Toledo Sediment Management and Use Solutions

Evaluation of Sediment Management and Use Options for the Toledo Harbor Sediment Management and Use Plan

Public Forum #2
June 19, 2012
TMACOG Grand Lobby

Forum Organizers and Funders:

Ohio Lake Erie Commission

TOLEDO | LUCAS COUNTY PORT AUTHORITY

Great Lakes Commission des Grands Lacs

Great Lakes RESTORATION

Great Lakes Commission

Dave Knight

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glc.org/dredging

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Logistics

- Restrooms
- Snacks/Beverages
- Health & Safety
- Agenda/Notes Page
- Survey

- Forum Rules
  - Please let the speaker know if something needs repeated
  - Please hold comments and questions pertaining to the content until the Q&A session
- Thank you for attending!

Today's Schedule

- Introduction to the issues from a regional, state, and local perspective
  - Dave Knight, Great Lakes Commission
  - Gail Hesse, Ohio Lake Erie Commission
  - Joe Cappel, Toledo-Lucas County Port Authority
- Presentation of Toledo Harbor Sediment Management and Use Options
  - John Hull, Hull & Associates, Inc.
- Question and Answer Session

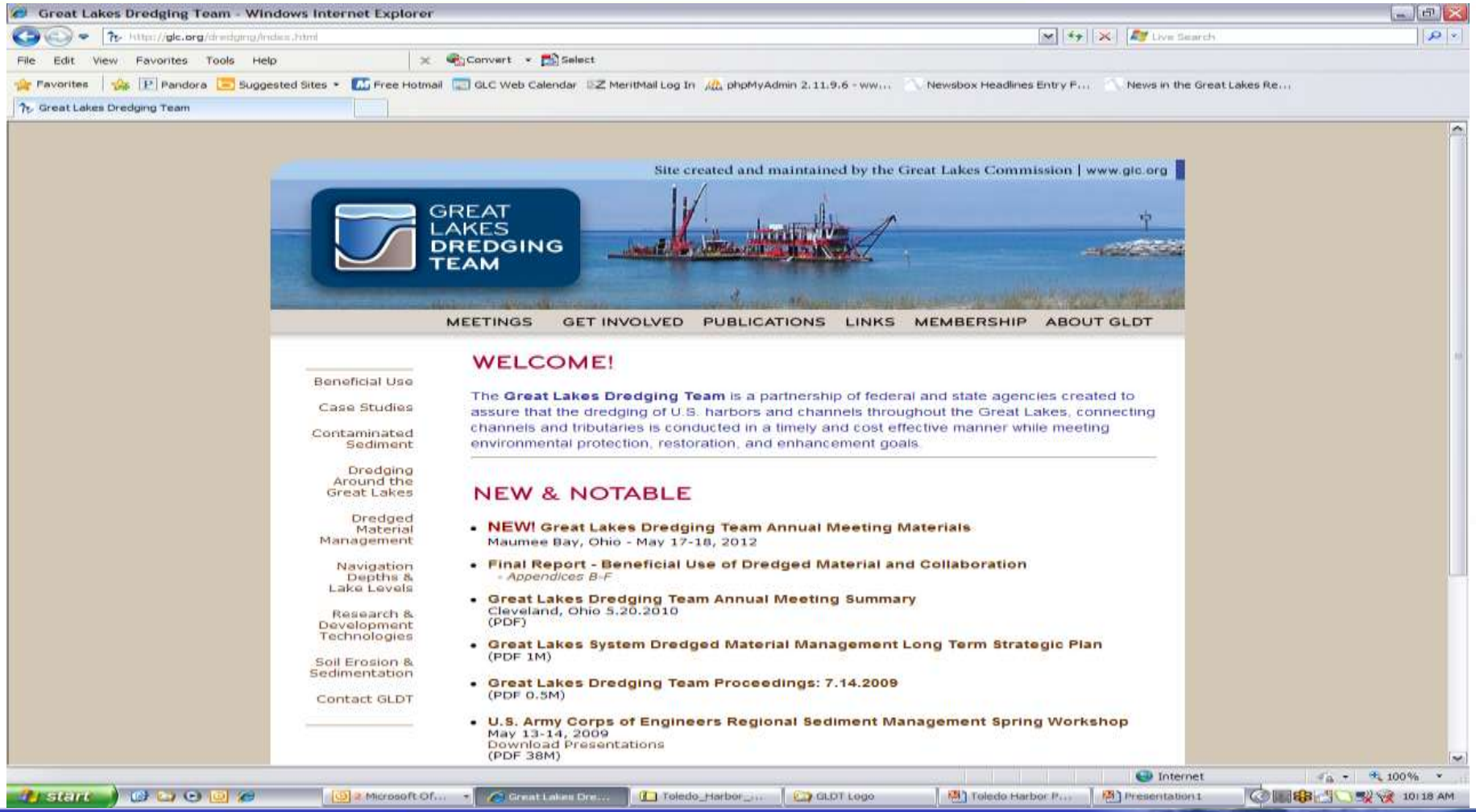
Great Lakes Commission

- **The GLC interest historically**

GREAT LAKES DREDGING TEAM

The **Great Lakes Dredging Team** is a partnership of federal and state agencies created to assure that the dredging of U.S. harbors and channels throughout the Great Lakes, connecting channels and tributaries is conducted in a timely and cost effective manner while meeting environmental protection, restoration, and enhancement goals.

Great Lakes Commission



Great Lakes Commission

- **Products:**
  - **“Testing and Evaluating Dredged Material for Upland Beneficial Uses: A Regional Framework”**
  - **“Open Water Disposal of Dredged Materials in the Great Lakes-St. Lawrence River Basin”**
  - **“Waste “Beneficially Using Dredged Materials to Resource: Beneficial Use of Great Lakes Dredged Material”**
  - **“Decision Making Process for Dredged Material Management”**
  - **“Regional Approach for Dredging Windows Determination”**
  - **“Create/Restore Habitat and Restore Brownfields”**

Great Lakes Commission

- **The GLC interest going forward**
  - **Ongoing viability and growth for the Port of Toledo: Jobs**
  - **Environmental quality of the Lake Erie basin: Sustainability**
  - **Lessons for all Great Lakes navigation dredging projects: Technology transfer**
  - **Refinement of best management practices: Collaboration**

State Perspective

Gail Hesse

Executive Director

Ohio Lake Erie Commission

Ohio | Lake Erie Commission

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Lake Erie Economic Values

- **Lake Erie**
  - **$10.7 Billion Lake Erie Tourism**
  - **$1 Billion Lake Erie Fishing**
  - **3 million Ohio drinking water users**

Sediment Entering Lake Erie – April 2008

Algal Blooms in Lake Erie – August 2011

Photo: NOAA Satellite Image

Ohio EPA Comparative Analysis

WWTP Effluent vs. Dredged Sediment

For Quantity Perspective Only

Parameter	Toledo Bay View WWTP Effluent (based on 2008 data)	Toledo Harbor Dredged Sediment (based on 2004 data & 1.25 million CY)
Cadmium	Samples below detection limit	2.50 tons/yr
Lead	Samples below detection limit	48.03 tons/yr
Mercury	2.18 pounds/yr	620 pounds/yr
Silver	Samples below detection limit	0.61 tons/yr
Zinc	5.1 tons/yr	250.74 tons/yr
Total Phosphorus	69.4 tons/yr	1096 tons/yr (2010)
Total Suspended Solids	983 tons/yr	2,062,500 tons/yr (total solids)
Selenium	Samples below detection limit	1.25 tons/yr
Ammonia	20.4 tons/yr	311.65 tons/yr
Operating Expenses	$41 million based on 2007 Annual Report	FY10 Budget - $5 million

Ohio's Regulatory Role

- Ohio EPA issues a Section 401 Water Quality Certification to the Corps of Engineers
  - Historically issued on a 5 year cycle
  - Recently issued annually

- Status of 2012 WQC
  - Will include sampling in the open-lake placement area

Ohio's Position

- Toledo Harbor must be kept open
- Lake Erie must be restored
- Best approaches include beneficial use and source reduction
- Support cooperative partnerships
- Sustainable practices

The Economic Impact of the Port of Toledo

Joseph Cappel

Director of Cargo Development

Toledo-Lucas County Port Authority

TOLEDO | LUCAS COUNTY PORT AUTHORITY

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Great Lakes Shipping: Environmental Benefits

- Toledo's 15 Marine Terminals handle over 700 vessel calls and 12 million tons of cargo per year.
- Ships help preserve North American energy resources: Ships carry vast amounts of cargo long distances using significantly less fuel than trains and trucks. They are 4 times more efficient than trucks and 1.75 times more efficient than trains.
- Ships have the smallest carbon footprint: A Great Lakes freighter produces 70 percent less carbon dioxide per metric ton/kilometer compared to trucks.
- Ships remove congestion from roadways: The largest Great lakes vessel can carry 70,000 metric tons- the equivalent to 3000 truckloads or 700 rail cars.

Great Lakes Shipping: Economic Benefits

- The shipping industry employs 227,000 people in the U.S. and Canada and produces business revenue of $33.5 billion.
- Shipping contributes $4.6 billion in federal, state and local taxes each year.
- Electrical utilities, steel mills, construction companies, mining companies, manufacturers and farmers all depend on the 164 million tons of cargo delivered by Great Lakes ships each year.
- Marine transportation on the System provides $3.6 billion in annual savings compared to the next best all land transportation alternative.

