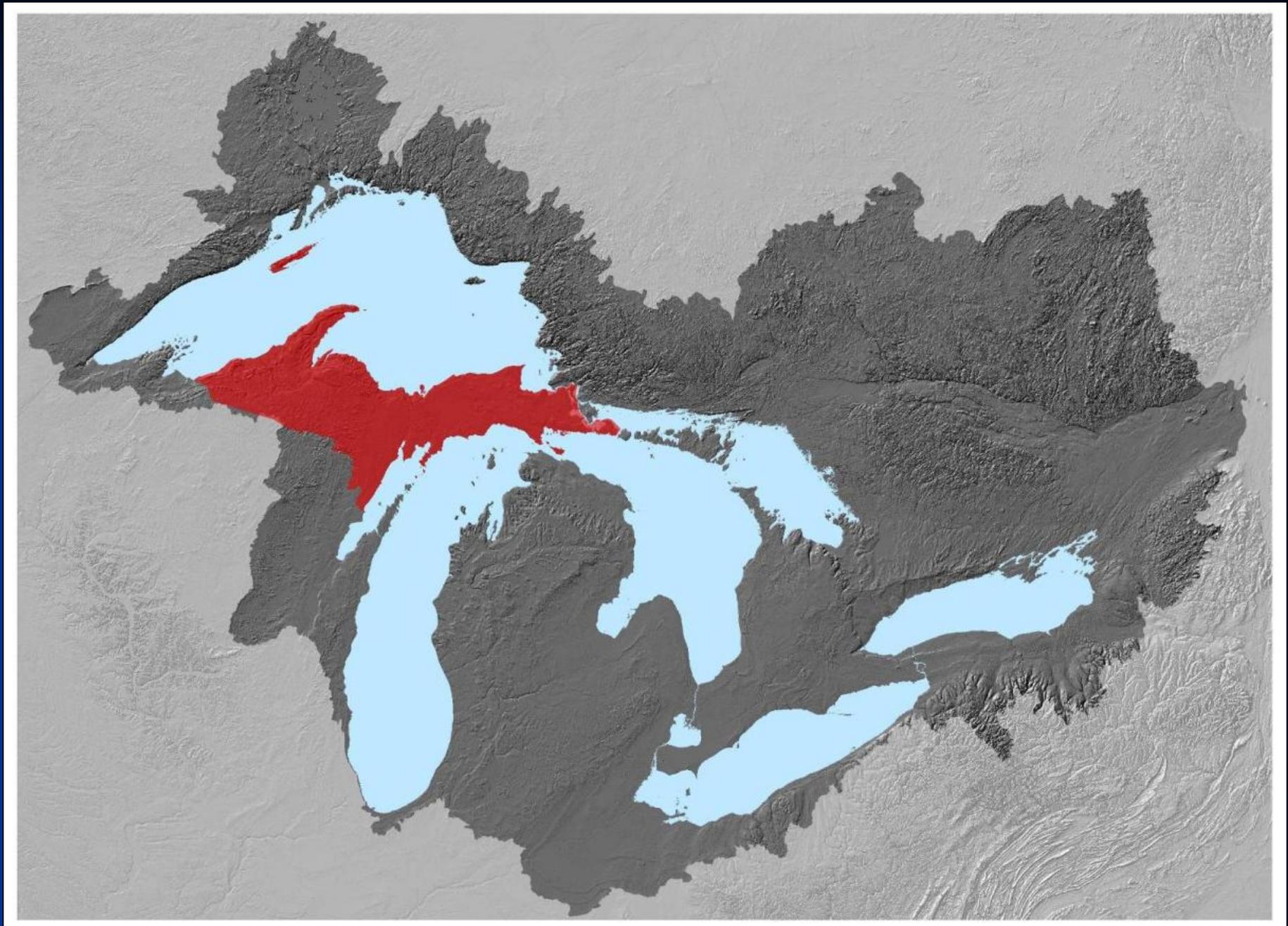




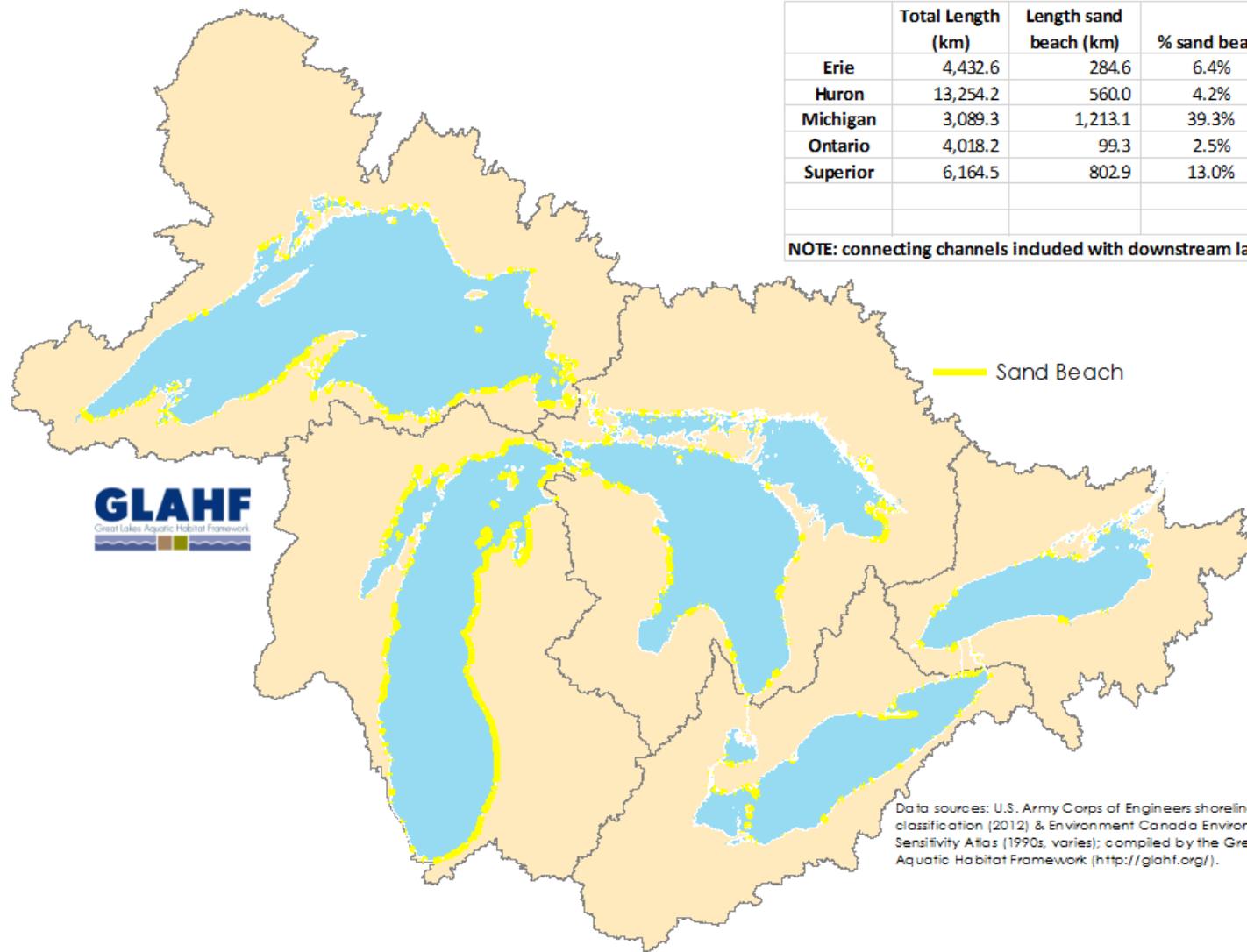
SUPERIOR  
WATERSHED  
PARTNERSHIP







© GreatLakesPhotography.net



	Total Length (km)	Length sand beach (km)	% sand beach
Erie	4,432.6	284.6	6.4%
Huron	13,254.2	560.0	4.2%
Michigan	3,089.3	1,213.1	39.3%
Ontario	4,018.2	99.3	2.5%
Superior	6,164.5	802.9	13.0%

NOTE: connecting channels included with downstream lake

**GLAHF**  
Great Lakes Aquatic Habitat Framework

Data sources: U.S. Army Corps of Engineers shoreline classification (2012) & Environment Canada Environmental Sensitivity Atlas (1990s, varies); compiled by the Great Lakes Aquatic Habitat Framework (<http://glahf.org/>).



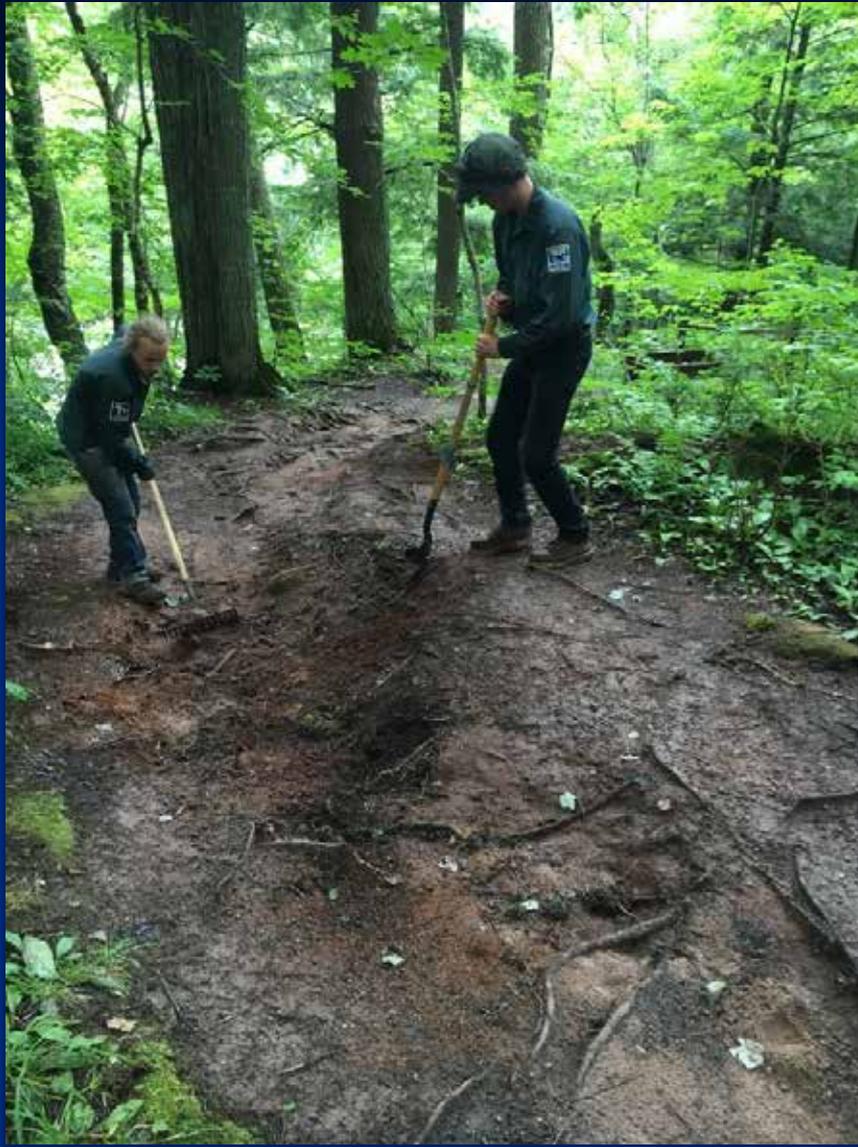
© GreatLakesPhotography.net

GLCC



GREAT LAKES  
CONSERVATION CORPS















**WARNING!**



**VEHICLES  
PROHIBITED**



**SENSITIVE  
COASTLINE**



**ENDANGERED  
SPECIES**



**THREATENED  
HABITAT**



**RARE  
PLANTS**





## ACCELERATING CLIMATE ADAPTATION

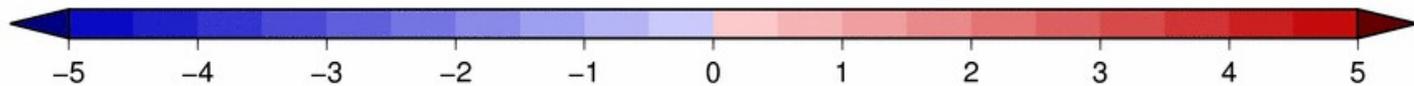
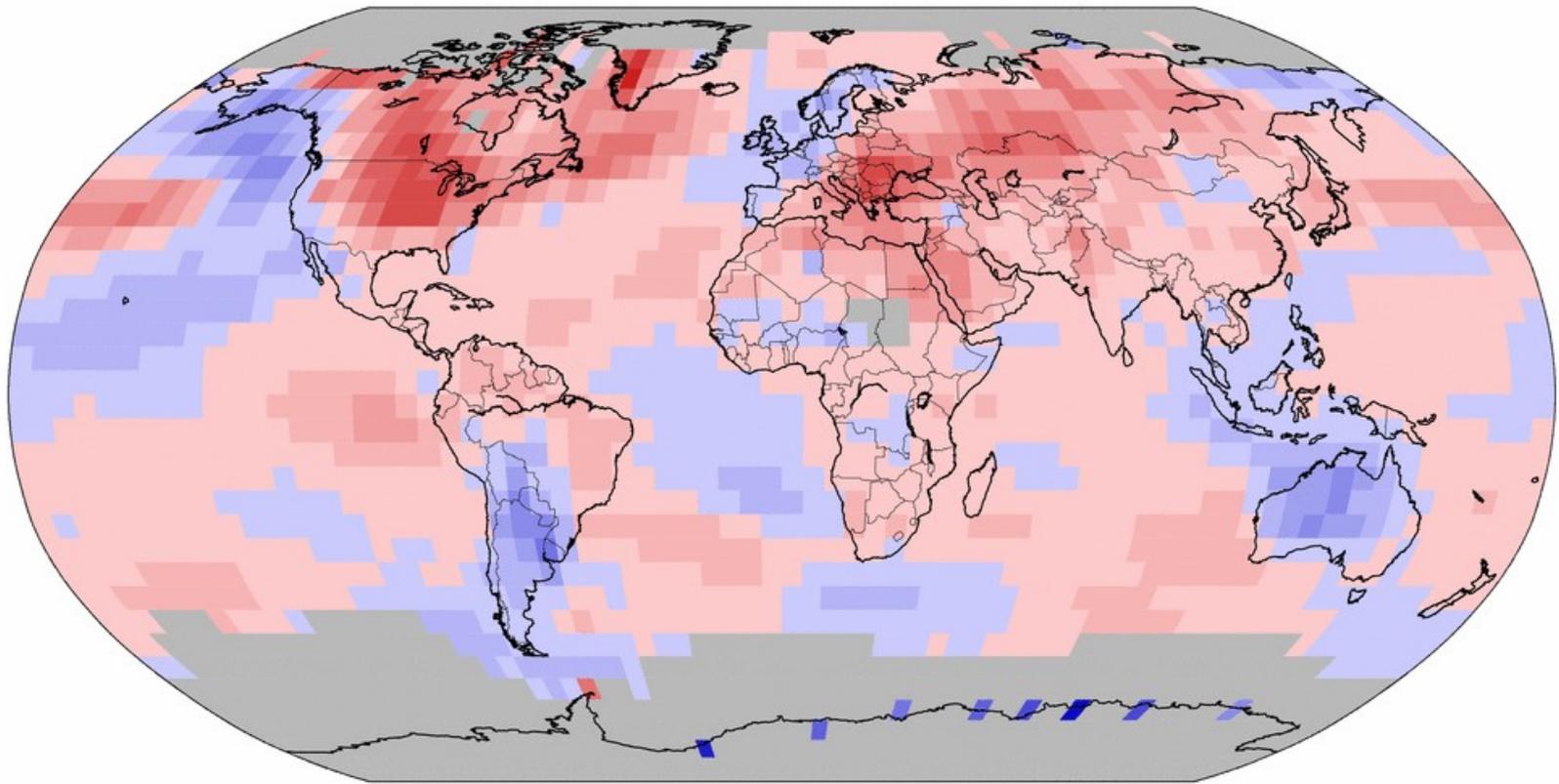
Assisting Great Lakes communities with climate adaptation.

