



Coastal Erosion Across the Great Lakes

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Project Overview



Project Background



Erosion Across Great
Lakes



Key Takeaways and
Discussion of

Don't Erode Away on Minnesota's North Shore




- 2 year fellowship program
- Work with CEHM on erosion mapping efforts for Minnesota
- Develop public outreach materials and engage with local stakeholders
- Seeking input on project activities and outcomes



Logic Model



| <p>Project Title: Don't Erode Away on the North Shore of Minnesota</p> | | <p>Issue: Coastal erosion threatens homes and other infrastructure, but communities lack information on where the hazards are greatest and how to respond to erosion hazards. Local government units (LGUs) are uncertain of how to respond to property owner's requesting assistance.</p> | |  OFFICE FOR COASTAL MANAGEMENT | |
|--|--|--|---|--|--|
| <p>Target Population: LGUs (which includes planning commissions and soil water conservation districts (SWCDs))</p> | | <p>Goal: Minnesota's coastal shoreline and its habitats will be protected from erosion</p> | | | |
| Inputs/Resources | Activities | Outputs | Short-Term Outcome | Mid-Term Outcome | Long-Term Outcome |
| <p>Updated aerial and Lidar imagery</p> <p>Field equipment for pilot studies</p> <p>Needs assessment to understand community interests and needs</p> | <p>Create an updated coastal erosion hazard map for the North Shore of Minnesota.</p> <p>Create tutorials for using the coastal erosion hazard map.</p> <p>Develop a workshop for LGUs about coastal erosion and the impacts of property development and land use strategies.</p> <p>Develop a property owner's guide for the North Shore.</p> | <p>Coastal erosion hazard map</p> <p>Tutorials to use hazard map</p> <p>Property owner's guide</p> <p>Workshop for LGUs</p> | <p>Local government units will be able to identify where coastal erosion hazard risks are greatest on Minnesota's coastline.</p> <p>Local government units would be aware of the costs associated with inappropriate development in coastal hazard zones to both communities and property owners.</p> <p>Local government units will know how to convey risk information about coastal hazards to their colleagues and property owners.</p> | <p>Local government units will update planning ordinances to increase minimum shoreline setbacks on Minnesota's North Shore.</p> <p>Local government units will reduce the number of granted variances on shoreline setbacks.</p> <p>Local government units will advise property owners on strategies to protect existing development (i.e., property owner's guide) and where to site future development.</p> | <p>Minnesota coastal communities will reduce development in high-risk coastal areas.</p> <p>Erosion on the Minnesota coast will be reduced.</p> <p>Coastal shoreline habitats will return to their natural conditions.</p> |

Erosion Hazard Definitions and Mapping:

- Mapping Basics:

- Multi-year data (Lidar, aerial imagery)
- Identify erosion hazard line
 - Choose features to measure from
- Calculate recession along transects

- Important Considerations:

- Legal framework
- Geology
- Level of shoreline development
- Labor and time costs
- Public input and outreach

Minnesota

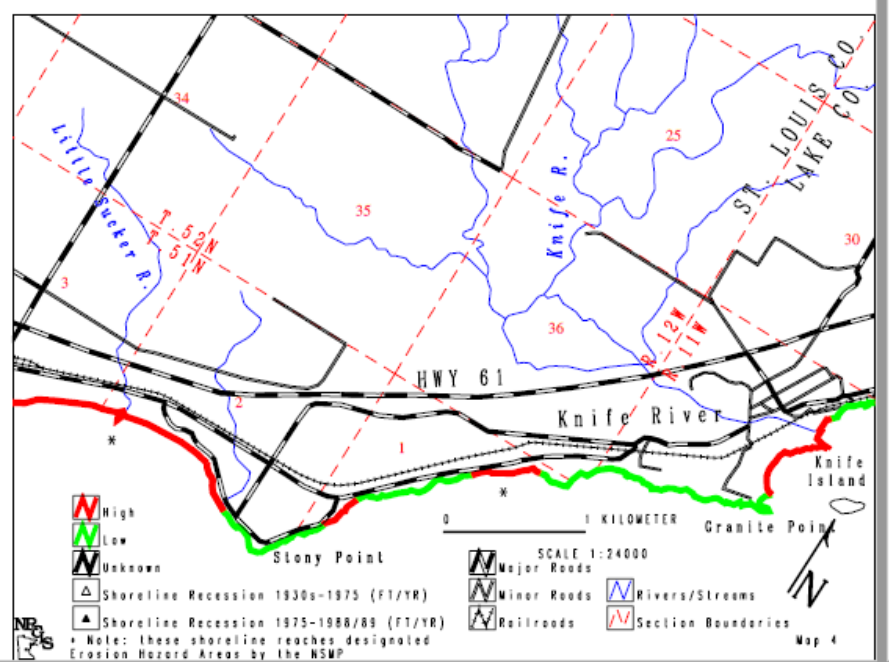
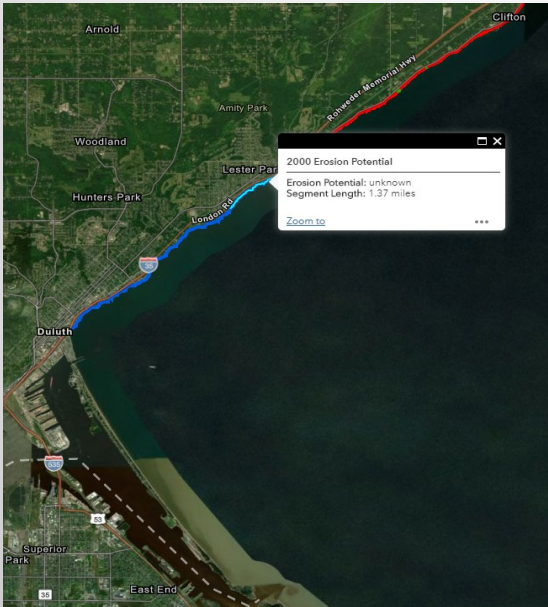
Where high water levels meet the rocky shore

Great Lake: Superior
Miles of Shoreline: 189
Geology: Bedrock with clay
High development
Mostly natural shoreline



Minnesota Mapping

- Maps created in 1989 using aerial imagery by NRRI, UMD
- Set a control line in each image and measured distance to bluff edge
- Incorporated soils and geology to assess erosion potential
- High risk was designated as 1 ft/yr



Seagrant - MN North Shore Erosion Airphoto Methods (1930's - 1975)