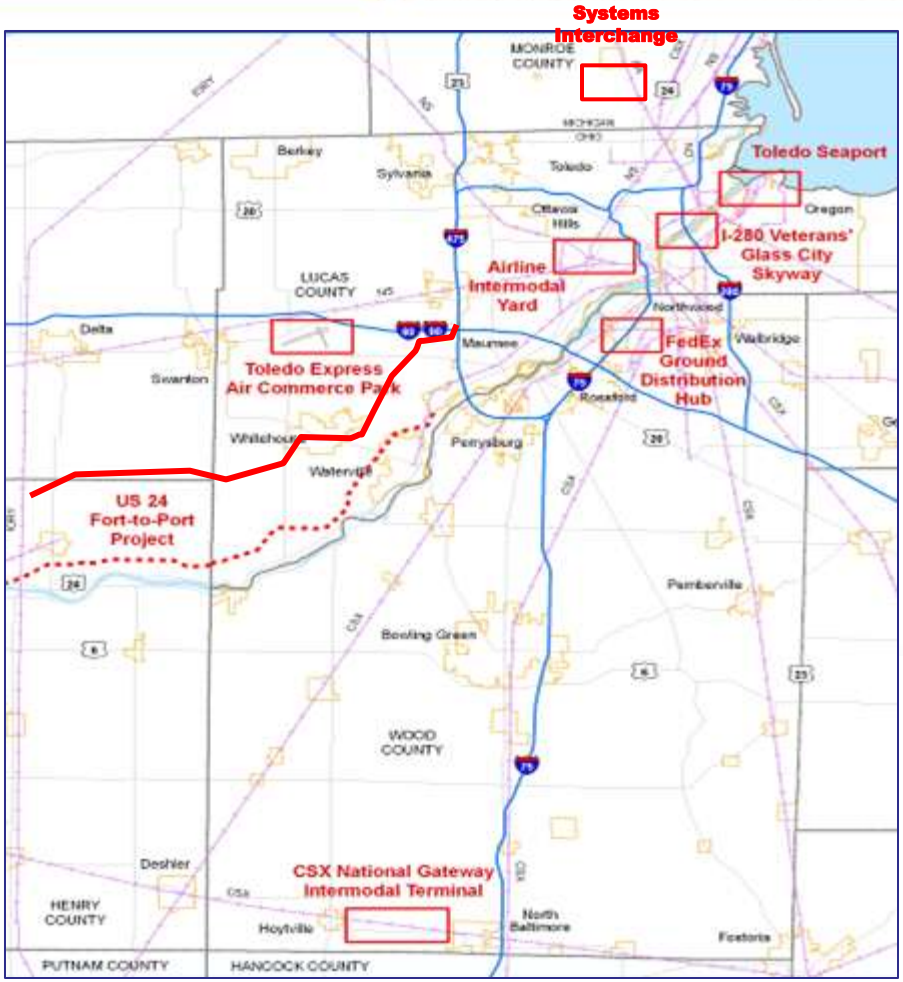
The Port of Toledo's Economic Impact

- 6,971 jobs are supported by the cargo moving via Toledo's marine terminals. 2,521 jobs were directly generated by the maritime activity at the terminals with wages and salaries totaling over $109 million.
- Direct business revenue received by the firms dependent upon the cargo handled at the Port totaled $381.3 Million in 2010.
- A total of $154.7 million in state and federal taxes were generated by cargo and vessel activity in 2010.

Regional Transportation Investment

- I-75/475 Systems Interchange Ph 1 $98 M
- Toledo Seaport Improvements $35 M
- I-280 Veterans Glass City Skyway Bridge & Roadway Proj. $300 M
- NS Airline Yard Intermodal $13 M
- **FedEx Ground Facility $87 M**
- Toledo Express Airport **$7 M**
- **US 24 Fort-to-Port Highway $490 M**
- **CSX Northwest OH Intermodal <u>$175 M</u>**

Regional Investment $1,205 M



But…

- Investments in infrastructure & economic impact won't matter unless Toledo's dredging issues are addressed with sustainable solutions considering the needs of industry, community and environment.
- For every one inch of reduced draft, a lake trading vessel forfeits 50 to 270 tons of cargo from their payload. Ocean vessels lose 115 tons of cargo for each inch of lost draft.
- The International Reputation of the Port of Toledo is on the Line! One bad experience can cause a vessel never to return.
- This is a complex issue and there is no silver bullet solution. We need the best and brightest to collaborate - this plan is a result of the efforts of many stakeholders.
- If we can continue to work together to address the needs of commerce and the environment we will achieve great things!

Toledo Harbor Dredging Task Force

- Membership
  - Toledo-Lucas County Port Authority
  - State agencies
  - Federal agencies
  - Local officials
  - Non-governmental organizations (environmental, commercial, and recreational)

Overview of Options

John H. Hull, P.E.

Principal

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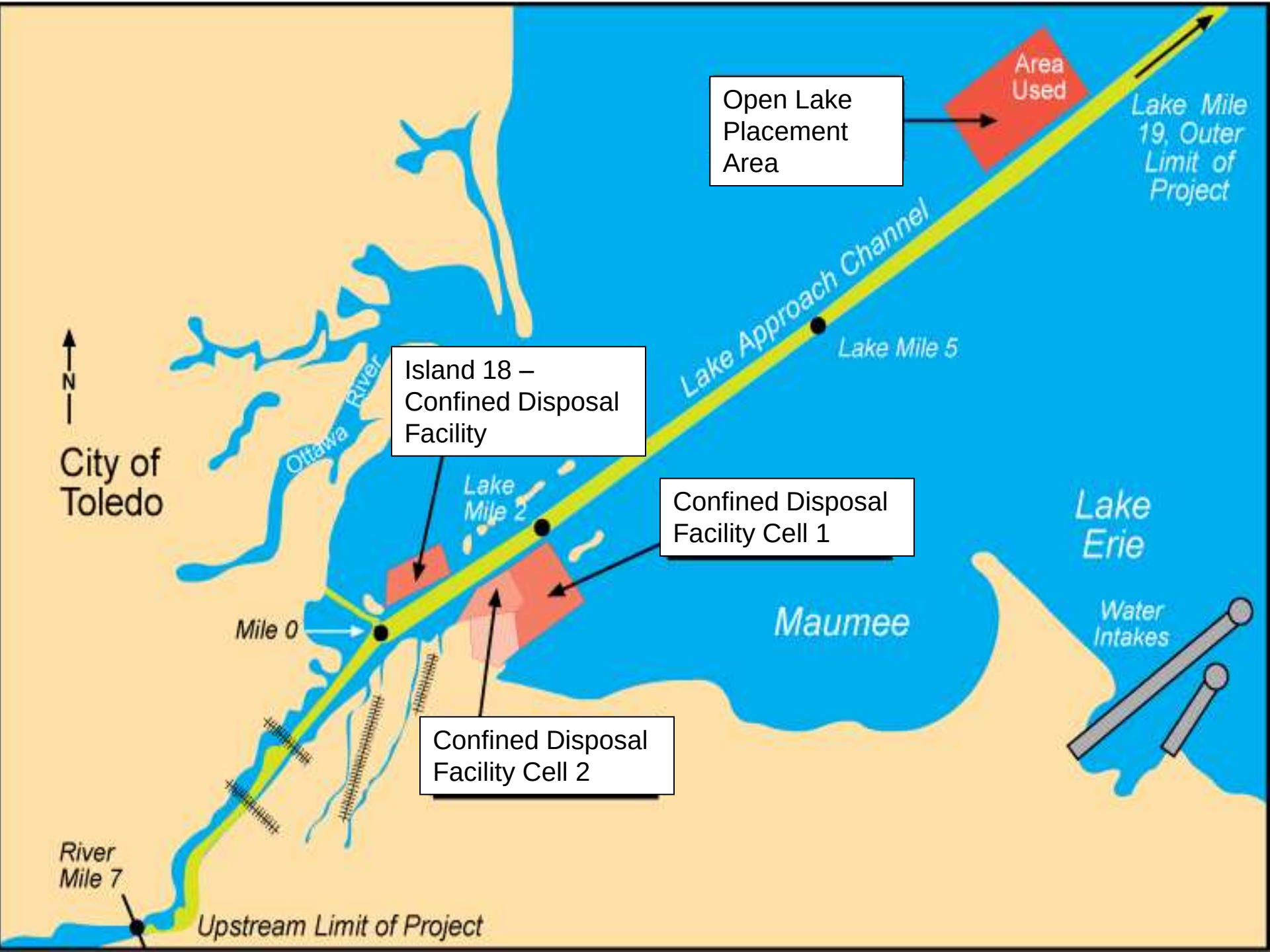
Toledo Harbor Sediment Management and Use

- Issues and Opportunities
- Technical Approaches
- Project Identification
- Prioritization for Implementation


Open Lake Placement Area
Area Used
Lake Mile 19, Outer Limit of Project
Lake Approach Channel
Lake Mile 5
Island 18 – Confined Disposal Facility
Ottawa River
N
City of Toledo
Lake Mile 2
Confined Disposal Facility Cell 1
Lake Erie
Mile 0
Maumee
Water Intakes
Confined Disposal Facility Cell 2
River Mile 7
Upstream Limit of Project

Toledo Harbor Sediment Management and Use Planning

- Introduction to the Project
  - The Ohio Lake Erie Commission was awarded a GLRI grant to create a sediment management strategy/plan for the Toledo Harbor that identifies and addresses:
    - recommended short-term (1-5 years) options
    - recommended long-term (30 year) options
    - funding needs/sources/mechanisms
    - timelines for implementation of recommended approaches

Toledo Harbor Sediment Management and Use Planning

- Sediment management and use plan status:
  - Solicited input on potential options and gathered value judgments from stakeholders on the importance of relative criteria to evaluate options (weighting factors)
    - Completion of June 2011 public forum
    - Completion of December 2011 Task Force consensus
  - Evaluation of short term (1-5 years) and long term (5-30 years) options
    - Compiled relevant data and information
    - Estimated dredge capacity needs
    - Completed preliminary screening of potential options identified internally and by stakeholders

Today's Objectives

- Review potential sediment use options
- Present Technical Team's evaluation process and results
- Present prioritized approaches for sediment management options
- Solicit input from stakeholders

Potential Sediment Use Options

- Solicited input on potential options from stakeholders at June 2011 Public Forum
  - Create Wetlands
  - Create Islands
  - New Metropark
  - Use of Geotubes
  - Erosion Control
  - Beneficial Use
  - Floodplain Berms

