

# Lake Michigan Shoreline

Bridgman, MI

July 31, 2017



**Guy Meadows, PhD.**

**Director, Great Lakes Research Center**

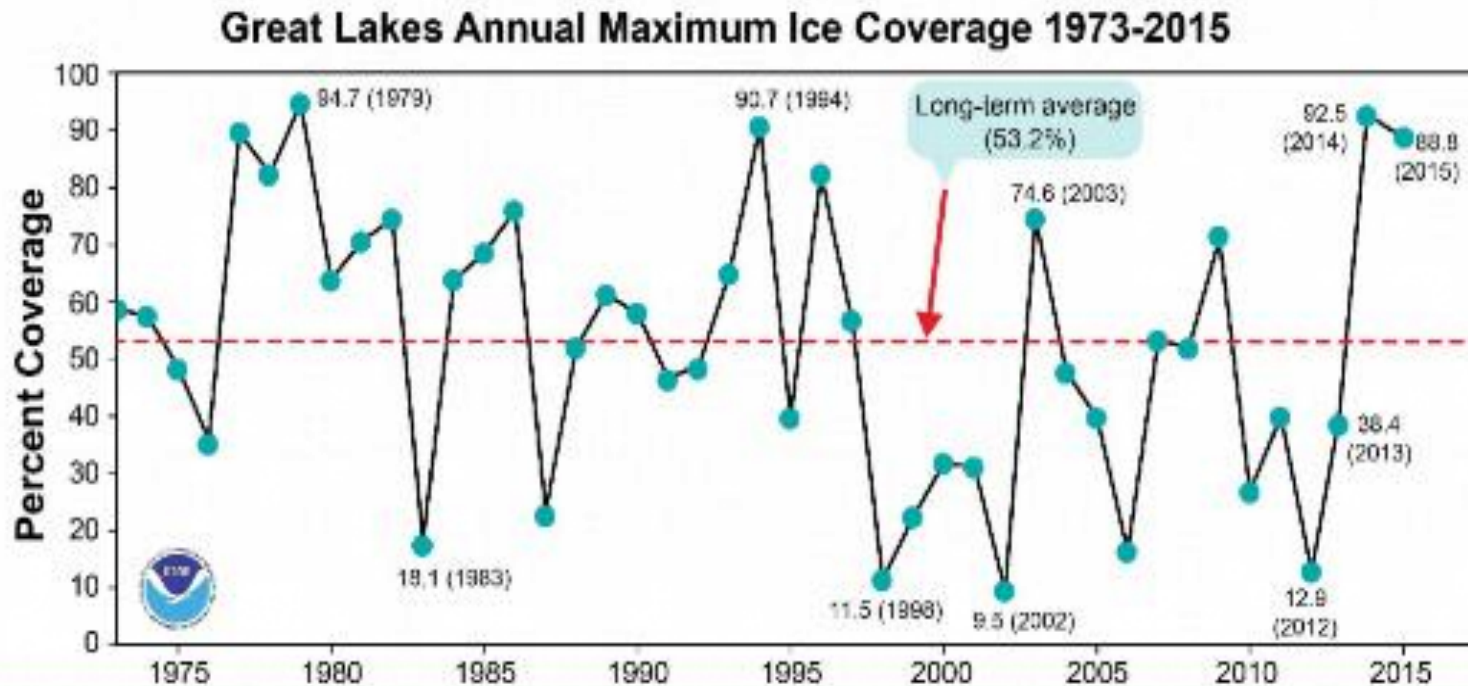
**Robbins Professor of Sustainable Marine Engineering**



# Sustainable Coastal Communities

## Water Level Hazards

- 1) Great Lakes Highs and Lows
- 2) Frequency and Intensity of Storms



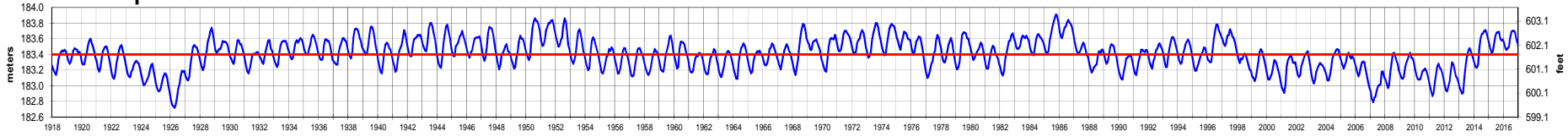




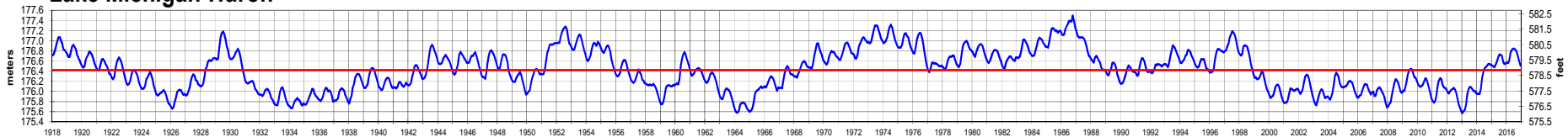
# Great Lakes Water Levels (1918-2016)

