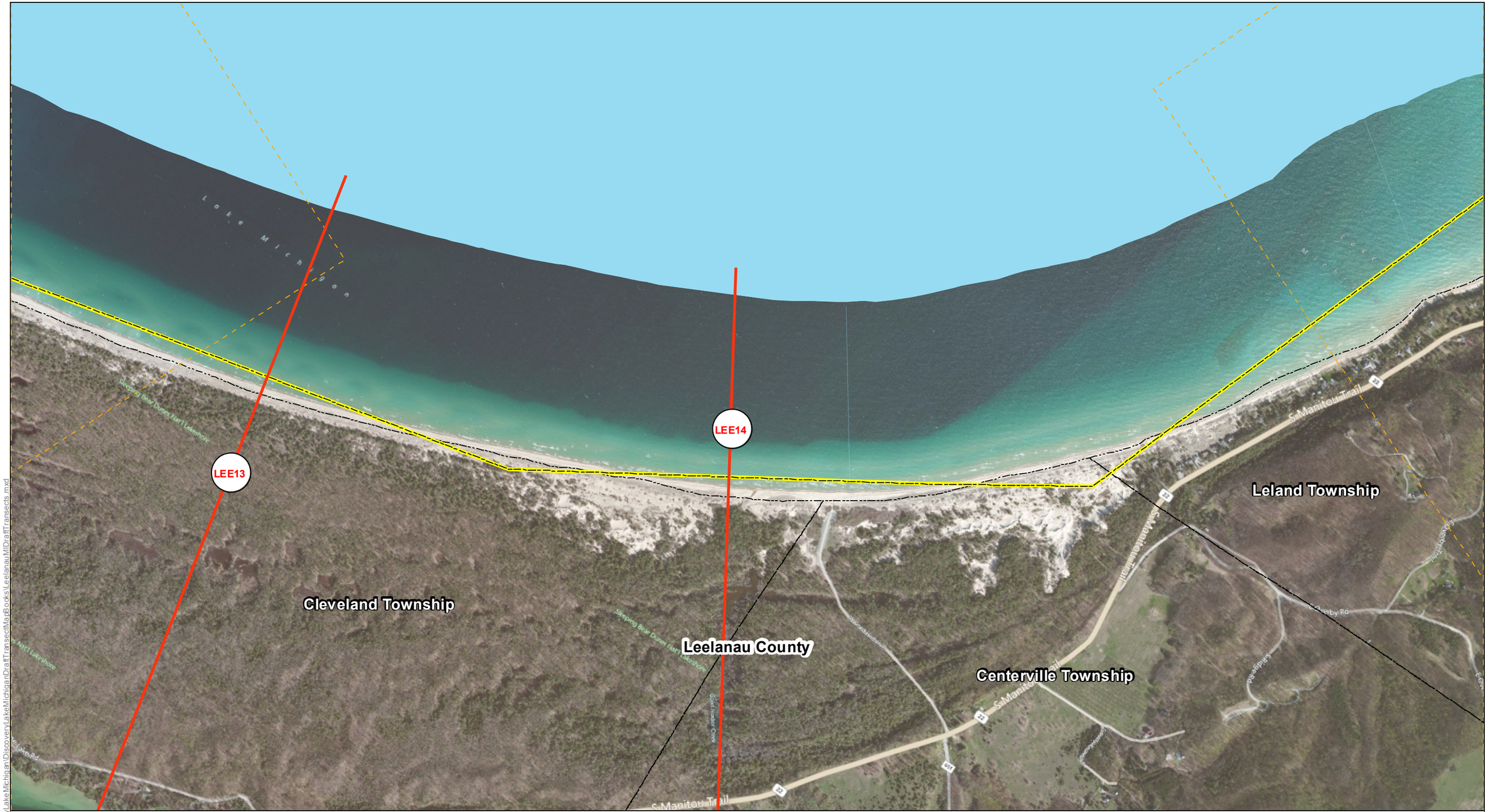
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

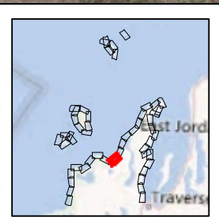
Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 9 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMI\DraftTransects.mxd



1 inch = 1,001 feet



- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

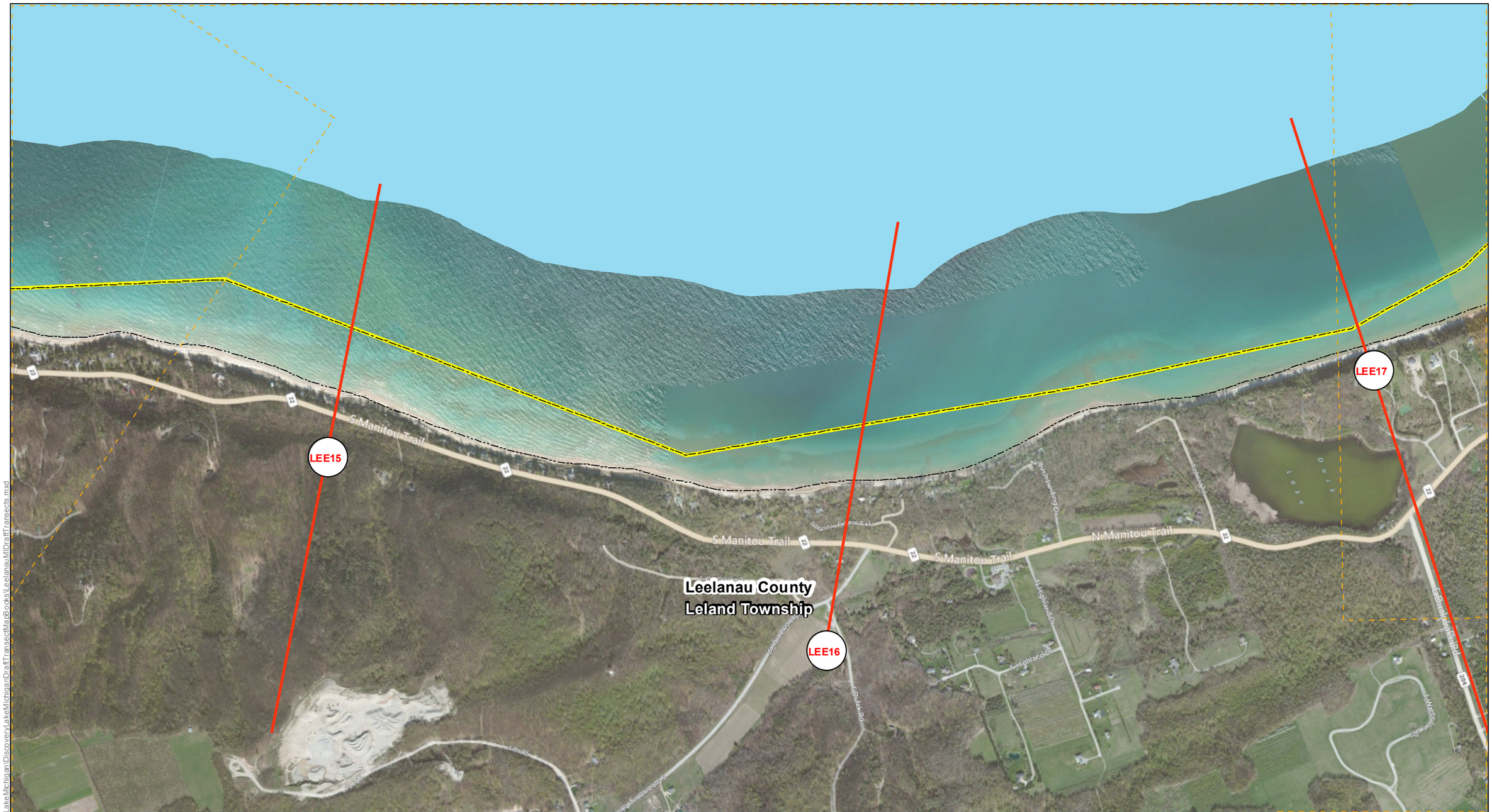
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

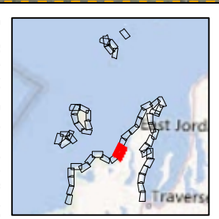
Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 10 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



1 inch = 1,003 feet



- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 11 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

LEE17

LEE18

Leelanau County

Leland Township

1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

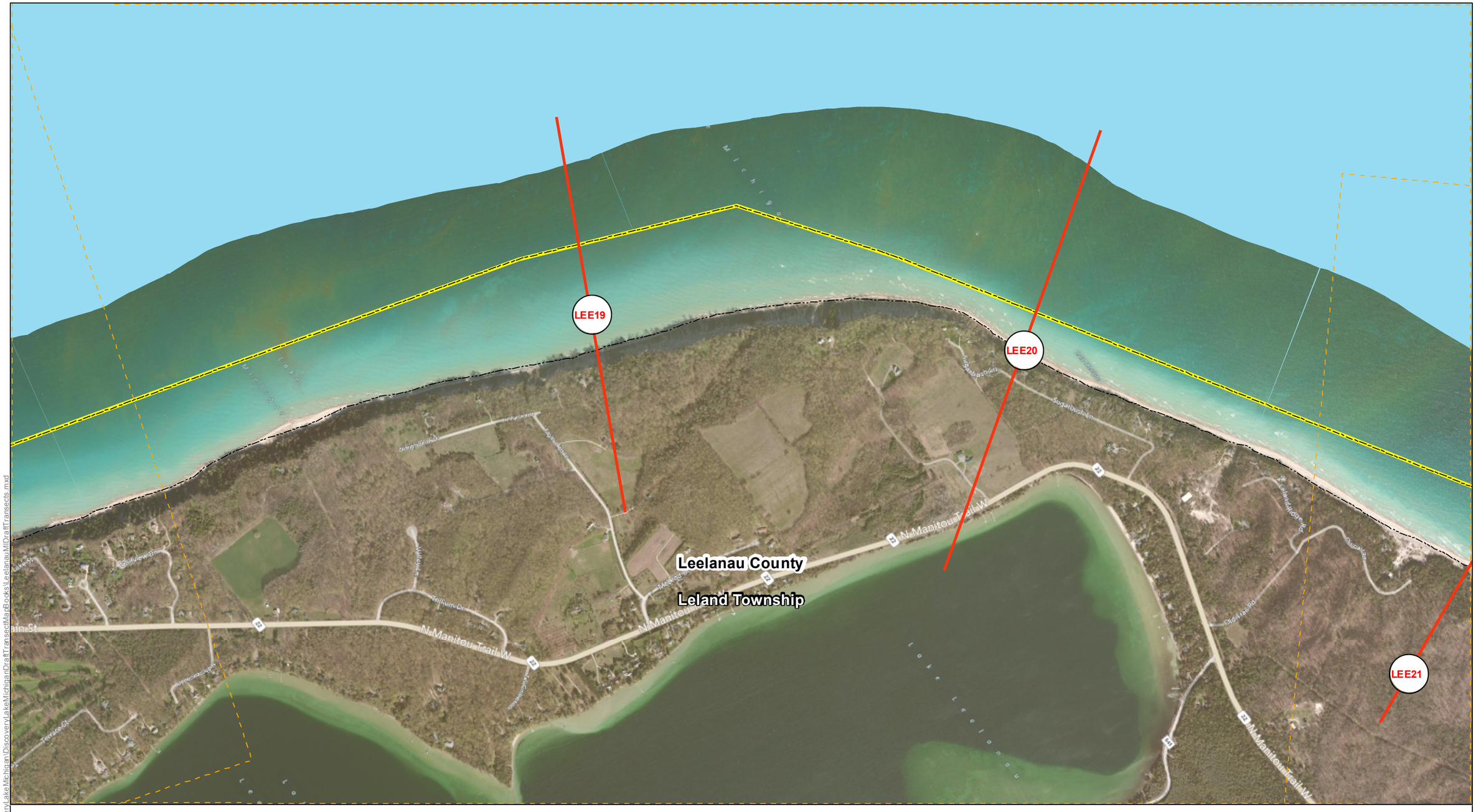
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 12 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



1 inch = 1,003 feet

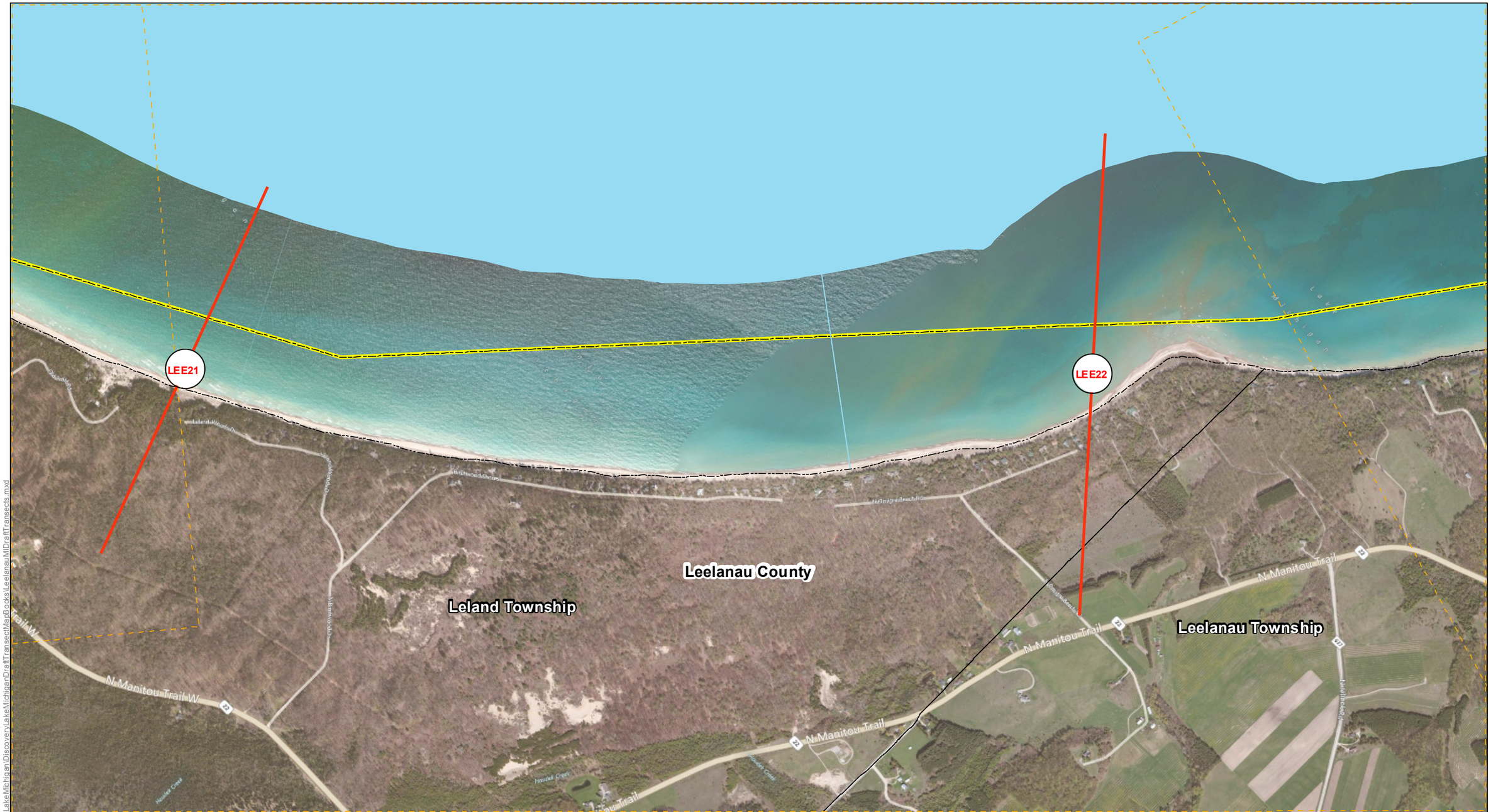
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 13 of 52



1 inch = 1,003 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 14 of 52

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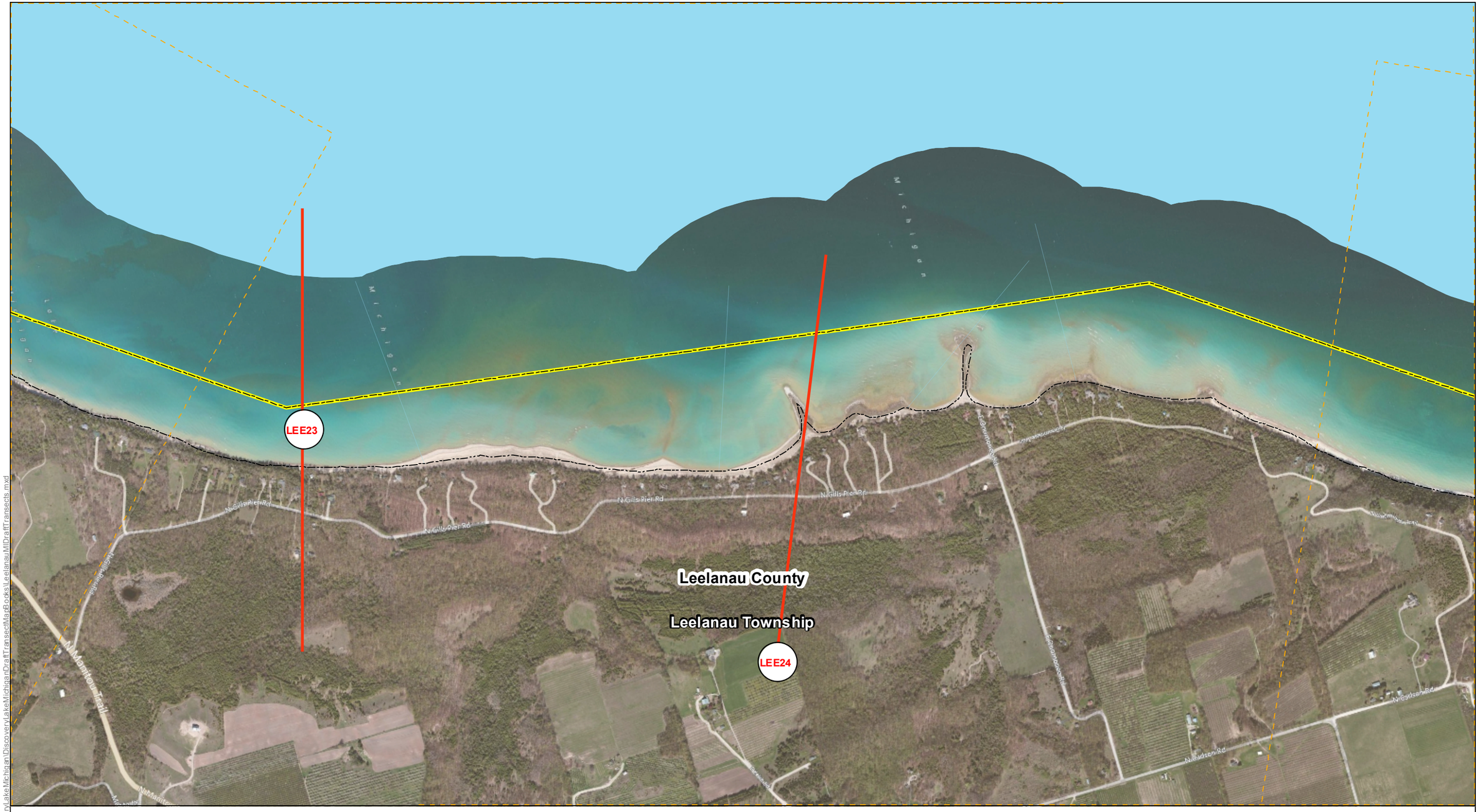
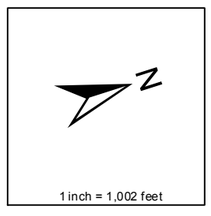
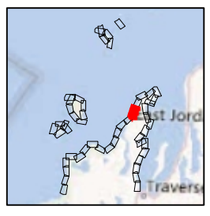






Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

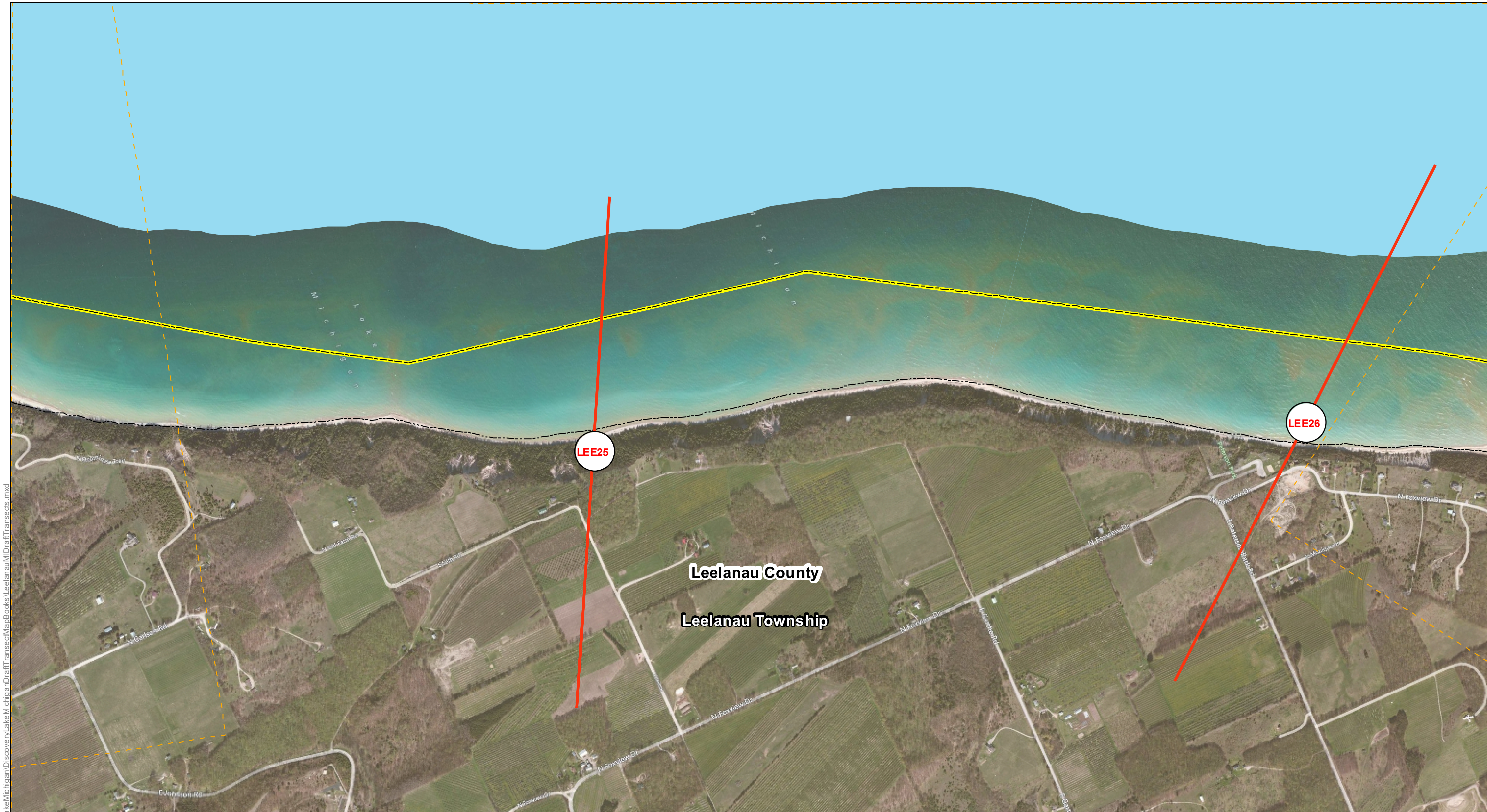
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

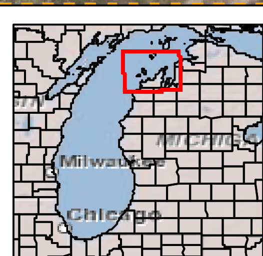
Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

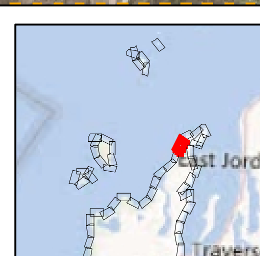
Leelanau County, Michigan
DRAFT TRANSECTS
Panel 15 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



1 inch = 1,002 feet





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 16 of 52

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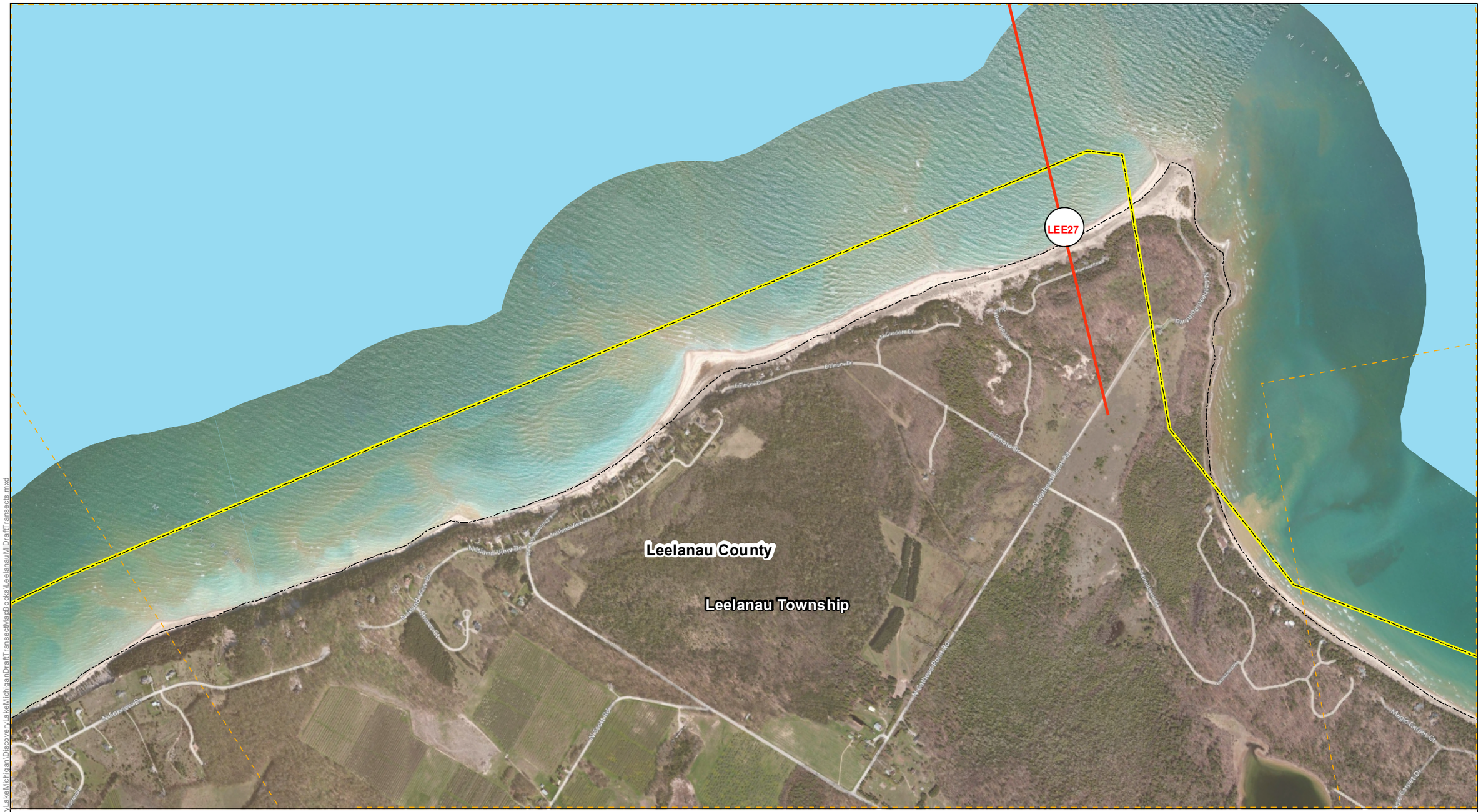

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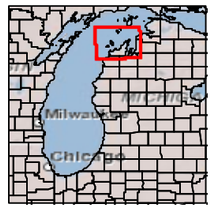
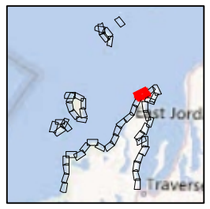
1 inch = 1,002 feet





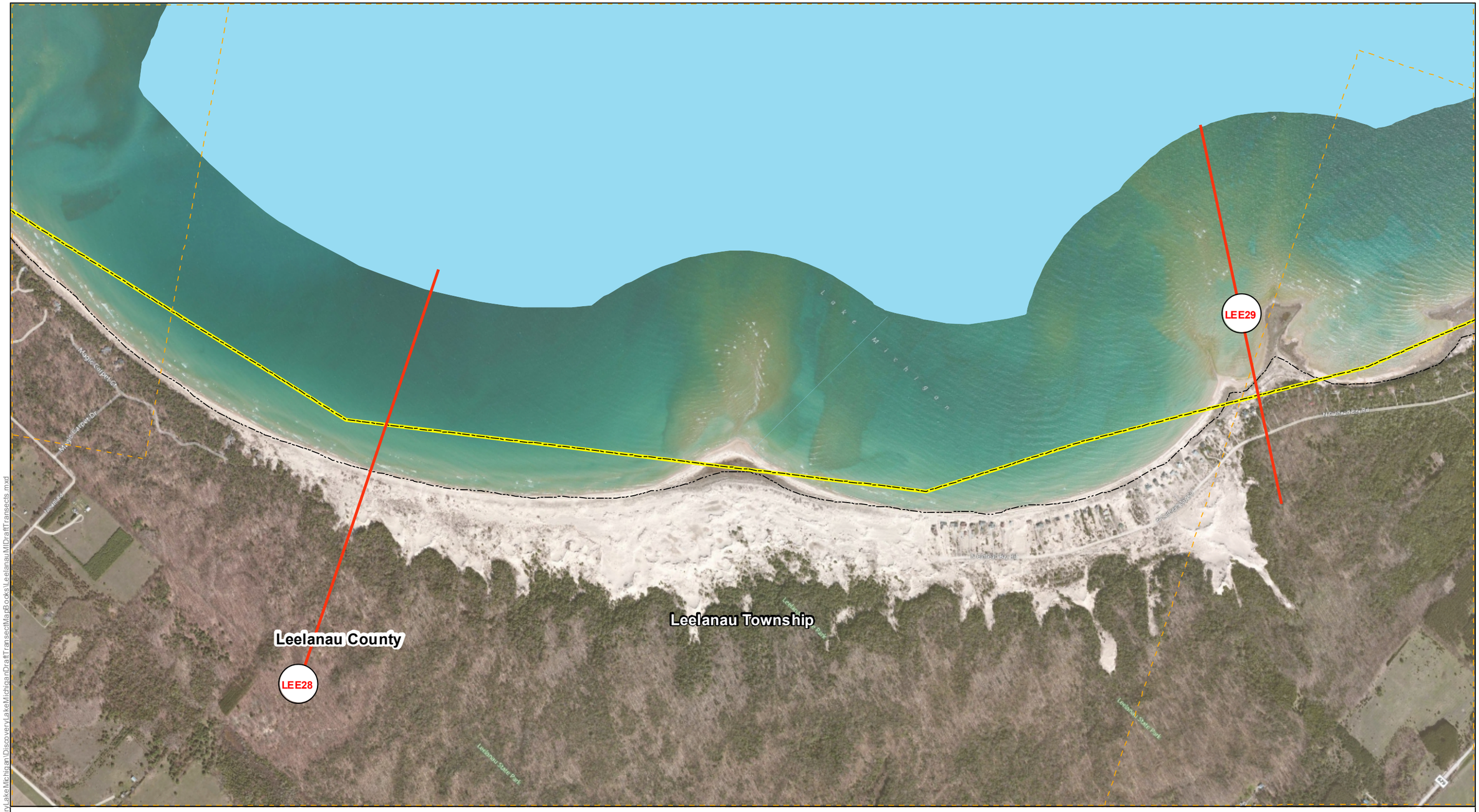
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 17 of 52



Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,003 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 18 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,001 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

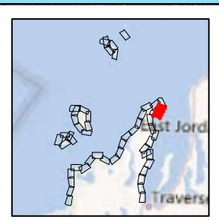
STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 19 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMI\DraftTransects.mxd

1 inch = 1,002 feet



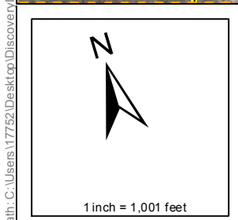
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

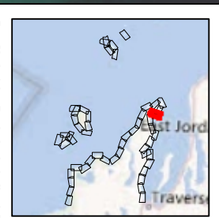
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 20 of 52





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

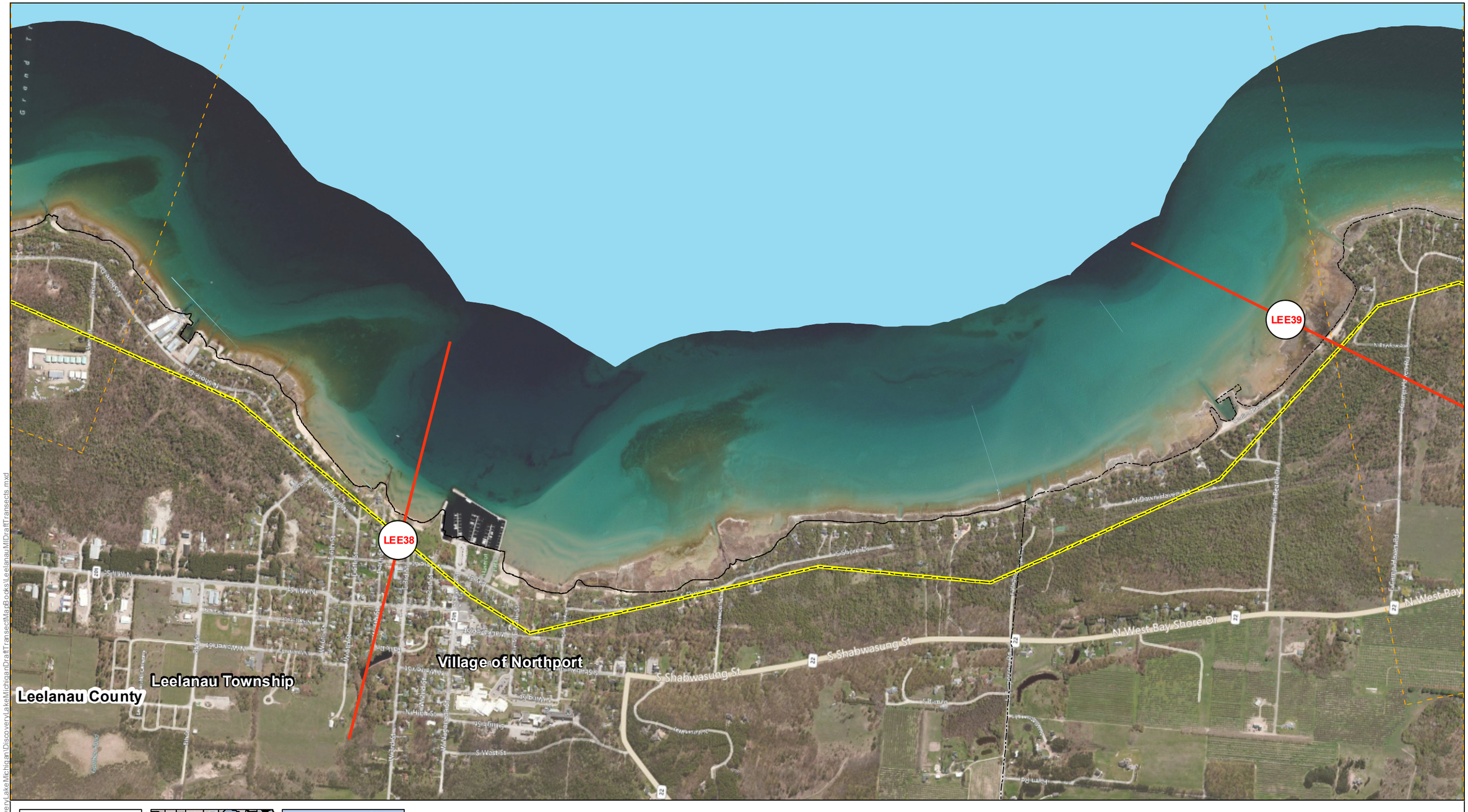
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 21 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



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N

1 inch = 1,001 feet

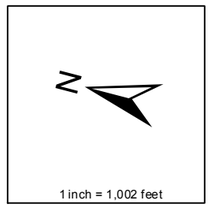
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

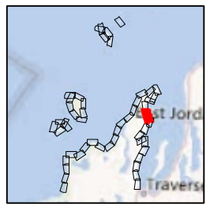
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 22 of 52





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 23 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\Leelanau\MIDraftTransects.mxd

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 24 of 52

Path: C:\Users\17752\Desktop\DiscoveryLake\Michigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

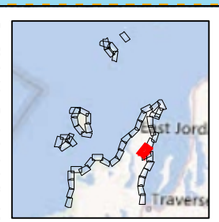
STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 25 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMI\DraftTransects.mxd

1 inch = 1,002 feet



- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 26 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Village of Suttons Bay

Suttons Bay Township

Leelanau County

LEE49

LEE50

LEE51

LEE52

LEE53

LEE54

1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 27 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Leelanau County
Suttons Bay Township

LEE52
LEE53
LEE54
LEE55

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

N

1 inch = 1,001 feet

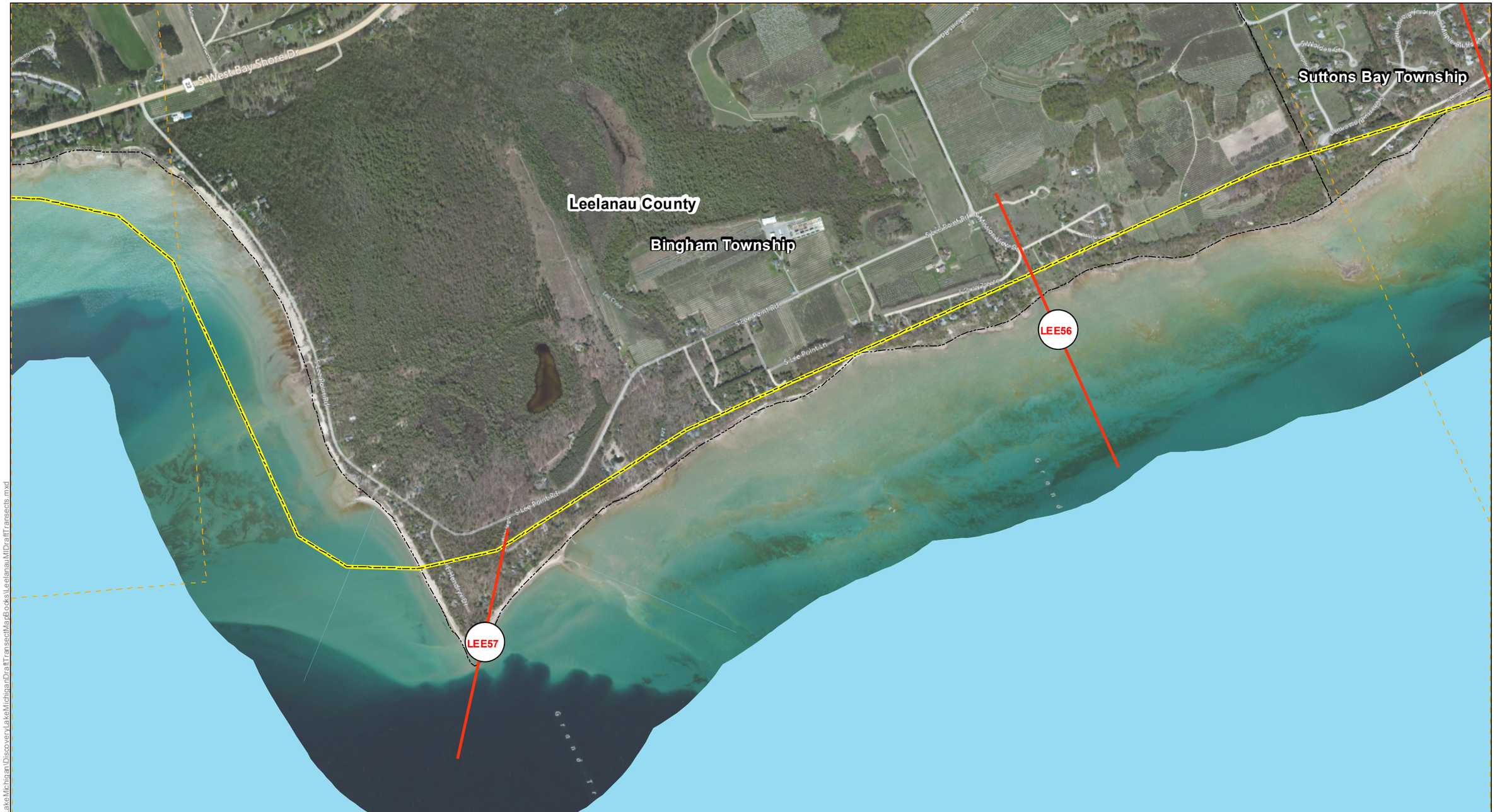
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 28 of 52