Identification of Options

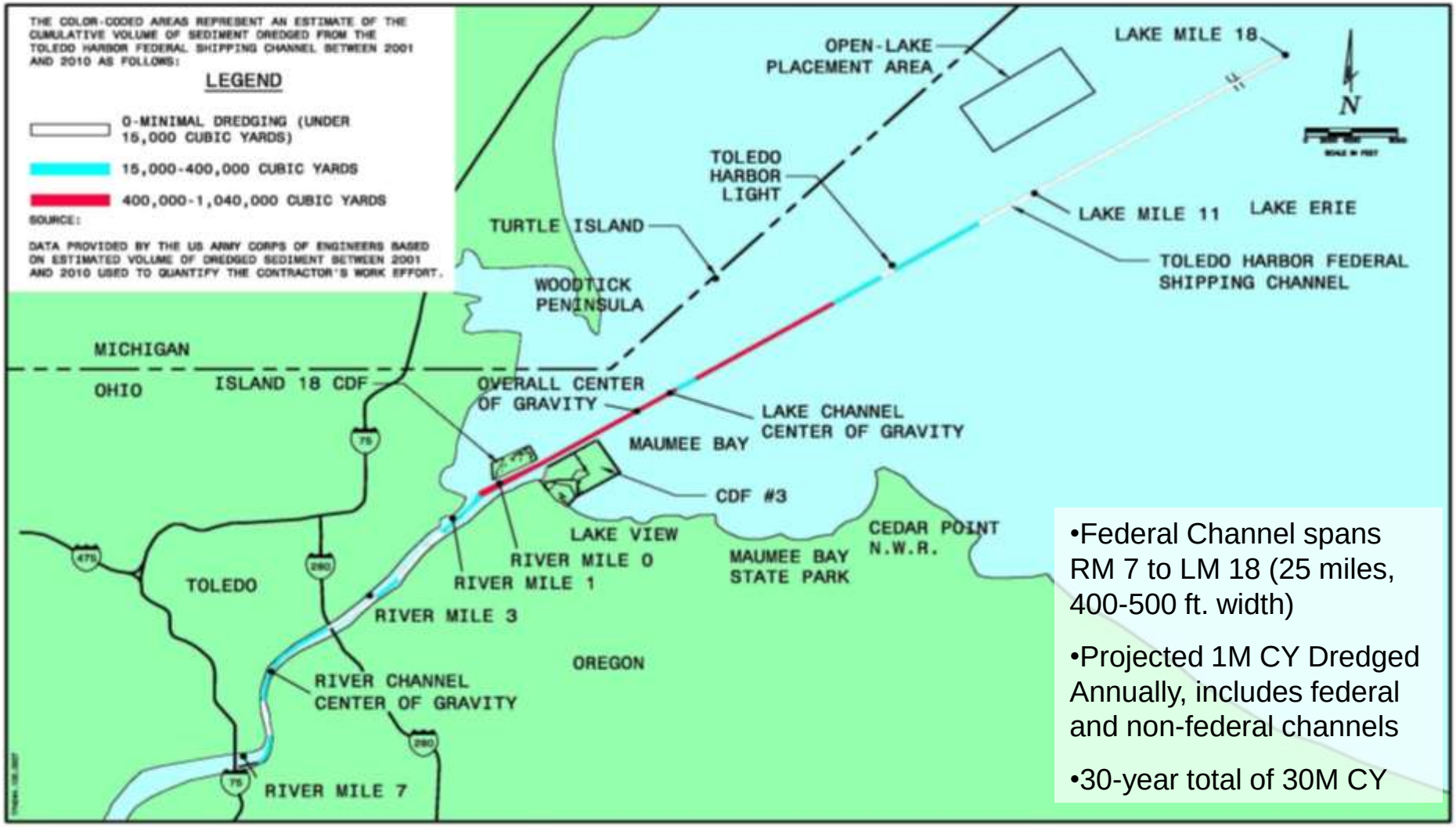
- Ideas from the 1st Public Forum were evaluated by the Technical Team

- Technical Team identified options/conceptual approaches to carry forward in the detailed evaluation using best professional judgment with respect to the conditions of Toledo Harbor and surrounding areas

Major Assumptions

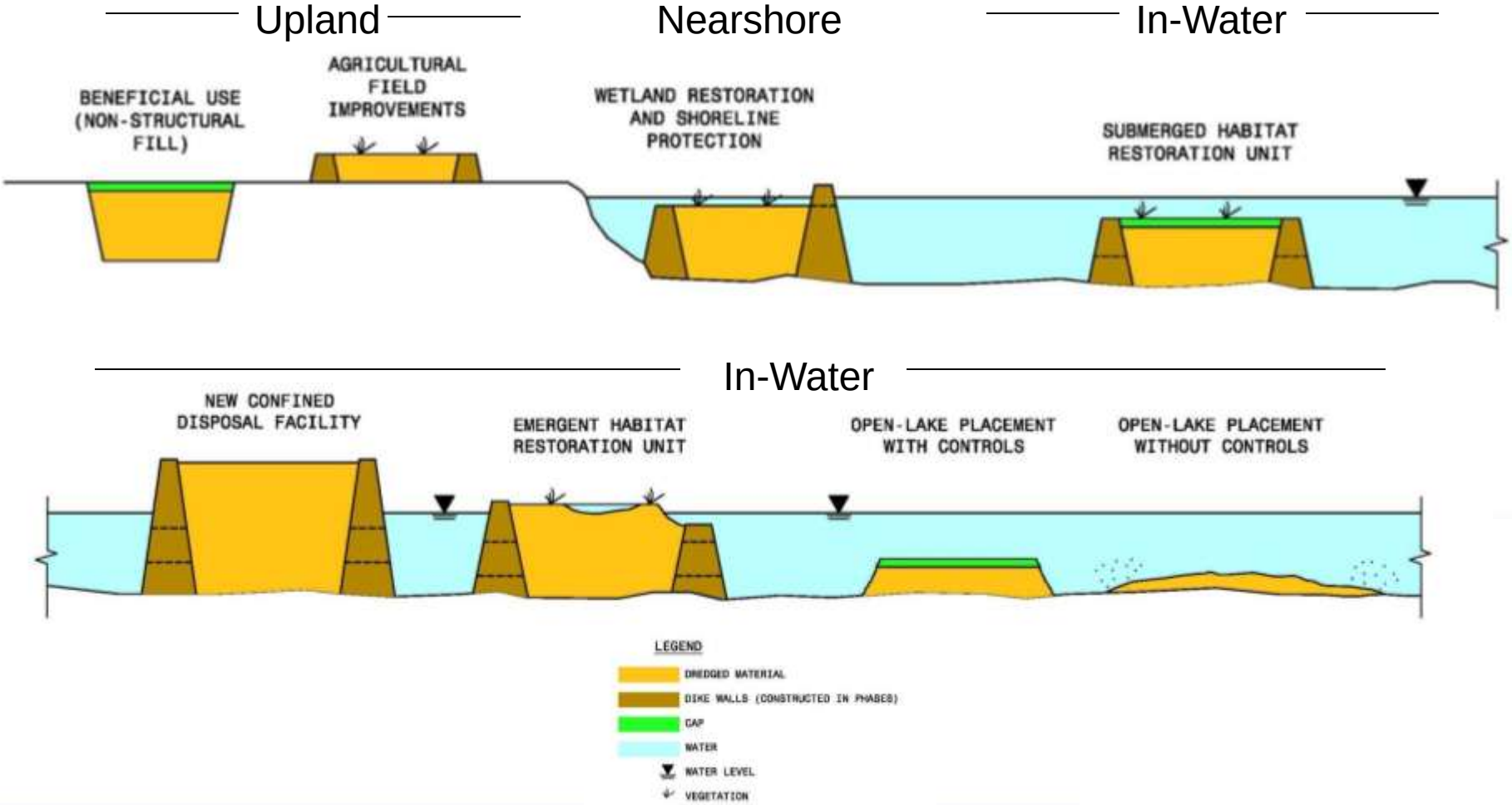
- No programmatic constraints
- A combination option is likely a better solution
- Option Costs
  - Basic recognition of major capital improvement and O&M costs
  - Used to serve as a relative comparison between options - not to be used as comprehensive cost estimate for each alternative
  - Approximate location of option used for estimating purposes

Toledo Harbor Dredging

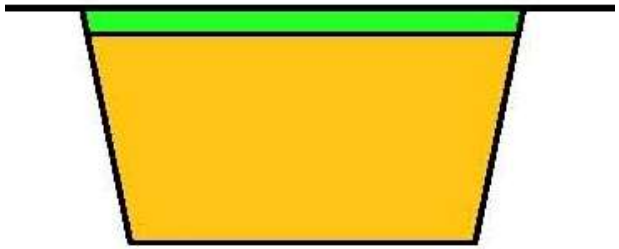


- Federal Channel spans RM 7 to LM 18 (25 miles, 400-500 ft. width)
- Projected 1M CY Dredged Annually, includes federal and non-federal channels
- 30-year total of 30M CY

Potential Sediment Management and Use Options



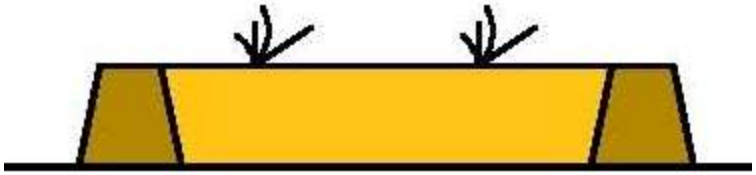
Beneficial Use of Dredged Material as Non-Structural Fill



Sediment off-loaded from barge/scow near the shore

- Use dredged materials in productive ways as a resource that results in environmental, economic, or social benefits.
- Examples:
  - Brownfield revitalization
  - Strip mine reclamation & solid waste management
  - Construction and industrial use (port development, airports, urban, residential)
  - Material transfer (fill, dikes, levees, parking lots, roads)