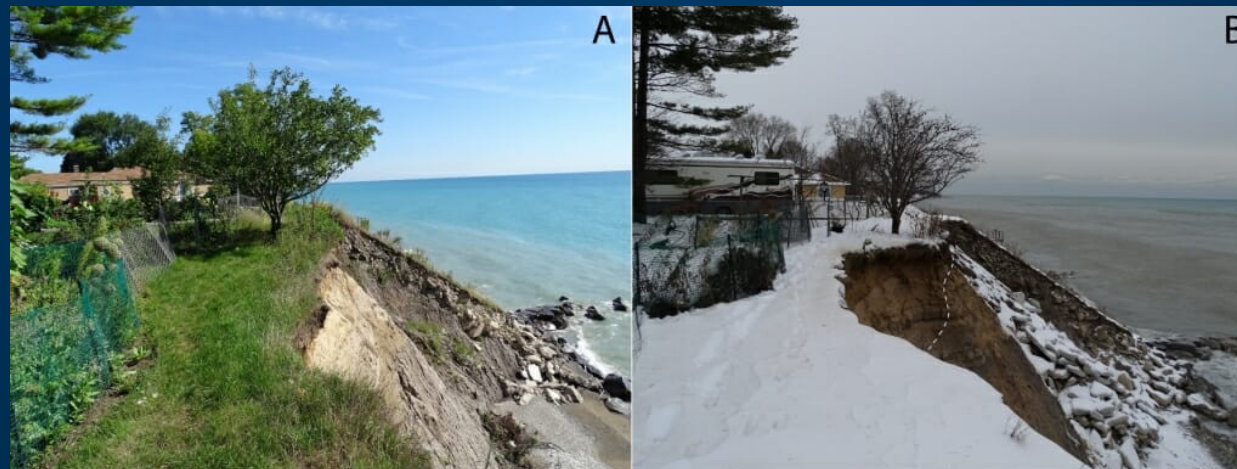
- 1) Find stereo pairs of photos for each study site and date.
- 2) For measurement purposes, use the photograph which has the site closest to the photo center. Tape clear mylar overlays to these photos.
- 3) Use the Zoom Transfer Scope (ZTS) with 4x map lens to mark all common reference points (houses, road intersections, etc.) on each photo date.
- 4) Use the ZTS to determine at least 3 points which can be identified on 1:24,000 U.S.G.S. maps to determine scale [these points must be approximately the same elevation and as close to the bluff as possible (usually Hwy. 61 and road intersections)].
- 5) Set up control lines on each photo date between control points near the bluff edge (the lines should be close to parallel with the bluff edge). A needle in a mechanical pencil is used to lightly mark the mylar. For some sites Hwy. 61 can be the control line.
- 6) Using the 1935 photo, measurement lines perpendicular to the control lines are drawn to the bluff approximately every 250 meters (about 10/site). These lines are picked subject to 2 conditions:
 - 1) The bluff edge must exist and be fairly clear on the photo.
 - 2) The bluff edge line and the measurement line must form close to a 90 deg. angle (within 25 deg. of 90 deg.).
- 7) Measurement lines are carefully transferred to the 1975 photos using the ZTS.
- 8) The measurement line lengths are measured with a Teledyne-Burley Rapid Comparator measuring instrument (300mm glass scale divided into 0.1mm increments with two 5x movable magnifying lenses for precision measurements). A Sokkisha stereoscope with 5x magnifying lenses is used to help determine the bluff edge. The glass scale is positioned on the bluff edge using the stereoscope. The stereoscope is then removed and the measurement is made using the glass scale's magnifying lenses.
- 9) Each measurement line includes a photo length in millimeters, an indication of bluff edge clarity (a level of accuracy in edge determination), and possibly a brief description of the bluff edge.
- 10) Scale differences between the photos are determined and the measurements are standardized to one scale and the differences are recorded.

The only difference between the 1930's-1975 method and the 1975-1988/9 method is in parts 5) to 7). To increase the accuracy of the measurements, no information was transferred from one photo to another. Each photo had to contain (in and of itself) the information needed to draw measurement lines. This eliminated error in transferring information and allowed for a more exact location of the starting point of a measurement line.

Great Lake: Superior, Michigan
Miles of Shoreline: 820
Geology: Sandy bluffs
Moderate development
Mostly natural shoreline

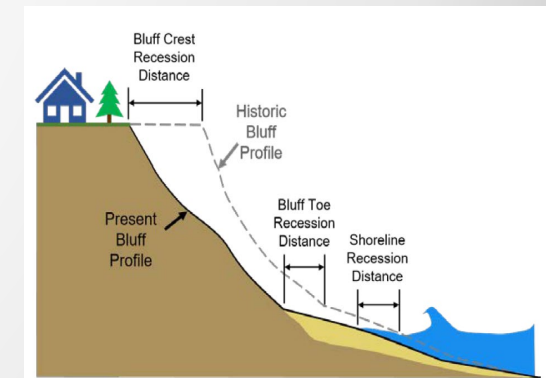
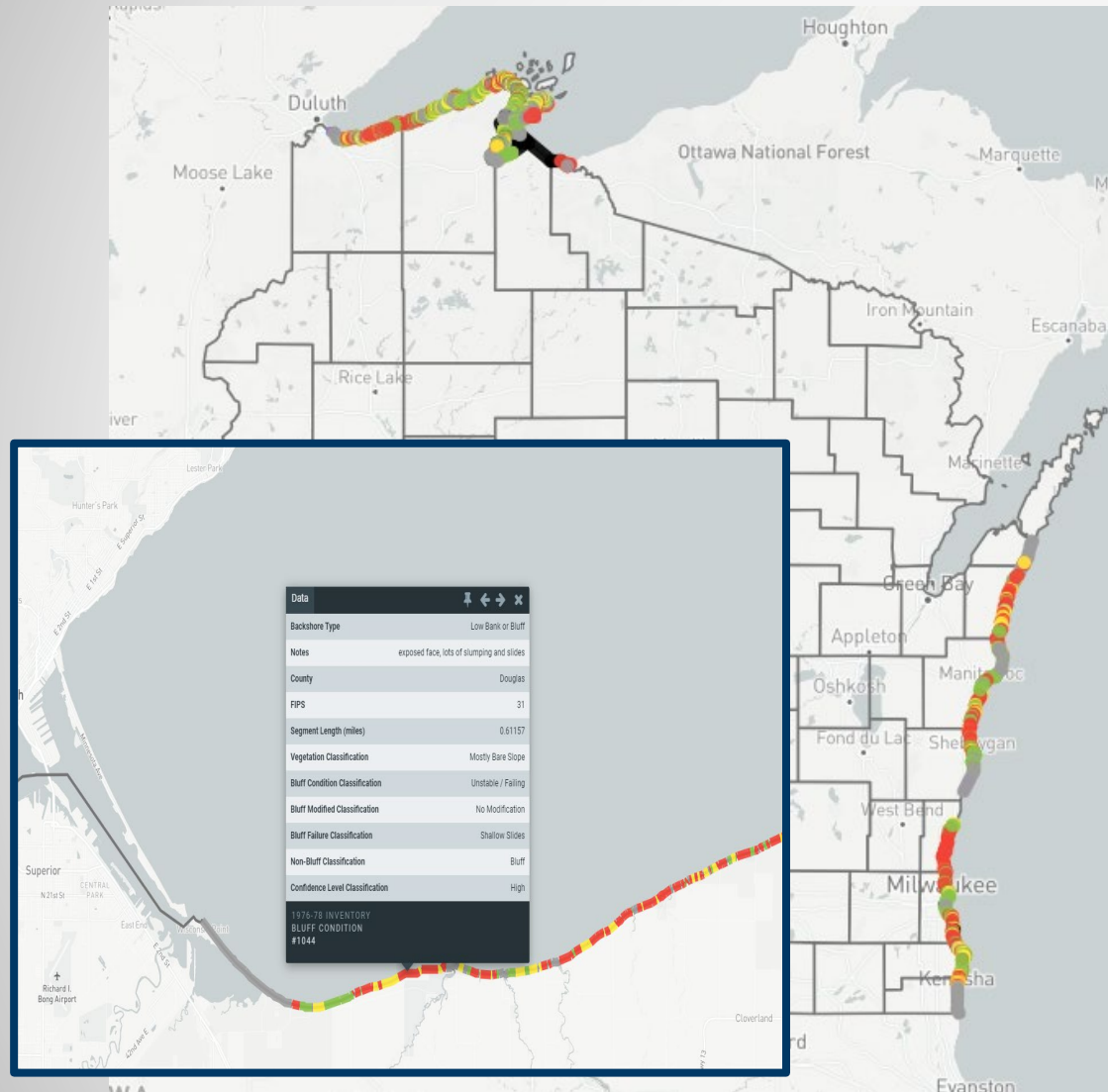
Wisconsin

