

# **APPENDIX G**

## **Part I**

### **LORAIN HARBOR ECONOMIC VIABILITY ANALYSIS**

## **Part II**

### **LORAIN HARBOR DMMP ECONOMIC EVALUATION OF ALTERNATIVE PLANS**

**APPENDIX G**  
**Part I**

**LORAIN HARBOR**  
**ECONOMIC VIABILITY ANALYSIS**

## **INTRODUCTION**

The Lorain Harbor Dredged Material Management Plan (DMMP) looks at developing various measures and alternatives plans that will allow continued operation and maintenance dredging of the harbor to continue for the next 20 years. The plans identify the amount of channel sediments to be dredged over the project evaluation period, disposal methods, and examines remaining CDF capacity.

In order to rank the alternative plans and determine if harbor maintenance is warranted, an economic evaluation of the viability of the harbor was completed. Data included in the economic evaluation is from the Operations and Maintenance (O&M) Lorain Harbor Economic Evaluation Report dated 2006. The project evaluation period used in O&M economic evaluations is 20 years. The project evaluation period in the 2006 report is 2006-2027 and is the period of analysis used to determine the economic viability of Lorain Harbor.

Continued maintenance of the harbor allows vessels to move commodities through the harbor at a specific transportation cost. Benefits attributable to continued maintenance of the harbor are vessel transportation cost increases avoided. Discontinued maintenance of the harbor would result in channel shoaling, increased vessel trips to move the same amount of tonnage, and thus increased transportation costs. Increase transportation cost avoided is a proxy for the value of continued harbor maintenance.

Current harbor dredging costs are calculated and subtracted from the total “Vessel Transportation Cost Increases Avoided Benefits”. This provides net benefits associated with the harbor and is used to determine the amount of new investment the harbor could support while maintaining a cost ration of one. The maximum expenditure that results from a benefit to cost ratio is compared to various harbor improvement costs to determine the economic viability of the alternative plans. Alternative plans that cost less than the maximum expenditure the harbor can support, the plan has a benefit to cost ratio greater than one and is economically justified. Alternative plans with a benefit to cost ration less than one are not economically justified.

## **HARBOR TONNAGES**

Total tonnages moving through the harbor in 2005 was 3,055,000. The major commodities that made up 89.5 percent of the tonnages include: iron ore (1,487,000), limestone (968,500), gypsum (193,300), coal (44,600), and salt (40,300). These commodities were used to develop net benefits associated with continued maintenance of the harbor. The actual vessels used to move these commodities and the origin/destination routes were identified (Table 1).

**Table 1- Lorain Harbor Tonnages –Origin Destinations- 2005**

<b>Commodity</b>	<b>Origin Port</b>	<b>Destination Port</b>	<b>Short Tons</b>
<b>Iron Ore</b>			
	Lorain Oh	Indiana harbor	10,005
	Lorain Oh	Burns Harbor	17,931
	Superior Wis.	Lorain Oh	34,723
	Duluth, MN	Lorain Oh	443,828
	Two Harbors	Lorain Oh	980,580
			-----
	Total		1,487,067
			-
<b>Limestone</b>			
	Spragge Ont	Lorain	76,658
	Lake Erie Ont	Lorain	27,093
	Kellys Island	Lorain	10,012
	Marblehead, O	Lorain	812,975
	Stoneport, Mi.	Lorain	41,732
			-----
	Total		968,470
			-
<b>Gypsum</b>			
	Port Gypsum, I	Lorain Harbor	193,330
			-
<b>Coal</b>			
	Lorain Harbor	St Lawrence River	34,713
	Hamilton, Ont.	Lorain	9,911
			-----
	Total		44,624
			-
<b>Salt</b>			
	Goderich Ont.	Lorain Harbor	40,313
			-
	<b>Total Harbor Tonnages</b>		<b>2,733,804</b>

There have been major changes in tonnages moving through Lorain Harbor since 2001. The majority of the iron ore historically received at Lorain Harbor (about 70 percent) is now received at an integrated steel mill located on the Cuyahoga River in Cleveland Harbor Ohio. In 2003, the Lorain pellet terminal transshipment facility was purchased by the Cleveland mill and all operations were relocated to Cleveland Harbor. Total tonnages moving through the harbor fell to three million tons in 2005. The tonnages in the economic evaluation reflect the loss of the outer harbor iron ore transshipment facility and reduced levels of iron ore and limestone needs at the current ICH steel making facilities at Lorain Harbor.

## **VESSEL TRANSPORTATION COSTS BY CHANNEL DEPTH**

There were around 300 commercial vessel movements (inbound and outbound) in 2005. Approximately 75 percent of the inbound vessel movements drafted 23 feet or greater. The same level of vessel activity is expected to continue during the project evaluation period.

These tonnages and corresponding vessel movements were used to develop vessel transportation costs associated with various harbor channel depths. A computer model developed by USACE, Buffalo District calculated increases in vessel transportation costs for each vessel movement given reductions in channel depth. The analysis is done in one foot increments to a maximum decrease in channel depth of six feet. Transportation costs associated with these various channel depths are provided in Table 2.

## **AVERAGE ANNUAL HARBOR BENEFITS**

Benefits for this evaluation are the transportation cost increases avoided, by continuing to maintain the harbor channels over a 20 year period. Table 2 calculates the average annual transportation costs associated with channel depths ranging from 21 to 27 feet. The average annual transportation costs to maintain the authorized channel depth of 27 feet is \$13,582,048.

The time streams were converted to average annual values using a 20 year project life and a 4.875% annual interest rate (Table 3). Table 4 presents a summary of average annual transportation costs during the 20 year evaluation period if dredging were to cease. The total average annual vessel transportation costs associated with not maintaining the harbor over a 20 year evaluation period is \$15,802,700.

Total average annual harbor transportation benefits, for the five key commodities by origin/destination pairs, is the difference between average annual transportation costs associated with not maintaining the harbor (\$15,802,700) and average annual transportation costs associated with maintaining current harbor depths of 27 feet (\$13,582,000). Total average annual harbor transportation benefits are \$2,220,700 (Table 5).

