

Appendix C:

Economic Analysis

*Lower Pool 2 Channel Management Study:
Boulanger Bend to Lock and Dam No. 2*

Economic Analysis

Introduction

This analysis evaluates the positive impacts (benefits) and adverse impacts (costs) for three alternatives that have survived the preliminary alternatives screening process. These alternatives include No Action, the Boulanger Cut-off Channel, and Increased Channel Maintenance with Structure. Costs and benefits are set at the 2016 price level and the interest rate used for amortizing costs is 2.875%, the FY17 federal discount rate for civil works projects. The project life is set at 40 years. This is based on the Channel Maintenance Management Plan (CMMP) and associated EIS which were both based on a 40-year planning period. This time period is consistent with the GREAT I study and is meant to address a sufficient time period for measuring the long-term impacts of channel maintenance at a given location.

The Corps of Engineers is responsible for maintaining a navigable channel on the Mississippi River. Authority for continued operation and maintenance of the Mississippi River Nine-Foot Channel project is provided in the River and Harbor Acts of 1930. Original authority for the Corps of Engineers to work on the Mississippi River was provided in the River and Harbor Act of 1878. The project defined herein is authorized by the referenced legislation and its purpose corresponds to that of the annual Operations and Maintenance appropriation.

The authorized width of straight reaches of the navigation channel in Pool 2 is 200 feet compared with a width of 300 feet below Lock and Dam 2. Bends in the channel are authorized at increased widths. The recommended bends widths in Lower Pool 2, as recommended in the Channel Maintenance Management Plan and the Great River Environmental Action Team study are listed below:

- Boulanger Bend (River Miles 820.3 - 821.5): Maximum: 500', Suggested: 500'
- Boulanger Bend Lower Light (River Mile 818.4 - 820.3): Maximum 500', Suggested: 400'
- Nininger Bend (River Mile 817.8 - 818.4): Maximum 500', Suggested: 400'

Due to increased dredging demand in lower Pool 2 and O&M budget constraints the channel has become increasingly difficult to maintain to its authorized width. This is especially troublesome in the area of Pool 2 between river miles 818 to 821 where a bend in the river exists. And in fact the channel has not been maintained to its fully authorized width. Considering the size of a full 15-barge tow (approximately 105 feet across by 1200 feet long) there is little extra room to maneuver a tow through this portion of the river. This affects the towing industry by reducing the carrying capacity in this area of the channel. For the purpose of this analysis, the carrying capacity is assumed to be reduced from 15-barge tows to 12-barge tows. This assumption is supported by the local towing industry.



Figure 1 – Map of Pool 2 and Surrounding Area

Project Impacts

The channel improvement project in Pool 2 will generate impacts of three types: savings to the barge industry of tow operating costs, savings to the Coast Guard of costs to maintain aids to navigation, and increased costs to the Corps for annual maintenance dredging. These impacts represent the change in costs as a result of the project compared with those under existing conditions (No Action alternative).

Dredging cost – One of the impacts of the channel improvement project is the increase in annual maintenance dredging relative to the No Action alternative. This includes the dredging itself as well as the periodic unloading necessary to maintain capacity at the temporary placement sites. These sites are unloaded, every 10-15 years or so to accommodate future dredge material placement. Cost data used for calculation of this impact was provided by the Channels and Harbors project office. Dredging and unloading costs are based on past operations as well as projections of dredging needs for the alternative conditions. Table 1 shows expected annual dredging volumes for the different alternatives. Table 2

summarizes the annual channel maintenance costs by alternative. Note that dredging cost savings for the Boulanger Cut-off are offset by increased unloading costs in Pool 3. Each of the with-project alternatives have higher annual dredging/unloading costs than the No Action alternative resulting in an adverse impact or “disbenefit” to the project.

