

LOW WATER DATUM UPDATES : NAVIGATION IMPACTS

Presenter:

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US Army Corps
of Engineers®

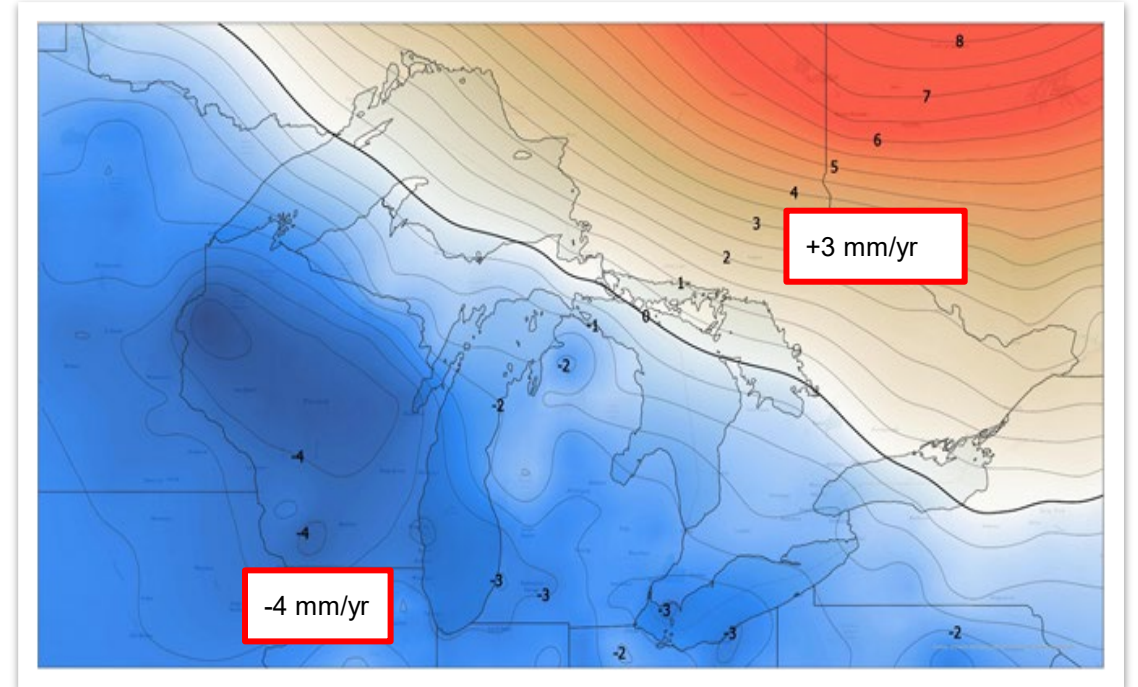




UPDATING IGLD AND LOW WATER DATUM (LWD)



- All Great Lakes water levels are referenced to a common vertical datum. The first common vertical datum on the Great Lakes was the International Great Lakes Datum (IGLD) of 1955 (IGLD (1955)). **Current datum is IGLD (1985)**
- Due to continual rebound of the earth's crust, **the datum must be updated every 25-30 years**
- Committee is targeting to publish and release IGLD2020 in calendar year 2027. The plan is to release IGLD and LWD updates at the same time.
- IGLD2020 update is a **IGLD2020 update is a bi-national effort** co-led by NOAA with Canadian Hydrographic Survey and Natural Resources Canada with input from the Vertical Control Water Level Subcommittee (Coordinating Committee)



Regional map depicting Glacial Isostatic Adjustment from GPS measurements (M. Craymer and C. Wisotzkey, 2021)

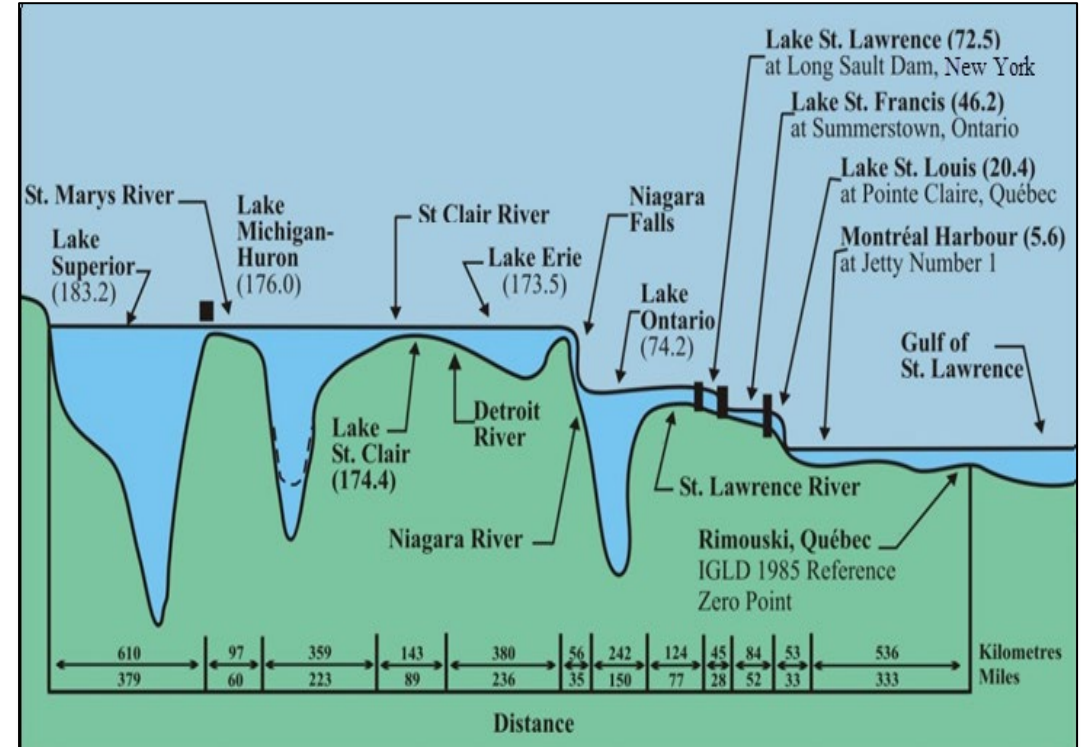




WHAT IS LOW WATER DATUM (LWD)?