— Monthly Mean Level  
— Long Term Annual Average

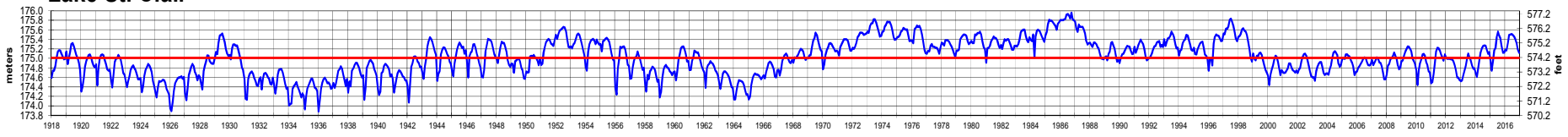
## Lake Superior



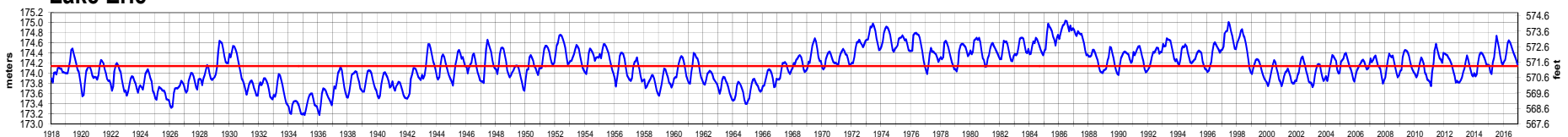
## Lake Michigan-Huron



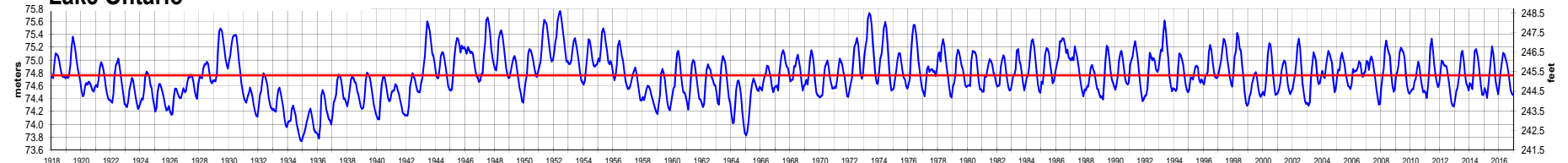
## Lake St. Clair



## Lake Erie



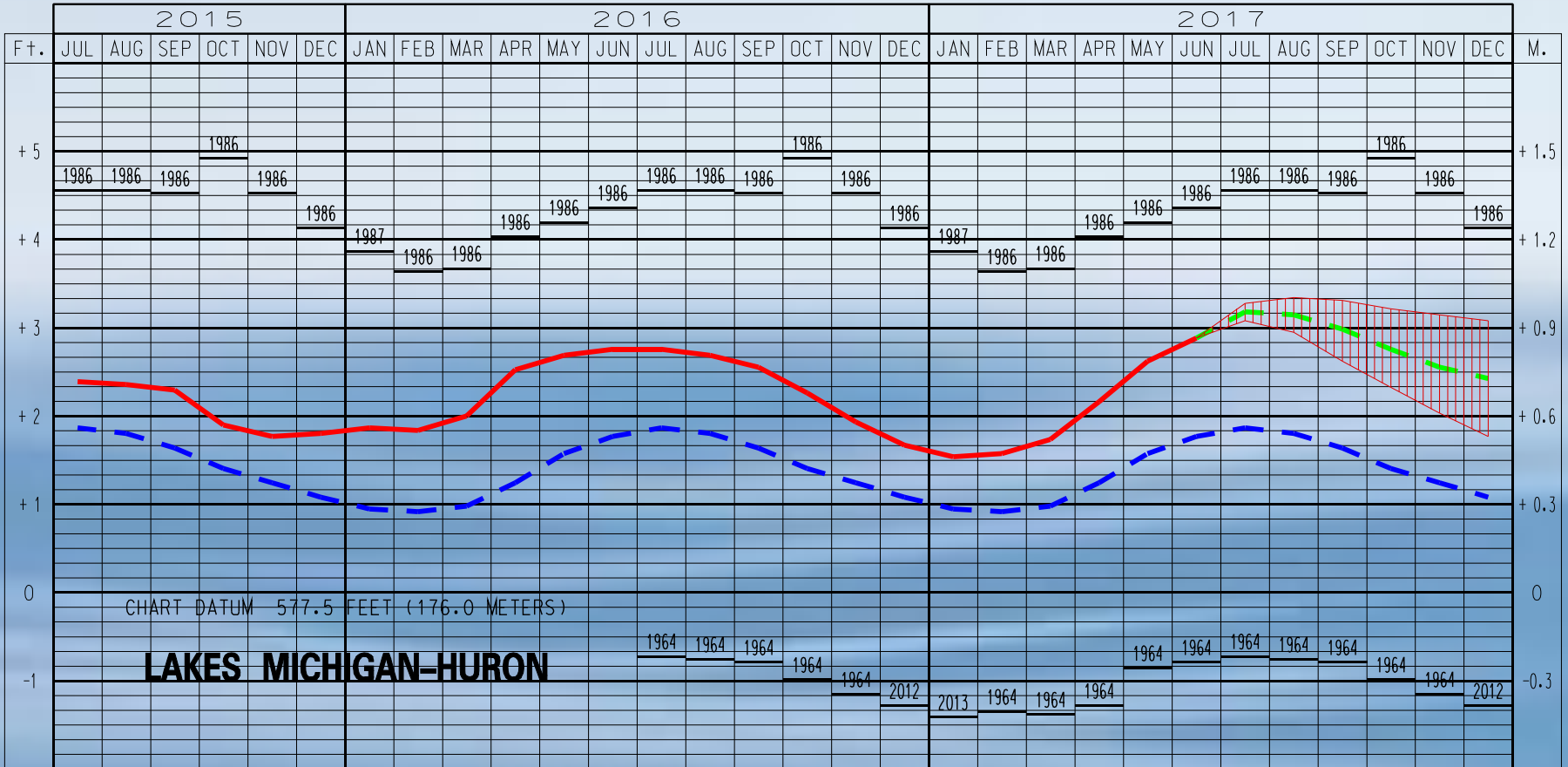
## Lake Ontario



The monthly average levels are based on a network of water level gages located around the lakes.

Elevations are referenced to the International Great Lakes Datum (1985).

# LAKES MICHIGAN-HURON WATER LEVELS - JULY 2017



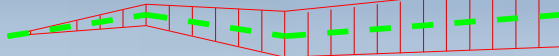
## LEGEND

### LAKE LEVELS

RECORDED



PROJECTED



AVERAGE \*\*



MAXIMUM \*\*

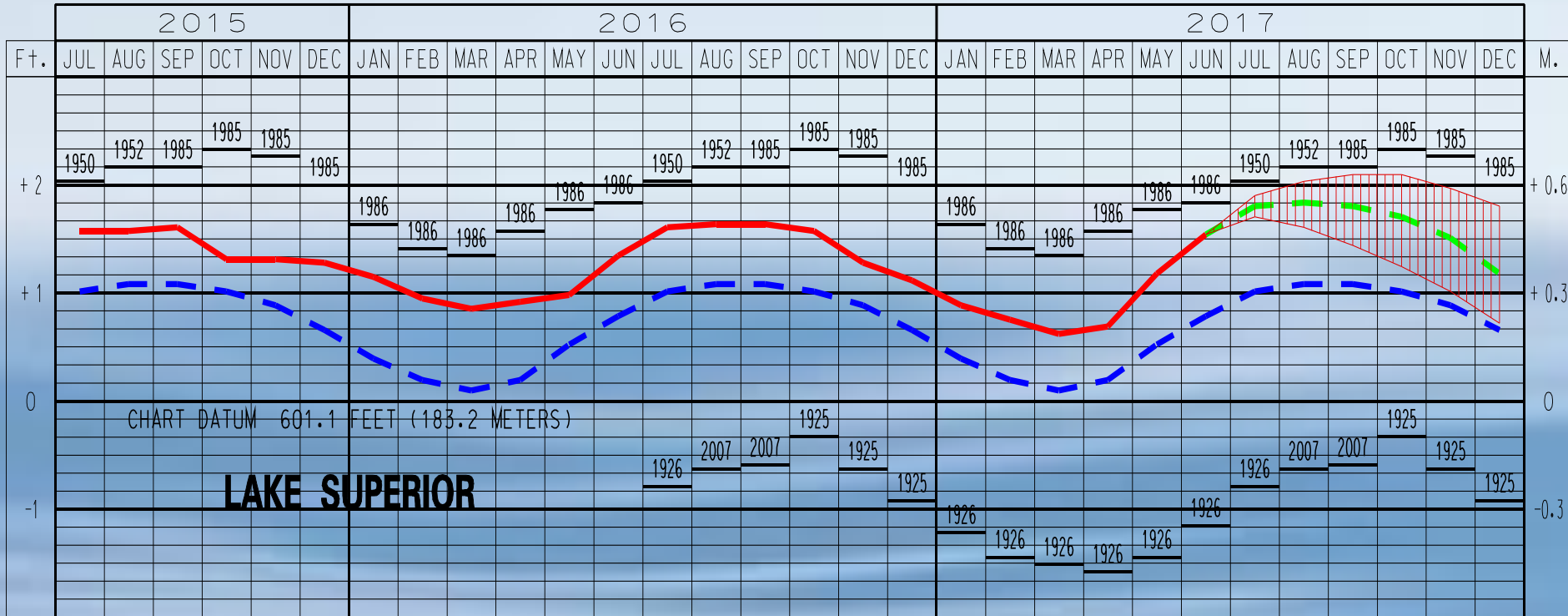


MINIMUM \*\*



\*\* Average, Maximum and Minimum for period 1918-2016

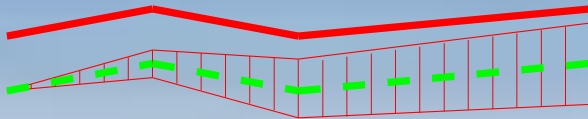
# LAKE SUPERIOR WATER LEVELS – JULY 2017