1 inch = 1,002 feet

- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

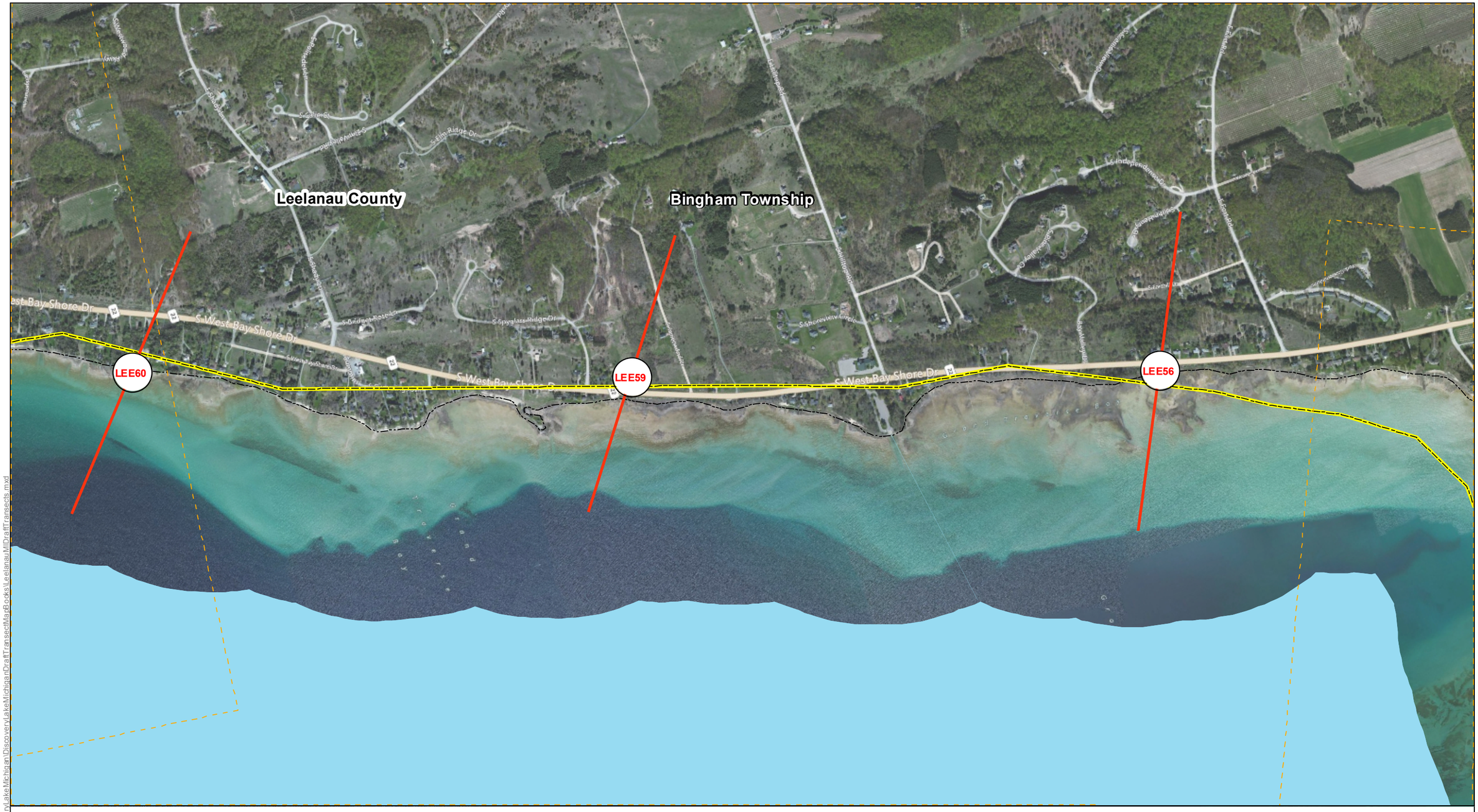
Basemap Source: Microsoft BING map service

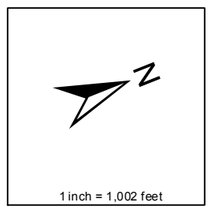
STUDY COMMUNITIES

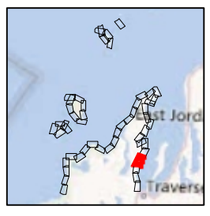
Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 29 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd







Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

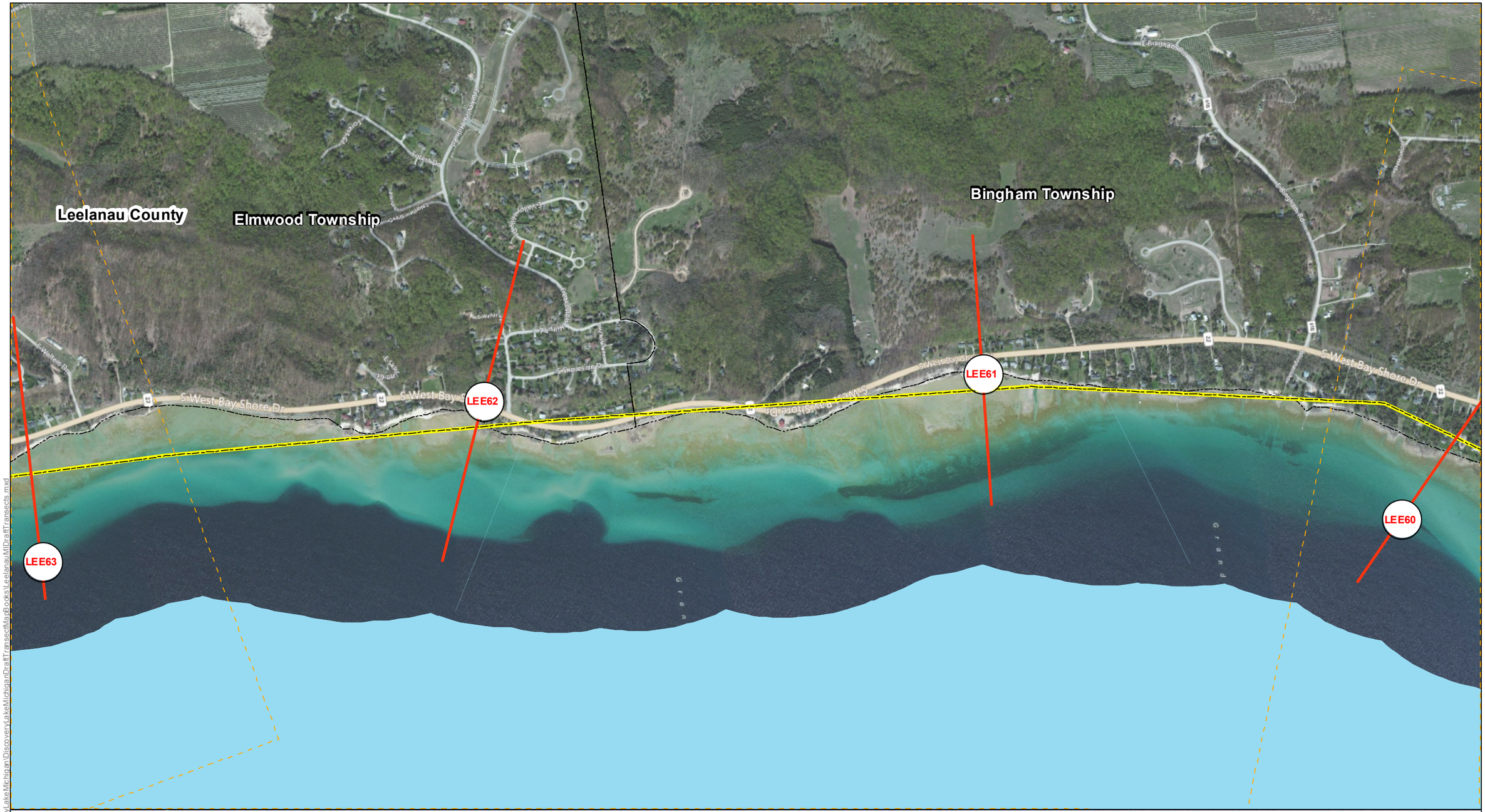
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 30 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\Leelanau\MIDraftTransects.mxd



1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

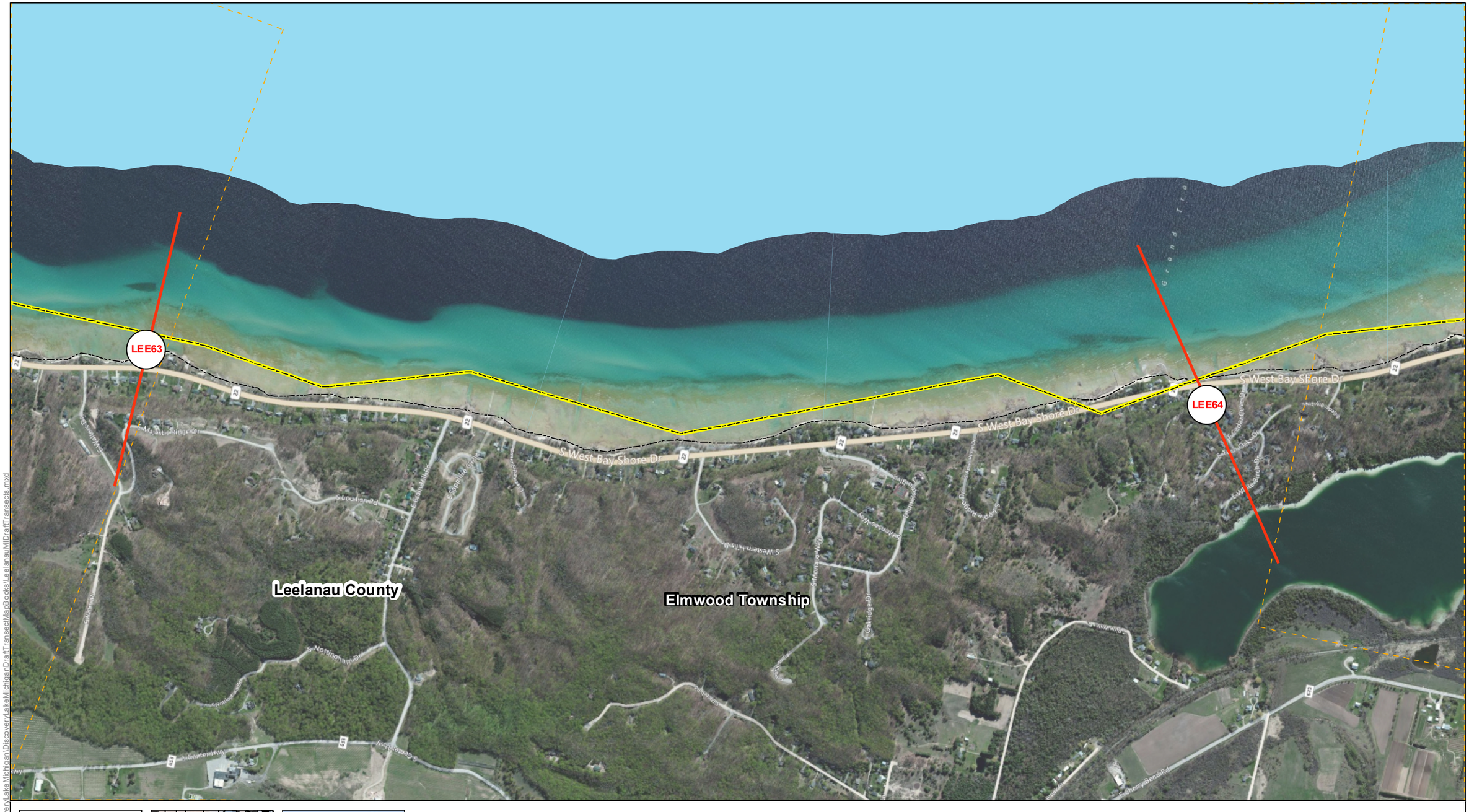
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 31 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd



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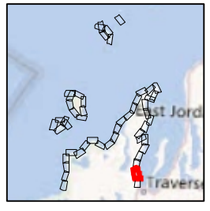
N

1 inch = 1,001 feet



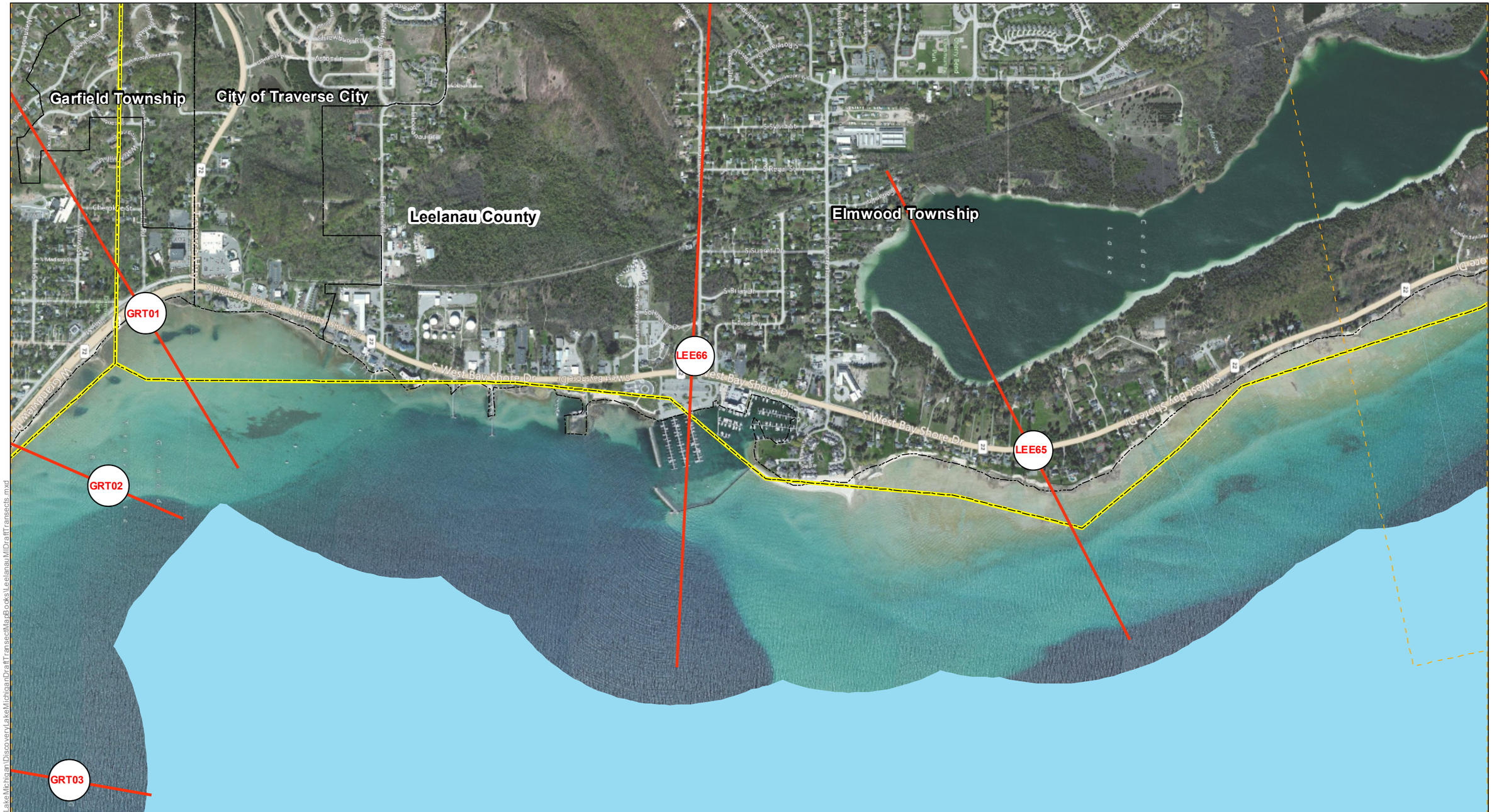
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 32 of 52



Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,001 feet

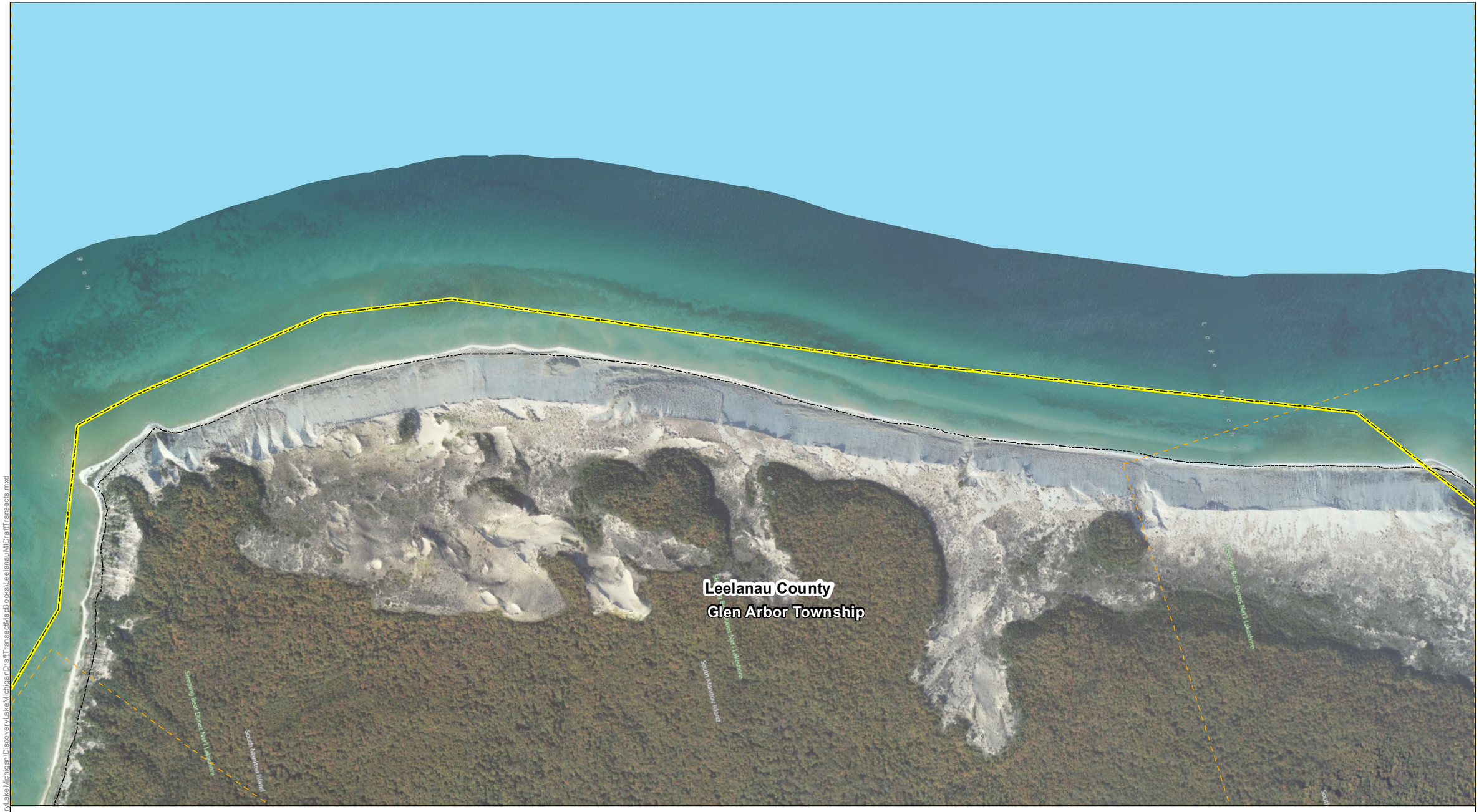
Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