- **LWD is the navigational chart datum**, one for each of the Great Lakes. Different LWD surfaces are defined for each lake & the connecting channels.
- By definition, LWD is supposed to **identify a surface so low that the water level will seldom fall below it**. The historical record of water levels has not been reviewed in the context of re-evaluating LWD since their original determination in 1933.
- **Depths shown on navigational charts and the authorized depths for navigation improvements are referred to LWD.**



Great Lakes and St. Lawrence Seaway System with current established LWD elevations (m)





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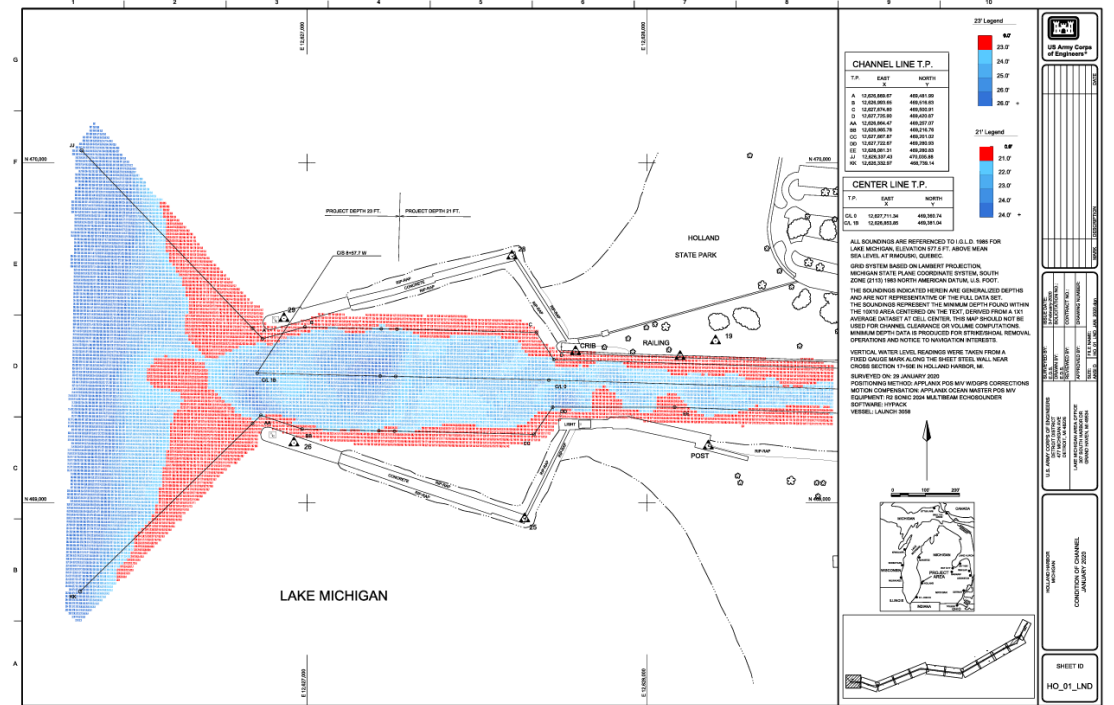


Image above is USACE condition survey of Holland Harbor, MI. Red represents areas of federal navigation channel where project depth is less than authorized (shoaling).

