Application of Existing Tools to Systematically Identify Nearshore Placement Sites for Beneficial Use of Navigation Sediments in Lake Michigan

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US Army Corps of Engineers

ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

Goal: Systematically apply available tools to identify potential sites for the beneficial use of sediment.

- 140 Great Lakes Federal harbors
- 3-5 MCY dredged per year; 12 MCY backlog
- Currently ~ 35% of Great Lakes sediment is used beneficially
- USACE Vision: 70% beneficial use by 2030

➢ Needed: a strategic and systematic approach to identifying BU sites

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Beneficial Use of Dredged Material

Program Vision

Chief of Engineers 70% Beneficial Use Practices by the year 2030 Target

Dredge Material is a valuable resource

- Increased dredging investments create beneficial use of dredge material management opportunities
- Benefits the ecosystem, economy, and can effectively and efficiently deliver the USACE mission.

There are opportunitites to expand beneficial use wihtin the Federal Standard

- Operational strategy should inherently include beneficial use placement options.
- If material is needed to implement a project, beneficial use from dredging operations should be considered as an option in the planning and execution strategy.

Partner collaboration is key to our success

- Innovative pursuit, both internally and externally, with partners and stakeholders will:
  - Maximize available solutions, strategies, and tools
  - Develop and apply new approaches and technologies

National Policy for Beneficial Use of Dredged Material

Congressionally established by section 125 of WRDA 2020 in doing so, Congress has underscored the importance of the Beneficial Use of Dredged Mateiral Program

Dredged material is valued as a resource not to be wasted but used for benefits to the ecosystem, economy, and project delivery

Address key obstacles to execution

Identify, develop, and share beneficial use practices

Collborate on innovative financing

Identify Key Contributors

Unify Enterprise Purpose

Foster Strong Partnerships

Deliver the Mission

Over the next 3-5 years, the Corps will expand the beneficial use of dredged material program. Achieving this vision will require all of us to be innovative and work alongside our partners, both internally and externally, to ensure we are finding the best use of sediments derived from our Navigation mission.

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USACE BU WEBSITE: https://budm.el.erdc.dren.mil/

A National View on Successful BU Project Implementation

A few observations

- **It is possible to "marry" funding sources and authorities to implement beneficial use projects such as habitat restoration using navigation channel sediment.**
- **To successfully implement BU projects, you need to ID the BU first! It's a longer lead item due to the need for NEPA, permit coordination, stakeholder input, etc.**
- **The nav program will run in the background, and if you have BU opportunities ID'd, then you will be in a position to use nav material when funding is available.**

Assumptions underlying the approach

- The sediment is chemically, physically, biologically suitable for beneficial use.
- This project is only looking at “in-water” uses (below the ordinary high water mark).
- All dredging and beneficial use projects must comply with applicable environmental laws.
- Permitting and real estate issues are not discussed here.
- Assumed priorities for BU include protecting and restoring parks, natural areas and beaches, and also protecting existing infrastructure.

Key Questions to Answer

1. What locations could be good for habitat construction or protection, shoreline nourishment, beach nourishment, infrastructure protection or other use? Where are these opportunities in reference to the harbor or channel to be dredged?
2. If we place sediment, do we expect the material to stay as placed or to migrate over a short period of time?
3. What direction do we expect sediment to migrate?
4. How does the nourishment fit into the overall coastal conditions, as far as material balance and erosion/accretion?

Tools

- Aerial Maps and Images
  - ArcGIS and Google Earth
  - NOAA digital coast (DEMs and coastal topography)
  - USGS Digital Shoreline Analysis System
  - CoastSat
- Lakeshore Geomorphic Vulnerability Index (LGVI)
- Sediment Mobility Tool (SMT)

Aerial Maps and Images

Key Information

- Distance from harbor
- Adjacent land uses (identification of parks, beaches, key infrastructure)
- Coastal conditions (natural or armored)
- Coastal changes over time (erosion, accretion, impacts of water level changes)

Algoma Harbor

Federal channel is in red. Natural beach to the south of harbor. Partly armored shoreline to the north.