**Table 2. Lorain Harbor- Vessel Transportation Costs By Channel Depth**

Commodity	Origin Port	Destination Port	Maintained						
			Channel Depth 27	Channel Depth 26	Channel Depth 25	Channel Depth 24	Channel Depth 23	Channel Depth 22	Channel Depth 21
<b>Iron Ore</b>									
	Lorain Oh	Indiana harbor	\$ 60,254	\$ 60,335	\$ 61,178	\$ 63,651	\$ 67,071	\$ 70,925	\$ 75,251
	Lorain Oh	Burns Harbor	\$ 161,474	\$ 164,145	\$ 171,558	\$ 180,269	\$ 189,988	\$ 200,903	\$ 213,236
	Superior Wis.	Lorain Oh	\$ 257,703	\$ 259,616	\$ 269,608	\$ 283,367	\$ 298,441	\$ 315,150	\$ 333,952
	Duluth, MN	Lorain Oh	\$ 3,074,299	\$ 3,080,509	\$ 3,128,045	\$ 3,254,466	\$ 3,424,882	\$ 3,612,208	\$ 3,819,435
	Two Harbors	Lorain Oh	\$ 6,555,847	\$ 6,593,141	\$ 6,793,943	\$ 7,141,356	\$ 7,562,026	\$ 8,017,494	\$ 8,523,499
	<b>Total</b>		<b>\$10,109,577</b>	<b>\$10,157,746</b>	<b>\$10,424,332</b>	<b>\$10,923,109</b>	<b>\$11,542,408</b>	<b>\$12,216,680</b>	<b>\$12,965,373</b>
<b>Limestone</b>									
	Spragge Ont	Lorain	\$ 208,787	\$ 211,026	\$ 217,152	\$ 227,649	\$ 240,949	\$ 256,217	\$ 273,502
	Lake Erie Ont	Lorain	\$ 53,365	\$ 53,918	\$ 55,339	\$ 57,744	\$ 60,751	\$ 64,213	\$ 68,439
	Kellys Island	Lorain	\$ 40,935	\$ 40,935	\$ 40,935	\$ 40,935	\$ 40,935	\$ 40,935	\$ 40,935
	Marblehead, O	Lorain	\$ 1,648,422	\$ 1,648,422	\$ 1,648,422	\$ 1,671,002	\$ 1,704,425	\$ 1,746,935	\$ 1,797,048
	Stoneport, Mi.	Lorain	\$ 137,649	\$ 137,800	\$ 138,981	\$ 142,230	\$ 146,998	\$ 152,986	\$ 160,258
	<b>Total</b>		<b>\$ 2,089,158</b>	<b>\$ 2,092,101</b>	<b>\$ 2,100,829</b>	<b>\$ 2,139,560</b>	<b>\$ 2,194,058</b>	<b>\$ 2,261,286</b>	<b>\$ 2,340,182</b>
<b>Gypsum</b>									
	Port Gypsum, I	Lorain Harbor	\$ 1,080,104	\$ 1,080,104	\$ 1,080,104	\$ 1,080,104	\$ 1,080,104	\$ 1,080,104	\$ 1,080,356
<b>Coal</b>									
	Lorain Harbor	St Lawrence River	\$ 159,294	\$ 160,633	\$ 164,244	\$ 170,534	\$ 178,481	\$ 187,484	\$ 197,551
	Hamilton, Ont.	Lorain	\$ 35,431	\$ 35,747	\$ 36,628	\$ 38,179	\$ 40,155	\$ 42,396	\$ 44,903
	<b>Total</b>		<b>\$ 194,725</b>	<b>\$ 196,380</b>	<b>\$ 200,872</b>	<b>\$ 208,713</b>	<b>\$ 218,636</b>	<b>\$ 229,880</b>	<b>\$ 242,454</b>
<b>Salt</b>									
	Goderich Ont.	Lorain Harbor	\$ 108,484	\$ 109,804	\$ 113,787	\$ 119,477	\$ 125,943	\$ 132,640	\$ 139,321
<b>Total Harbor WP Transportation Costs</b>			<b>\$13,582,048</b>	<b>\$13,636,135</b>	<b>\$13,919,924</b>	<b>\$14,470,963</b>	<b>\$15,161,149</b>	<b>\$15,920,590</b>	<b>\$16,767,686</b>

**Table 3- Average Annual WOP Transportation Costs -Iron Ore**

**WOP Condition Transportation Costs**

**1. Iron Ore- Duluth Mn.**

Iron Ore moving from Duluth Mn. to Lorain is received at ICH Docks  
The WOP condition assumes a 1.0 foot per year shoaling rate. Channel depths are allowed to shoal up to a 21 foot channel depth. Transportation costs are kept constant thereafter. The Starting Channel Depth is 27 feet.

Project Year	Channel Depth	Iron Ore Transportation Costs	Present worth Factor	Present worth value
1	27	\$ 3,074,299	0.95352	\$ 2,931,393
2	26	\$ 3,080,509	0.90919	\$ 2,800,777
3	25	\$ 3,128,045	0.86693	\$ 2,711,796
4	24	\$ 3,254,466	0.82663	\$ 2,690,245
5	23	\$ 3,424,882	0.78821	\$ 2,699,515
6	22	\$ 3,612,208	0.75157	\$ 2,714,819
7	21	\$ 3,819,435	0.71663	\$ 2,737,129
8	21	\$ 3,819,435	0.68332	\$ 2,609,897
9	21	\$ 3,819,435	0.65156	\$ 2,488,579
10	21	\$ 3,819,435	0.62127	\$ 2,372,900
11	21	\$ 3,819,435	0.59239	\$ 2,262,598
12	21	\$ 3,819,435	0.56485	\$ 2,157,424
13	21	\$ 3,819,435	0.53860	\$ 2,057,138
14	21	\$ 3,819,435	0.51356	\$ 1,961,514
15	21	\$ 3,819,435	0.48969	\$ 1,870,335
16	21	\$ 3,819,435	0.46693	\$ 1,783,395
17	21	\$ 3,819,435	0.44522	\$ 1,700,496
18	21	\$ 3,819,435	0.42453	\$ 1,621,450
19	21	\$ 3,819,435	0.40479	\$ 1,546,079
20	21	\$ 3,819,435	0.38598	\$ 1,474,211
				\$ 45,191,691
Partial Payment				0.079394
Avg Annual costs				\$ 3,587,963
Rounded				\$ 3,588,000

**WOP Condition Transportation Costs**

**2. Iron Ore - Lorain**

Iron Ore moving from Lorain to Indiana Harbor  
The WOP condition assumes a 1.0 foot per year shoaling rate. Channel depths are allowed to shoal up to a 21 foot channel depth. Transportation costs are kept constant thereafter. The Starting Channel Depth is 27 feet.

Project Year	Channel Depth	Iron Ore Transportation Costs	Present worth Factor	Present worth value
1	27	\$ 60,254	0.95352	\$ 57,453
2	26	\$ 60,335	0.90919	\$ 54,856
3	25	\$ 61,178	0.86693	\$ 53,037
4	24	\$ 63,651	0.82663	\$ 52,616
5	23	\$ 67,071	0.78821	\$ 52,866
6	22	\$ 70,925	0.75157	\$ 53,305
7	21	\$ 75,251	0.71663	\$ 53,927
8	21	\$ 75,251	0.68332	\$ 51,421
9	21	\$ 75,251	0.65156	\$ 49,030
10	21	\$ 75,251	0.62127	\$ 46,751
11	21	\$ 75,251	0.59239	\$ 44,578
12	21	\$ 75,251	0.56485	\$ 42,506
13	21	\$ 75,251	0.53860	\$ 40,530
14	21	\$ 75,251	0.51356	\$ 38,646
15	21	\$ 75,251	0.48969	\$ 36,850
16	21	\$ 75,251	0.46693	\$ 35,137
17	21	\$ 75,251	0.44522	\$ 33,503
18	21	\$ 75,251	0.42453	\$ 31,946
19	21	\$ 75,251	0.40479	\$ 30,461
20	21	\$ 75,251	0.38598	\$ 29,045
				\$ 888,464
Partial Payment				0.079394
Avg Annual costs				\$ 70,539
Rounded				\$ 70,500

**WOP Condition Transportation Costs**

**3. Iron Ore - Lorain**

Iron Ore moving from Lorain to Burns Waterway  
The WOP condition assumes a 1.0 foot per year shoaling rate. Channel depths are allowed to shoal up to a 21 foot channel depth. Transportation costs are kept constant thereafter. The Starting Channel Depth is 27 feet.