## LEGEND

### LAKE LEVELS

RECORDED

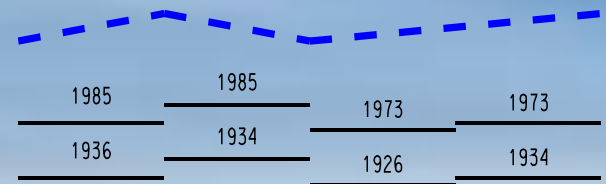


PROJECTED

AVERAGE \*\*

MAXIMUM \*\*

MINIMUM \*\*



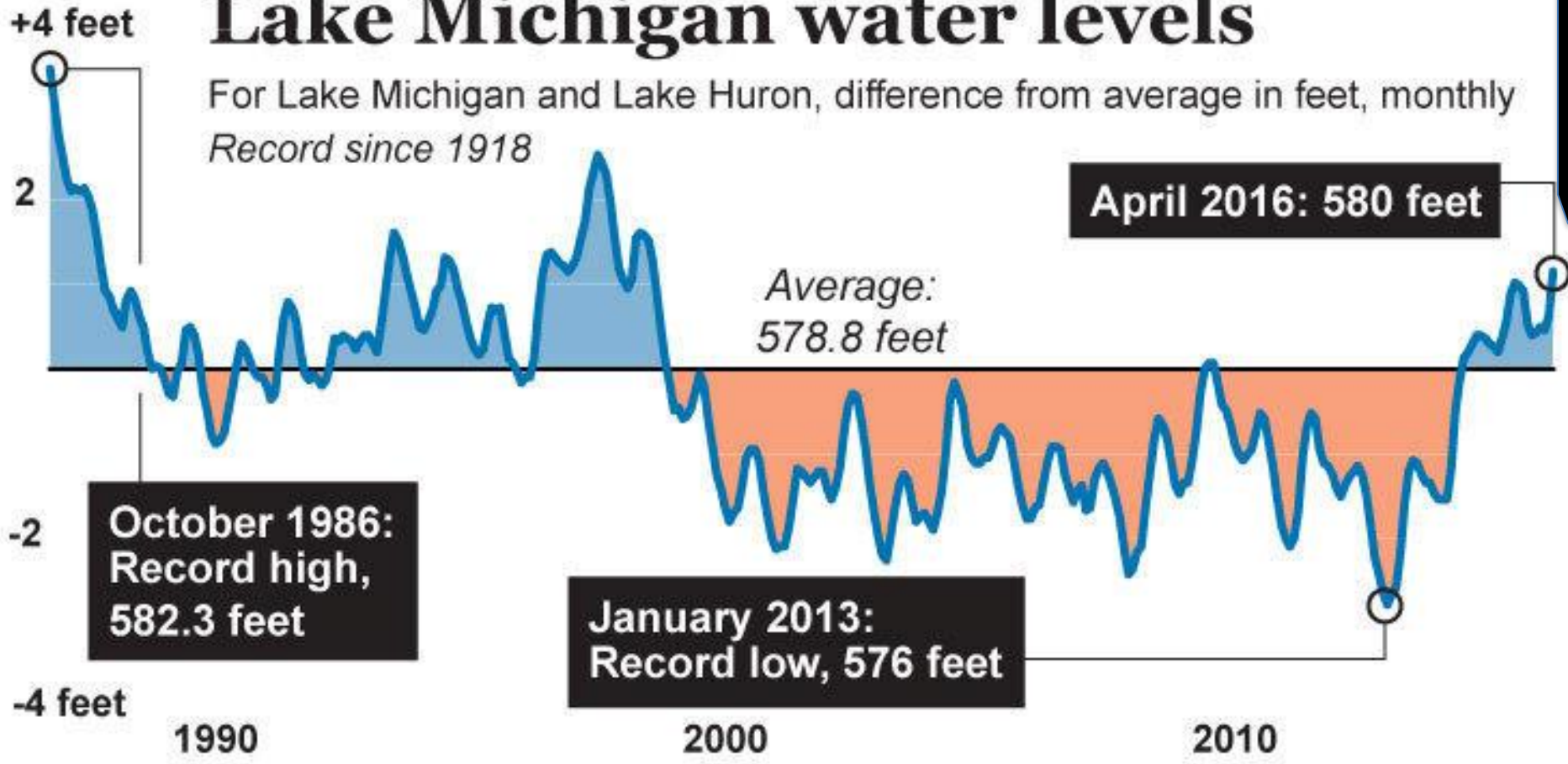
\*\* Average, Maximum and Minimum for period 1918-2016

# Water Levels and FEMA

July 2017: 580.6 feet

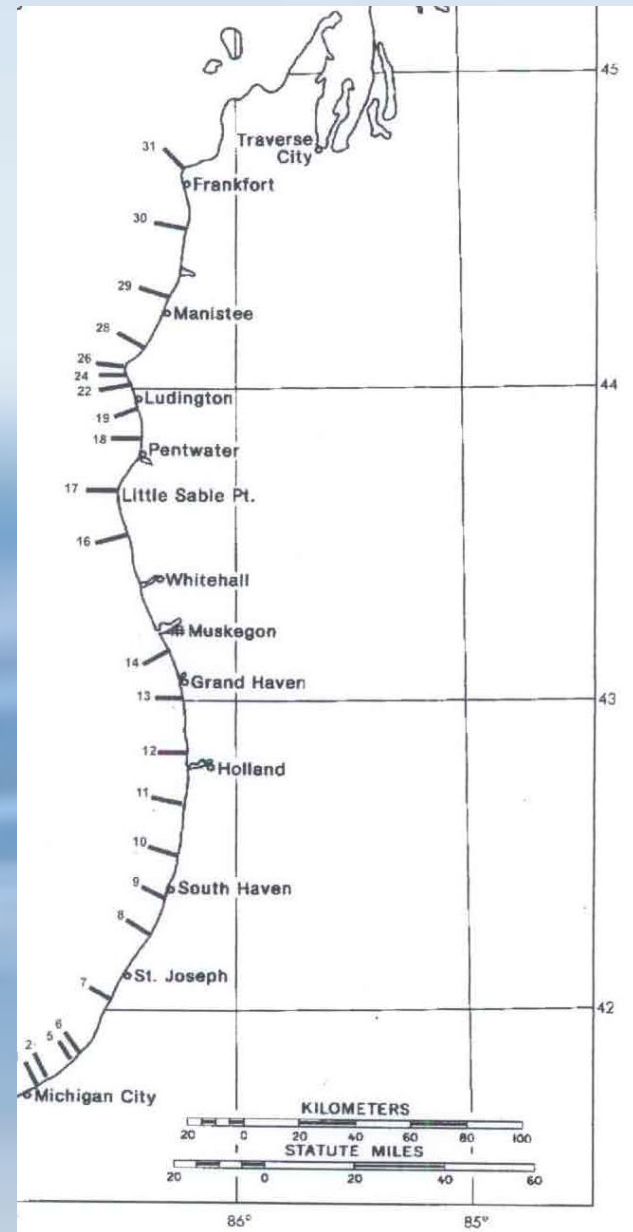
## Lake Michigan water levels

For Lake Michigan and Lake Huron, difference from average in feet, monthly  
*Record since 1918*



