



Decision Support for the Beneficial Reuse of Dredged Materials in the St. Louis River

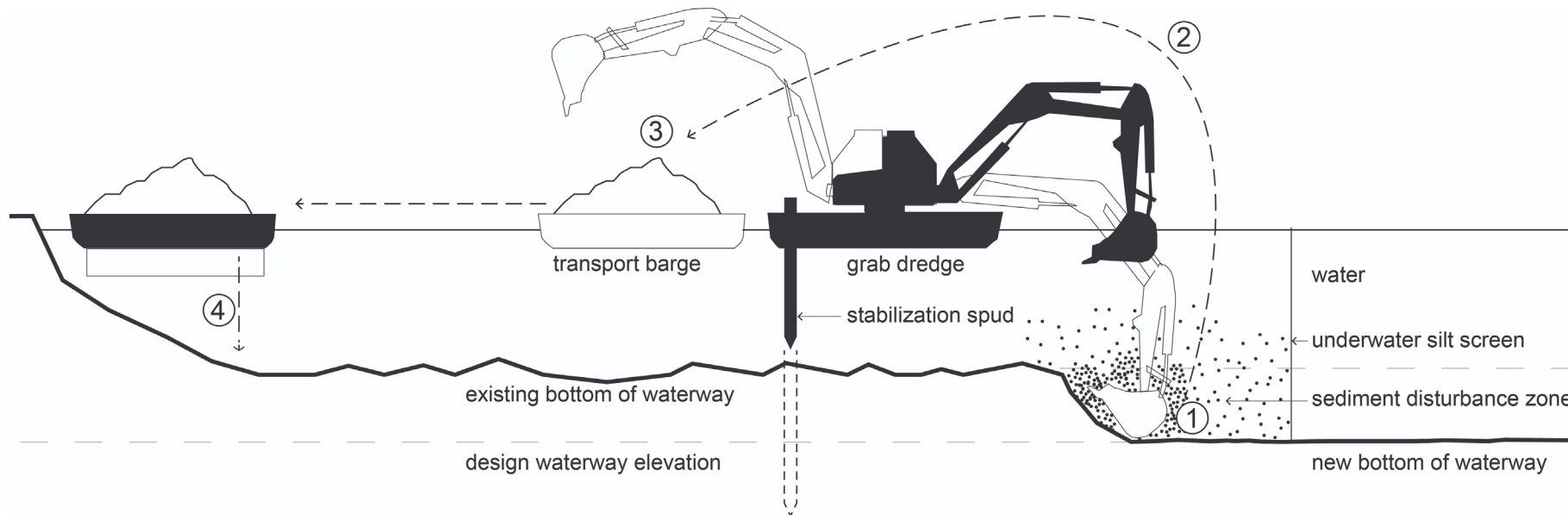
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Overview

- **Introduction to port dredging and the beneficial reuse of dredged materials**
- **Description of research methodology**
- **Summary of progress**
- **Implications going forward**

Operations and Maintenance Dredging



- ① - dislodging of in-situ sediment
- ② - raising of dredged material to the surface
- ③ - horizontal transport
- ④ - placement or further treatment



<https://dredgeresearchcollaborative.org>

Obstacles for O&M Dredging

- **Amounts**
- **Cost**
- **Stakeholder coordination**
- **Material characterization**
- **Placement**
 - **Confined Disposal Facilities (CDFs)**
 - **Open water placement**
 - **Beneficial reuse**

The Potential of Beneficial Reuse

- **Dredged materials as “resource” versus “waste”**
- **Aquatic and terrestrial habitat restoration**
- **Beach nourishment**
- **Construction and materials**
- **Brownfields remediation**

Beneficial Reuse Examples



<https://www.duluthnewtribune.com/news/science-and-nature/4363841-corps-may-use-dredged-sand-bolster-duluths-park-point-beach>

- **Minnesota Point Beach Nourishment**



https://trb-adc60.org/wp-content/uploads/2018/06/July-19-Focus-Session_DeLuca-and-Timm-Bijold_Brownfield-Success-Duluth-Style.pdf

- **DWP Roundhouse Restoration Site**

Beneficial Reuse Challenges

- **Funding challenges**
 - Project-by-project basis
 - Significant collaborative effort
- **Matching dredged material suitability to projects**
- **Flexibility demands**