[READ MORE](#)

# Land & Ocean Temperature Anomalies Jul 2012

(with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.1.0 & ERSST version 3b



NOAA's National Climatic Data Center

Degrees Celsius

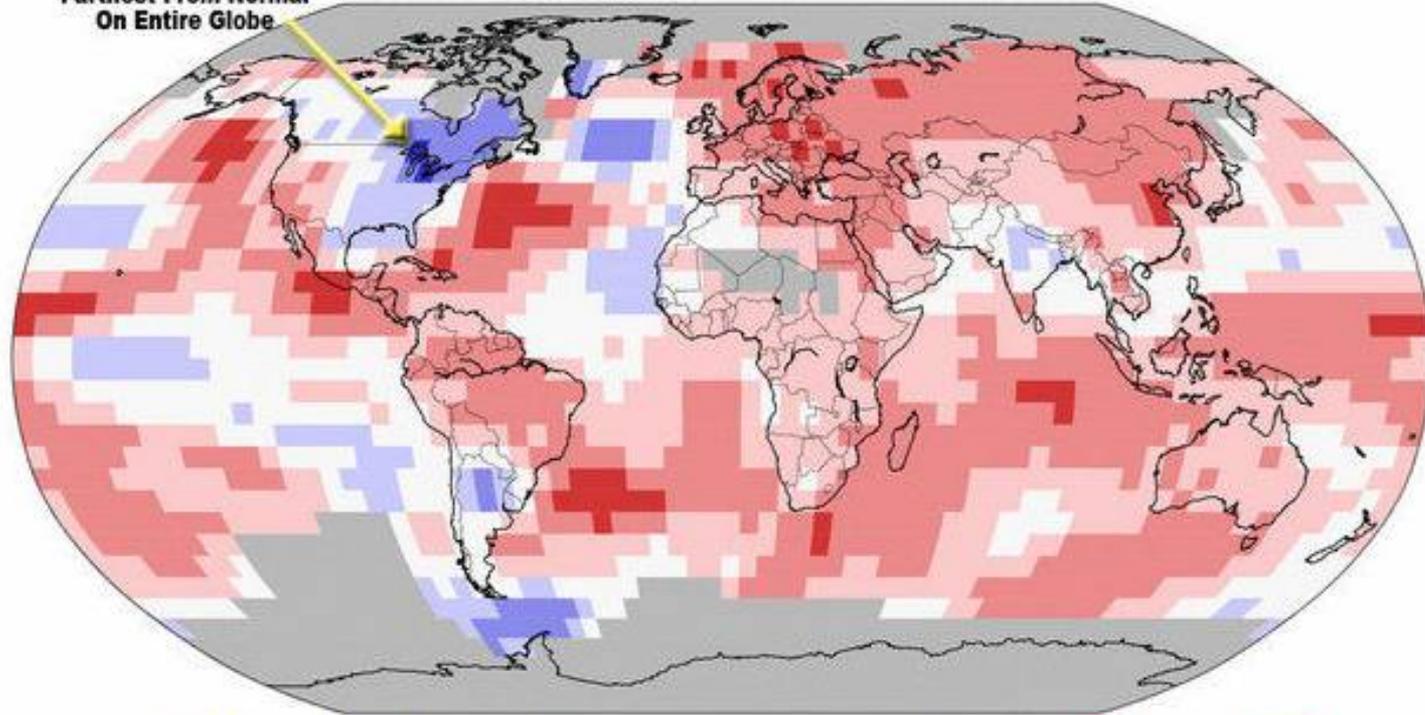
Please Note: Gray areas represent missing data

# Global Temperature Anomaly - March 2014

Dark Blue Showing Michigan's  
March Temperatures  
Farthest From Normal  
On Entire Globe

NOAA's National Climatic Data Center

Data Source: GHCN-M version 3.2.2 & ERSST version 3b



Record  
Coldest

Much  
Cooler than  
Average

Cooler than  
Average

Near  
Average

Warmer than  
Average

Much  
Warmer than  
Average

Record  
Warmest

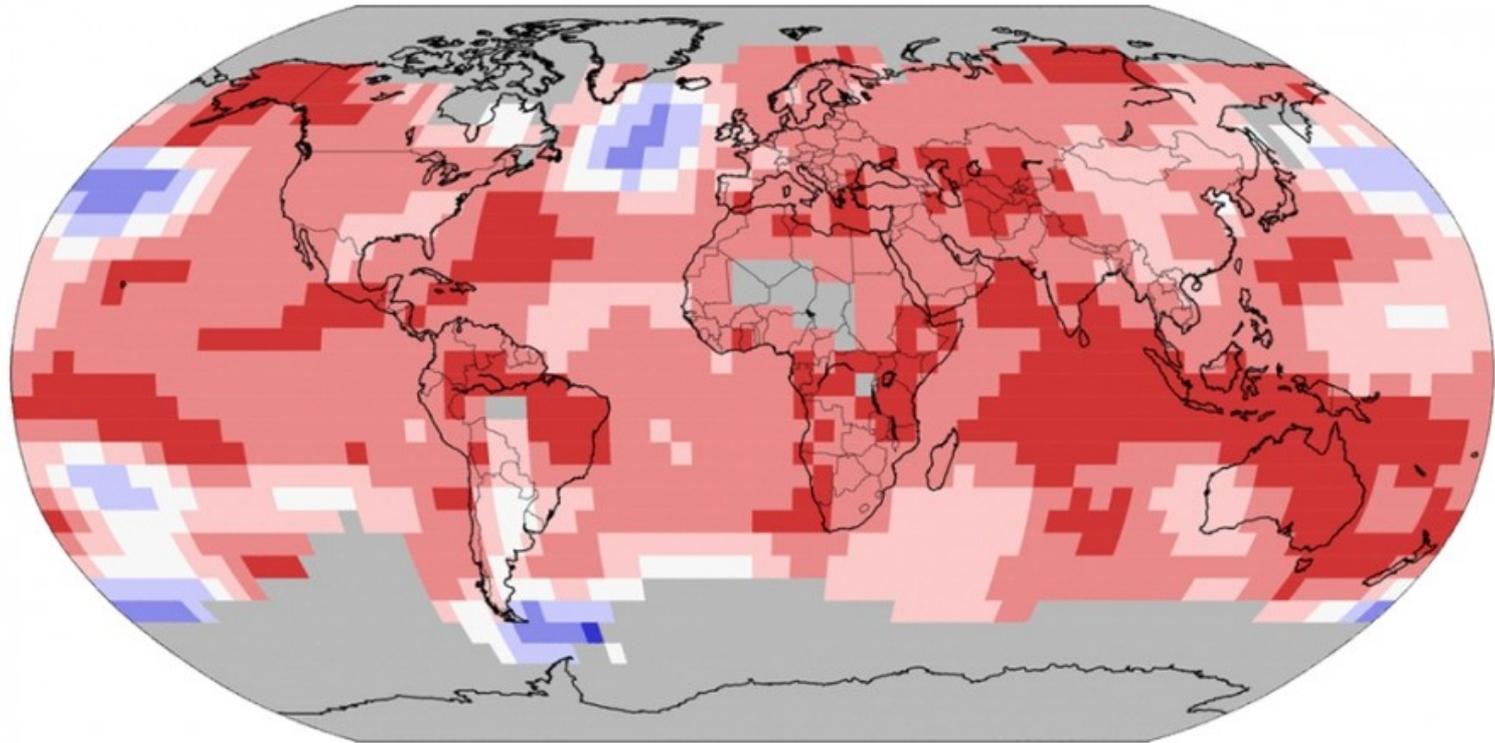


Tue Apr 15 07:56:11 EDT 2014

This graphic shows the temperature departure from normal for March 2014. You can see the darkest blue area signifies the departures farthest from normal. Michigan had the largest departures from normal of any region on the globe. (National Climatic Data Center)

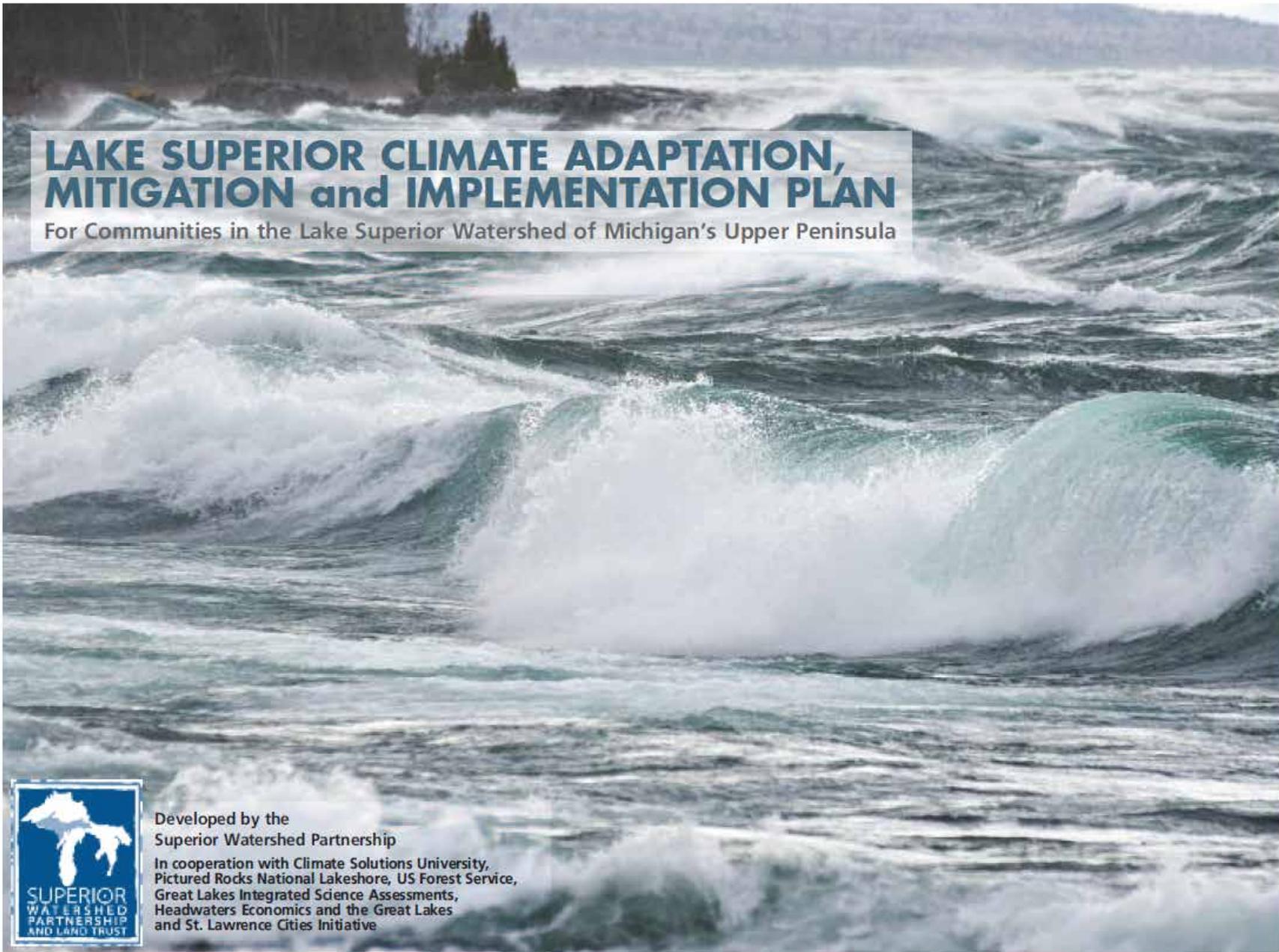
# 2016: Hottest Year So Far

Land and ocean temperature percentiles Jan-Jun 2016



Source: NOAA NCEI

CLIMATE  CENTRAL



# LAKE SUPERIOR CLIMATE ADAPTATION, MITIGATION and IMPLEMENTATION PLAN

For Communities in the Lake Superior Watershed of Michigan's Upper Peninsula



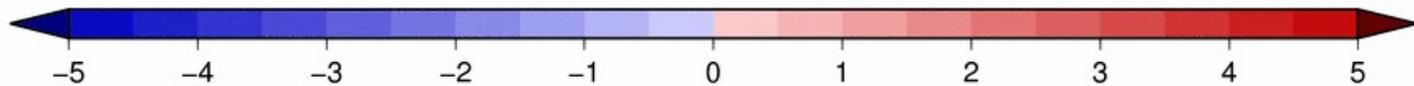
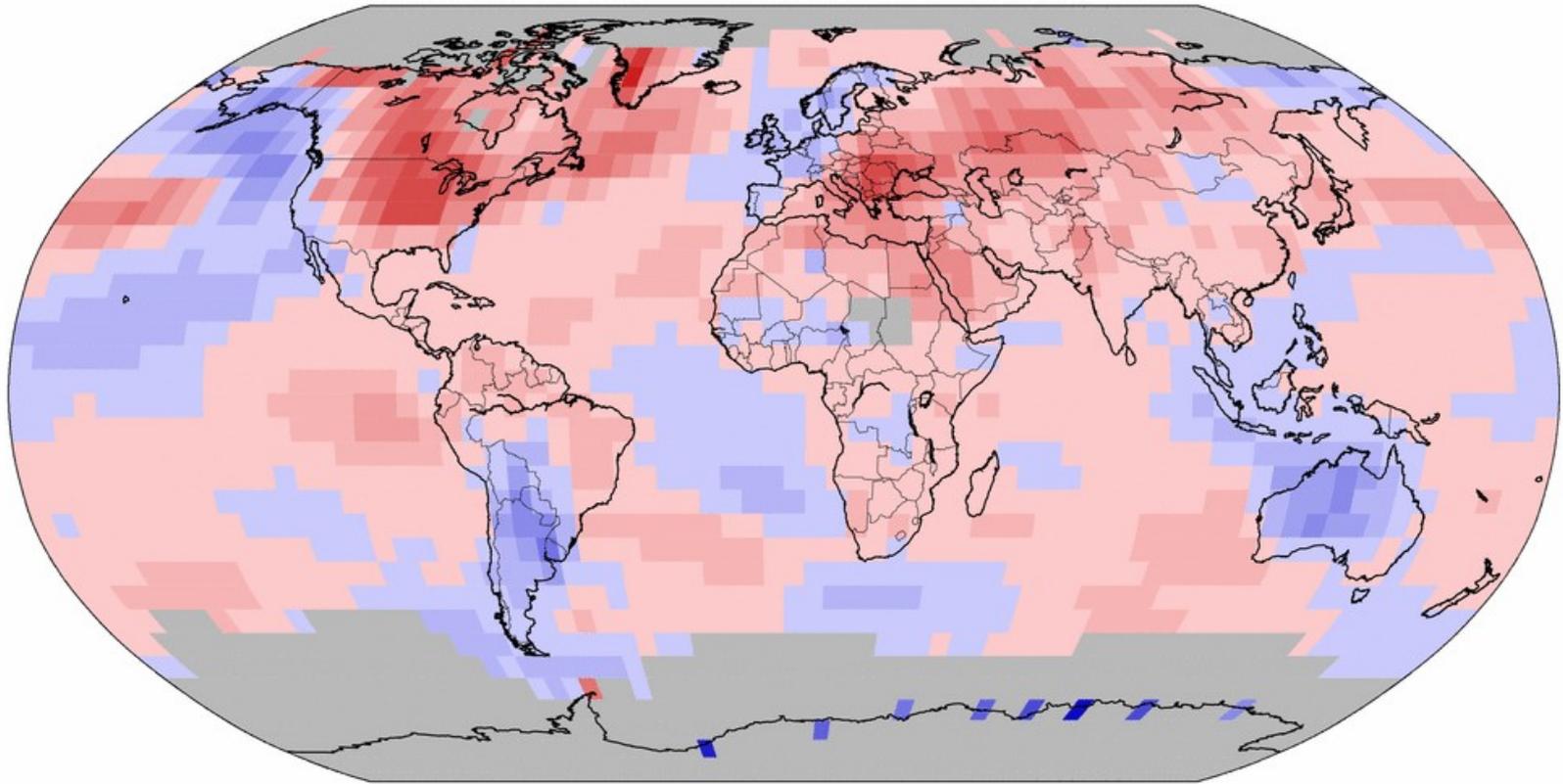
Developed by the  
Superior Watershed Partnership

In cooperation with Climate Solutions University,  
Pictured Rocks National Lakeshore, US Forest Service,  
Great Lakes Integrated Science Assessments,  
Headwaters Economics and the Great Lakes  
and St. Lawrence Cities Initiative

# Land & Ocean Temperature Anomalies Jul 2012

(with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.1.0 & ERSST version 3b



NOAA's National Climatic Data Center

Degrees Celsius

Please Note: Gray areas represent missing data

# NOTICE:

---

# BEACH CLOSED



The City of Marquette in cooperation  
with the Superior Watershed  
Partnership have issued a

**NO BODY CONTACT  
ADVISORY DUE TO RECENT  
HIGH BACTERIA LEVELS.**

For more information: <http://www.deq.state.mi.us/beach/>  
or call the City of Marquette: 228-0488





## TAKE THE STORMWATER CHALLENGE!

Cleaner stormwater means a cleaner Lake Superior



The City of Marquette includes four major watersheds that naturally drain to Lake Superior (Dead River, Whetstone Brook, Orianna Creek and the Carp River). But did you know that underneath the city there is a system of stormwater pipes that also drain directly to the lake (see map)?

Each time it rains (or snow melts) water from roads, roofs, sidewalks and yards enters the nearest storm drain and makes its way to an outlet at Lake Superior. It's important to keep our stormwater runoff as clean as possible especially since most stormwater outlets are located near our public beaches.



Did you know that there are over 3,300 storm drains in the City of Marquette and they ALL drain to Lake Superior!



 City of Marquette     Storm Drain     Underground Stormwater Drainage System (not to scale)     Storm Water Outlet





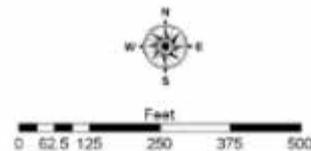
# City of Marquette, Michigan

Making Lake Superior Beaches Safer through Implementation of Green Practices to Mitigate Storm Sewer Impacts Identified by Great Lakes Sanitary Surveys



## Legend

-  Stormwater Drainage Ditch
-  Wetlands/ Buffer Project











### Improving Water Quality; Protecting Public Beaches A CLIMATE ADAPTATION PROJECT

The City of Mansfield, in collaboration with the Southern Watershed Partner (SWP) is implementing this water quality and climate adaptation project with a \$1.7 million grant from the Ohio State Lake Restoration Initiative. The "Green Infrastructure" project will reduce sediment and nutrient runoff from the watershed, improve water quality, and protect public beaches. The project will also improve water quality and protect public beaches from the effects of climate change. The project will also improve water quality and protect public beaches from the effects of climate change.



NO POSTING NEAR THIS SIGN

- 1. No parking
- 2. No littering
- 3. No smoking
- 4. No alcohol
- 5. No dogs
- 6. No firearms
- 7. No weapons
- 8. No explosives
- 9. No fireworks
- 10. No illegal substances





©Tom Buchkoe

# Improving Water Quality; Protecting Public Beaches

## A CLIMATE ADAPTATION PROJECT

The City of Marquette in cooperation with the Superior Watershed Partnership (SWP) is implementing this water quality and climate adaptation project with a \$179,700 grant from the EPA Great Lakes Restoration Initiative (GLRI). This “green infrastructure” project will reduce bacterial and chemical contamination that have been identified through a cooperative monitoring program. Historically, this area was an open ditch that carried both natural drainage and storm water runoff from neighborhoods, roads and parking lots.

In the summer of 2012 Marquette experienced record warm air temperatures, record warm water temperatures in Lake Superior (71 degrees Fahrenheit) and a record number of public beach closures due to high bacteria levels. Monitoring confirmed that this city storm drain had the highest bacteria levels entering Lake Superior.