Agricultural Field Improvements

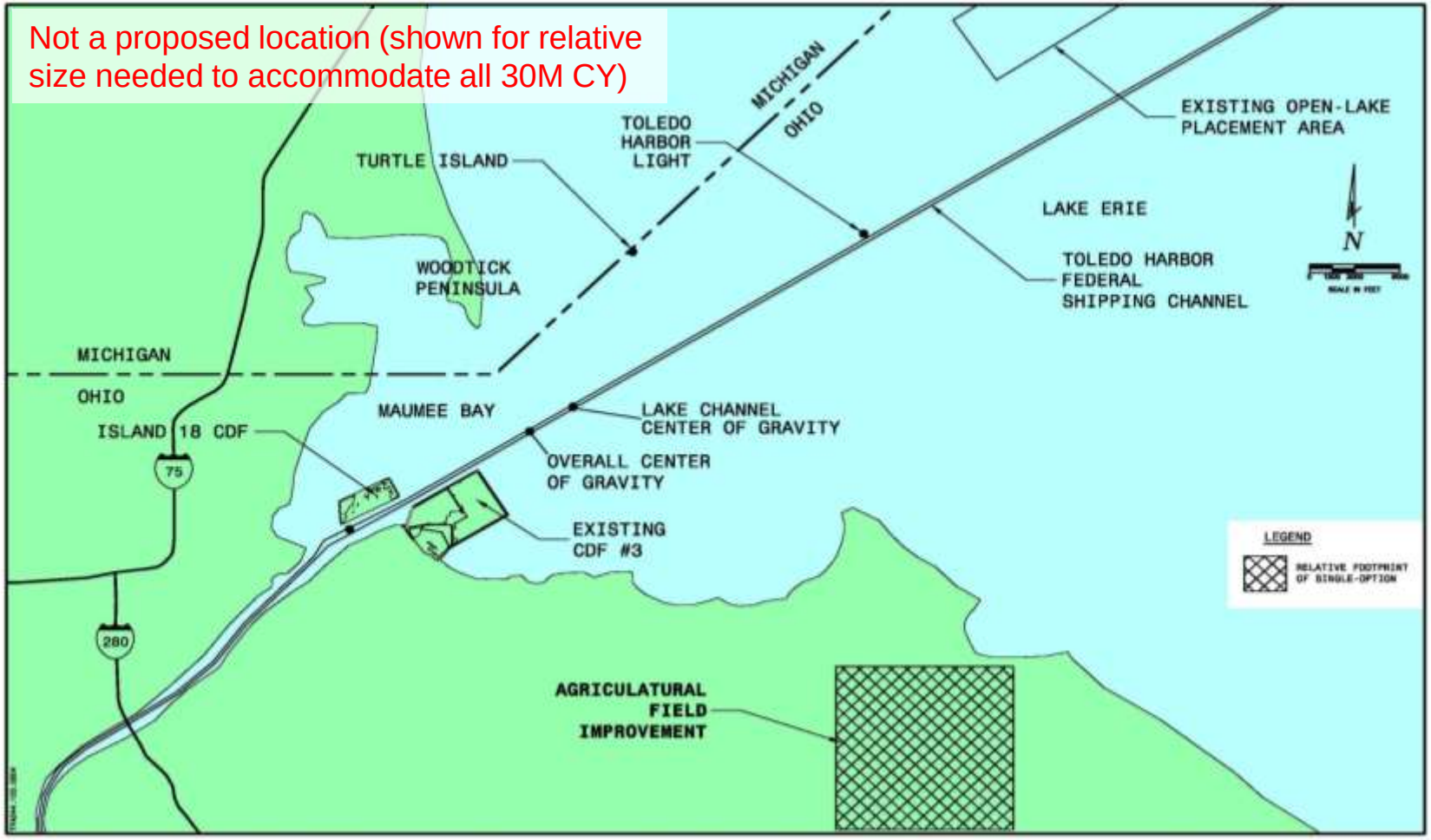


Sediment pumped onto shore from dredging operations center of gravity and subsequently pumped to final site via booster pump structure(s)

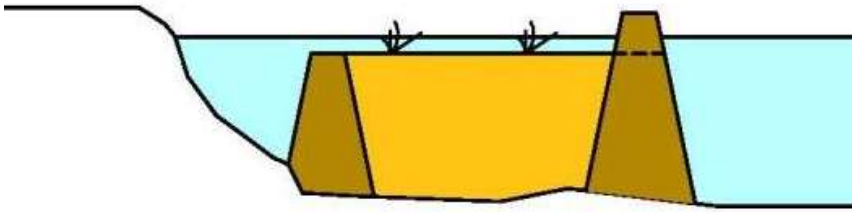
- Use dredged material to raise the elevation of agricultural fields, thus, improving drainage and future productivity
  - 5-mile radius
  - 10-mile radius
    - 4 ft. improvement height

Agricultural Field Improvements

Relative Footprint of 30M CY for Single-Option



Wetland Restoration and Shoreline Protection

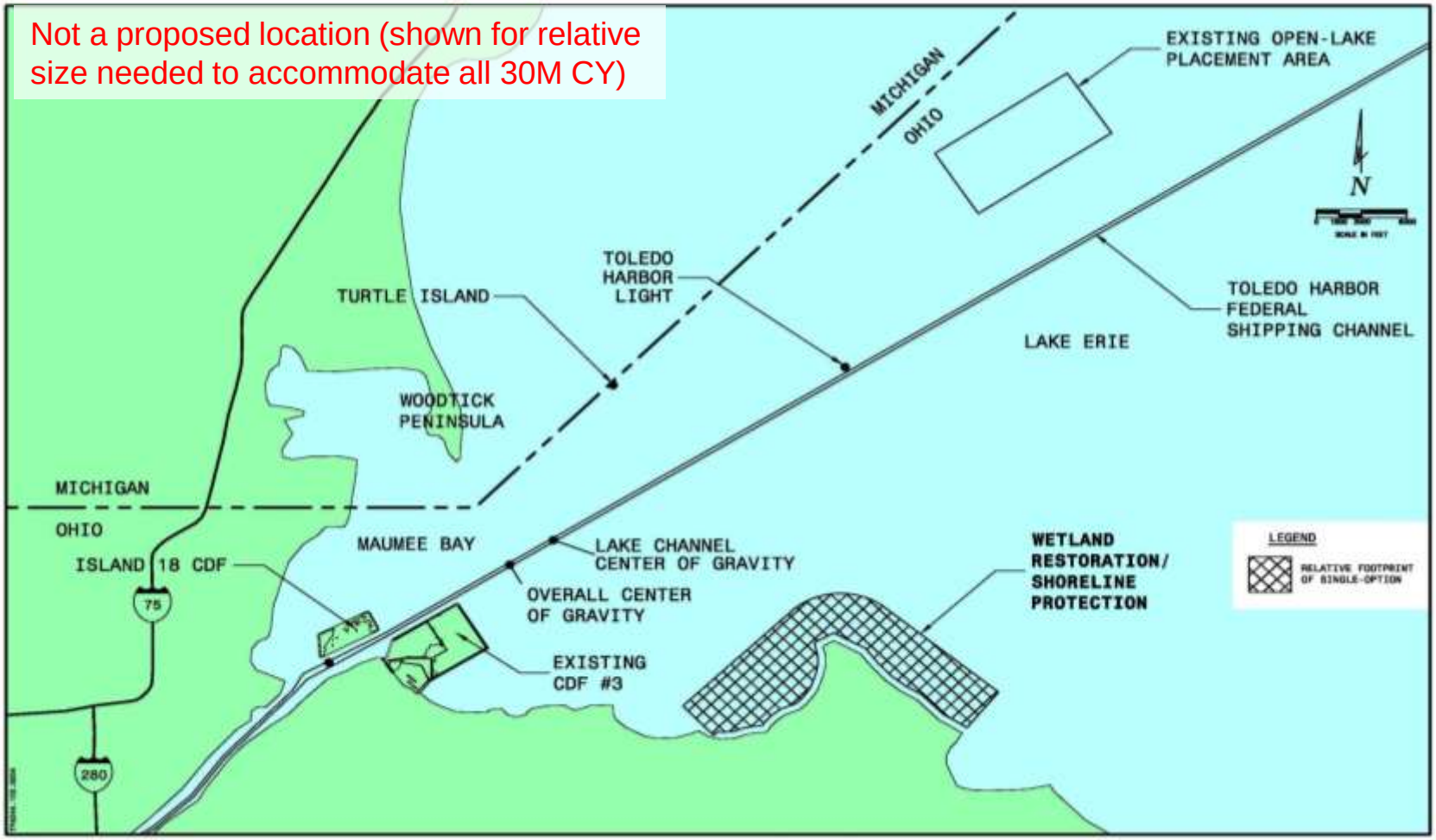


Sediment pumped from dredging operations center of gravity to final location

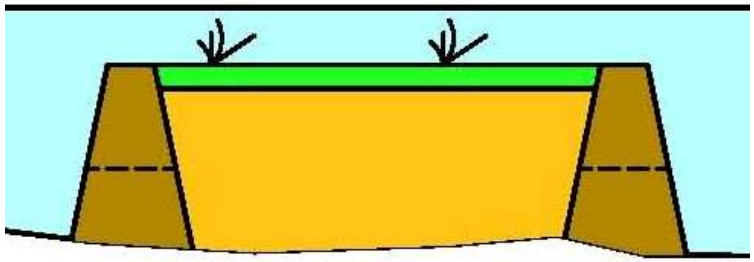
- Use dredged material to create additional wetland areas and a protective barrier for the existing shoreline
  - Structure base 5-7 ft. below LWD
  - Final dike surface 4-12 ft. above LWD
  - Final wetland surface near LWD

Wetland Restoration and Shoreline Protection

Relative Footprint of 30M CY for Single-Option



Submerged Habitat Restoration Unit

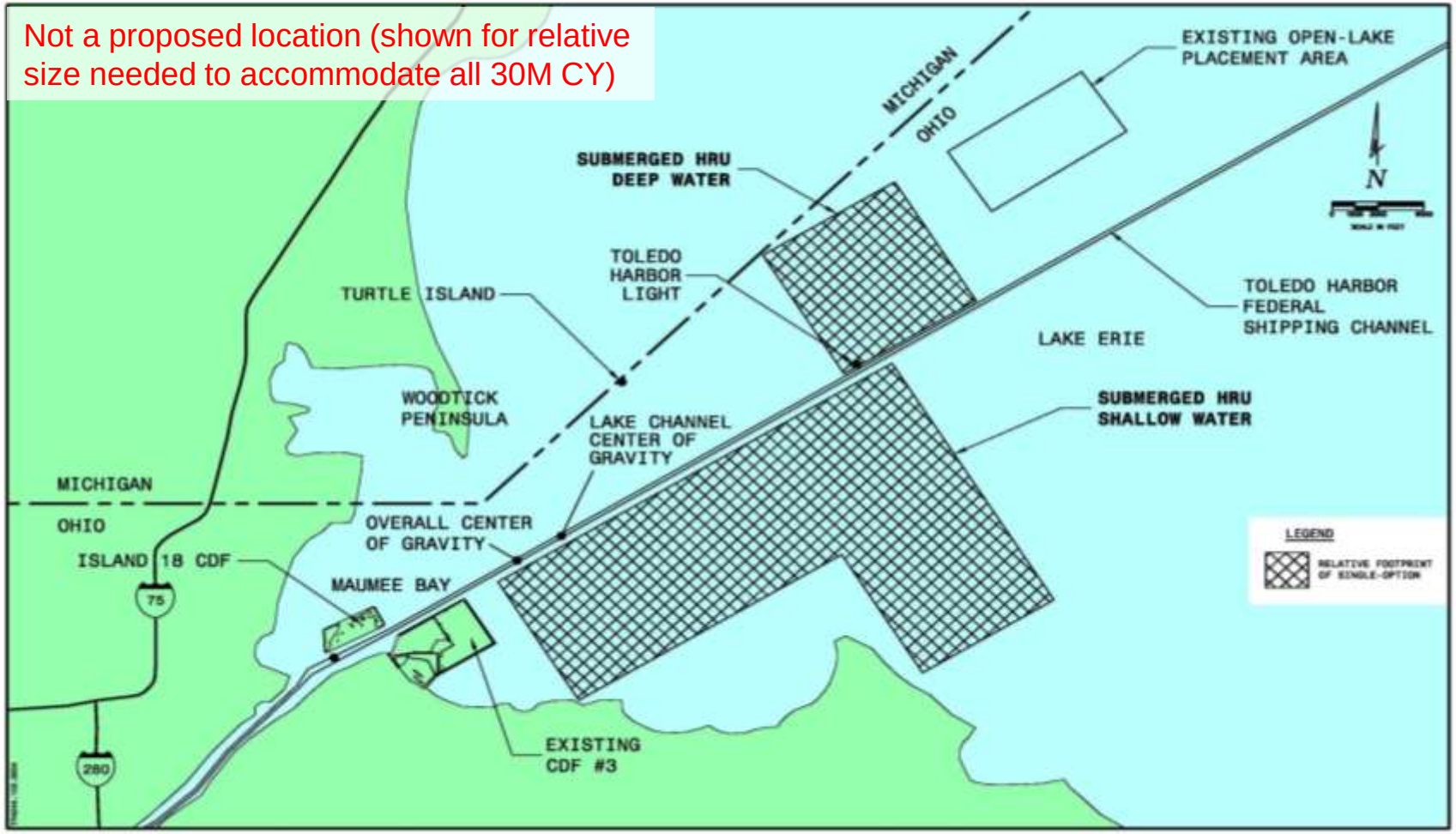


Dredged material transported from channel to final location via scow/barge and pumped or released into HRU diked area