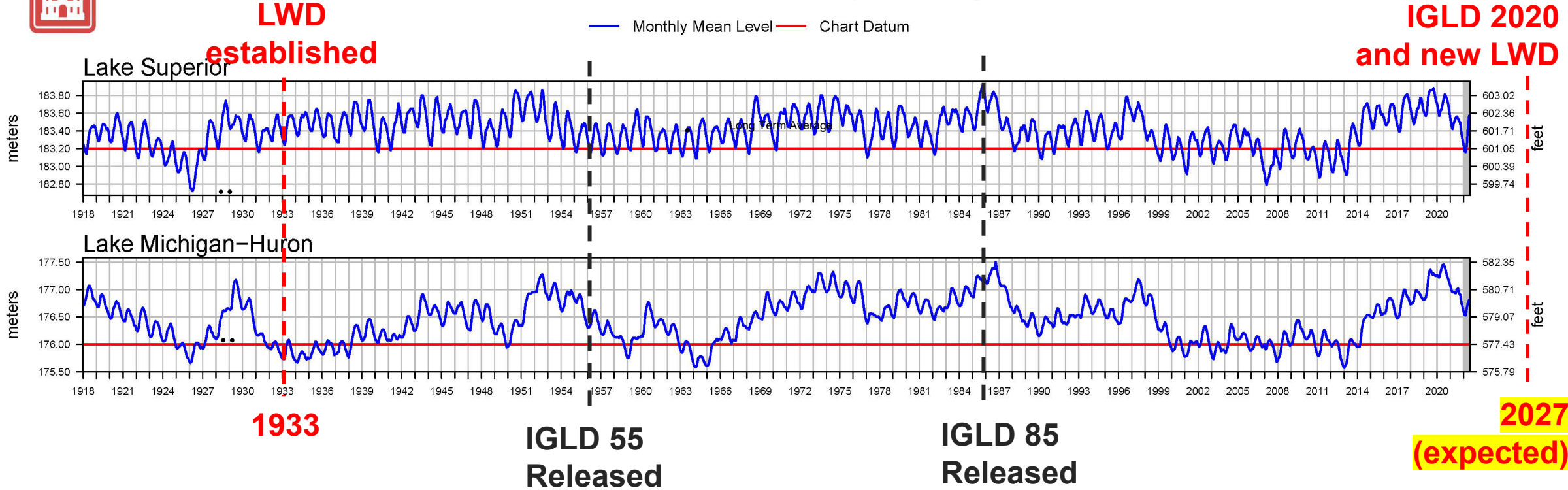




IGLD AND LWD HISTORY



Great Lakes Water Levels (1918–2022)



- Opportunity to complete in conjunction with the IGLD (2020) Update
- Longer period of record of water levels, which may better represent current/expected climate
- The physical Great Lakes system has changed since 1933 (channel deepening, natural hydraulic changes, regulations plans, etc)





THE LOW WATER DATUM CHALLENGE: ESTABLISH A LEVEL SUCH THAT THE WATER WILL “SELDOM” FALL BELOW IT.



Frequency of Exceedance of Current Low Water Datum

Lake	Existing LWD	Time Below LWD
	(Feet)	(1918-2017)
Superior	601.10	40%
Michigan-Huron	577.50	26%
St. Clair	572.30	22%
Erie	569.20	11%
Ontario	243.30	15%





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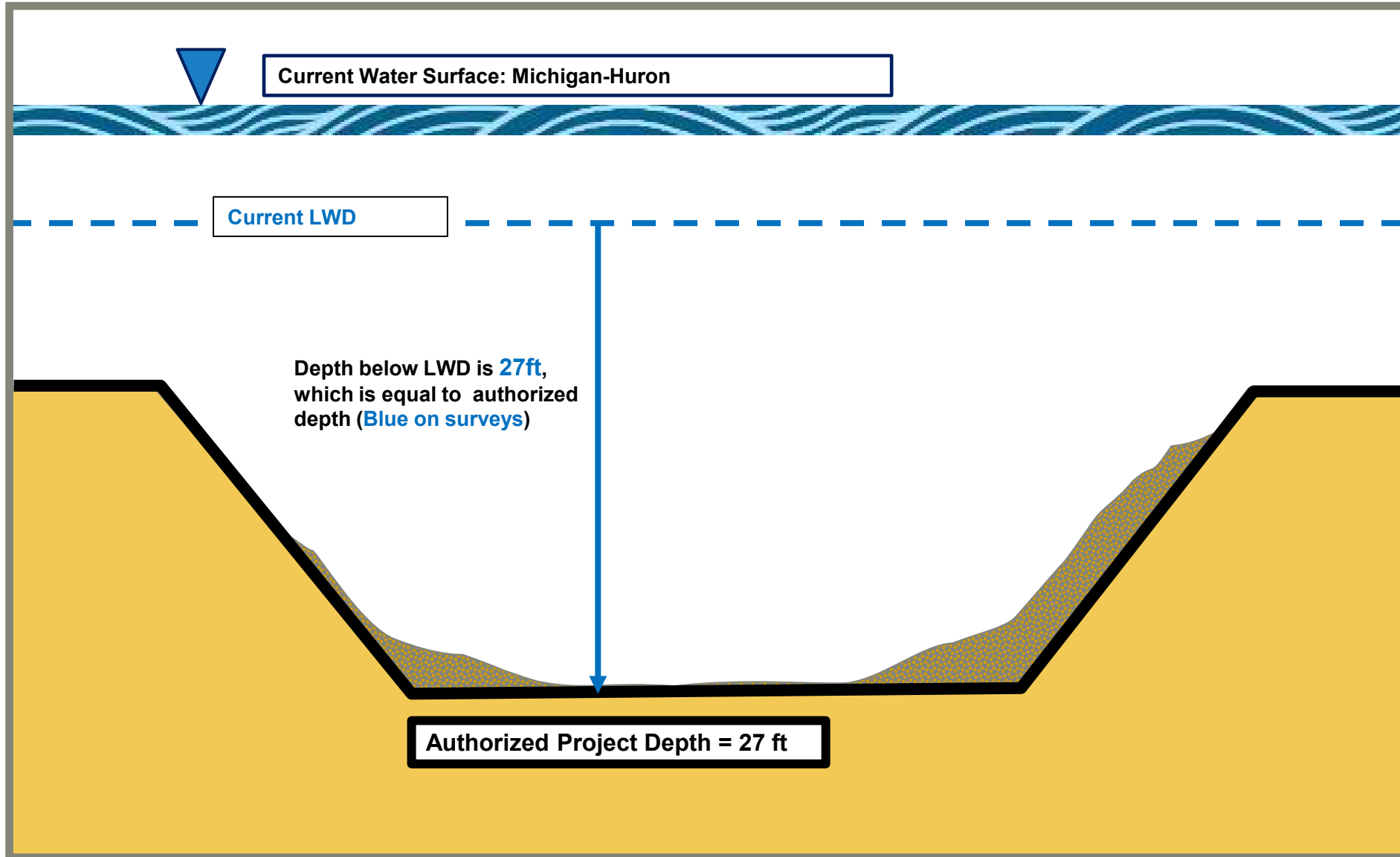
Lake	Existing LWD	Time Below LWD	Potential Change Relative to LWD*
	(Feet)	(1918-2017)	(Inches)
Superior	601.10	40%	-9
Michigan-Huron	577.50	26%	-12
St. Clair	572.30	22%	-1.5
Erie	569.20	11%	+3
Ontario	243.30	15%	-2

* Extreme value analysis using CGLRRM Supply/Routing model 90% exceedance. Final values still be developed.



