

# Part 1: Grand River Mapping and Sediment Sampling - Past, Present, and Future

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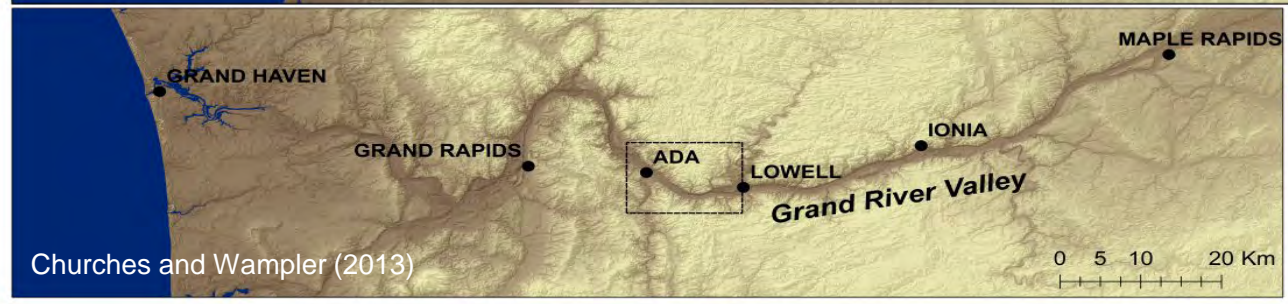
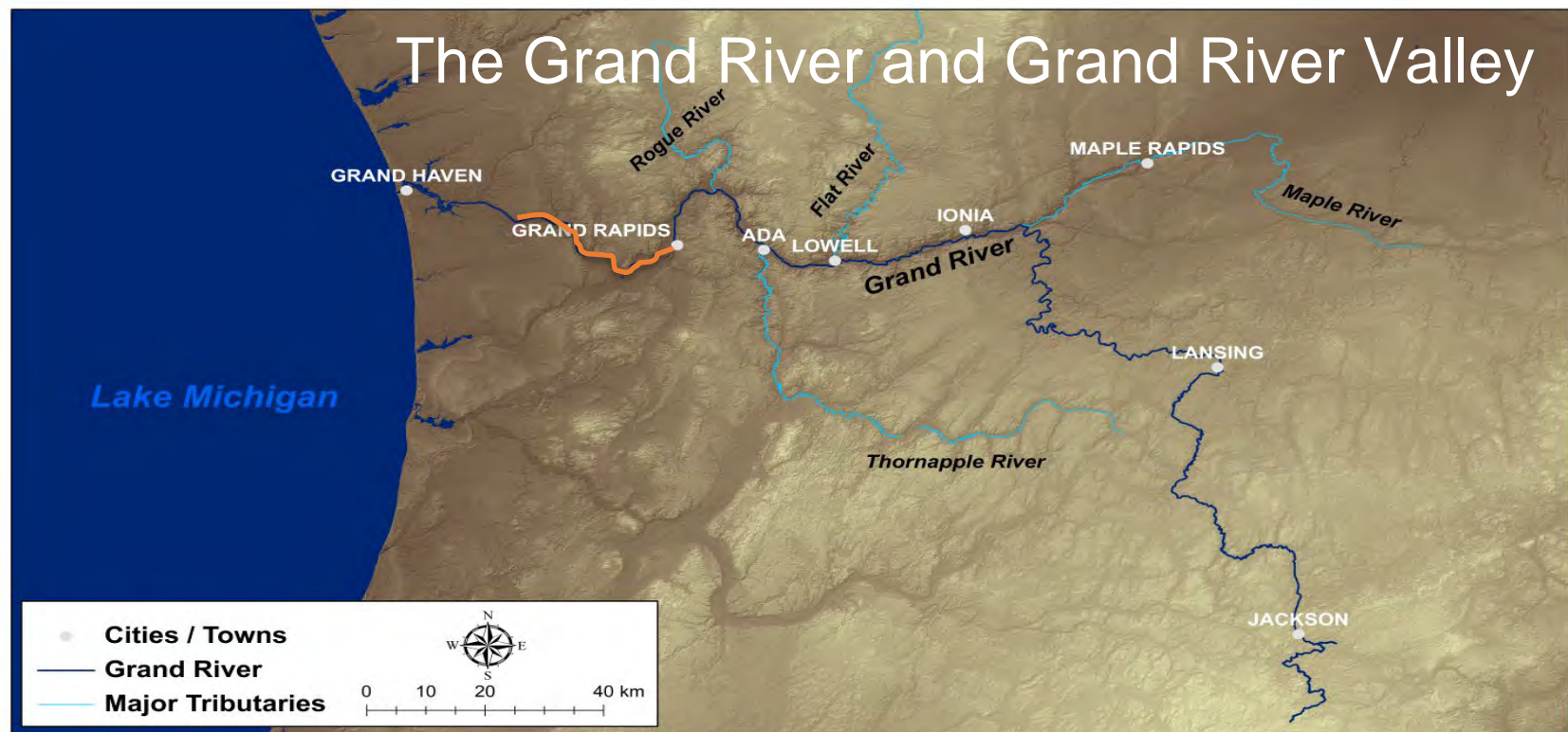
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**Louisiana State University**