Project Year	Channel Depth	Iron Ore Transportation Costs	Present worth Factor	Present worth value
1	27	\$ 161,474	0.95352	\$ 153,968
2	26	\$ 164,145	0.90919	\$ 149,239
3	25	\$ 171,558	0.86693	\$ 148,729
4	24	\$ 180,269	0.82663	\$ 149,016
5	23	\$ 189,988	0.78821	\$ 149,750
6	22	\$ 200,903	0.75157	\$ 150,992
7	21	\$ 213,236	0.71663	\$ 152,812
8	21	\$ 213,236	0.68332	\$ 145,708
9	21	\$ 213,236	0.65156	\$ 138,935
10	21	\$ 213,236	0.62127	\$ 132,477
11	21	\$ 213,236	0.59239	\$ 126,319
12	21	\$ 213,236	0.56485	\$ 120,447
13	21	\$ 213,236	0.53860	\$ 114,848
14	21	\$ 213,236	0.51356	\$ 109,510
15	21	\$ 213,236	0.48969	\$ 104,419
16	21	\$ 213,236	0.46693	\$ 99,566
17	21	\$ 213,236	0.44522	\$ 94,937
18	21	\$ 213,236	0.42453	\$ 90,524
19	21	\$ 213,236	0.40479	\$ 86,316
20	21	\$ 213,236	0.38598	\$ 82,304
				\$ 2,500,818
Partial Payment				0.079394
Avg Annual costs				\$ 198,551
Rounded				\$ 198,600

**Table 3- Average Annual WOP Transportation Costs -Iron Ore- Continued**

**WOP Condition Transportation Costs**

**4. Iron Ore- Two Harbors**

Iron Ore moving from Two Harbors to Lorain is received at ICH Docks  
 The WOP condition assumes a 1.0 foot per year shoaling rate. Channel depths are allowed to shoal up to a 21 foot channel depth. Transportation costs are kept constant thereafter. The Starting Channel Depth is 27 feet.

Project Year	Channel Depth	Iron Ore Transportation Costs	Present worth Factor	Present worth value
1	27	\$ 6,555,847	0.95352	\$ 6,251,106
2	26	\$ 6,593,141	0.90919	\$ 5,994,437
3	25	\$ 6,793,943	0.86693	\$ 5,889,874
4	24	\$ 7,141,356	0.82663	\$ 5,903,272
5	23	\$ 7,562,026	0.78821	\$ 5,960,440
6	22	\$ 8,017,494	0.75157	\$ 6,025,690
7	21	\$ 8,523,499	0.71663	\$ 6,108,212
8	21	\$ 8,523,499	0.68332	\$ 5,824,278
9	21	\$ 8,523,499	0.65156	\$ 5,553,543
10	21	\$ 8,523,499	0.62127	\$ 5,295,393
11	21	\$ 8,523,499	0.59239	\$ 5,049,242
12	21	\$ 8,523,499	0.56485	\$ 4,814,534
13	21	\$ 8,523,499	0.53860	\$ 4,590,735
14	21	\$ 8,523,499	0.51356	\$ 4,377,340
15	21	\$ 8,523,499	0.48969	\$ 4,173,864
16	21	\$ 8,523,499	0.46693	\$ 3,979,847
17	21	\$ 8,523,499	0.44522	\$ 3,794,848
18	21	\$ 8,523,499	0.42453	\$ 3,618,448
19	21	\$ 8,523,499	0.40479	\$ 3,450,249
20	21	\$ 8,523,499	0.38598	\$ 3,289,868
				-----
				\$ 99,945,219
Partial Payment				0.079394
Avg Annual costs				\$ 7,935,082
Rounded				\$ 7,935,100

**WOP Condition Transportation Costs**

**5. Iron Ore- Superior**

Iron Ore moving from Superior to Lorain is received at ICH Docks  
 The WOP condition assumes a 1.0 foot per year shoaling rate. Channel depths are allowed to shoal up to a 21 foot channel depth. Transportation costs are kept constant thereafter. The Starting Channel Depth is 27 feet.

Project Year	Channel Depth	Iron Ore Transportation Costs	Present worth Factor	Present worth value
1	27	\$ 257,703	0.95352	\$ 245,724
2	26	\$ 259,616	0.90919	\$ 236,041
3	25	\$ 269,608	0.86693	\$ 233,731
4	24	\$ 283,367	0.82663	\$ 234,240
5	23	\$ 298,441	0.78821	\$ 235,233
6	22	\$ 315,150	0.75157	\$ 236,857
7	21	\$ 333,952	0.71663	\$ 239,321
8	21	\$ 333,952	0.68332	\$ 228,196
9	21	\$ 333,952	0.65156	\$ 217,589
10	21	\$ 333,952	0.62127	\$ 207,474
11	21	\$ 333,952	0.59239	\$ 197,830
12	21	\$ 333,952	0.56485	\$ 188,634
13	21	\$ 333,952	0.53860	\$ 179,866
14	21	\$ 333,952	0.51356	\$ 171,505
15	21	\$ 333,952	0.48969	\$ 163,533
16	21	\$ 333,952	0.46693	\$ 155,931
17	21	\$ 333,952	0.44522	\$ 148,683
18	21	\$ 333,952	0.42453	\$ 141,771
19	21	\$ 333,952	0.40479	\$ 135,181
20	21	\$ 333,952	0.38598	\$ 128,898
				-----
				\$ 3,926,237
Partial Payment				0.079394
Avg Annual costs				\$ 311,721
Rounded				\$ 311,700