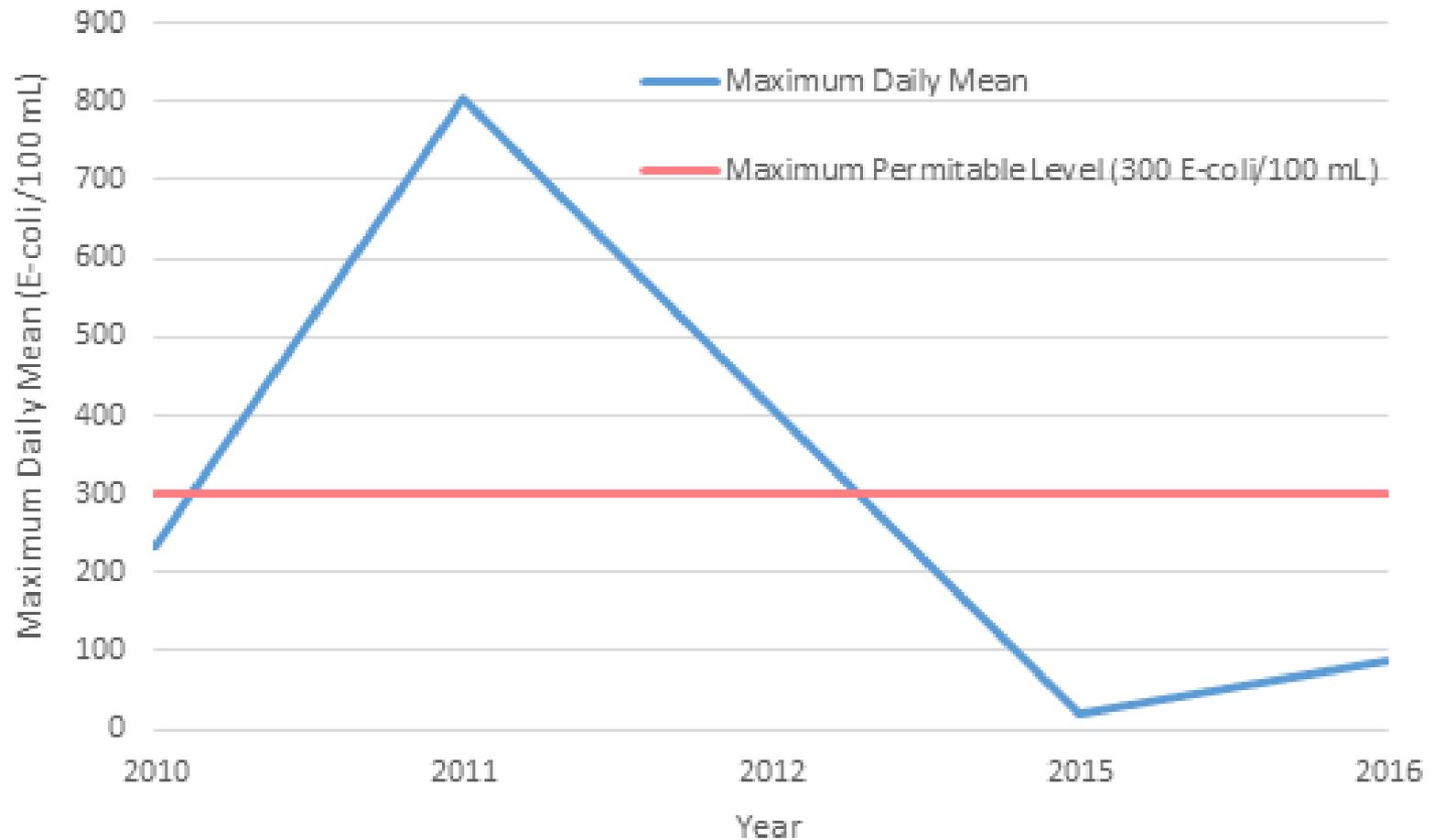
Water quality improvements will be achieved by creating approximately one acre of coastal wetland and adjacent riparian buffers to filter pollutants and reduce bacteria. This project is also designed to further climate adaptation and community resiliency by incorporating features that accommodate potential severe weather events and warming climate trends.





© Tom Buchko

## Maximum Daily Mean E. coli Values Shiras Beach 2010-2016

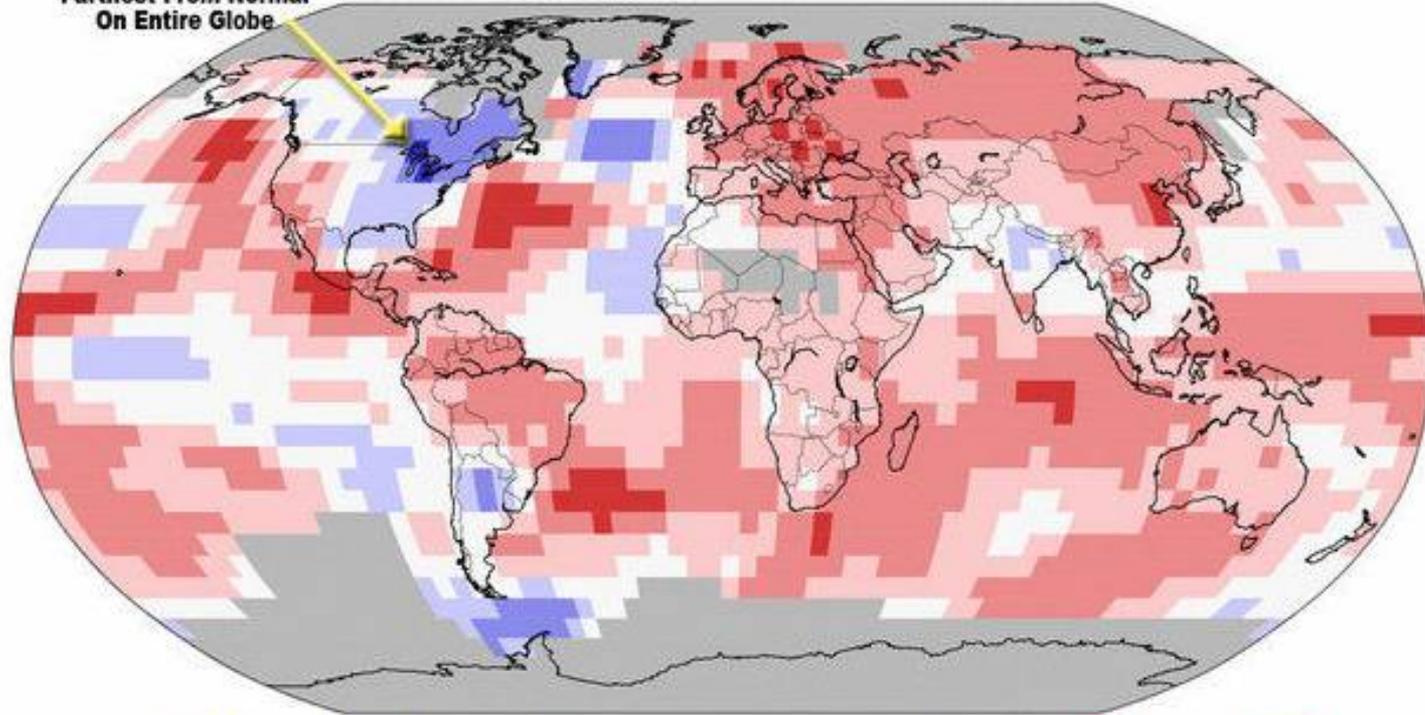


# Global Temperature Anomaly - March 2014

Dark Blue Showing Michigan's  
March Temperatures  
Farthest From Normal  
On Entire Globe

NOAA's National Climatic Data Center

Data Source: GHCN-M version 3.2.2 & ERSST version 3b



Record  
Coldest

Much  
Cooler than  
Average

Cooler than  
Average

Near  
Average

Warmer than  
Average

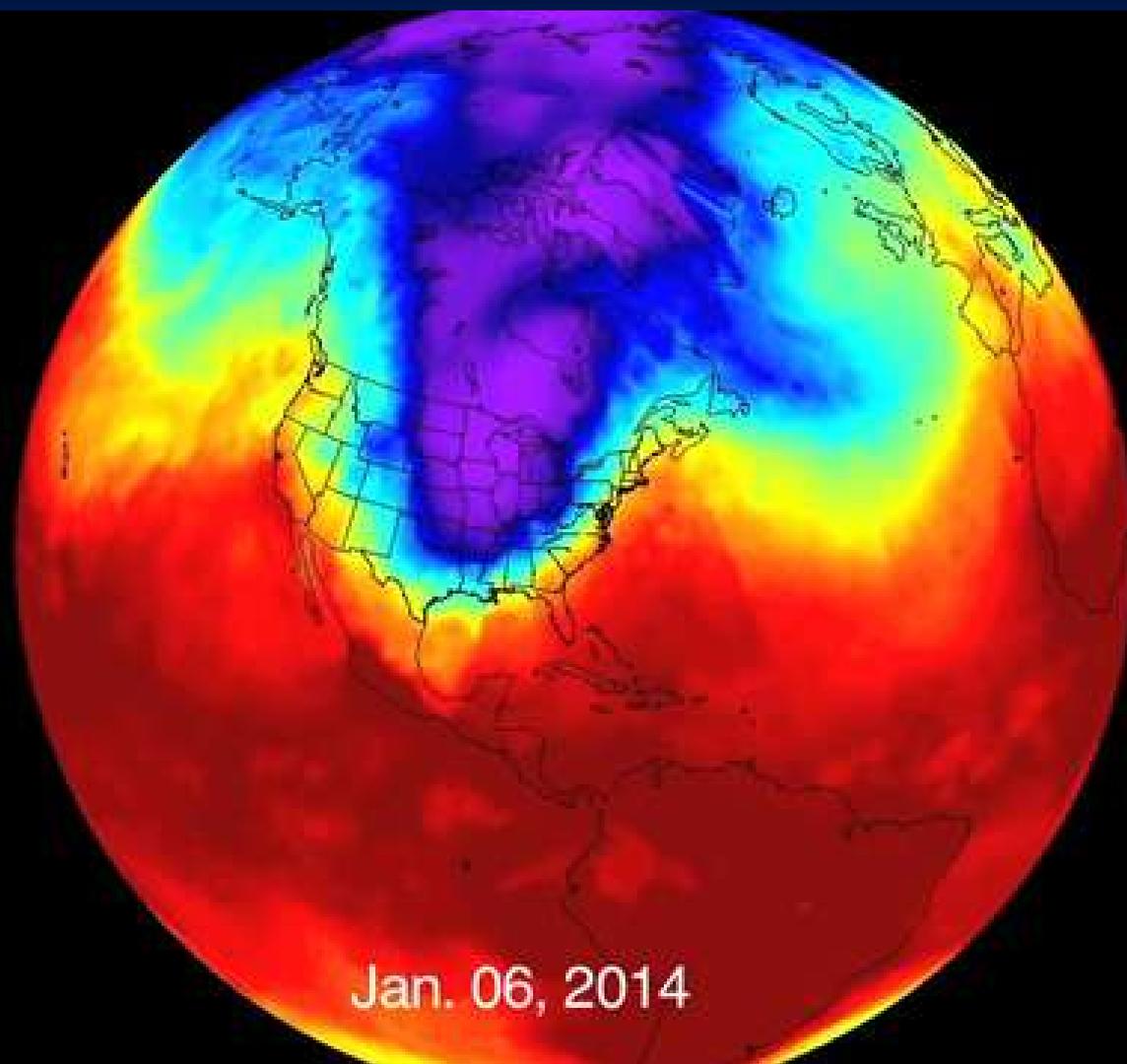
Much  
Warmer than  
Average

Record  
Warmest



Tue Apr 15 07:56:11 EDT 2014

This graphic shows the temperature departure from normal for March 2014. You can see the darkest blue area signifies the departures farthest from normal. Michigan had the largest departures from normal of any region on the globe. (National Climatic Data Center)



Jan. 06, 2014



Marquette June 2014



Lake Superior Ice Cover February 16, 2014





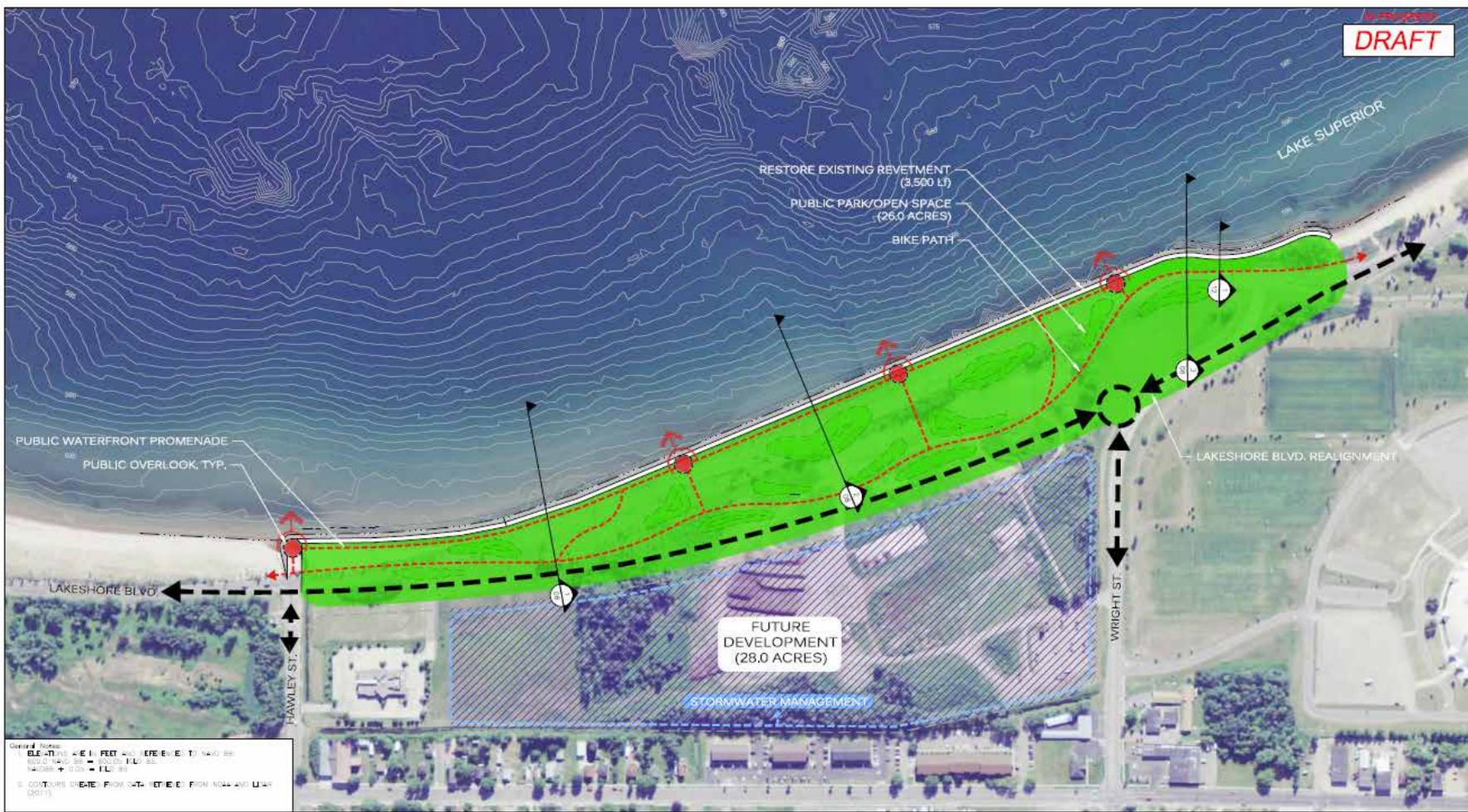




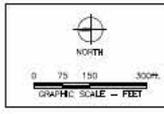




DRAFT



General Notes:  
 1. ALL ELEVATIONS ARE IN FEET UNLESS OTHERWISE NOTED.  
 2. HATCHES ARE AS SHOWN.  
 3. CONTOUR SPACING FROM OUTLINE FIELD FROM 100' AND 150' (2017)



## SHORELINE RESTORATION - ALTERNATIVE 2 RESTORE EXISTING REVETMENT

MARQUETTE SHORELINE RESTORATION	
Figure Number: 12035-CD-04	Project Number: 12035-100
Description: ALTERNATIVE 2 - LAYOUT	Date: 02/04/2013

Baird







## GREAT LAKES COASTAL WETLAND RESTORATION

Coastal wetlands provide many unique environmental benefits including improved water quality and important habitat for migrating birds and wildlife. Sadly, more than 50% of Great Lakes coastal wetlands have been lost to filling and development.

This coastal wetland is being restored as a cooperative project between the City of Marquette and the Superior Watershed Partnership. Fill material and debris has been removed (see photos), with the reintroduction of native plant species continuing over several years.

This historic map (1846) shows that this site was once predominately coastal wetland.



Historic 1846 Survey Map with Wetlands Highlighted



For more information please call the  
City of Marquette (228-0440) or  
Superior Watershed Partnership (228-6095)







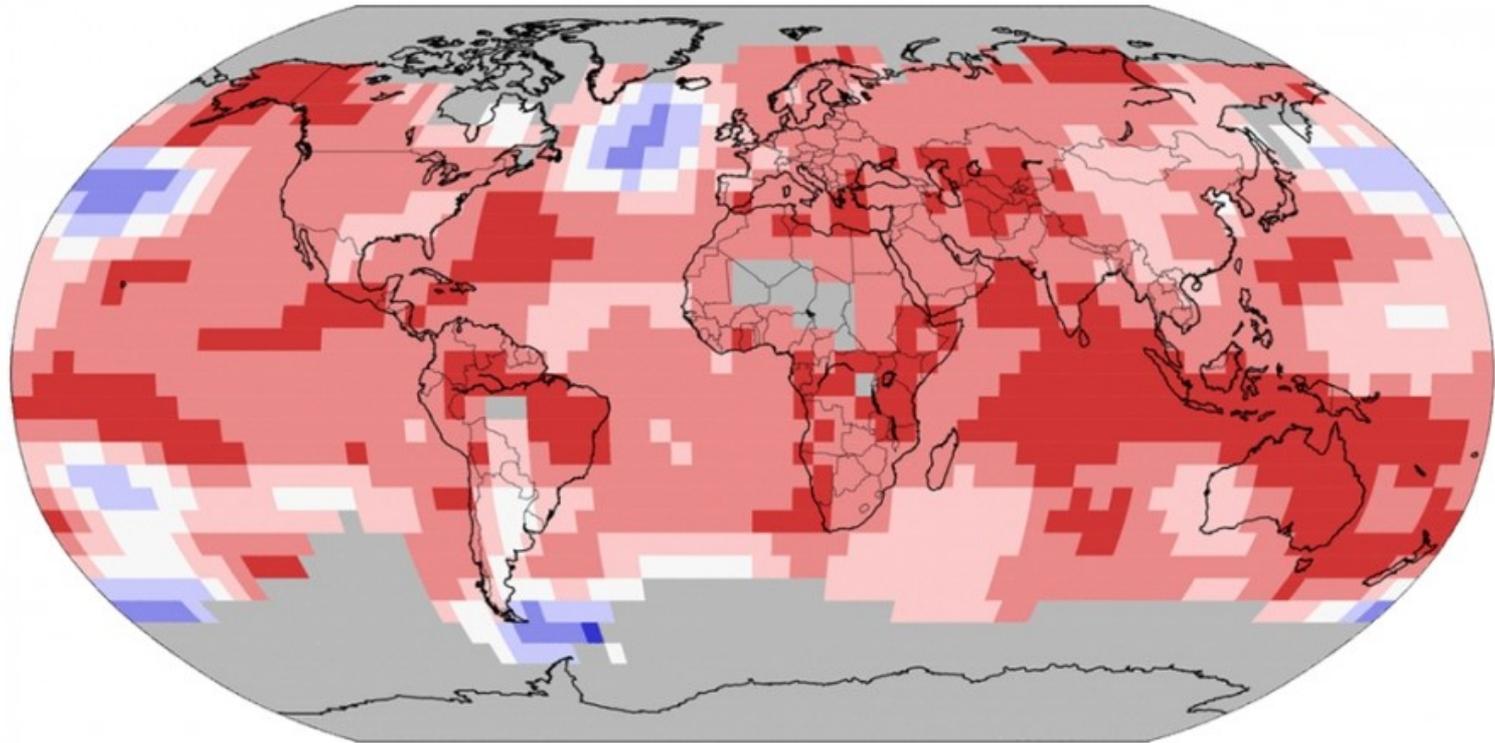




**CLIMATE ADAPTATION  
TASK FORCE**

# 2016: Hottest Year So Far

Land and ocean temperature percentiles Jan-Jun 2016



Source: NOAA NCEI

CLIMATE  CENTRAL







© GreatLakesPhotography.net





**2010: 4 drownings**  
**2011-2016: 0 drownings**







# Clark Lambros' Beach Park

CITY OF MARQUETTE PARK SYSTEM  
2401 LAKESHORE BLVD.