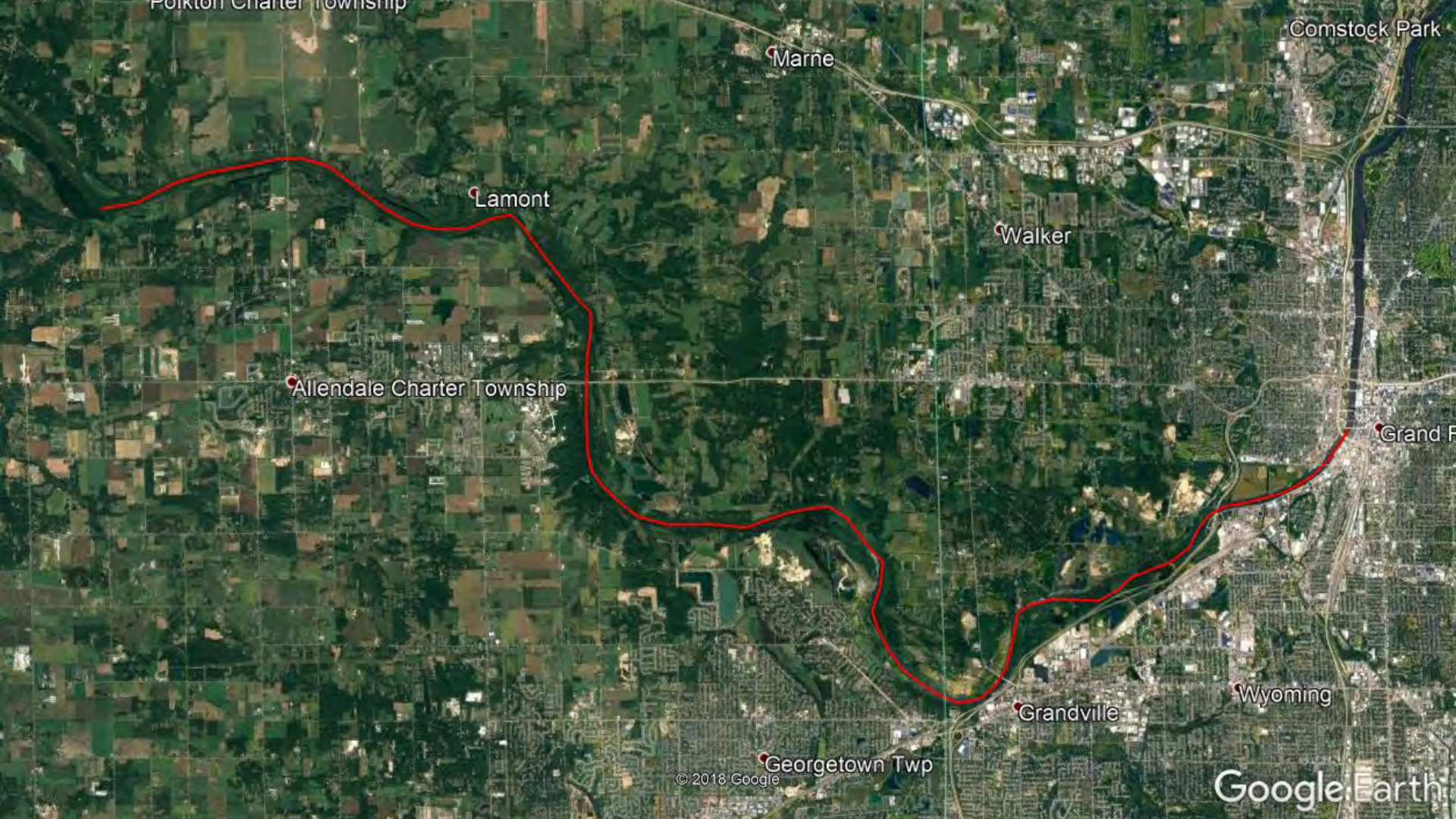
# What is being proposed?

- The Grand River Waterway project is proposing to dredge ~ 22.5 miles of river to create a roughly 50-foot wide channel to a depth of 7 feet.
  - Phase 1 – Sediment sampling and analysis to determine if sediments are contaminated and refine dredge volumes. Restricted to proposed dredging
  - Phase 2 – Dredging of the river after successful completion of phase 1.
- Channel Data collected to date:
  - 2016-17 - Side-Scan Sonar of a portion of the channel (Areas that would require dredging)
  - Sporadic and Limited data on submerged “obstructions” and substrates

# The Grand River and Grand River Valley



Churches and Wampler (2013)



Poikton Charter Township

Marne

Comstock Park

Lamont

Walker

Allendale Charter Township

Grandville

Grandville

Wyoming

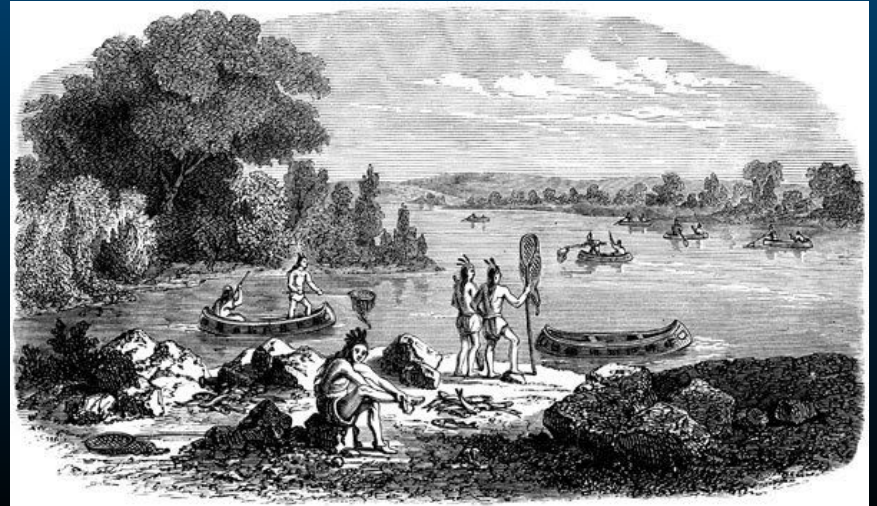
Georgetown Twp

© 2018 Google

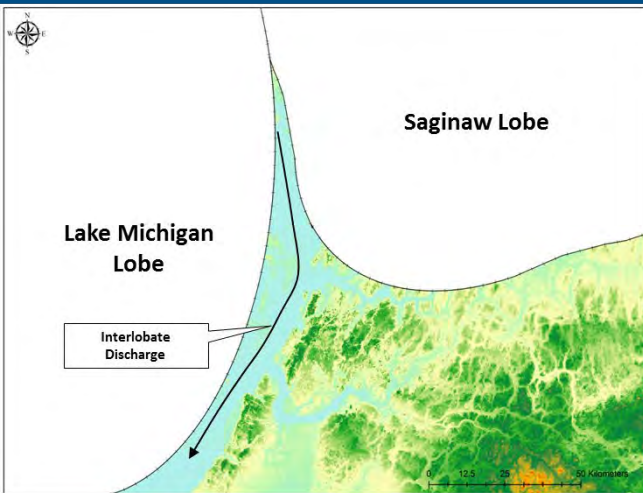
Google Earth

# What we know about the Grand River

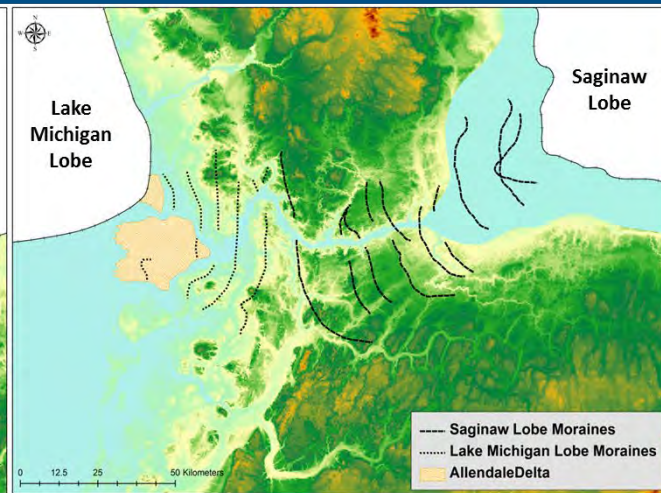
- The overall shape and structure was set as the glaciers retreated.
- The river outlet has moved progressively north and west since glacial times.  
As the river broke through natural dams (glacial moraines)
- The river was used as a transportation route for indigenous people for hundreds to thousands of years.