**Table 4- Average Annual WOP Condition Transportation Costs- All Commodities**

<b>Commodity</b>	<b>Origin Port</b>	<b>Destination Port</b>	<b>WOP Condition AA Transportation Cost</b>
<b>Iron Ore</b>			
	Lorain Oh	Indiana harbor	\$ 70,500
	Lorain Oh	Burns Harbor	\$ 198,600
	Superior Wis.	Lorain Oh	\$ 311,700
	Duluth, MN	Lorain Oh	\$ 3,588,000
	Two Harbors	Lorain Oh	\$ 7,935,100
			-----
	Total		\$ 12,103,900
<b>Limestone</b>			
	Spragge Ont	Lorain	\$ 254,100
	Lake Erie Ont	Lorain	\$ 63,900
	Kellys Island	Lorain	\$ 40,900
	Marblehead, O	Lorain	\$ 1,747,800
	Stoneport, Mi.	Lorain	\$ 153,000
			-----
	Total		\$ 2,259,700
<b>Gypsum</b>			
	Port Gypsum,	Lorain Harbor	\$ 1,080,300
<b>Coal</b>			
	Lorain Harbor	St Lawrence Riv	\$ 186,100
	Hamilton, Ont.	Lorain	\$ 42,100
			-----
	Total		\$ 228,200
<b>Salt</b>			
	Goderich Ont.	Lorain Harbor	\$ 130,600
<b>Total Harbor WOP Transportation Costs</b>			<b>\$ 15,802,700</b>

**Table 5- Total Average Annual Harbor Transportation Benefits**

Commodity	Origin Port	Destination Port	WOP	WP	Total
			Condition AA Transportation Cost	Condition AA Transportation Cost	AA Transportation Benefits
<b>Iron Ore</b>					
	Lorain Oh	Indiana harbor	\$ 70,500	\$ 60,300	\$ 10,200
	Lorain Oh	Burns Harbor	\$ 198,600	\$ 161,500	\$ 37,100
	Superior Wis.	Lorain Oh	\$ 311,700	\$ 257,700	\$ 54,000
	Duluth, MN	Lorain Oh	\$ 3,588,000	\$ 3,074,300	\$ 513,700
	Two Harbors	Lorain Oh	\$ 7,935,100	\$ 6,555,800	\$ 1,379,300
	Total		\$ 12,103,900	\$ 10,109,600	\$ 1,994,300
<b>Limestone</b>					
	Spragge Ont	Lorain	\$ 254,100	\$ 208,800	\$ 45,300
	Lake Erie Ont	Lorain	\$ 63,900	\$ 53,400	\$ 10,500
	Kellys Island	Lorain	\$ 40,900	\$ 40,900	\$ -
	Marblehead, Oh	Lorain	\$ 1,747,800	\$ 1,648,400	\$ 99,400
	Stoneport, Mi.	Lorain	\$ 153,000	\$ 137,600	\$ 15,400
	Total		\$ 2,259,700	\$ 2,089,200	\$ 170,600
<b>Gypsum</b>					
	Port Gypsum, Mi	Lorain Harbor	\$ 1,080,300	\$ 1,080,100	\$ 200
<b>Coal</b>					
	Lorain Harbor	St Lawrence River	\$ 186,100	\$ 159,300	\$ 26,800
	Hamilton, Ont.	Lorain	\$ 42,100	\$ 35,400	\$ 6,700
	Total		\$ 228,200	\$ 194,700	\$ 33,500
<b>Salt</b>					
	Goderich Ont.	Lorain Harbor	\$ 130,600	\$ 108,500	\$ 22,100
<b>Total Harbor WOP Transportation Costs</b>			\$ 15,802,700	\$ 13,582,000	\$ 2,220,700

**NET HARBOR BENEFITS**

Average annual dredging costs were subtracted from total harbor transportation benefits to arrive at net harbor benefits. Average annual dredging costs were calculated assuming 150,000 cubic yards of sediment are dredged every other year. Biennial dredging costs include Engineering and Design (E&D), Supervision and Administration (S&A), and management of E&D. These costs were placed into a 20 year time stream and converted to an average annual dollar value of \$541,300, using a 4.875 percent annual interest rate (Table 6). Average annual harbor dredging costs (\$541,300) were subtracted from total average annual harbor benefits (\$2,220,700) to calculate the average annual net benefits of \$1,679,400.

**Table 6- Average Annual Harbor Dredging Costs**

**Dredging costs Per Dredging Event**

Dredging Cycle Once every two years

Cost Per Dredging Event

Cubic Yards Removed Per Cycle		150,000
\$/cubic Yard for removal	\$	5.50
Dredging costs	\$	825,000
E&D and S&A	\$	82,500
Total Variable Costs	\$	907,500
Management of Engineering&Design	\$	150,000
Total Dredging Costs Per Event	\$	1,057,500

**Average Annual Dredging Costs- 27- Ft Channel Depth**

Project Year	Channel Depth	Dredging Costs	Present worth Factor	Present worth value
1	27	\$ 1,057,500	0.95352	\$ 1,008,343
2	27	\$ -	0.90919	\$ -
3	27	\$ 1,057,500	0.86693	\$ 916,779
4	27	\$ -	0.82663	\$ -
5	27	\$ 1,057,500	0.78821	\$ 833,529
6	27	\$ -	0.75157	\$ -
7	27	\$ 1,057,500	0.71663	\$ 757,838
8	27	\$ -	0.68332	\$ -
9	27	\$ 1,057,500	0.65156	\$ 689,021
10	27	\$ -	0.62127	\$ -
11	27	\$ 1,057,500	0.59239	\$ 626,453
12	27	\$ -	0.56485	\$ -
13	27	\$ 1,057,500	0.53860	\$ 569,567
14	27	\$ -	0.51356	\$ -
15	27	\$ 1,057,500	0.48969	\$ 517,846
16	27	\$ -	0.46693	\$ -
17	27	\$ 1,057,500	0.44522	\$ 470,822
18	27	\$ -	0.42453	\$ -
19	27	\$ 1,057,500	0.40479	\$ 428,068
20	27		0.38598	\$ -
				-----
Present Worth Of Harbor Dredging Over 20 years				\$ 6,818,266
Partial Payment				0.079394
Avg Annual costs				\$ 541,332
Rounded Avg Annual costs				\$ 541,300

Net benefits were converted to equivalent first costs to identify the cost of improvement projects economically justified at Lorain Harbor (Table 7).

**Table 7- Viable Project Improvement Costs**

Plan Depth	Shoaling Rate Per Year	Total Average Annual Harbor Benefits	Average Annual Dredging Costs	Net Average Annual Benefits	Present Worth Of 1\$/Period	Coverable Project Costs
27	1.0 Ft.	\$2,220,700	\$541,300	\$1,679,400	12.59536	\$21,152,600

**LORAIN HARBOR BREAKWATER MAINTENANCE COSTS**

Lorain Harbor breakwater maintenance costs were not included in the economic evaluation of the plans because major rehabilitation of the Lorain Harbor breakwater system was completed in 2003. The expected project life of the repairs is 30 years. Therefore, the next scheduled O&M activity on the breakwaters would occur after the study period end date of 2028.

