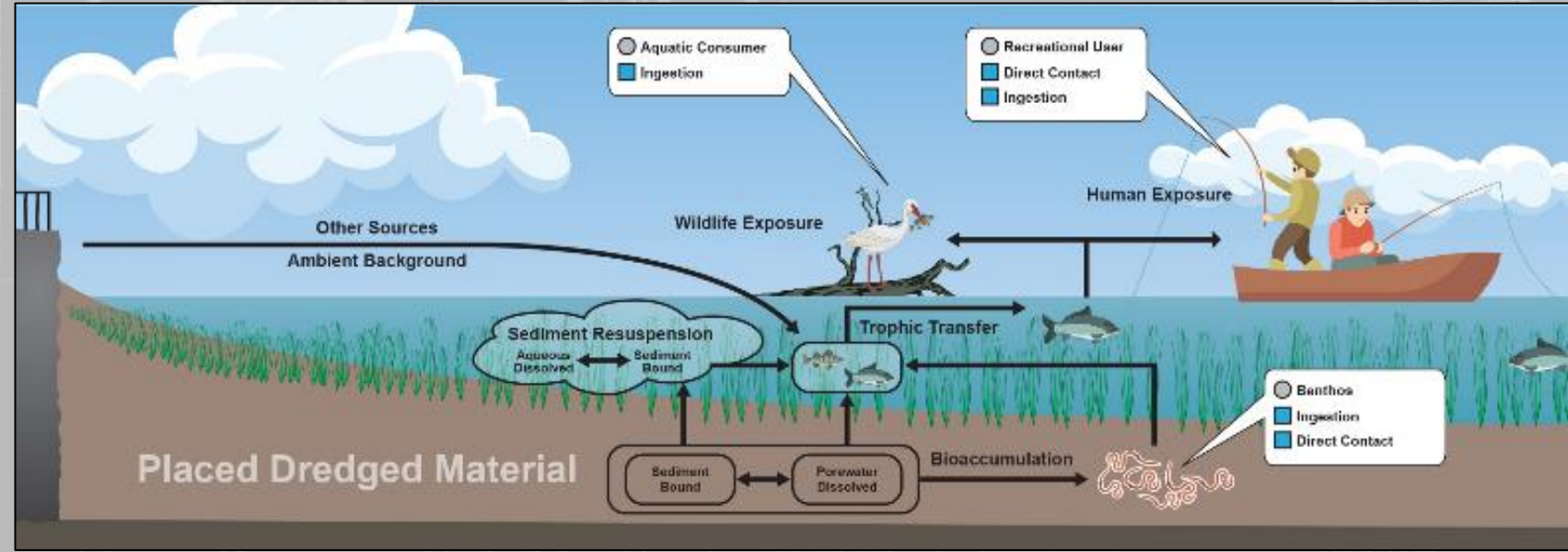
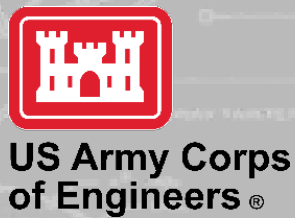


# DEVELOPMENT OF A GUIDANCE MANUAL FOR DETERMINING THE ENVIRONMENTAL SUITABILITY OF DREDGED SEDIMENTS FOR BENEFICIAL USES IN THE GREAT LAKES



"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."



Karen G. Keil, Ph.D.  
U.S. Army Corps of Engineers Buffalo District

WEDA Webinar March 12, 2021



# ACKNOWLEDGEMENTS - USACE CONTRIBUTORS



## Engineer Research and Development Center

Cynthia Banks  
Dennis Brandon  
Todd Bridges  
Trudy Estes\*  
Alan Kennedy  
Joe Kreitinger\*  
Guilherme Lotufo\*  
David Moore  
Richard Price\*  
Paul Schroeder\*  
Burton Suedel\*  
Chuck Theiling

## Buffalo District

Mike Habberfield\*  
Victoria Harms  
Bryan Hinterberger  
Karen Keil\*  
Andrew Lenox\*  
Scott Pickard\*  
Martin Wargo\*