*"This park is a gift to the Marquette Community from the family of  
Clark Lambros, Michele Butler and the Michigan Natural Resources Trust Fund."*







DUNE RESTORATION  
PLEASE STAY OFF  
BEACH GRASS

DUNE RESTORATION  
PLEASE STAY OFF  
BEACH GRASS

STIHL

True's  
TRAILER  
PULLER



**Even X-Ray Vision Can't Do this**



Try the Simulator

**FLIR**

Search by Ship name / IMO / MMSI



Ship Info **My Fleet** My Places

**BBC MONT BLANC**  
General Cargo Ship

[TRACK](#)  
[MORE INFO](#)  
[UPLOAD PHOTO](#)

SEP 30, 2018 18:01 UTC

Sailing to / ETA  
**BREMERHAVEN / Oct 02, 04:00**

Course	Speed	Current draught
N/A	8 kn	5.2 m
Gross Tonnage	Built	IMO number
8255 t	2011	9508433

**News**

-  [Wilson Offshore & Marine Completes Performance Test for World's First Floating LNG Production Facility](#)
-  [Icebreaker Otso back from Greenland](#)
-  [Mega Container ship MSC Eivane delivered](#)
-  [Ocean Yield Announces Investment in Two Chemical Tankers With Long Term Charters](#)
-  [Wärtsilä 31 engine's high efficiency](#)

**CLICK HERE TO FIND MORE**













## **COMMUNITY INVOLVEMENT**

Working closely with communities to implement projects and provide programs that protect our Great Lakes.

# PLEASE DO YOUR PART TO HELP KEEP OUR BEACHES CLEAN.

The City of Marquette in cooperation with the Superior Watershed Partnership conducts regular water quality monitoring at public beaches.



For more information please visit:  
[www.superiorwatersheds.org](http://www.superiorwatersheds.org)



[www.mqcity.org](http://www.mqcity.org)





## TAKE THE STORMWATER CHALLENGE!

Cleaner stormwater means a cleaner Lake Superior



The City of Marquette includes four major watersheds that naturally drain to Lake Superior (Dead River, Whetstone Brook, Orianna Creek and the Carp River). But did you know that underneath the city there is a system of stormwater pipes that also drain directly to the lake (see map)?

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Did you know that there are over 3,300 storm drains in the City of Marquette and they ALL drain to Lake Superior!



 City of Marquette     Storm Drain     Underground Stormwater Drainage System (not to scale)     Storm Water Outlet



WHEN YOUR DOG  
GOES ON THE LAWN,  
REMEMBER

IT DOESN'T JUST GO ON THE LAWN.



Did you know that there are over 3,300 storm drains in the City of Marquette and they ALL drain to Lake Superior! Stormwater is a Resource, Not a Waste Product. Please Help Keep it Clean!

Suggestion: Always carry a baggie and properly dispose of pet waste. Refrain from taking your dog to public beaches.

Brought to you by the Superior Watershed Partnership. For more information contact the SWP:  
[www.superiorwatersheds.org](http://www.superiorwatersheds.org) or 906.228.6095

# KEEP OUR BEACHES CLEAN



## CIGARETTE BUTTS ARE LITTER.



**FLICK IT,  
GET A TICKET!**

Drivers who throw their cigarette butts out the window are not just littering the road... they are polluting Lake Superior and littering our beaches.

**EACH TIME IT RAINS, THOUSANDS OF CIGARETTE BUTTS ARE WASHED DOWN THE STORM DRAINS AND INTO LAKE SUPERIOR!**

The Superior Watershed Partnership in cooperation with the City of Marquette Police Department and the Marquette County Health Department are working together to raise awareness about this problem and help keep our beaches clean!

If you smoke, or know someone who smokes, please make sure that cigarette butts are properly disposed of (better yet, quit). Don't throw them out the window!

When you throw a cigarette butt on the road or the sidewalk it ends up in Lake Superior. So, think again and help keep our beaches clean!

For more information on how to protect our beaches, participate in volunteer clean-up events or how to quit smoking please call: 906-228-6095



[www.superiorwatersheds.org](http://www.superiorwatersheds.org)

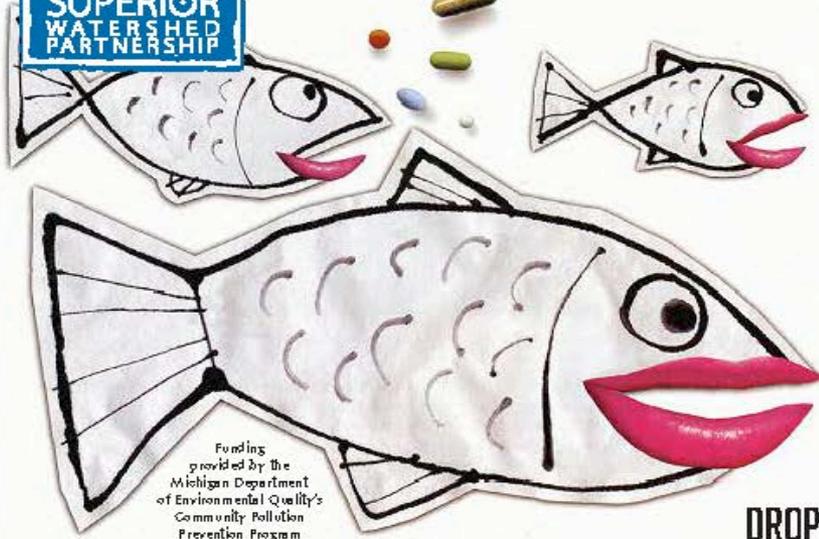


©Tom Buchkoe



# PHARMACEUTICAL COLLECTION

## Keeping drugs out of our waters!



**SATURDAY, APRIL 26, 2014**  
10:00 AM - 2:00 PM

**VISIT:**

[WWW.SUPERIORWATERSHEDS.ORG/POLLUTIONPREVENTION](http://WWW.SUPERIORWATERSHEDS.ORG/POLLUTIONPREVENTION)  
FOR A COMPLETE LISTING OF COLLECTION SITES.

**FREE AND OPEN TO THE PUBLIC**

- Items accepted: prescription and over-the-counter medications, liquids, sharps, mercury thermometers, soaps containing micro-beads
- Keep medications in original containers if possible

**FOR MORE INFORMATION CALL 906-228-6095**  
Brought to you by the Superior Watershed Partnership

**DROP-OFF SITES IN 18 COMMUNITIES ACROSS THE UPPER PENINSULA:**

Fortune Lake Lutheran Camp  
138 Fortune Lake Camp Rd. • Crystal Falls

First Presbyterian Church  
819 1st Ave. • Escanaba

First Lutheran Church  
1212 Minneapolis Ave. • Gladstone

Trinity Episcopal Church  
205 Montezuma • Houghton

Salvation Army Bread of Life Assistance  
Center 212 Woodward • Iron Mountain

Our Lady of Peace Catholic Church  
108 S. Marquette St. • Ironwood

Trinity Lutheran Church  
414 E. Ridge St. • Ishpeming

United Methodist Church  
304 N. Main • L'Anse

First United Methodist Church  
190 N. Cedar St. • Marquette

Grace United Methodist  
927 W. Fair Ave • Marquette

Messiah Lutheran  
305 W. Magnetic • Marquette

First United Methodist Church  
601 10th Ave • Menominee

Sacred Heart of Jesus Parish  
110 W. Jewell St. • Munising

Luce County Sheriff's Office  
411 W. Harrie St. • Newberry

First United Presbyterian  
555 Bingham St. • Sault Ste. Marie

St. Ignace United Methodist  
615 W. US 2 • St. Ignace

White Pine Community Methodist Church  
9 Tamarack St. • White Pine

Stephenson City Hall  
W. 628 Samuel St. • Stephenson

**22** HAPPY  
APRIL EARTH DAY  
2014









© GreatLakesPhotography.net

Traditional Process. Premium Ingredients. Reclaiming the Craft.  
Ore Dock Brewing Company, Marquette, Michigan

# ORE DOCK BREWING CO. FRESH COAST

BELGIAN STYLE INDIA PALE ALE



12 FL. OZ.  
7.5% ALC/VOL IBU 70



SUPERIOR SOURCED

Drawn From The Greatest Of Lakes. Fashioned Into  
The Finest Of Beers. What Water Wants To Be.

# FRESH COAST

A breaking wave of effortless enjoyment. Notes of deep citrus and juicy tropical fruit oscillate through the hoppy depths of a cold and steady current of freshwater flavors. Second only in intensity to Lake Superior herself.

Proceeds benefit the Superior Watershed Partnership.

Preferred Glassware:  Best Served at: 45°F



GOVERNMENT WARNING: (1) ACCORDING TO THE SURGEON GENERAL, WOMEN SHOULD NOT DRINK ALCHOLIC BEVERAGES DURING PREGNANCY BECAUSE OF THE RISK OF BIRTH DEFECTS. (2) CONSUMPTION OF ALCHOLIC BEVERAGES IMPAIRS YOUR ABILITY TO DRIVE A CAR OR OPERATE MACHINERY AND MAY CAUSE HEALTH PROBLEMS.

CT-ME-VT-DE-MA-NY-IA-HI-OR 5¢ | MI 10¢ REF. | CA CASH REFUND

[WWW.ORE-DOCK.COM](http://WWW.ORE-DOCK.COM)



# Great Lakes Shoreviewer™

A Great Lakes Planning and Protection Tool

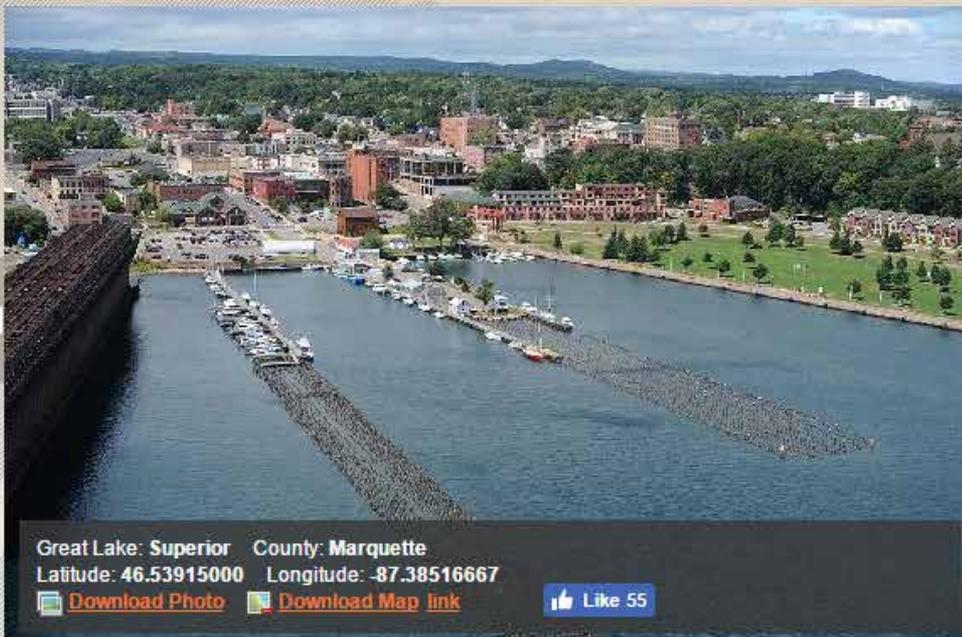
# (Created 2011)

The Great Lakes Shoreviewer provides professional color photography of every inch of coastline (and many islands) in the Upper Peninsula of Michigan (Lake Superior, Lake Michigan and Lake Huron). Each coastline photo also has a series of maps showing important natural features for planning and protection efforts. To start, simply click on the locator map to view photos.

**Note:** Scroll Back and Forth With Arrows

## Downloadable Planning Maps

These maps are specific to the photo being viewed and include: soils, wetlands, critical dunes, topography, color infrared photography and true color vertical photography. Just click the map link under the photo you want to see the map for.



Great Lake: Superior County: Marquette  
Latitude: 46.53915000 Longitude: -87.38516667

[Download Photo](#) [Download Map link](#)

Like 55

Available on the  
**App Store**

DOWNLOAD THE  
Great Lakes  
**Shoreviewer**  
APP



Click on *coastline below* to start your search.



### Downloadable Planning Maps

These maps are specific to the photo being viewed and include; soils, wetlands, critical dunes, topography, color infrared photography and true color vertical photography. Just click the map link under the photo you want to see the map for.

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[Download Photo](#) [Download Map link](#)

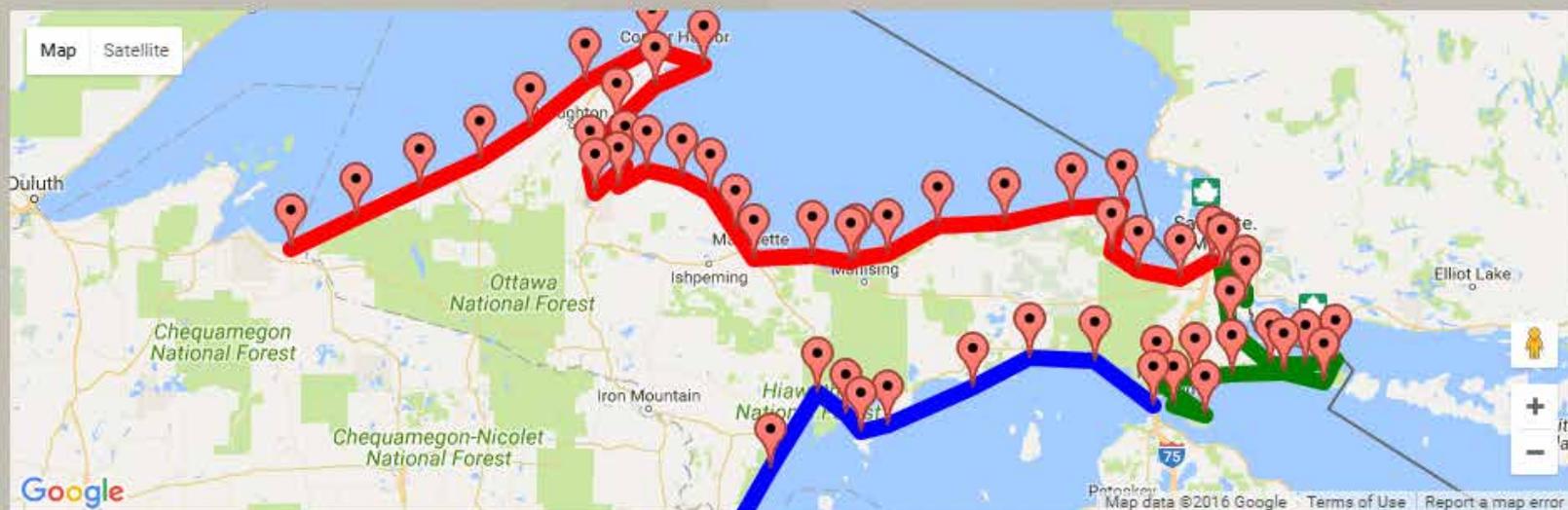
Like 55

Available on the  
**App Store**

DOWNLOAD THE  
Great Lakes  
**Shoreviewer**  
APP



Click on *coastline below* to start your search.