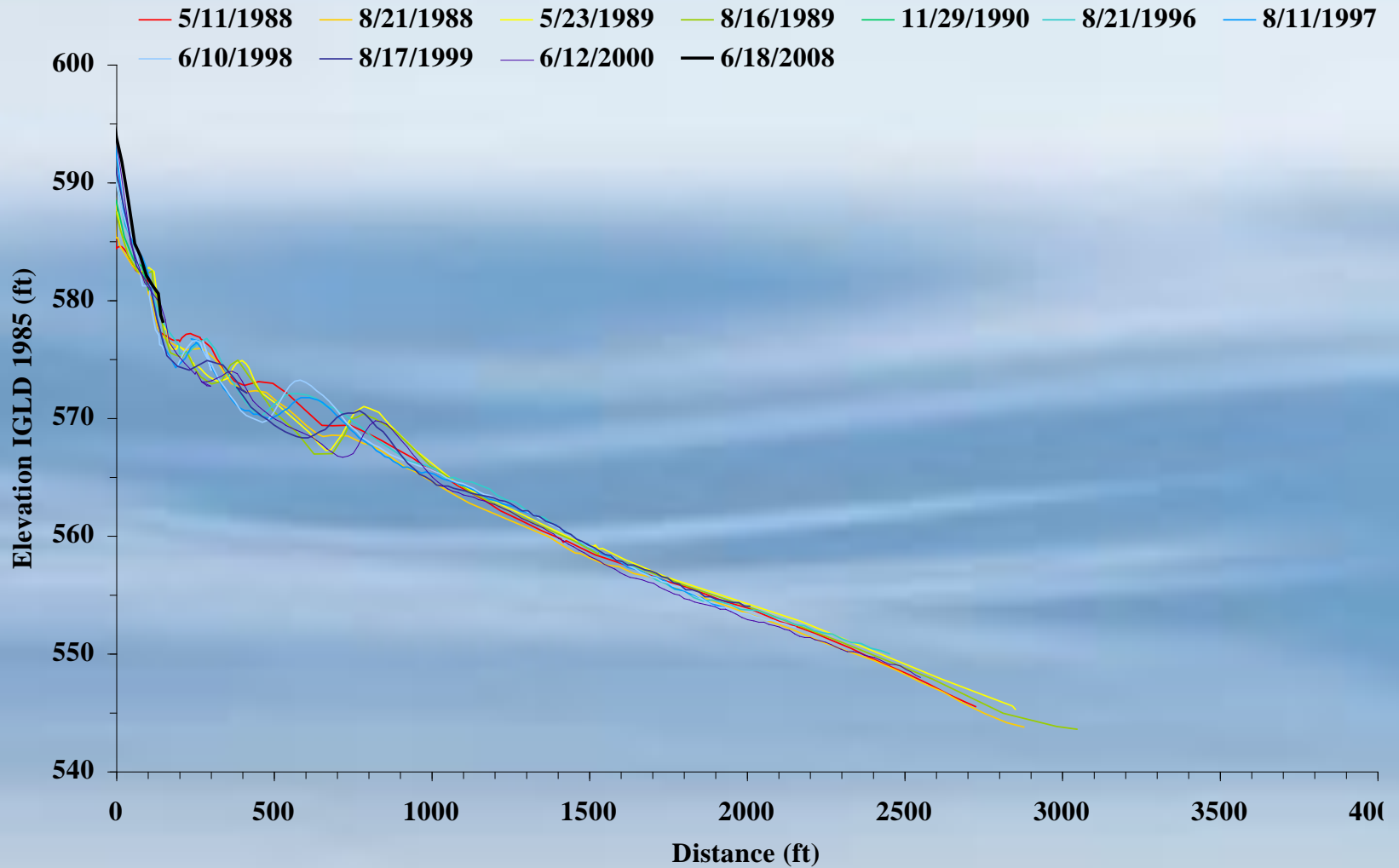
# Historic Survey Data

- 45 Survey Sites
- 31 on Lake Michigan
- 1988-2008 (periodically)
- Primarily MDEQ funded
- Referenced to known bench marks (vertically and horizontally)