## Chicago District

Jen Miller\*

## Detroit District

Pam Horner  
Jason Miller\*  
Marie Strum

## Great Lakes and Ohio River Division

Tony Friona  
Carl Platz

*\* Primary author*

# ENTITIES WHICH PROVIDED INPUT



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY





# COMPANION DOCUMENT TO THE TESTING MANUAL



## Guide to Policies and Projects Related to Beneficial Use of Dredged Material in the Great Lakes



Prepared for and by:  
**GREAT LAKES DREDGING TEAM**  
July 2016

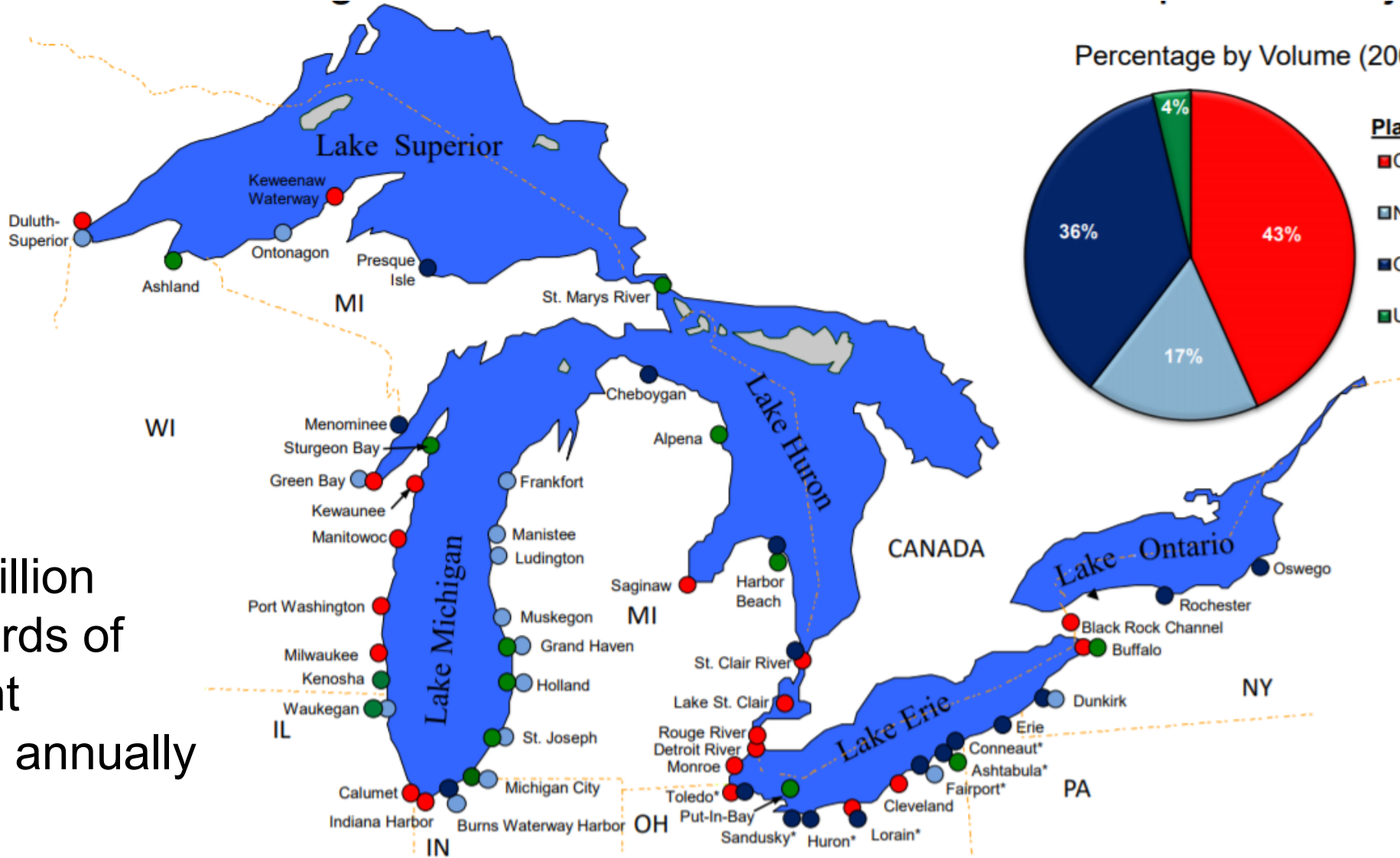


Cat Island Chain, Green Bay, Wisconsin

<https://greatlakesdredging.net/publications/guide-policies-projects-related-beneficial-use-dredged-material-great-lakes/>



# THE GREAT LAKES NAVIGATION SYSTEM

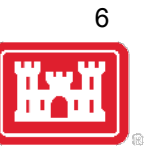


3 to 5 million cubic yards of sediment dredged annually

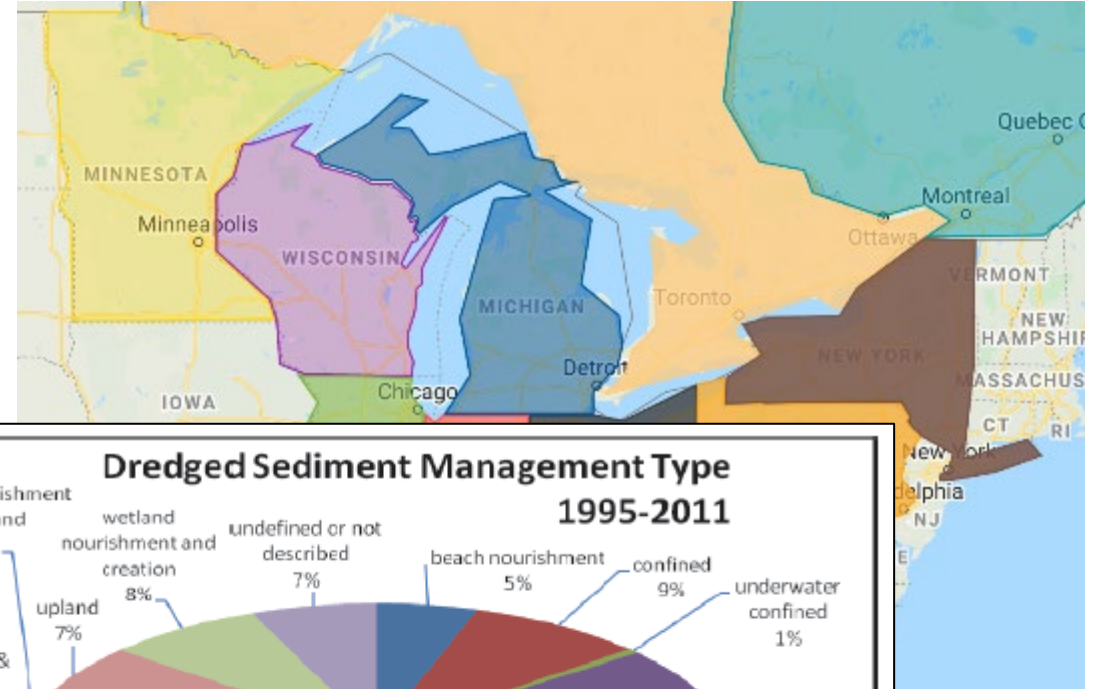
\*Placement method likely to change due to restrictions on open water placement in Ohio beginning July 2020.




