

Lake Superior Water Levels and Coastal Impacts

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CSS Inc on contract to NOAA Office for Coastal Management



Overview

Historical Water Levels

Current Water Levels

Coastal Storms and Impacts

Data to Information

Resources

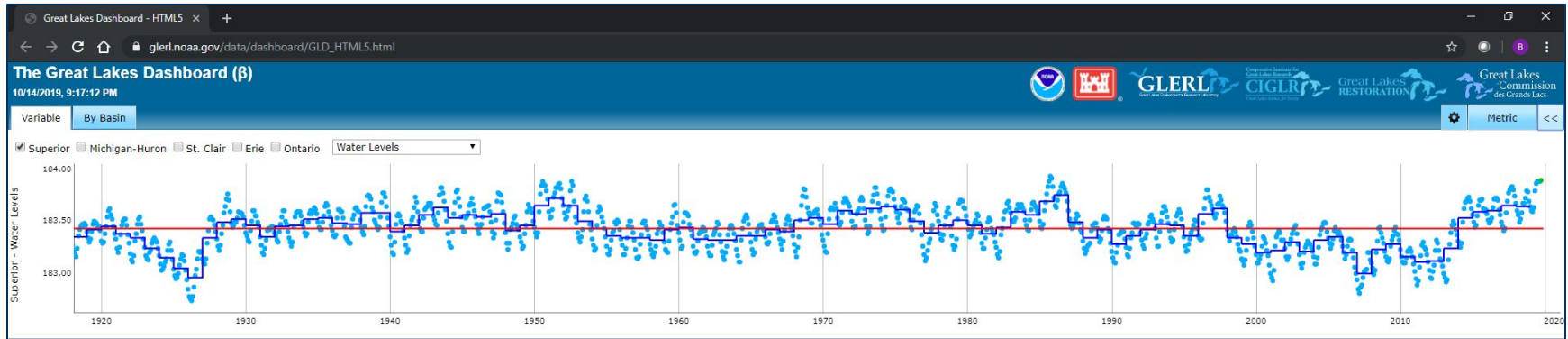
Questions/Comments/Discussion

Historical Water Levels

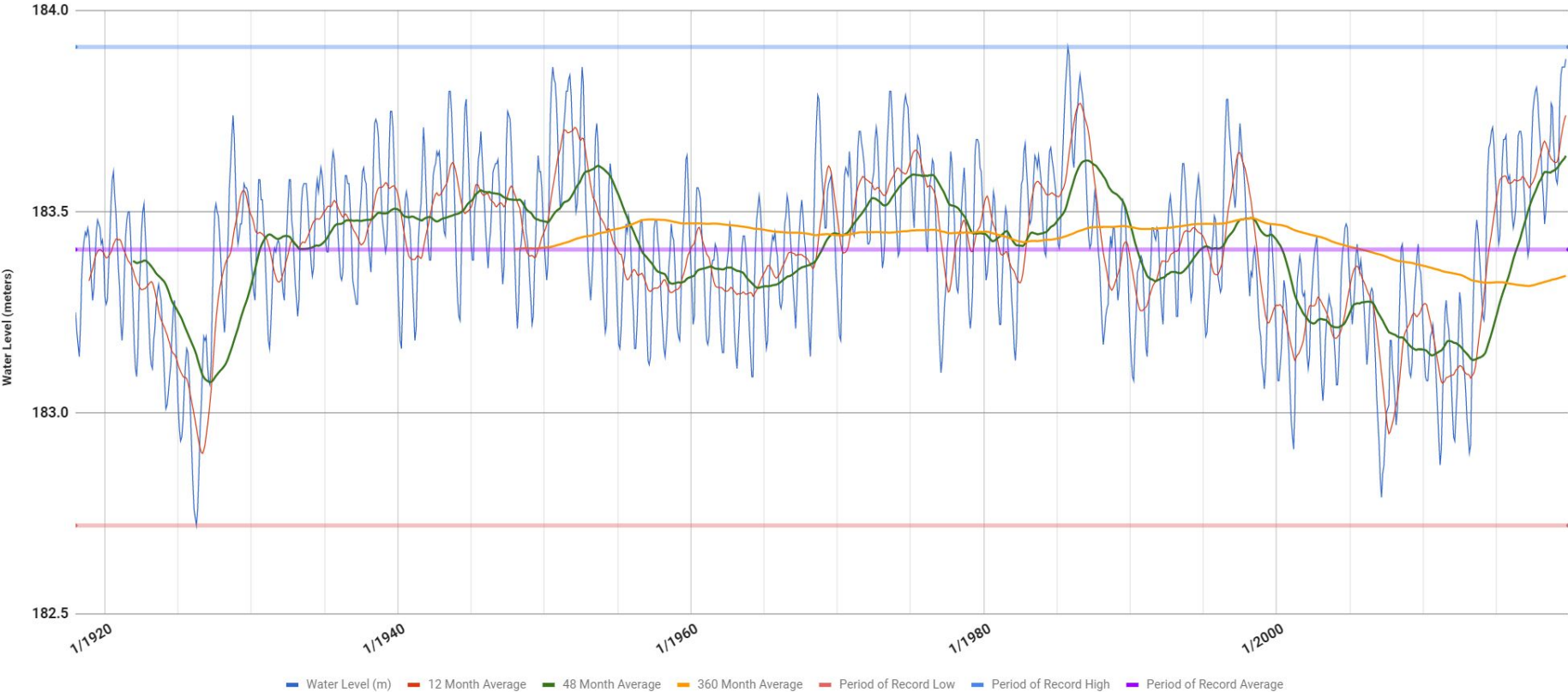
Record High: October 1985 - 183.91 meters / 603.38 feet

Record Low - April 1926 - 182.72 meters / 599.48 feet

Change of 1.19 meters / 3.9 feet



Lake Superior Water Levels (Source: NOAA / USACE)