# Sample Survey Data

## UM 18 - SUMMIT





# The 1988 Beach

Summit Township Park



October 28, 2008

9

# The 1988 Beach

Chikaming Township Park



October 28, 2008

10



# The 1988 Beach



October 28, 2008

11



# The 1988 Beach

Buttersville Park - Ludington South



October 28, 2008

12



# Juanita Street 1989 & 2008





# Summit Township Park 1989 & 2008





# The 1988 Beach



October 28, 2008

15



# 2008 Beach

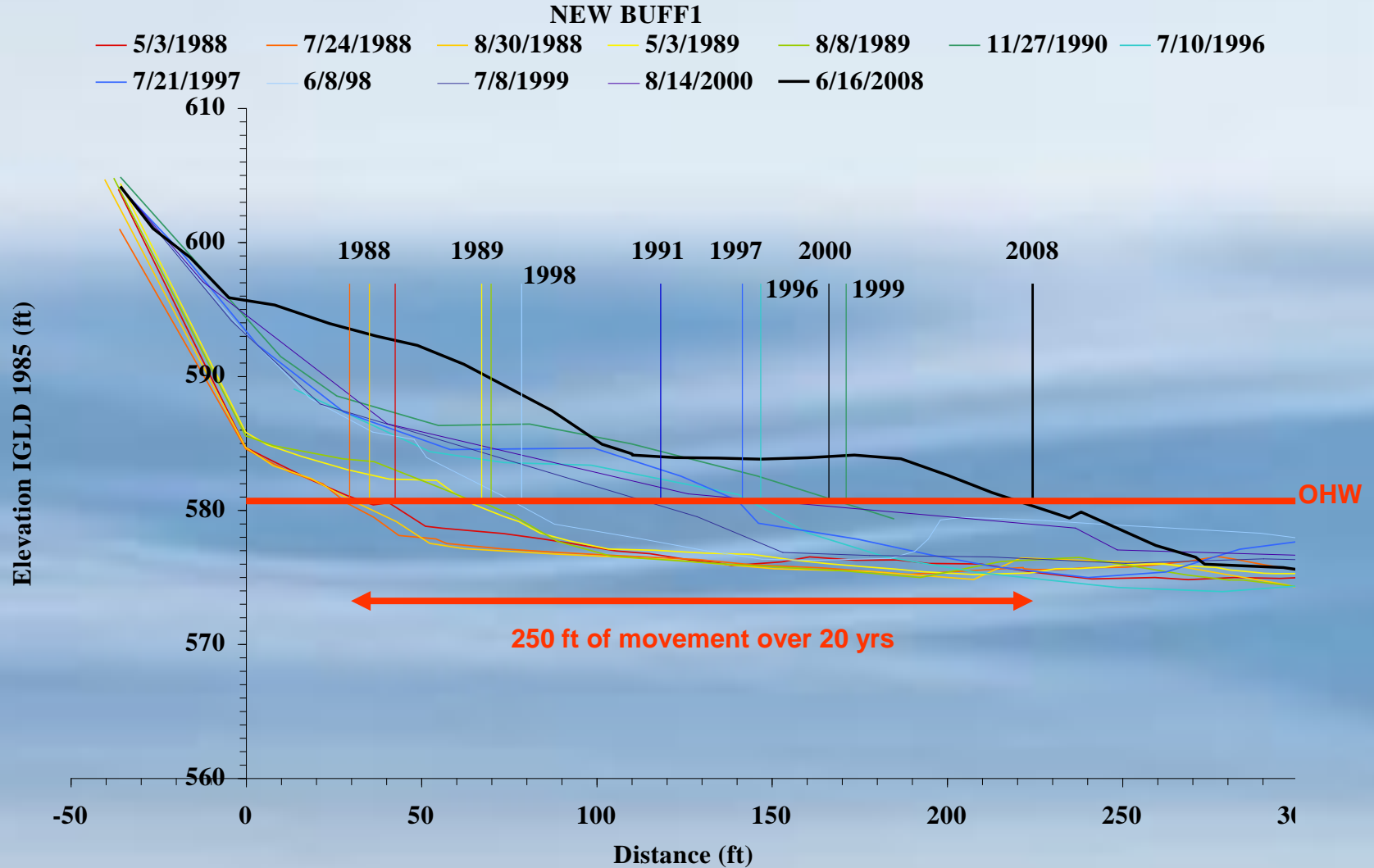


October 28, 2008

16



# UM01

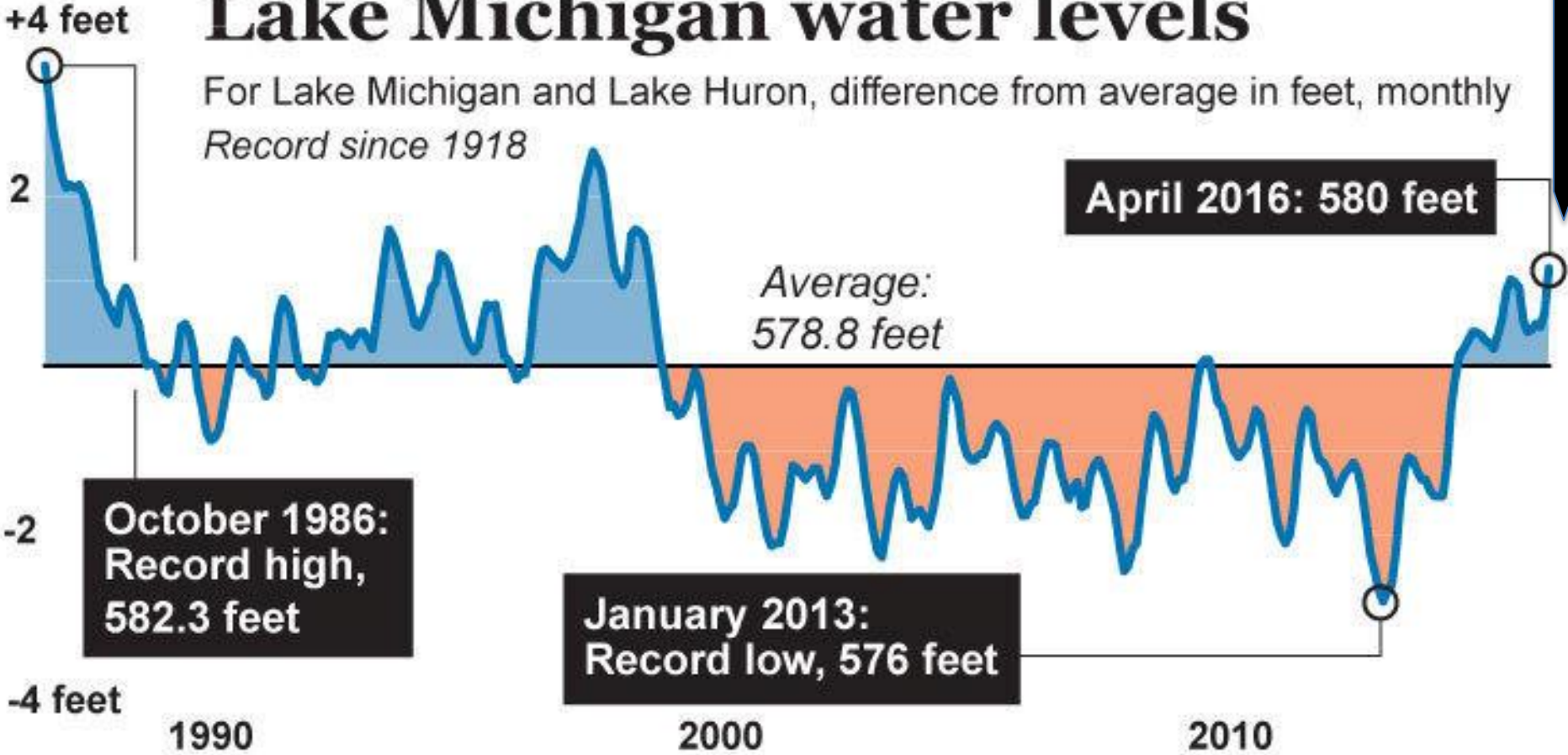


# Water Levels and FEMA

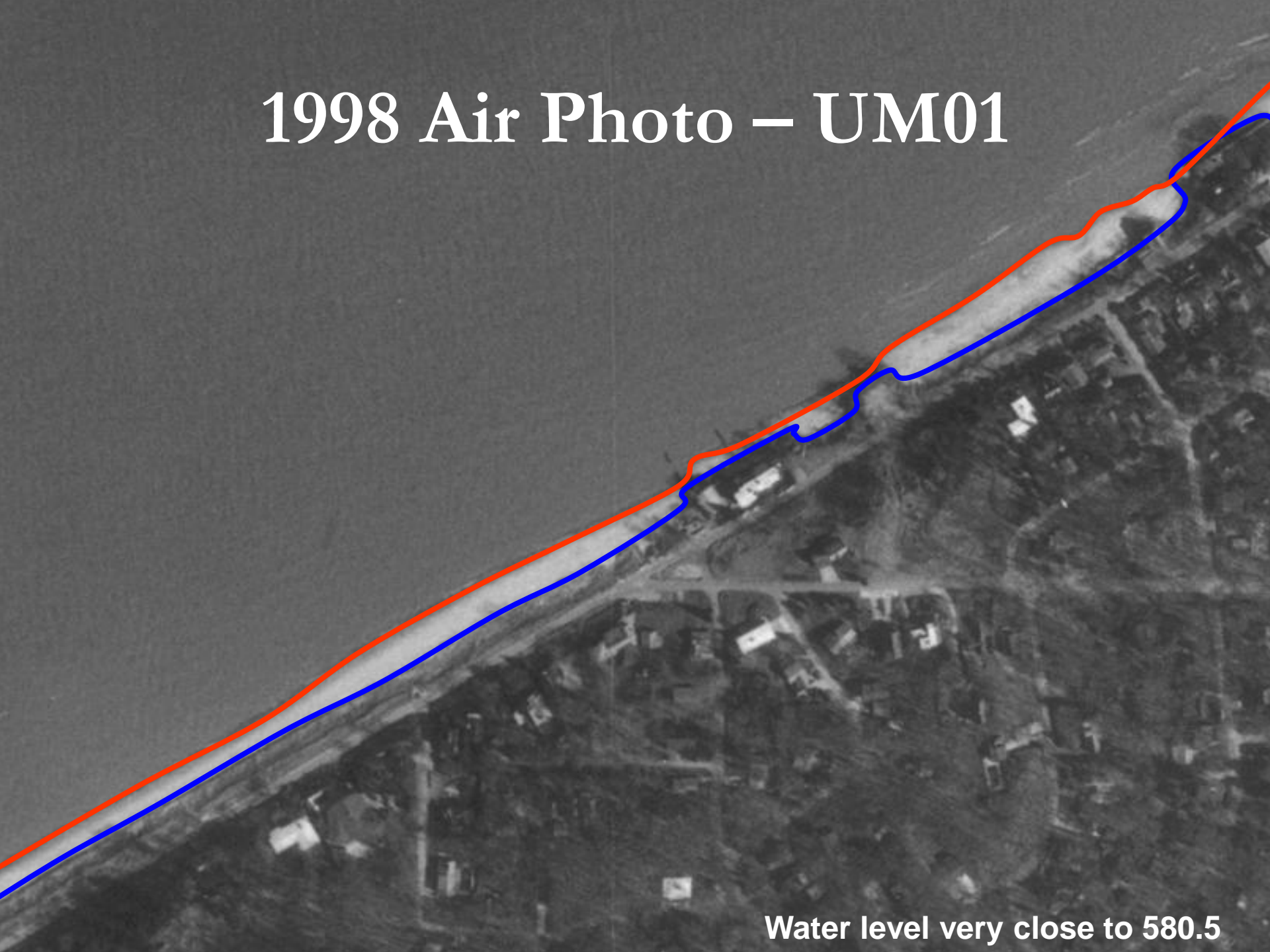
July 2017: 580.6 feet

## Lake Michigan water levels

For Lake Michigan and Lake Huron, difference from average in feet, monthly  
*Record since 1918*