# CHALLENGES TO IDENTIFYING DREDGED MATERIAL THAT IS ENVIRONMENTALLY SUITABLE FOR BENEFICIAL USES IN THE GREAT LAKES




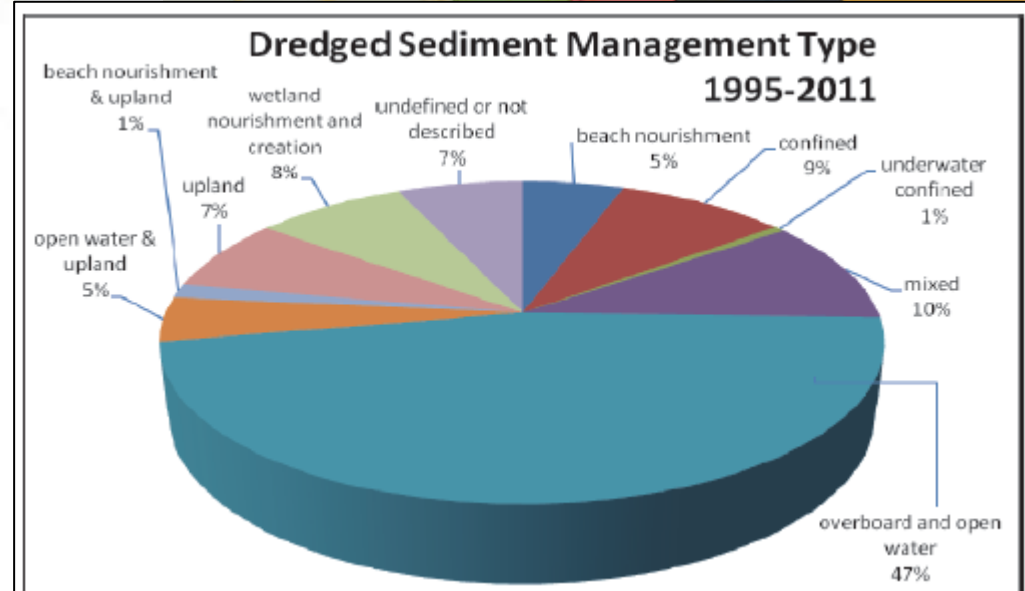
## AOCs in the U.S.





 United States Environmental Protection Agency  
 Office of Water (4305)  
**Evaluation of Dredged Material Proposed For Discharge in Waters of the U.S. - Testing Manual**  
 Inland Testing Manual  
 1998  
 Department of The Army  
 US Army Corps of Engineers

---



 1998  
**Great Lakes Dredged Material Testing and Evaluation Manual**

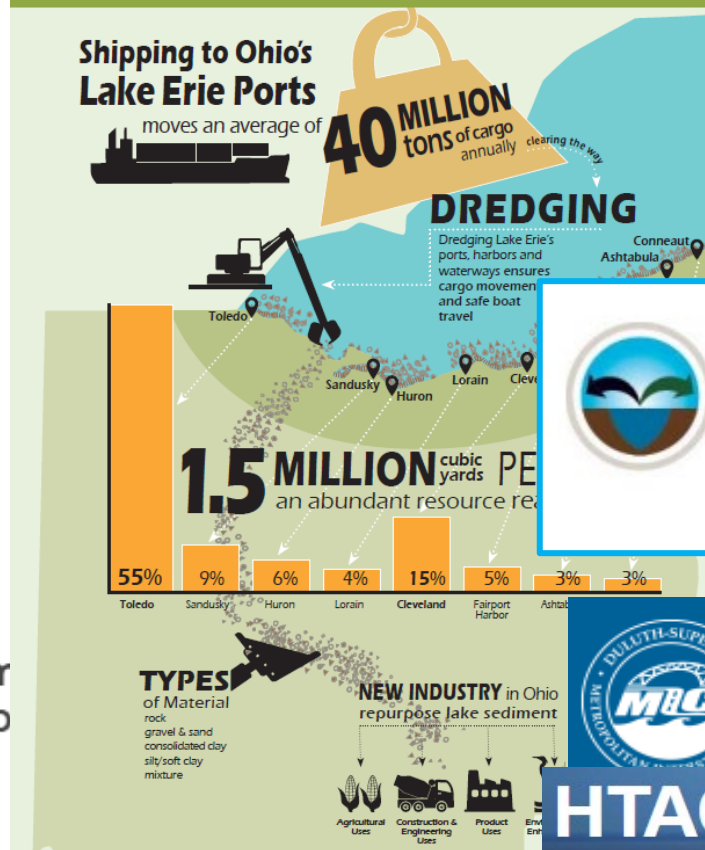




# SUPPORT FOR IDENTIFYING ENVIRONMENTALLY SUITABLE DREDGED MATERIAL FOR BENEFICIAL USES IN THE GREAT LAKES



## Dredged Material | Make it Your Business



NEW YORK STATE

Services News Governme

Department of Environmental Conservation

Recreation Nature

Home » Chemical and Pollution Control » Recycling and Composting » Recycling f

**Beneficial Use Determinations (BUDs)**



U.S. Army Corps of Engineers  
Engineer Research and Development  
Dredging Operations Technical Support

DULUTH - SUPERIOR  
**Metropolitan Interstate Council**

**HTAC** Harbor Technical Advisory Committee



# ENVIRONMENTAL EVALUATION AND MANAGEMENT OF DREDGED MATERIAL FOR BENEFICIAL USE:

## *A REGIONAL BENEFICIAL USE TESTING MANUAL FOR THE GREAT LAKES*

- **Objective** is to support beneficial use of dredged material by **developing a standard approach to evaluating the environmental suitability** of dredged material for beneficial uses.
- **Recognize** that **beneficial use of dredged material projects can support regional remediation and restoration efforts** throughout the Great Lakes.
- **Uses a risk-based approach** and incorporates federal and state assessment paradigms





# GREAT LAKES BENEFICIAL USE TESTING MANUAL PROVIDES:



- A risk-based approach which frames the evaluations.
- **Evaluations are broken into 2 main sections,** depending on whether the placement occurs in an **aquatic** or **upland** environment



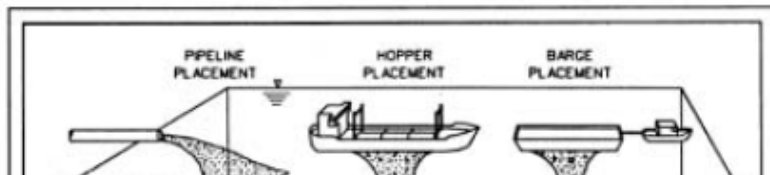
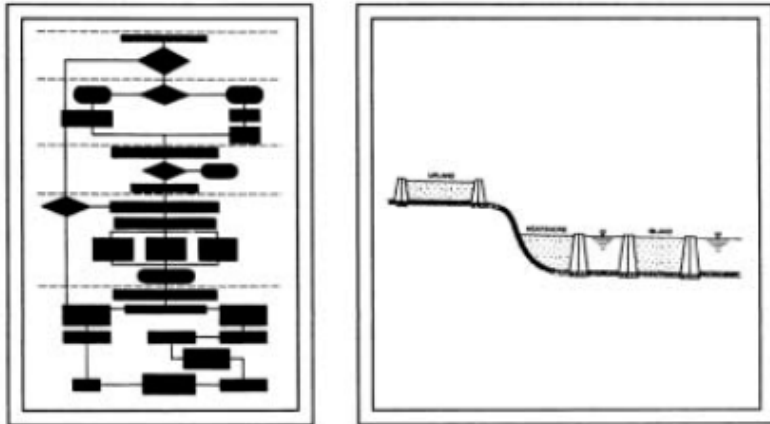
# SECTION 1: INTRODUCTION