Current Water Levels

Game of Inches

October 2019 Monthly Average Water Level:

183.88 meters / 603.28 feet

Shy of record by 3 cm / 1.18 inches

Quick Calculation:

March 2007 - 182.79 meters / 599.7 feet

Change of 1.09 meters / 3.57 feet in ~13 years

Area of Lake Superior: 82,103 km²

Change in Water Volume: 0.0019 km x 82,103 km² = 155.99 km³

Current Water Levels

41,208,200,000,000 gallons



Olympic swimming pool: ~660,253 gallons

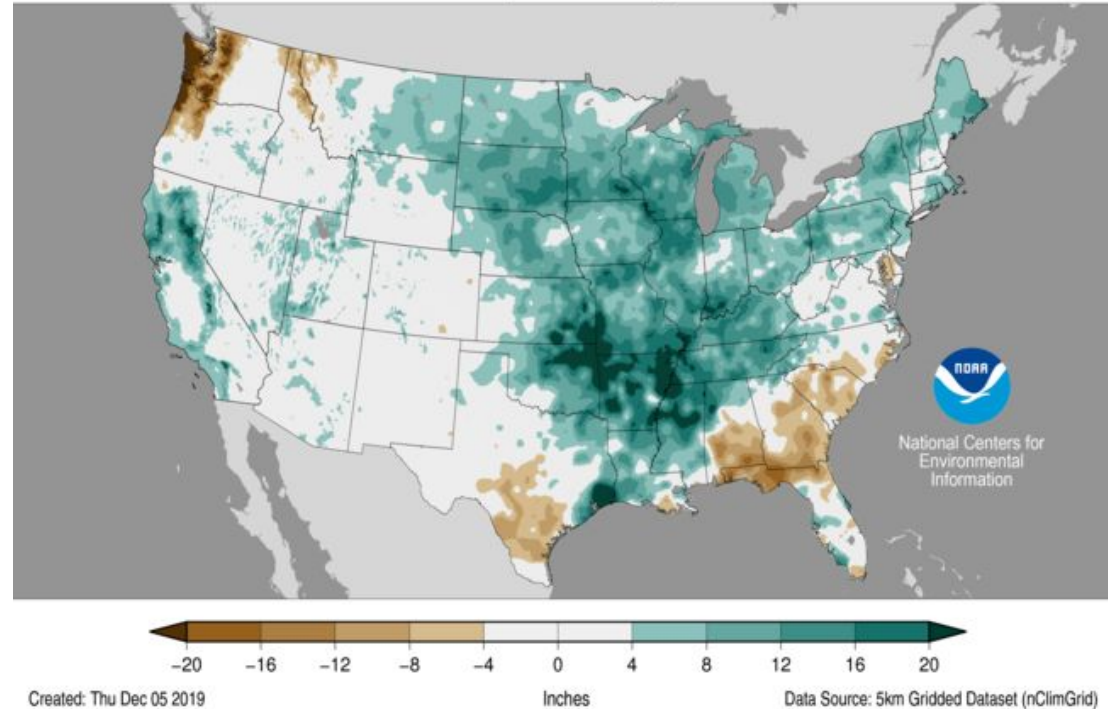
X ~62,412,742

Current Water Levels

Precipitation Departures from Average
January–November 2019
Average Period: 20th Century

Wet across much of
the central U.S.

Year to Date
Precipitation
Departure from
Average





Water + Wind

Office for Coastal Management



Coastal Storms: Duluth, MN

AN ANGRY LAKE SUPERIOR

Today through This Evening

Highest Wind Gusts Today (mph)



GALE WARNING

- Gale-force winds and near storm-force gusts today through this evening.

IMPACTS

- Isolated tree damage and power outages near the lake.
- Flooding, erosion, and damage to shoreline.
- Difficult travel for high-profile vehicles on high bridges between Duluth and Superior.

NATIONAL WEATHER SERVICE DULUTH, MN

weather.gov/duluth

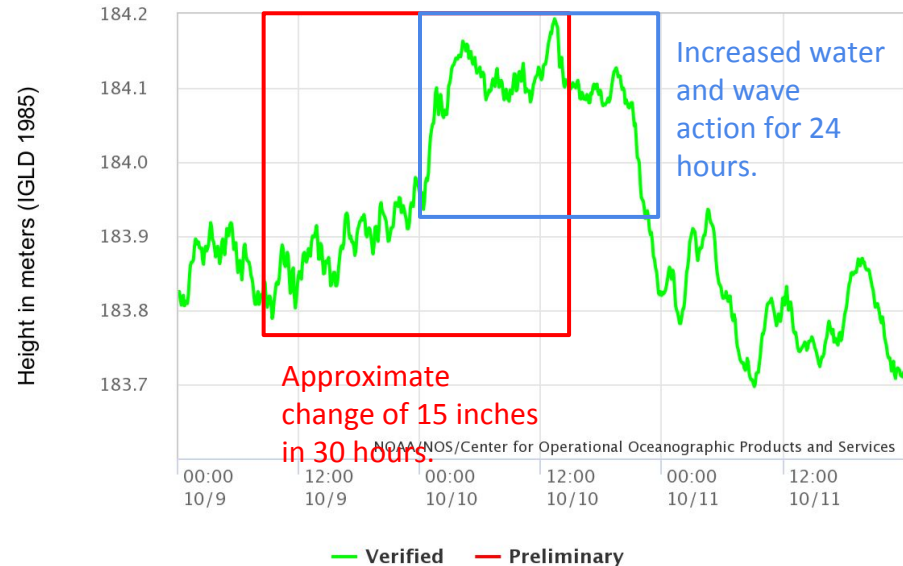


Published on: 10/10/2018 at 6:58AM

NOAA/NOS/CO-OPS

Observed Water Levels at 9099064, Duluth MN

From 2018/10/09 00:00 LST/LDT to 2018/10/11 23:59 LST/LDT



Coastal Storms: Duluth, MN



October 2018, Gale Warning. Canal Park, Duluth, MN
Source: WDIO HarborCam



March 1975, Blizzard causes flooding. Canal Park, Duluth, MN
Source: Duluth News Tribune