**APPENDIX G**  
**Part II**

**LORAIN HARBOR DMMP**  
**ECONOMIC EVALUATION OF ALTERNATIVE**  
**PLANS**

## Economic Evaluation of Alternative Plans

### Alternative Plan Components

The DMMP identified 10 alternative management measures that could be implemented to meet some or all of the objectives of the study. These management measures were described in Chapter 2, paragraph 2.31 of the Main Report. These measures were evaluated with respect to meeting Planning Objectives in Table 2.3 of the Main Report. Five measures were identified that would be carried into detailed planning. These five measures were:

1. Measure A- No Action
2. Measure B5 – Brownfields Restoration-RT-2 (Coke Plant) Site
3. Measure C -Open-Lake Placement
4. Measure D- Construction of a New CDF
5. Measure E- Management of the Existing CDF to Extend Its Useful Life (FMP)

The five measures carried forward to detailed planning were used to develop a range of plans that would allow the harbor to be maintained over the 20 year evaluation period 2009-2028. Four plans were developed using these five measures. (Table A).

**Table A Alternative Plans Evaluated- Plan Components**

	(A) No Action	(B5) Beneficial Use – Brownfields Restoration	(C) Open Lake Placement	(D) New CDF	(E) Fill Mgmt Plan at Existing CDF
<b>Alternative 1</b> (Open Lake Placement, new CDF, FMP)			X	X	X
<b>Alternative 2</b> (Brownfields Restoration, FMP)		X			X
<b>Alternative 3</b> (Brownfields Restoration, Open Lake Placement, FMP)		X	X		X
<b>Alternative 4</b> (No Action)	X				

The four alternative plans are: Alternative 1- Open Lake Placement, New CDF, Fill Management Plan; Alternative 2- Brownfield Restoration, Fill Management Plan; Alternative 3- Brownfield Restoration, Open Lake Placement, Fill Management Plan; and Alternative 4, No Action. Each alternative Plan assumes the need to dredge 150,000 cubic yards of sediment once every other year.

The first 3 alternative plans each have a common component, Measure E- implementing a Fill Management Plan (FMP) at Lorain's existing CDF in the Outer Harbor. This measure will provide interim capacity for dredged sediments from 2007 through 2012. This measure involves three phases to be implemented in 2007, 2009, and 2011. Each phase includes grading existing dredged material within the current Outer Harbor CDF to create four to six foot perimeter lifts (i.e. berms). Each phase will provide additional capacity of approximately 150,000 cubic yards. The anticipated cost per lift is \$231,800. The first perimeter lift was completed in 2007 to accommodate dredging in Fiscal Year 2008. Two more perimeter lifts are scheduled during the project evaluation period (2009-2028). These lifts will take place in 2009 and 2011 and provide space for sediments dredged in 2010 and 2012 that require placement in a CDF.

Incorporation of Measure E into the Alternative Plans will allow sufficient time for planning and construction of the various disposal components of the alternative plans. Table A presents the components of the four plans that will be evaluated in detail. These plans are presented in detail in Section 2.13 of the Main Report. A brief summary of the four plans and their components follows.

### **Alternative Plan Descriptions**

**Alternative Plan 1- Open Lake Placement, New CDF, Fill Management Plan** - Plan 1 includes implementation of the FMP from 2009 through 2013, open lake placement of sediments dredged from the river mouth to river mile 2 plus 1,400 feet, and construction of a new CDF along the north side of the outer breakwater. Implementation of the FMP component at the current CDF will allow sufficient time for planning and construction of the new CDF. Open lake placement of 102,000 cubic yards would accommodate sixty eight percent of the total 150,000 cubic yards of sediment dredged during the dredging cycle. Costs associated with placing sediment in the open lake are approximately \$769,100 per dredging event. The remaining thirty two percent (48,000 cubic yards) would be placed in the new CDF. Costs associated with putting the remaining sediments into the outer harbor CDF are approximately \$510,000 per dredging event. Total dredging costs per dredging event is \$1,279,100. Construction of the new CDF would take place in approximately twenty to twenty six feet of water, be constructed over a three year period (2011, 2012, 2013), provide approximately one million cubic yards of capacity and cost \$31.9 million. Plan implementation costs in current dollars are \$50,149,800. The CDF capacity has been sized to accept all sediment dredged from the Federal channels from 2014-2028 in the event OEPA amends Section 401 Water Quality Guidelines within the study period to eliminate open lake placement.

**Alternative Plan 2- Brownfields Restoration And Fill Management Plan** - Plan 2 includes implementation of the FMP from 2009 through 2013, and usage of sediment generated from 2013 -2028 for Brownfields restoration. Implementation of the FMP component at the current CDF will allow sufficient time for planning and construction of the Brownfields restoration project. The Brownfield's Restoration Project is a beneficial use measure and would be located at RT-2. RT-2 is a 130 acre site located above the left bank of the Black River on the turning basin at the upstream end of the Federal channel. The property is the former site of a RTI coke plant and has been designated for Brownfield redevelopment. The 130 acre site is a viable

location for constructing a fifteen year capacity CDF and this use is consistent with the City of Lorain Master Plan for Brownfields redevelopment. All sediment removed during a dredging event would either be placed in the current CDF (2009-2013) or at the Brownfield Restoration site (2014 to 2028). Dredging costs per dredging event from 2009-2013 are estimated at \$1,434,500. Dredging costs per dredging event from 2014-2028 are estimated at \$1,523,600. Construction would take place over a two year period (2012-2013) and cost \$6.4 million. Plan implementation costs in current dollars are \$24,494,300.

### **Alternative Plan 3- Brownfields Restoration, Open Lake Placement And Fill**

**Management Plan** - Plan 3 includes implementation of the FMP from 2009 through 2013, open lake placement of sediments dredged from the river mouth to river mile 2 plus 1,400 feet, and usage of sediment generated from 2014 -2028 for Brownfields restoration. Implementation of the FMP component at the current CDF will allow sufficient time for planning and construction of the Brownfields restoration project. The Brownfield's Restoration Project is a beneficial use measure that would be located at RT-2. RT-2 is a 130 acre site located above the left bank of the Black River on the turning basin at the upstream end of the Federal channel. The property is the former site of RTI coke plant and has been designated for Brownfields redevelopment. The 130 acre site is a viable location for constructing a fifteen year capacity CDF and this use is consistent with the City of Lorain Master Plan for Brownfield's redevelopment. The sediment removed during a dredging cycle that meets federal open lake placement standards, would be placed in the open lake. All other sediment would be placed either at the existing CDF or the Brownfields restoration site. Open lake placement costs for 102,000 cubic yards are approximately \$769,100 per dredging event. Placement of sediment at the existing CDF (approximately 48,000 cubic yards per dredging cycle) is approximately \$510,000 per dredging event. Costs associated with putting the same amount of sediments at the brownfield restoration site are \$538,500. Total dredging costs per dredging event during the 2009-2013 period are \$1,279,100. Total dredging costs per dredging event during the 2014-2028 period are \$1,307,600. Construction would take place over a two year period (2012-2013) and cost \$6.4 million. Plan implementation costs in current dollars are \$22,456,300. RT-2 has the capacity to accept all sediment dredged from the Federal channels from 2014-2028 in the event OEPA amends Section 401 Water Quality Guidelines within the study period to eliminate open lake placement.