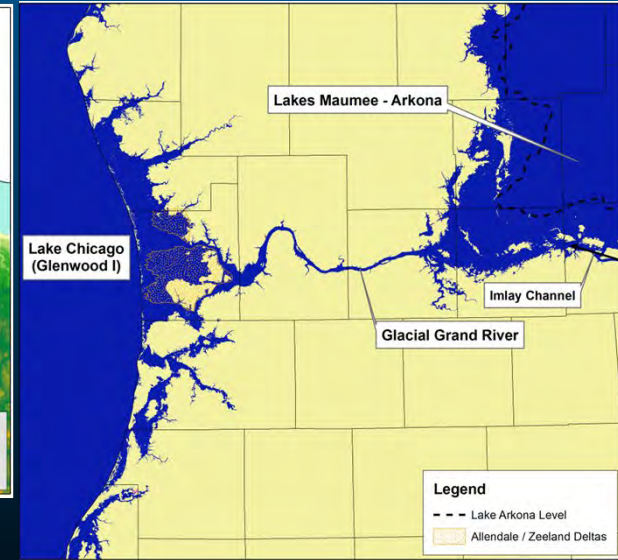
# A Restless River and a Grand Valley



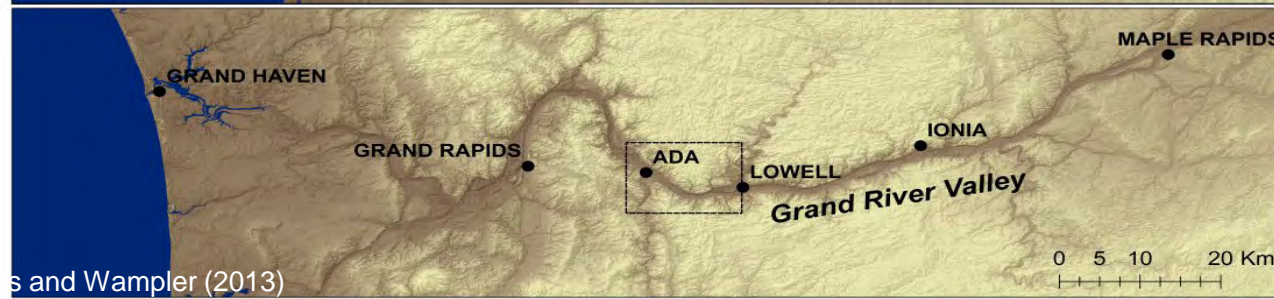
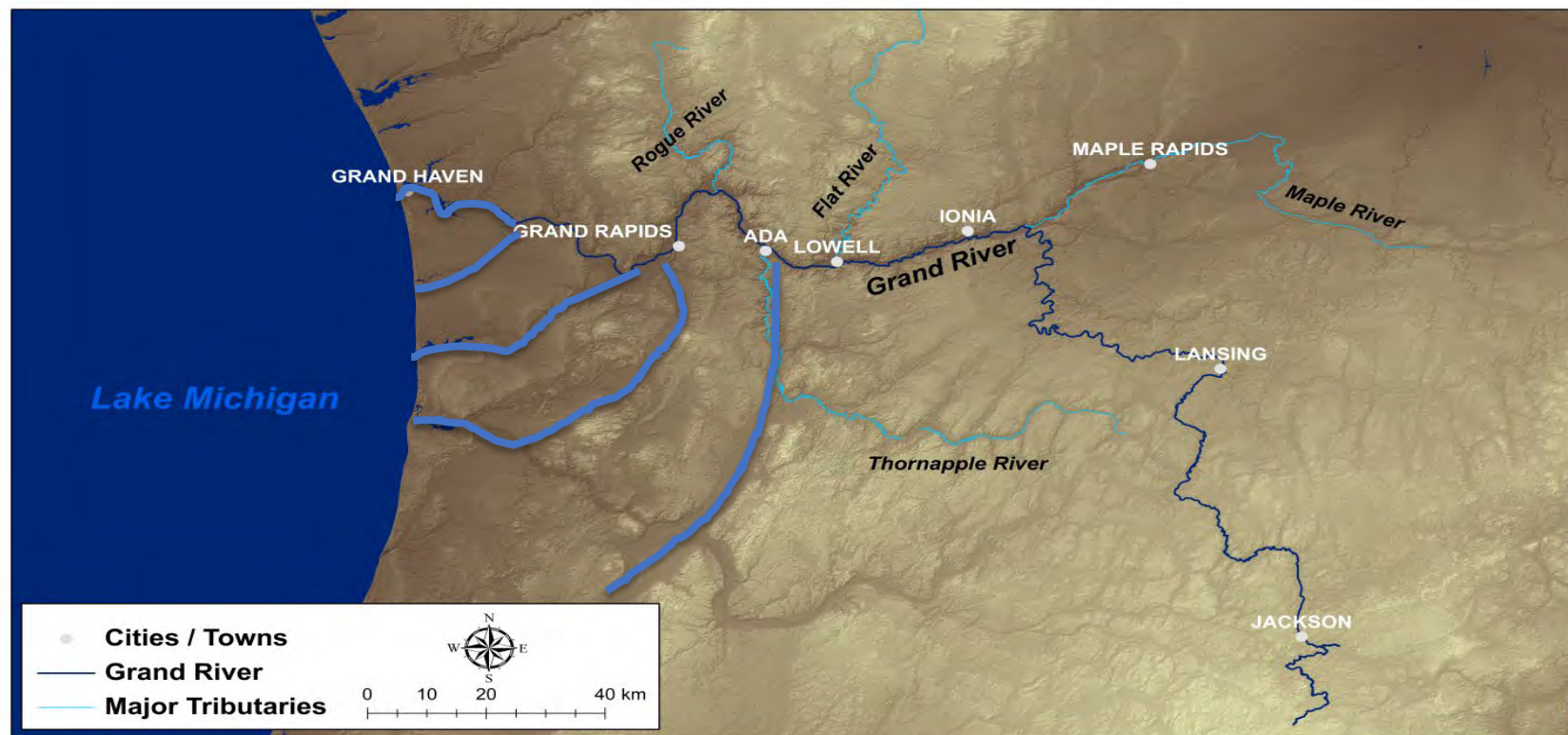
~ 15,000 years ago



~ 14,000 years ago



~ 13,000 years ago



# Changes to the Grand River Post-settlement

- Mid- to late-1800's - extensive use of the river for log transport leads to flooding, bank modifications, in-channel structures, dredging, and other physical changes to the river
- Late 1800's - training walls and dredging used to reduce width, increase flow velocity, and “train” the river.
- April 1906 - a detailed bathymetric survey was conducted to document river depths and the location of training walls and dredging.
- ~1900 to present - Industries and urbanization in Grand Rapids, Lansing, and other urban areas have contributed contaminants to sediments including heavy metals, PCBs, PFOs, and other human-created compounds.