Superior Watershed Partnership  
2 Peter White Drive, Presque Isle Park  
Marquette, Michigan 49855  
906-228-6095 or by fax at 906-228-6863



Partners



# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool

Coastal Risk • Infrastructure Risk • Building Risk



Location #3862    PREV    NEXT    [Link Icon]    [Close Icon]

Date Taken: 2015-05-07  
Latitude: 42.409°  
Longitude: -86.284°

### Risk Assessment Layers:

- > **Building Risk** (Click to expand)
  - Building Exposure To Potential Risk (Distance) ?
  - Building Exposure To Potential Risk (Slope) ?
- > **Road/Infrastructure Risk**
- > **Coastline Risk**

### Color Key:

**Building Exposure To Potential Risk (Distance)** [About This Layer](#)

- Close (0 to 100m)
- Moderate (100 to 200m)
- Far (200 to 300m)

**Aerial Natural Color** [About This Layer](#)



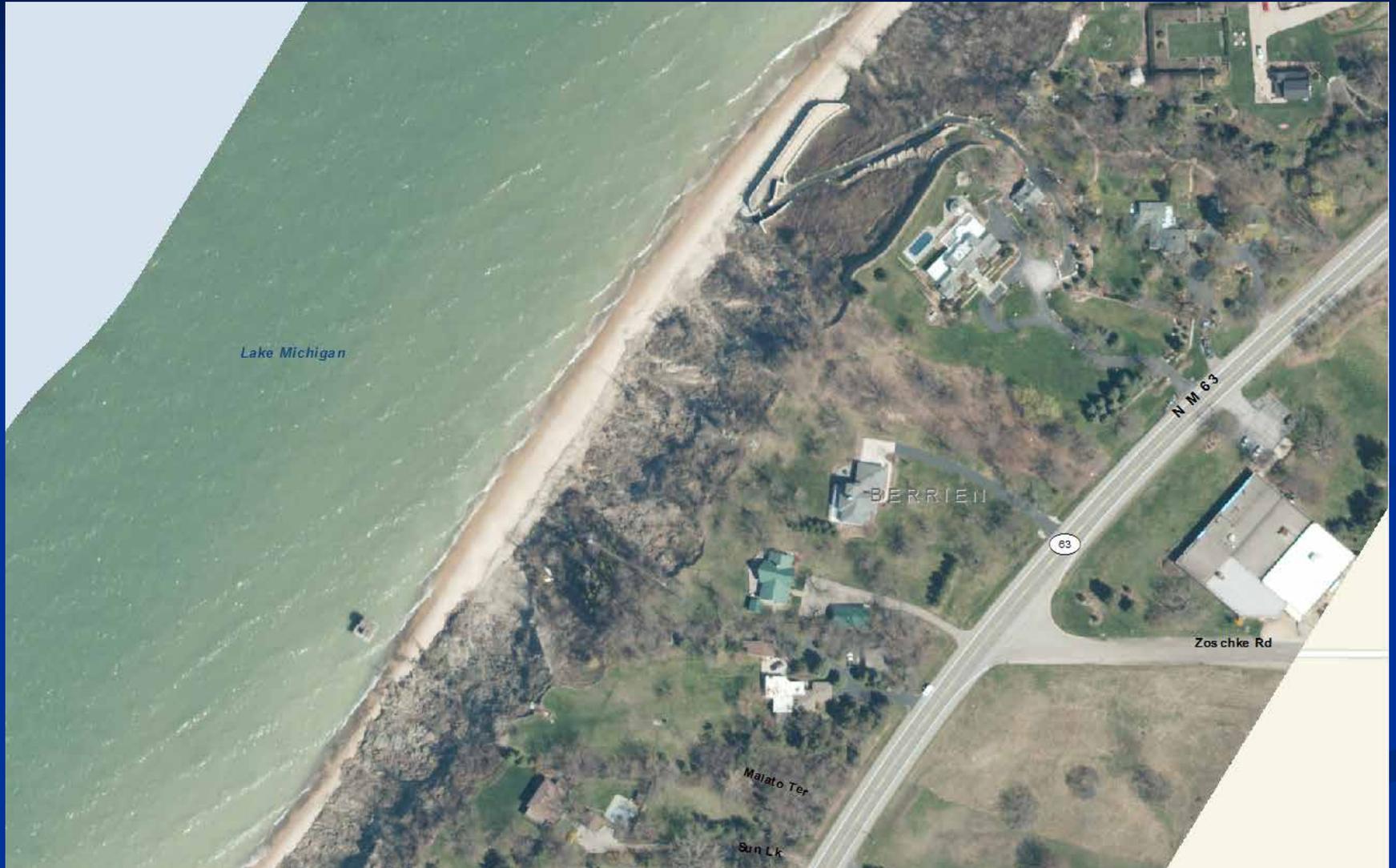




# Low Altitude, High Resolution Oblique Images



# Natural Color, 12-inch resolution Ortho-photography



# Infra-red, 12-inch resolution Ortho-photography



# Land Cover Classification (13-classes)



Landcover\_09

Legend

- 0- No Data
- 11- Open Water
- 12- Shallow Water, Shadow
- 13- Great Lake, Michigan
- 21- Developed, Building
- 22- Developed, Road
- 41- Forest, Low Biomass
- 42- Forest, Moderate Biomass
- 43- Forest, High Biomass
- 71- Grass/Herbaceous, Low Biomass, Low Slope
- 72- Grass/Herbaceous, Low Biomass, Moderate Slope
- 73- Grass/Herbaceous, Low Biomass, High Slope
- 74- Grass/Herbaceous, Moderate Biomass
- 75- Grass/Herbaceous, High Biomass

# LiDAR



DEM/Slope



Feature Heights

Water/lake

Water\_shallow\_submerged\_veg

Tree/shrub high biomass  
Water/lake

Tree/shrub moderate biomass  
Water/lake

Tree/shrub low biomass  
Water/lake

Grass low biomass  
Water/lake

Grass moderate biomass  
Water/lake

Sanddune\_bareland\_impervious

S\_high\_risk

S\_moderate\_risk

S\_low\_risk

Road\_high\_risk

Road\_low\_risk

Road\_moderate\_risk

Road

*By slope*

High\_risk

Moderate\_risk

Low\_risk

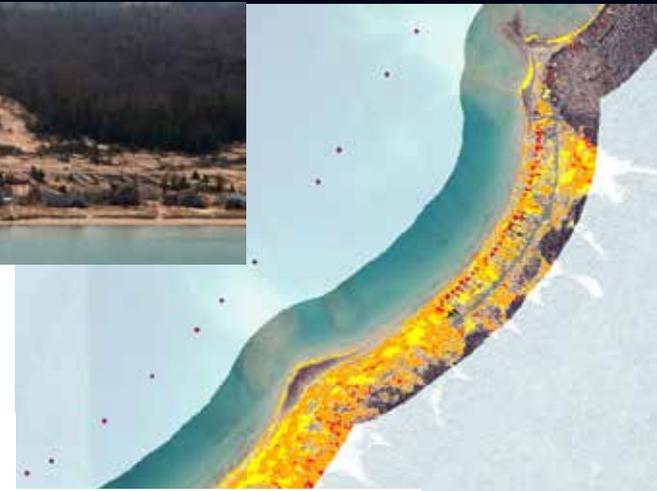
*By distance*

High\_risk\_d

Moderate\_risk\_d

Low\_risk\_d

Houses/building



### Ranked By Slope & Distance

#### Slope Thresholds

- High: >20 degrees
- Moderate: 5-20%
- Low: <5%

#### Distance from Lake Shore Thresholds

- High: <100m
- Moderate: 100-200m
- Low: >200m

# Coastal Risk Mapping



# Risks Near Infrastructure



# Lakeshore Utilities



**Natural Areas**



**Tourism/Natural Areas**



**Lakeshore Communities**

# GREAT LAKES SHOREVIEWER

## Welcome To The Great Lakes Shoreviewer



The Great Lakes Shoreviewer is a risk assessment and climate adaptation planning tool. It provides stunning, oblique-angle color photography plus multiple layers of additional analysis for prioritized sections of Great Lakes coastline in Michigan (Lake Superior, Lake Michigan, Lake Huron). It also provides potential risk rankings (high, medium, low) for coastal property, buildings, roads and infrastructure.

- The Shoreviewer offers potential risk assessments. It does not suggest land valuation and should not be used to appraise property.
- Shoreviewer users acknowledge that aerial photographs and remote-sensing technologies do not include on-the-ground confirmation of mapped features.
- Shoreviewer users assume full responsibility for confirming current coastal conditions. Great Lakes coastal conditions are constantly changing.
- The Shoreviewer includes some data that is publicly available from local, state and federal agencies and other parties.
- Shoreviewer high resolution aerial photographs were acquired to document existing conditions as of the date of the photography (Spring, 2015).
- Shoreviewer users agree to the above points and assume all responsibility for interpretations, decisions and guidance with regards to any and all uses.



Developed by the Superior Watershed Partnership in cooperation with Applied Ecological Services and 906 Technologies.



Financial assistance for this project was provided, in part, by the Michigan Coastal Management Program, Department of Environmental Quality (DEQ), through a grant from the National Oceanic and Atmospheric Administration (NOAA). The statements, findings, conclusions, and recommendations in this report are those of the Superior Watershed Partnership (Grantee) and do not necessarily reflect the views of the DEQ and the NOAA.

For more information please contact the Superior Watershed Partnership: [info@superiorwatersheds.org](mailto:info@superiorwatersheds.org).

# GREAT LAKES SHOREVIEWER

## How To Use The Great Lakes Shoreviewer



### Map Navigation:

- To zoom in and out, either use the mouse scroll wheel or the +/- buttons on the bottom right of the screen. Touchscreen users can pinch the map to zoom in and out.
- To slide the map in any direction, click and hold the mouse button while moving the mouse. Touchscreen users can simply swipe the map in any direction.
- A small map window of the Great Lakes will show the location of the main map with a red dot.
- Aerial photography and risk assessment layers are only available for the shorelines highlighted in red.

### Map Data Control Buttons:

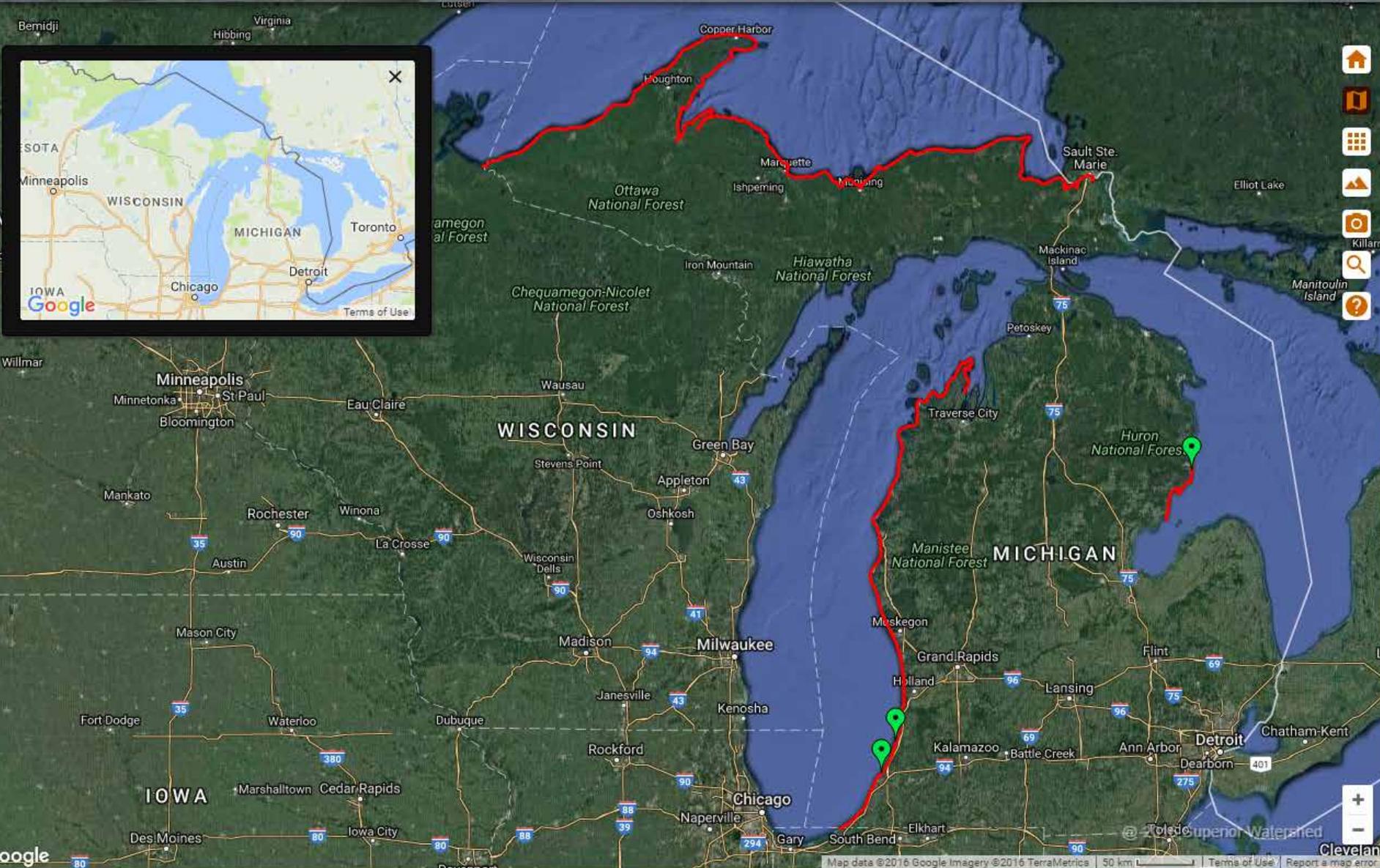
- The buttons located in the top right of the map screen are used to switch map data windows on or off.
- If you hover the mouse cursor over a button, a popup text will tell you what it controls.
- Data windows can also be turned off by pressing the X in top right corner of its window.
- Most windows are moveable by clicking and holding anywhere in the window and dragging with the mouse.

### Button Functions:

-  Return to top level (zooms map all the way out)
-  Locator Map (on/off for the locator map)
-  Layer Control (on/off for the Risk Assessment Layers control window)
-  Color Keys (on/off for the Risk Assessment Layers color keys)
-  Shoreline Photography (on/off for the photo window)
-  Bookmarks (on/off for the bookmarked locations and locations of interest window)

# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool  
Coastal Risk • Infrastructure Risk • Building Risk



# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool

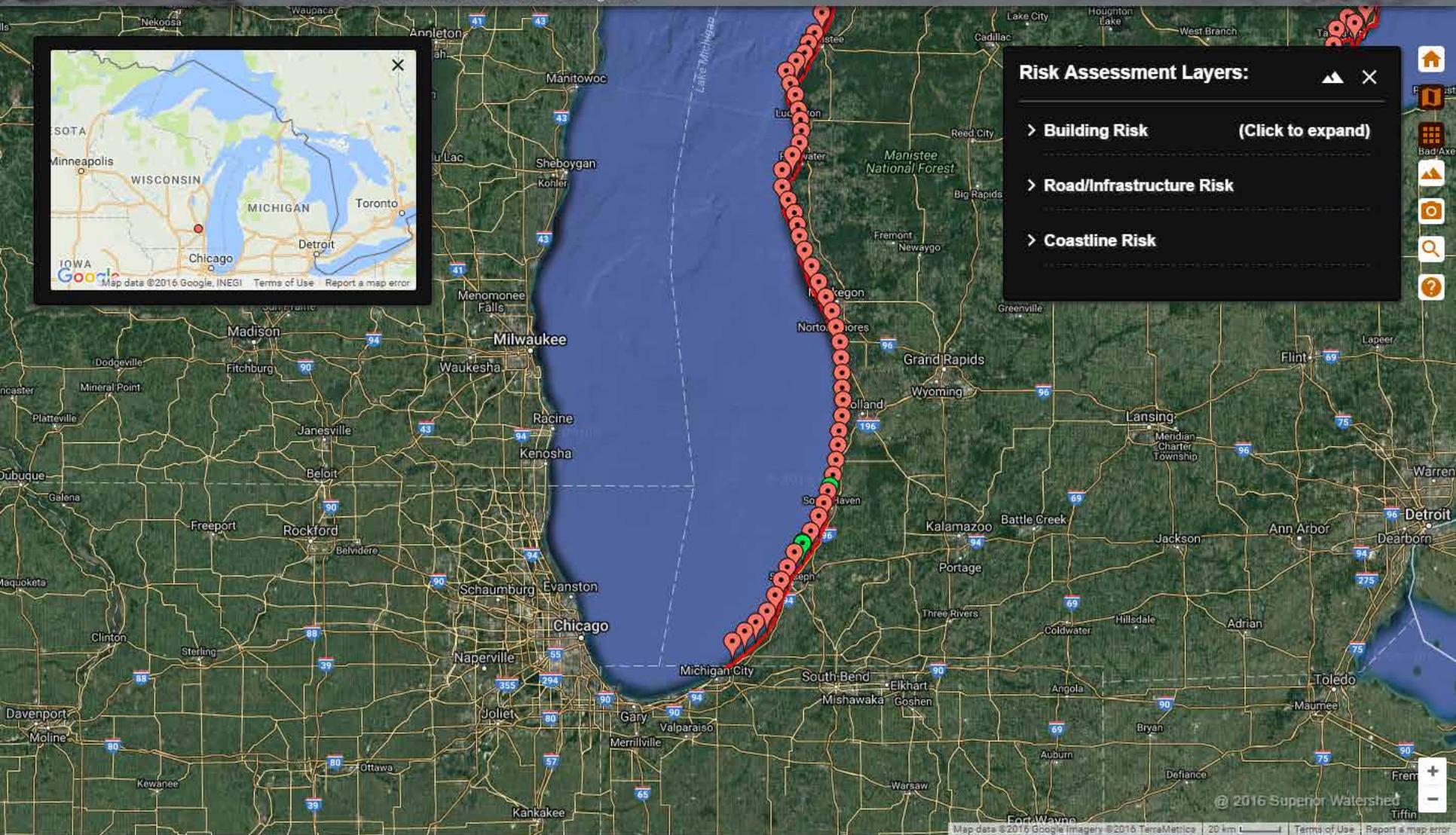
Coastal Risk • Infrastructure Risk • Building Risk



### Risk Assessment Layers:

- > **Building Risk** (Click to expand)
- > **Road/Infrastructure Risk**
- > **Coastline Risk**

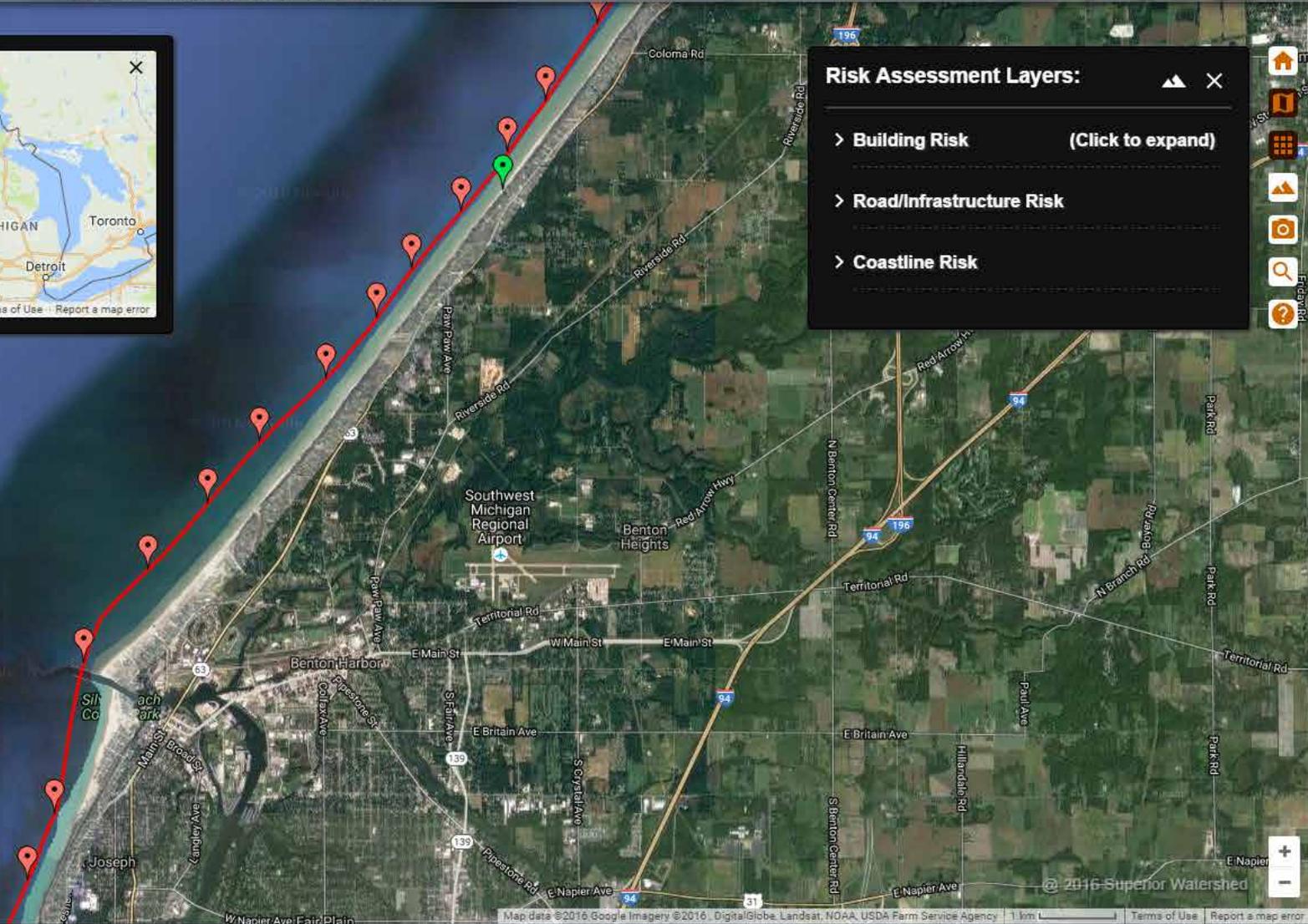
Map navigation icons: Home, Full Screen, Bad Axe, Layers, Search, Help, and a zoom control (+/-).



# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool

Coastal Risk • Infrastructure Risk • Building Risk

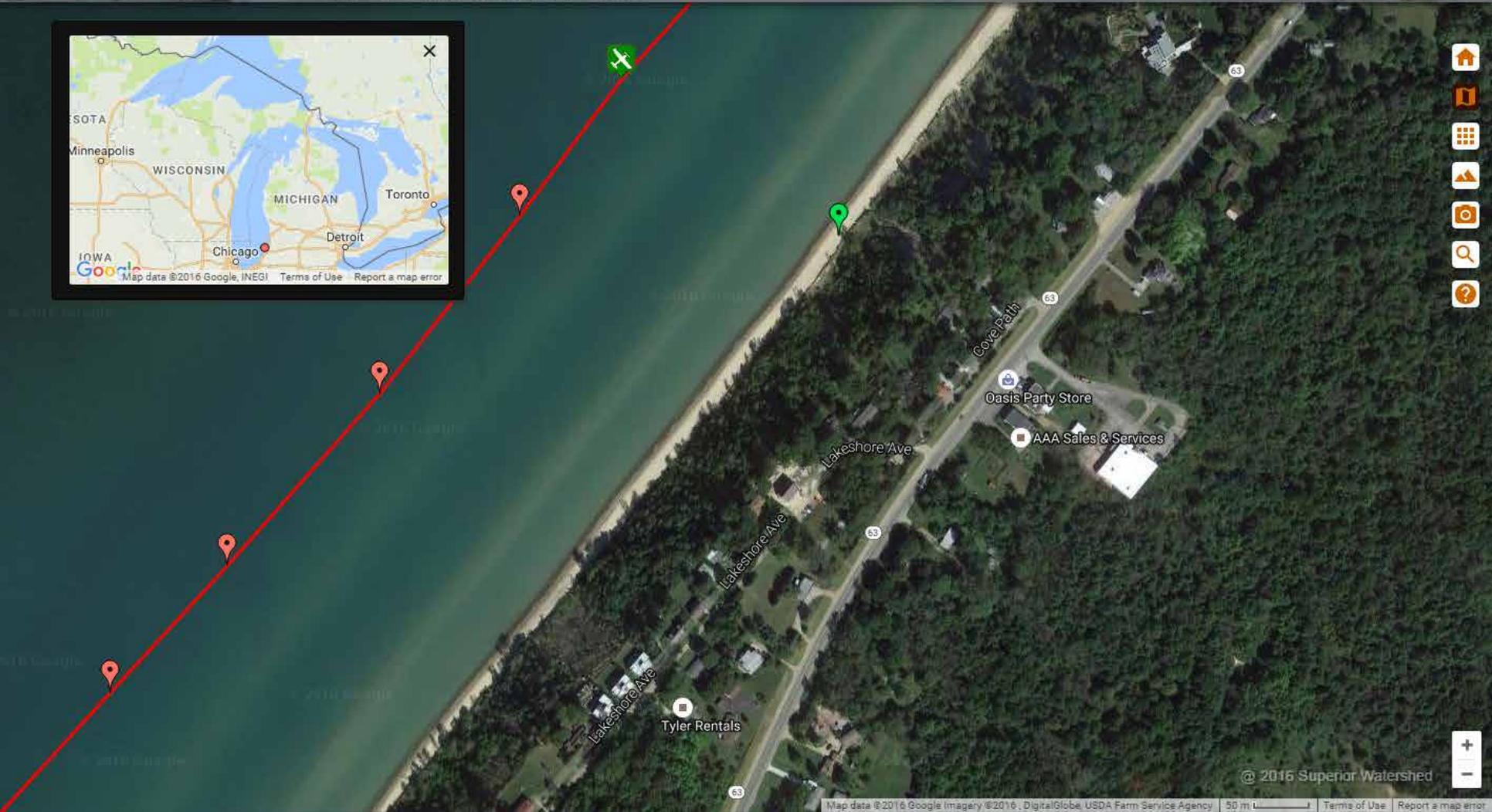


### Risk Assessment Layers:

- > **Building Risk** (Click to expand)
- > **Road/Infrastructure Risk**
- > **Coastline Risk**

# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool  
Coastal Risk • Infrastructure Risk • Building Risk



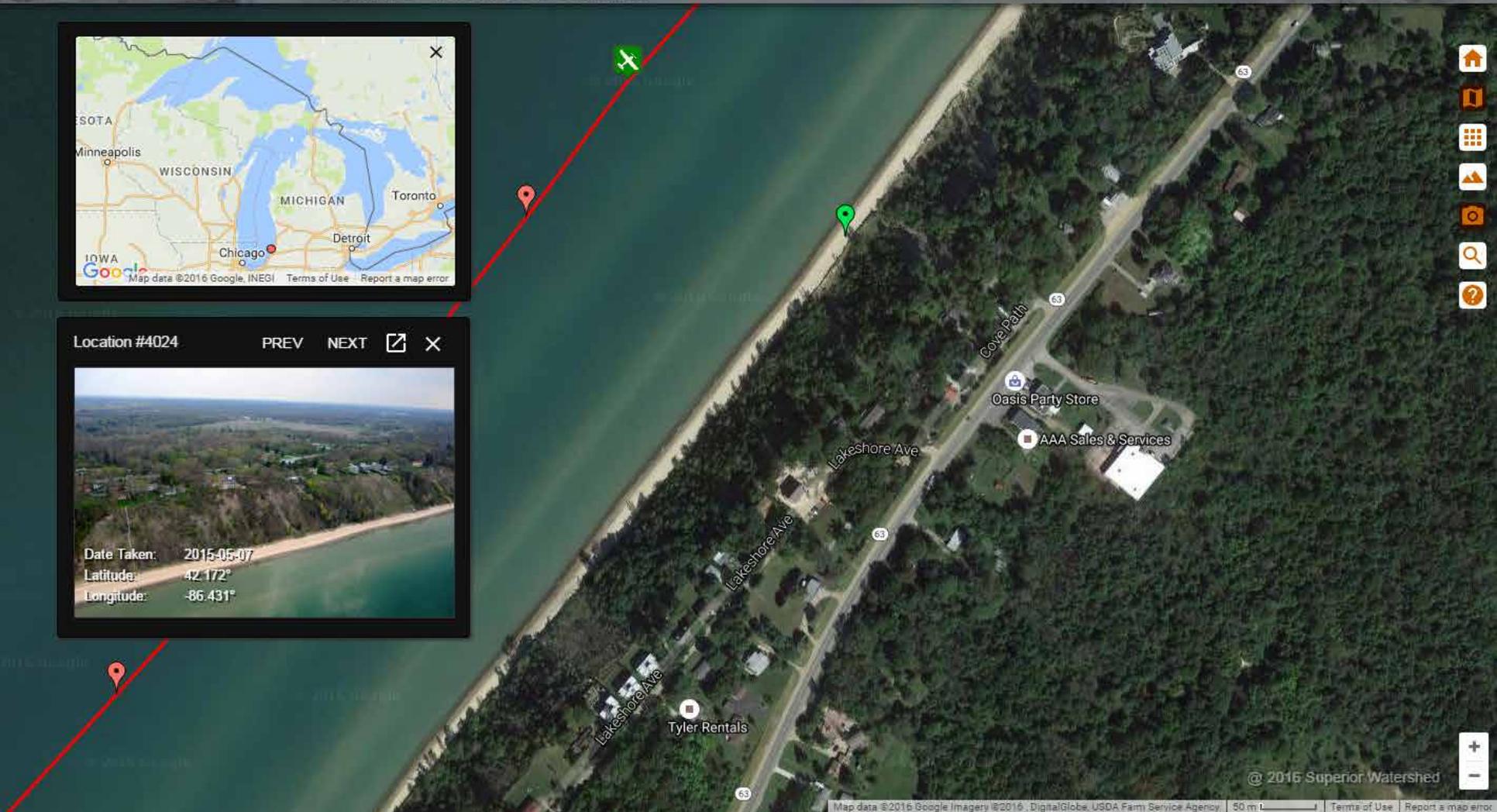
# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool  
Coastal Risk • Infrastructure Risk • Building Risk



Location #4024    PREV    NEXT    [Share Icon]    [Close Icon]

Date Taken: 2015-05-07  
Latitude: 42.172°  
Longitude: -86.431°



Location #4024

(Latitude: 42.172°, Longitude: -86.431°, Date: 2015-05-07)

PREV NEXT 🔍 ✕



[Open full-sized version of image in new window.](#)

Eaman Rd  
Lynch Rd  
Eaman Rd  
Eaman Rd

- Home
- Layers
- Grid
- 3D
- Image
- Search
- Help



# GREAT LAKES SHOREVIEWER

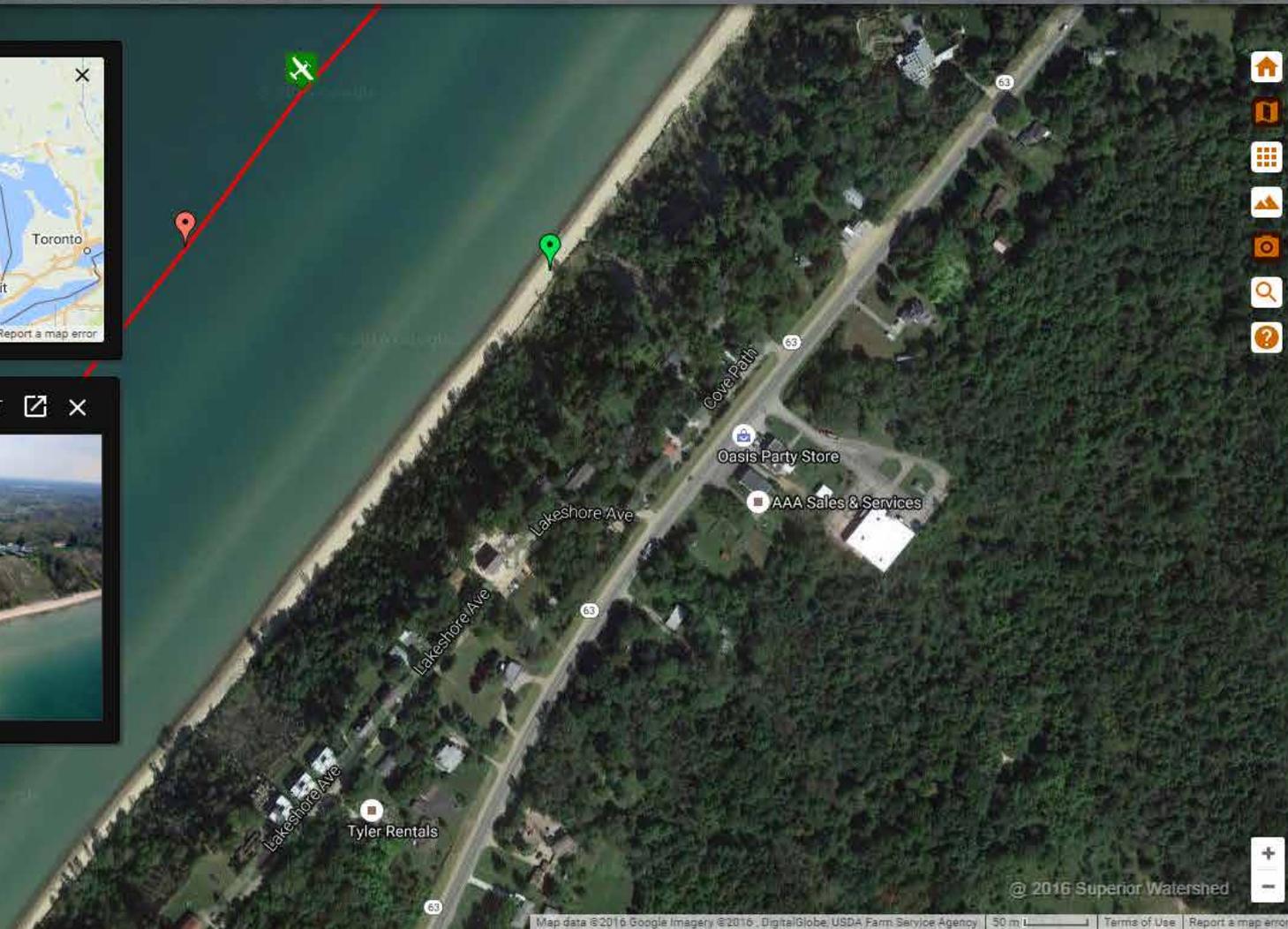
A Coastal Risk and Climate Adaptation Tool

Coastal Risk • Infrastructure Risk • Building Risk



Location #4024    PREV    NEXT    [Icon]    [X]

Date Taken: 2015-05-07  
Latitude: 42.172°  
Longitude: -86.431°



# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool  
Coastal Risk • Infrastructure Risk • Building Risk



Location #4024    PREV    NEXT    [Share Icon]    [Close Icon]

Date Taken: 2015-05-07  
Latitude: 42.172°  
Longitude: -86.431°

### Risk Assessment Layers: [Close Icon]

- > **Building Risk** (Click to expand)
  - Building Exposure To Potential Risk (Distance) ?
  - Building Exposure To Potential Risk (Slope) ?
- > **Road/Infrastructure Risk**
  - Road Exposure To Potential Risk (Distance) ?
- > **Coastline Risk**
  - Slope Hazard ?
  - Slope/Relief ?
  - LiDAR Feature Height (available for LP MI only) ?
  - Land Cover ?
  - Soils/Slope Potential Risk ?
  - Aerial Infrared ?
  - Aerial Natural Color ?



## Risk Assessment Layers:



### > Building Risk

(Click to expand)

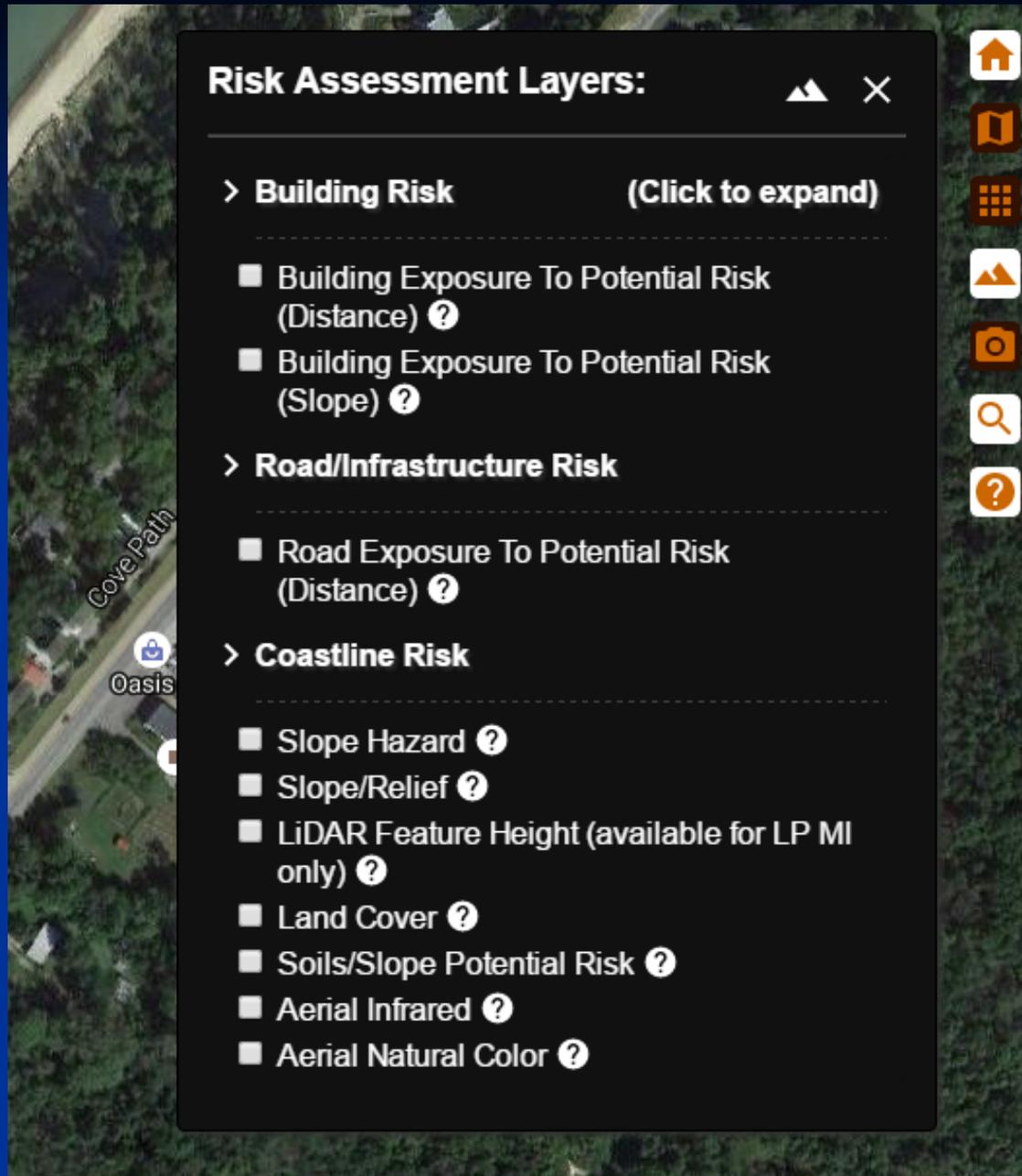
- Building Exposure To Potential Risk (Distance) ?
- Building Exposure To Potential Risk (Slope) ?