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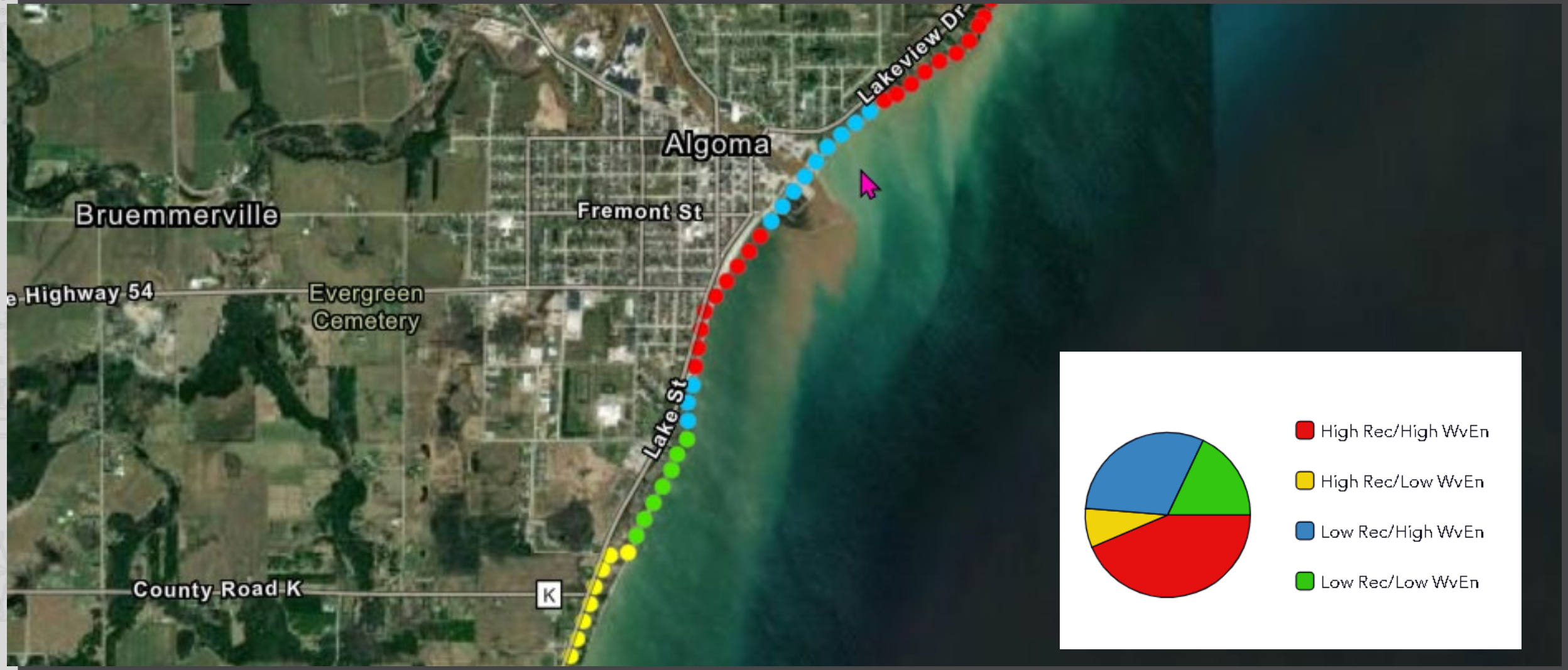
Lakeshore Geomorphic Vulnerability Index (LGVI)*

The LGVI website has useful tools:

1. **nearshore feature database**
   - **nearshore slope**
   - **sand bar properties (number of bars, depth of water, and distance offshore)**
   - **beach width**
   - **shoreline type**
2. **recession rate and shoreline wave energy indices**
   - **the wave energy environment and the erosion tendencies inform sediment mobility modeling and placement site decisions**

***development of the LGVI was funded by GLRI Focus Area 5**

LGVI for Algoma Harbor



Recession rate verses wave climate

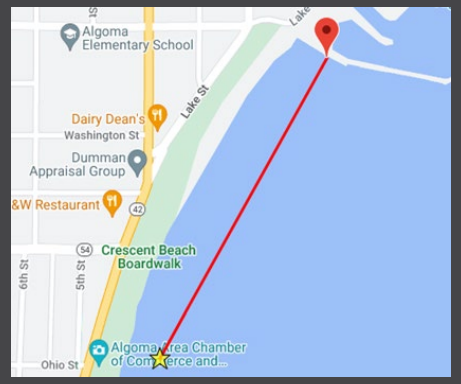
Sediment Mobility Tool (SMT)

- Web-based tool https://navigation.usace.army.mil/SEM/SedimentMobility
- Assess sediment transport at potential nearshore placement sites
- *Models placement as a nearshore berm*
  - Efficient placement
  - Engineering with Nature approach
- Quantifies how frequently placed sediment will be mobilized and how the migration estimates compare to historical nearshore nourishments

Sediment Mobility Tool Input

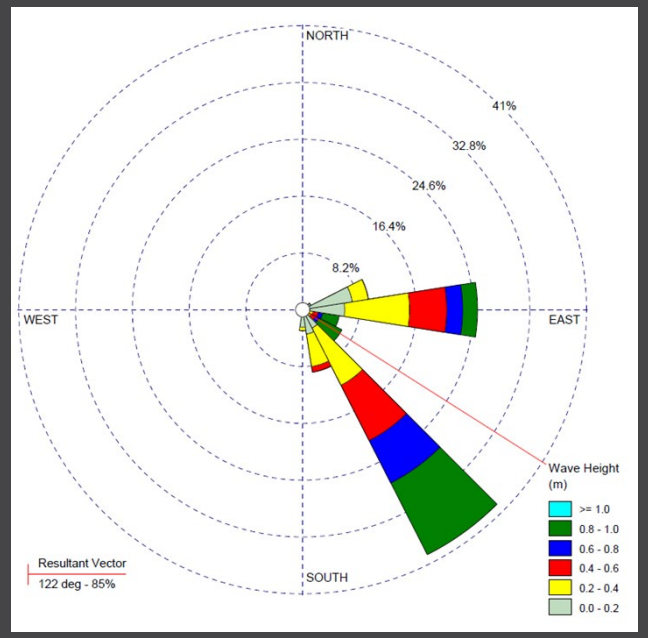
- Uses Wave Information Study (WIS) hindcast wave data
- Basic site information
  - Shoreline angle
  - Placement site
- Dredging project information
  - Quantity of material
  - Berm dimensions
  - Anticipated placement month