Two very different coasts



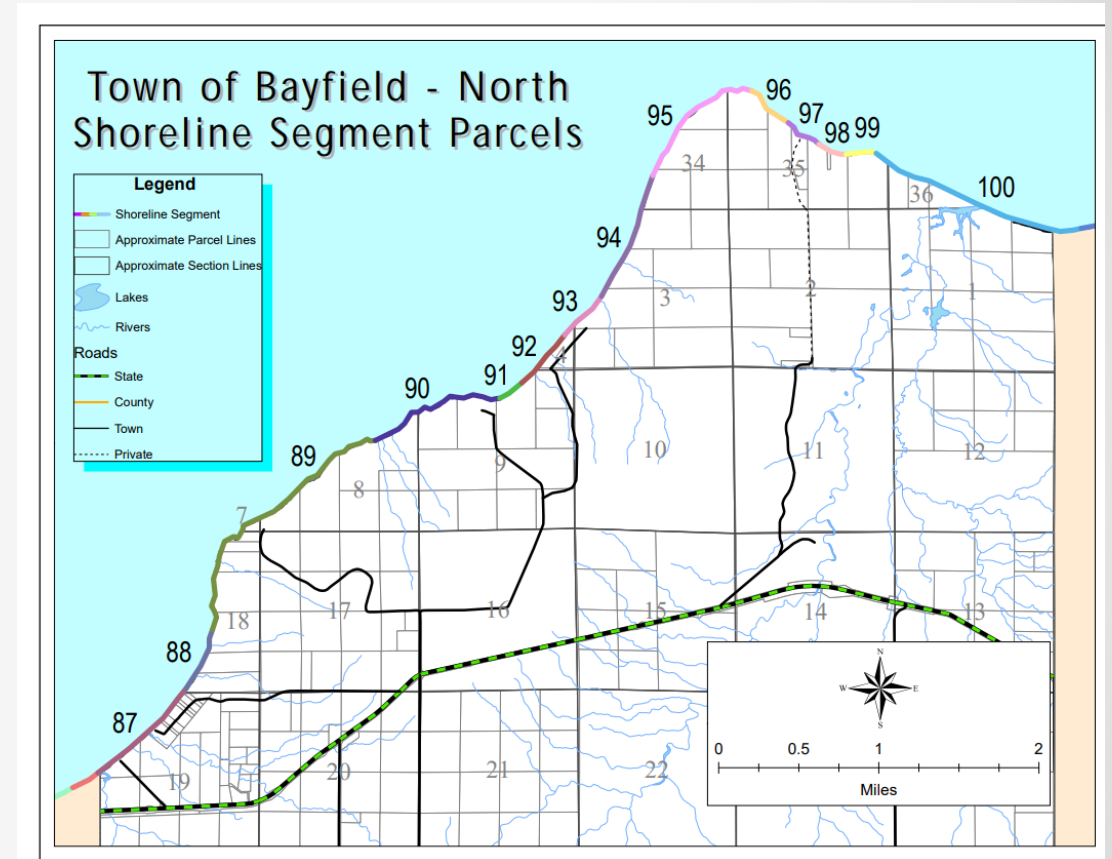
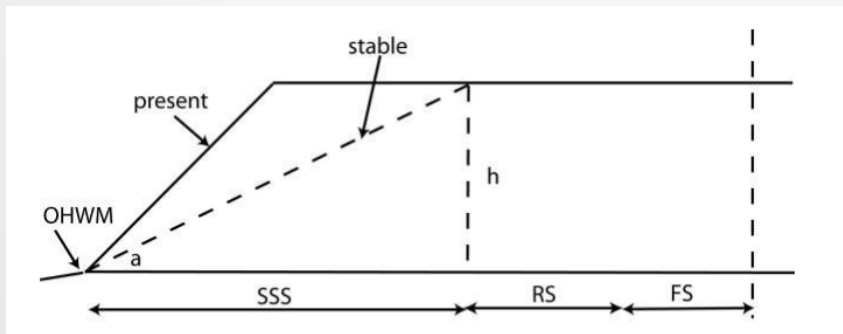
WI Erosion Mapping

- Traced feature lines on bluff crest, bluff toe or shoreline at different time frames
- Digitized the lines and used USGS Digital Shoreline Analysis Software (DSAS) to measure recession on 10 m intervals
- Provided recession distance and rate, made no determination of severity



Defensible Setbacks

- Bayfield County 2011 project:
 - High bluffs with clay and sand
 - Looking at stable angles of repose for bluffs
 - Setback from that angle
- Failed because of one objection
 - Need outreach



WI Erosion Outreach



Building resilience to coastal hazards

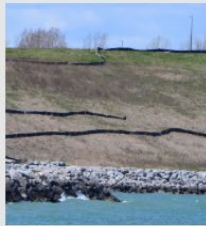
ABOUT THE PROJECT

Erosion, coastal storms and fluctuating water levels can threaten coastal properties and impair assets important to tourism and commerce. This project will provide resources and assistance to communities in Ozaukee, Milwaukee, Racine, and Kenosha Counties to plan and prepare for coastal hazards.

[LEARN MORE](#)



ASSESS AND MAP SHORELINE CHANGE



IDENTIFY LOCAL RESILIENCE OPPORTUNITIES



DEVELOP EDUCATIONAL RESOURCES ON RESILIENT COASTAL ACTIONS



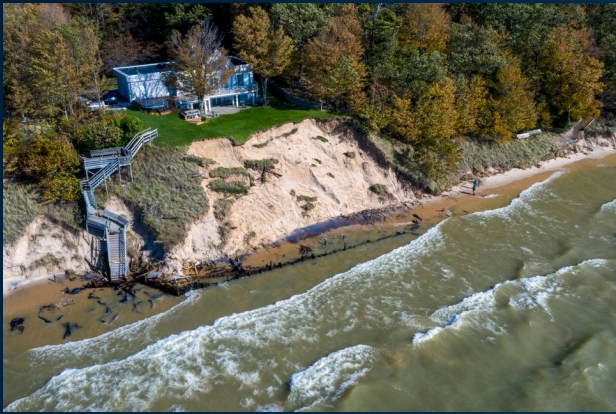
ORGANIZE A COMMUNITY OF PRACTICE FOR COASTAL RESILIENCE



OPTIONS AND RESOURCES FOR LAKE MICHIGAN PROPERTY OWNERS

Adapting to a Changing Coast

UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE



Michigan

Largest freshwater coast falling into four lakes

250 miles shoreline designated as high-risk

Great Lake: Superior, Michigan, Huron, Erie
Miles of Shoreline: 3,224
Geology: Sandy bluffs
Moderate development
Mostly natural shoreline