Coastal Storms: Grand Marais, MN

AN ANGRY LAKE SUPERIOR

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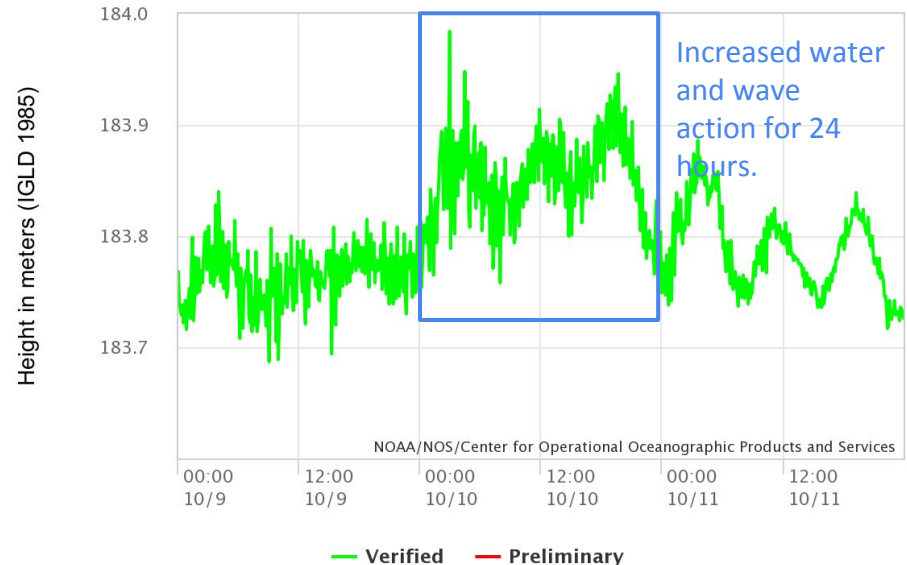
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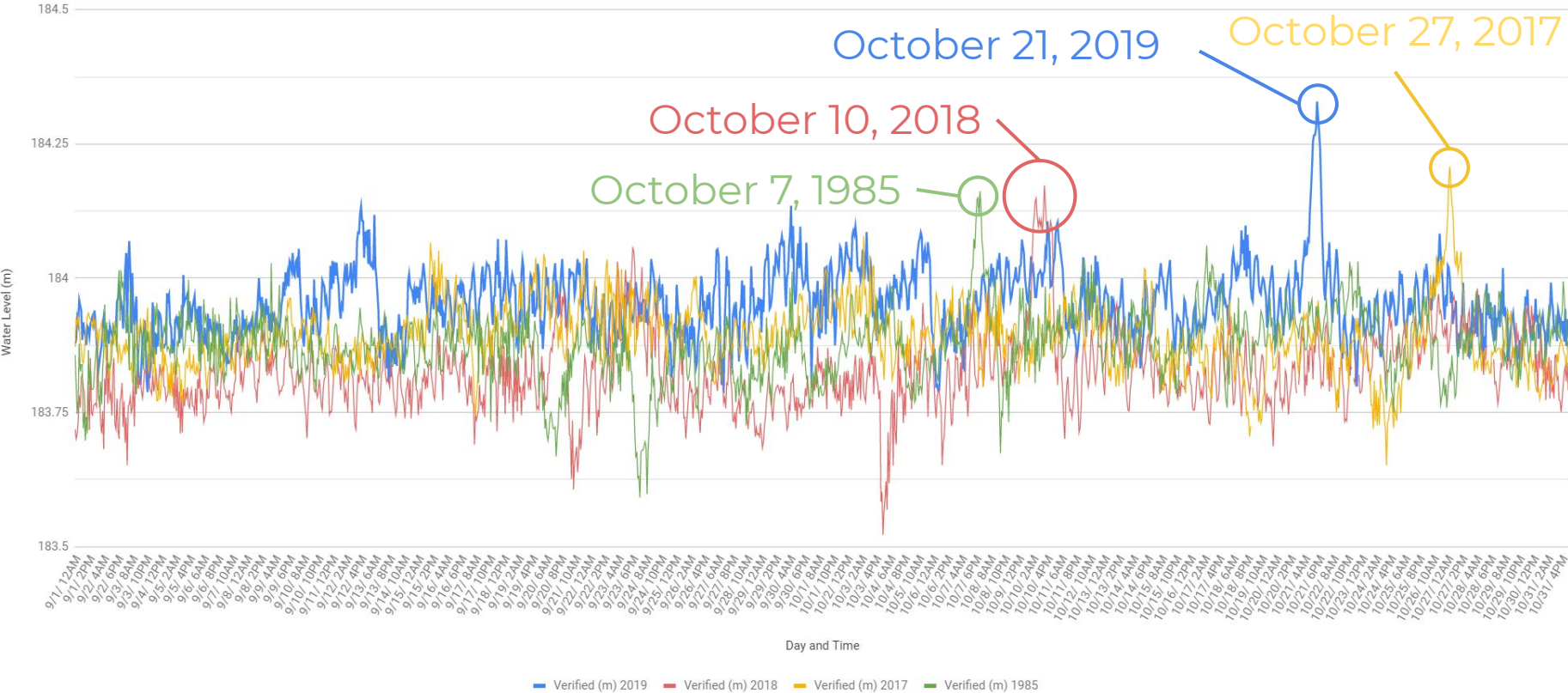


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NOAA/NOS/CO-OPS
Observed Water Levels at 9099090, Grand Marais, Lake Superior MN
From 2018/10/09 00:00 LST/LDT to 2018/10/11 23:59 LST/LDT