### > Road/Infrastructure Risk

- Road Exposure To Potential Risk (Distance) ?

### > Coastline Risk

- Slope Hazard ?
- Slope/Relief ?
- LiDAR Feature Height (available for LP MI only) ?
- Land Cover ?
- Soils/Slope Potential Risk ?
- Aerial Infrared ?
- Aerial Natural Color ?



## Building Exposure To Potential Risk (Distance)

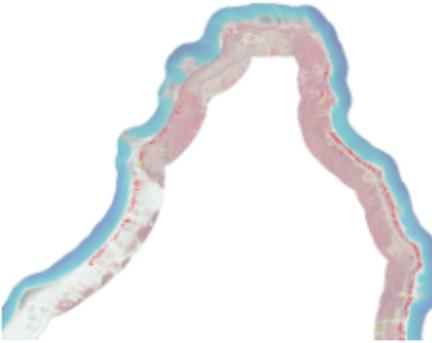


The Building Exposure to Potential Risk (Distance) layer displays the risk associated with buildings being located near a great lakes coastline.

The closer to a shoreline a building is, the more likely it will be impacted by waves, wind and erosion.

Three risk categories are shown:

- **Close** (less than 100 meters) is shown in red.
- **Moderate** (100 to 200 meters) is shown in yellow
- **Far** (200 to 300 meters) is shown in green

Graphic Screenshot	Description
	<p><b>2015, 12" resolution, Risk - Buildings Distance:</b> is a characterization of building exposure to risk based upon distance from the shoreline.</p> 

# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool

Coastal Risk • Infrastructure Risk • Building Risk

## Color Key:

### Building Exposure To Potential Risk (Distance)

[About This Layer](#)

Close (0 to 100m)



Moderate (100 to 200m)



Far (200 to 300m)



### Slope/Relief

[About This Layer](#)

20 Deg - 100 Deg



5 Deg - 20 Deg



## Risk Assessment Layers:

### > Building Risk (Click to expand)

- Building Exposure To Potential Risk (Distance) ?
- Building Exposure To Potential Risk (Slope) ?

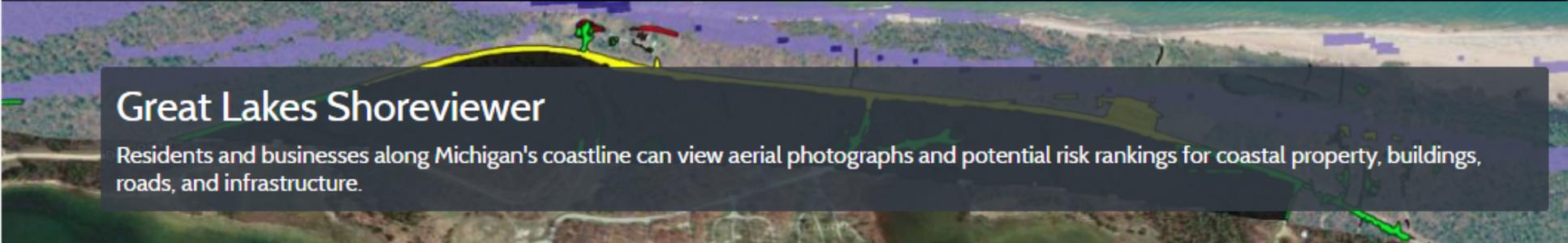
### > Road/Infrastructure Risk

- Road Exposure To Potential Risk (Distance) ?

### > Coastline Risk

- Slope Hazard ?
- Slope/Relief ?
- LiDAR Feature Height (available for LP MI only) ?
- Land Cover ?
- Soils/Slope Potential Risk ?
- Aerial Infrared ?
- Aerial Natural Color ?

@ 2016 Superior Watershed



## Great Lakes Shoreviewer

Residents and businesses along Michigan's coastline can view aerial photographs and potential risk rankings for coastal property, buildings, roads, and infrastructure.

[Tools](#) › [Great Lakes Shoreviewer](#) ›

The Great Lakes Shoreviewer is a risk assessment and climate adaptation planning tool. It provides oblique-angle color photography plus multiple layers of additional analysis for prioritized sections of Great Lakes coastline in Michigan (Lake Superior, Lake Michigan, and Lake Huron). It also provides potential risk rankings (high, medium, low) for coastal property, buildings, roads, and infrastructure.

The tool provides professional color photography of every inch of coastline (and many islands) in the Upper Peninsula of Michigan. Each coastline photo also has a series of maps showing important natural features for planning and protection efforts.

A Help screen in the tool describes map navigation, data control, and button functions and instructions for viewing risk assessment layers, viewing aerial imagery, and save a location or obtaining coordinates.

Local, state, and federal data, including high-resolution aerial imagery, were used to create the Shoreviewer. Risk categories indicated in the tool are for preliminary planning purposes only and should not be used for actual planning decisions without additional site assessment.

### Webpage:

[Great Lakes Shoreviewer](#) ›

### Topic:

[Built Environment](#) › [Buildings and Structures](#) ›

[Coasts](#) › [Coastal Erosion](#) ›

### Partners:

[Superior Watershed Partnership & Land Trust](#) ›

[Applied Ecological Services](#) ›

[906 Technologies](#) ›

[Michigan Department of Environmental Quality | Coastal Zone Management Program](#) ›

[National Oceanic and Atmospheric Administration](#) ›



# GREAT LAKES SHOREVIEWER

A Coastal Risk and Climate Adaptation Tool

Coastal Risk • Infrastructure Risk • Building Risk



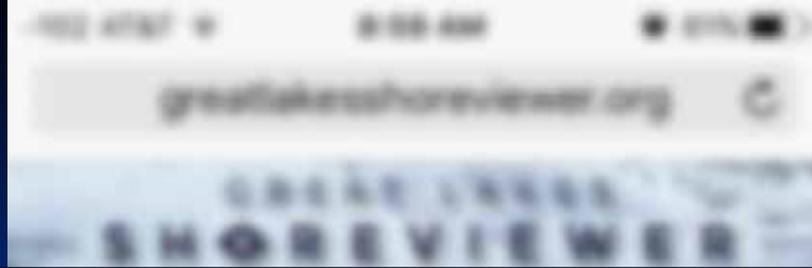
© 2016 Superior Watershed

Google

Map Data

50 m

Terms of Use



[www.GreatLakesShoreviewer.org](http://www.GreatLakesShoreviewer.org)



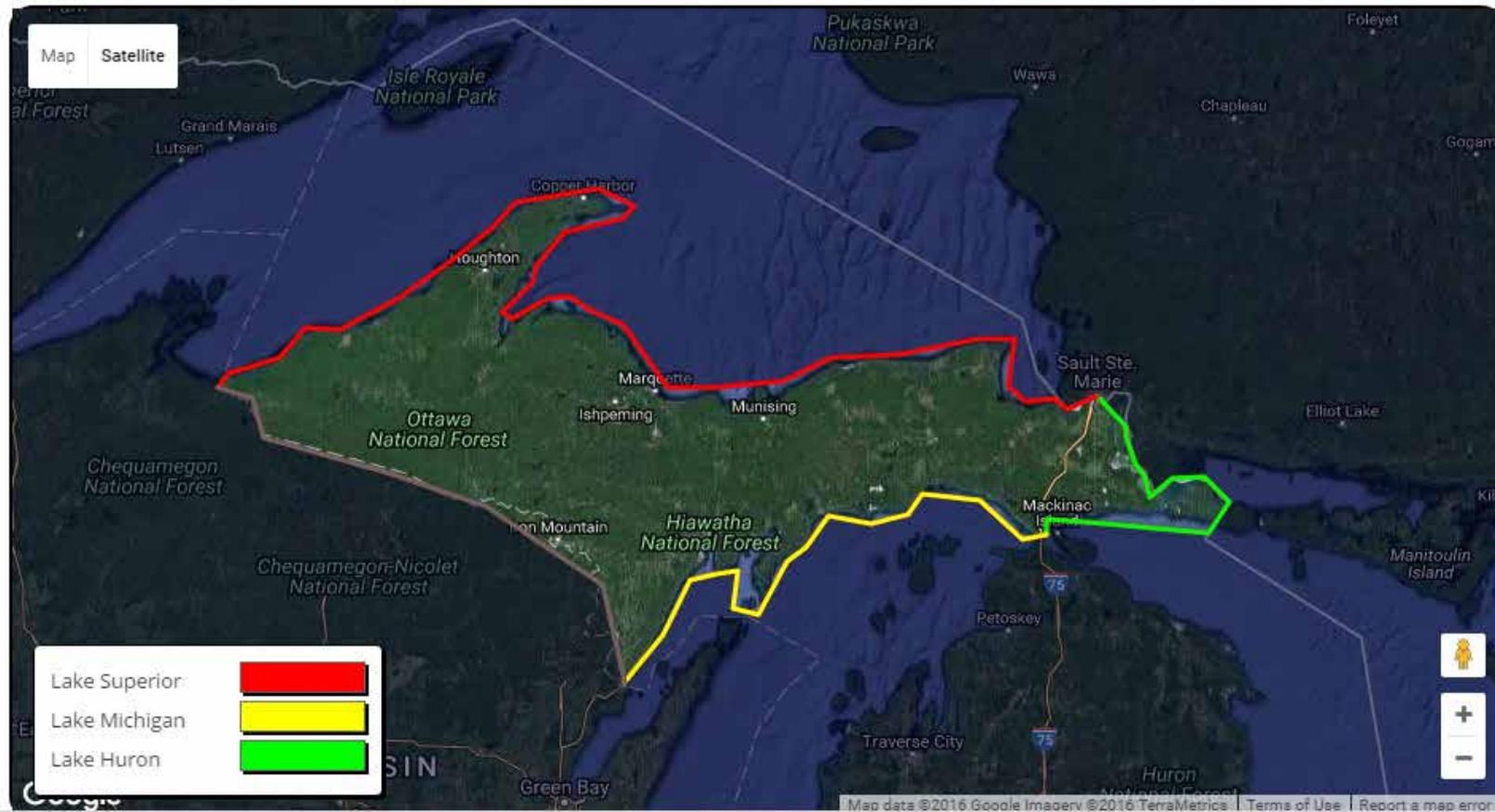


## Great Lakes Coastal Inventory

### *Mapping Coastal Erosion Sites and other Shoreline Impacts*

The Great Lakes Coastal Inventory is a simple way for people to provide information about coastal problems including: erosion sites, habitat impacts, polluted runoff, dumping sites and improper off-road vehicle use. The inventory is designed for all Great Lakes coastal areas in the Upper Peninsula of Michigan; Lake Superior, Lake Michigan and Lake Huron.

The inventory is easy to use: simply click and place a locator pin on the site, upload a photo if available and type in any additional information about the site in the form below (optional: name, phone number, directions to site, nearest street address, dimensions of site if applicable, etc.). The SWP will use the inventory to prioritize sites and seek resources to address coastal impacts.





📍 **Your Name**

Your name (optional)

📍 **Your Phone Number**

Phone number (optional)

📍 **Contact Email**

Email address (optional)

📍 **Latitude \***

📍 **Longitude \***

📍 **Site Description/Comments \***

Description/Comments



➤ **Site Dimensions**

Site dimensions (optional)

➤ **Directions to site**

Directions to site (optional)

➤ **Photo upload**

Choose File No file chosen

Accepted file types: jpg, gif, png.

Submit



1. What is the problem?

Text input field for describing the problem.

2. What is the location?

Text input field for describing the location.

3. What is the contact information?

Text input field for contact information.

Submit button labeled "Report Erosion Hazard".