# Physical surveys of the Grand River

- 1830's Public Land Survey
- Detailed notes and survey data along section lines and property boundaries



1838 Public Land Survey of Tallmadge Township

# Physical surveys of the Grand River

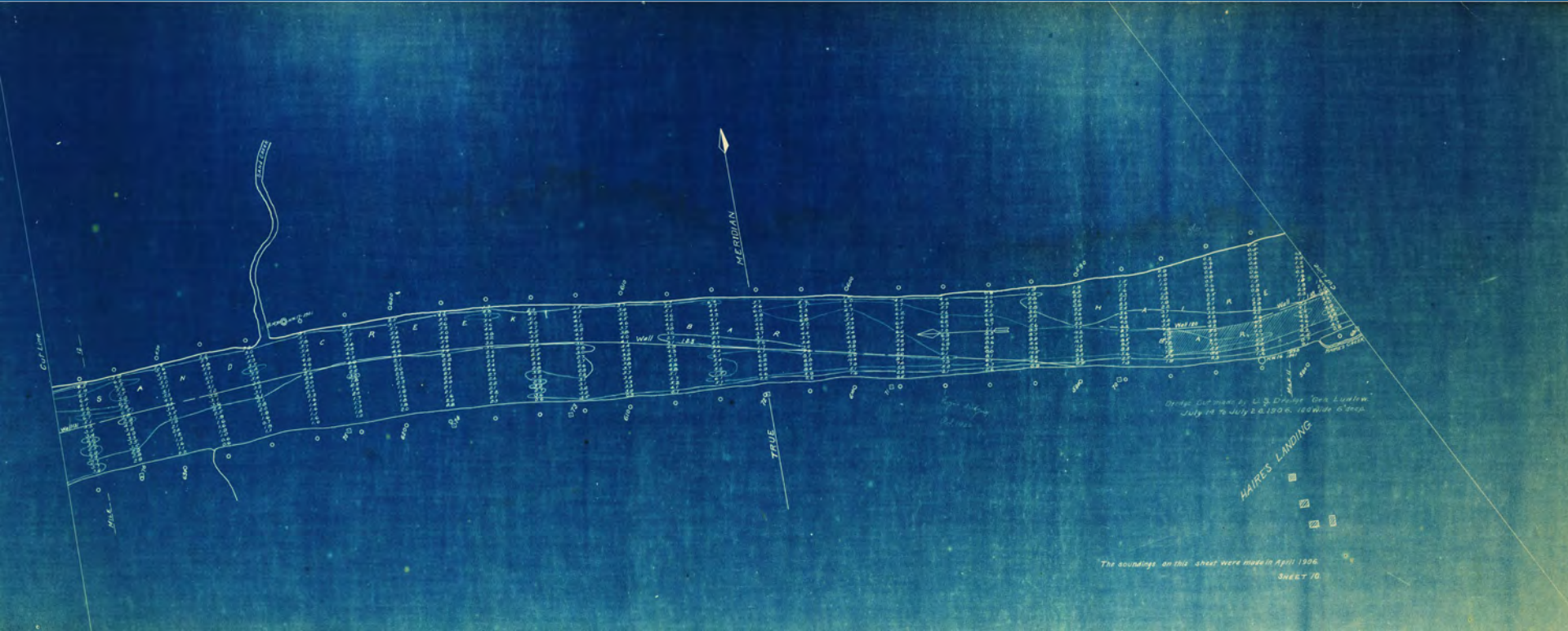
- 1860's Township surveys
- Focused on parcels and less on physical features



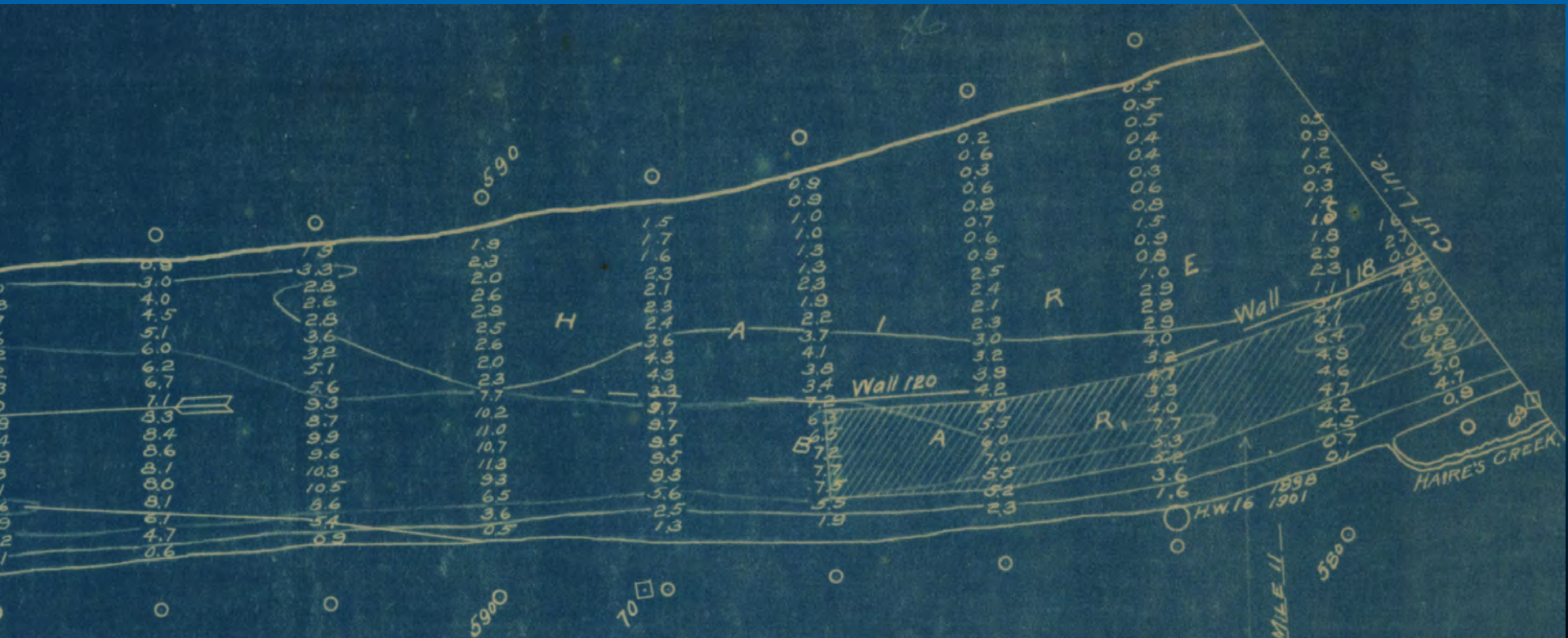
1864 Map of Tallmadge and Georgetown Townships

# Physical surveys of the Grand River

- 1906 Bathymetry and Channel Feature Mapping



# 1906 Mapping Details



Dredge Cut made by U.S. Dredge "Gen. Ludlow"  
 July 14 to July 28, 1906. 100' wide 6' deep.