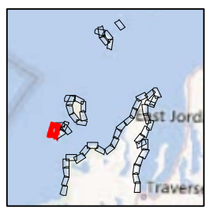
STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 33 of 52



1 inch = 1,001 feet



- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 34 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichigan\DraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Lake Michigan

Leelanau County

Glen Arbor Township

Lake Michigan

South Manitou Island

Sleeping Bear Dunes Nat'l Lakeshore

Sleeping Bear Dunes Nat'l Lakeshore

Sleeping Bear Dunes Nat'l Lakeshore

South Manitou Island

N

1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 35 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Leelanau County

Glen Arbor Township

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 36 of 52

Glen Arbor Township
Leelanau County

Lake Michigan

Sleeping Bear Dunes Nat'l Lakeshore

South Manitou Island

1 inch = 1,001 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 37 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 38 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Leelanau County

Leland Township

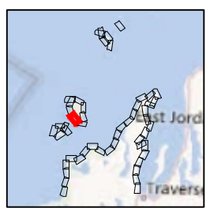
Manitou Island Rd

North Manitou Island

Stepping Bear Dunes Nat'l Lakeshore

Lake Michigan

1 inch = 1,002 feet



Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 39 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

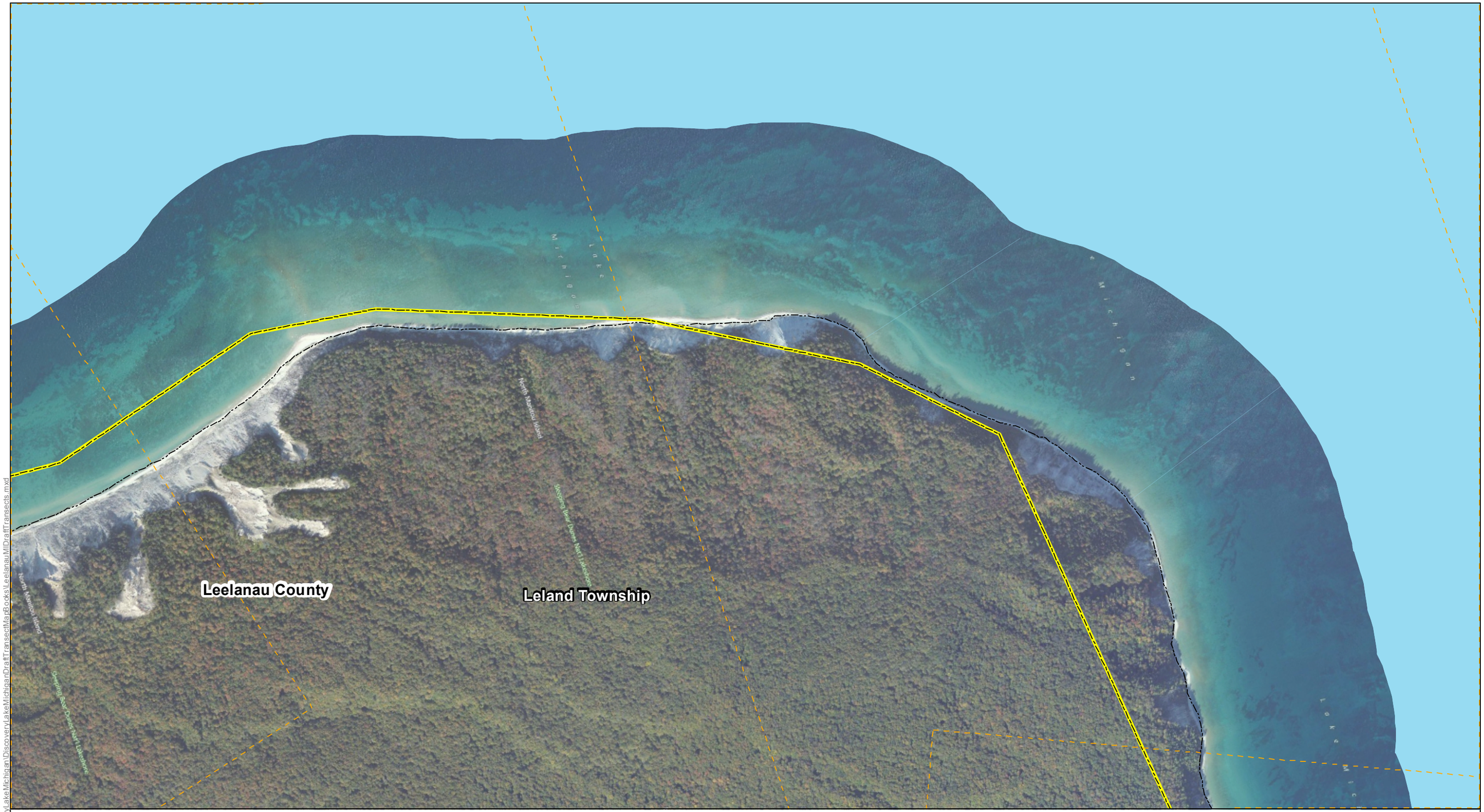
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

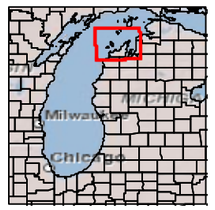
Leelanau County, Michigan
DRAFT TRANSECTS
Panel 40 of 52

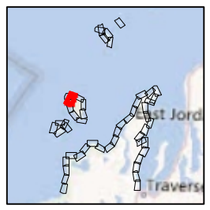
Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMI\DraftTransects.mxd



Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\Leelanau\MIDraftTransects.mxd

1 inch = 1,001 feet





Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 41 of 52

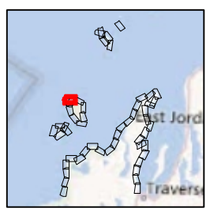
Lake Michigan

Leland Township

Leelanau County

N

1 inch = 1,002 feet



Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 42 of 52

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

Leland Township
Leelanau County

1 inch = 1,001 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 43 of 52

Path: C:\Users\17752\Desktop\DiscoveryLakeMichigan\DiscoveryLakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

LEE67

Leland Township

Leelanau County

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMI\DraftTransects.mxd

1 inch = 1,003 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 44 of 52

Leelanau County

Leland Township

Lake Michigan

Sleeping Bear Dunes (Nat'l Lakeshore)

North Manitou Island

Manitou Island Rd

Path: C:\Users\17752\Desktop\Discovery\LakeMichigan\Discovery\LakeMichiganDraftTransectMapBooks\LeelanauMIDraftTransects.mxd

1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

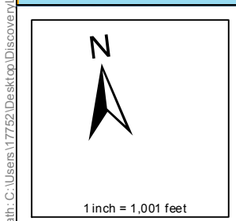
Adjoining Panel Edge

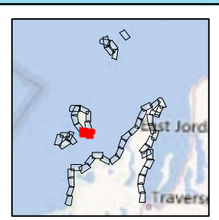
Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 45 of 52





- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 46 of 52

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Leelanau Township

Leelanau County

South Fox Island

South Fox Island

South Fox Island

Lake Michigan

Lake Michigan

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1 inch = 1,002 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan

DRAFT TRANSECTS

Panel 47 of 52

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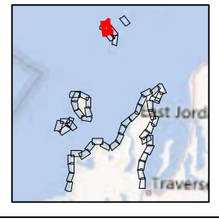
1 inch = 1,001 feet



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- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

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Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
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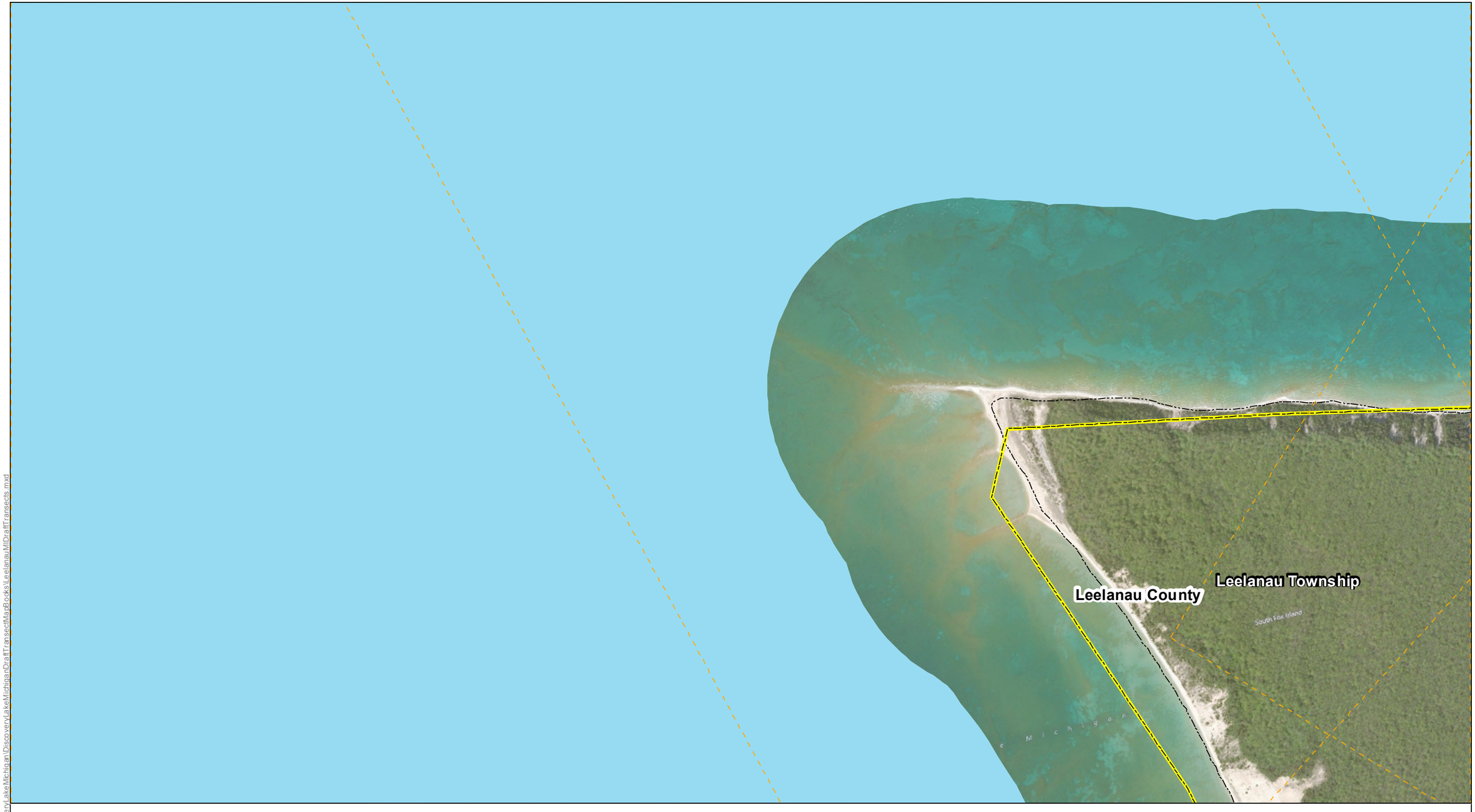
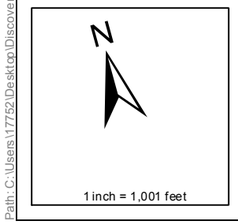
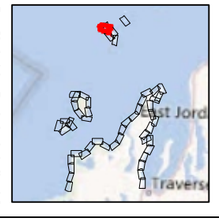
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 48 of 52







- Draft Transects
- County Boundary
- Municipal Boundary
- Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

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Township of Empire
Village of Empire
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Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 49 of 52

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1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
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Township of Leelanau
Township of Leland
Village of Northport
Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 50 of 52

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Leelanau County

Leelanau Township

LEE68

1 inch = 1,001 feet

Draft Transects

County Boundary

Municipal Boundary

Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

Township of Bingham
Township of Centerville
Township of Cleveland
Township of Elmwood
Township of Empire
Village of Empire
Township of Glen Arbor
Township of Leelanau
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Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 51 of 52

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Leelanau Township

Leelanau County

1 inch = 1,002 feet

Draft Transects
County Boundary
Municipal Boundary
Adjoining Panel Edge

Basemap Source: Microsoft BING map service

STUDY COMMUNITIES

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Township of Centerville
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Township of Solon
Township of Suttons Bay
Village of Suttons Bay

Leelanau County, Michigan
DRAFT TRANSECTS
Panel 52 of 52

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Attachment G.

Benzie, Grand Traverse, and Leelanau Counties Discovery Meeting Documents

U.S. Department of Homeland Security
536 S. Clark St. 6th Floor
Chicago, IL 60605
FEMA

July 13, 2012

«Salutation» «First_Name» «Last_Name»
«Title», «Organization»
«Street_1» «Street_2»
«City», «State_Province» «Zip_Code»

Re: Invitation to Attend Community Meetings Regarding Lake Michigan Coastal Flood Risk

Dear «Salutation» «Last_Name»:

The Federal Emergency Management Agency (FEMA) is conducting a comprehensive study of flood hazards for Lake Michigan and the rest of the United States Great Lakes through FEMA's Risk Mapping, Assessment, and Planning (MAP) Program. Data from this study will eventually be used to convey coastal flood hazard risk through revised Flood Insurance Rate Maps (FIRMs), also known as regulatory products, and new risk planning and assessment products and datasets, also referred to as non-regulatory products and datasets. Please see enclosed Risk MAP Flood Risk Products Fact Sheet. More information about the Great Lakes Coastal Flood Study may be found at http://www.greatlakescoast.org.

The goal of Risk MAP is to support actions that make communities safer from flooding. The Risk MAP program wants to achieve continued improvement of flood hazard information for the National Flood Insurance Program (NFIP); to promote increased awareness and understanding of flood risk; to increase community engagement; and to identify and support actions that local stakeholders can take to reduce natural hazard risks. For additional information on the Risk MAP Program, please visit http://www.fema.gov/plan/prevent/fhm/rm_main.shtm.

The first phase of the Risk MAP process is Discovery. Through Discovery, input provided by communities will help FEMA to better understand local coastal flood risk data and needs, and characterize local conditions that contribute to coastal flood risk.

Your Discovery Meeting is scheduled to occur:

Date:	Thursday, September 13, 2012
Time:	1:00pm – 4:00pm
Location:	County Training Room at the Governmental Center
Address:	400 Boardman Avenue, Traverse City, Michigan 49684

Please save this date on your calendar. At the meeting, we will review the coastal flood risk data we have gathered to date and discuss your community's coastal floodplains, mitigation plan and projects, coastal flood risk concerns, and coastal floodplain management activities. This discussion will allow us to better identify your community's coastal flood hazard needs and subsequent Risk MAP regulatory and non-regulatory products and datasets that can be delivered during the Risk MAP project. We will also discuss how the coastal flood risks and needs are related to mapping, risk assessment, Hazard Mitigation planning, and grant programs available to eligible communities. To best facilitate this discussion, we would like to request your help in inviting community leaders, emergency managers, GIS specialists, engineers, outreach specialists, and local planners to the meeting. Please RSVP to FEMA's study contractor (STARR) Holly Davis at (904) 363-8451 or email to GreatLakesFloodStudy@starr-team.com no later than **August 17, 2012.** Please reference the Discovery Meeting date and time in your RSVP.

So that we can better prepare for the upcoming Discovery Meeting, we are asking local communities to participate in an Information Exchange conference call and WebEx. This call will provide an overview of

FEMA's Risk MAP program and the Discovery process, and will allow us to review with you our request for the exchange of coastal flood risk and hazard mitigation data, and to learn more about your community's coastal flood hazard risks and needs, in advance of the Discovery Meeting. The partnership and exchange of data between FEMA, the State, and your community is vital to the success of identifying flood risks and needs that may impact your citizens.

The Information Exchange conference call is scheduled to occur:

Date:	Wednesday, August 8, 2012
Time:	1:00pm – 2:00pm EST
Link to WebEx:	https://www.webex.com/login/attend-a-meeting
Meeting No:	652 352 734
Call in number:	877-537-6647
Participant Code:	31578

If you or another community representative is unable to attend the Information Exchange conference call, we ask that you fill out and return the enclosed data request form by **August 17, 2012.** This is the same data request form that will be discussed during the conference call. The completed form can be sent to:

Via e-mail:	GreatLakesFloodStudy@starr-team.com
By mail:	Holly Davis Atkins/STARR 7406 Fullerton Street, Suite 350 Jacksonville, Florida 32256

We look forward to working with you to reduce the risks associated with coastal flooding and increase your community's resiliency for the long term. To learn more about Discovery, please visit http://www.fema.gov/library and search keywords "Discovery brochure" or contact Ken Hinterlong, FEMA Region V Senior Engineer, at (312) 408-5529, or by email at ken.hinterlong@fema.dhs.gov . We look forward to discussing this with you during the Information Exchange call and/or seeing you at the upcoming Discovery Meeting.