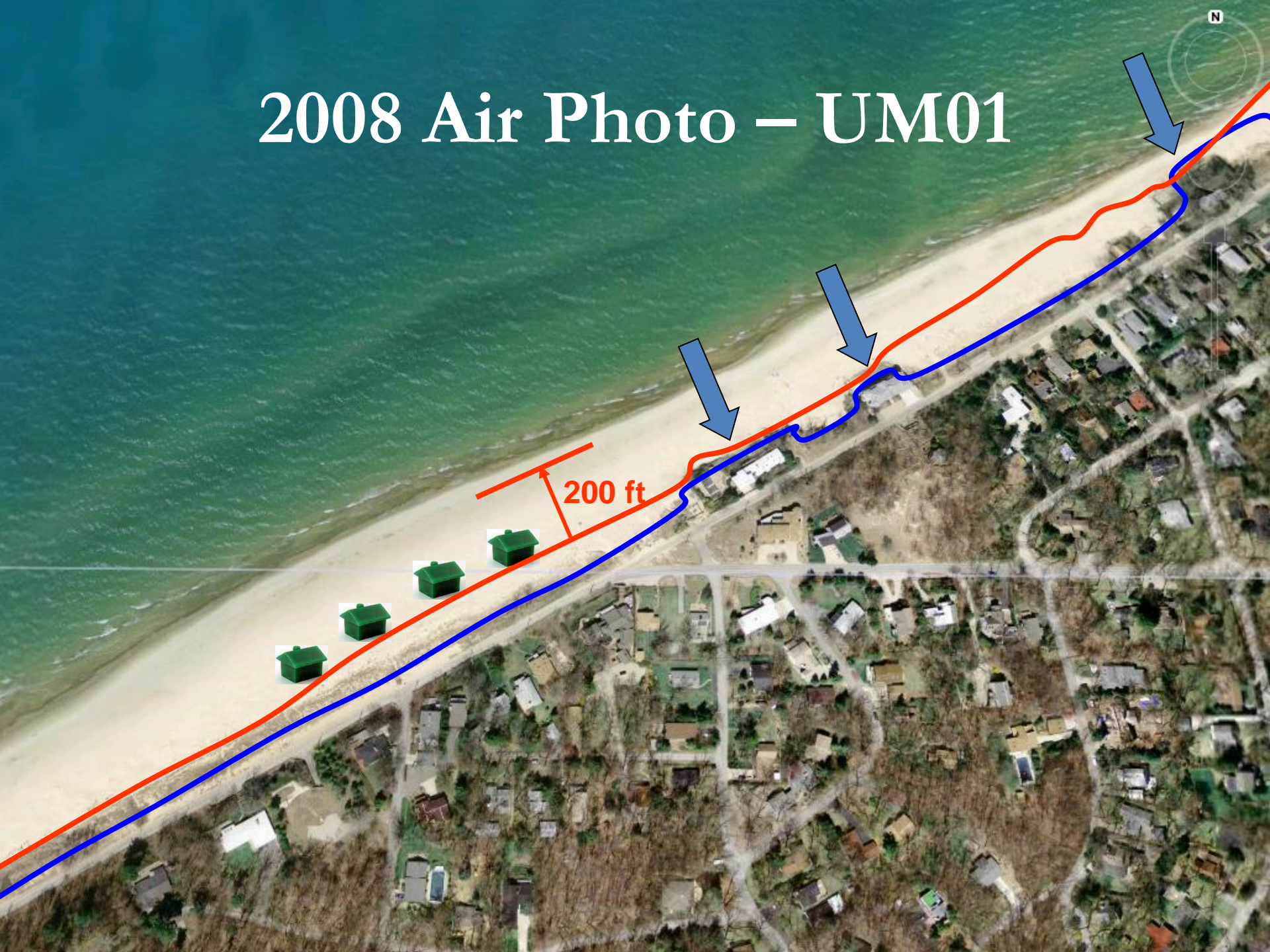
# 1998 Air Photo – UM01



Water level very close to 580.5



# 2008 Air Photo – UM01





# Beaches Change Quickly...And Will Forever Continue to Do So...

- Above the water

- On the water and

- Below the water



**St Joseph, MI**



# Thank You!

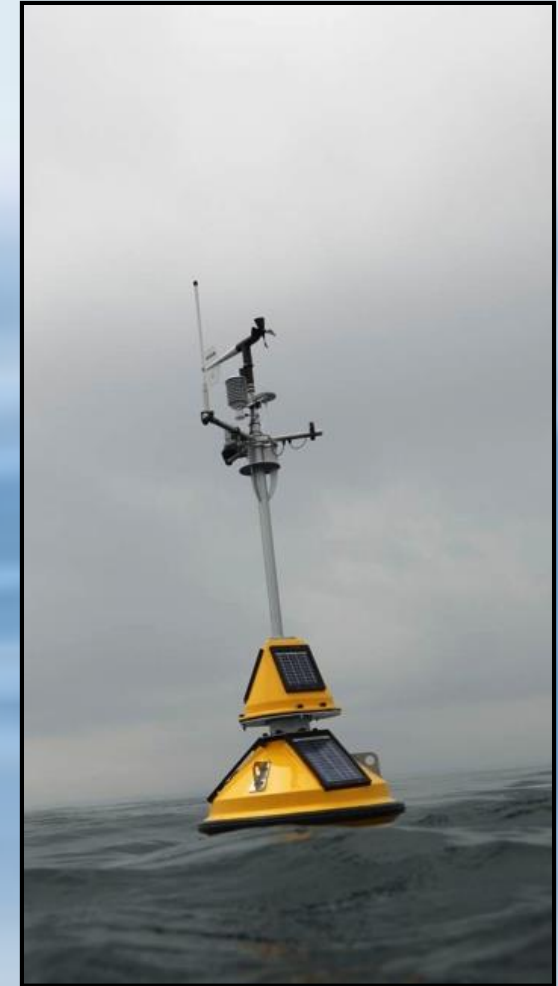
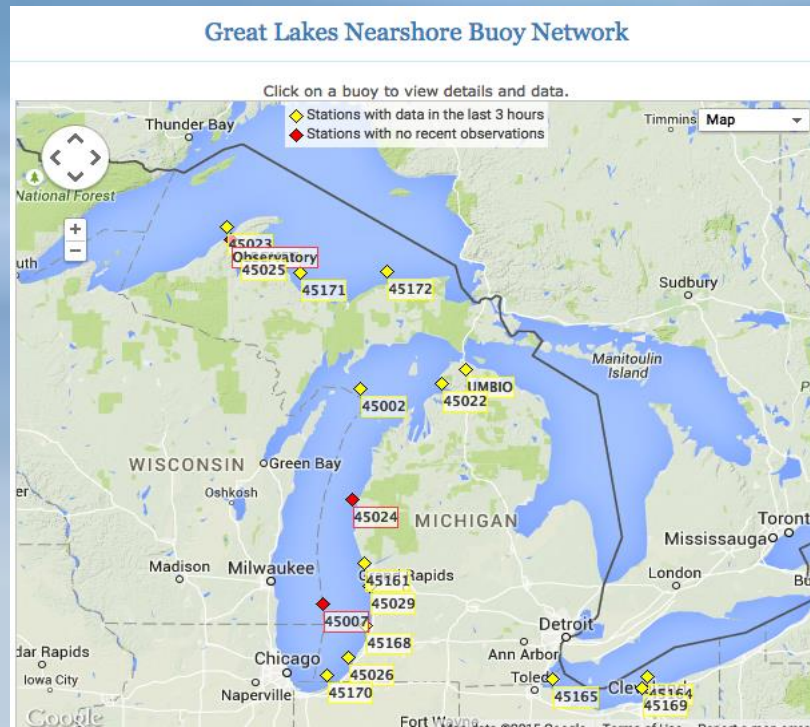
## Questions ?