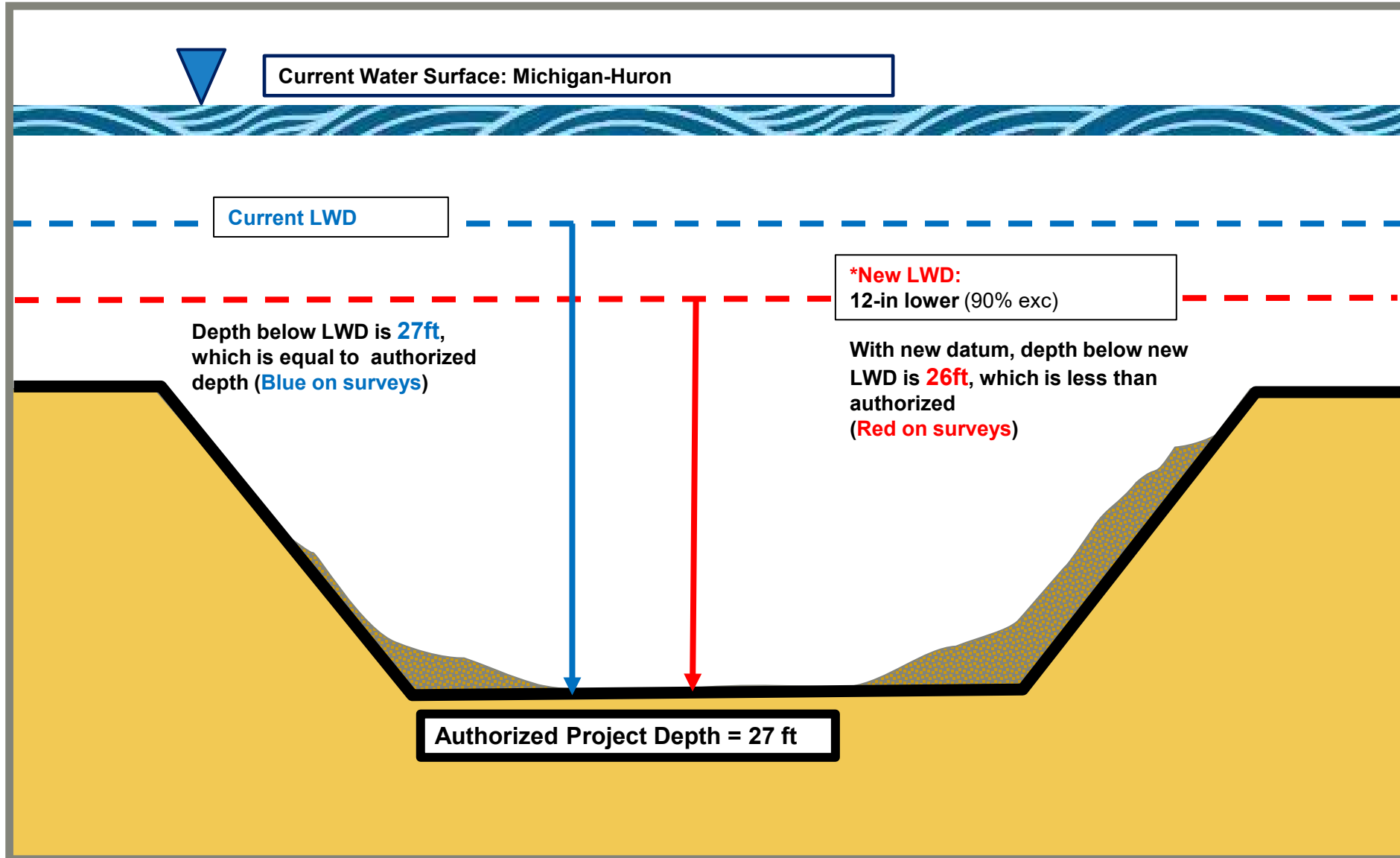


NEW LOW WATER DATUM IMPLICATIONS TO AUTHORIZED PROJECT DEPTH





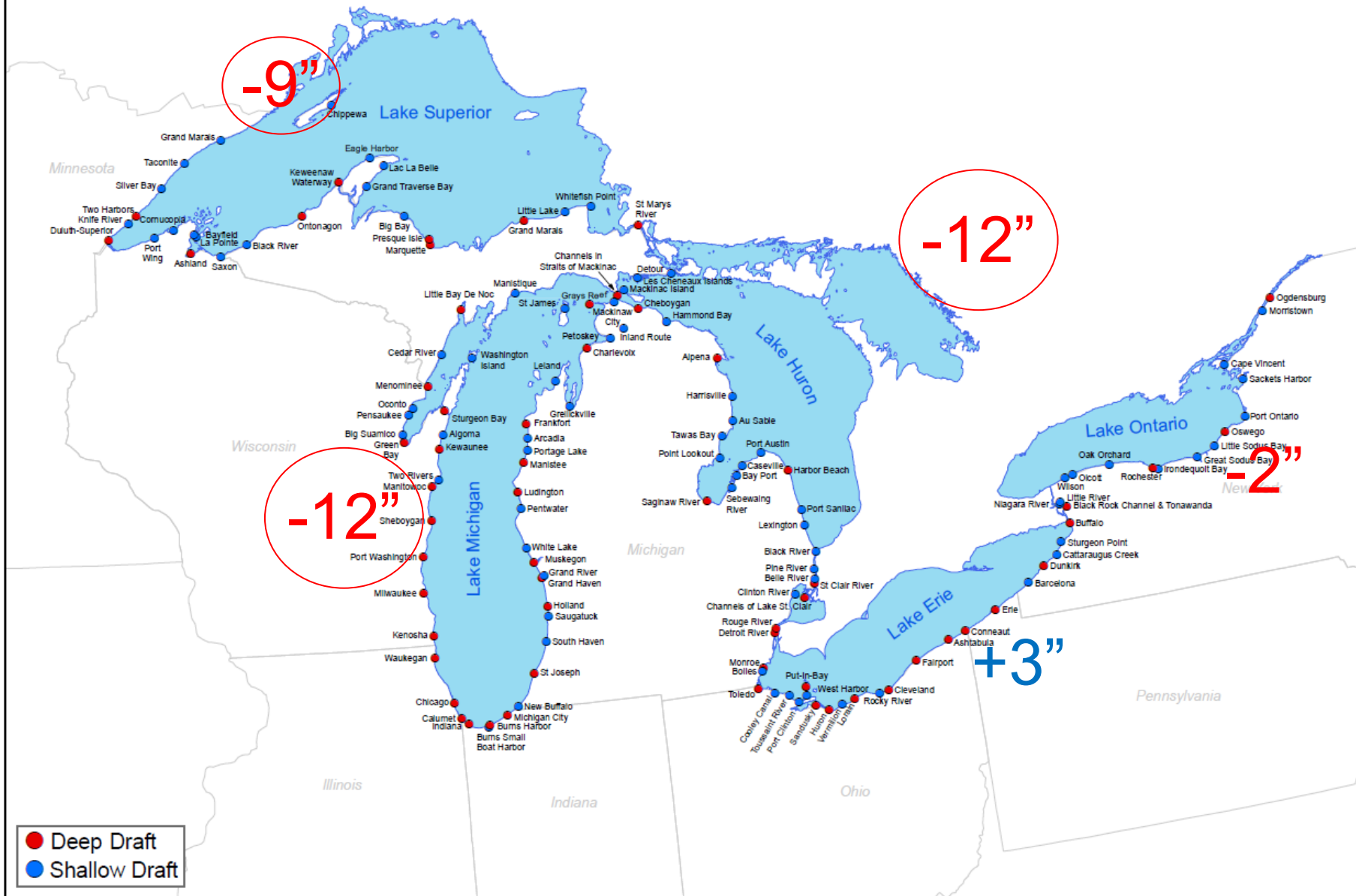
NEW LOW WATER DATUM IMPLICATIONS TO AUTHORIZED PROJECT DEPTH