US Army Corps of Engineers

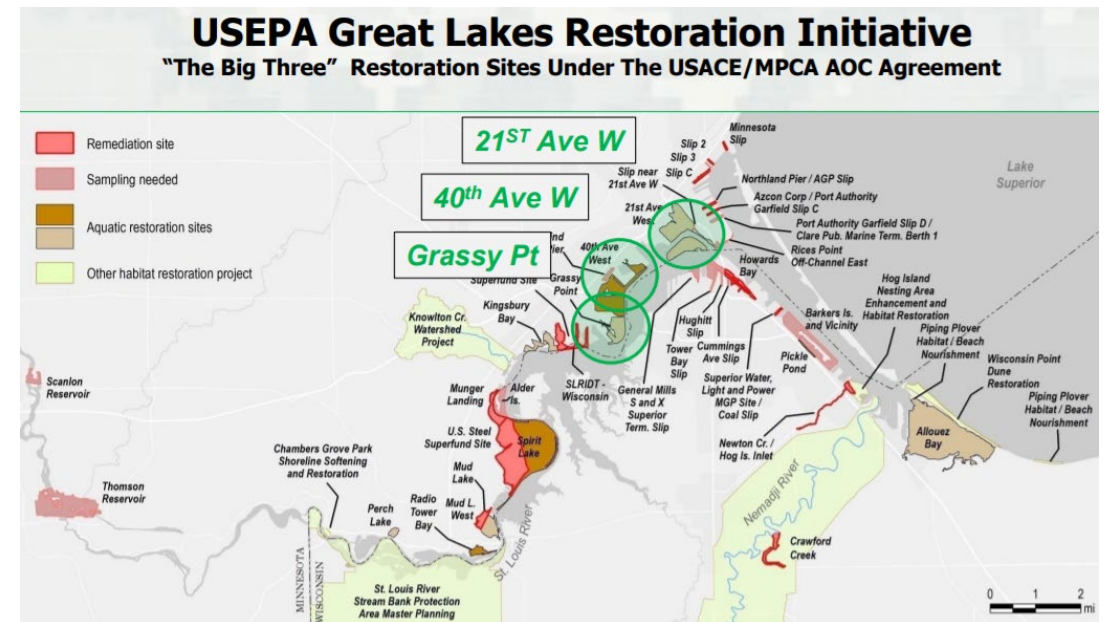
## Evaluating Environmental Effects of Dredged Material Management Alternatives— A Technical Framework

1992 / 2004



## Dredged material evaluation frameworks

## Great Lakes-specific issues





## SECTION 2: STATUTORY / REGULATORY OVERVIEW

### *National Environmental Policy Act (NEPA)*

#### Aquatic placement

Clean Water Act

**Endangered Species Act**

**Coastal Zone Management**

#### Other

National Historic Preservation Act

Clean Air Act

Federal Surface Mining Control and Reclamation Act

National Flood Insurance Program

Natural Resources Damage Assessment and Restoration

#### Upland placement

*New York B.U.D.*

*Ohio H.S.A.*

Solid waste  
(RCRA, TSCA)

ESA

CZMA



# ***Disclaimer!***

The Manual is not intended to direct the public, but rather to **provide a framework for a recommended approach** and evaluations.

**It is not binding**, nor does it regulate or change any authority in determining environmental suitability for the management of dredged material.



## SECTION 3: BENEFICIAL USE CATEGORIES

### Aquatic placement

Habitat creation  
Shore protection  
Capping / remediation



### Upland placement

Habitat development  
General fill  
Manufactured soils  
Agricultural field amendment