# 1906 Mapping Details




# 1906 Mapping Details

- Very detailed depths reported to the 0.1 feet (~20-25 per line)
- Lines spaced about 200-250 feet apart
- Training walls locations and dredging mapped in detail
- Vertical datum is problematic due to missing water level data




# 2016-2017 Dredging Feasibility Study



Grand River Waterway  
Dredging Feasibility Study

Prepared for:  
State of Michigan  
Department of Natural Resources  
Department of Technology, Management & Budget  
May 3, 2017

Prepared by:  
  
Edgewater Resources LLC  
519 Broad Street, Suite 200  
Saint Joseph, Michigan 49085  
269 922 4502

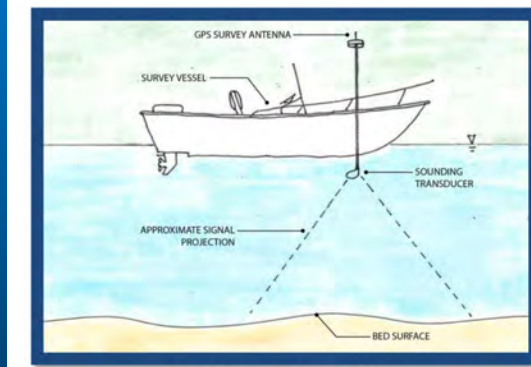


Figure 5. Hydrographic Surveying Schematic

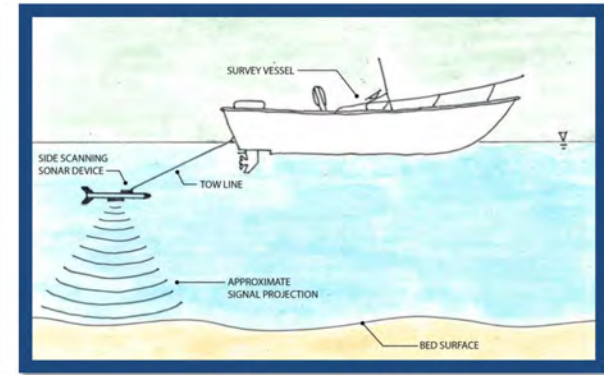


Figure 7. Side Scanning Sonar Schematic

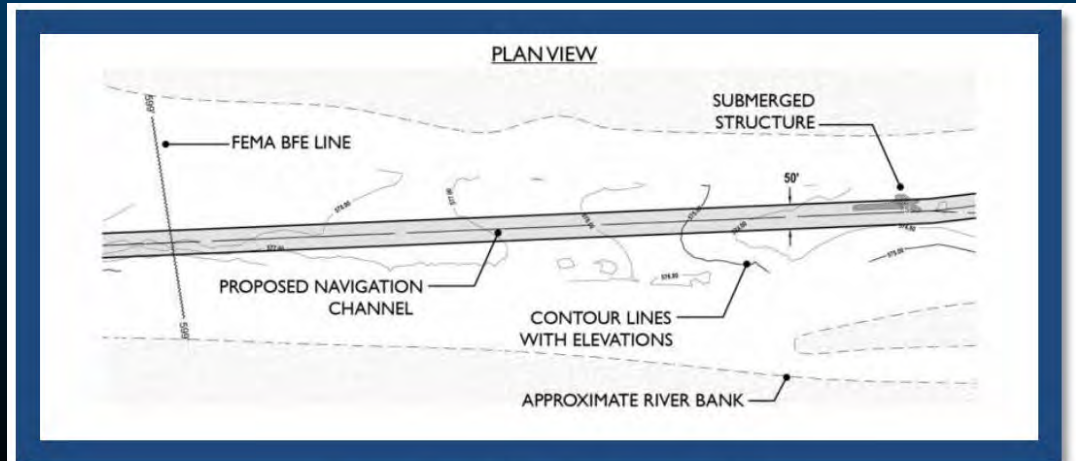
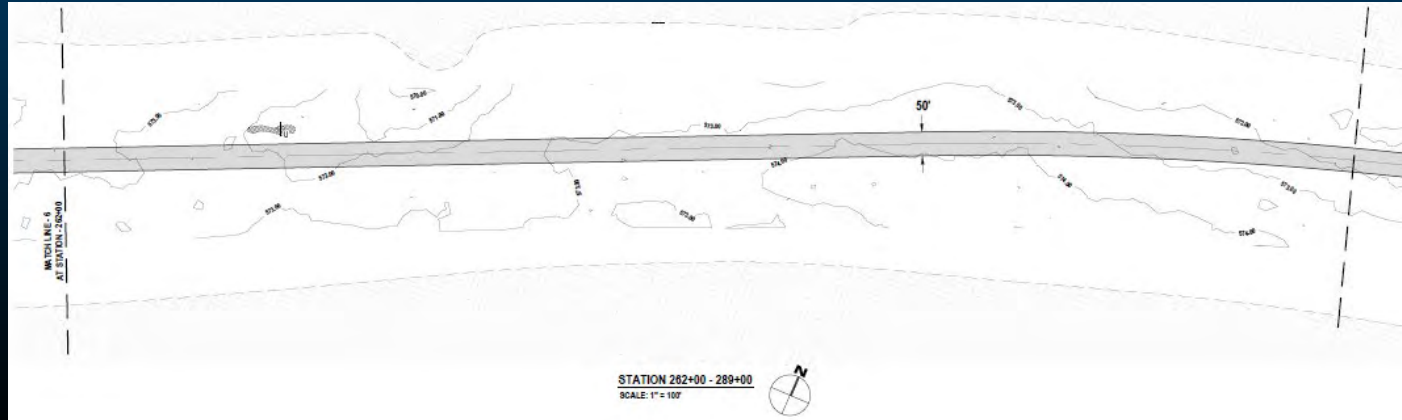


Figure 6. Example Plan View from AutoCAD

# Limitations of 2017 Bathymetry Study

- Limited data on the shape and morphology of the river.
- Significant areas near the edges of the river were not surveyed.
- Some area that have converted to upland due to sediment deposition and training wall structures installed in the late 1800's were not surveyed
- 1800's training walls are clearly controlling modern river velocities, bedforms, sedimentation, and erosion, and should be carefully mapped and inventoried.

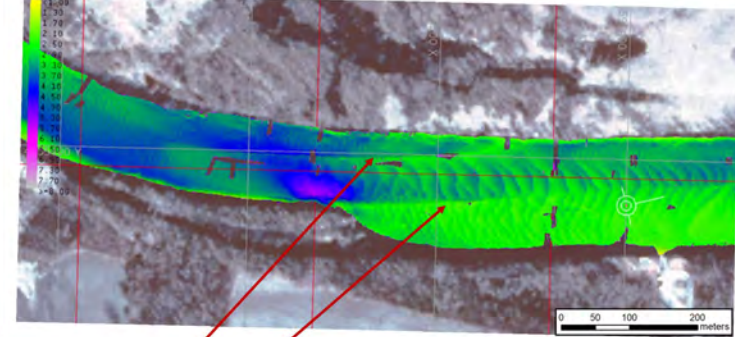
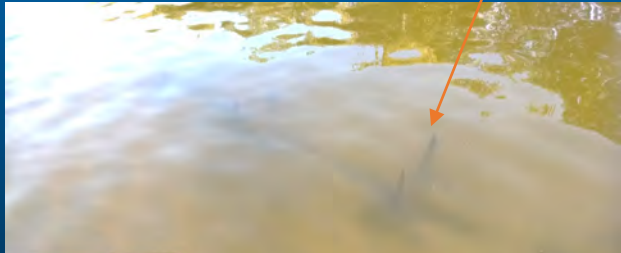