Research Questions

- 1) What is the environmental quality, programmatic, and human benefit information needed to beneficially reuse dredged materials?**
- 2) How are sediments dredged, moved, tested, planned for, and applied for?**

Guiding Principles

- **Collaborative problem-solving**
- **Environmental justice**
- **Translational science**
- **Transparency**

Methodology

- **Collaborative Case Study**
 - **Context-dependent**
 - **3 different reuse projects**
 - 1) DWP Roundhouse 2) Atlas Industrial Park 3) 40th Ave West Aquatic Habitat
 - **Stakeholder engagement**
 - **Data sources:**
 - Document analysis
 - Stakeholder meetings
 - Stakeholder feedback & review
 - Stakeholder workshops



Discussion of progress & future implications

Original Decision Support Tool

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T																														
22	Sediment to be dredged Disposal capacity available on 7/19/19 Is sediment dredged ≤ available disposal capacity Unit cost Total cost										CDF Disposal			Beneficial Use: Recycler			Beneficial Use: Land Reclamation																																	
23											50,000 cy			50,000 cy			70,000 cy																																	
24											5,000,000 cy			1,000,000 cy			50,000 cy																																	
25											OK			OK			Reduce Volume																																	
26											\$ 46.80 per cy			\$ 3.57 per cy			\$ 3.06 per cy																																	
27	\$ 2.34 million			\$ 0.18 million			\$ 0.21 million																																											
28	EES Category	Criterion	C Rank	Per-centile	Adjust WF	Weighting Factor (WF) Scale: 0.05 to 1.0	WF Sum	WF Share	Scoring Scale Min = 1 Max = 5		U	W	C	U	W	C	U	W	C																															
29																																																		
30	Environment	Habitat Gain QUANTITY	22	100.00%	1X	0.05	4.1	35%	1 to 5	1	0.1		4	0.2		1	0.0	0%																																
31		Habitat Loss QUANTITY	21	90.40%	1X	0.14				1	0.1		3	0.4		4	0.0																																	
32		Habitat Gain QUALITY	7	23.80%	1X	0.77				1	0.8		1	0.8		3	0.0																																	
33		Habitat Loss QUALITY	10	38.00%	1X	0.64				1	0.6	20%	5	3.2	67%	1	0.0																																	
34		Lake habitat	4	9.50%	1X	0.91				1	0.9		5	4.6		3	0.0																																	
35		Reduce contamination	2	0.00%	1X	1.00				1	1.0		4	4.0		5	0.0																																	
36		Wetlands	12	47.60%	1X	0.55				1	0.6		1	0.6		2	0.0																																	
37	Economy	Capital cost	6	19.00%	1X	0.82	4.6	39%	1 to 5	1	0.8		5	4.1		4.9	0.0	0%																																
38		Diversion to construction	13	52.30%	1X	0.50				1	0.5		2	1.0		2	0.0																																	
39		Lake habitat	11	42.80%	1X	0.59				1	0.6		1	0.6		4	0.0																																	
40		Maintain shipping	3	4.70%	1X	0.96				1	1.0	20%	3	2.9	63%	1	0.0																																	
41		Reuse business profit	17	71.40%	1X	0.32				1	0.3		5	1.6		4	0.0																																	
42		Secondary economic benefit	18	76.10%	1X	0.28				1	0.3		2	0.6		1	0.0																																	
43		Speedy implementation	15	61.90%	1X	0.41				1	0.4		4	1.6		3	0.0																																	
44	Policy reform	9	33.30%	1X	0.68	1	0.7		3	2.0		5	0.0																																					
45	Social	Environmental justice	16	66.60%	1X	0.37	2.6	23%	1 to 5	1	0.4		3	1.1		2	0.0	0%																																
46		Human health	5	14.20%	1X	0.87				1	0.9		4	3.5		1	0.0																																	
47		Infrastructure	8	28.50%	1X	0.73				1	0.7	20%	3	2.2	71%	1	0.0																																	
48		Jobs	14	57.10%	1X	0.46				1	0.5		5	2.3		1	0.0																																	
49		Policy reform	20	85.70%	1X	0.19				1	0.2		1	0.2		1	0.0																																	
50	Other	Diversion to construction	21	90.40%	1X	0.14	0.4	3%	1 to 5	1	0.1	20%	3	0.4	35%	1	0.0	0%																																
51		Replicability	19	80.90%	1X	0.23				1	0.2		1	0.2		4	0.0																																	
52											Total Score																																							
53	Total Score										100%										11.6										38.0										0.0									
54											OK										of 58.05										of 58.05										of 58.05									
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◀ ▶ ... Help Sheet1 Analysis ScorecardA ScorecardB CostMaster Alt1Cost Alt2Cost Alt3Cost Soil Data Ⓡ Ⓢ Ⓣ Ⓤ Ⓥ Ⓦ Ⓧ Ⓨ Ⓩ ⓐ ⓑ ⓓ ⓔ ⓖ ⓗ ⓘ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ ⓾ ⓿ ⓫ ⓬ ⓭ ⓮ ⓯ ⓰ ⓱ ⓲ ⓳ ⓴ ⓵ ⓶ ⓷ ⓸ ⓹ ⓺ ⓻ ⓼ ⓽ 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Increasing Accessibility