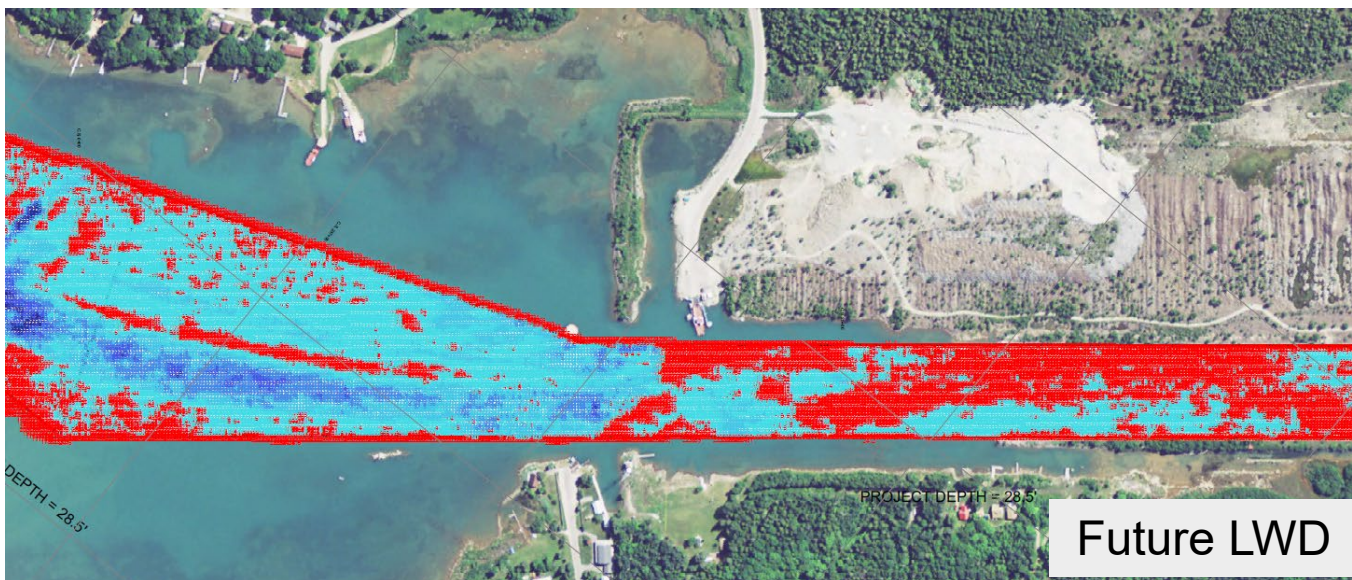
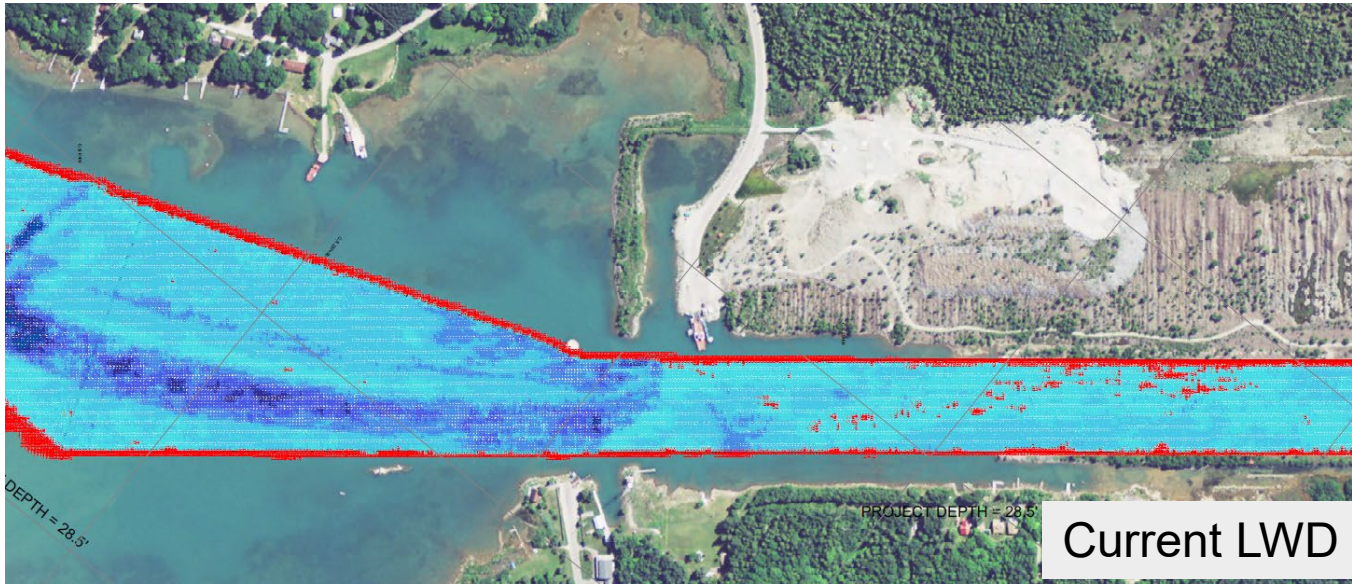
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Projected Change in LWD