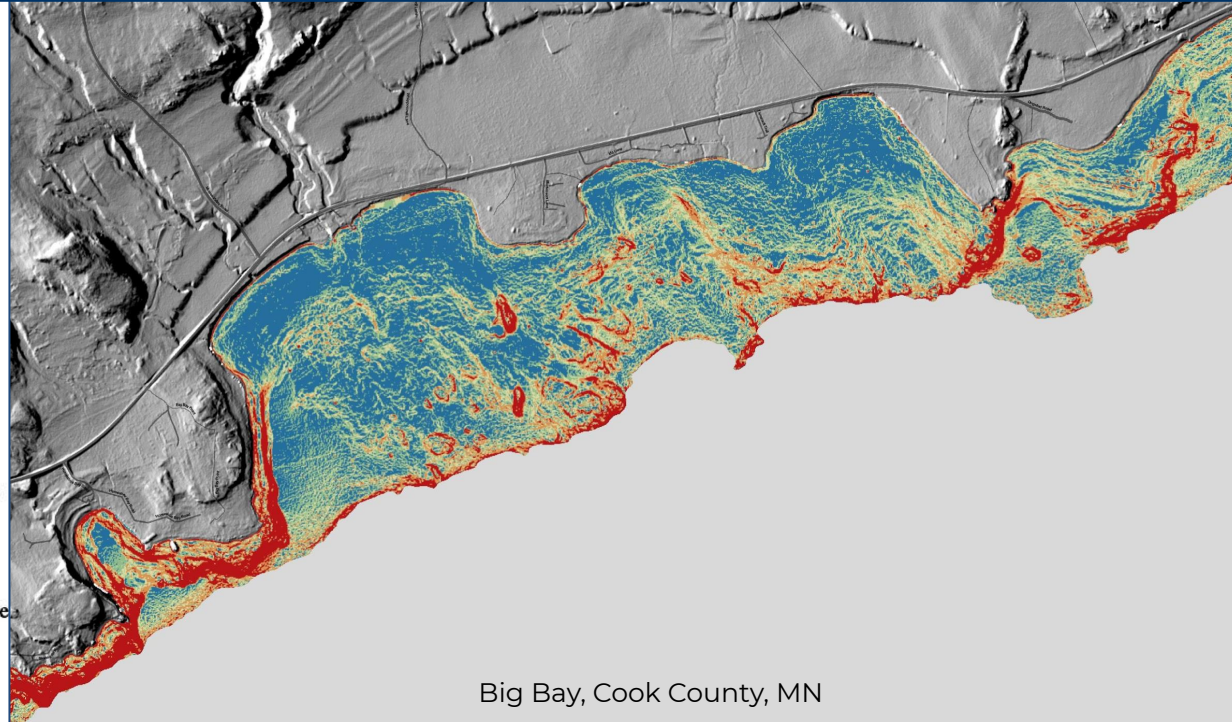
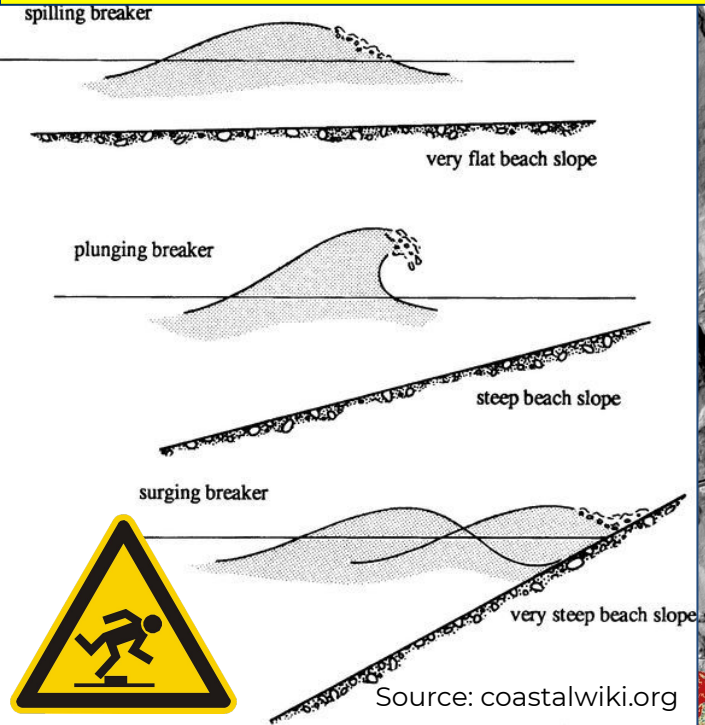


Comparison of Water Levels and Storm Events - Duluth, MN 9099064



Wave Development

Increased Erosion with Slope



Big Bay, Cook County, MN

Wave Development



Coastal Impacts

- Shoreline Erosion
- Increased sediment transport
- Alterations to stream and river mouths
- Damage to coastal infrastructure
- Flooded marinas and docks
- Electric shock drowning
- Hazards to navigation
- Loss of coastal terrestrial and wetland habitat
- Shrinking beaches for recreational use
- Increased wave runup