Table 1 - Annual Dredging Volume (cubic yards) and Costs by Scenario			
<u>Area Dredged</u>	<u>No Action</u>	<u>Boulanger Cut-off</u>	<u>Increased Channel Maint with Structure</u>
Pool 2	72,800	56,800	71,300
Pool 3	58,600	72,100	59,200
Pool 4	<u>13,200</u>	<u>14,700</u>	<u>13,700</u>
Total volume (cy)	144,600	143,600	144,200
Dredging cost/cy	\$13.00	\$13.00	\$13.00
Dredging cost	1,879,800	1,866,800	1,874,600

Table 2 - Annual Channel Maintenance Costs by Alternative			
<u>Dredging</u>	<u>No Action</u>	<u>Boulanger Cut-off</u>	<u>Increased Channel Maint with Structure</u>
Pool 2	\$ 946,400	\$ 738,400	\$ 926,900
Pool 3	761,800	937,300	769,600
Pool 4	<u>171,600</u>	<u>191,100</u>	<u>178,100</u>
	1,879,800	1,866,800	1,874,600
<u>Unloading</u>			
Pool 3	539,000	663,000	545,000
Total	2,418,800	2,529,800	2,419,600

Tow cost savings - Tow cost savings result by reducing the number of tows necessary to haul barge freight between Red Wing and St. Paul. Table 3 shows the tonnage through Lock 2 in recent years. Average tonnage from 2007 to 2016 amounts to 7,037,000 tons. Significant commodity categories include farm products, chemicals, non-metallic minerals, cement, and petroleum products. It is assumed for this analysis that this level of tonnage will continue in the future. Currently, tow size averages approximately eight barges with a maximum size no larger than 12 barges in order to transit the

currently constricted Pool 2 navigation channel. The channel improvement project will allow tows to be configured into larger 15-barge units, thus reducing the total number of tows required to haul tonnage through Pool 2. With this capability, tow size is assumed to increase from its current average of 8.1 barges to an average of 10.1 barges per tow. This represents an increase of 25%, the same percentage increase expected for maximum tow size from 12 to 15 barges. Calculation of tow cost savings is presented in Table 4. By shortening the distance through the project area by one mile, the Boulanger Cut-off generates somewhat greater benefits than the Increased Channel Maintenance alternative. Straightening the channel also allows a tow to transit this stretch of the river more quickly (6 mph versus 3 mph around the bend) and decreases the waiting time for meeting tows (1/2 hour versus 1 hour).

Table 3 - Tonnage Through Lock 2 - 2007-2016 (000 Tons)			
<u>Year</u>	<u>Upbound</u>	<u>Downbound</u>	<u>Total</u>
2016	3,817	6,382	10,199
2015	3,706	3,700	7,406
2014	3,714	3,167	6,881
2013	3,380	2,842	6,222
2012	3,167	3,729	6,896
2011	3,244	3,491	6,735
2010	2,847	4,338	7,185
2009	2,797	4,275	7,072
2008	2,962	1,767	4,729
2007	<u>2,893</u>	<u>4,149</u>	<u>7,042</u>
Average	3,253	3,784	7,037

Table 4 - Calculation of Tow Cost Savings by Alternative			
		Boulanger	Increased
<u>Item</u>	<u>No Action</u>	<u>Cut-off</u>	<u>Channel Maint</u>
Tons through Lock and Dam 2 *	7,036,700	7,036,700	7,036,700
# Barges *	6,081	6,081	6,081
# Barges per tow *	8.1	10.1	10.1
# Tows	751	602	602
Miles Red Wing to St. Paul	40	39	40
Speed in miles / hour (2)	4.5	4.5	4.5
# Hrs per tow (3)	9.31	8.71	9.31
Cost / hour - towboat	\$657.15	\$657.15	\$657.15
Cost / hour - barge	\$20.04	\$20.04	\$20.04
Cost / hr / tow (4)	\$819.47	\$859.55	\$859.55
Cost / tow/ trip (5)	\$7,629.30	\$7,486.72	\$8,002.45
Total costs / year for tows (6)	\$5,727,629	\$4,507,596	\$4,818,107
Annual benefits		\$1,220,033	\$909,521
Notes: (1) Savings between Red Wing (RW) and St. Paul (SP)			
(2) For No Action and ICM: 3 mph for 2 miles through river bend; for Boulanger cutoff; 6 mph for 1 mile			
(3) (Miles RW to SP / Speed) plus waiting time for meeting tows at Boulanger Bend of 1 hour for 20% of tows for No Action and ICM alternatives and 1/2 hr for 20% of tows for Boulanger cutoff alternative.			
(4) (Cost/hr barge x Number of Barges) + Cost/hr towboat			
(5) Cost per hr / tow x number of hrs per tow			
(6) Cost per tow x number of tows			
* Source: LPMS Lockage data			

Cost savings for maintenance of aids to navigation - A third impact of a channel improvement project is the savings to the Coast Guard of maintaining aids to navigation within the project area. The Coast Guard estimates that savings will result from a decrease in the number of buoys needed to mark the channel due to fewer incidents of damage or loss from contact with tows. Additional savings will result due to less time in which the CG vessel will be needed to perform the buoy and light maintenance operations. Annual benefits for the Boulanger Cut-off are estimated to be \$79,000 and for the Increased Channel Maintenance alternative it is estimated at \$37,000.