# SECTION 4: PRINCIPLES FOR BENEFICIAL USE EVALUATIONS



## Risk-based approach



## Methodology for Evaluating Beneficial Uses of Industrial Non-Hazardous Secondary Materials

USEPA 2016

- ✓ Project Goal
- ✓ Conceptual Site Model
- ✓ Evaluate ambient conditions

# Aquatic Placement

**LEGEND**

- Receptors
- Exposure Routes
- Placed Dredged Material
- Existing Sediment

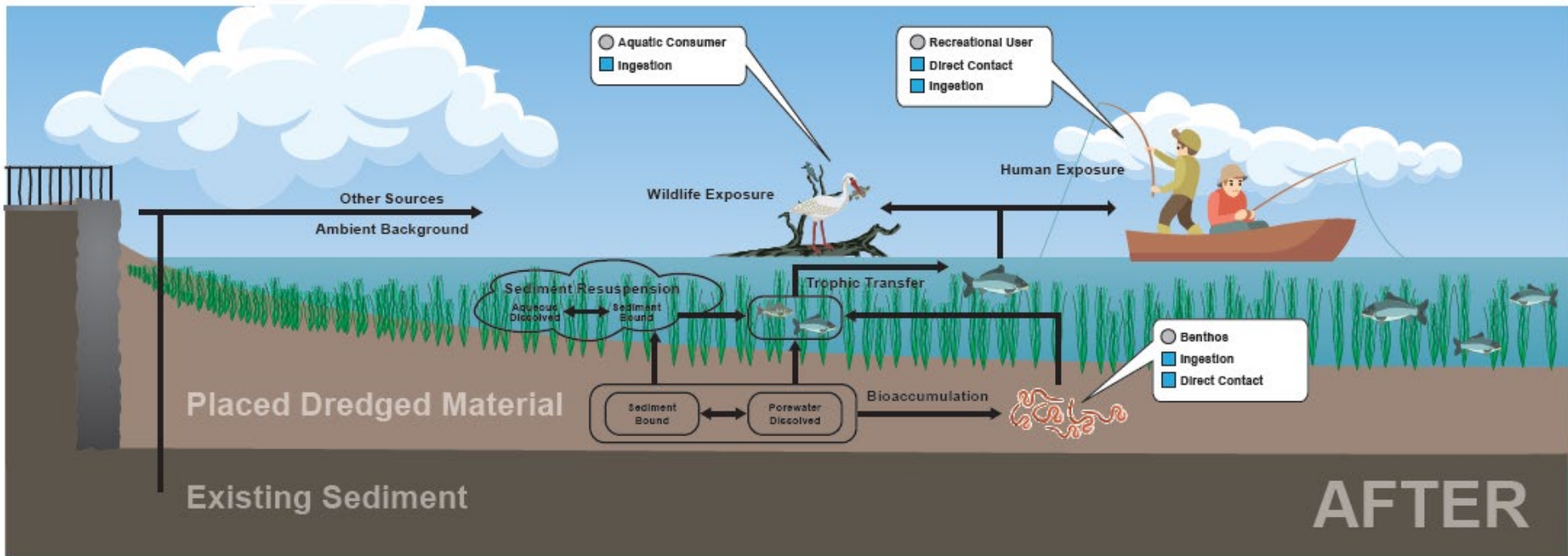
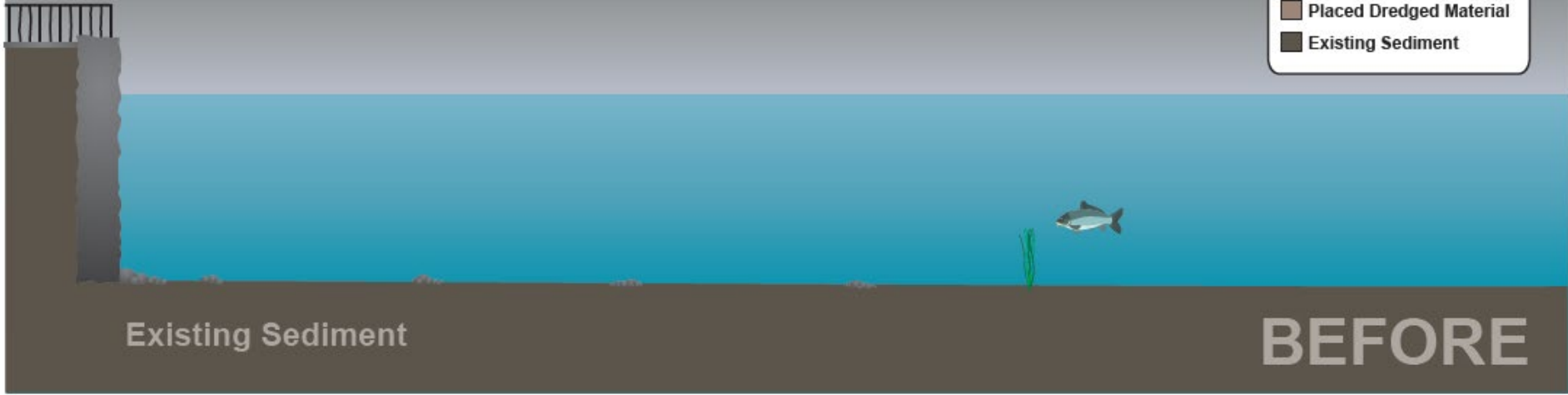


Figure 4-2. Generalized Conceptual Model for Dredging Operations at Beneficial Use Aquatic Placement Sites.

# Upland Brownfield Placement

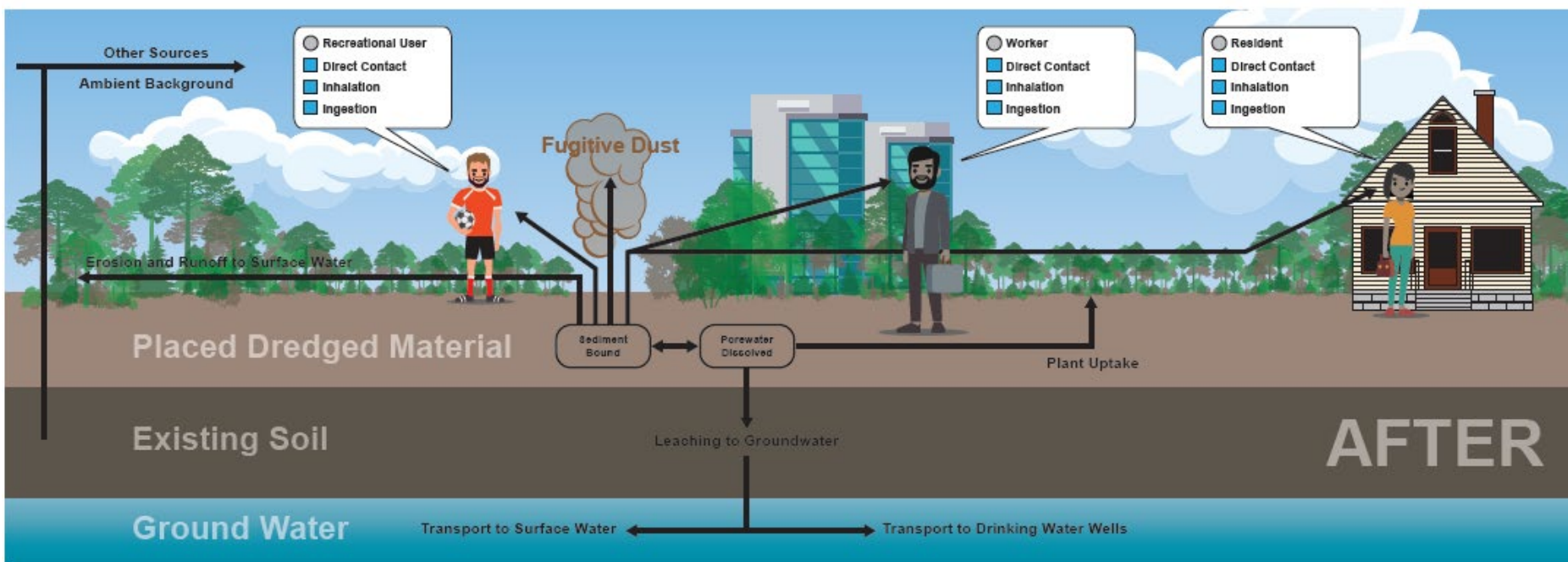


Figure 4-5. Generalized Conceptual Model for Dredging Operations at Beneficial Use Aquatic Placement Commercial, Residential, or Athletic Field Sites.