SMT Output for Algoma (Crescent Beach)



Shoreline angle and placement site

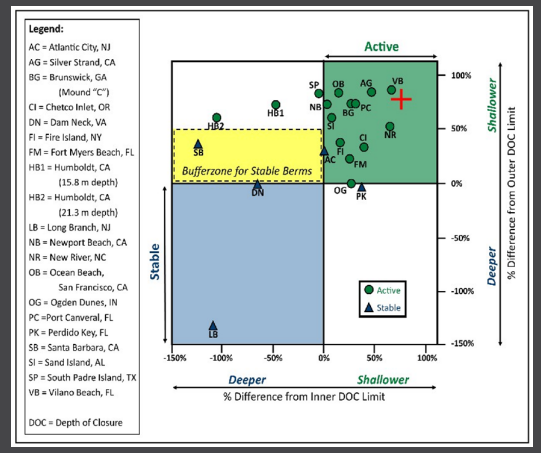
Deflation rate ≈ 8,100 CY/month



Wave rose – informs what direction sediment will migrate

d50 [mm]	Bed Shear Stress: Frequency of Mobilization (F_M)	Near-Bottom Velocity: Frequency of Mobilization (F_{Mu})	Predicted Sediment Migration
0.1	76%	82%	70% Offshore
0.15	74%	79%	56% Onshore
0.2	71%	76%	68% Onshore
0.3	67%	71%	82% Onshore
0.4	67%	67%	91% Onshore
0.5	66%	64%	95% Onshore

Fate of material by grain size (here, the smallest fractions are washed offshore)



Comparison to historical nearshore berms. A berm placed along Crescent Beach would be active and would migrate.

What do you end up with?

- **A short list of potential beneficial use sites**:
  - Within X distance of harbor
  - Consistent with adjacent land uses and shoreline conditions
  - Understanding whether we expect sediment to move
    - How fast
    - What direction
    - Future placement capacity?

Use the short list to start discussions with the State and local stakeholders, evaluate costs, evaluate environmental impacts

Example

Harbor	Beneficial Use	Proposed Placement Location(s)	Proposed Placement Method(s)	Placement configuration
Kenosha Harbor	Coastal resiliency along eroding shoreline	Kenosha Dunes shoreline	Hydraulic dredging and placement	Parallel to shoreline, filling behind revetment
	Alternate: Beach nourishment	Alternates: Eichelman Park beach or Southport Park beach	Hydraulic or mechanical dredging/placement	Cross shore swash zone or nearshore berm. Alt: traditional beach placement
Two Rivers Harbor	Beach nourishment	North Beach Alternate: Neshotah Park	Hydraulic dredging and placement	Cross shore swash zone placement at southern end of beach or nearshore berm Alt: traditional beach placement
Oconto Harbor	Habitat development and coastal resiliency	South of harbor: City Breakwater Park or along natural shoreline	Hydraulic dredging and placement	Discrete locations based on bathymetry, wetland surveys and other site-specific habitat factors, to achieve a desirable habitat endpoint.
	Alternate: beach nourishment	Alternate: City Park beach	Hydraulic dredging and placement	Nearshore berm or cross shore swash zone placement at the southern end of the beach. Alt: traditional beach placement
Pensaukee Harbor	Habitat development and coastal resiliency	South of harbor along Green Bay West Shore State Wildlife Area	Hydraulic dredging and placement	Discrete locations based on bathymetry, wetland surveys and other site-specific habitat factors, to achieve a desirable habitat endpoint.
			Alt. Mechanical dredging and placement	
Big Suamico Harbor	Habitat development, beach augmentation, and coastal resiliency	Longtail Point	Hydraulic dredging and placement	Nearshore berm, cross shore swash zone or beach placement.
	Alternate: Coastal resiliency	Alternate: Sensiba State Wildlife Area	Hydraulic or mechanical dredging and placement	Upland berm construction
	Alternate: Habitat restoration and coastal resiliency	Alternate: Duck Creek Delta	Hydraulic or mechanical dredging and placement	Discrete locations based on bathymetry, wetland surveys and other site-specific habitat factors, to achieve a desirable habitat endpoint.

Questions?