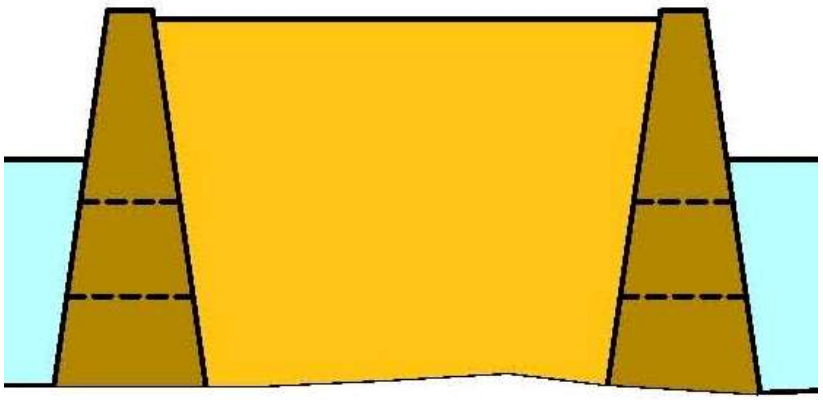
- Use of dredged material to assist in the development of a Habitat Restoration Unit (HRU) that will provide future submerged wildlife refuge/habitat
  - Deep water HRU
    - Structure base 20 ft. below LWD
    - Final structure surface 10 ft. below LWD
  - Shallow water HRU
    - Structure base 7 ft. below LWD,
    - Final structure surface 3 ft. below LWD

Submerged Habitat Restoration Unit

Relative Footprint of 30M CY for Shallow and Deep Single-Options



New Confined Disposal Facility



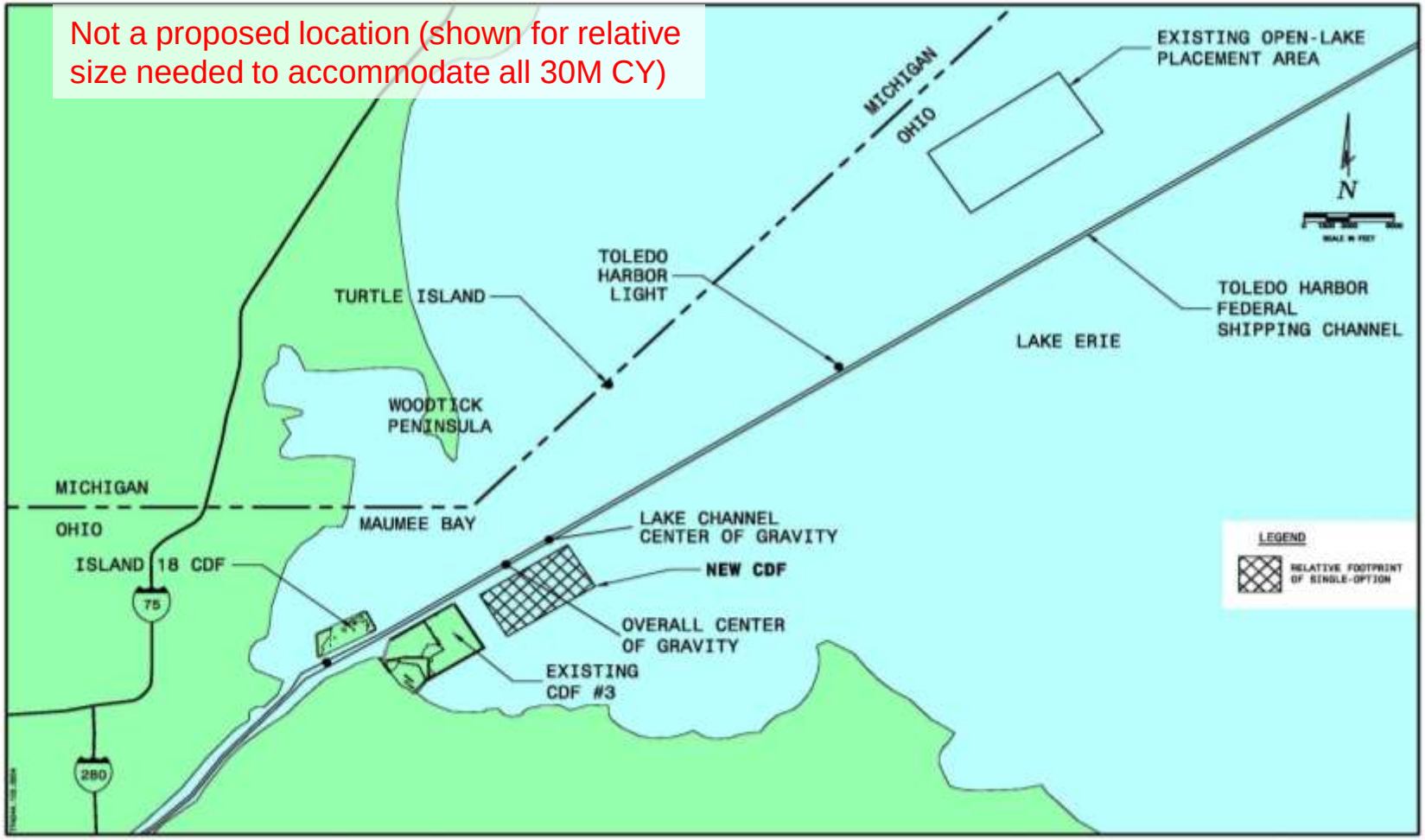
Dredged material transported from channel to final location via scow/barge and pumped or released into contained area

- Construct a new confined disposal facility (CDF) to contain the material
  - Not specifically designed for habitat enhancement
  - Structure base 5 ft. below LWD
  - Final structure surface 30 ft. above LWD

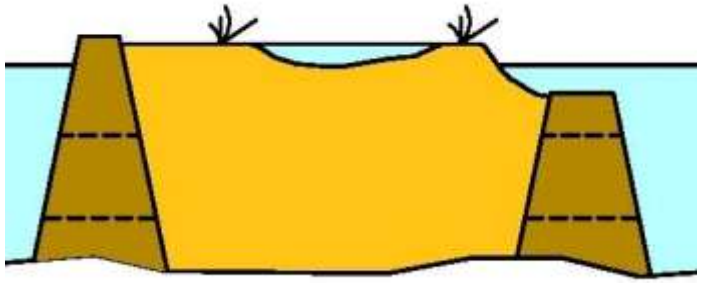
New Confined Disposal Facility

Relative Footprint of 30M CY for Single-Option

Not a proposed location (shown for relative size needed to accommodate all 30M CY)