# CROSS WALK BETWEEN AQUATIC AND UPLAND EVALUATION TIERS AND RELEVANT RISK-BASED PROCESSES

TIER	RISK-BASED PROCESS	AQUATIC PATHWAYS		UPLAND PATHWAYS	
		Water column	Benthic	Human Health	Environmental Health
<b>Tier I</b>	Development of project goals and conceptual site model to focus pathways being evaluated	Comparison to placement / reference site sediment concentrations		Comparison to placement / reference site soil concentrations	
<b>Tier II</b>	Reliance on chemical analysis of samples, and modeling	Elutriate chemistry and dispersion/dilution modeling	Theoretical bioaccumulation potential	Comparison to generic soil screening levels	Modeling and/or further chemical analysis
<b>Tier III</b>	Incorporation of laboratory bioassays and/or additional site-specific exposure assumptions	Elutriate toxicity tests	Sediment toxicity & bioaccumulation tests	Site-specific risk-based screening levels and/or modeling or extractions	Bioaccumulation tests
<b>Tier IV</b>	Site-specific evaluation	Site-specific sampling, analysis, and/or evaluations		Site-specific sampling, analysis, and/or evaluations	

## SECTION 5: AQUATIC PLACEMENT EVALUATIONS

- ✓ Mirrors existing guidance for inland (Great Lakes) aquatic placement of dredged material (USEPA / USACE 1998).



- ✓ Additional detailed guidance provided for interpreting the results of laboratory bioaccumulation assays (Appendix F).



# SECTION 6: UPLAND PLACEMENT EVALUATIONS

Upland Testing Manual (USACE 2003)

Risk based screening levels (USEPA)

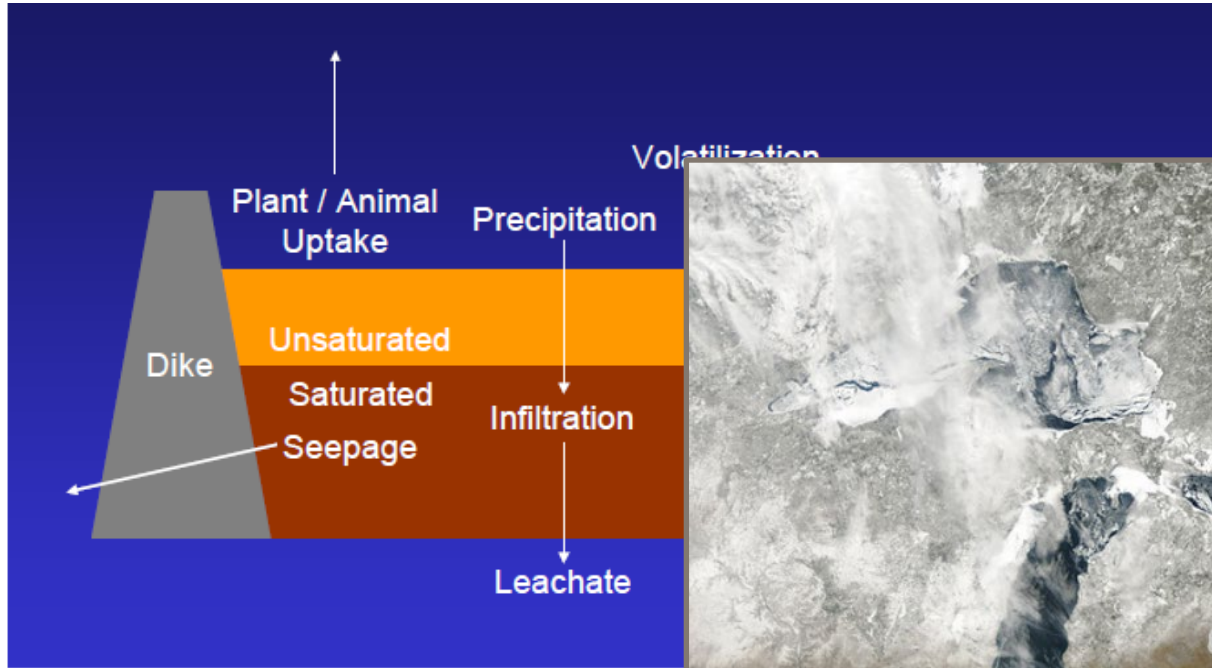
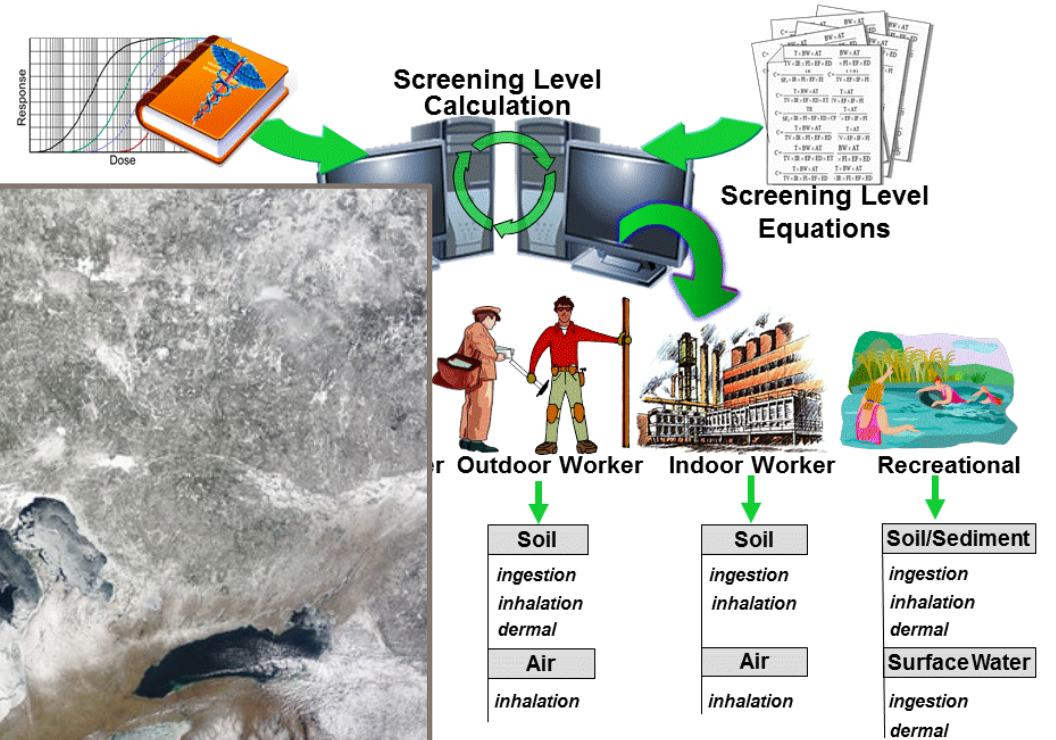