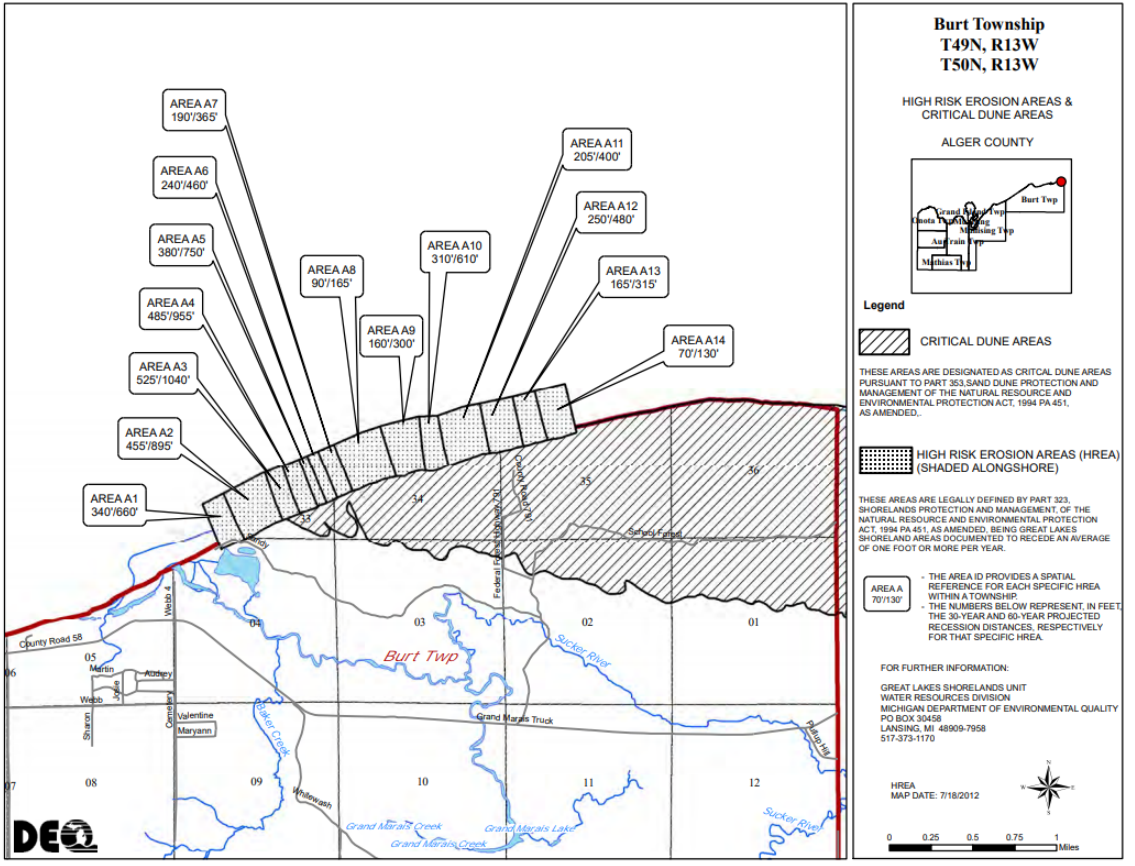
Images courtesy: [mlive.com](https://www.mlive.com)

MI HREA Maps

- State law (1994) sets mapping standards
- High risk erosion area: 1 ft/yr over 15 yrs (min)
- Maps updated by county
- 30 and 60 yr recession rates = setbacks
 - 60 yr setback example:

$(\text{Recession rate (ft/yr)} * 60 \text{ yrs}) + 15 \text{ ft}$

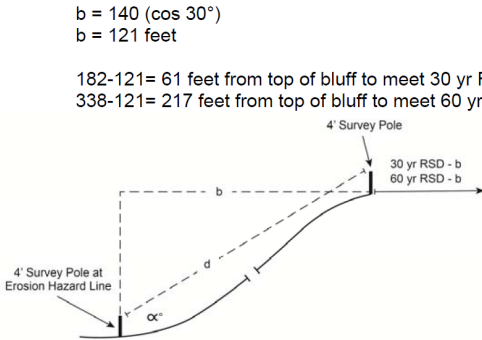
 Rapid Erosion



MI HREA Maps

- Aerial image analysis with field support
- Modern vs. historic erosion hazard line (EHL)
 - EHL: vegetation line or current erosion area
 - Transects every 150 ft
- High Risk Erosion Area: At least three transects with >1 ft/yr
- Parcel identification
 - Public meetings and comments

Example: For a high bluff with a 30° angle of the bluff face and 140 feet between the toe and top of bluff. 30-year RSD of 182 feet and 60-year RSD of 338 feet as a result of step 13.



| | Step | Substep | County Study | Individual Property Study R 281.22(c) |
|----|------|---------|--------------|---------------------------------------|
| 1 | | | | |
| 2 | 1 | a | WRD Staff | Owner/Agent |
| 3 | | b | WRD Staff | Owner/Agent |
| 4 | | c | WRD Staff | Owner/Agent |
| 5 | | d | WRD Staff | Owner/Agent |
| 6 | | e | WRD Staff | Owner/Agent |
| 7 | 2 | a | WRD Staff | Owner/Agent |
| 8 | | b | WRD Staff | Owner/Agent |
| 9 | | c | WRD Staff | Owner/Agent |
| 10 | | d | WRD Staff | Owner/Agent |
| 11 | | e | na | Owner/Agent |
| 12 | | f | na | WRD Staff |
| 13 | 3 | a | WRD Staff | WRD Staff |
| 14 | | b | WRD Staff | WRD Staff |
| 15 | 4 | a | WRD Staff | WRD Staff |
| 16 | | b | WRD Staff | WRD Staff |
| 17 | | c | WRD Staff | WRD Staff |
| 18 | 5 | a | WRD Staff | WRD Staff |
| 19 | | b | WRD Staff | WRD Staff |
| 20 | | c | WRD Staff | WRD Staff |
| 21 | | d | WRD Staff | WRD Staff |
| 22 | | e | WRD Staff | WRD Staff |
| 23 | | f | WRD Staff | WRD Staff |
| 24 | 6 | a | WRD Staff | na |
| 25 | | b | WRD Staff | na |
| 26 | | c | WRD Staff | na |
| 27 | | d | WRD Staff | na |
| 28 | | e | WRD Staff | na |
| 29 | | f | WRD Staff | na |
| 30 | | g | WRD Staff | na |
| 31 | | h | WRD Staff | na |
| 32 | | i | WRD Staff | na |
| 33 | 7 | a | WRD Staff | WRD Staff |
| 34 | | b | WRD Staff | WRD Staff |
| 35 | | c | WRD Staff | WRD Staff |
| 36 | | d | WRD Staff | WRD Staff |
| 37 | | e | WRD Staff | na |
| 38 | | f | WRD Staff | WRD Staff |
| 39 | | g | WRD Staff | na |
| 40 | | h | WRD Staff | WRD Staff |
| 41 | | | | |
| 42 | | | | |
| 43 | | | | |

GREAT LAKES SHORELINE EROSION

Shorelands Protection and Management: High risk erosion areas on Lakes Huron, Michigan and Superior

WHAT CAUSES EROSION?

Erosion is the wearing away of the shoreline by forces moving sand and soil from one area to another. Waves, water levels, rain, wind, groundwater, frost and people all contribute to eroding shorelines.

WHAT ARE HIGH RISK EROSION AREAS?

The Great Lakes shoreline is an actively eroding coast. Some shorelines erode more quickly than others. These are high risk erosion areas (HREAs). The HREAs are eroding at an average rate of one foot or greater per year over at least 15 years. The Michigan Department of Environmental Quality (MDEQ) studies the shoreline to identify HREAs. The law* tells MDEQ how to conduct the studies of the shoreline.

Building a structure too close to the edge of the bluff puts it at risk of falling into the lake. Planned development and construction in a HREA helps to prevent the loss of structures. Locating structures safely back from the bluff may also reduce the need for engineered shore protection. Less shore protection promotes natural shorelines for you, your neighbors, and wildlife.

HOW ARE HREAS DETERMINED?

The MDEQ compares the shorelines on historic and current aerial photos one county at a time. They measure the distance between the old shoreline and current shoreline. Then they calculate the rate (feet/year) the shoreline moved. Using this information, the MDEQ calculates the recession distances for the shoreline. Often the recession distances are also the setbacks for proposed buildings and septic systems. The MDEQ notifies those property owners with high rates of erosion on their property. Property owners may comment on the proposed recession distances before the HREA is designated.

WHAT IF I WANT TO BUILD IN A HIGH RISK EROSION AREA?

You will need a permit for construction in an HREA depending on the project. Even if the building or septic system is behind the setbacks on your property, you will need a permit. Contact the MDEQ for more information. You may also need a permit from the United States Army Corps of Engineers (USACE).

WHAT KINDS OF CONSTRUCTION PROJECTS REQUIRE A PERMIT?

- Construction of a house, addition, garage, outbuilding, or other structure.
- The installation or upgrade of a septic system or commercial building.
- Significant reconstruction or restoration of an existing home.