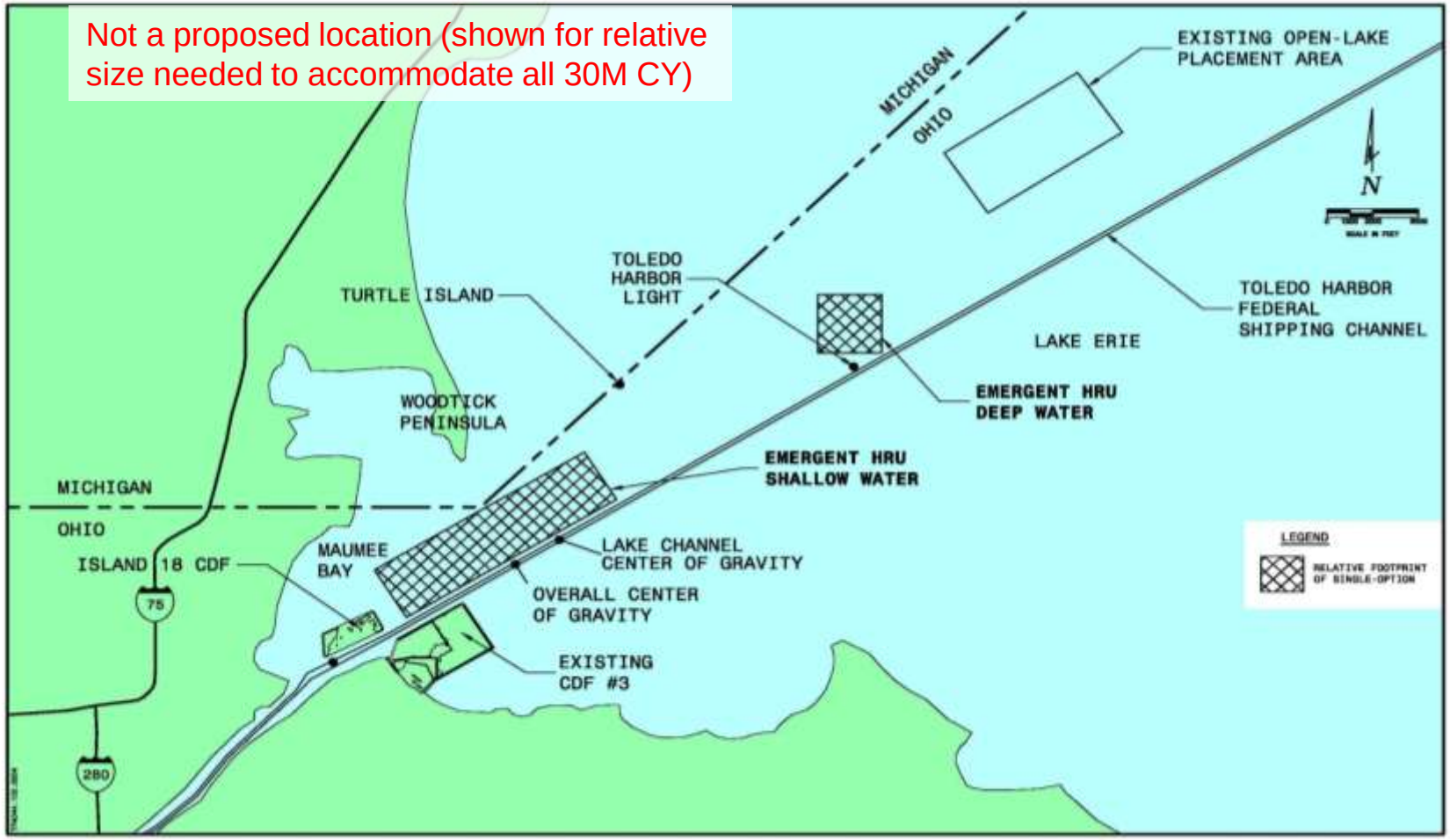
Emergent Habitat Restoration Unit



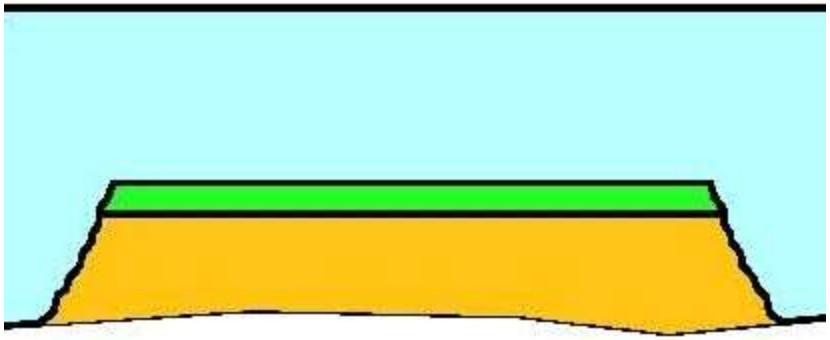
Dredged material transported from channel to final location via scow/barge and pumped or released into HRU diked area

- Use of dredged material to assist in the development of a Habitat Restoration Unit (HRU) that will provide a future emergent wildlife refuge/habitat
- Deep water HRU
  - Structure base 20 ft. below LWD
  - Final structure surface 30 ft. above LWD
- Shallow water HRU
  - Structure base 5 ft. below LWD,
  - Final structure surface 12.5 ft. above LWD

Emergent Habitat Restoration Unit
Relative Footprint of 30M CY for Shallow and Deep Single-Options



Open-Lake Placement with Controls

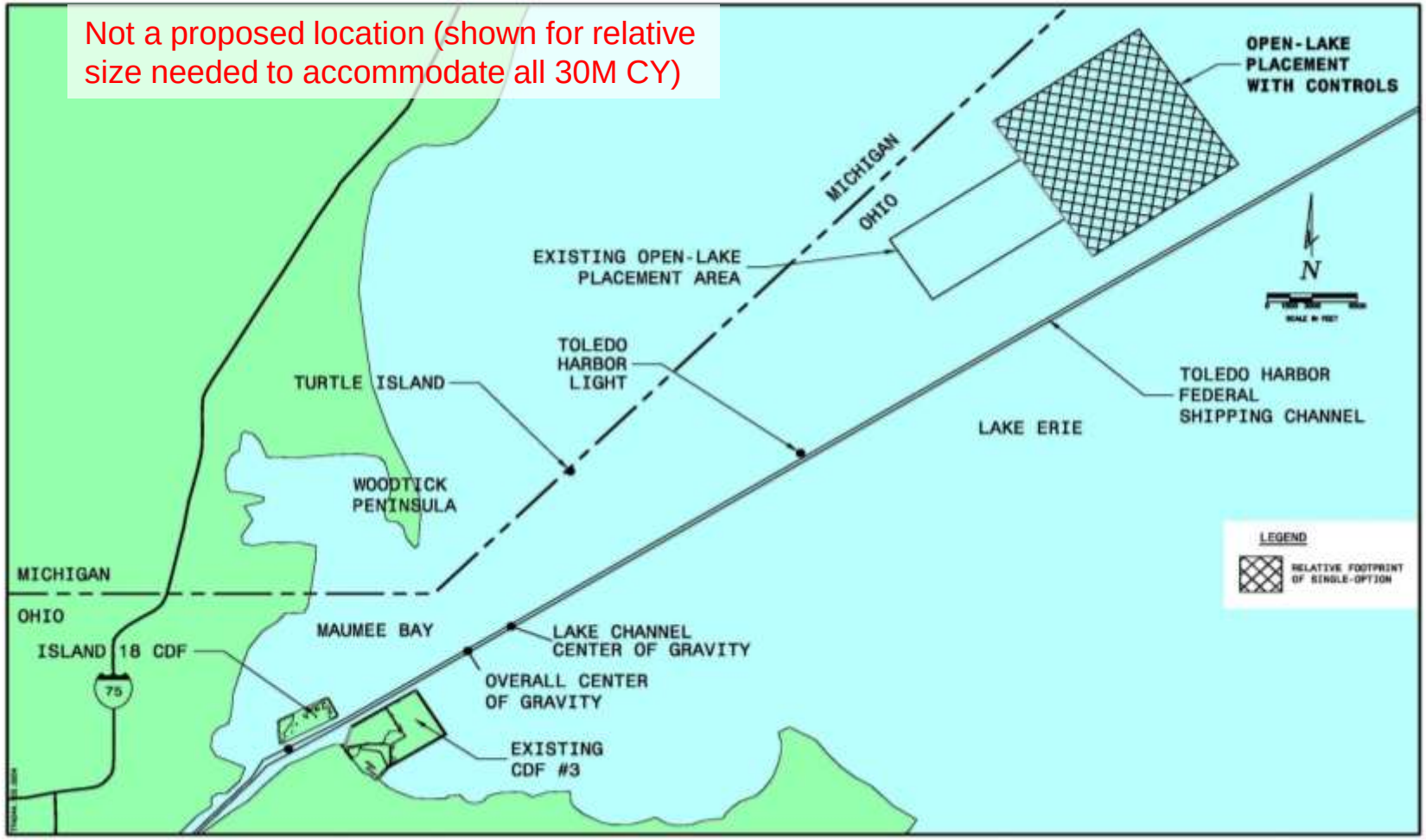


Dredged material transported from channel to final location via scow/barge and released to placement area

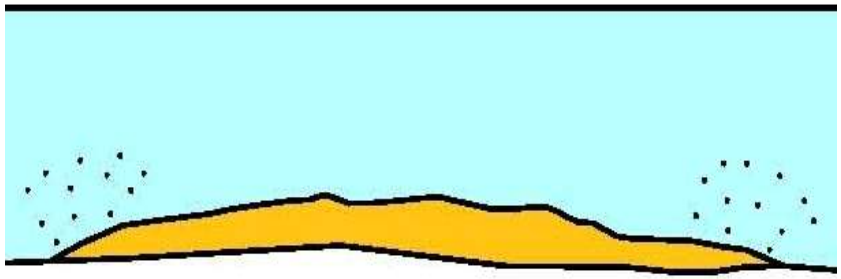
- Open-lake placement with controls to decrease nutrient availability and/or increase shear strength of material
  - Potential HRU aspect
  - Either at or near the current open lake placement area

Open-Lake Placement with Controls

Relative Footprint of 30M CY for Single-Option



Open-Lake Placement without Controls

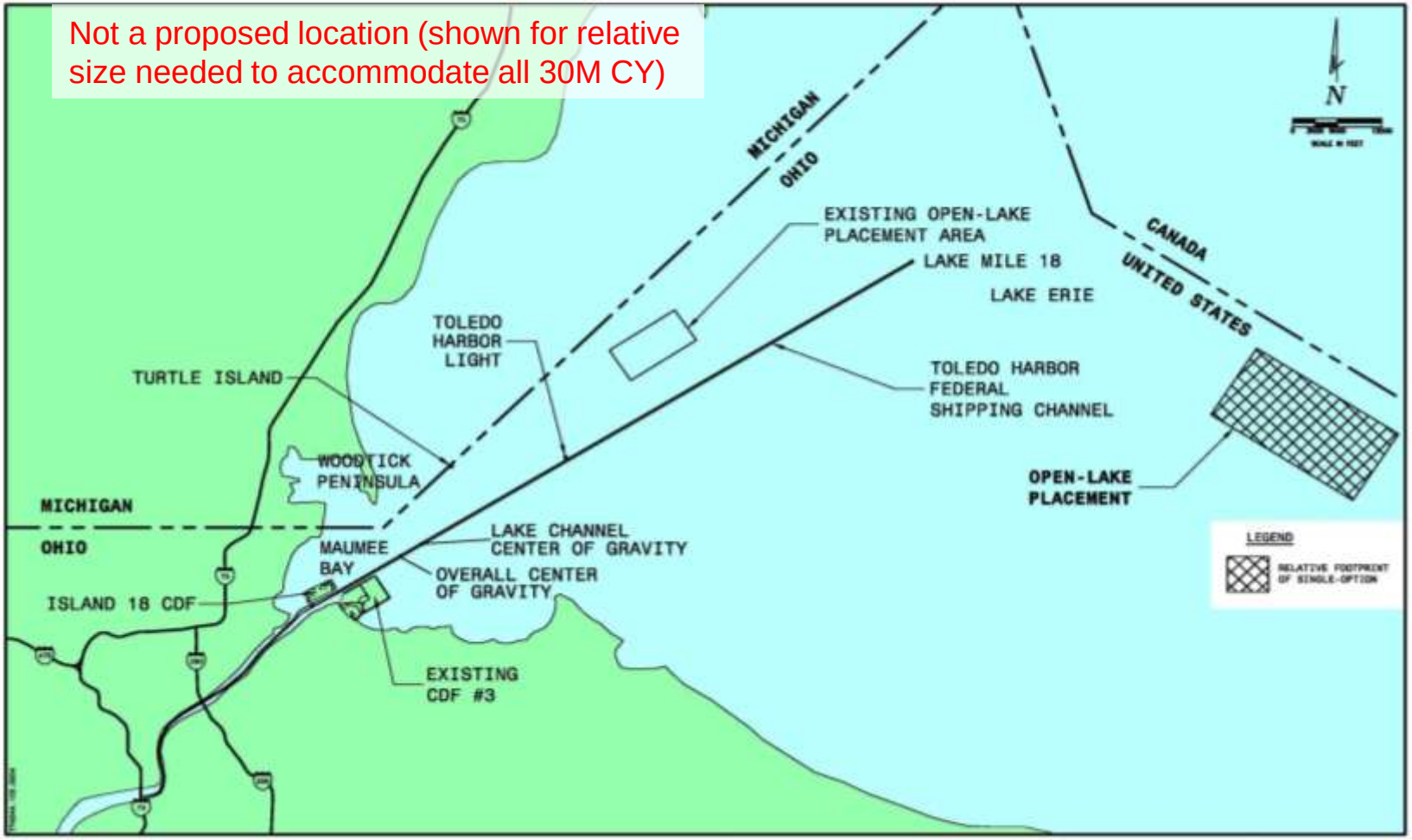


Dredged material transported from channel to final location via scow/barge and released to placement area

