

Monitoring the Effectiveness of Sediment Dredging



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EPA Science Policy Meeting
Managing Risks at Sediment Sites
Chicago, June 26, 2001



Is Dredging a Viable Remedial Alternative?

Lower Fox River and Green Bay Feasibility Study

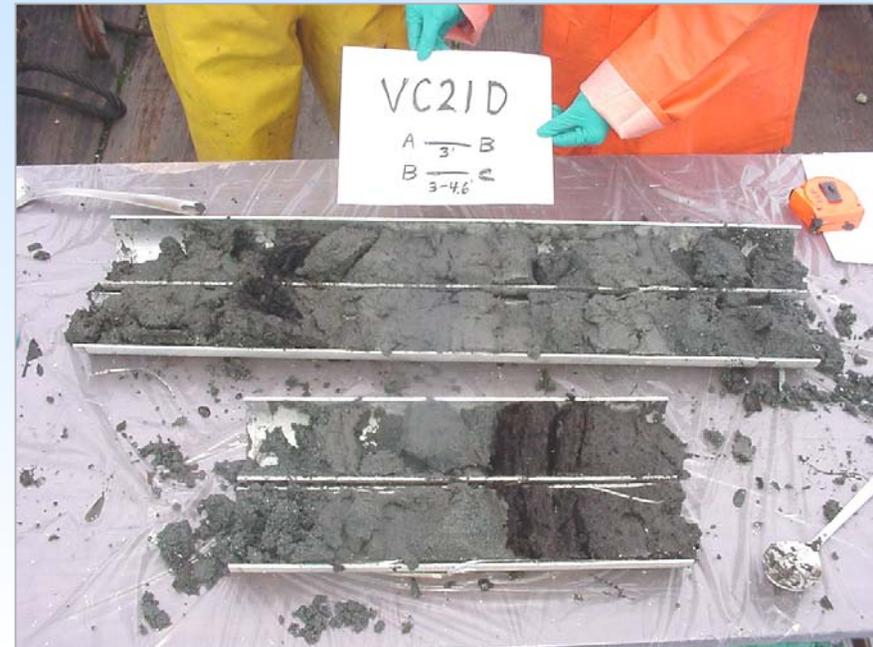
- Independent review of dredging effectiveness
- Evaluate “success” of short and long-term goals based on project expectations
- Assess the quality and types of monitoring plans



Selection Methods

Dredging Case Studies

- Identified 60 contaminated sediment dredging projects
- Queried and obtained a comprehensive set of site documentation
- Retained 20 projects for evaluation



A large, dark, textured object, possibly a piece of machinery or a large rock, with a blue horizontal bar at the top. The object has a rough, metallic or stone-like surface with many cracks and crevices. The text is overlaid in the center of the image.

**How Do We Determine
Effectiveness?**

Remediation Expectations

Short-Term Goals

- Source control
- Navigational depth
- Community support
- Minimize impacts
- Mass reduction

Long-term Objectives

- Eat the fish
- Swim in water
- Protect environment
- Reduce transport
- Redevelopment
- Risk reduction

Short-term Goals

Dredging Performance

Target	N	Performance Based Criteria Achieved
Chemical	10	8
Depth	3	3
Elevation	2	2
Horizon	2	2
Mass	3	3
Total	20	18

Short-term Lessons

Dredging Limitations

- Adequate site investigations
- Buried debris (wood, concrete, boulders)
- Bedrock or “refusal”
- Steep side slopes
- Passing ships

→ Engineered Designs



Short-term Risks and Common Criticisms



- Residual surface sediments
 - 19 of 20 had lower concentrations (avg 89%)
- Downstream surface water quality
 - 13 projects used silt curtains, 2 sheetpile walls
 - Minimal exceedences of water quality
 - Less than 1% of mass lost during removal
- Air quality
 - Minor exceedences immediately around dredging

Long-term Goals

Remedial Action Objectives

- Reduce toxicity (6)
- Reduce fish tissue levels (7)
- Source control or mass removal (3)
- None specified (4)