If there is a question about whether your project needs a permit, contact your local MDEQ office.

FAST FACTS

- Erosion is a natural shoreline process
- Michigan has over 3,300 miles of Great Lakes coastline
- Shoreline erosion rates may be as high as 17 feet per year



MI Erosion Outreach

- EGLE HREA permits



Illinois

Great Lake: Michigan
Miles of Shoreline: 63
Geology: Sandy beaches
Extremely Developed
Heavily modified shoreline

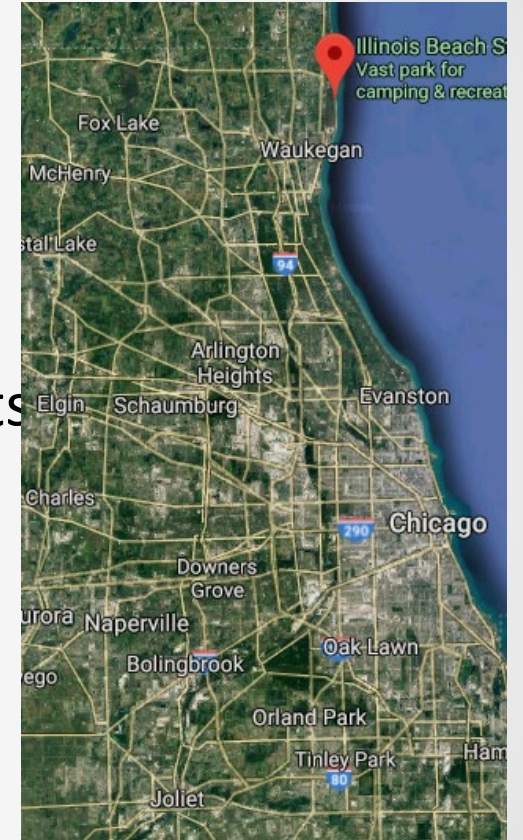
If you want natural shoreline, go to Indiana



Image courtesy: IL DNR

IL focuses on sand management

- Only natural shoreline is Illinois Beach State Park
 - Ongoing research by USACE on this shoreline
- No recession mapping projects
- Sand Management WG focusing on sand depth measurements
 - Current progress unknown





Or do they?

A banner image with a blue sky and a dark silhouette of a dune on the left. The text "WHERE IS THE BEACH GOING?" is written in white capital letters across the top right.

Illinois Natural History Survey Prairie Research Institute University of Illinois

[Illinois Beach](#)

- [Ancestral Lake Michigan](#)
- [Dead River](#)
- [Dune Formation](#)
- [Erosion](#)
- [Blowouts](#)
- [Succession](#)
- [Rear Dunes](#)
- [Swales](#)
- [Prairie](#)
- [Black Oak Savanna](#)
- [Wetlands](#)
- [Sand Pond](#)
- [Threats to Lake Michigan](#)
- [Exotic Species](#)
- [Lake Michigan Fisheries](#)

Over thousands of years, waves have pushed sand from southern Wisconsin, grain by grain to the shores of Illinois Beach. However, little sand now comes from Wisconsin due to beach protection measures and harbor jetties that divert sand into deep water. Waves continue to move sand southward, but because there is little replenishment from Wisconsin, the remaining beach deposits in Illinois are eroding, endangering structures and wildlife habitat.

Sand is periodically dredged from Waukegan Harbor and brought back to the North Unit to replenish and protect the beach. Without this intervention, Lake Michigan will continue to erode the shoreline, threatening the delicate ecosystems of the park.

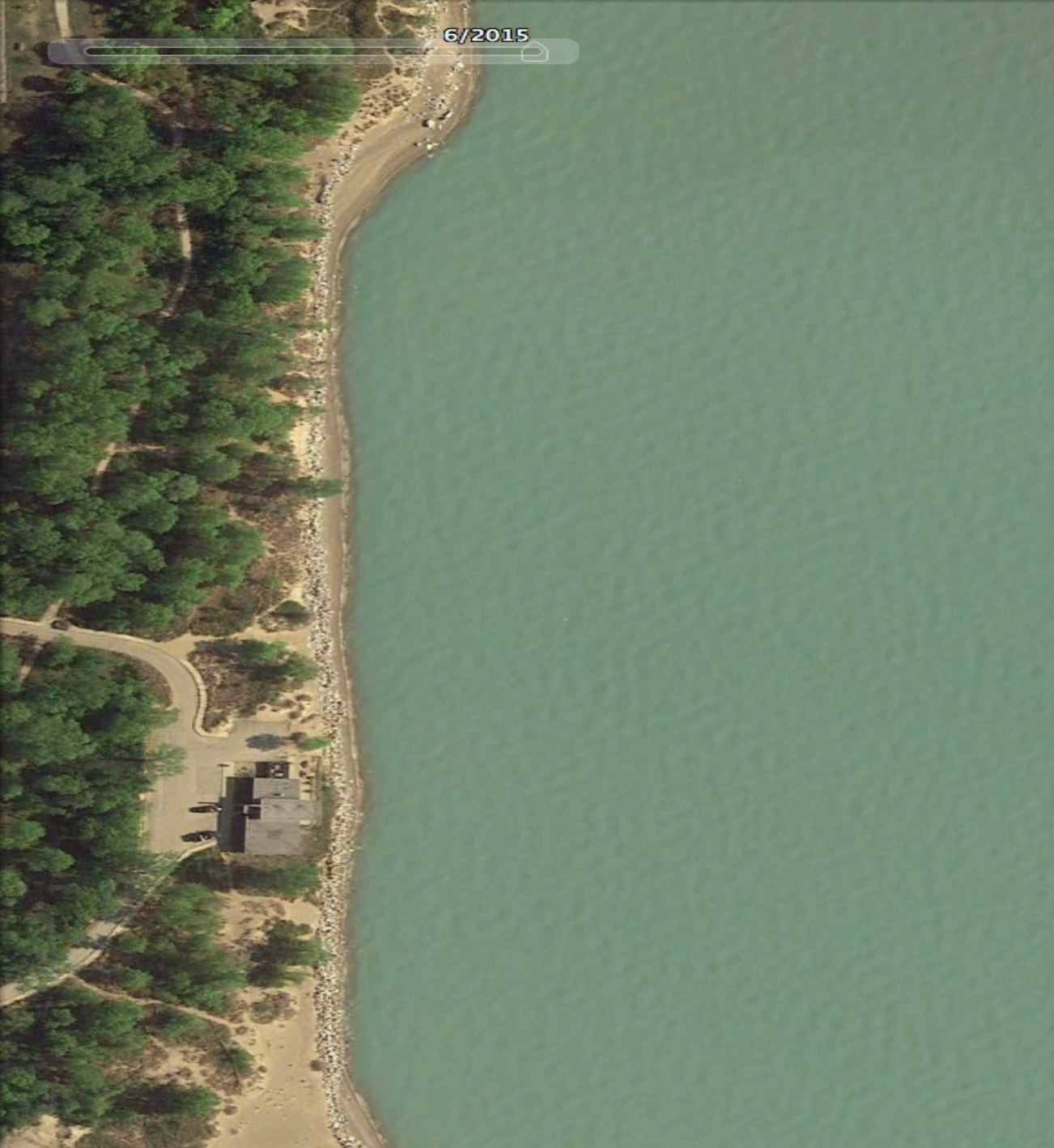
At left, see the shoreline at the Illinois Beach State Park office recede from 2010 to 2015.

An aerial photograph showing a narrow strip of land between a forested area and a body of water. A small building is visible on the land. A vertical line indicates the shoreline's position in 2010, and a shorter vertical line indicates its position in 2015, showing a significant recession.