Photo courtesy of FTC&H

# A Real-time Monitoring Buoys for the Great Lakes

- <http://greatlakesbuoys.org/>
- Data available to all every 10 min





# Straits Buoy Launched August 2015





# Buoy Launch August 2015

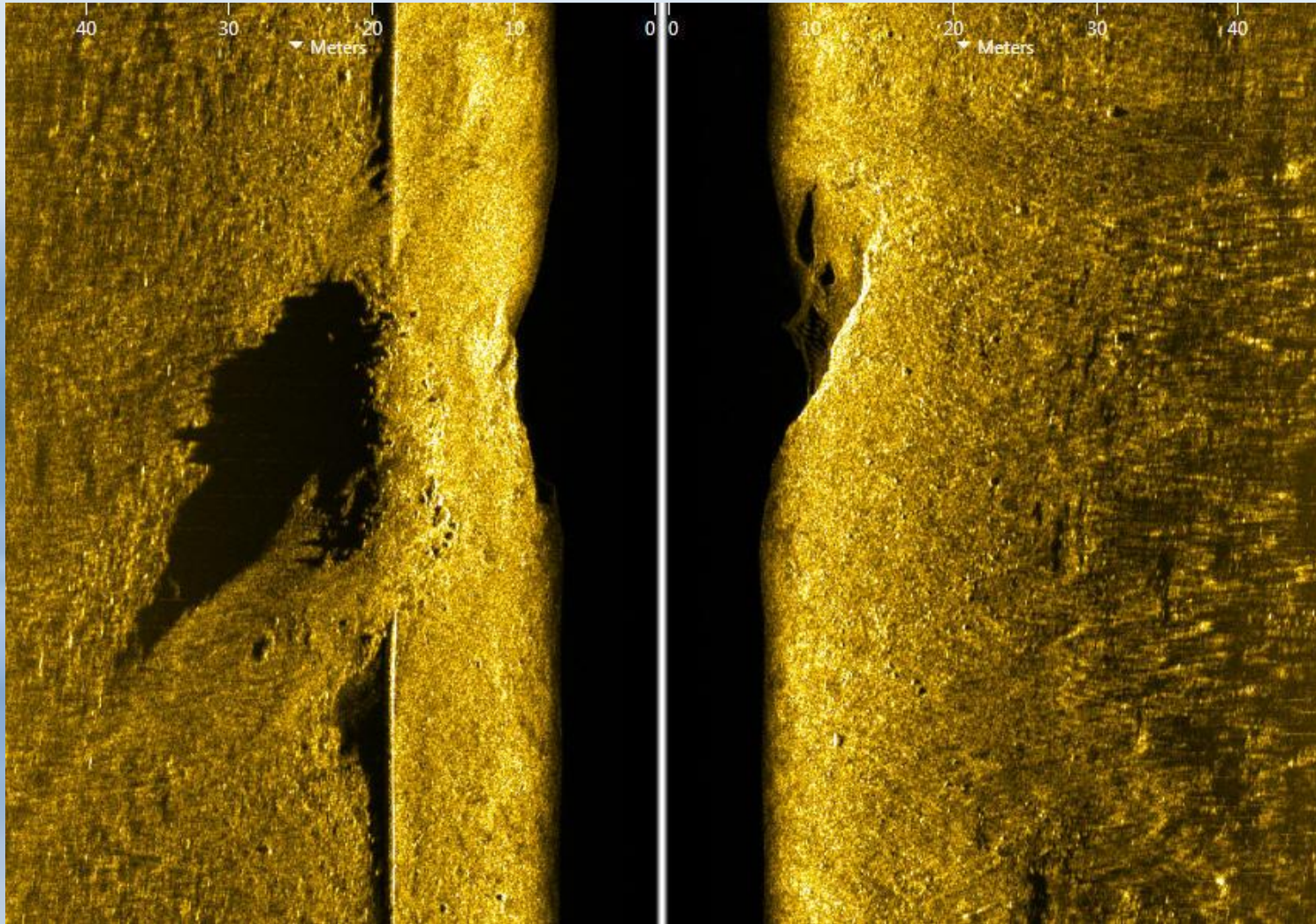


# Autonomous Underwater Vehicle (AUV)





# High Resolution Sonar Surveys and Advanced Processing of Bottom Terrain

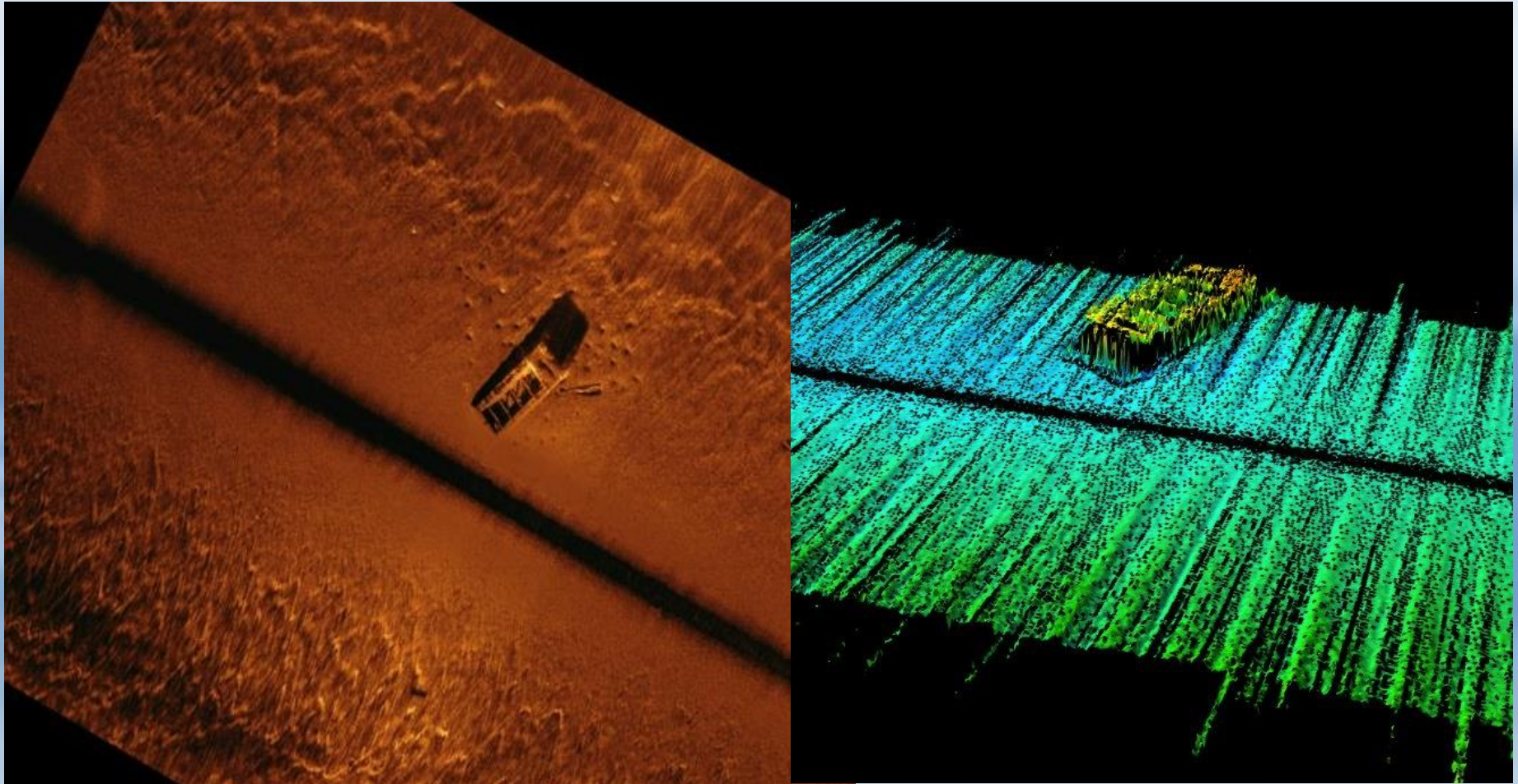