Brighton Beach



Brighton Beach Monday October 21, 2019 8:48AM



Brighton Beach Monday October 28, 2019 8:50AM



McQuade Safe Harbor



McQuade Safe Harbor



McQuade Safe Harbor Tuesday October 22, 2019

Debris Transport



McQuade Safe Harbor Tuesday October 22, 2019



Brighton Beach Monday October 28, 2019

From Data to Information

Physical Environment Data

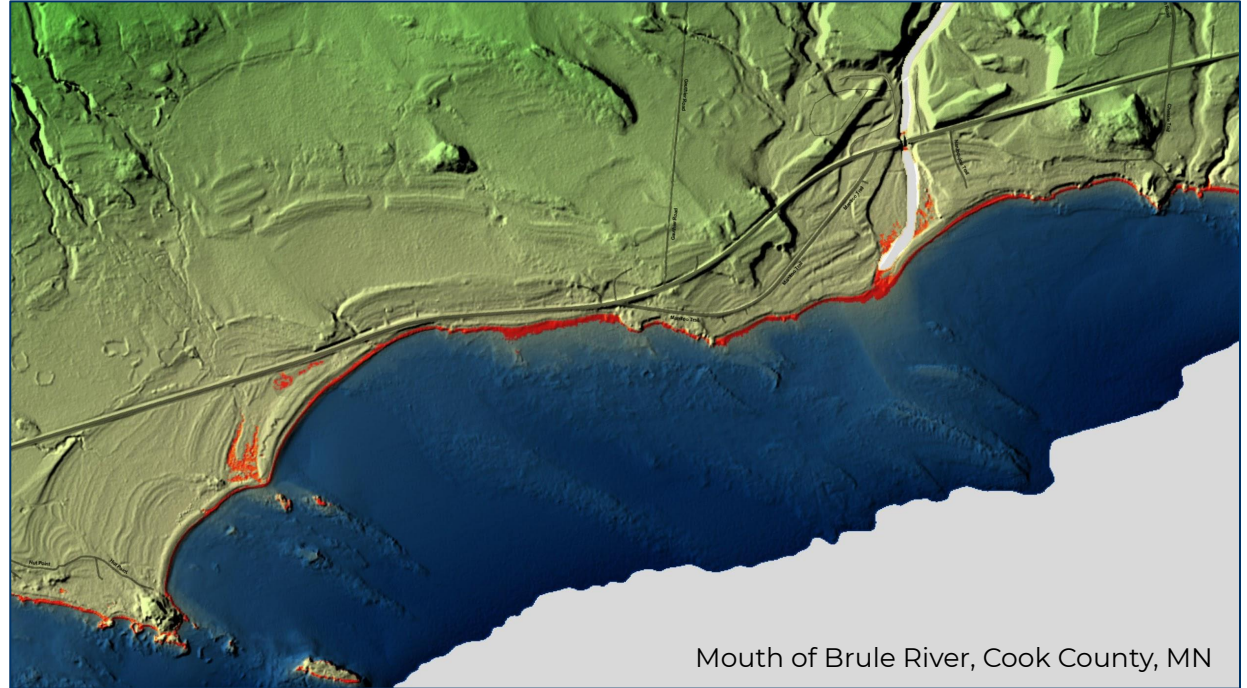
Water Level Data

Lake Level Viewer

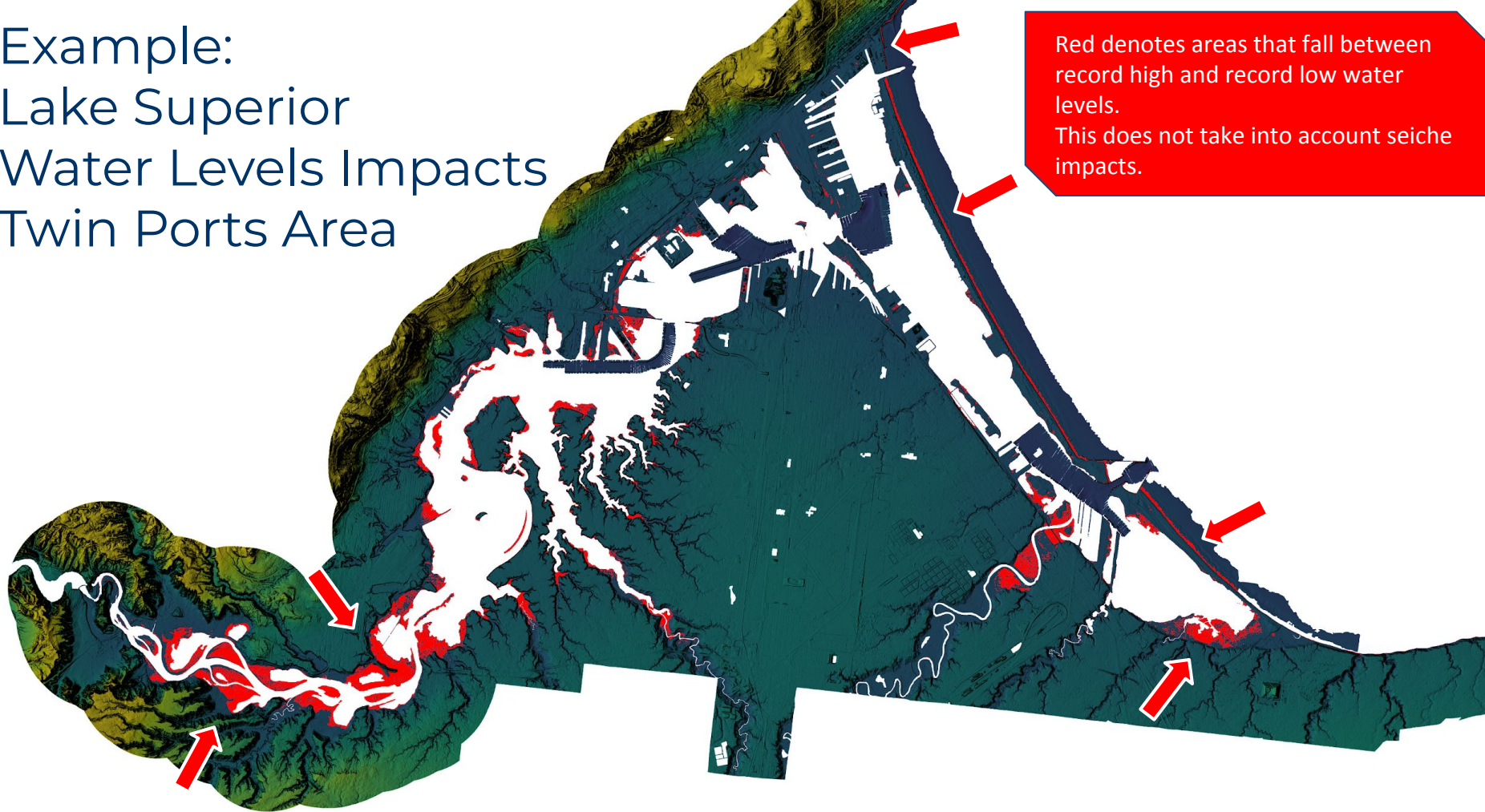
Available Data: DEMs

Digital Elevation
Models (DEMs):