5/2010



6/2015



Great Lake: Michigan
Miles of Shoreline: 45
Geology: Sandy beaches & dunes
Moderate Development
Mostly natural shoreline

Indiana

Children fall into our shoreline



Image courtesy: Indiana National Dunes Lakeshore

IN nourishes beaches

- Indiana has no erosion mapping program
 - No shoreline setbacks
 - Focus is on beach nourishment

Great Lake: Erie
Miles of Shoreline: 312
Geology: Sandy beaches & bluffs
Very Developed
Modified shorelines

Ohio

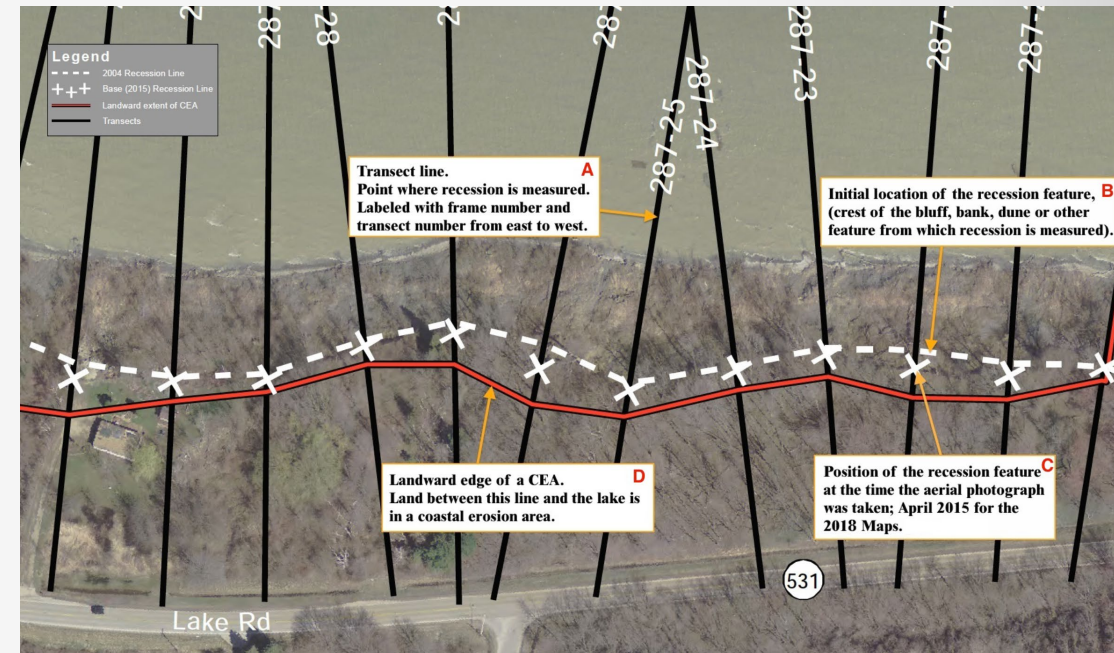
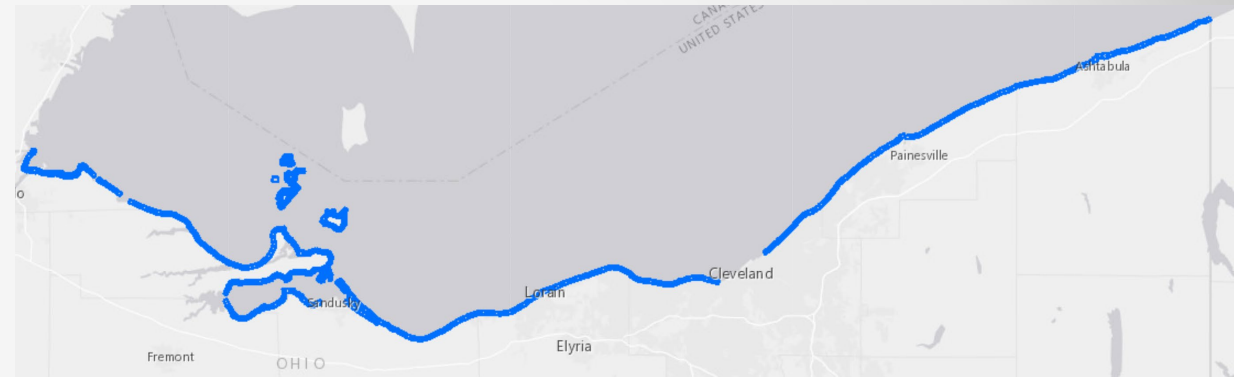
Green and loving it



Image courtesy: The Toledo Blade

Lake Erie Erosion Maps

- Newest maps from 2018
- Combined aerial imagery with Lidar data
- Set natural features as erosion hazard line
- Transect every 100 ft = ~14,000 (takes 2 ½ yrs)
- Public comment and appeals period
- Setbacks determined by shoreline protection



OH Outreach Focused on Property Protection

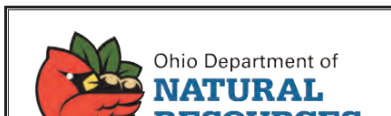
- Required POS disclosure
- Coastal Erosion Area Permits
- Coastal Erosion Loan Program
- 3 engineers on staff

Coastal Guidance

for construction or development along Ohio's Lake Erie shore

Contents

- Coastal Regulations (Sheet No. 1)
- Shore Structure Permits (Sheet No. 2)
- Temporary Shore Structure Permits (Sheet No. 3)
- Submerged Lands Leases (Sheet No. 4)
- Local Resolution or Ordinance (Sheet No. 5)
- Coastal Erosion Area Permits (Sheet No. 6)
- Federal Consistency (Sheet No. 7)



Coastal Guidance Sheet No. 1

Coastal Regulations



Lakefront property owners may be interested in improving their property through construction or development along the shore of Lake Erie. However, such construction and development activities can impact fishing, swimming, boating, beaches, property values, habitat and other aspects of Lake Erie that make the coast a prized natural resource. For this reason, various federal, state and local regulations require property owners to obtain authorization before construction activities take place along the Lake Erie shore. This guidance sheet summarizes the most common coastal regulations and how they apply to construction activities and lakefront property.

Federal Regulations

Under Section 404 of the Clean Water Act [www.epa.gov/cwa-404/clean-water-act-section-404] and Section 10 of the Rivers and Harbors Act of 1899 [www.epa.gov/cwa-404/section-10-rivers-and-harbors-appropriation-act-1899], a permit from the U.S. Army Corps of Engineers may be required for the construction, excavation, or deposition of materials in, over or under navigable waters of the United States, and for the discharge of dredged or fill material into the waters of the United States, including certain wetlands. Information about USACE permits can be found online at [www.lrb.usace.army.mil/Missions/Regulatory] or by contacting a Corps office:

Property Address _____

I) UNDERGROUND STORAGE TANKS/WELLS: Do you know of any underground storage tanks (existing or removed), oil or natural gas wells (plugged or unplugged), or abandoned water wells on the property? Yes No

If "Yes", please describe: _____

Do you know of any oil, gas, or other mineral right leases on the property? Yes No

Purchaser should exercise whatever due diligence purchaser deems necessary with respect to oil, gas, and other mineral rights. Information may be obtained from records contained within the recorder's office in the county where the property is located.

J) FLOOD PLAIN/LAKE ERIE COASTAL EROSION AREA:

Is the property located in a designated flood plain?

Yes No Unknown

Is the property or any portion of the property included in a Lake Erie Coastal Erosion Area?

