FOCUSED FEASIBILITY STUDY REPORT
FOR
40TH AVENUE PROJECT AREA
IN THE ST. LOUIS RIVER AREA OF CONCERN

August 28, 2015

APPENDIX R. DESIGN REFINEMENTS

Presented in this Appendix are revised concepts explored for the 40th Avenue West Complex. These concepts were developed without the input of the entire Site Team and represent efforts by the FFS authors to explore additional alternatives for improving habitat in the Project Area.

Figure No.

Appendix R -Figure 1

Title

40th Ave West Proposed Bathymetry Alternative Proposed Design

Client/Project

U.S. Fish and Wildlife Service
40th Avenue West
Remediation to Restoration Project
St. Louis River Estuary

Project Location

T49N, R14W, S07; 08; 17; 18
C of Duluth, St. Louis Co., MN

Prepared by TBJ
Technical Review by EGL

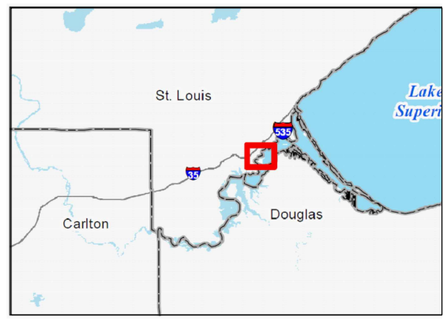
100 300 600 Feet
1:9,600 (At original document size of 11X17)

N

Legend

Proposed Water Depth Based on Water Surface at Elevation 601.1'

-3.0' - 0.0'	
0.0' - 0.5'	
0.5' - 1.0'	
1.0' - 1.5'	
1.5' - 2.0'	
2.0' - 2.5'	
2.5' - 3.0'	
3.0' - 3.5'	
3.5' - 4.0'	
4.0' - 4.5'	
4.5' - 5.5'	
5.5' - 6.5'	
6.5' - 8.0'	
8.0' - 14.0'	
14.0' - 30.5'	



Notes
1. Coordinate System: NAD83 MN State Plane North

Stantec

JEWELL associates engineers, inc. Engineers · Surveyors · Architects

U.S. FISH & WILDLIFE SERVICE

FILE NAME : S:\PROJECTS\U18010 – USFW ST LOUIS RIVER FEASIBILITY STUDY\BASEDATA\U18010_OVERALL GRADING (REVISED).DWG
LAYOUT : LAYOUT
PLOT DATE : 6/16/2015
PLOT TIME : 3:20:43 PM
PLOT BY : BALLWEG,THOMAS
PLOT SCALE : 0.500000

Based on the findings of the environmental analysis, vegetation modeling, and stakeholder comments, a revised concept was explored for the Project Area. These concepts were developed without the input of the entire Site Team and represent efforts by the FFS authors to explore additional alternatives for improving habitat development in the Project Area

Figure R1 shows both the initial concept for the FFS and the proposed refinements. (See Figure 26 for island/shoal and dredge area numbering and descriptions).