Red area denotes
coastal areas that
fall between
record high and
record low water
levels for Lake
Superior



Example: Lake Superior Water Levels Impacts Twin Ports Area



Available Data: Lidar

JALBTCX Lidar



Available Data: Imagery

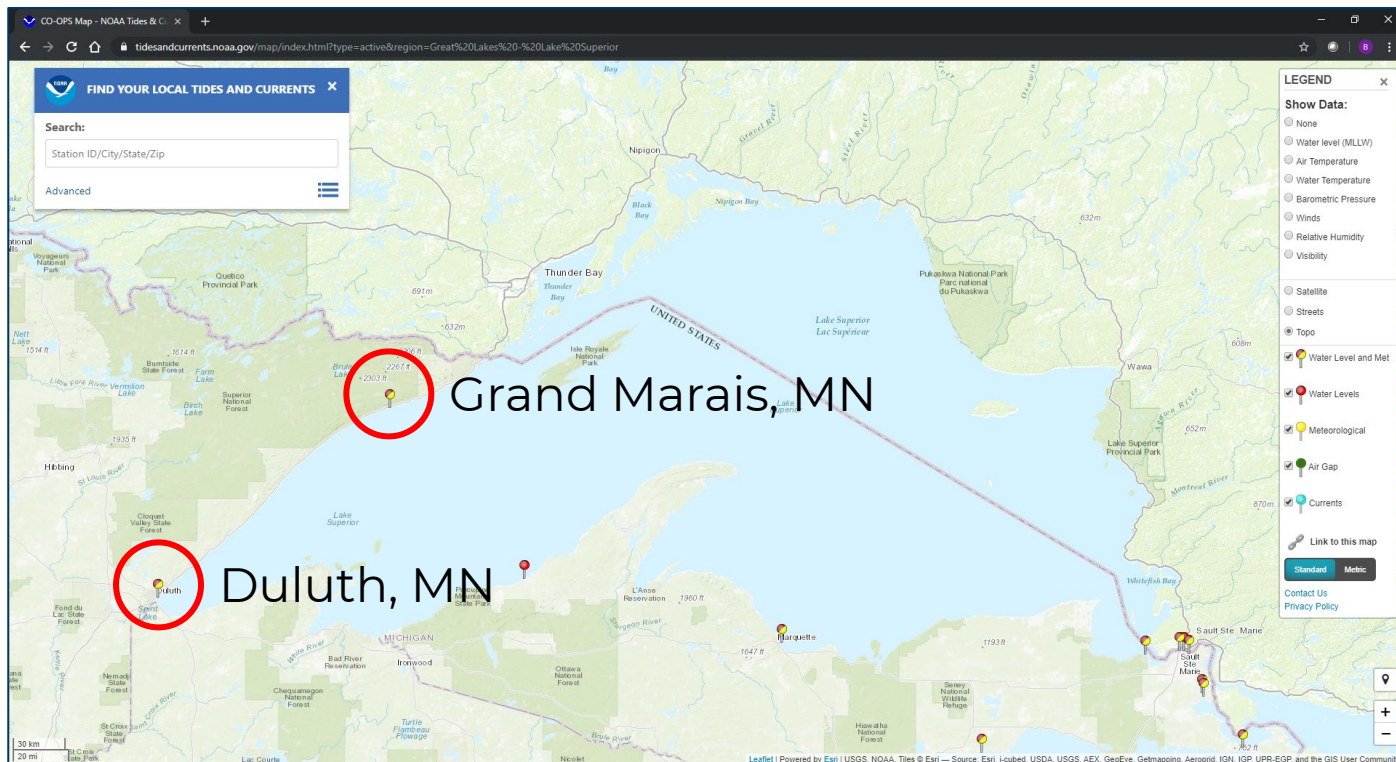


MN Lake Superior Coastal Program 2007

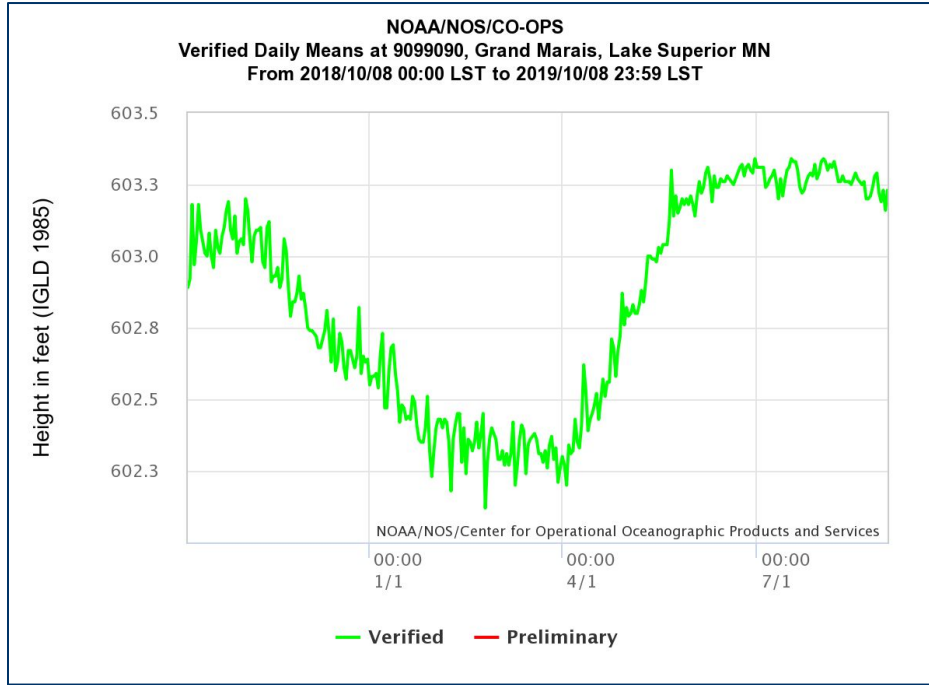


NOAA NGS 2016

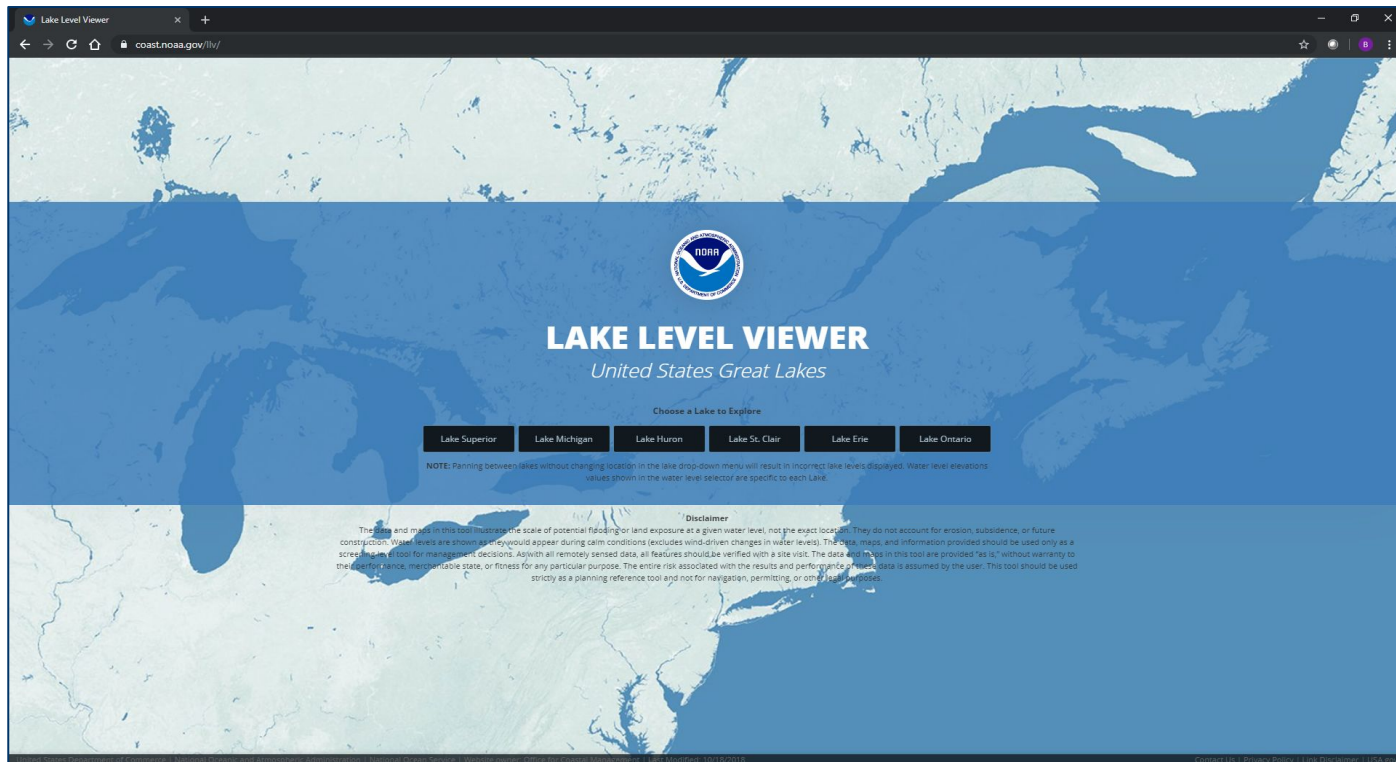