# Coastal Weather Buoy Project



Lake Superior

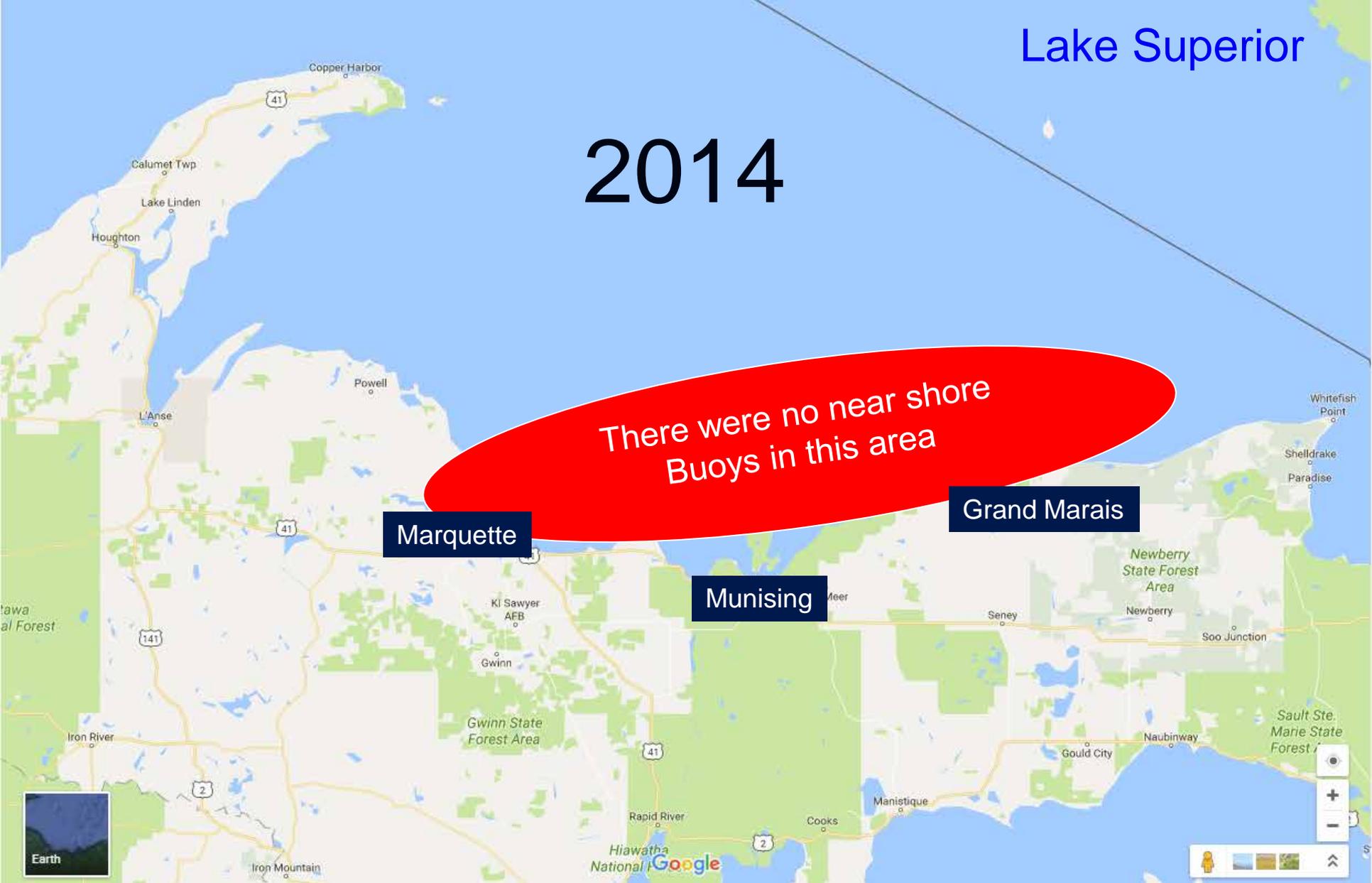
2014

There were no near shore  
Buoys in this area

Marquette

Grand Marais

Munising





ARGONNE NATIONAL LABS

ME 549

ERDA 1

NORTHERN MICHIGAN UNIVERSITY

Department of Energy



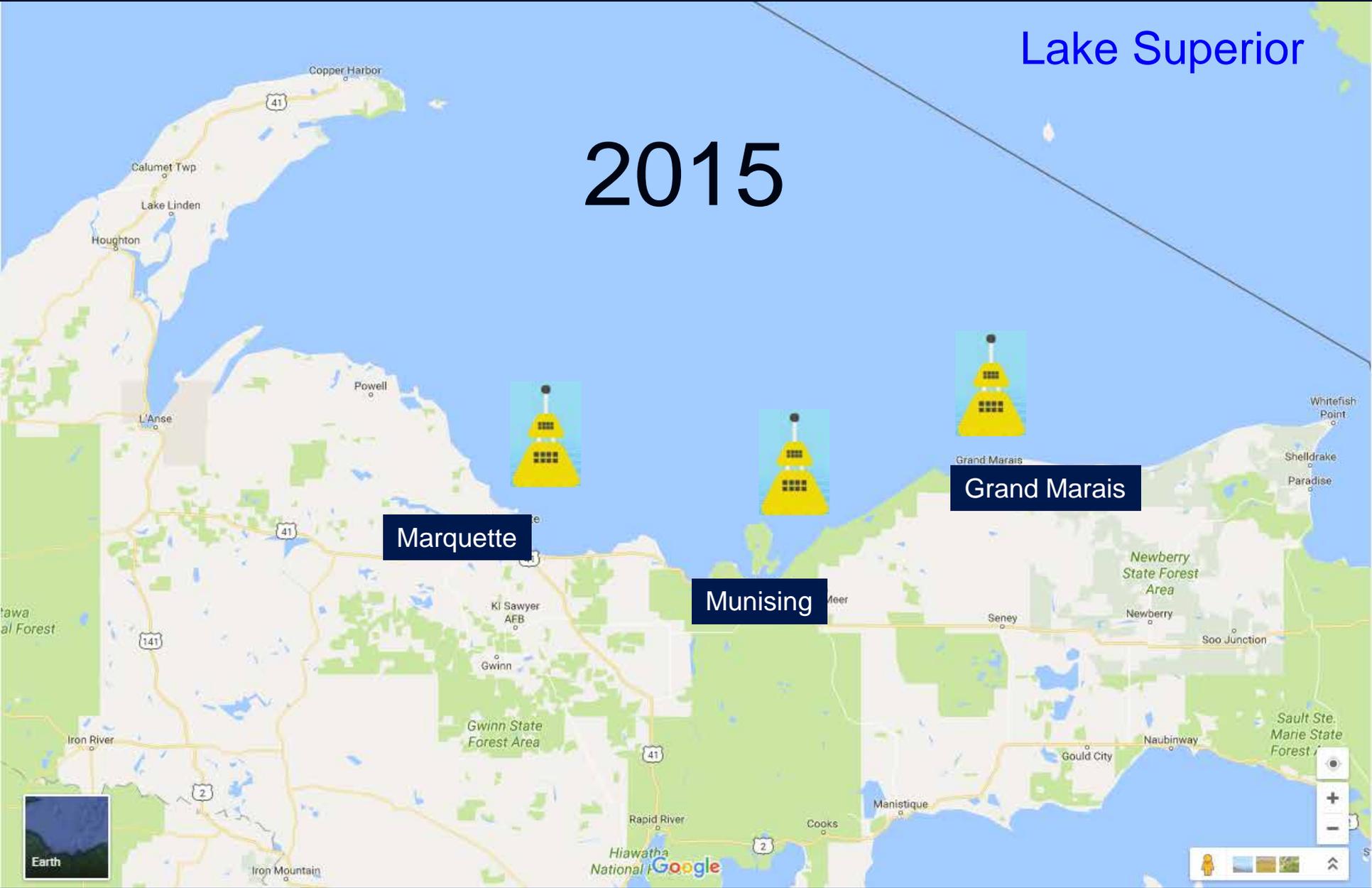
CENTRAL LAKE SUPERIOR WATERSHED PARTNERSHIP





Lake Superior

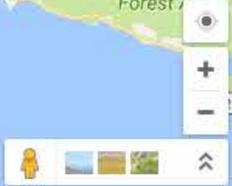
2015



Marquette

Munising

Grand Marais





Munising buoy with camera



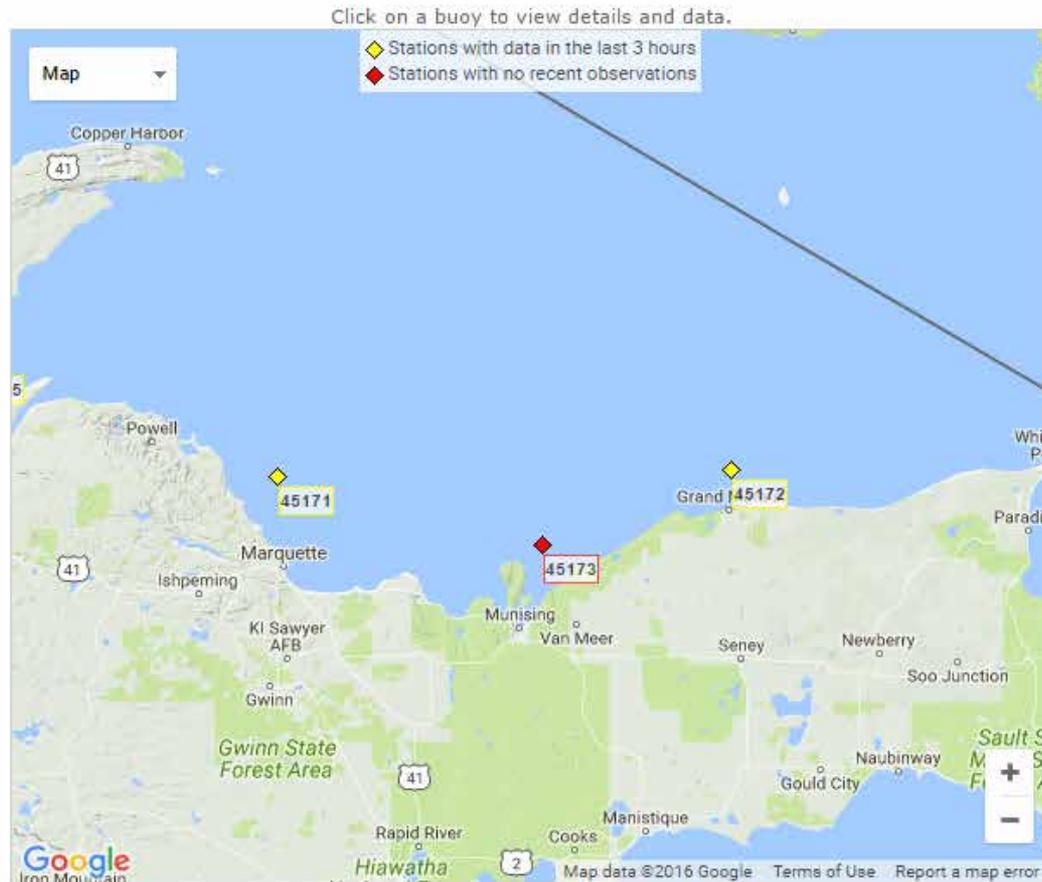
Granite Island buoy



## Great Lakes Nearshore Buoy Network

[home](#)

Access real-time observations from buoys and monitoring stations in the Great Lakes regions





## Granite Island Buoy

[home](#)



Northern  
Michigan  
University

Owned & maintained by [Northern Michigan University](#). Contact John Lenters at [jlenters@limno.com](mailto:jlenters@limno.com) for further information.

### Conditions at Station 45171 as of 10/05/2016 08:00:00 EST

(Click on 'Update' to enter changes)

Unit of Measure:  Time Zone:

Measurements in red indicate failed validity tests.

Measurements in orange indicate questionable validity tests.

Click on the graph icon, in the table below, to see a time series plot of the last five days of that observation.

Click on the page icon to view datasheet of sensor.



Text the Station ID (45171) to  
(734)-418-7299 to receive the latest  
observation on the go.



Barometric Pressure (BARO1) 1012.2 mBar

46.7238888 87.4113888 Decimal Degrees [DDD.DDDDD]  
46 43.433328 N 87 24.683328 W Degrees, Decimal Minutes [DDD MM.MMMM]  
46 43 25 N 87 24 40 W Degrees, Minutes, Seconds [DDD MM SS]



Air Temperature (ATMP1) 56.3 °F



Wind Direction (WDIR1) SSE (157°)



Wind Speed (WSPD1) 18.3 knots



Water Temperature at Surface (WTMP1) 62.2 °F



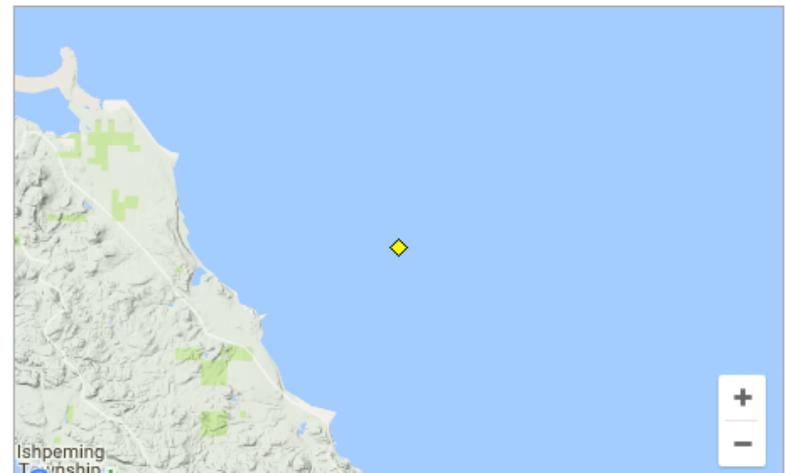
Significant Wave Height (VWHT) 2.7 ft.



Dominant Period of Waves (DOMPD) 4 Sec.



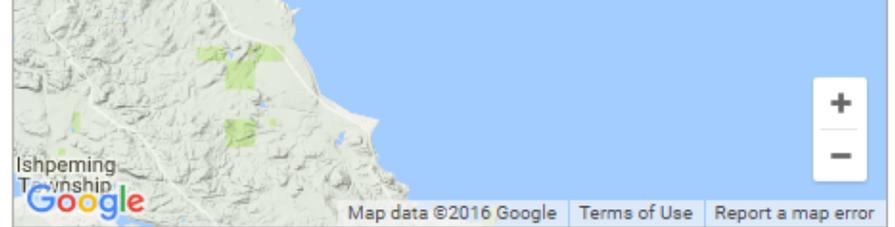
Wave Direction (MWDIR) 102 °



  Dominant Period of Waves (DOMPD ) 4 Sec.

  Wave Direction (MWDIR ) 102 °

 Battery Voltage (VBAT ) 12.6 V



-  Currently selected station
-  Stations with recent data
-  Stations with no data in last hour

Station 45171

### Previous Observations

ID	DATE	 BARO1 (mBar)	 ATMP1 (°F)	 WDIR1	 WSPD1 (knots)	 WTMP1 (°F)	 WVHGT (ft.)	 DOMPD (Sec.)	 MWDIR (°)	 A1	 B1	 A2	 B2	AGE	VBAT (V)
41631	10/05/2016 08:00:00	1012.2	56.3	SSE	18.3	62.2	2.7	4	102	-0.2	0.8	1.2	0.3	324	12.6
41630	10/05/2016 07:00:00	1012.9	56.7	S	17.7	62.2	2.5	---	161	-0.9	0.3	3.1	-0.3	365	12.6
41629	10/05/2016 06:00:00	1013.4	56.8	SE	15.9	62.1	2.1	---	---	-	-	-	-	411	12.6
41628	10/05/2016 05:00:00	1013.8	56.8	SE	14.2	62	2	3	112	-0.3	0.8	1	-0.1	452	12.6
41627	10/05/2016 04:00:00	1014.3	57.2	S	11.9	62.1	2	3	116	-0.4	0.8	1.1	-	498	12.6
41626	10/05/2016 03:00:00	1015.3	56.8	SSE	11.9	62.1	1.9	4	96	-0.1	0.8	1.3	0.3	23	12.6
41625	10/05/2016 02:00:00	1015.4	56.3	SSE	9.7	62.1	1.9	4	89	-	0.7	1	-	66	12.6
41624	10/05/2016 01:00:00	1015.7	55.9	SE	12.1	62.1	1.9	4	105	-0.2	0.7	1.3	-	112	12.6
41623	10/05/2016 00:00:00	1016.1	55.8	SSE	9.9	62	1.8	4	82	0.1	0.7	1.1	-0.5	153	12.6
41622	10/04/2016 23:00:00	1016.5	55.6	SSE	13.4	62	1.8	4	100	-0.1	0.7	1.4	0.3	198	12.6
41621	10/04/2016 22:00:00	1016.5	55.9	SSE	10.1	61.8	1.9	4	90	-	0.6	1.2	-0.4	244	12.6
41620	10/04/2016 21:00:00	1016.7	56.5	SSE	10.7	61.8	2.1	3	153	-0.7	0.4	1.3	-0.5	287	12.6
41619	10/04/2016 20:00:00	1016.6	57.2	SSE	13.6	61.8	2	3	137	-0.6	0.5	0.9	-0.4	333	12.6
41618	10/04/2016 19:00:00	1016.4	57.9	SE	14.8	61.9	1.9	---	205	-0.3	-0.1	3.4	1.2	374	12.7
41617	10/04/2016 18:00:00	1016.5	58.5	SSE	12.3	62	1.5	4	99	-0.1	0.7	1.3	0.8	419	12.8
41616	10/04/2016 17:00:00	1017.1	57.6	SE	6.4	62	1.5	4	88	-	0.8	0.9	-	461	12.8
41615	10/04/2016 16:00:00	1017.6	56.8	E	9.1	62	1.5	4	109	-0.2	0.7	1	0.1	507	12.8

[Download data here](#)

Station 45171

# Superior Buoys

By 906 Technologies

Open iTunes to buy and download apps.



[View in iTunes](#)

This app is designed for both iPhone and iPad

**Free**

Category: [Weather](#)

Updated: Jul 26, 2016

Version: 1.4.3

Size: 10.1 MB

Language: English

Seller: 906 Technologies LLC

© 906 Technologies

Rated 4+

**Compatibility:** Requires iOS 6.0 or later. Compatible with iPhone, iPad, and iPod touch.

## Customer Ratings

We have not received enough ratings to display an average for the current version of this application.

## Description

Weather information recorded from buoys on Lake Superior. Stats include Air Temperature, Water Temperature, Wind Speed, Wave direction and Wave Height. Map and buoy cam video are also available.

[906 Technologies Web Site](#) ▶ [Superior Buoys Support](#) ▶

## What's New in Version 1.4.3

Updated video feed settings.

## Screenshots

[iPhone](#) | [iPad](#)



-96 AT&T

1:28 PM

90%

# Granite Island

September 28, 2016 1:00 pm EDT

54.5°F Air



62.4°F Water



Wind Speed

15.6 knots



Wind Direction

E (100°)



Wave Height

3.3 ft



Map



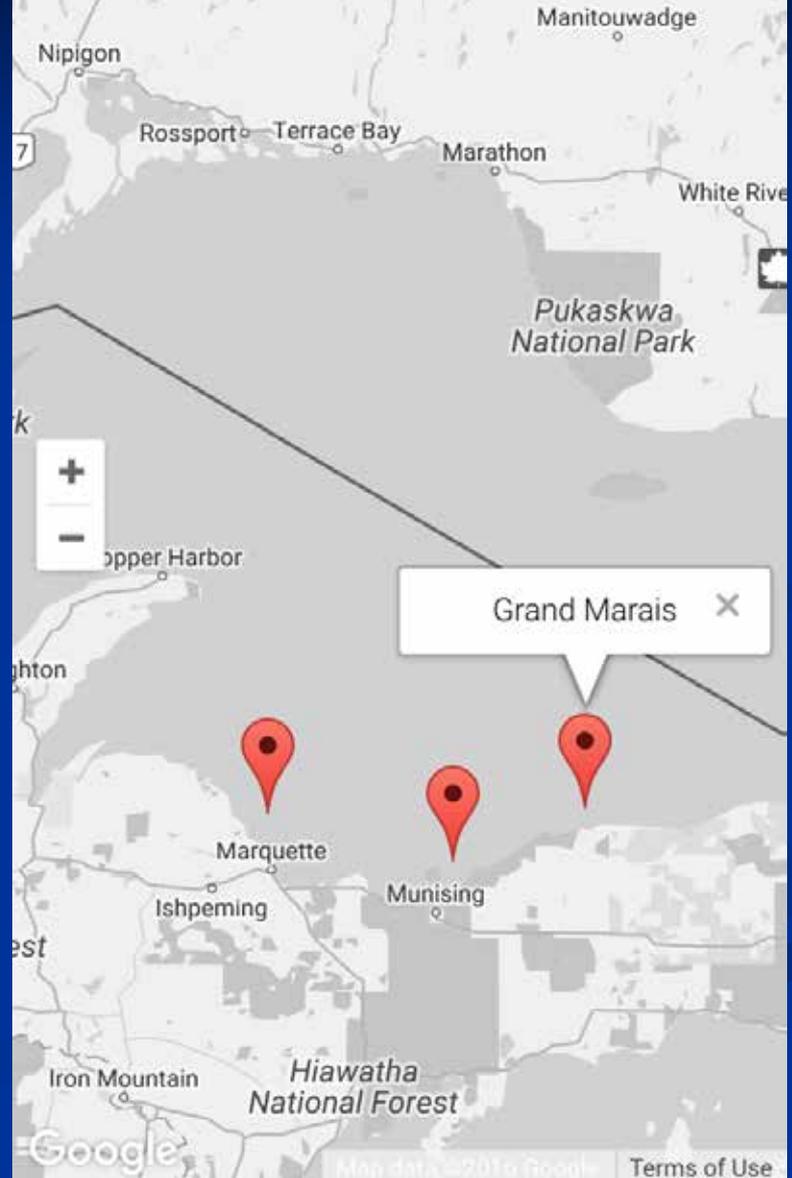
-98 AT&T

1:31 PM

89%

Map

Satellite



Grand Marais

Google

Map data ©2016 Google

Terms of Use



[www.munising.org](http://www.munising.org)



PICTURED ROCKS  
National Lakeshore

[www.picturedrocks.com](http://www.picturedrocks.com)

Movie from Munising buoy in 11 foot waves



# COASTAL STORMS BUOY PROJECT

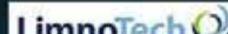


The Lake Superior coastline is rugged, wild, and notorious for shipwrecks that attest to the combined dangers of water, wind, and waves. Until recently, the 185-mile (300-km) section of shoreline from the Huron Islands to Whitefish Point was without any modern offshore equipment to provide critical coastal storm data such as wave height and water temperature. In 2014, Northern Michigan University – in cooperation with LimnoTech and the Superior Watershed Partnership – received funding from the Great Lakes Observing System ([www.glos.us](http://www.glos.us)) to deploy a number of coastal storm buoys along the southeastern shoreline of Lake Superior. The three buoys are located 5-10 miles offshore of Marquette, Munising, and Grand Marais, providing real-time wave height, water temperature, and meteorological data.

A free smartphone app is available to view data from all three buoys, and more detailed information on these and many other Great Lakes buoys can be found at [www.greatlakesbuoys.org](http://www.greatlakesbuoys.org). In addition to reporting coastal storm data, the Munising buoy has a webcam to view weather and wave conditions every hour. The buoys are deployed in spring and retrieved in fall to provide critical data during most of the commercial and recreational boating season. Project partners are also using the buoy data for regional climate adaptation planning. For more information, please visit: [www.superiorbuoys.org](http://www.superiorbuoys.org).



DOWNLOAD THE  
**SUPERIOR BUOYS**  
APP



SCIENCE ON TAP



# MAKING WAVES

Lake Superior's New Coastal Storms Buoys

by John Lenters, LIMNOTECH,  
Norma Froelich, NMU DEPARTMENT OF EECS,  
and Staff from SUPERIOR WATERSHED PARTNERSHIP

THURSDAY, MAY 12 • 7PM

upstairs in the community space at  
**ORE DOCK BREWING COMPANY**

FREE & OPEN TO ALL AGES OF THE PUBLIC  
SECOND THURSDAY OF EVERY MONTH

For more information contact [scienceontop@nmu.edu](mailto:scienceontop@nmu.edu)  
ILLUSTRATION AND DESIGN BY EMILY WEDDLE DESIGN, LLC

 APPROVED FOR POSTING THROUGH MAY 12, 2016

BROUGHT TO YOU BY



NMU'S CHAPTER OF SIGMA XI  
THE SCIENTIFIC RESEARCH SOCIETY

NORTHERN MICHIGAN UNIVERSITY



[greatlakesbuoys.org](http://greatlakesbuoys.org)  
and the  
Superior Buoys app





New live webcam  
[Superiorwatersheds.org](http://Superiorwatersheds.org)



SUPERIOR  
WATERSHED  
PARTNERSHIP  
AND LAND TRUST