**Enbridge Pipeline**

**Reduced survey time from two years to two days**

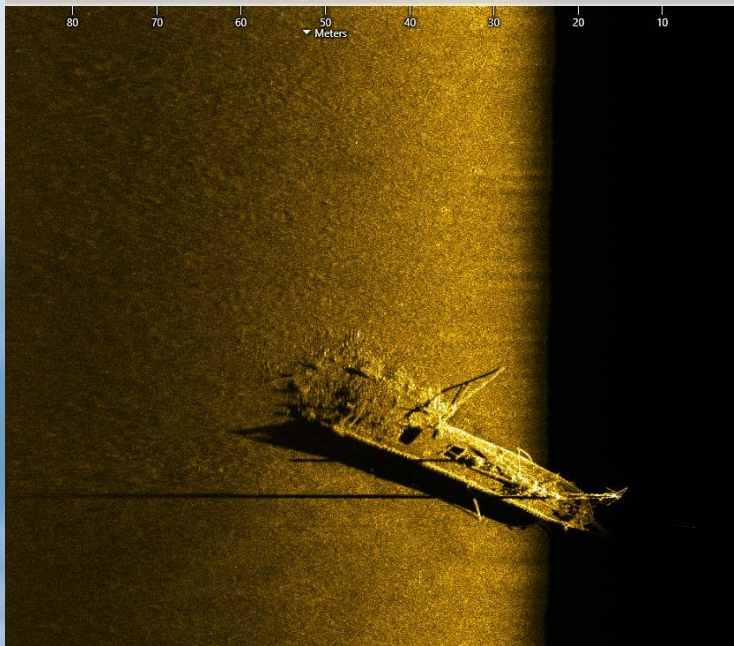


# Three-Dimensional Bathymetry to Map Bottom Changes





# Thunder Bay National Marine Sanctuary Alpena, MI - 2017





# John J. Audubon - Sank 1854



**Great Lakes  
Research Center**

Michigan Technological University



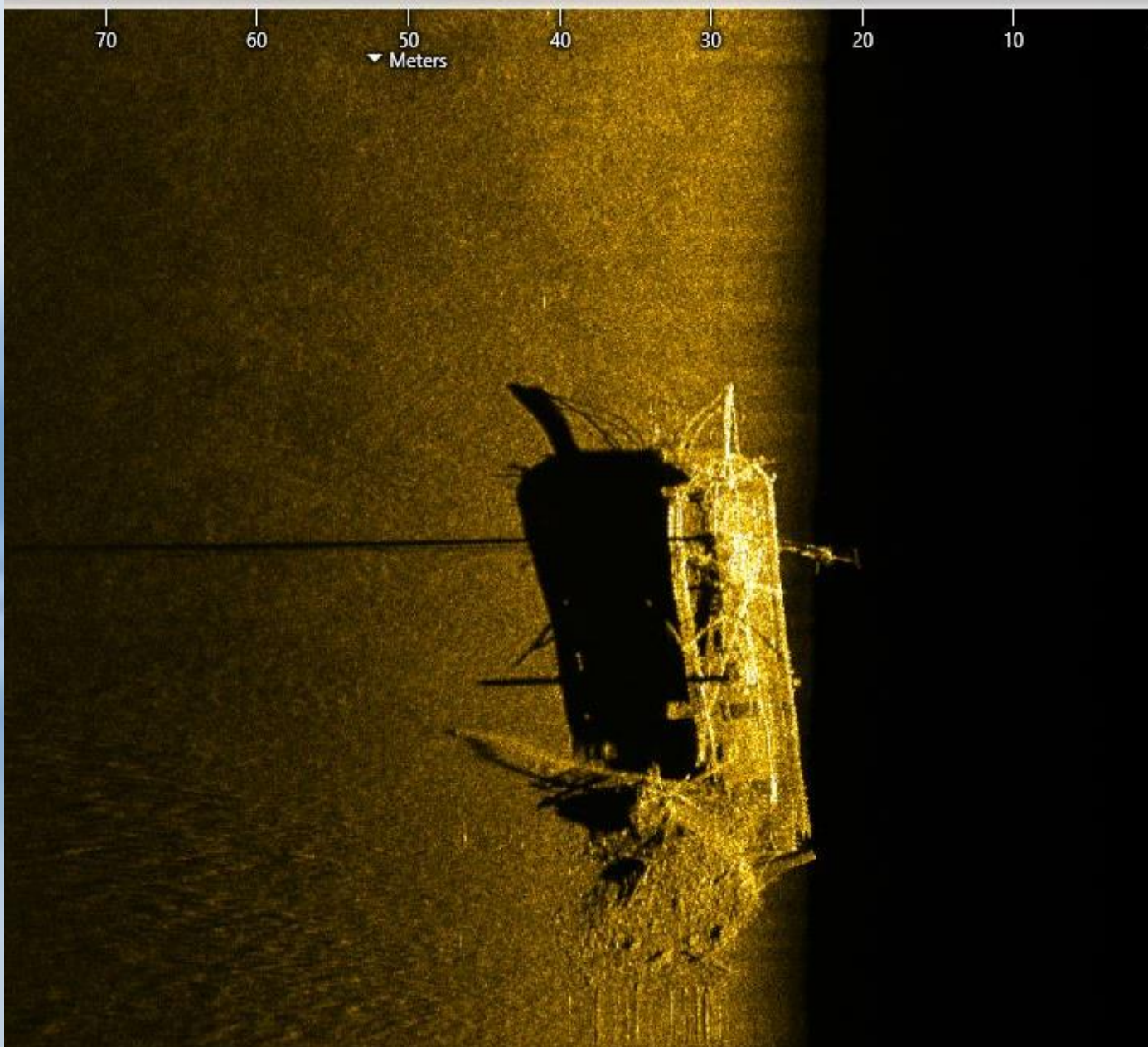
# Norman – Bulk Freighter

Sank 1895





# Typo – Wooden Three-Masted Schooner



Sank 1899