K) DRAINAGE/EROSION: Do you know of any previous or current flooding, drainage, settling or grading or erosion problems affecting the property? Yes No

If "Yes", please describe and indicate any repairs, modifications or alterations to the property or other attempts to control any problems (but not longer than the past 5 years): _____

Great Lake: Erie
Miles of Shoreline: 77
Geology: Glacial deposits, bluffs
Moderate Development
Mostly natural shoreline

Pennsylvania

Small but mighty (and cold)



Image courtesy: PA Sea Grant

PA In-Situ Erosion Measurements

- ~130 stationary in-land control points
 - Utility pole, rebar, etc.
 - Started in 1975, with most points established in 1980s
- Measure from control point to bluff crest (4-5 yrs)
- Recession rate is calculated based on movement from control point/time between measurements
- Bluff Recession Hazard Areas (BRHA) requires study, public comments
- **Setbacks established by local municipalities**

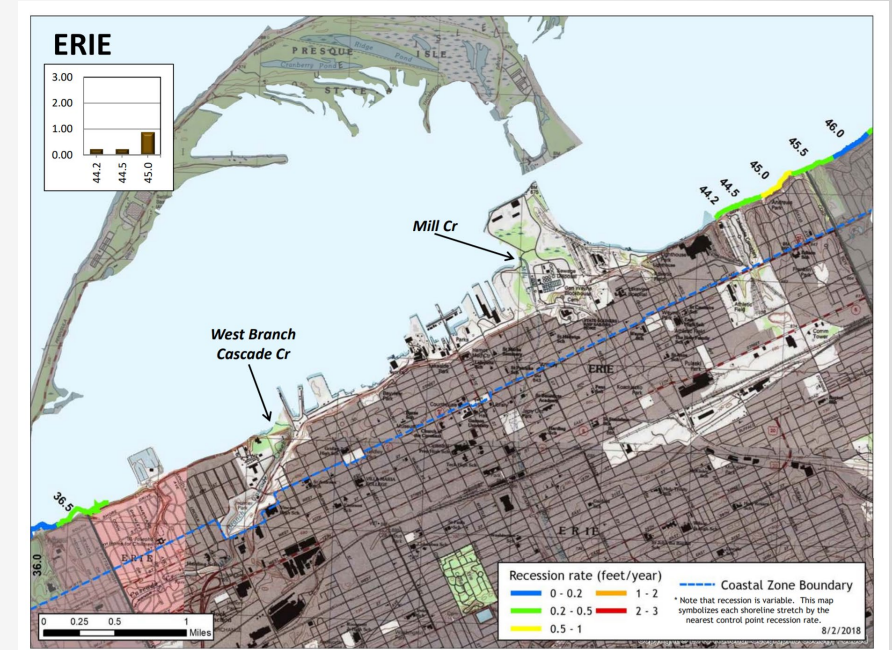


Table 1: Municipal* Minimum Bluff Setback Distances (MBSD) and Bluff Recession Hazard Areas (BRHA)

| Municipality | Residential MBSD | Commercial MBSD | Industrial** MBSD | BRHA*** |
|--------------------|------------------|-----------------|-------------------|---------|
| Springfield Twp. | 100 | 150 | 200 | 200 |
| Girard Twp. | 200 | 200 | 200 | 200 |
| Lake City Boro. | 150 | 150 | 150 | 150 |
| Fairview Twp. | 100 | 100 | 100 | 100 |
| Millcreek Twp. | 50 | 75 | 100 | 100 |
| City of Erie | 25 | 25 | 25 | 25 |
| Lawrence Park Twp. | 75 | 75 | 100 | 100 |
| Harborcreek Twp. | 50 | 75 | 100 | 100 |
| North East Twp. | 50 | 75 | 100 | 100 |

*Municipal-enacted MBSDs are shown in Table 1 and may be more stringent than those appearing in the Chapter 85 regulations. Municipal-enacted MBSDs are subject to change. Please confirm the MBSD by consulting the most recent municipal ordinances.

Great Lake: Erie, Ontario
Miles of Shoreline: 418
Geology: Clay/silt bluffs
Highly Development
Modified shoreline

New York

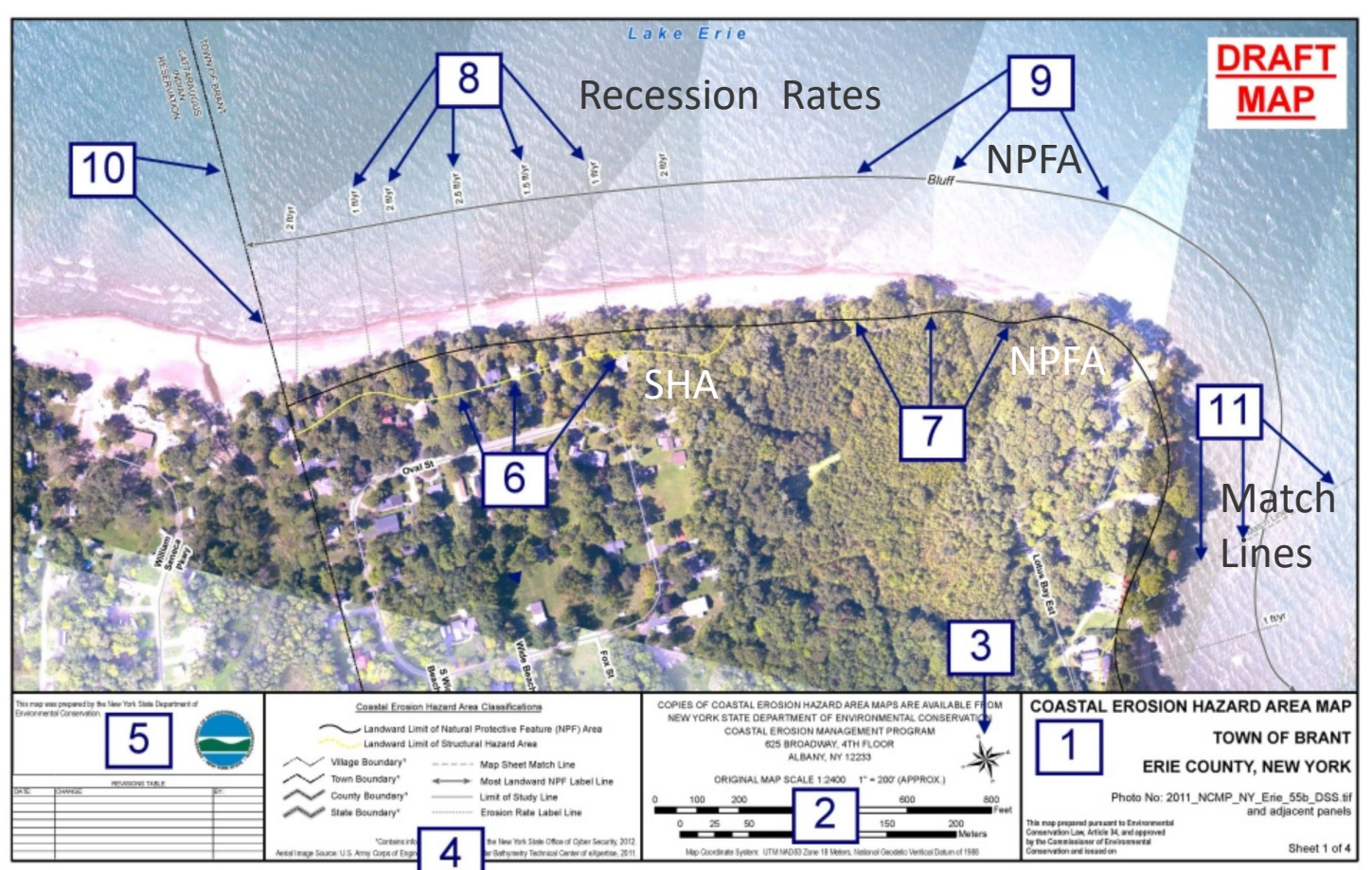
Suing the IJC, because its someone's fault



Image courtesy: Eos

NY Erosion Mapping

- Last map in the 1980s, update ongoing
- Datasets:
 - Aerial and oblique imagery
 - Lidar
- Natural Protected Features Areas
 - Beaches, dunes, bluffs
 - Supporting field work
- Structural Hazard Areas (SHAs): > 1ft/yr
 - Setback: Rounded rate * 40 ft
- Public comments & appeals



Examples of Structural Hazard Area (SHA) Calculations

| Calculated Erosion Rate (feet/year) | Rounded Erosion Rate (feet/year) | Approximate Setback from the NPFA Line (feet) |
|-------------------------------------|----------------------------------|---|
| 0.9 | NA | 0 |
| 1.2 | 1.0 | 40 |
| 1.6 | 1.5 | 60 |
| 1.9 | 2.0 | 80 |
| 2.3 | 2.5 | 100 |

NY Outreach to Homeowners

- CEHA permit program



WHAT IS COASTAL EROSION?