# Mapping Comparison 2018-2019

Mapping

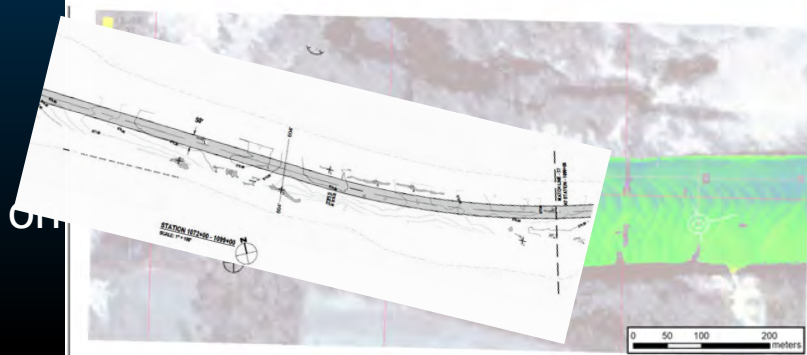
Late-1800's "wall"



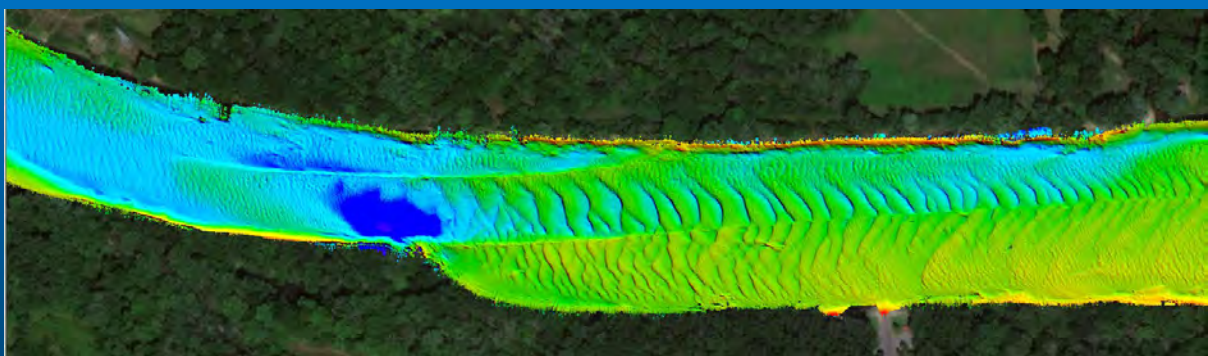
1906 Mapping



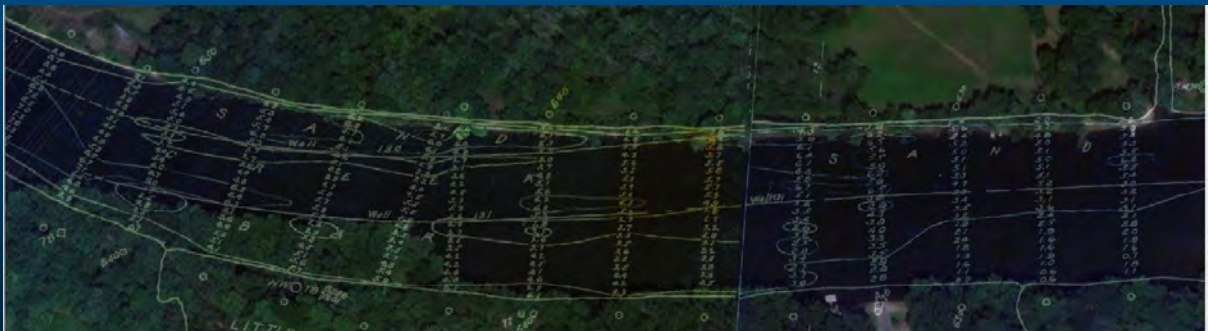
2016-2017  
Mapping  
superimposed on  
2019 mapping