Sincerely,

Christine Stack

Christine Stack
Division Director
Mitigation Division, FEMA Region V

Enclosures: Risk MAP Flood Risk Products Fact Sheet
Community Discovery Coastal Data Request Form

cc: Community FPA
Linda Burke, Michigan Department of Environmental Quality
Les Thomas, Michigan Department of Environmental Quality
Byron Lane, Michigan Department of Environmental Quality

Thursday, September 13, 2012
1:00pm - 4:00pm ET
County Training Room at the Governmental Center
400 Boardman Avenue
Traverse City, MI 49684

No.	Sign Intials	Affiliation	Title	Name First	Name Last	Street Address	Phone	Email Address
1		Grand Traverse County	County Administrator	David	Brenda	400 Boardman Avenue Governmental Center Traverse City, MI 49684	(231) 922-4780	dbenda@grandtraverse.org
2		Grand Traverse County	Director of Planning	John	Sych	400 Boardman Avenue Governmental Center Traverse City, MI 49684	(231) 992-4676	jsych@grandtraverse.org
3		Grand Traverse County	Emergency Manager	Dan	Scott	400 Boardman Avenue Governmental Center Traverse City, MI 49684	(231) 995-6059	dscott@gtchd.org
4		Grand Traverse County Health Department	Emergency Preparedness Coordinator	Jason	Block	2650 LaFranier Road Traverse City, MI 49686	(231) 995-6010	jblock@grandtraverse.org
5		City of Traverse City	Asset Mgmt Technician	John	Travis	400 Boardman Avenue Traverse City, MI 49684	(231) 735-4124	jtravis@traversecitymi.gov
6		East Bay Township	Planning and Zoning Supervisor	Leslie Glen	Couturier Lile	1965 N. Three Mile Road Traverse City, MI 49696	(231) 947-8681	lcouturier@eastbaytwp.org
7		Acme Township	Zoning Administrator	Nikki	Lennox	6042 Acme Road Williamsburg, MI 49690	(231) 983-1350	nlennox@acmetownship.or
8		FEMA	FEMA Region V	Ken	Hinterlong	536 S. Clark Street, 6th Floor Chicago, IL 60605	(312) 408-5529	Ken.Hinterlong@fema.dhs.gov
9		FEMA	FEMA Region V Risk Analysis	Erin	Maloney	536 S. Clark Street, 6th Floor Chicago, IL 60605	(312) 408-5435	erin.maloney@fema.dhs.gov
10		STARR	Project Manager/Coastal Engineer	Stacey	Roberts		(850) 580-7896	stacey.roberts@starr-team.com

Thursday, September 13, 2012
1:00pm - 4:00pm ET
County Training Room at the Governmental Center
400 Boardman Avenue
Traverse City, MI 49684

No.	Sign Intials	Affiliation	Title	Name First	Name Last	Street Address	Phone	Email Address
11		STARR	Outreach Coordinator	Holly	Davis		(904) 363-8451	holly.davis@atarr-team.com
12		STARR	Sr. Technical Coordinator	Janet	Luce		(321) 242-4942	janet.luce@atkinsglobal.com
13		MI SEA GRANT	EDUCATOR	MARK	BREEDERLAND	520 W FRONT TC 49684	231 922 4628	breederl@msu.edu
14		NWMCOG	PLANNER	SCOTT	GEST	600 E. FRONT STREET TC 49685	231 929 5091	SGEST@NWM.COG.MI.US
15	DS	Blair Twp	Zoning Admin	Dylan	Sullivan	2121 CoRd 633	231-590-4084	zoning@blairtownship.org
16		G.T. County	Soil Erosion Inspector	Gwen	Zagore	2650 LaFranier	995-6042	gzagore@grandtraverse.org
17		CITY OF TRAVERSE CITY	CITY ENGINEER	Tim	Lodge	400 Boardman Ave	231 922 4455	tlodge@traversecitymi.gov
18		G.T. Co						
19				KEVIN	MCELYEA	400 BOARDMAN	922-4807	KMCELYEA@GRANDTRAVERSE.ORG
20		Leelanau County	County Planning Comm	Victor			231 256 9058	

Thursday, September 13, 2012
1:00pm - 4:00pm ET
County Training Room at the Governmental Center
400 Boardman Avenue
Traverse City, MI 49684

No.	Sign Intials	Affiliation	Title	Name First	Name Last	Street Address	Phone	Email Address
21	[illegible]	City of TC	Public Services Asst.	Alex	Yocker	400 Boardman Av. TC, MI 49684	231 922-4463	ayocker@traversecitymi.gov
22	[illegible]	GTC	GIS DIR.	ERNEST	CACC-IACC-IA	" " "	231-922-4771	
23								
24								
25								
26								
27								
28								
29								
30								

Meeting Schedule: Thursday, September 13, 2012 1:00 – 3:00 pm (ET)
Meeting Location: County Training Room at the Governmental Center, Traverse City, MI

PARTICIPANTS

FEMA
Ken Hinterlong, FEMA Region V

STARR Contractor
Stacey Roberts, STARR
Holly Davis, STARR
Janet Luce, STARR

Discovery Meeting Agenda

1. Why are we here?
- Great Lakes Coastal Flood Study Overview and Schedule
- Discovery Process and Outcomes

2. Coastal mapping (Regulatory) flood risk products (Non Regulatory)

3. How does this apply to my community?

4. Hazard mitigation opportunities and grant funding

5. Interactive Session
- View and Discuss Local Coastal Areas of Concern Using the Discovery Map
- Introduce the Mitigation Action Form and Mitigation Action Tracker
- Discuss Mitigation Action Opportunities

7. Wrap Up
- Review of action items and next steps

Optional Interactive Stations (30 minutes - 1hr following meeting)
- *Draft Transect* Map *Station: Talk to technical staff about draft transects and view draft transects in GIS*
- *Mitigation* Resources*, Strategies, and Actions Station: Talk with FEMA and State staff about areas of concern and potential mitigation actions to help reduce risk. Fill out Mitigation Action Form.*

INTERACTIVE DISCUSSION:

A. Questions asked during the presentations *(summary of answers provided in italics)*

1. In the mid 1980's there was a storm in which ice was pushed up onto the shore. This in combination with melting snow causes significant damage. How/why does the study not consider the repetitive losses that result in these types of events? *This type of damage is a relatively rare event that has localized effects and, as such, is not included in FEMA's analysis of flood hazards.*
2. What is the water level on which the modeling is done? *The lake levels are modeled using continuous record of 50 years of data and considers the lake level variability over time.*
3. Without taking geotech into consideration, how are you defining erosion? Under the sand dunes are layers and clay lenses that are not likely to erode. The surface layer of sand may erode, but will go back only so far before protected by clay/other layers. How can you map a zone based on erosion calculated without taking geotech into consideration? *Beach sediment samples will be collected at representative sites for use in the erosion analysis. As we will only be able to collect data in a limited number of areas, any geotechnical information that a community can provide would be greatly appreciated.*
4. Some people have been involved in the recent resilience meetings. Where does this stand? *For information on resilience meetings, please contact Erin Maloney, FEMA at Erin.Maloney@fema.dhs.gov.*
5. Does the AAL data represented on the maps, only include flood data? *Yes, the AAL data is only representative of flood hazards.*
6. What is a transect? *The shore perpendicular profile along which the coastal analysis is performed.*
7. How does this study handle harbors areas and estuaries? *Each harbor and/or estuary will be evaluated and handled on a situational basis.*
8. When will revised maps be issued? *Revised maps will be issued when the zones are set.*
9. How are you taking into account erosion? *Erosion will be taken into account by using the methodology in Appendix D.3, the Bruun Rule.*
10. Are actual damages being tied to events for this study? Are you looking at damaged areas and related issues of what actually caused the damage? *We are using the 1% annual chance storm event for this study.*
11. How can a setback be determined by the data we are using for this study? *Using the HAZUS Model, we can look at estimated losses to flooding. We can also look at the high risk erosion areas.*
12. In reference to High Water Marks, can we request a reference point on the maps to be able to start talking about setbacks? *Unfortunately, FEMA's guidelines and specifications do not allow us to include benchmarks or reference points on the standard Flood Insurance Rate Maps. However, this information is available in digital format for communities to use with their own data.*

B. Questions/comments raised during the discussion and break out session

1. Does the AAL data represented on the maps, only include flood data? *Yes, the AAL data is only representative of flood hazards.*
2. Bluff and dune loss is different than shoreline loss.

C. General notes

1. No one in attendance from Benzie County.
2. Due to budget restrictions, NOAA's LIDAR data is not currently available for the peninsula in Leelanau County. The 2012 LIDAR being flown by the USACE, will be available approximately March 2013.
3. Lake Charlevoix did not have oblique photos flown as part of the USACE effort. Why is this, when Lake Charlevoix is a direct link to Lake Michigan?

FEATURES NOTED ON MAPS:

State	County	Community	FIPS	CID	Comment	Type
Michigan	Grand Traverse	Acme Township	26055	260749	Mitigation action taken to remove structures to create Shoreline Park.	General Comment
Michigan	Grand Traverse	Acme Township	26055	260749	State Park	General Comment
Michigan	Grand Traverse	Acme Township	26055	260749	Township Park	General Comment
Michigan	Leelanau	Leelanau	26089		AAL is "incredible"	General Comment
Michigan	Leelanau	Village of Northport	26089	260580	Relocate transect to approach from the northeast.	Transect Comment

ACTIONS:

- STARR will send out the discovery presentation as well as contact information to attendees.

FEMA

Lake Michigan Discovery

Benzie County, MI
Grand Traverse County, MI
Leelanau County, MI

September 13, 2012
1pm to 3pm ET

County Training Room at the
Governmental Center
Traverse City, Michigan

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

Introductions

Who's here?

- **State Representatives**
  - MDEQ
- **Risk MAP Project Team**
  - FEMA
  - STARR
- **Local Stakeholders**
  - CEOs
  - Floodplain Administrators
  - Planners
  - Engineers
  - Emergency Managers
  - Community Leaders
  - Regional Planning Agencies
  - Coastal Organizations
  - Property Owner Associations and Other Key Stakeholders

Discovery Meeting Agenda

- Why are we here?
  - Risk MAP Program, Great Lakes Study, and Discovery Overview
- Coastal mapping (regulatory products)
- Flood risk products (non-regulatory products)
- How does this apply to my community?
  - NFIP compliance, local impacts of coastal study, hazard mitigation, and grant funding
- Interactive Session
  - View and Discuss Local Coastal Areas of Concern Using the Discovery Map and Community Risk MAP Questionnaire
  - Discuss Mitigation Action Opportunities and Introduce the Mitigation Action Form
- Wrap Up
- Optional Interactive Stations

Risk Mapping, Assessment and Planning
Risk MAP

FEMA

Through collaboration with State, Local, and Tribal entities, Risk MAP aims to deliver quality data that increases public awareness and leads to action that reduces risk to life and property

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

Great Lakes Coastal Flood Study

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

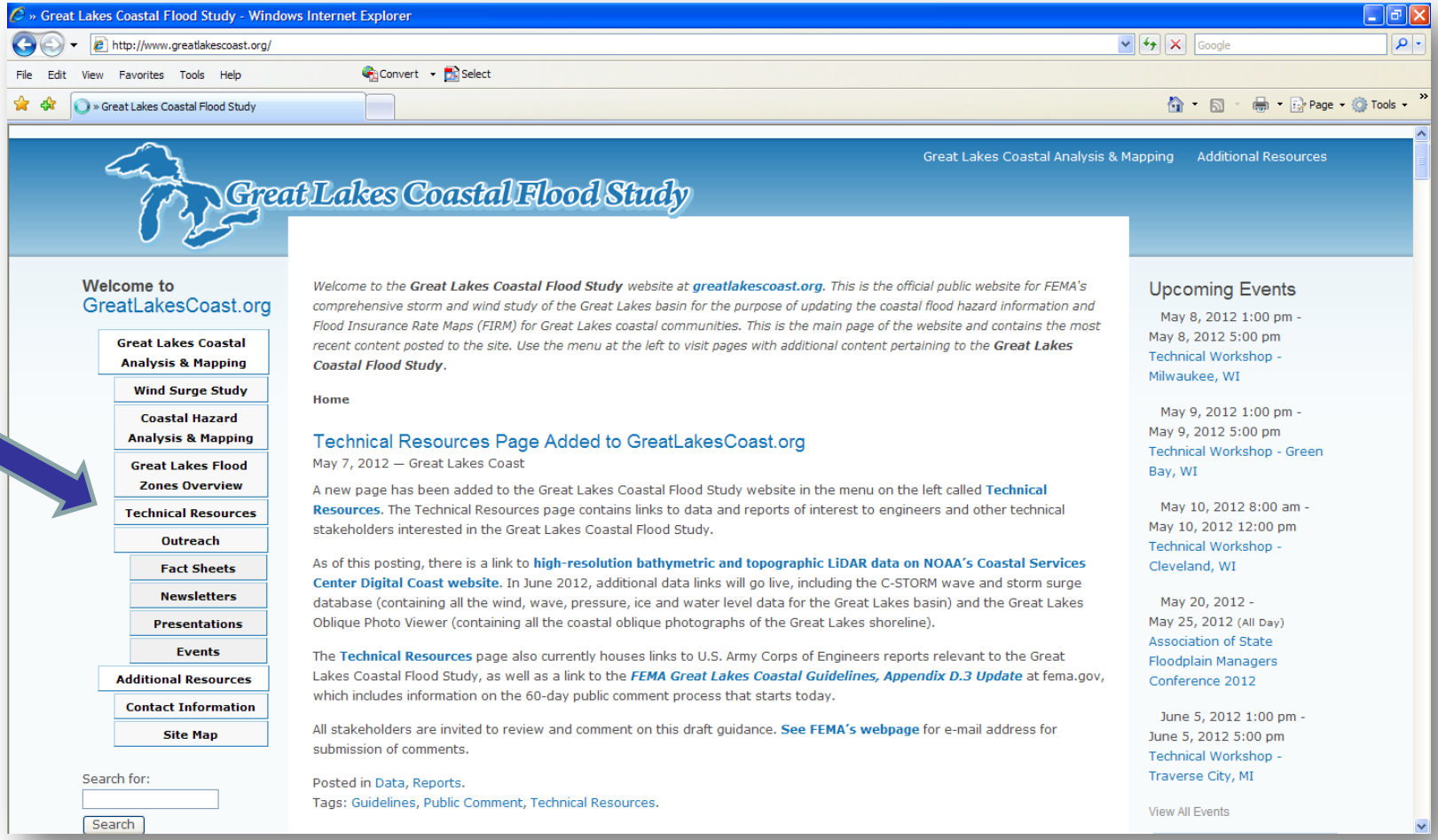
Great Lakes Coastal Flood Study Overview

- Latest models, data, and technology
- Deliver updated flood maps and flood risk datasets
- Equip Federal Agencies, eight States and hundreds of coastal communities with data and planning tools to facilitate flood risk actions to enhance resiliency along the Great Lakes
- Partners Involved:
  - FEMA
  - USACE
  - ERDC
  - ASFPM
  - States
  - FEMA Contractors

RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

Technical Resources



RiskMAP
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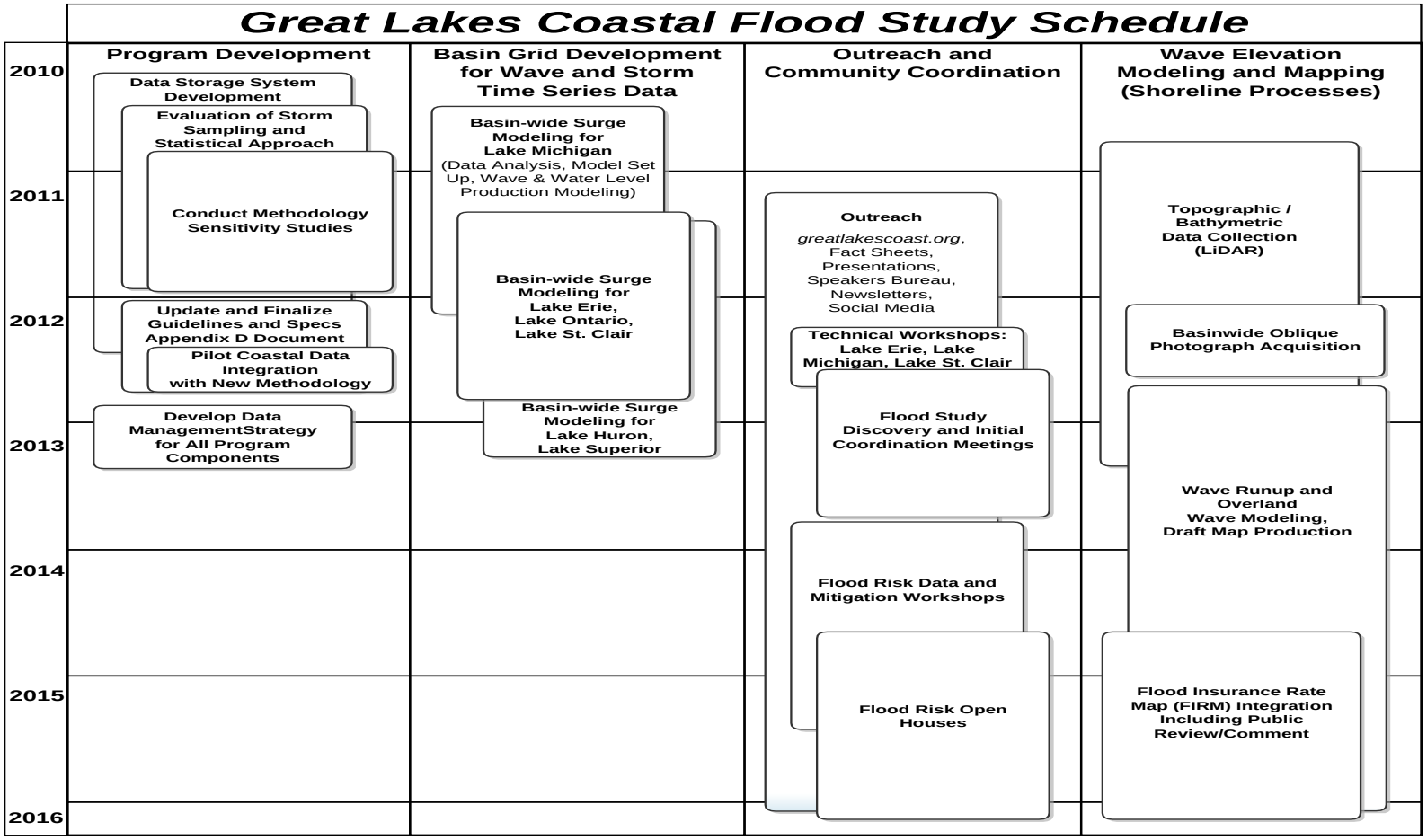
Great Lakes Coastal Flood Study
greatlakescoast.org

Great Lakes Coastal Flood Study Schedule

FEMA



RiskMAP
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Great Lakes Coastal Flood Study
greatlakescoast.org

Lake Michigan Discovery

- 34 counties in total
  - 4 counties in UP Michigan
  - 11 counties in Wisconsin
  - 2 counties in Illinois
  - 3 counties in Indiana
  - 14 counties in lower Michigan
- 226 coastal communities

RiskMAP
Increasing Resilience Together

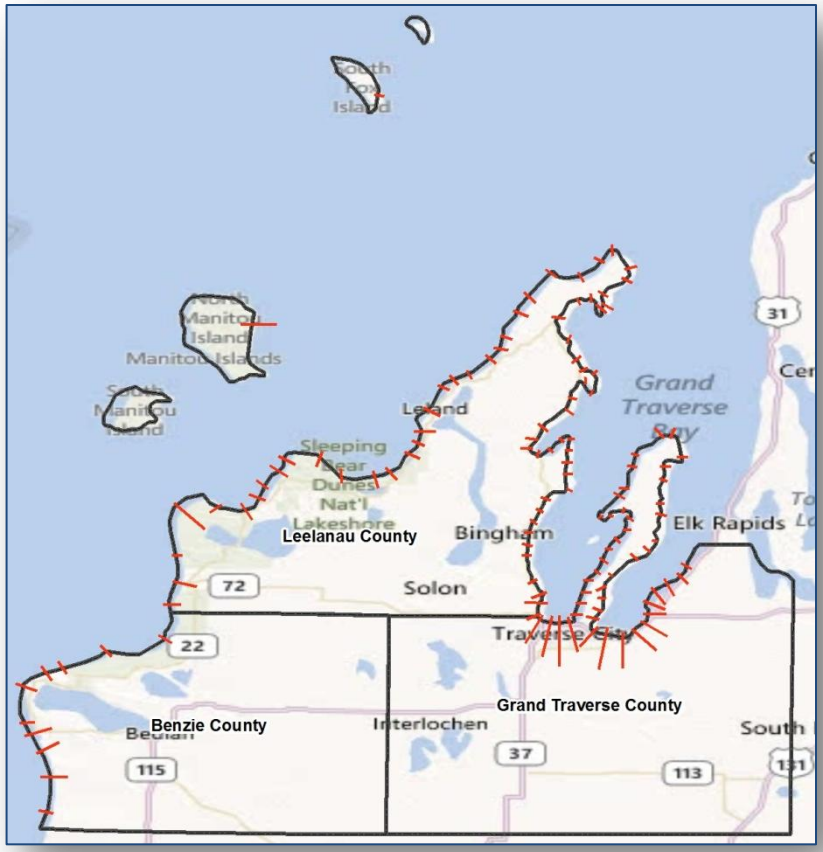
Great Lakes Coastal Flood Study
greatlakescoast.org

Great Lakes Coastal Flood Study Discovery Study Area

FEMA

Lake Michigan coastal communities in Benzie, Grand Traverse and Leelanau Counties:

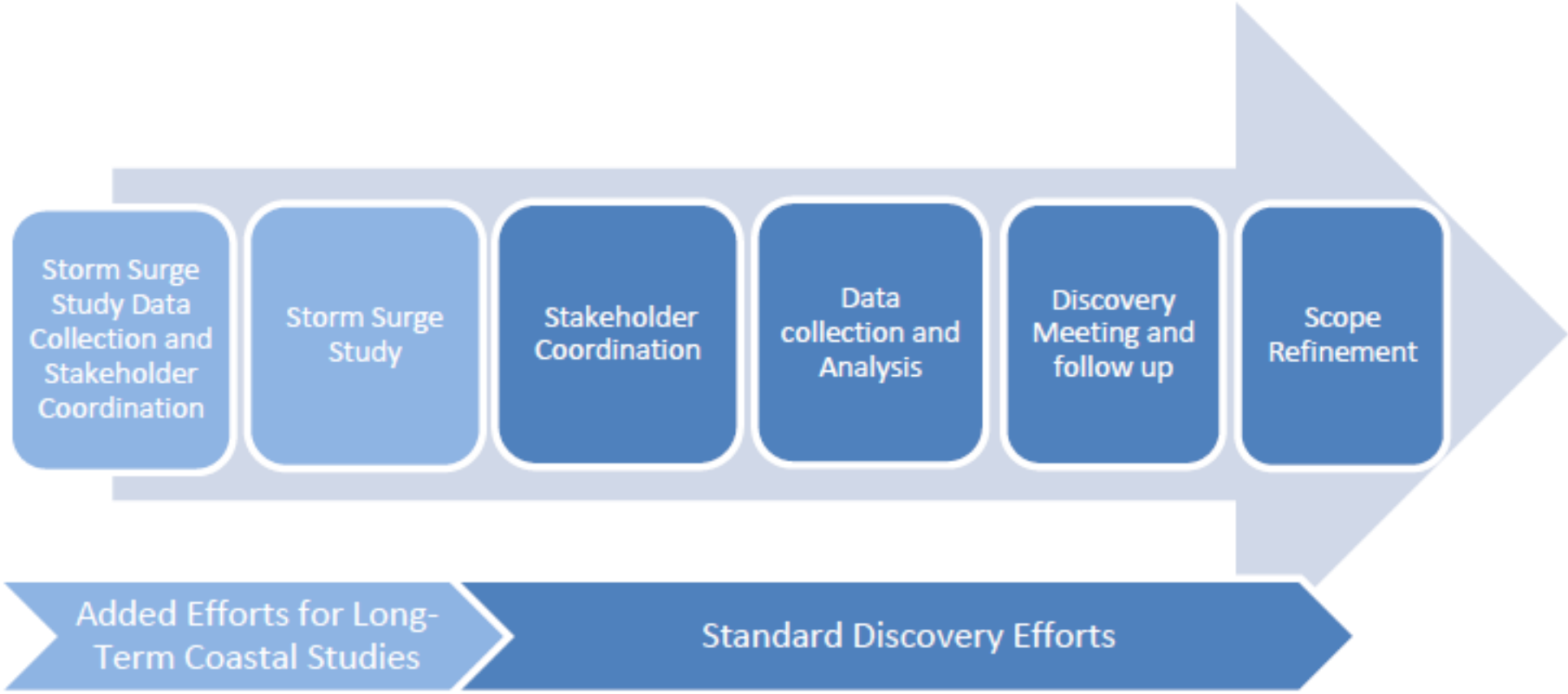
Benzie County	Grand Traverse County	Leelanau County (cont.)
Benzonia, Township of	Acme, Township of	Cleveland, Township of
Benzonia, Village of	Blair, Township of	Elmwood, Township of
Beulah, Village of	East Bay, Township of	Empire, Township of
Blaine, Township of	Garfield, Township of	Empire, Village of
Crystal Lake, Township of	Peninsula, Township of	Glen Arbor, Township of
Elberta, Village of	Traverse City, City of	Leelanau, Township of
Frankfort, City of	White Water, Township of	Leland, Township of
Gilmore, Township of		Northport, Village of
Lake, Township of	**Leelanau County**	Solon, Township of
Platte, Township of	Bingham, Township of	Suttons Bay, Township of
	Centerville, Township of	Suttons Bay, Village of



RiskMAP
Increasing Resilience Together

Great Lakes Coastal Flood Study
greatlakescoast.org

Discovery Schedule Overview



Discovery Outcomes

- **Explain the Project**
  - Regulatory and non-regulatory products/datasets
  - Analysis, concepts, timelines
- **Encourage Community Participation**
  - Transect Locations
  - Areas of concern and need
  - Data to improve upon products and datasets
- **Introduce Mitigation Action**
  - Mitigation Action Form
  - Action Tracker
  - Mitigation strategies for coastal flood and erosion

Lake Michigan Discovery

Schedule of Activities

- Identify Draft Transect Locations – Completed
- Research available data – Ongoing
- Information Exchange with Community Stakeholders – August 2012
- Prepare draft Discovery Maps and Reports – September 2012
- Discovery Meetings – September 2012
- Final Discovery Report and Maps – November/December 2012
- Create library of digital data – November/December 2012

Data Collection in Progress

- New high quality USACE Topographic – Light Detection and Ranging (LiDAR) and Bathymetry Data
- Base data – boundaries, streams, census blocks, etc.
- Average Annualized Loss data
- Shoreline Classification Dataset
- Dams
- Federal and State disaster information
- Repetitive loss data
- Hazard Mitigation plans
- Hazard Mitigation Grants Program (HMGP) projects
- Stream, wave, and water level gage locations
- Pre-Disaster Mitigation Program projects
- Draft Transects

Great Lakes Coastal Flood Study Discovery Products

- **Final Discovery Report**
  - Single, comprehensive report for all of Lake Michigan, with appendices for each Discovery meeting
  - Includes pre-discovery data, meeting agenda, sign-in sheets, discussion topics, decisions made, etc.
- **Final Discovery Maps**
  - Including feedback from participants
  - Visual representation of meeting outcomes
  - Delivered in digital format

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Coastal Mapping

- Draft Transects
- VE Zone Mapping
- Limit of Moderate Wave Action (LiMWA)

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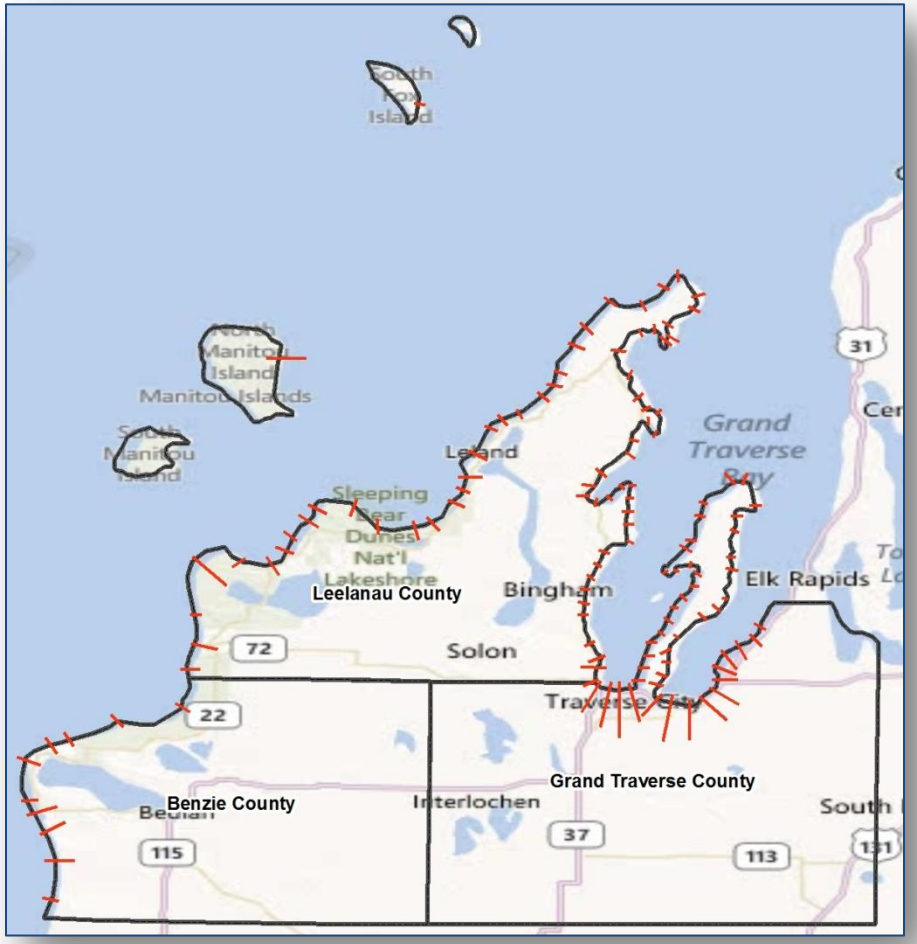
Draft Transect Layout – Benzie, Grand Traverse and Leelanau Counties

County	# Shoreline Miles	# Transects
Benzie	25	8
Grand Traverse	53	38
Leelanau	143	54



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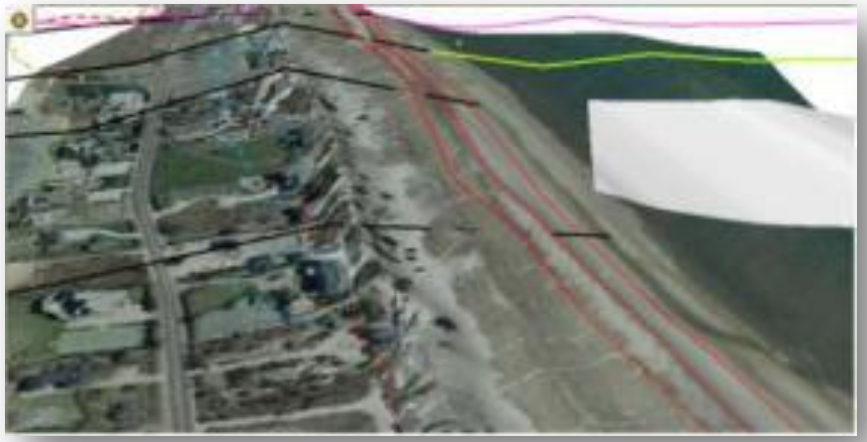
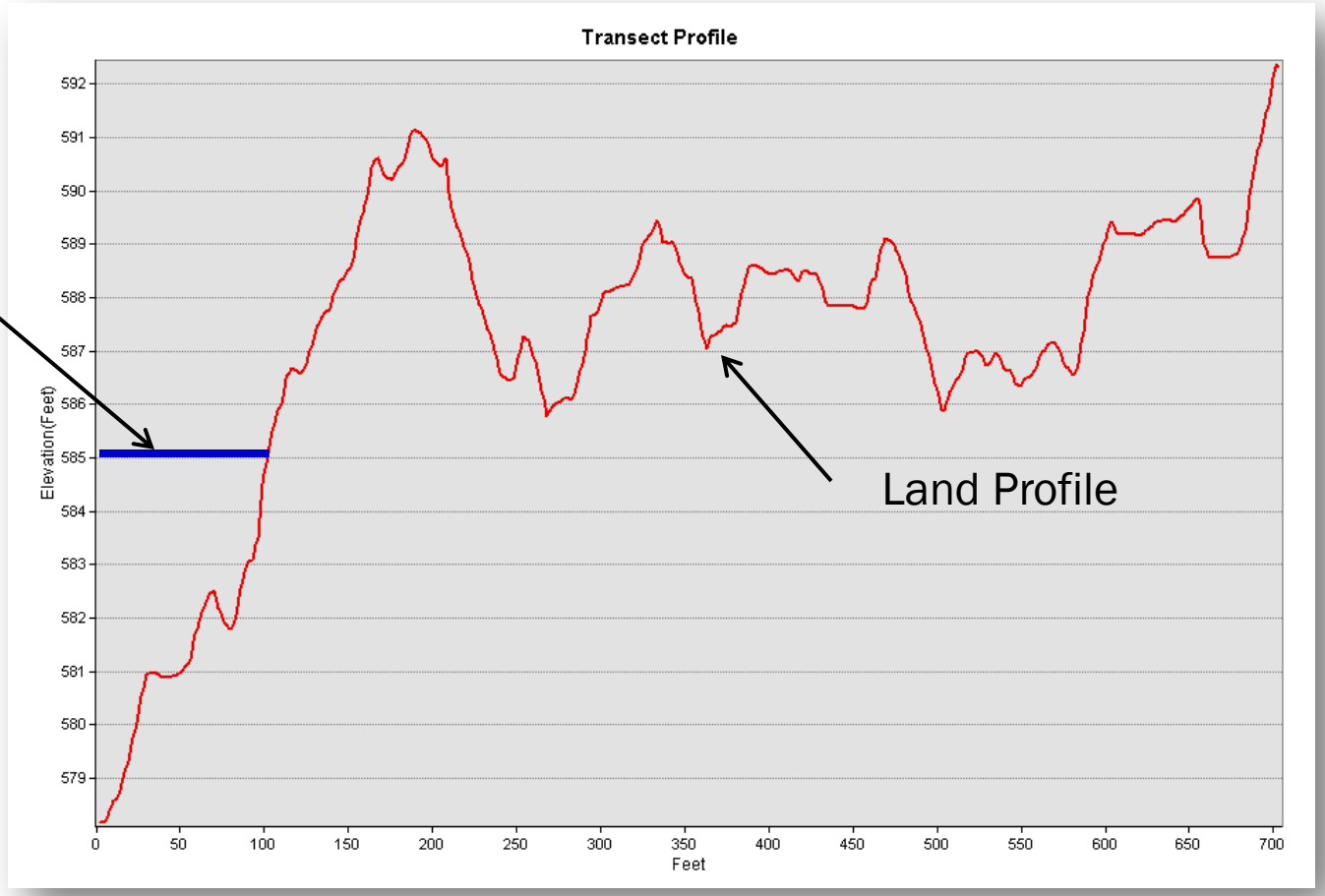
Transect Placement

- Transects are placed to define representative profiles for a shoreline reach
- Transect spacing depends on upland development
  - Developed areas – As dense as 1,000 ft
  - Rural areas – Spacing can be 1-2 miles
- Transects are:
  - Profiles along which flooding analysis is performed
  - Used to transform offshore conditions to shoreline
  - Use to define coastal flood risks inland of shoreline



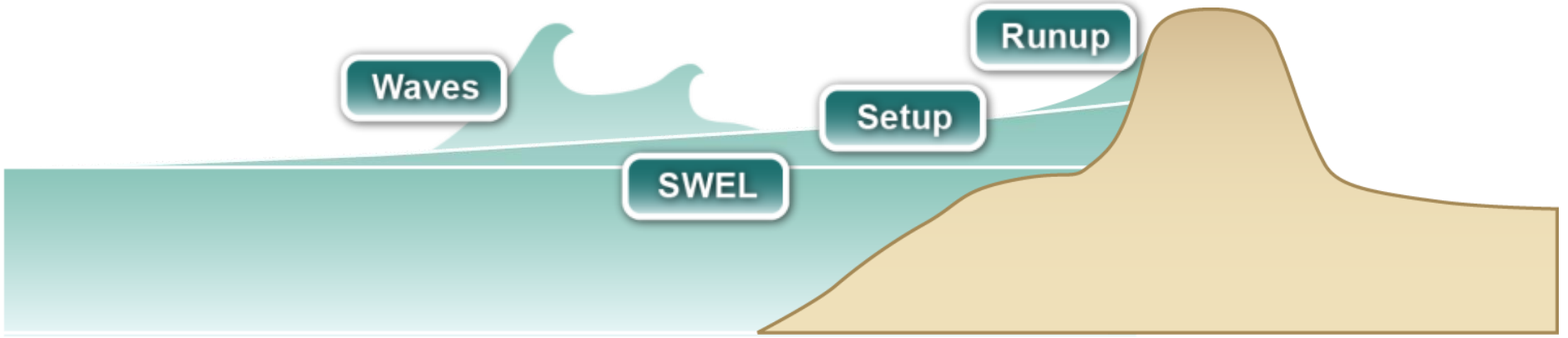
Coastal Transect



Basic Elements of a Coastal Hazard Analysis

Base Flood Elevation (BFE) on FIRM includes 4 components:

1. Stillwater elevation (SWEL) – determined from storm surge model
2. Amount of wave setup
3. Wave height above storm surge (stillwater) elevation
4. Wave runup above storm surge elevation (where present)



Coastal Flood Hazard Zones

- **Hazard Zones**
  - Zone AE – Areas expected to be flooded by inundation in 100-year event
    - BFE established (wave heights/runup less than 3 feet)
    - Limit of Moderate Wave Action (LiMWA) – Areas subject to wave heights of at least 1.5 feet
  - Zone X – Areas not expected to be flooded in 100-year event
    - Shaded X – Areas expected to be flooded in 500-year event
    - BFE not established
  - Zone VE – Areas expected to be affected by high velocity wave impact in 100-year event (wave heights or runup depth greater than or equal to 3 feet)
    - Base Flood Elevation (BFE) established
- **Gutters**
  - Internal zone breaks where BFE changes
  - VE/AE Gutter - Location where risk of damage due to wave action diminishes

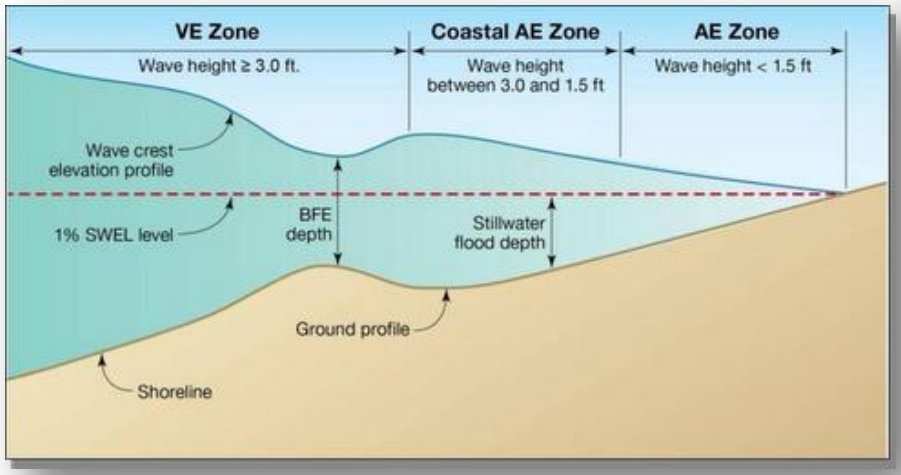
How is Limit of Moderate Wave Acton (LiMWA) Defined?

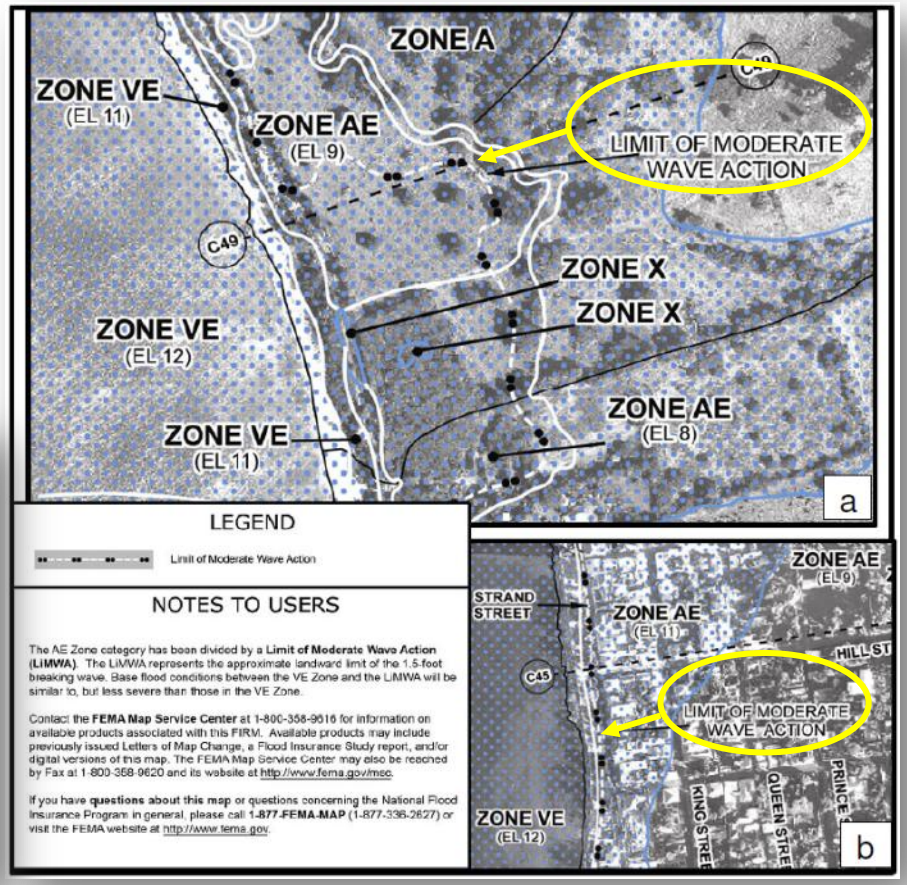
- LiMWA is the line mapped to delineate the inland extent of wave heights of at least 1.5 feet
  - Wave heights as small as 1.5 feet can cause significant damage to structures
- LiMWA is the same as coastal AE zones and can trigger coastal building codes for certain communities
- Community Rating System (CRS) benefits for communities implementing higher construction standards

Limit of Moderate Wave Action (LiMWA)

FEMA Procedure Memorandum No. 50, 2008

- Not a regulatory requirement
- No Federal Insurance requirements tied to LiMWA





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Wave Action – Structural Risk

- **US Army Corps of Engineers – 1973**
  - Breaking wave height of 3 feet
  - "area subject to high velocity waters, including but not limited to hurricane wave wash"
- **FEMA – 2000**
  - Coastal Construction Manual
  - Additional post-storm damage assessments identified 1.5 wave also can knock a structure off a foundation

http://www.fema.gov/pdf/rebuild/mat/coastal_a_zones.pdf

V Zones for Lake Michigan?