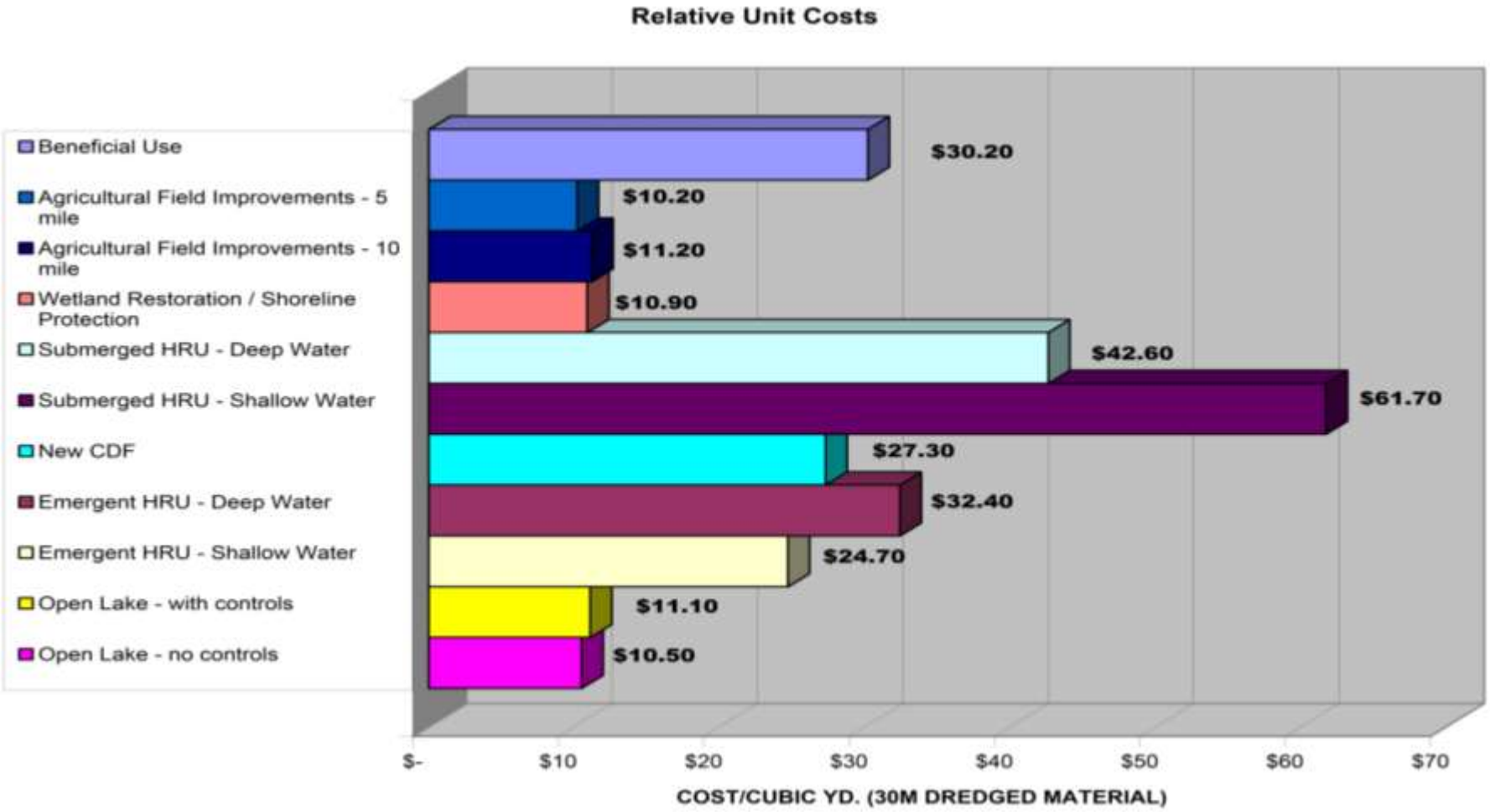
- Relocated/new open-lake placement from overall dredging operations center
  - No controls
  - Minimizes the potential for individual redistribution of sediment in the Western Lake Erie Basin
  - Possible reduction in influence of algae blooms

Open-Lake Placement without Controls

Relative Footprint of 30M CY for Single-Option



Single Option Relative Unit Costs



Toledo Harbor Sediment Management and Use Options

- Is one option that can accommodate all 30 million CY feasible?
  - Complex logistics
  - Compounded eco-habitat uses/impacts
  - Unintended consequences
  - Programmatic constraints

Evaluation Process

- Each option evaluated to receive all of the 30-year estimated dredged material volume (30M CY) – despite initial assumption that a Combination Option is likely a better solution
- Initial evaluation did not consider
  - All aspects of a specific location of option
  - Current programmatic/regulatory restrictions
  - Funding availability and sources
  - Limitations on currently accepted practices
  - Inflation of current market costs
- Initial evaluation did consider
  - Location relative to Center of Gravity of estimated volume of material dredged between 2001-2010
  - Current lake bathymetry
  - Current market costs

Evaluation Process (Continued)

- Matrix to score the dredge material management and use options across six major categories of technical criteria and sub-categories identified and discussed at the June 2011 Public Forum:
  - Feasibility
  - Ecological Benefits
  - Environmental Impacts
  - Human Benefits
  - Economic Benefits
  - Implementation Cost

Evaluation Process (Continued)

For each Technical Criteria category:

Weighting Factors

- Assigned by Task Force members
- 1-100, for each technical criteria category

Technical Criteria

- Assigned by Hull Technical Team
- 1-5, for multiple technical criteria for each option

Avg. Weighting Factor

x

Avg. Technical Criteria Score

=

Score for Each Option

June 2011 Public Forum Input

- Summarized in public forum report and posted online and discussed at Task Force meeting
  - Input on ranking of major factors was considered by the Task Force in weighting factor determination
  - Input on sub-categories was considered by technical team in development of technical criteria scoring

Feasibility

Scale:

1 - Highly complicated
2 - Moderately to highly complicated
3 - Moderately complicated
4 – Minimally to moderately complicated
5 - Minimally complicated

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Placement Timing and Sequencing	1	5	5	5	4	3	3	4	5	4	5
Capacity Expansion Capability	5	5	4	5	3	2	5	5	5	5	4
Size of Overall Footprint	2	4	2	2	1	2	2	2	3	3	3
Implementation/Construction Complexity	4	1	2	2	2	3	4	3	5	4	3
Construction Duration	5	1	2	2	2	3	4	4	5	5	2
Site Accessibility	4	4	4	4	4	4	4	3	2	4	4
Average Score	**3.5**	**3.3**	**3.2**	**3.3**	**2.7**	**2.8**	**3.7**	**3.5**	**4.2**	**4.2**	**3.5**

Ecological Benefits/Effects

Scale:

1- negative overall effect, high level of effort to overcome
2- negative effect, moderate level of effort to overcome
3 - minimal effect
4 - positive effect, moderate degree of benefit
5 - positive effect, high degree of benefit

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Planktonic and Benthic Community/Habitat	3	2	2	4	4	4	3	3	2	2	2
Fish and Aquatic Inverterbrate species/habitat	3	4	4	4	4	4	3	3	2	2	2
Wetlands (tidal, non-tidal)	3	4	4	3	3	4	3	3	3	3	3
Protected Species/Habitat	3	3	4	3	3	4	3	3	3	3	3
Pelagic Birds/Habitat	3	4	4	3	3	4	3	3	3	3	4
Terrestrial Species/Habitat	3	4	4	3	3	4	3	3	3	3	3
Creation of Surface Water Features with Ecologically Beneficial Habitat	3	4	4	3	3	4	3	3	3	3	4
Average Score	**3.0**	**3.6**	**3.7**	**3.3**	**3.3**	**4.0**	**3.0**	**3.0**	**2.7**	**2.7**	**3.0**

Environmental Impacts/Effects

Scale:

1- negative overall effect, high level of effort to overcome
2- negative effect, moderate level of effort to overcome
3 - minimal effect
4 - positive effect, moderate degree of benefit
5 - positive effect, high degree of benefit

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Hydro-dynamic Effects	5	4	4	4	4	4	4	4	1	3	2
Land Improvements	5	4	4	3	3	4	5	5	3	3	4
Surface Water Quality	3	3	3	3	3	3	4	4	1	4	2
Groundwater Quality	3	3	3	3	3	3	4	4	3	3	3
Average Score	**4**	**3.5**	**3.5**	**3.25**	**3.25**	**3.5**	**4.25**	**4.25**	**2**	**3.25**	**2.75**

Human Benefits/Effects

Scale:

1- negative overall effect, high level of effort to overcome
2- negative effect, moderate level of effort to overcome
3 - minimal effect
4 - positive effect, moderate degree of benefit
5 - positive effect, high degree of benefit

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Recreation Opportunity	3	4	5	3	4	4	3	3	3	3	3
Flood Protection	3	3	3	3	3	5	5	5	3	3	3
Aesthetics	3	4	5	3	3	4	2	2	3	2	2
Human Health Risk	3	3	3	3	3	3	3	3	2	3	2
Navigational Safety	3	2	2	3	2	3	3	3	3	3	2
Average Score	**3**	**3.2**	**3.6**	**3**	**3**	**3.8**	**3.2**	**3.2**	**2.8**	**2.8**	**2.4**

Economic Benefits

Scale:

1- negative overall effect, high level of effort to overcome
2- negative effect, moderate level of effort to overcome
3 - minimal effect
4 - positive effect, moderate degree of benefit
5 - positive effect, high degree of benefit

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Revenue Generation - During Operation	5	3	3	3	3	3	4	4	3	3	5
Revenue Generation - Post-Operation	4	4	4	3	3	3	5	5	3	3	4
Public Need	5	4	4	4	4	4	4	4	3	3	3
Job Creation	5	4	4	4	4	4	4	4	3	3	4
Tourism	3	5	5	4	4	4	4	4	4	3	3
Local Commerce	4	5	5	4	4	4	5	5	3	3	3
Average Score	**4.3**	**4.2**	**4.2**	**3.7**	**3.7**	**3.7**	**4.3**	**4.3**	**3.2**	**3.0**	**3.7**