**Alternative Plan 4 No action** – Under the No Action plan, all expenditures associated with dredging would cease in project year one, 2009. Future sediments deposited in commercial navigation channels from shoaling over the twenty year evaluation period (2009-2028) would not be dredged and would result in reduced channel depths for commercial vessels. Since dredging would cease in Project year 1, there would also be no Fill Management Plan costs during the project evaluation period.

### **Alternative Plan Dredging Costs**

**Introduction** Dredging costs per dredging event were calculated for each alternative. There are a number of pieces of information that need to be known before dredging costs can be calculated. These include, frequency of dredging, cubic yards removed per cycle, the quality of

the sediments and location of disposal sites (CDF / Open Lake). Once this information is known, fixed and variable costs for dredging associated with the various plans, can be calculated.

**Dredging Frequency, Cubic Yards Removed Per Dredging Event, Sediment Quality**

Lorain harbor has been characteristically dredged on an every other year basis. Dredging every other year is assumed in this evaluation. During the 20 year project evaluation period (2009-2028) 10 dredging cycles are assumed to take place: 2010, 2012, 2014, 2016, 2018, 2020, 2022, 2024, 2026, and 2028.

Cubic yards removed per dredging event from 1992-2002 indicate that approximately 150,000 cubic yards are dredged per dredging event (Table B). The cubic yards dredged during this time frame are considered to be representative of the cubic yards that will be dredged per dredging event over the project evaluation period, 2009-2028.

**Table B. Lorain Harbor- Recent Dredging History (Cubic Yards per Year)**

Years In Which Dredging took Place						Disposal Site
1992	1995	1996	1998	2000	Average	
172,756	179,539	152,425	165,000	62,000	146,344	CDF

Since 1979, all dredged material from the harbor has been classified as unsuitable for open-lake disposal and has been discharged into the CDF at Lorain Harbor. The CDF is located adjacent to the east breakwater shore arm. Recent sediment test results indicate that the material from the Outer Harbor meets Federal water quality standards and is suitable for open-lake disposal. Based on 2005/06 sediment analysis of sediment dredged from the Federal navigation channels, outer harbor sediment and Black River sediments lakeward from station 143+47 currently meet the Federal guidelines for open lake placement. Approximately 102,000 cubic yards would be dredged from this area during a dredging event. Approximately 48,000 cubic yards of sediment would be removed upstream of this location during a typical dredging event and would require placement in a confined disposal facility. This analysis assumes 102,000 cubic yards will be placed in the open lake, and 48,000 cubic yards would be placed in a confined disposal area per dredging event. The open lake disposal site is a 960 acre facility located 3.5 miles northwest of the west breakwater light. The sediment will be placed in the southern two-thirds (640 acres) of the site.

**Dredging Costs Per Dredging Event** The cost of dredging at any one time is a function of the dredging event’s variable and fixed costs. The variable costs of dredging are the product of an estimated cost per cubic yard of material projected to be removed and an estimated volume. Cost Estimating has provided the cost per cubic yard for placement of sediment either at the open lake disposal site or the various confined disposal locations associated with various plans. Fixed costs consist of mobilization and demobilization costs, Engineering & Design (E&D) and Supervision and Administration (S&A) costs. Table C provides a summary of dredging costs, by disposal/placement location.

**Table C. Dredging Costs By Disposal Location, By Alternative, By Project Evaluation Year**

		Existing		Existing	All To	CDF
	Open Lake	CDF	Total	CDF Only	RTI	Sediments To
					Site Only	RTI Site
Cubic Yards Removed	102,000	48,000		150,000	150,000	48,000
Cost/Cubic Yard	\$ 5.50	\$ 7.33		\$ 7.33	\$ 7.87	\$ 7.87
Variable Costs	\$ 561,000	\$ 351,840	\$ 912,840	\$ 1,099,500	\$ 1,180,500	\$ 377,760
E&D and S&A	0.1 \$ 56,100	\$ 35,184	\$ 91,284	\$ 109,950	\$ 118,050	\$ 37,776
Total Variable Costs	\$ 617,100	\$ 387,024	\$ 1,004,124	\$ 1,209,450	\$ 1,298,550	\$ 415,536
Management of Engineering&Design	\$ 102,000	\$ 48,000	\$ 150,000	\$ 150,000	\$ 150,000	\$ 48,000
Mob Demob Costs	\$ 50,000	\$ 75,000	\$ 125,000	\$ 75,000	\$ 75,000	\$ 75,000
	-----	-----	-----	-----	-----	-----
Total Dredging Costs Per Disposal Site	\$ 769,100	\$ 510,024	\$ 1,279,124	\$ 1,434,450	\$ 1,523,550	\$ 538,536

The information in Table C was used to develop dredging costs per dredging event for each of the plans evaluated, over the project evaluation period. These dredging costs per dredging cycle, by alternative, are summarized in Table D. These dredging costs per dredging cycle were then placed into a time stream. The time stream of dredging costs was used as inputs to calculating Average annual implementation costs associated with the plans evaluated.

**Development of Plan Implementation Average Annual Costs**

The alternative plan description identifies the year when various major expenditures would take place over the 20 year planning evaluation period. These major expenditures included dredging costs, implementing the Fill Management Plan, and new disposal site implementation costs (real estate, engineering and design, plans and specs, construction costs, etc). “Other Recurring Costs” were also identified as well as the frequency of their occurrence. “Other Recurring Costs” include such items as sediment consolidation practices, harbor facility condition inspections/facility surveys, channel soundings, sediment sampling, periodic performance of baseline environmental, economic, and real estate studies, and active solicitation of sediment recycling and beneficial use projects.

Plan costs were developed for each year of the 20 year project evaluation period for each Plan under With Project conditions. These expenditure time streams are provided in Table E for each of the alternative Plans evaluated. Table E also provides the time stream of costs associated with the Base Plan. These time streams of costs were then brought back to their present worth values using the current Federal discount rate of 4.875%. Table F provides a summary of this procedure.

These present worth values for the various plans represent an estimate of Project Implementation Costs. Interest During Construction was added to Project Implementation Costs to calculate Investment Costs. Since project benefits accrue immediately at project year one, there is no Interest During Construction costs for these alternatives. Total Investment Costs were converted to an average annual basis using the current water resources Federal discount rate of 4.875%, based on a 20 year project life. Annual maintenance costs were calculated as a Percentage of Contractors Earnings and Contingencies. Table G provides Average Annual Costs by Alternative Plan.