Figure 1-2. Schematic of contaminant migration



Great Lakes specific considerations



## SECTION 7: RISK MANAGEMENT



- Risk versus uncertainty
  - Complex systems cannot be completely understood / characterized
  - Conditions may be unpredictable during project implementation
  - Projects may involve interdependent systems
  
- Controls
  
  
- Adaptive management



# SECTION 8 REFERENCES





## APPENDICES



- A. Sources of Regional Soil and Sediment Background Concentrations
- B. State-Specific Regulations / Guidance
- C. Ecological Biota Screening Levels for Upland Beneficial Use Determination – Plant Pathway
- D. Treatment Options for Impaired Sediments
- E. Practical Considerations for Dredged Material Management
- F. Interpreting Bioaccumulation Assays



## USE OF THE GREAT LAKES BENEFICIAL USE TESTING MANUAL



- Refer to this manual when your beneficial use **project** is developing a **Quality Assurance Project Plan** for sampling and evaluations.
- **Harmonize** the recommendations in this Manual with your agency's perspectives on environmental evaluations.



U.S. Army Corps of Engineers  
 Engineer Research and Development Center  
 Dredging Operations Technical Support Program



Knowledge base +

Submit a DOTS Request

Contact Us

USACE / ERDC / EL / DOTS

Wednesday, March 3, 2021

Quick Link

DOTS



Discover

#### Webinars

20 May 2020, 1:00 PM CDT - The Natural Infrastructure Opportunities Tool by Dr. Safra Altman, ERDC Environmental Laboratory.

#### Training

6-8 March 2019 – Sustainable sediment management and dredging seminar, Sausalito, CA.

#### Models

The ERDC Dredging Operations Technical Support Program (DOTS) provides environmental and engineering technical support to the U.S. Army Corps of Engineers Operations and Maintenance navigation and dredging missions. Technology transfer products and activities support diverse field needs that directly benefit navigation and dredging operations throughout the United States.

[View DOTS Responses](#)

Explore DOTS resources

## FUTURE PUBLICATION OF THE FINAL MANUAL

<https://dots.el.erdcdren.mil/>

## CURRENT LOCATION OF DRAFT FINAL VERSION OF MANUAL

<https://greatlakesdredging.net/priorities/dredged-material-management/>





# RESOURCES ON BENEFICIAL USE OF DREDGED MATERIAL IN THE GREAT LAKES



<https://www.lre.usace.army.mil/Missions/Great-Lakes-Navigation>

<https://greatlakesdredging.net/>

<https://dots.el.erdc.dren.mil/>

**GREAT LAKES DREDGING TEAM**  
(Graphic modified from GLDT)

**Cat Island Restoration Project**  
Green Bay, WI

**Lorain Harbor (planned)**  
Lorain, OH

**21st Avenue West Pilot Project Demonstration**  
Duluth, MN

**Unity Island**  
Buffalo, NY  
(Image from The Buffalo News)

**Golf Course Turf Restoration**  
Duluth, MN

**Calumet River Brownfield Restoration**  
Chicago, IL

**Brownfield Redevelopment**  
Cleveland, OH

**Cleveland Lakefront Nature Preserve (formerly Dike 14)**  
Cleveland, OH

The infographic features a central map of the Great Lakes basin, color-coded by state/province: MN (yellow), WI (orange), MI (green), IL (red), IN (orange), OH (red), PA (teal), and ONT (blue). The five Great Lakes are labeled: Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario. Major cities are marked: Duluth, Marquette, Milwaukee, Chicago, Detroit, Cleveland, and Buffalo. Eight circular inset images provide visual details of specific projects: Cat Island Restoration (aerial view of a bay), Lorain Harbor (planned) (aerial view of a harbor), 21st Avenue West Pilot Project Demonstration (aerial view of a river), Unity Island (aerial view of an island with a building), Golf Course Turf Restoration (excavator loading a truck), Calumet River Brownfield Restoration (aerial view of a river), Brownfield Redevelopment (excavator working on a site), and Cleveland Lakefront Nature Preserve (aerial view of a lakefront area).