Available Data: Water Level Station



Available Data: Water Level Station



Available Tools: Lake Level Viewer

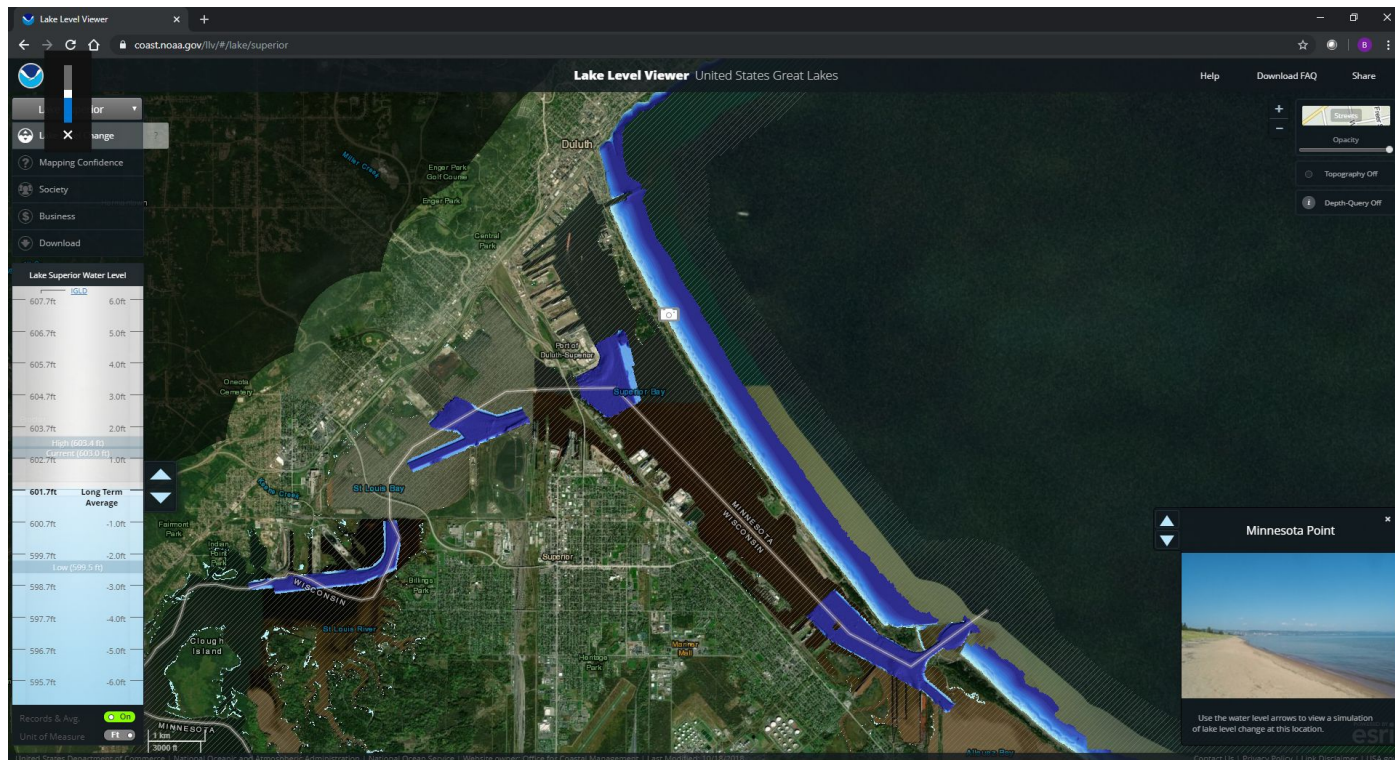


Available Tools: Lake Level Viewer

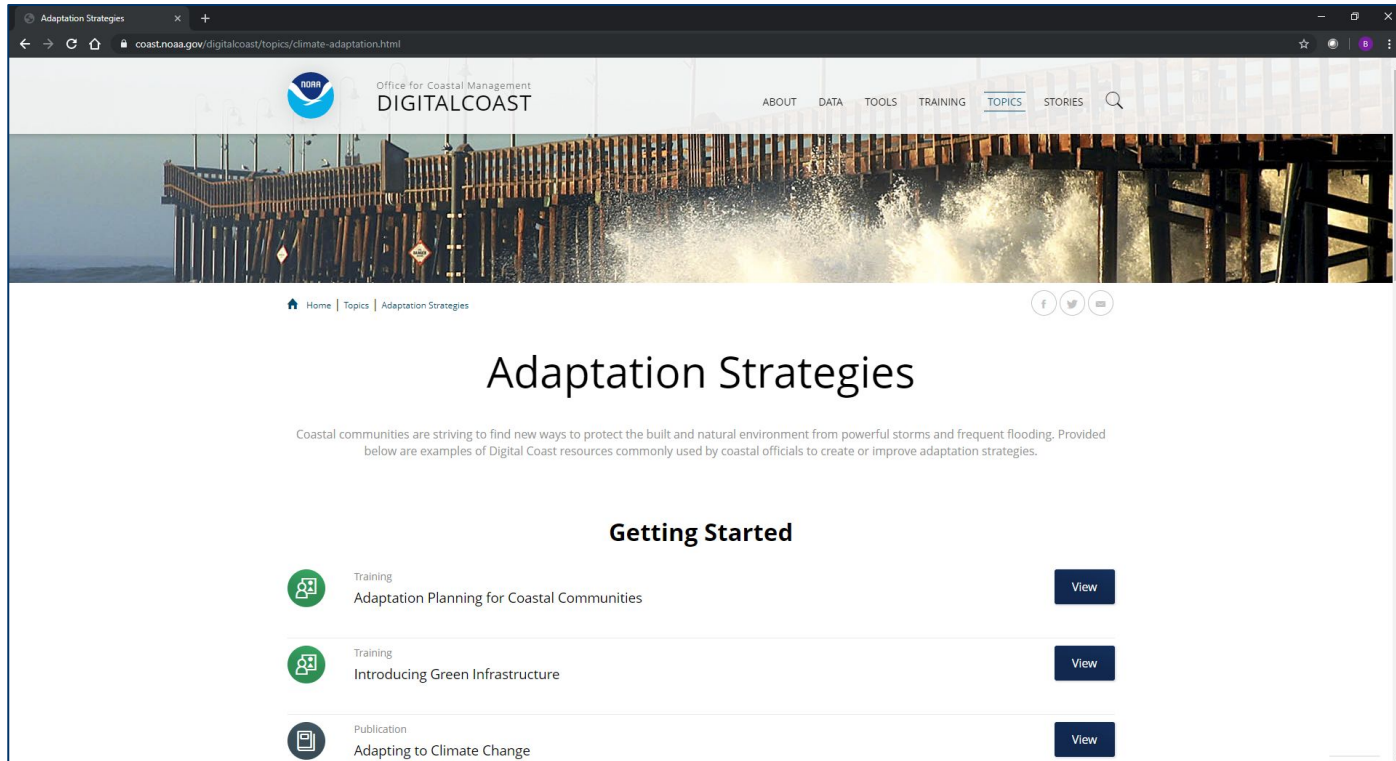
- First official release in November 2014
- Funded by the Great Lakes Restoration Initiative
- Fills a critical information data gap
- 40% of Coastal Storms Program survey respondents said current data on future lake level changes are inadequate
- Only 26% said existing tools to work with or visualize these data are adequate

Source: 2013 Shoreline Change Workshop: Perspectives on the Great Lakes Survey

Available Tools: Lake Level Viewer



Additional Resources



Questions/Comments/Discussion

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