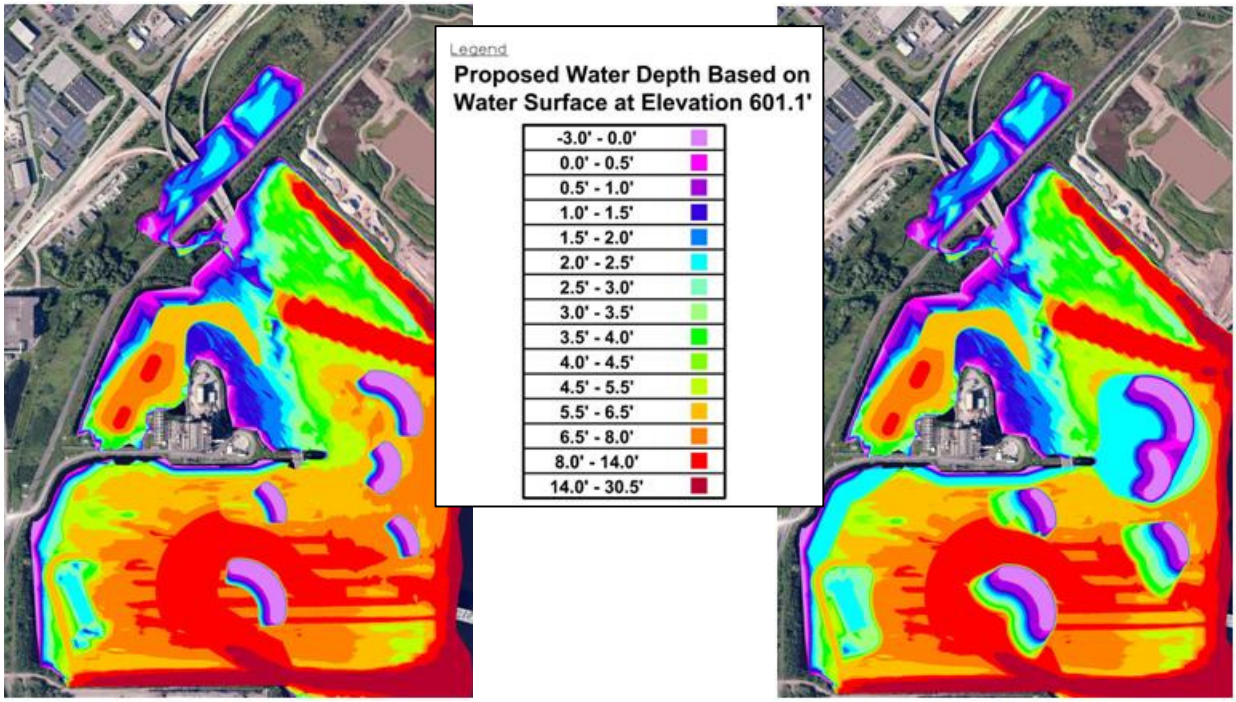


Figure R1. Bathymetry for Initial Concept Design (Left) Versus Refined Concept (Right)

The refinements include the expansion of the shelves on the leeward side of the islands, increasing the shoal area between the two existing islands, expanding the shoreline softening areas south of the Minnesota Power Hibbard power plant, and creating a large shoal area around Islands 4 and 5 to promote vegetative establishment, provide habitat variation and to enhance the bioactive zone. Dredge volume and cost data for these refinements can be found Appendix P

Although not fully analyzed in this study, two surface models for the refinement of the deepwater fish passage area (Dredge Area 2 on Figure 26 and Figure R2) were created and evaluated. One alternative created a larger deepwater area and incorporated more habitat variation within the channel by creating variation in the depth along the leeward side of the channel. This alternative for Dredge Area 2 generates over 200,000 cy of dredge material and would require the relocation or elimination of Island 2. A second design model similarly incorporates more habitat variation along the leeward side of the channel but allows more space for the refinements to Islands 1 and 2 discussed above. This model generates 136,550 cy of dredge material versus 101,160 cy for the original FFS concept design. The models can be made available to the Site Team for further analysis or use in final designs. A comparison of the original FFS design for Dredge Area 2 versus the second refined alternate is shown in Table 36.

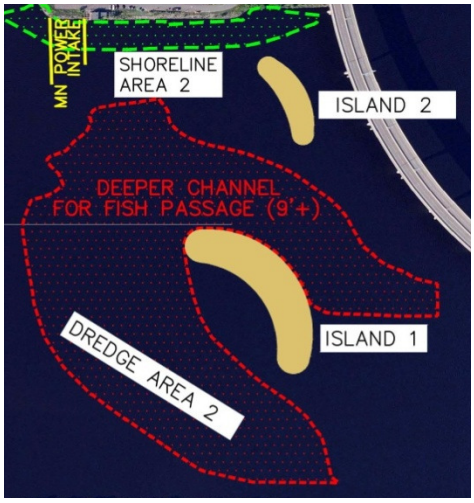


Figure R2. 40th Avenue Preferred Ecological Dredge Area 2

Table 36 shows a comparison of the materials generated between the two alternatives. Note the channel was shifted west to accommodate an enlarged Island 1 in the revised design. This explains the significant shift in material classifications in the dredged material.

Table 36. Comparison of Alternatives for Fish Passage Channel (Dredge Area 2)

Feature	Total Dredge Volume (CY)	Silt (ML) (CY)	Peat (Pt) (CY)	Silty Sand (SM) (CY)	Organic Silt (OL) (CY)	Sand (SP) (CY)	Wood (CY)
Dredge Area 2 FFS Concept Design	101,160	36,885	23,866	18,415	18,020	0	3,974
Dredge Area 2 Alternate Design	136,550	19,390	47,960	18,366	47,228	1,854	1,752

HABITAT COMPARISON OF REFINED AND ORIGINAL CONCEPTS

As previously discussed, the refined concept design includes expansion of the shelves on the leeward side of the islands, increasing the shoal area between the two existing islands, expanding the shoreline softening areas south of the Minnesota Power Hibbard Plant, and creating a large shoal area around Islands 4 and 5. If fully implemented, the revised design could provide an additional 3.5 acres of softened shoreline and over 21 acres of additional SAV when compared to the original FFS concept. Table 37 compares the habitat improvements of the two alternatives.

Table 37. Summary of Habitat Area Improvements for Original Island Concept and Refined Concept Designs

Habitat Type	Proposed	Original Concept Net Benefit	Refined Concept Net Benefit*
Islands	5 islands	7 acres of additional island habitat 5900 linear feet of shoreline habitat 3.9 acres of SAV habitat 0.9 acres of FLV habitat	7 acres of additional island habitat 5900 linear feet of shoreline habitat 20.4 acres of SAV habitat 0.9 acres of FLV habitat
Shoals	1 shoal	-0.11 acres of SAV habitat 0.5 acres of FLV habitat	1.89 acres of SAV habitat 0.5 acres of FLV habitat (shoal SAV for Islands 4& 5 is considered in Island benefits)
Shoreline Softening	See net benefit	5.6 acres softened 4.8 acres of SAV habitat 0.5 acres of FLV habitat	9.1 acres softened 7.4 acres of SAV habitat 0.5 acres of FLV habitat

*Note: SAV and FLV values were not modeled for the refined concepts. No change in FLV values were assumed. SAV increases were based on area of additional habitat created at the appropriate REI and Depth for ≥ 0.75 probability of SAV favorability.