# ADDITIONAL DETAILS: APPENDICES



# A. SOURCES OF BACKGROUND (REFERENCE) CONCENTRATIONS IN THE REGION



Soil surveys have been conducted in

New York

Ohio (several counties adjacent to Lake Erie)

Michigan

Illinois (metropolitan and non-metropolitan areas)

Wisconsin

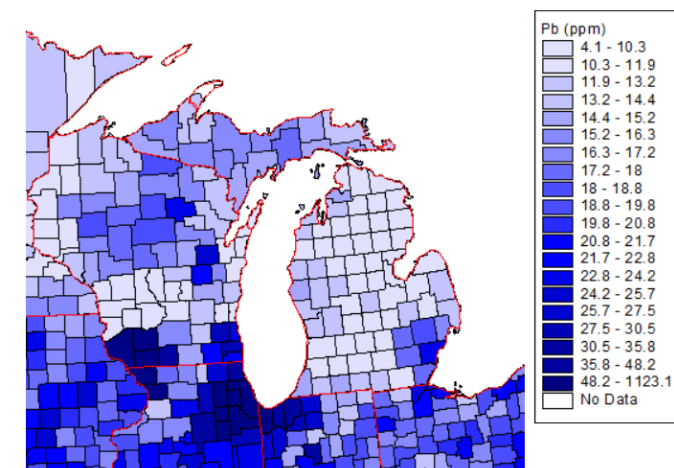
Minnesota

Sediment surveys have been conducted in

Ohio (statewide)

Nationwide (US Geological Survey)

Lead in Counties of the Upper Midwestern US





## B. STATE-SPECIFIC ENVIRONMENTAL REGULATIONS AND GUIDANCE



Appendix B-1 focuses on human health (upland evaluations)

Reflects state responses to questionnaires sent out in 2015 & 2019

**Table B.1-1** compares basis of state brownfield risk-based soil concentrations

**Table B.1-2** compares state-specific residential (non-industrial) risk-based soil concentrations with proposed regional approach following regionally-modified U.S.EPA risk-based screening levels

**Table B.1-3** compares state-specific industrial (non-residential) risk-based soil concentrations with proposed regional approach following regionally-modified U.S.EPA risk-based screening levels



## B. STATE-SPECIFIC ENVIRONMENTAL REGULATIONS AND GUIDANCE



Appendix B-2 focuses on environmental health (aquatic evaluations)

Minnesota guidance regarding aquatic placement of dredged sediments for ecosystem restoration

- St. Louis River Area of Concern, Duluth-Superior Harbor



# C. ECOLOGICAL BIOTA SCREENING LEVELS FOR UPLAND PLACEMENT – PLANT PATHWAY



Focuses on soil-to-plant pathway exposures for ecological receptors

**U.S.EPA Ecological Soil Screening Levels** were not developed for the unique chemical/physical attributes associated with upland placement of dredged material

Plant uptake of metals from 3 Lake Erie CDFs in Ohio (and reference locations) were measured to calculate bioaccumulation factors.

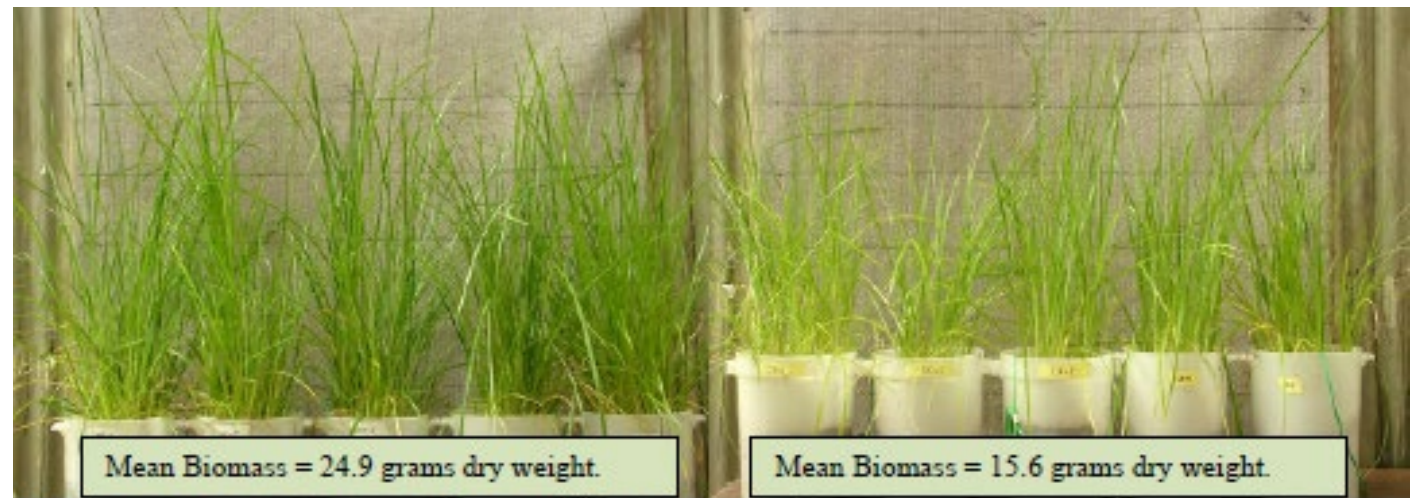


Figure 1. Plant growth in Cleveland CDF (l) and REF soils (r).

Biota screening levels for herbivores were developed using the site specific plant bioaccumulation factors combined with toxicity reference values (U.S.EPA eco-SSL based)



# D. TREATMENT OPTIONS FOR IMPAIRED SEDIMENTS



Impaired sediments may not be suitable for beneficial use without treatment, but, treatment may be cost prohibitive.



Figure 1.2 Photograph of Boskalis-Dolman physical separation system, Miami River, FL (Courtesy Bastiaan Lammers, Boskalis Dolman).

Synopsis of available sediment treatment technology alternatives

History of development of treatment alternatives

Key operational characteristics of alternatives

Many examples in the Great Lakes and around the nation where treatment is being or has been used





## E. PRACTICAL CONSIDERATIONS FOR DREDGED MATERIAL MANAGEMENT



### Water management for upland placement of dredged material

Upland placement of dredged material can involve direct, indirect, or no discharge of water.

This appendix offers water management approaches for the different water discharge configurations, and considers

- Clean Water Act requirements
- Timeframes for water discharges
- Water quality conditions
- Dredging operation options (hydraulic vs. mechanical)
- Land requirements



# F. INTERPRETING LABORATORY BIOACCUMULATION TESTS FOR WATER PLACEMENT

Further evaluation recommended when the mean worm tissue concentration exposed to dredged sediment is statistically greater than the worm tissue concentrations exposed to placement (reference) sediments.

FIGURE 1. Laboratory total PCB *L. variegatus* bioaccumulation data on all Lake Erie background sediments offshore of Ashtabula, Ohio