1. Data Worksheet

	A	B	C	D	E	F	G
1	Biophysical Environment						
2	Habitat Gain and Loss	Quantity	Quality		Quantity		Quality
3	Rivers and Streams						
5	Gain	<input type="checkbox"/>	<input type="checkbox"/>	Likelihood (of habitat gain or loss)			
7	Loss	<input type="checkbox"/>	<input type="checkbox"/>	Magnitude (of changes due to gain or loss)			
9	No impact	<input type="checkbox"/>	<input type="checkbox"/>	Direction (impact on health of habitat and organisms)			
11	N/A	<input type="checkbox"/>	<input type="checkbox"/>				
12	Lakes and Ponds						
14	Gain	<input type="checkbox"/>	<input type="checkbox"/>	Likelihood (of habitat gain or loss)			
16	Loss	<input type="checkbox"/>	<input type="checkbox"/>	Magnitude (of changes due to gain or loss)			
18	No impact	<input type="checkbox"/>	<input type="checkbox"/>	Direction (impact on health of habitat and organisms)			
20	N/A	<input type="checkbox"/>	<input type="checkbox"/>				
22	Near Coastal Marine/Estuarine						
24	Gain	<input type="checkbox"/>	<input type="checkbox"/>	Likelihood (of habitat gain or loss)			
26	Loss	<input type="checkbox"/>	<input type="checkbox"/>	Magnitude (of changes due to gain or loss)			
28	No impact	<input type="checkbox"/>	<input type="checkbox"/>	Direction (impact on health of habitat and organisms)			
30	N/A	<input type="checkbox"/>	<input type="checkbox"/>				
31	Open water						
33	Gain	<input type="checkbox"/>	<input type="checkbox"/>	Likelihood (of habitat gain or loss)			
35	Loss	<input type="checkbox"/>	<input type="checkbox"/>	Magnitude (of changes due to gain or loss)			

2. Score cards

	A	B	C	D	E	F	G	H	I
1	Scorecard A: Scoring 1-5								
3				Likelihood, Impact, Feasibility					
4				5	4	3	2	1	N/A
5				Definite	High	Moderate	Somewhat	Low	
6	e Criteria	Maintain navigation channels							
7		Enrollment in voluntary program							
8		Able to complete within Environmental Windows							
9		Included in existing guidance documents							
		with							
			eline						
			ents						
			ame						
			able						
			rship						
			ified						
			ared						
			shed						
1	Scorecard B: Yes/No								
3		Criteria	Yes	No	N/A				
4	Governance	Maintain navigation channels							
5		Enrolled in voluntary program							
6		Able to be completed within Environmental Windows							
7		Referred to in existing guidance documents							
8		Permitting timeline conducive with project timeline							
9		Meets zoning requirements							
10		Flexible timeline							
11		Replicable in other harbors, ports, environments, jurisdictions							
12		Site ownership							
13	Economic	Funding pathway secured							
14		Funding application prepared							
15		Partnerships established							
16		Potential partnerships identified							
17		Feasible transportation- dredged materials to placement site							
18		Project can accept material for 5 years							
19		Project can accept material long term (20 years)							
20		Project leads to the creation/growth of a viable business							
21		Secondary benefits created							
22		Requires long-term maintenance or management							
1	Scorecard C: Ranking								
3		Criteria	Rank						
4	Governance	Maintain navigation channels							
5		Enrolled in voluntary program							
6		Able to be completed within Environmental Windows							
7		Referred to in existing guidance documents							
8		Permitting timeline conducive with project timeline							
9		Meets zoning requirements							
10		Flexible timeline							
11		Site ownership							
12		Replicable in other harbors, ports, environments, jurisdictions							
13		Funding pathway secured							
14	Economic	Funding application prepared							
15		Partnerships established							
16		Potential partnerships identified							
17		Feasible transportation of dredged materials to the placement site							