**Table D.- Dredging Costs Per Cycle By Alternative, By Project Evaluation Year**

<b>Alternative Plan 1- New CDF, Open Lake Placement, Fill Management Plan</b>			
	2009-2013- 68% open lake, 32% current CDF		
	Open Lake Costs	\$ 769,100	
	Placement At Exiting CDF	\$ 510,024	
		-----	
		\$ 1,279,124	
	2014-2028- 68% open Lake- 32% new CDF		
	Open Lake Costs	\$ 769,100	
	Placement At New CDF	\$ 510,024	
		-----	
		\$ 1,279,124	
<b>Alternative Plan 2- Brownfields Restoration, Fill Management Plan</b>			
	2009-2013- 100% in current CDF		
	Open Lake Costs	\$ -	
	Placement At Exiting CDF	\$ 1,434,450	
		-----	
		\$ 1,434,450	
	2014-2028- 100% At Brownfields Site		
	Open Lake Costs	\$ -	
	Placement At Brownfields	\$ 1,523,550	
		-----	
		\$ 1,523,550	
<b>Alternative Plan 3- Brownfields Restoration, Open Lake Placement, Fill Management Plan</b>			
	2009-2013- 68% open lake, 32% current CDF		
	Open Lake Costs	\$ 769,100	
	Placement At Exiting CDF	\$ 510,024	
		-----	
		\$ 1,279,124	
	2014-2028- 68% open Lake- 32% new CDF		
	Open Lake Costs	\$ 769,100	
	Placement At Brownfields	\$ 538,536	
		-----	
		\$ 1,307,636	
<b>Alternative Plan 4- No Action Plan</b>			
	2009-2013- No Dredging		
	Open Lake Costs	\$ -	
	Placement At Exiting CDF	\$ -	
		-----	
		\$ -	
	2014-2028- No Dredging		
	Open Lake Costs	\$ -	
	Placement At Brownfields	\$ -	
		-----	
		\$ -	
<b>Base Plan- Brownfields Restoration, Open Lake Placement, Fill Management Plan</b>			
	2009-2013- 68% open lake, 32% current CDF		
	Open Lake Costs	\$ 769,100	
	Placement At Exiting CDF	\$ 510,024	
		-----	
		\$ 1,279,124	
	2014-2028- 68% open Lake- 32% new CDF		
	Open Lake Costs	\$ 769,100	
	Placement At Brownfields	\$ 538,536	
		-----	
		\$ 1,307,636	

**Table E - Time Stream of Plan Costs**

**Alternative Plan 1- New CDF, Open Lake Placement, Fill Management Plan**

Alternative Plan 1- New CDF, Open Lake Placement, Fill Management Plan																						
Time Stream Of Plan Costs Over The Project Evaluation Period- 2009-2028																						
										Outer Harbor												
										CDF		Best										
										Construct		Management										
										Facility		Practices										
										Costs		Annual										
										Management		Annual										
										Plans &		Envrmntl										
										Bid &		Estate										
										Cnstrctn		Solicitation										
										New CDF		Costs In										
										Surveys		Current										
										Soundings		Dollars										
										Studies												
										Studies												
										Sampling												
										Complianc												
										Mngmnt												
										Recycling												
Evaluation	Calendar	Dredging	Outer Harbor	USFW	EIS &	Real	Develop &	Real	Design	Construct	Facility	Practices	Annual	Annual	Envrmntl	Economic	Sediment	Envrmntl	Estate	Solicitation		
Period	Year	Costs	CDF	Survey	Coordination	Estate	PCA	Acquisitions	Analysis	Plans &	Costs	New CDF	Surveys	Soundings	Studies	Studies	Sampling	Complianc	Mngmnt	Recycling		
1	2009	\$ -	\$ 231,800		\$ 30,000	\$ 40,000	\$ 30,000		\$ 478,500	\$ 957,000		\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 10,000	\$ 5,000	\$ 1,850,300
2	2010	\$ 1,279,124				\$ 40,000	\$ 30,000	\$ 79,750	\$ 478,500	\$ 957,000			\$ 5,000	\$ 43,000		\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 3,032,374	
3	2011	\$ -	\$ 231,800				\$ 30,000	\$ 79,750			\$ 4,485,900	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 4,900,450	
4	2012	\$ 1,279,124									\$ 9,968,600		\$ 5,000	\$ 43,000						\$ 5,000	\$ 11,300,724	
5	2013	\$ -									\$17,445,000	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000						\$ 5,000	\$ 17,518,000
6	2014	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 5,000	\$ 1,337,124
7	2015	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 188,000	
8	2016	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,332,124	
9	2017	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 73,000	
10	2018	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,332,124	
11	2019	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 5,000	\$ 78,000
12	2020	\$ 1,279,124											\$ 5,000	\$ 43,000		\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 1,447,124	
13	2021	\$ -											\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000				\$ 5,000	\$ 73,000	
14	2022	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,332,124	
15	2023	\$ -											\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000				\$ 5,000	\$ 73,000	
16	2024	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,337,124	
17	2025	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 188,000	
18	2026	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,332,124	
19	2027											\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000				\$ 5,000	\$ 93,000	
20	2028	\$ 1,279,124											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,332,124	
Eval Period 2009-28		\$12,791,240	\$ 463,600	\$ -	\$ 30,000	\$ 80,000	\$ 90,000	\$ 159,500	\$ 957,000	\$ 1,914,000	\$31,899,500	\$ 100,000	\$ 100,000	\$ 860,000	\$ 100,000	\$ 100,000	\$ 340,000	\$ 40,000	\$ 25,000	\$ 100,000	\$ 50,149,840	
Cmpnts as% Total		25.51%	0.92%	0.00%	0.06%	0.16%	0.18%	0.32%	1.91%	3.82%	63.61%	0.20%	0.20%	1.71%	0.20%	0.20%	0.68%	0.08%	0.05%	0.20%	100.00%	