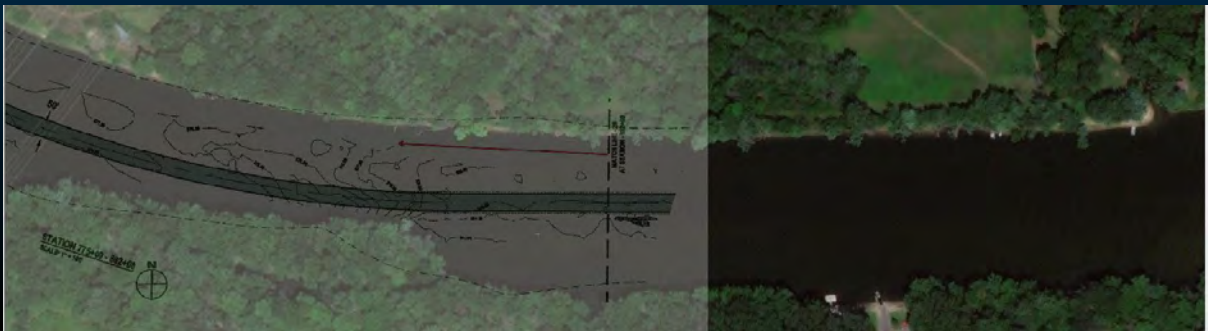
- 2019 MBES survey



- 1906 georeferenced map



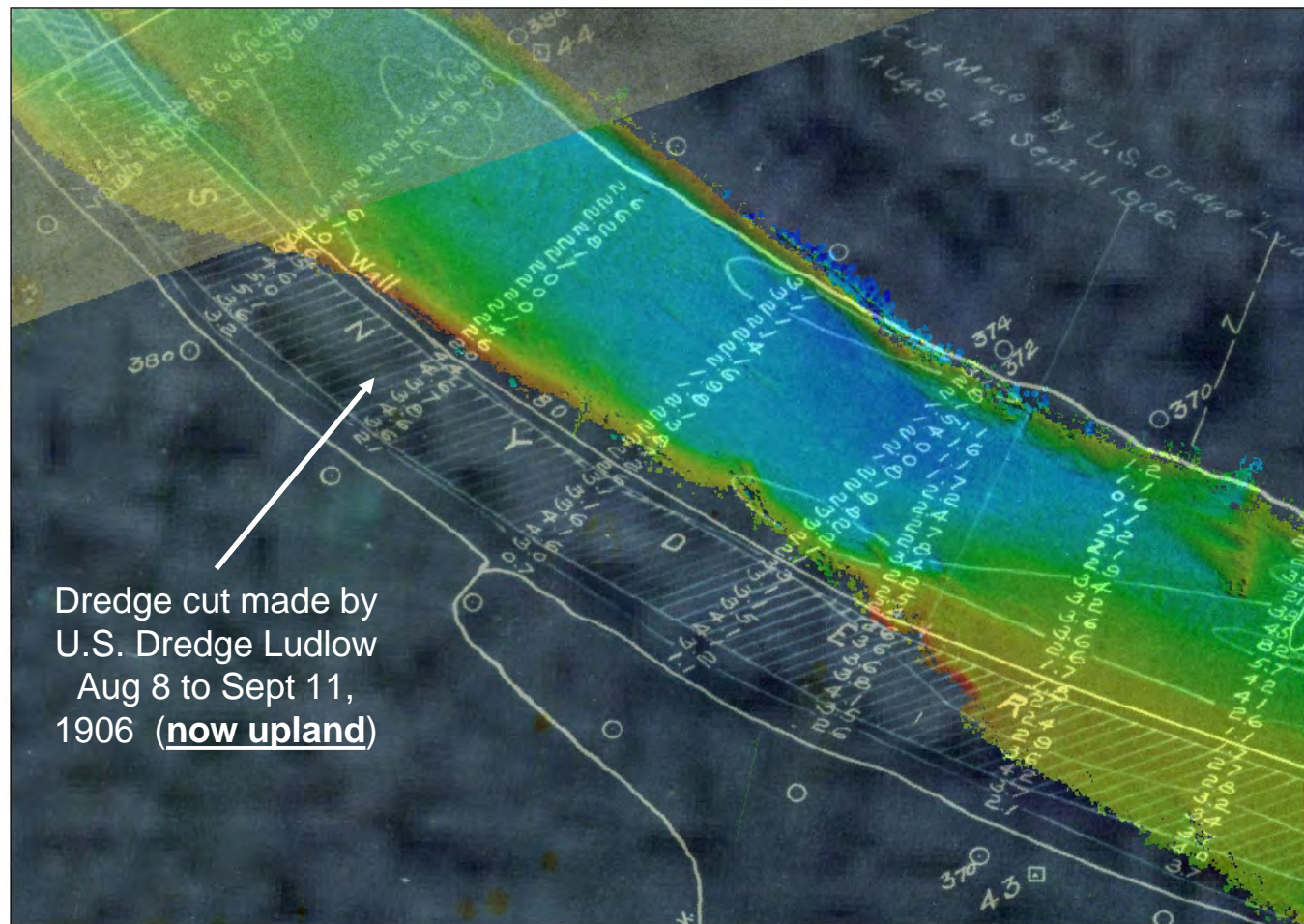
- 2017 Edgewater Survey proposed dredge map



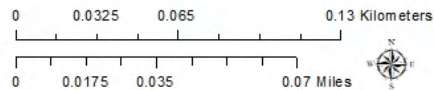
# High Resolution Bathymetry Collected in 2019



# Multi-Beam Echosounder (MBES) Example

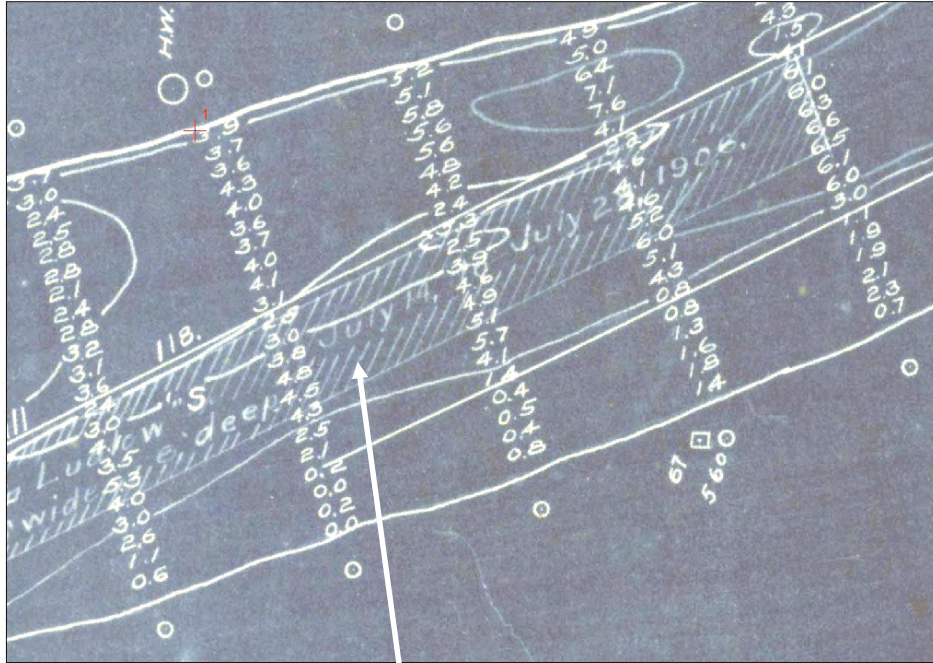


Dredge cut made by  
U.S. Dredge Ludlow  
Aug 8 to Sept 11,  
1906 (now upland)