Coastal erosion is the endless reshaping of shorelines by waves, currents, tides, storms, ice, rain and groundwater seepage. Human activities, like construction, dredging, excavation and vegetation removal, can accelerate erosion of beaches, dunes and bluffs. This reduces the natural protection these features provide against flooding and property damage.

Where Can I Find More Information?

Go to dec.ny.gov/lands/28923.html for additional information on Coastal Erosion Management (CEM).
Go to www.dec.ny.gov/permits/6064.html for additional information on CEM Permits.

If the website doesn't answer your questions or you have difficulty with internet access, call **518-402-8185** for help.

Coastal Erosion Hazard Areas and the Coastal Erosion Management Permit Program:

A GUIDE FOR HOMEOWNERS

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Key Takeaways

Build off the rigorous methodologies of Ohio, Michigan, New York

Choose a defensible erosion hazard line on geomorphology

Use USGS DSAS for recession calculations

Back up map with field work?

Seek public input on map

Choose a defensible life span for structures and setbacks

Public policy changes: State programs, Setbacks, Permits, POS disclosures

Need more outreach and support for property owners

Thank You!

Melanie Perello

melanie.perello@state.mn.us

218-834-1404



500 Lafayette Road
St. Paul, MN 55155-4040
888-646-6367 or 651-296-6157
mndnr.gov

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Next Steps:


- Needs Assessment:

- Define target populations
 - LGUs, Property Owners, Realtors
- Determine information needs
 - Jurisdictions and permitting
- Identify best outreach tools and timing


- Project Design

- My project vs. ARDC-led efforts
- What data to use
- Best methodology

Logic Model

| <p>Project Title: Don't Erode Away on the North Shore of Minnesota</p> | | <p>Issue: Amidst rising lake levels, erosion threatens private properties along the Superior shoreline. Despite the evident dangers, new property buyers are purchasing homes that are endangered and/or land that is unsuitable for further development. Minnesota has no required point of sale disclosure of erosion hazards and/or failing shoreline protection structures.</p> | | |  <p>OFFICE FOR COASTAL MANAGEMENT</p> |
|--|---|---|---|---|---|
| <p>Target Population: Coastal realtors (and indirectly, prospective property owners)</p> | | <p>Goal: Protect coastal Minnesota from erosion.</p> | | | |
| Inputs/Resources | Activities | Outputs | Short-Term Outcome | Mid-Term Outcome | Long-Term Outcome |
| <p>Updated aerial and Lidar imagery</p> <p>Field equipment for pilot studies</p> <p>Needs assessment to understand community interests and needs</p> <p>Outreach professional support</p> <p>Funds for material development, field studies, etc.</p> | <p>Create an updated coastal erosion hazard map for the North Shore of Minnesota.</p> <p>Create tutorials for using the coastal erosion hazard map.</p> <p>Develop a workshop for realtors about the drivers of erosion, the new hazard map (and other relevant floodplain and wetland mapping), and shoreline protections</p> <p>Develop a property owner's guide for the North Shore.</p> | <p>Coastal erosion hazard map</p> <p>Tutorials to use hazard map</p> <p>Property owner's guide</p> <p>Workshop and related training materials</p> | <p>Realtors will know:</p> <ul style="list-style-type: none"> - Drivers of erosion - Property management to reduce erosion - How shoreline setbacks protect properties - Shoreline protection options <p>Realtors will be able to identify:</p> <ul style="list-style-type: none"> - Erosion hazard areas - Floodplains - Wetlands <p>Realtors will know how to advise prospective property owners about coastal erosion hazards and relevant resources and programs when viewing coastal properties</p> | <p>Realtors will advise prospective sellers about coastal erosion hazards and recommend possible mitigation solutions before listing.</p> <p>Realtors will advise prospective buyers about the location of coastal erosion hazards (as well as floodplain and wetlands) and provide them with the property owner's guide on coastal properties.</p> | <p>Buyers will avoid purchasing properties in high risk areas, resulting in changes in development patterns.</p> <p>New property owners will be aware of coastal hazards and have access to information to make informed decisions.</p> <p>Erosion on the coast will be reduced, protecting coastal habitats and water quality.</p> |

Logic Model

| <p>Project Title: Don't Erode Away on the North Shore of Minnesota</p> | | <p>Issue: Rising lake levels have accelerated natural erosion processes and are compounded with poor land management decisions. Property owners are facing potentially disastrous consequences, but are uncertain of the right actions to take. When they turn to LGUs for advice, many find that they are given either no assistance or receive limited information and no follow-up support.</p> | | |  <p>OFFICE FOR COASTAL MANAGEMENT</p> |
|--|---|--|--|--|---|
| <p>Target Population: Shoreline property owners</p> | | <p>Goal: Protect coastal Minnesota from erosion.</p> | | | |
| Inputs/Resources | Activities | Outputs | Short-Term Outcome | Mid-Term Outcome | Long-Term Outcome |
| <p>Updated aerial and Lidar imagery</p> <p>Field equipment for pilot studies</p> <p>Needs assessment to understand community interests and needs</p> <p>Outreach professional support</p> <p>Funds for material development, field studies, etc.</p> | <p>Create an updated coastal erosion hazard map for the North Shore of Minnesota.</p> <p>Create tutorials for using the coastal erosion hazard map.</p> <p>Develop a public presentation for property owners about the drivers of erosion, the new hazard map, and how they can address/mitigate erosion on their properties</p> <p>Develop a property owner's guide for the North Shore.</p> | <p>Coastal erosion hazard map</p> <p>Tutorials to use hazard map</p> <p>Property owner's guide</p> <p>Presentation and related handout materials</p> | <p>Property owners will know:</p> <ul style="list-style-type: none"> - Drivers of erosion - How their actions can increase erosion on their property - How shoreline setbacks protect property - Importance of protecting shoreline habitats - Options for shoreline protection - Available resources <p>Property owners will understand the costs and benefits of different shoreline protection methods and be able to identify which method is best for their property.</p> | <p>Property owners will alter their lawn and shoreline management to reduce erosion risks.</p> <p>Property owners will include erosion considerations in plans for new developments.</p> | <p>Communities will reduce development in high-risk coastal areas on Minnesota's North Shore.</p> <p>Erosion on the coast will be reduced, protecting coastal habitats and water quality.</p> |

Windows window header with standard minimize, maximize, and close buttons.

Microsoft Teams interface showing a conversation list on the left sidebar. The list includes:

- A header with a person icon and a plus sign.
- A horizontal separator line.
- A message bar with a light blue background and a timestamp of 11:59 AM.
- A message bar with a light blue background and a timestamp of 12:02 PM.
- A message bar with a light blue background and a timestamp of 12:03 PM.

Windows window header with standard minimize, maximize, and close buttons.

Microsoft Teams interface showing a conversation window for "Perello, Melanie (DNR)".

- Header: Perello, Melanie (DNR) Share
- Content area: A large, mostly blank white space, possibly containing a redacted image or a large text block.
- Vertical scrollbar on the right side of the content area.