ST. MARYS RIVER



Current Functional Channel Backlog:
752,900 cyds

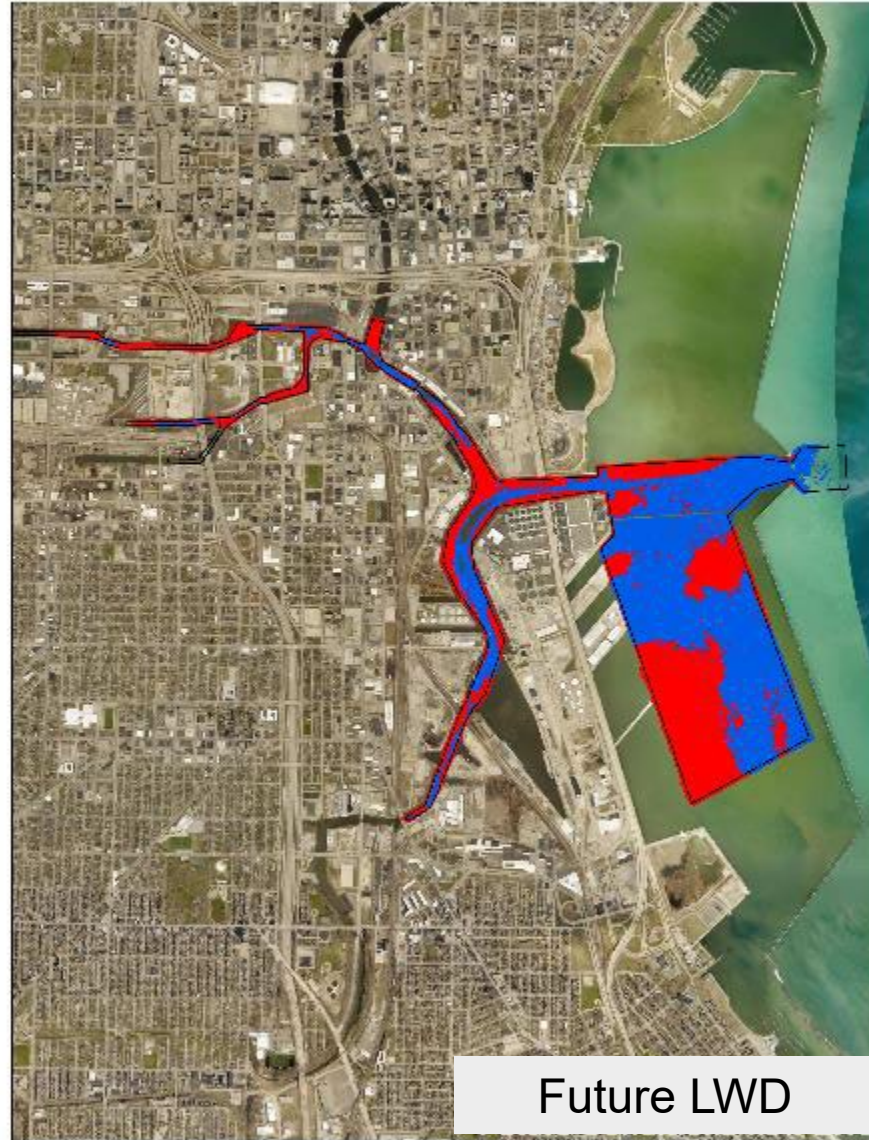
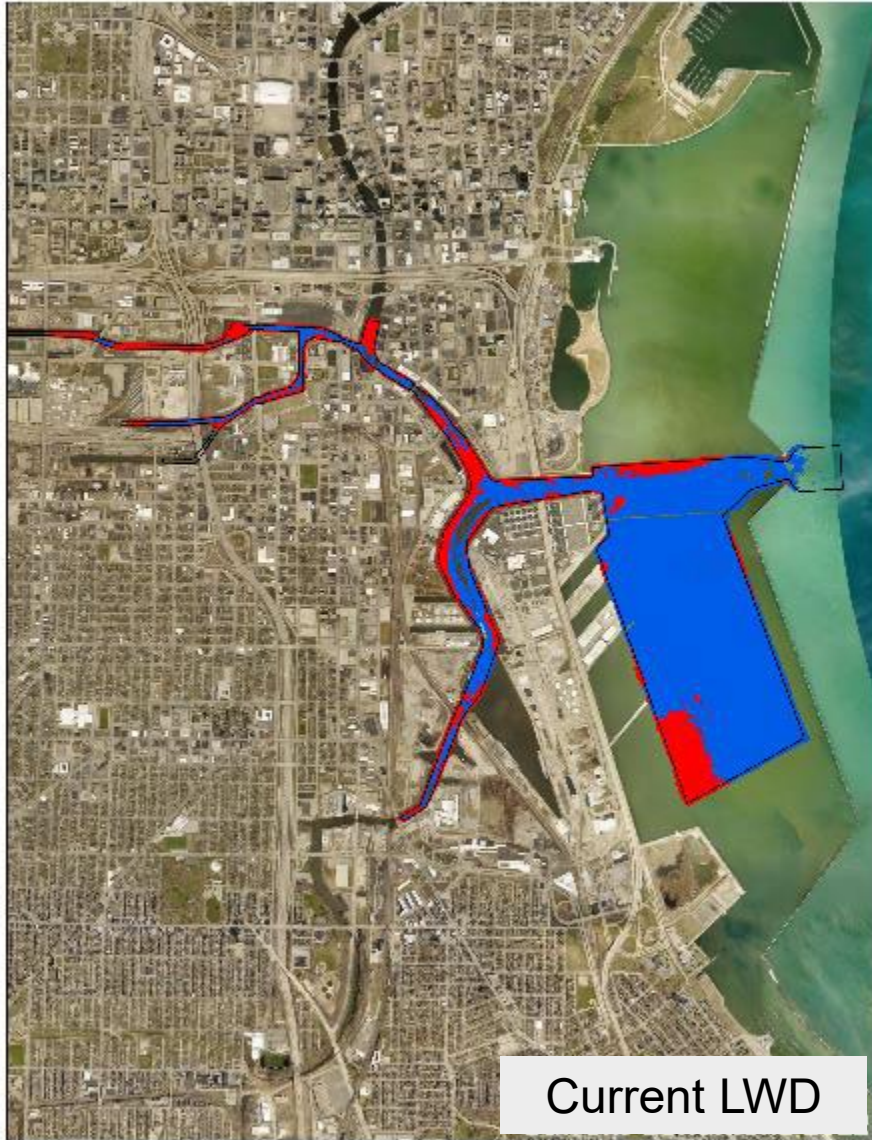
Volume Material between Existing LWD and New LWD:
759,700 cyds

Total Material to New LWD:
1,512,600 cyds

Notes:
Costly removal of hard bottom channel material; deficit of established placement sites with capacity



MILWAUKEE



Current Functional Channel Backlog:
368,000 cyds

Volume Material between Existing LWD and New LWD :
197,000 cyds

Total Material to New LWD:
565,000cyds

Notes:
Placement challenges with Milwaukee Harbor DMDF; remediation projects; will have deficit of placement capacity



UPDATE SUMMARY OF QTY AND COST IMPACTS RELATIVE TO DRAFT LWD PROJECTIONS



	Material Between CURRENT LWD > NEW LWD <u>FUNCTIONAL</u> Project Dimensions (cyds)	Material Between CURRENT LWD > NEW LWD <u>AUTHORIZED</u> Project Dimensions (cyds)	GROSS ESTIMATED COSTS (costs relative to <u>FUNCTIONAL</u> Project Dimensions)*	NUMBER OF PROJECTS CAPTURED
SUMMARY CALCULATED (Incl. Superior, Mich-Huron, Connecting Channels)	5.8M – 6.5M	8.5M – 9.3M	\$365M - \$400M	110
DEEP DRAFT PROJECTS	4.8 – 5.4M	7.5M-8.0M	\$300M - \$315M	43
DEEP DRAFT PROJECTS (Active Commercial)	4.2M – 4.6M	5.2M – 5.8M	\$210M - \$240M	37
SHALLOW DRAFT PROJECTS	1.0 – 1.1M	1.0 – 1.1M	\$65M - \$70M	67