Project Impacts for the various alternatives are summarized in Table 5. They are derived by subtracting costs associated with the alternative from those under the No Action alternative.

Table 5 - Summary of Project Impacts					
<u>Category</u>	<u>No Action</u>	<u>Boulanger (North)</u>		<u>Increased Channel Maint with Structure</u>	
	<u>Cost</u>	<u>Cost</u>	<u>Impact</u>	<u>Cost</u>	<u>Impact</u>
Tow Costs	\$5,728,000	\$4,508,000	\$1,220,000	\$4,818,000	\$910,000
Maint Dredging	2,419,000	2,530,000	-111,000	2,420,000	-1,000
Nav Aids (USCG)	<u>120,000</u>	<u>41,000</u>	<u>79,000</u>	<u>83,000</u>	<u>37,000</u>
Total	8,267,000	7,079,000	1,188,000	7,321,000	946,000

Benefit-Cost Summary Table 6 summarizes the benefit-cost analysis. The savings in tow operating costs and in USCG aids to navigation are positive impacts and considered project benefits while the increased annual dredging costs are negative impacts and considered a project disbenefit. Total benefits are compared with project costs to derive the benefit-cost ratio and net benefits. The Increased Channel Maintenance alternative has the higher benefit-cost ratio and greater net benefits indicating it as the preferred plan for implementation based on economic criteria.

Table 6 - Benefit - Cost Summary		
<u>Category</u>	<u>Boulanger Cut-off</u>	<u>Increased Channel Maint with Structure</u>
<u>Annual Benefits</u>		
Tow Costs	-	910,000
Maintenance Dredging	1,220,000	(1,000)
Navigation Aids (USCG)	(111,000)	<u>37,000</u>
Total	<u>79,000</u>	946,000
<u>Costs</u>		
First Cost	1,188,000	9,000,000
LERRD (pipeline relocation)	14,000,000	NA
Mitigation	18,000,000	300,000
Interest During Construction	2,600,000	122,000
Total Costs	454,000	9,422,000
Average Annual		
Int & Amort factor (40 yrs @ 2.875%)	0.04239	0.04239
Int & Amort cost	1,486,000	399,000
BCR	0.80	2.37
Net Benefits	(298,000)	547,000

NOTES:

- Mitigation costs for this alternative are based on \$2,600,000 to move mussels over a 60 acre impacted area.

2. Mitigation costs of \$300,000 for this alternative are based on mussel mitigation. This alternative will impact 6 acres where an estimated $85,154 \pm 25,750$ freshwater mussels currently reside. Mussels would be translocated to a nearby area.
3. Utility relocation costs. For the Boulanger Cut-off alternative there are two Northern Natural Gas pipelines one 24 inch and the other 30 inches buried under the channel including Boulanger Slough. In order to maintain a 12 navigation channel depth, excavation would come within a few feet of the 30 inch gas line for at least half the length of the gas line and then taper down for the rest of the channel width. There is a concern with 1) safely excavating over the pipe line and 2) the buoyancy of the pipeline once the work is done and the line is placed back in operation. Per NNG they would like 15 feet of fill over their lines to counteract the buoyancy and provide protection from marine vessels. NNG estimates it would cost \$36 million to relocate both pipelines. These are large diameter pipelines and would require horizontal directional drilling (HDD) to route new pipelines 1-1/4 miles each under the Mississippi River. Utility relocations are part of the total project costs and included in Lands, Easements, Right-of-ways, Relocations and Disposals (LERRD's). The cost to relocate even one line is significant enough that this alternative is not economically justified compared to the Channel Maintenance with Structure alternative.
4. Utility relocation costs. For the Channel Maintenance with Structure alternative, there is a single 4-foot diameter HDPE Sewer outfall pipe buried approximately 10 feet under the rock sill alignment. This pipe discharges treated water from the Eagle Point Sewage treatment plant directly into the navigation channel. Presently, it is assumed that this pipe will not need to be relocated.