- Lake Michigan communities currently do not have V/VE Zones. Majority of the communities have coastal A/AE zones.
- If coastal AE and VE Zones are added on maps where they did not exist before, all affected communities must update regulations to include coastal requirements.
  - State will provide regulations assistance and technical support if/when coastal flood zones are added.

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Coastal Flood Risk Products

- Coastal Depth Grids and HAZUS
- Changes Since Last FIRM
- Coastal Non-Regulatory Products

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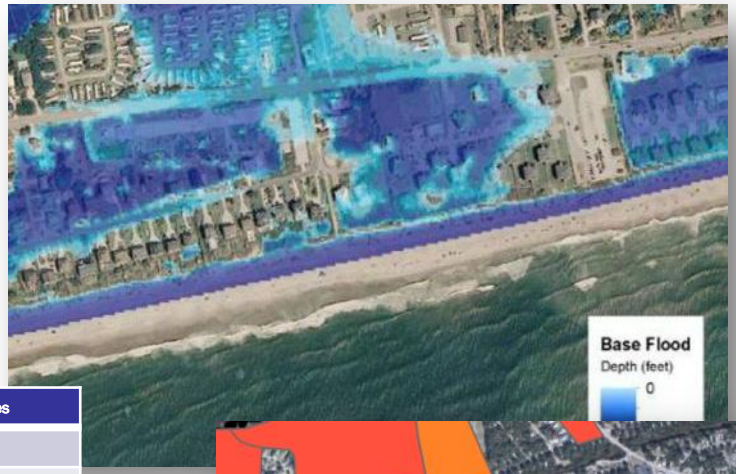
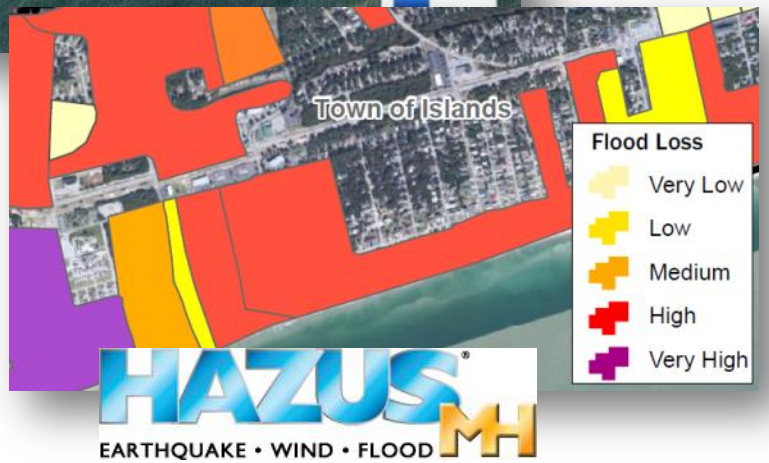
Standard Flood Risk Products

- Coastal Depth Grids
- Flood Risk Assessment (HAZUS)
- Changes since last FIRM



Data Fields Include	Example Data Values
Old Study Date	e.g. 1985
Old Model Type(s)	e.g. HEC-1 / HEC-2
Old Zone Type	e.g. Zone A
Old Topography	e.g. USGS 10-ft
New Study Info/Methods	Dates, Models, etc.
New Study Zone	e.g. Zone AE
New Topography	e.g. LiDAR 2-ft
New Study Engineering Factors / Changes	e.g. new structures, gages, topo, landuse, etc.
Estimated Structures	e.g. 9
Estimated Population	e.g. 27



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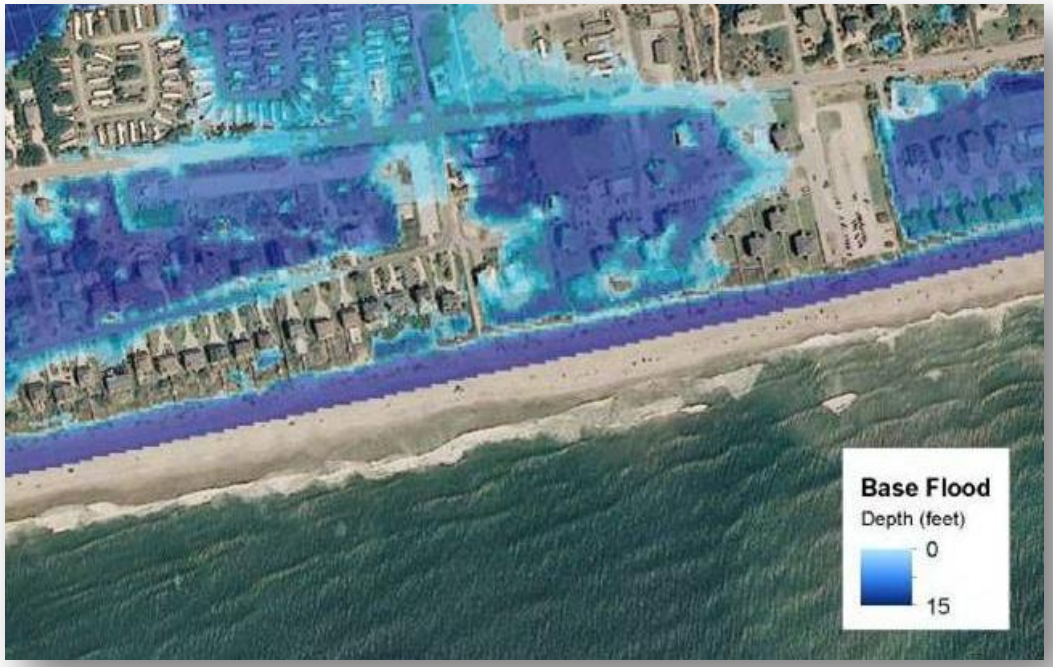
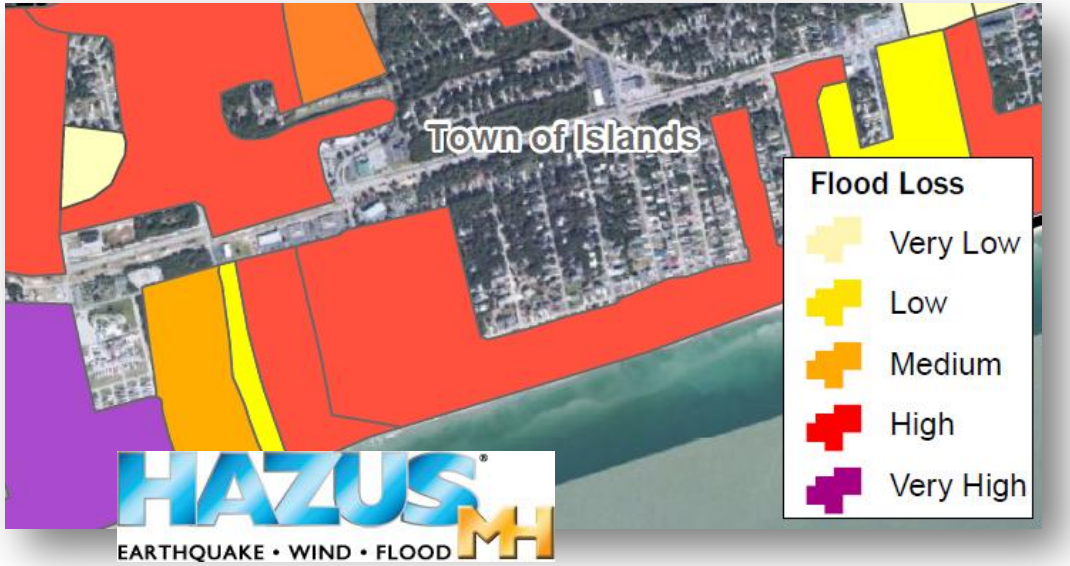
Coastal Depth Grid

- Should reflect total depth (i.e. stillwater and waves) – typically only produced for the 1% annual chance flood
- Created using the regulatory mapping and associated zone breaks as input



Coastal Flood Risk Assessments

- Similar to Flood Risk Assessments for riverine, but using the coastal depth grids as input for the refined analysis
- Hazus analysis and data can support adoption of higher regulatory standards for structures in high loss areas
- Provides justification to fund mitigation actions



Changes Since Last FIRM

Data Fields Include	Example Data Values
Old Study Date	e.g. 1985
Old Model Type(s)	e.g. HEC-1 / HEC-2
Old Zone Type	e.g. Zone A
Old Topography	e.g. USGS 10-ft
New Study Info/Methods	Dates, Models, etc.
New Study Zone	e.g. Zone AE
New Topography	e.g. LiDAR 2-ft
New Study Engineering Factors / Changes	e.g. new structures, gages, topo, landuse, etc.
Estimated Structures	e.g. 9
Estimated Population	e.g. 27

Coastal Non-Regulatory Products in Development

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Erosion

Red Lantern Restaurant, Lake Michigan, IN

Lake Levels

Lake Michigan Shoreline
Reference

Shoreline Feature Dataset

Upper Peninsula Shoreline
Reference

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Shoreline Features Database

Shoreline Material
Sand
Cohesive
Cobble
Diamicton*
Shingle
Bedrock
Artificial

Primary Land Use
High Density Residential
Moderate Density Residential
Low Density Residential
Commercial/Industrial
Park Land
Farm Land
Forested

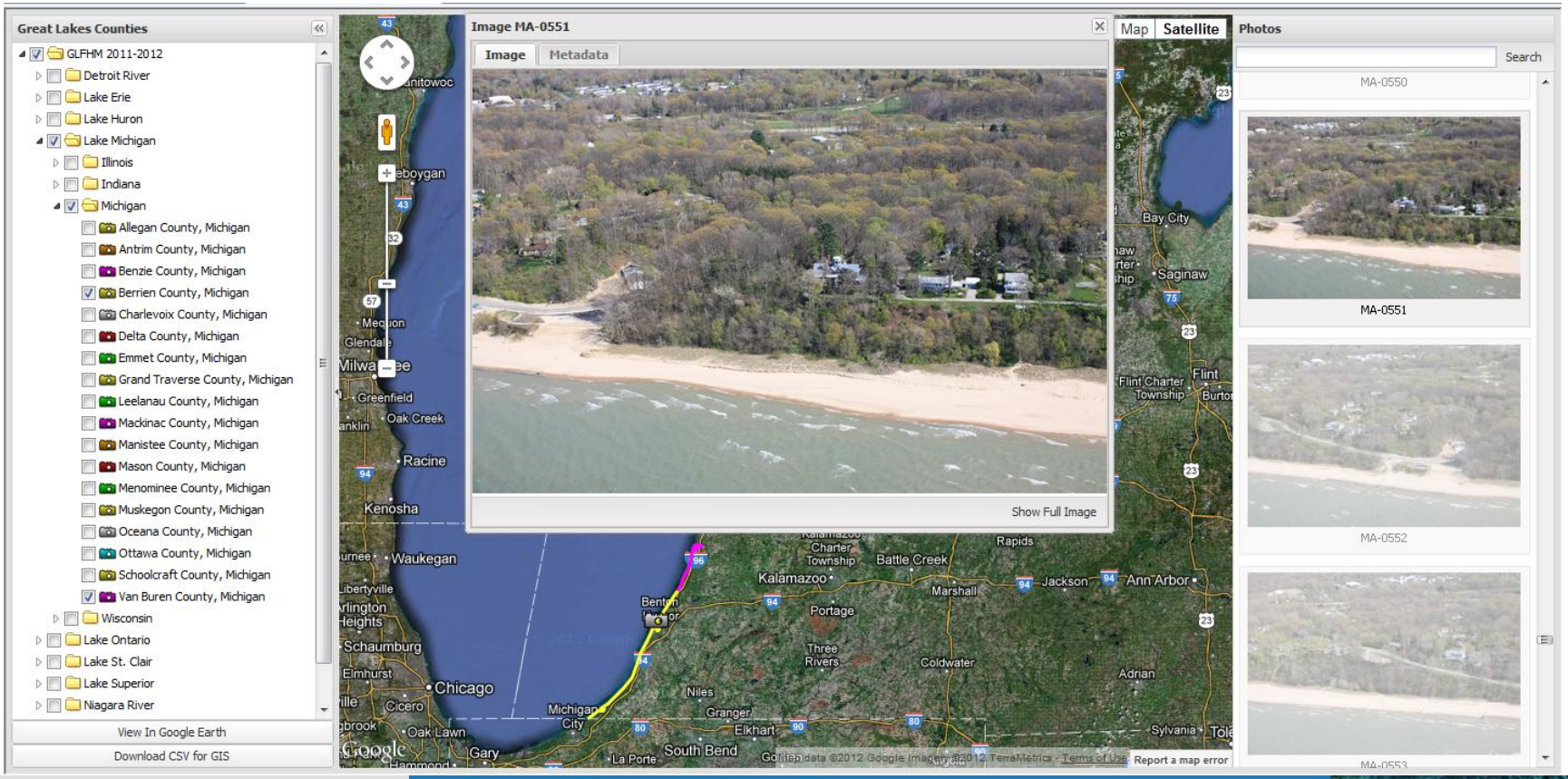
Primary Coast Type
High Dune, 10'+
Dune, 2' - 10'
High Bluff, 10'+
Bluff, 2' - 10'
Coastal Wetland
Flat Coast

Primary Vegetation
None
High Density Shrubs/Trees
Moderate Density Shrubs/Trees
Low Density Shrubs/Trees
Manicured Lawn
Native Vegetation

- Contains primary and secondary Land Use tables – same for coast type and vegetation
- Current project collects data at one-mile spacing, for scoping and cost
- Current project does not include field-based reconnaissance or sediment/subsurface soils collection

USACE Oblique Aerial Photo Viewer

http://greatlakes.usace.army.mil/



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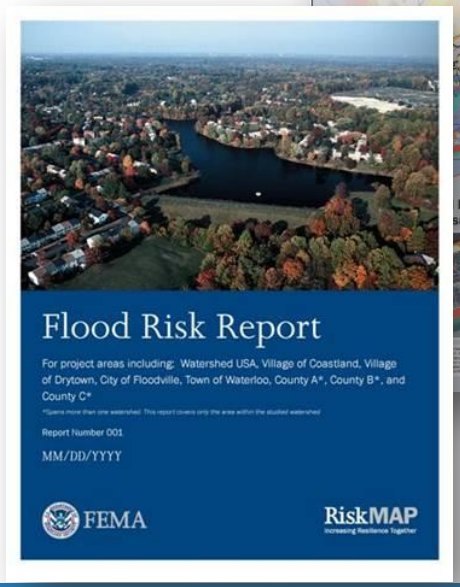
Coastal Flood Risk Map and Report

- Highlights area where datasets were produced
- Use of callout boxes
- Should drive the conversation towards mitigation



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How Can You Use These (Non-Regulatory) Products?

- Risk MAP Products and Datasets help communities make good decisions to reduce flood risk:
  - Hazard Mitigation Planning
  - Floodplain Management and Community Rating System
  - Community Comprehensive or General Planning
  - Community Investment - Capital Improvement Planning
  - Public Outreach
  - Hazard Mitigation Assistance Grant Application Prioritization and Support
  - Other Non-FEMA Grants to Reduce Flood Risk
  - Response and Recovery Planning
- Mitigation Action Form

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How does this apply to my community?

- NFIP Compliance
- Local impacts of coastal study

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National Flood Insurance Program (NFIP)

- Allows property owners to purchase flood insurance at reduced rates
- Community responsibilities
  - Adopt and enforce compliant regulations
- FOCUS is in building the local floodplain management capability

Coastal Zones and NFIP Compliance

- Must meet minimum NFIP and community coastal requirements
- V Zones will be treated as floodways for ordinance purposes and construction will be restricted in these areas.
- Recommendations for exceeding the minimum NFIP requirements (Coastal A Zones)
  - Can obtain CRS credits for Coastal A Zone Requirements
- Resources Available

Community Rating System (CRS)

- Flood insurance premium rates discounted to reward community actions that reduce flood losses, facilitate accurate insurance ratings, and promote the awareness of flood insurance
- Class rating system from 1 to 10
- Each Class improvement (500 point increments) results in additional 5% discount, up to 45% in SFHAs for Class 1 communities
- Uniform minimum credits give you points for activities on the state level (state laws) and make achieving a Class 9 relatively easy
- 18 creditable activities organized under four categories:

Public Information	Mapping and Regulations
Flood Damage Reduction	Flood Preparation

- http://training.fema.gov/EMIWeb/CRS/

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Hazard Mitigation

- Opportunities
- Grant Funding

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Great Lakes Coastal Flood Study
HM Resources, Strategies & Actions

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- The right action (or mix of actions) will be based on recent community experiences and level of complexity in existing infrastructure
  - *Public Works*
  - *Building Standards*
  - *Community Planning and HM Plan Update / Integration processes*
  - *Communication Processes, GIS, etc.*
- Get the right people to the table: Integrated vs. Discipline-specific
- Document ideas and actions through the FEMA Action Tracking form

Land Use Ordinances	Local Building Codes	Mitigation Projects	Community Identified Mitigation Programs	Management Best Practices
Zoning, Setbacks, Floodplain Management, etc.	IBC, IRC, Local Regulations, etc.	Acquisition, Elevation, Floodproofing, etc.		Integration of natural hazards into other planning mechanisms

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Example Mitigation Actions

STRUCTURAL /NON-STRUCTURAL PROJECTS

Detention
Drainage
Acquisition
Elevation
Retrofits

PLANNING MECHANISMS

Zoning
Building Codes
Ordinances
Open Space Plan

EDUCATION & OUTREACH

Public Awareness
Outreach
Educational programs

NATURAL RESOURCE PROTECTION

Stream and wetland restoration
Erosion control

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Local Hazard Mitigation Plans

Risk MAP
Risk MAP products and Datasets

Hazard Mitigation Plan
- Uses Risk Information
- Identifies Projects/Actions
- Integrated with Other Community Plans

Other Community Plans
- Comprehensive plans
- Land Use Plans
- Capital Improvement
- Stormwater
- Management Plans
- Emergency Operations

Mitigation Actions/Projects

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Mitigation Actions

- Address specific **existing** assets (e.g., elevate critical facility, enlarge a culvert, acquisition of floodplain properties, floodproof floodproone properties)
- Address **future** risks (e.g., update building codes)
- Based on local capabilities
  - Build on current strengths, ongoing efforts (add-on to stormwater management regulations)
  - Coordinate with Federal programs (e.g., NFIP, CRS)

FEMA Funding Opportunities

- Hazard Mitigation Assistance includes both post-disaster and pre-disaster grants

HMGP is a post-disaster grant program.

PDM, FMA, RFC and SRL are available annually, subject to Congressional appropriations.