# Multi-Beam Echosounder (MBES)

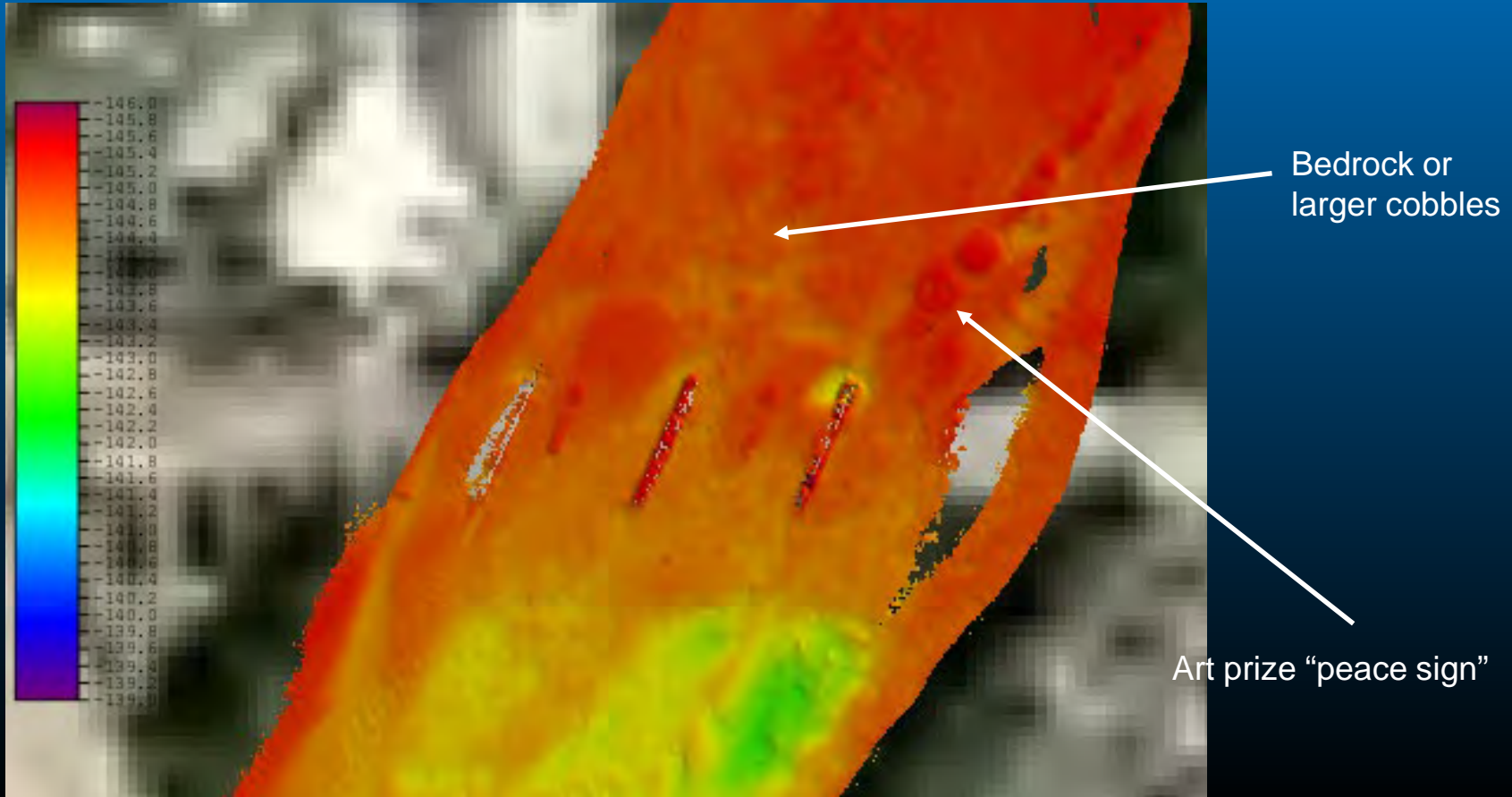
## Examples



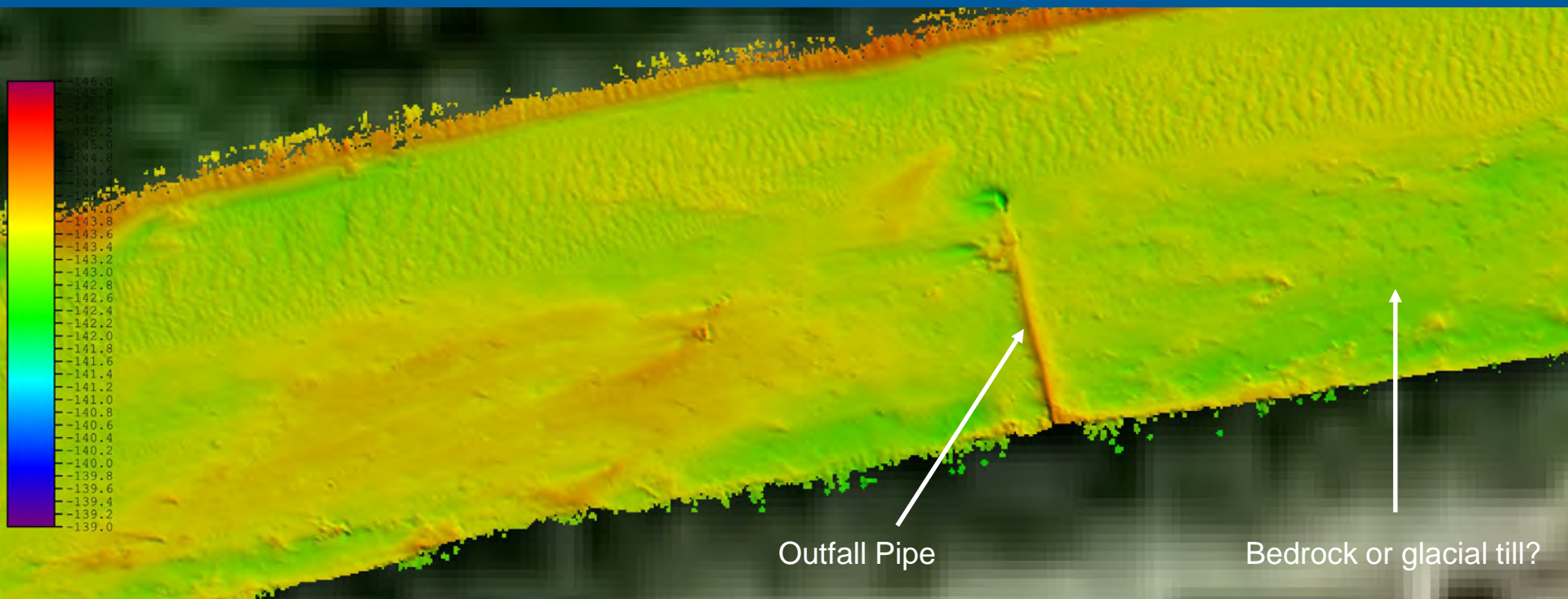
Dredged in 1906



# Multi-Beam Echosounder (MBES) Examples



# Multi-Beam Echosounder (MBES) Example



# Sediment Sampling

- Most sediment sampling has been done near the mouth of the grand river or as discrete sampling
- Sediment sampling in a river environment is different than sampling on land and requires specialized techniques and equipment.



Substrate Surveying on the Grand River near Ada, MI

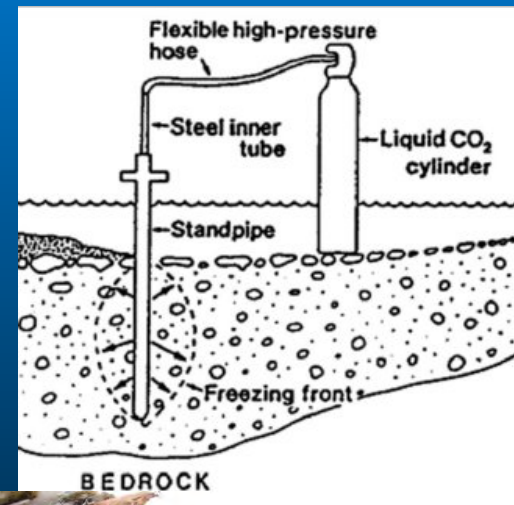


# Limitations of Proposed Sediment Sampling Plan

- Focused on the dredging plan and locations where material will be removed rather than the geomorphic settings in the river that are likely to contain sediments of different ages.
- Proposed “soil boring” sampling methods appear to be more suitable for sampling an upland site rather than within an active waterway.
- Proposed methods will not fully sample fine materials (likely sites for adsorption of contaminants of concern).
- Sediments should be sampled in a way that preserves the position of different sediment layers and interstitial water.

# Freeze-Core Method for Sampling Sediments

- Create less disturbance of the bed and water column
- Provide a more representative sample of different parts of the sediment column in a river environment
- Capture interstitial water as well as sediments



Source: <https://www.geology.lu.se/>

# Data needed to make science-based decisions

- Accurate and complete bathymetry integrated with LIDAR (elevation data) for areas outside the channel (to capture areas that have converted to upland).
- Comprehensive and complete sampling of modern sediments and legacy sediments using a method appropriate for a river environment.
- Modern and historic sediment transport, erosion, and deposition patterns.