Long-term Goals

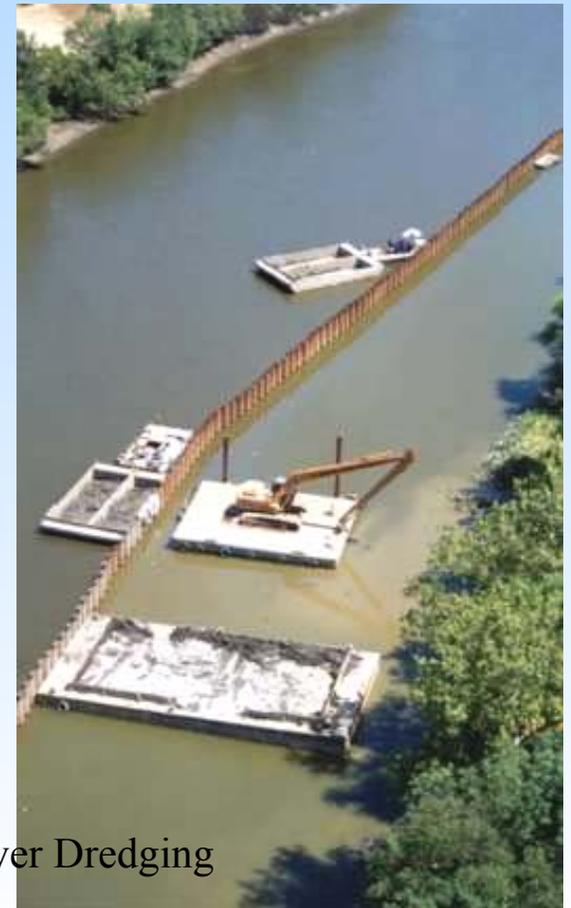
Performance and Risk Reduction

Performance-based Criteria	N	Target Goal Met	Long-term Risk Reduction		
			Achieved RAOs	Progress Towards	Variable Results
Chemical	10	8	3	4	3
Mass	3	3	1	1	1
Elevation	2	2			2
Horizon	2	2	1	1	
Depth	3	3	1	1	1
Project Total	20	18	6	7	7

Key Issues

Contaminated Sediment Remediation

- Inadequate site characterization limited “success”
- Well engineering projects met remedial expectations
- Lack of well defined monitoring plans



Christina River Dredging

Monitoring Methods

Monitoring Program	Physical	Chemical		Biological				
	Bathymetry/ Sediment Properties	Surface Water Quality	Sediment Quality	Benthic Abundance	Invert Toxicity Tests	Invertebrate Tissue	Fish Tissue	Fish Histopathology
ational Programs								
EMAP	♦		♦	♦		♦	♦	
NOAA NS&T			♦			♦	♦	♦
egional Programs								
DAMOS	♦		♦	♦	♦	♦	♦	
GLNP		♦	♦	♦		♦	♦	
PSAMP	♦		♦	♦	♦			
SF-Bay Estuary Program	♦	♦	♦	♦	♦	♦	♦	
edging Projects								
Black River, OH	♦							
Dokai Bay, Japan	♦	♦		♦				♦
Ford Outfall, MI	♦		♦				♦	
GM Foundry, NY	♦						♦	
Grasse River, NY	♦	♦	♦	♦			♦	
Lake Jarnsjon, Sweden	♦	♦	♦				♦	♦
Minamata Bay, Japan	♦	♦	♦				♦	
New Bedford Harbor, MA	♦		♦	♦	♦		♦	
Santa Gilla Lagoon, Italy	♦		♦					
Shiawassee River, MI	♦	♦					♦	
United Heckathorn, CA	♦	♦					♦	
Waukegan Harbor, IL	♦		♦		♦		♦	
opping Projects								
East Eagle Harbor, WA	♦		♦	♦				
Hamilton Harbor, Canada	♦		♦		♦			
NY Mud Dump, NY	♦		♦	♦			♦	
Simpson Cap, WA	♦		♦					
tural Recovery Projects								
James River, Virginia	♦	♦	♦				♦	
Sangamo-Weston, SC	♦		♦				♦	

When is Monitoring Conducted?

1	2	3	4	5
Baseline Monitoring	Implementation Monitoring	Post-Verification Monitoring	Long-Term Risk-reduction Monitoring	OMMP Stability Monitoring
<ul style="list-style-type: none"> • Bathmetry • Sediment 	<ul style="list-style-type: none"> • Bathmetry • Sediment • Surface water • Air • Residuals/mass balance 	<ul style="list-style-type: none"> • Bathmetry • Sediment • Surface water 	<ul style="list-style-type: none"> • Bathmetry • Sediment • Surface water 	<ul style="list-style-type: none"> • Bathmetry • Sediment
<ul style="list-style-type: none"> • Fish Tissue • Sed/SW toxicity • Community-level • Habitat 	<ul style="list-style-type: none"> • Caged-fish 		<ul style="list-style-type: none"> • Fish Tissue • Sediment toxicity • Community-level • Habitat 	



Model

Long-term Monitoring Plan

- RAO 1: Surface Water Quality
 - Surface water
- RAO 2: Human health
 - Fish tissue
 - Bird tissue
- RAO 3: Ecological health
 - Fish and bird tissue (5 fish, 2 birds)
 - Bird reproductive and population assessment
 - Invertebrate tissue (mussels)
- RAO 4: Contaminant transport
 - Surface sediment
 - Water column



Acknowledgements

- Peg Johnson, Cynthia Lowe (former OBAI)
- Tim Thompson, Bob Paulson (RETEC)
- Mike Palermo, David Bowman (USACE)
- Ed Lynch, Bill Fitzpatrick (WDNR)
- EPA, NOAA, USFWS
- Private, state, and federal project managers