- Mitigation Plan Requirement
- Local/State Cost Share
- States Manage Programs and Set Funding Priorities
- State Hazard Mitigation Officer (SHMO) is contact

Mitigation Grants/Programs: Other Federal Agencies (OFA)

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US Army Corps of Engineers®

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Meet the Action Form

Mitigation Action Form

Contact Information

Please enter the primary contact assc

1. **Full Name:**

2. **Title and Organization :**

3. **Jurisdiction Name(s) :**

Mitigation Action Information

4. **Mitigation Activity Name**

5. **Describe the natural hazard and mitigati**

6. **Hazard Type?**

☐ *Flood* ☐ *Erosion* ☐*Storm Sur*
☐ *Landslide* ☐ *Lighting* ☐ *Seve*
☐ *Wind* ☐ *Multiple Hazards* ☐

7. **What is the Mitigation Category?**

☐ *Local Plans and Regulations*
*Category*_____

8. **How was this action/strategy identi**

☐ *Risk Map Process*
☐ *Comprehensive Land Use Plan*
☐ *Capital Improvement Plan*

9. **Who is the Responsible Agency?**

☐ *Building Code Department*
☐ *Community Development*
☐ *Emergency Management*

9. **Who is the Responsible Agency?**

☐ *Building Code Department* ☐ *Planning* *Other*_____
☐ *Community Development* ☐ *Public Works*
☐ *Emergency Management* ☐ *State DOT*

10. **What is the expected/potential funding source?**

☐ *Community* ☐ *FEMA*
☐ *Private Sector, including Foundations* ☐ *Other Federal Agency*
☐ *Regional Water Management District* ☐ *Property Owner*
☐ *County* ☐ *Other*_____
☐ *State*

11. **What is the commitment for this action?**

☐ *new* ☐ *strengthen existing* ☐ *maintain existing*

12. **What is the status of this action?**

☐ *identified* ☐ *scoped* ☐ *in progress* ☐ *complete*

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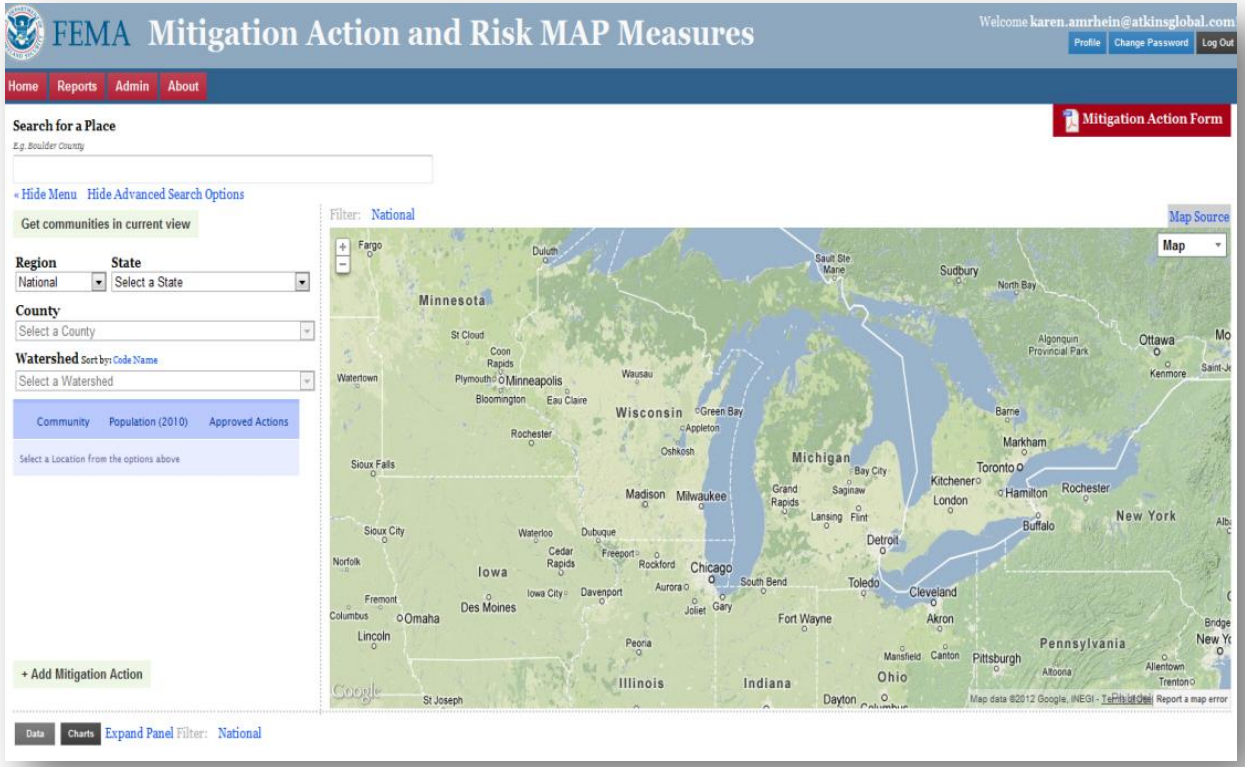
Action Tracker



- New mitigation tool
- Houses community-identified mitigation actions
- Actions can be edited by community officials
- A tool for communities to support future mitigation planning efforts

We will input your community's action into the Action Tracker and send you a report and a link - http://fema.starr-team.com

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Next Steps

- **Communities:**
  - Provide data and Mitigation Action Forms to STARR with a target date of September 28, 2012

- **STARR/FEMA will:**
  - Assess data and information provided
  - Email summary of today's Discovery Meeting to you within one month
  - Prepare final Discovery Maps and Discovery Report
  - Follow-up regarding Risk MAP Project

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Questions?

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Interactive Session

- View and Discuss Local Coastal Areas of Concern Using the Discovery Map
- Discuss Mitigation Action Opportunities and Introduce the Mitigation Action Form

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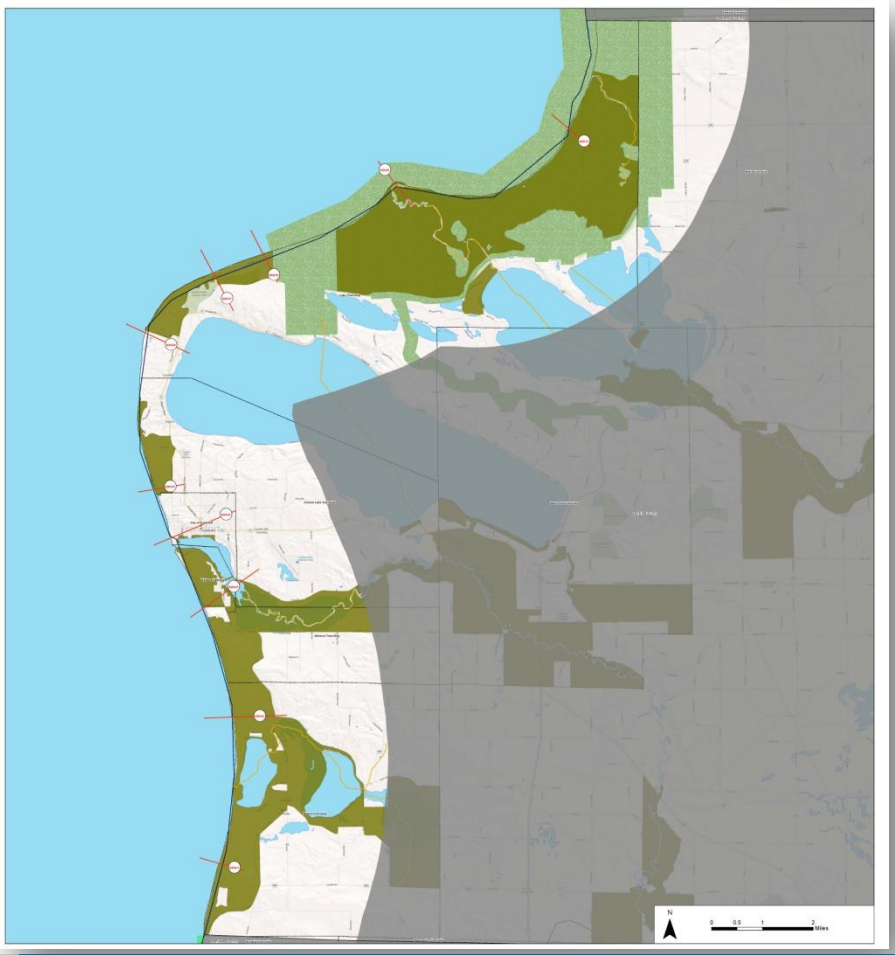
Benzie County, MI
Discovery Map



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Grand Traverse County, MI Discovery Map

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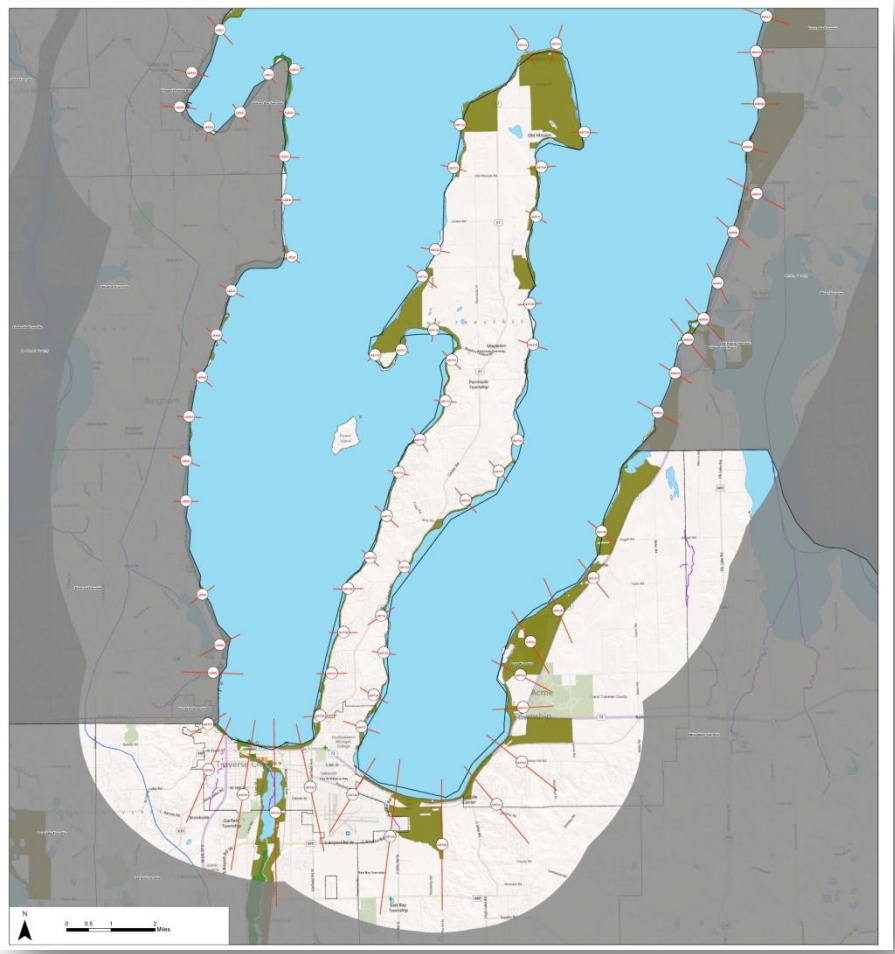

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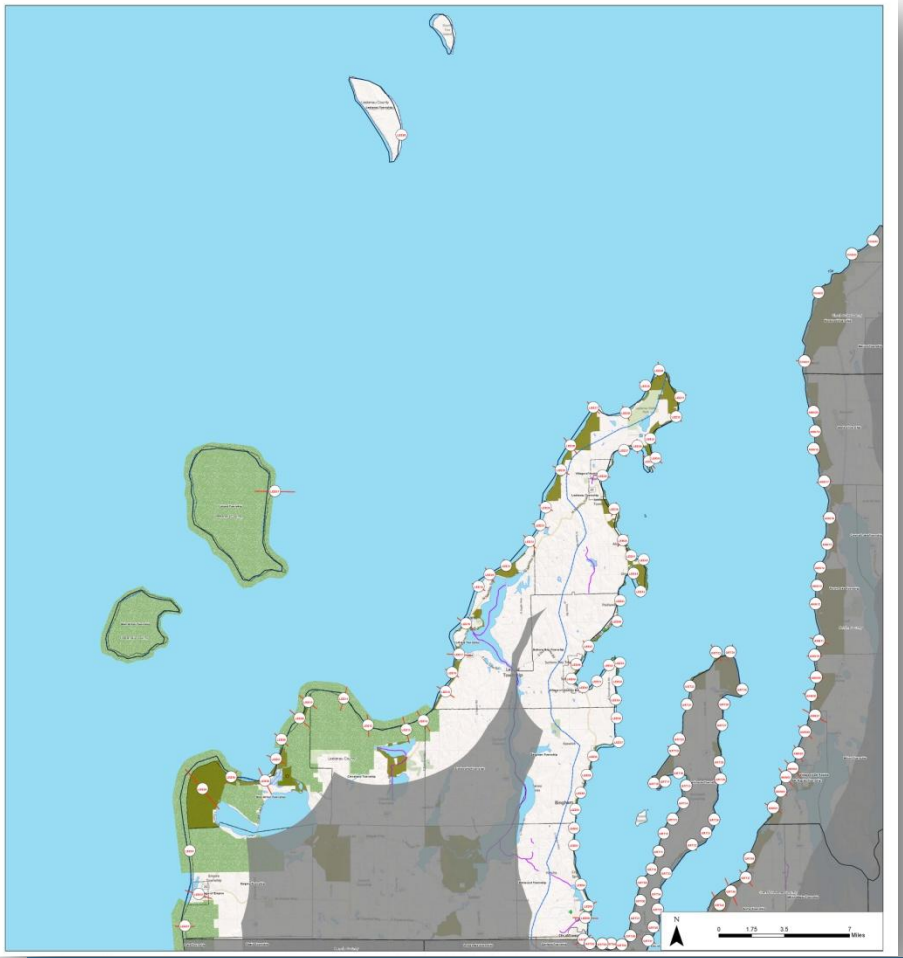
Leelanau County, MI
Discovery Map

FEMA



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Data Gaps

Do you know of any:

- Building footprints
- Coastal Structures
- Critically eroded beach areas
- Coastal construction control/setback line
- Critical Facilities (in GIS format)
- High water marks
- Areas of recent or planned development
- Areas of high growth
- Recent land changes due to development, erosion, etc.
- Known flooding issues not represented on effective FIRMs

Contact

- FEMA Region V
  - Ken Hinterlong @ ken.hinterlong@fema.dhs.gov
  - Erin Maloney @ Erin.Maloney@fema.dhs.gov
- Michigan Partners
  - Linda Burke (MDEQ) @ BURKEL4@michigan.gov
- STARR
  - Stacey Roberts (technical) @ stacey.roberts@starr-team.com
  - Holly Davis (outreach) @ holly.davis@starr-team.com
- Online
  - info@greatlakescoast.org

Optional Interactive Stations

- **Draft Transect Map Station**
  - View draft transect locations and oblique imagery in data viewer http://greatlakes.usace.army.mil/
  - Discuss draft transect locations with technical staff
- **Mitigation Resources, Strategies, and Actions Station**
  - Talk with FEMA and State representatives about areas of concern and potential mitigation actions to help reduce risk
  - Fill out Mitigation Action Form

Attachment H.

Locally Identified Mitigation Projects

Name of Plan	County	Hazard Mitigation Actions and Strategies
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage cooperation and communication between planning and emergency management officials
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage additional local governmental agencies to participate in the natural hazards mitigation process
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage public and private organizations to participate
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Create or update ordinances to reflect building codes, shoreline protection rules, etc.
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Incorporate natural hazards mitigation into basic land use regulation mechanisms
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Develop community education programs and public warning systems
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Strengthen the role of the Local Emergency Planning Committee in the land development process
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Integrate natural hazards mitigation into the capital improvement planning process so that public infrastructure does not lead to development in natural hazards areas
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage county agencies to assess local roads, bridges, dams, and related transportation infrastructure for natural hazards vulnerability
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Provide a list of desired community mitigation measures to the State for possible future funding
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage the application for project funding from diverse entities
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Encourage public and business involvement in natural hazards mitigation projects
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Mapping of flood prone areas (Blueberry Creek/Trout Pond area off of US 31 west of Honor
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Wetland protection
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Enforcement of stormwater/drainage control statutes/ordinances and other state and county ordinances – The County is working on creating a new 50 foot and 100 foot building/septic development setback for residential and commercial entities on all water bodies in The Sanitary Code and proposed as 50 to 75 feet for Crystal Lake and the Betsie River; presently only a 25 foot set back
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Enforcement of building codes
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Public education
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Promote the relocation of structures – property owner's expense or demolition
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Drainage control and placement of vegetation, utilizing native vegetation
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Enforcement of soil erosion statutes/permits – water levels rising at new construction sites; and enforcement of the grading levels no more than 10%
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Enforcement of building codes (there is building now where no one would have built before)
Benzie County Michigan 2007 Natural Hazards Mitigation Plan	Benzie County	Public Education

Name of Plan	County	Hazard Mitigation Actions and Strategies
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Encourage cooperation and communication between planning and emergency management officials
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Encourage additional local governmental agencies to participate in the natural hazards mitigation process
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Encourage public and private organizations to participate
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Enforce and/or incorporate natural hazards mitigation provisions in building code standards, ordinances, and procedures
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Create or update ordinances to reflect building codes, shoreline protection rules, etc.
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Incorporate natural hazards mitigation into basic land use regulation mechanisms
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Develop community education programs and public warning systems
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Strengthen the role of the Local Emergency Planning Committee in the land development process
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Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Provide a list of desired community mitigation measures to the State
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Encourage the application for project funding from diverse entities
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Encourage public and business involvement in natural hazards mitigation projects
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Drainage improvements in high flooding potential areas
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Continue enforcement of building codes and soil erosion regulations
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Drainage control projects
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Enforcement of soil erosion statutes/permits – water levels rising at new construction sites
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Enforcement of building codes (there is building now where no one would have built before)
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Enforcement of the grading levels no more than 10%
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Placement of vegetation and utilizing native vegetation
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Public education and awareness activities
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Work towards uniform mapping and zoning throughout the county for natural hazards mitigation
Grand Traverse County Michigan 2007 Natural Hazards Mitigation Plan	Grand Traverse County	Incorporate the Natural Hazards Mitigation Plan into the County's Master Plan and local zoning ordinances if in place.
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage cooperation and communication between planning and emergency management officials
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage additional local governmental agencies to participate in the hazard mitigation process
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage public and private organizations to participate

Name of Plan	County	Hazard Mitigation Actions and Strategies
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Enforce and/or incorporate hazard mitigation provisions in building code standards, ordinances, and procedures; and into the county's comprehensive master plan
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Create or update zoning ordinances to reflect any new building codes, shoreline protection rules, etc.
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Incorporate hazard mitigation into basic land use regulation mechanisms
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Incorporate hazard area classifications into standard zoning classifications
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Develop community education and warning systems
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Strengthen the role of the Local Emergency Planning Committee in the land development process
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Integrate hazard mitigation into the capital improvement planning process so that public infrastructure does not lead to development in hazard areas
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage county agencies to review local roads, bridges, dams, and related transportation infrastructure for hazard vulnerability
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Provide a list of desired community mitigation measures to the State for possible future funding
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage the application for project funding from diverse entities
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Encourage public and business involvement in hazard mitigation projects
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Inventory shoreline erosion sites
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	More detailed soil erosion permits: slide areas, drainage control, grading, debris flow measures, vegetation (native species) placement
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Zoning administration and enforcement of ordinances: development setbacks, lot sizes, driveways, relocation of structures, Lake Michigan coastal zoning ordinances – U.S. Army Corps of Engineers and Michigan Department of Environmental Quality
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Open space designations: acquisition or conservation easements by land conservancies, county, townships
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Public education
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Building code enforcement through permits
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Assessment of flood threat and dam inspections results
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Research a flood warning system
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Public education
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Building code enforcement
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Work with other governmental entities such as townships, villages, and the Grand Traverse Band of Ottawa and Chippewa Indians; organizations; businesses; and the public
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Develop mutual support and aid from surrounding communities

Name of Plan	County	Hazard Mitigation Actions and Strategies
Leelanau County Natural Hazards Mitigation Plan 2006	Leelanlau County	Incorporate the Plan's hazard mitigation concepts, strategies, and policies into existing elements of Leelanau General Plan