Expansion of Criteria/Sub-Criteria

Environmental, Economic, Social, Other

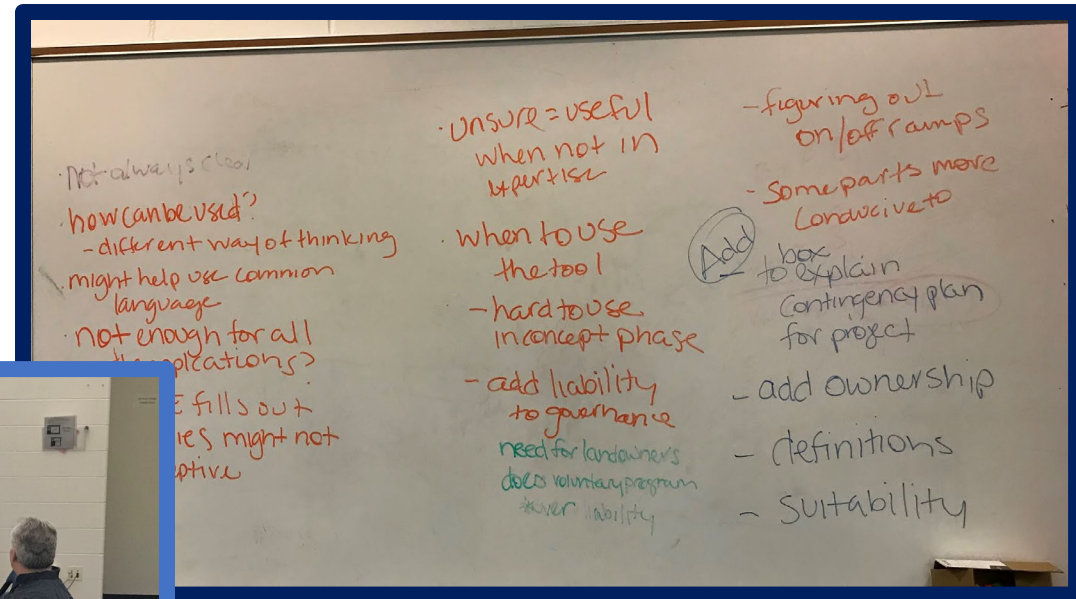


Assess feasibility	Governance	Compliance with place and project relevant gov. structures
	Built Environment	Site's end uses and material use
	Economic	Potential economic incentives and constraints
Assess harms & benefits	Biophysical	Habitat and organisms
	Social	Human health and well-being

Building up to a Workshop

- **Collaborative identification of placement sites**
 - Allouez Bay
 - Interstate Island (known site, using as example)
- **Request for completed Data Worksheets**
- **Inclusion of all interested stakeholders**
 - Natural resource agencies
 - Regulating agencies
 - Municipalities
 - Private consultants and contractors
 - Transportation authorities
 - Port authorities

Hosting the Workshop



- Not always clear
- how can be used?
 - different way of thinking
 - might help use common language
- not enough for all complications?
- fills out
- ies might not
- ptive

- Unsure = useful when not in expertise
- When to use the tool
 - hard to use in concept phase
 - add liability to governance
 - need for landowners
 - does voluntary program
 - over liability

- figuring out on/off ramps
- Some parts more conducive to
- Add box to explain contingency plan for project
- add ownership
- definitions
- Suitability

Going Forward

Project

Refinement of
products

Database building

Beyond the project

Testing long term
placement sites

Building into other
tools and databases

Expansive uses of the
tool