Table 38. Dredge Material Volumes for Original Concept Design

Feature	Total Dredge Volume (CY)	Silt (ML) (CY)	Peat (Pt) (CY)	Silty Sand (SM) (CY)	Organic Silt (OL) (CY)	Sand (SP) (CY)	Wood (CY)
D1 - Dredge Area 1 near Shoal 6	7,030	3135	1567	2328	0	0	0
D2- Dredge Area 2 for Fish Passage East of Island 1	101,160	36,885	23,866	18,415	18,020	0	3,974
D3 Dredge Area 3 North of MN Power Plant	67,080	22,836	0	21,733	21,682	829	0
Total Dredge Volume	175,270	62,856	25,433	42,476	39,702	829	3,974

Table 39. Dredge Material Volumes for Expanded Fish Passage Area

Feature	Total Dredge Volume (CY)	Silt (ML) (CY)	Peat (Pt) (CY)	Silty Sand (SM) (CY)	Organic Silt (OL) (CY)	Sand (SP) (CY)	Wood (CY)
D1 - Dredge Area 1 near Shoal 6	7,030	3,135	1,567	2,328	0	0	0
D2- Dredge Area 2 for Fish Passage East of Island 1	136,550	19,390	47,960	18,366	47,228	1,854	1,752
D3 Dredge Area 3 North of MN Power Plant	67,080	22,836	0	21,733	21,682	829	0
Total Dredge Volume	210,660	45,361	49,527	42,427	68,910	2,683	1,752

Table 40. Island Concept Dredge/Dredge Placement Volumes for Refined Concept Design

Feature	Dredge Volume (CY)	Dredge Placement Volume (CY)	Dredge Placement Volume (CY)Adjusted for Consolidation
I1 - Island 1	0	87,140	128,637
I2 - Island 2	0	30,000	50,903
I3 - Island 3	0	47,890	77,907
I4 & I5 - Island 4 & 5	0	156,700	250,589
S6 - Shoal 6	0	15,880	25,725
D1 - Dredge Area 1 near Shoal 6	7,030	0	0
D2- Dredge Area 2 for Fish Passage East of Island 1	101,160	0	0
D-3 Dredge Area 3 North of MN Power Plant	67,080	0	0
F1- Shoreline 1 Placement Area Southwest of MN Power	0	17,881	26,341
F2 - Shoreline 2 Placement Area South of MN Power Plant	0	16,265	22,435
F3 - Dredge Placement Area Between Erie Pier and Bong Bridge	0	37,240	37,240
Total	**175,270**	**408,996**	**619,777**

Table 41. Opinion of Probable Construction Costs – Refined Concepts - Islands

Item No.	Description	Quantity	Unit	Unit Price	Total Cost
1	Mobilization & Demobilization	1	LS	$250,000	$250,000
2	On Site Dredge Removal/Placement[1]	175,270	CY	$15	$2,629,050
3	Maintenance Dredging Placement[2]	511,068	CY	$15	$7,666,020
4	Turbidity Barriers	5,667	SY	$27	$153,009
5	Wood Waste Disposal	29,407	CY	$10	$294,070
6	Undistributed Quantity of Turbidity Barriers	500	SY	$27	$13,500
	Subtotal				$11,005,649
	Engineering (15%)				$1,650,847
	Contingency (15%)				$1,650,847
	Total				**$14,307,344**

Notes: 1. This volume contains a quantity of contaminated sediments. Adjustments to the sediment removal costs in Appendix Q were made so that the cost of dredging this material was not estimated twice.
2. Adjusted for beneficial reuse of onsite dredge material

Table 42. Opinion of Probable Construction Costs – Refined Concepts - Shoals

Item No.	Description	Quantity	Unit	Unit Price	Total Cost
1	Mobilization & Demobilization	1	LS	$250,000	$250,000
2	On Site Dredge Removal/Placement[1]	175,270	CY	$15	$2,629,050
3	Maintenance Dredging Placement[2]	441,558	CY	$15	$6,623,370
4	Turbidity Barriers	5,667	SY	$27	$153,000
5	Wood Waste Disposal	29,407	CY	$10	$294,070
6	Undistributed Quantity of Turbidity Barriers	500	SY	$27	$13,500
	Subtotal				$9,962,990
	Engineering (15%)				$1,494,449
	Contingency (15%)				$1,494,449
	Total				**$12,951,887**

Notes: 1. This volume contains a quantity of contaminated sediments. Adjustments to the sediment removal costs in Appendix Q were made so that the cost of dredging this material was not estimated twice.
2. Adjusted for beneficial reuse of onsite dredge material