About 35 % of projects have been identified **with risks due to sediment characteristics** or challenges with material below existing channel depth (ex: materials with contaminants; capping/remediation, hard bottom material, TSCA, anthropogenetic material)

Nearly 50% projects have been identified with **challenges relative to dredged material management including placement availability and capacity** (ex: CDF capacity, environmental compliance, placement identification)

* Escalated to FY29 costs based on anticipating budget development in FY25 (full work package cost)



NEXT STEPS



- Continue to inform stakeholders on IGLD2020 & LWD change. **New LWD expected to be in place by 2027.**
- Move forward engaging with stakeholders on project-by-project basis with survey results to discuss prioritizing new LWD material removal areas.
 - **Need detailed input from ports and users on priority areas within the projects, and feedback on prioritization within the GL Nav system**
 - Can begin immediately discussing placement challenges and solutions
- Continue **refinement in calculated quantities and costs expected due to new LWD**, incorporate risks related to sediment characteristics (contaminated areas, hard material or bedrock) and placement (material management, capacity, suitability).
- Develop recommended **phased approach for budgeting, taking into consideration material management**. Layout funding strategy within typical 2-year budget cycle. Communicate both internally within Corps and externally with stakeholders on funding needs.



UPCOMING MEETING



NOAA and Vertical Control – Water Levels Subcommittee Coordinating Committee hosting : **6 April 2023 – Virtual Meeting Only**

IGLD Outreach Committee is presenting an all-day virtual session on IGLD 2020 Updates including new Low Water Datum

- Intro LWD and Coming Updates
- Impacts on Nautical Charts
- Impacts to Channel Maintenance

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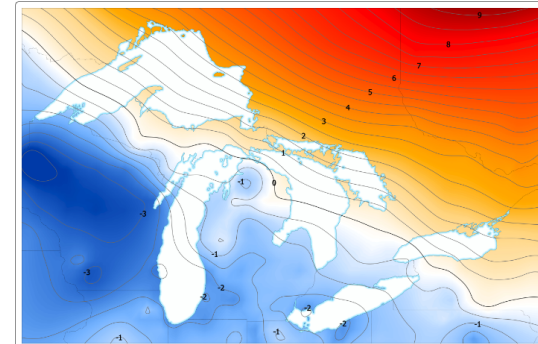
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International Great Lakes Datum

The International Great Lakes Datum (IGLD) is a common reference system used to measure water level heights throughout the Great Lakes, their connecting waterways, and the St. Lawrence River System. A common system is needed for marine navigation, water level regulation, water management, surveying, mapping, and shoreline use planning. Established in 1955, the IGLD is a binational effort between the United States and Canada that ensures cohesive water management in eight states and two provinces. The IGLD is managed by a binational group of federal scientists known as the [Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data](#) and its [Vertical-Control Water-Levels Subcommittee \(SC\)](#).

The 2020 Update: A New IGLD Is Coming!

To account for movements of the Earth's crust and accurately measure water levels, the IGLD needs to be updated approximately every 25-30 years. CO-OPS and its partners currently utilize IGLD 1985. This existing IGLD will be revised over the next several years and replaced by IGLD (2020). As part of the revision, the SC will also evaluate and potentially revise the Low Water Datum (LWD). IGLD (2020) will align with the National Geodetic Survey's new geoid-based North American-Pacific Geopotential Datum. The new IGLD is scheduled for tentative release in 2025.



<https://tidesandcurrents.noaa.gov/datum-updates/igld.html>



QUESTIONS/DISCUSSION





ONGOING EFFORT – INDIVIDUAL PROJECT REVIEW OF LWD IMPACTS



Project	Current <u>Functional</u> Channel Backlog (Cubic Yards)	Functional Channel Material Between Current LWD to New LWD (Cubic Yards)	Total Material to New LWD (Cubic Yards)	Sediment Concerns/Challenges	Placement and Dredged Material Management Concerns
Burns Waterway Harbor	28,200	73,600	101,800		None – beneficial use nearshore placement
Calumet Harbor Calumet River	82,900 458,300	356,800 310,900	439,700 769,200	Rock infused with bitumen in functional outer harbor	Beneficial Reuse Deficit of storage capacity Chicago Area DMDF
Green Bay Harbor	314,200	120,900	435,100		Cat Island DMDF
Indiana Harbor and Canal	78,400	57,600	136,000	Potential for TOSCA material	Indiana Harbor and Canal DMDF
Milwaukee Harbor	368,000	197,000	565,000	Remediation and capping projects	Deficit of storage capacity Milwaukee Harbor DMDF
Duluth-Superior Harbor	1,313,500	602,900	1,916,400	Anthropogenic material in backlog areas	Limited capacity in Erie Pier for silty material
Muskegon	72,900	31,900	104,800	Potential fine material in deeper depths of inner portions of project	None – beneficial use nearshore placement with beach nourishment
St. Marys River	752,900	759,700	1,512,600	Sections with hard bottom channel removal	Deficit of established placement sites
St. Clair	398,200	61,500	459,700		None – beneficial use and Dickenson Island CDF

* All quantities to New LWD are draft, based on current conditions and variable to change while LWD updates are still being developed

* Assumes 12-in lowering of LWD on Michigan-Huron with IGLD 2020; 9-in lowering of LWD on Lake Superior