Implementation Costs

Scale:

1 - Highest relative cost
5 – Lowest relative cost
Intermediate score values relatively based on range of costs per CY

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Score (Based on Estimated Cost per CY)	3.45	3.27	3.87	2.48	1.00	4.95	5.00	4.92	4.98	4.93	3.67

Average Technical Criteria Scores	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Feasibility Avg. Score	3.5	3.3	3.2	3.3	2.7	2.8	3.7	3.5	4.2	4.2	3.5
Ecological Benefits Avg. Score	3.0	3.6	3.7	3.3	3.3	4.0	3.0	3.0	2.7	2.7	3.0
Environmental Impacts Avg. Score	4	3.5	3.5	3.25	3.25	3.5	4.25	4.25	2	3.25	2.75
Human Benefits Avg. Score	3	3.2	3.6	3	3	3.8	3.2	3.2	2.8	2.8	2.4
Economic Benefits Avg. Score	4.3	4.2	4.2	3.7	3.7	3.7	4.3	4.3	3.2	3.0	3.7
Implementation Cost Score	3.45	3.27	3.87	2.48	1.00	4.95	5.00	4.92	4.98	4.93	3.67
Total Score	**21.3**	**21.0**	**22.0**	**19.0**	**16.9**	**22.8**	**23.5**	**23.2**	**19.8**	**20.9**	**19.0**

Ranking of Options Based on Average Technical Scores

Rank	Option	Average Score
1	Agricultural Fields (5-mile Radius)	23.5
2	Agricultural Fields (10-mile Radius)	23.2
3	Wetland Restoration & Shoreline Protection	22.8
4	Emergent HRU - Shallow Water	22.0
5	Beneficial Use	21.3
6	Emergent HRU - Deep Water	21.0
7	Open-Lake - With Controls	20.9
8	Open-Lake - No Controls	19.8
9	Submerged HRU - Deep Water	19.0
9	New CDF	19.0
11	Submerged HRU - Shallow Water	16.9

Weighting Factors

Category of Technical Criteria	Public Forum #1 Rank (n=100)	Task Force Rank (n=12)	Task Force Assigned Weighting Factors
Feasibility	4	3	17
Ecological Benefits	2	1	22
Environmental Impacts	1	2	20
Human Benefits	6	6	10
Economic Benefits	5	5	14
Implementation Costs	3	3	17

Weighted Technical Criteria Scores	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF
Feasibility Weighted Score (17)	59.5	56.7	53.8	56.7	45.3	48.2	62.3	59.5	**70.8**	**70.8**	59.5
Ecological Benefits Weighted Score (22)	66.0	78.6	81.7	72.3	72.3	**88.0**	66.0	66.0	59.7	59.7	66.0
Environmental Impacts Weighted Score (20)	80	70	70	65	65	70	**85**	**85**	40	65	55
Human Benefits Weighted Score (10)	30	32	36	30	30	**38**	32	32	28	28	24
Economic Benefits Weighted Score (14)	**60.7**	58.3	58.3	51.3	51.3	51.3	**60.7**	**60.7**	44.3	42.0	51.3
Implementation Cost Weighted Score (17)	58.7	55.6	65.8	42.2	17.0	84.2	**85.0**	83.6	84.7	83.8	62.4
Total Weighted Score	**354.8**	**351.2**	**365.7**	**317.4**	**281.0**	**379.7**	**391.0**	**386.8**	**327.5**	**349.4**	**318.2**

Ranking of Options Based on Weighted Technical Score

Rank	Option	Weighted Technical Score
1	Agricultural Fields (5-mile Radius)	391.0
2	Agricultural Fields (10-mile Radius)	386.8
3	Wetland Restoration & Shoreline Protection	379.7
4	Emergent HRU - Shallow Water	365.7
5	Beneficial Use	354.8
6	Emergent HRU - Deep Water	351.2
7	Open-Lake - With Controls	349.4
8	Open-Lake – No Controls	327.5
9	New CDF	318.2
10	Submerged HRU - Deep Water	317.4
11	Submerged HRU - Shallow Water	281.0

Single-Option Challenges

- Challenges of using only one alternative:
  - Practicality/Logistics (low flexibility, seasonal limitations)
  - Costs (high initial capital investment, balance between capital and O&M)
  - Location (large overall footprint)
  - Optimization of alternative (compromise/tradeoff between technical categories)
  - Size (large structural requirements/site-specific impacts)
- Both short-term and long-term plans will likely consist of a combination of approaches due to the challenges of single-option

Combination Option

- Use a combination of options to minimize challenges
- Criteria for combination option:
  - Weighted scores
  - Estimated costs
  - Practicality/feasibility
  - Shorter implementation time
  - Improved short-term benefits

Selection of Combination Option

Rank	Single Option (30M CY)	Feasibility Weighted Score	Weighted Technical Score	Relative Total Cost
1	Agricultural Fields (5-mile Radius)	62.3	391.0	$305M
2	Agricultural Fields (10-mile Radius)	59.5	386.8	$336M
3	Wetland Restoration & Shoreline Protection	48.2	379.7	$326M
4	Emergent HRU - Shallow Water	53.8	365.7	$741M
5	Beneficial Use	59.5	354.8	$906M
6	Emergent HRU - Deep Water	56.7	351.2	$972M
7	Open-Lake - With Controls	70.8	349.4	$334M
8	Open-Lake – No Controls	70.8	327.5	$314M
9	New CDF	59.5	318.2	$820M
10	Submerged HRU - Deep Water	56.7	317.4	$1,280M
11	Submerged HRU - Shallow Water	45.3	281.0	$1,850M

Selection of Combination Option

- Options selected generally have a lower unit cost increase when a smaller footprint / feasible quantity was analyzed
- More feasible options
- Options selected ranked the highest in at least one technical category
- Arbitrary selection of volumes for purposes of discussion
- Will need a detailed design analysis completed

Combination Option

- Wetland Restoration and Shoreline Protection (7M CY)
- Agricultural fields (7M CY)
- Beneficial Use (3M CY)
- Open-lake with controls (13M CY)

Conceptual Locations of Combination Option

For illustrative purposes

OPEN-LAKE PLACEMENT WITH CONTROLS

TOLEDO HARBOR LIGHT

TURTLE ISLAND

LAKE ERIE

WOODTICK PENINSULA

TOLEDO HARBOR FEDERAL SHIPPING CHANNEL

MICHIGAN

OHIO

LAKE CHANNEL CENTER OF GRAVITY

OVERALL CENTER OF GRAVITY

ISLAND 18 CDF

MAUMEE BAY

WETLAND RESTORATION AND SHORELINE PROTECTION

UNDERWATER PIPELINE

EXISTING CDF #3

MAUMEE RIVER

BENEFICIAL USE PROCESSING

5 MI

AGRICULATURAL FIELD IMPROVEMENT

LEGEND

RELATIVE FOOTPRINT OF COMBINATION OPTION

AVAILABLE FOR LOCATING AGRICULTURAL FIELD IMPROVEMENT SITE

Single and Combination Option Weighted Score Evaluation

Technical Criteria	Beneficial Use	Emergent HRU - Deep Water	Emergent HRU - Shallow Water	Submerged HRU - Deep Water	Submerged HRU - Shallow Water	Wetland Restoration & Shoreline Protection	Agricultural Field Improvements (5-mile radius)	Agricultural Field Improvements (10-mile radius)	Open-Lake - No Controls	Open-Lake - With Controls	New CDF	Combination
Feasibility Weighted Score (17)	59.5	56.7	53.8	56.7	45.3	48.2	62.3	59.5	70.8	70.8	59.5	79.3
Ecological Benefits Weighted Score (22)	66.0	78.6	81.7	72.3	72.3	88.0	66.0	66.0	59.7	59.7	66.0	75.4
Environmental Impacts Weighted Score (20)	80	70	70	65	65	70	85	85	40	65	55	75
Human Benefits Weighted Score (10)	30	32	36	30	30	38	32	32	28	28	24	32
Economic Benefits Weighted Score (14)	60.7	58.3	58.3	51.3	51.3	51.3	60.7	60.7	44.3	42.0	51.3	56
Implementation Cost Weighted Score (17)	58.7	55.6	65.8	42.2	17.0	84.2	85.0	83.6	84.7	83.8	62.4	79.9
Total Weighted Score	**354.8**	**351.2**	**365.7**	**317.4**	**281.0**	**379.7**	**391.0**	**386.8**	**327.5**	**349.4**	**318.2**	**397.7**

Single and Combination Option Final Ranking and Relative Costs

Rank	Option	Weighted Score	Relative Unit Costs ($/CY)
1	Combination	397.7	$13.50
2	Agricultural Fields (5-mile Radius)	391.0	$10.20
3	Agricultural Fields (10-mile Radius)	386.8	$11.20
4	Wetland Restoration & Shoreline Protection	379.7	$10.90
5	Emergent HRU - Shallow Water	365.7	$24.70
6	Beneficial Use	354.8	$30.20
7	Emergent HRU - Deep Water	351.2	$32.40
8	Open-Lake - With Controls	349.4	$11.10
9	Open-Lake – No Controls	327.5	$10.50
10	New CDF	318.2	$27.30
11	Submerged HRU - Deep Water	317.4	$42.60
12	Submerged HRU - Shallow Water	281.0	$61.70

Enhanced Environmental Dredging Techniques

- Hydraulic Dredging with permanent discharge lines
- Enhanced open-lake placement techniques

Short-term vs. Long-term Options

- Short-term options have minimal delays resulting from permitting, design, etc.
  - Beneficial use of sediment from the river at upland locations
  - Enhanced open-lake placement
- Long-term options promote activities with lower habitat impacts and lower cost
  - Agricultural use
  - Nearshore options

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- Hull & Associates, Inc.
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- Proudfoot
- Great Lakes Marketing
- ARCADIS

Toledo Harbor Sediment Management and Use Planning

Questions and Answer Session

Next Steps

- Survey – We would like your feedback!

- For additional information or to provide follow up input, please email lakeeriecommission@lakeerie.ohio.gov or call 419-621-2040.

Next Steps

- Technical Team will:
  - Incorporate feedback from stakeholders and the Toledo Harbor Task Force
  - Complete Final Plan in Summer 2012

- Updates, forum results, and this presentation will soon be available at www.lakeerie.ohio.gov

Thank You for Your Participation!

Ohio | Lake Erie Commission

lakeerie.ohio.gov

Great Lakes Commission des Grands Lacs

glc.org/dredging

Great Lakes RESTORATION

greatlakesrestoration.us

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