**Table E - Time Stream of Plan Costs-Continued**

**Alternative Plan 2- Brownfields Restoration, Fill Management Plan**

Alternative Plan 2- Brownfields Restoration, Fill Management Plan																										
Time Stream Of Plan Costs Over The Project Evaluation Period- 2009-2028																										
Plan, Design, Construct New Brownfields Restoration Project																										
FMP										Brownfields Restoration			Best Management Practices			Annual Harbor Channel			Annual Environmental Studies			Real Estate		Solicitation		Plan 2
Existing	USFW	EIS & NEPA	Real Estate	Develop & Execute	Real Estate	Design	Plans & Specs	Bid & Construct	Current & New CDF	Harbor Surveys	Channel Soundings	Envmntl Studies	Economic Studies	Sediment Sampling	Envmntl Compliance	Estate Mngmnt	Sediment Recycling	Current Costs	In Dollars							
Calendar Year	Dredging Costs	Outer Harbor CDF	USFW Survey	EIS & NEPA Coordination	Real Estate	Develop & Execute PCA	Real Estate Acquisition	Design Analysis	Plans & Specs	Bid & Construct	Current & New CDF	Harbor Surveys	Channel Soundings	Envmntl Studies	Economic Studies	Sediment Sampling	Envmntl Compliance	Estate Mngmnt	Sediment Recycling	Current Costs						
1	2009	\$ -	\$ 231,800		\$ 30,000	\$ 40,000	\$ 30,000		\$ 96,300	\$ 192,550		\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000				\$ 10,000	\$ 5,000	\$ 703,650					
2	2010	\$ 1,434,450				\$ 40,000	\$ 30,000	\$ 16,050	\$ 96,300	\$ 192,550			\$ 5,000	\$ 43,000		\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 1,977,350					
3	2011	\$ -	\$ 231,800				\$ 30,000	\$ 16,050			\$ 902,600	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 1,253,450					
4	2012	\$ 1,434,450									\$ 2,005,800		\$ 5,000	\$ 43,000						\$ 5,000	\$ 3,493,250					
5	2013	\$ -									\$ 3,510,200	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 3,583,200					
6	2014	\$ 1,523,550											\$ 5,000	\$ 43,000					\$ 5,000	\$ 5,000	\$ 1,581,550					
7	2015	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 188,000					
8	2016	\$ 1,523,550											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,576,550					
9	2017	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 73,000					
10	2018	\$ 1,523,550											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,576,550					
11	2019	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000				\$ 5,000	\$ 5,000	\$ 78,000					
12	2020	\$ 1,523,550											\$ 5,000	\$ 43,000		\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 1,691,550					
13	2021	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 73,000					
14	2022	\$ 1,523,550											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,576,550					
15	2023	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 73,000					
16	2024	\$ 1,523,550											\$ 5,000	\$ 43,000					\$ 5,000	\$ 5,000	\$ 1,581,550					
17	2025	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000		\$ 5,000	\$ 188,000					
18	2026	\$ 1,523,550											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,576,550					
19	2027	\$ -										\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000					\$ 5,000	\$ 73,000					
20	2028	\$ 1,523,550											\$ 5,000	\$ 43,000						\$ 5,000	\$ 1,576,550					
Eval Period 2009-28		\$ 15,057,300	\$ 463,600	\$ -	\$ 30,000	\$ 80,000	\$ 90,000	\$ 32,100	\$ 192,600	\$ 385,100	\$ 6,418,600	\$ 100,000	\$ 100,000	\$ 860,000	\$ 100,000	\$ 80,000	\$ 340,000	\$ 40,000	\$ 25,000	\$ 100,000	\$ 24,494,300					
Cmpnts as% Total		61.47%	1.89%	0.00%	0.12%	0.33%	0.37%	0.13%	0.79%	1.57%	26.20%	0.41%	0.41%	3.51%	0.41%	0.33%	1.39%	0.16%	0.10%	0.41%	100.00%					



**Table E - Time Stream of Plan Costs-Continued**

**Alternative Plan 4- No Action**

Alternative Plan 4- No Action Plan																							
Time Stream Of Plan Costs Over The Project Evaluation Period- 2009-2028																							
No Action Plan											CDF/												
FMP											Brownfields		Best		Plan 4								
			Existing		EIS &		Develop &		Real		Construct		Restoration	Management	Annual		Annual		Real		Solicitation		Costs In
Evaluation	Calendar	Dredging	Outer Harbor	USFW	NEPA	Real	Execute	Estate	Design	Plans &	Bid &	Existing	Harbor	Channel	Envrmtl	Economic	Sediment	Envrmtl	Estate	Sediment	Current		
Period	Year	Costs	CDF	Survey	Coordination	Estate	PCA	Acquisitions	Analysis	Specs	Cnstrctn	CDF	Surveys	Soundings	Studies	Studies	Sampling	Compliance	Mngmnt	Recycling	Dollars		
1	2009	\$ -										\$ -	\$ -	\$ -	\$ -				\$ -	\$ -	\$ -		
2	2010	\$ -											\$ -	\$ -		\$ -	\$ -	\$ -		\$ -	\$ -		
3	2011	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
4	2012	\$ -											\$ -	\$ -						\$ -	\$ -		
5	2013	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
6	2014	\$ -											\$ -	\$ -					\$ -	\$ -	\$ -		
7	2015	\$ -										\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -		
8	2016	\$ -											\$ -	\$ -						\$ -	\$ -		
9	2017	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
10	2018	\$ -											\$ -	\$ -						\$ -	\$ -		
11	2019	\$ -										\$ -	\$ -	\$ -	\$ -				\$ -	\$ -	\$ -		
12	2020	\$ -											\$ -	\$ -		\$ -	\$ -	\$ -		\$ -	\$ -		
13	2021	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
14	2022	\$ -											\$ -	\$ -						\$ -	\$ -		
15	2023	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
16	2024	\$ -											\$ -	\$ -					\$ -	\$ -	\$ -		
17	2025	\$ -										\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -		
18	2026	\$ -											\$ -	\$ -						\$ -	\$ -		
19	2027	\$ -										\$ -	\$ -	\$ -	\$ -					\$ -	\$ -		
20	2028	\$ -											\$ -	\$ -						\$ -	\$ -		
Eval Period 2009-28		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		

**Table E - Time Stream of Plan Costs-Continued**

**Base Plan - Brownfields Restoration, Open Lake Placement, Fill Management Plan**

Base Plan - Brownfields Restoration, Open Lake Placement, Fill Management Plan																							
Time Stream Of Plan Costs Over The Project Evaluation Period- 2009-2028																							
		Base Plan- Plan, Design, Construct RT-2 Site										CDF		Best									
		FMP		EIS &		Develop &		Real		Construct		Facility		Management						Real		Base Plan	
Evaluation	Calendar	Dredging	Existing	Outer Harbor	USFW	NEPA	Real	Execute	Estate	Design	Plans &	Bid &	Current &	Harbor	Channel	Envrnmntl	Economic	Sediment	Envrnmntl	Estate	Solicitation	Costs In	
Period	Year	Costs	CDF	Survey	Coordination	Estate	PCA	Acquisitions	Analysis	Specs	Constrctn	New CDF	Surveys	Soundings	Studies	Studies	Sampling	Complianc	Mngmnt	Recycling	Dollars		
1	2009	\$ -	\$ 231,800	\$ -	\$ 30,000	\$ 40,000	\$ 30,000	\$ -	\$ 96,300	\$ 192,550	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 703,650		
2	2010	\$ 1,279,124	\$ -	\$ -	\$ -	\$ 40,000	\$ 30,000	\$ 16,050	\$ 96,300	\$ 192,550	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ 20,000	\$ 85,000	\$ 10,000	\$ -	\$ 5,000	\$ 1,822,024		
3	2011	\$ -	\$ 231,800	\$ -	\$ -	\$ -	\$ 30,000	\$ 16,050	\$ -	\$ -	\$ 902,600	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,253,450		
4	2012	\$ 1,279,124	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,005,800	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 3,337,924		
5	2013	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 3,510,200	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 3,583,200		
6	2014	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 5,000	\$ 1,365,636		
7	2015	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000	\$ -	\$ 5,000	\$ 188,000		
8	2016	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,360,636		
9	2017	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 73,000		
10	2018	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,360,636		
11	2019	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ 5,000	\$ 5,000	\$ 78,000		
12	2020	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ 20,000	\$ 85,000	\$ 10,000	\$ -	\$ 5,000	\$ 1,475,636		
13	2021	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 73,000		
14	2022	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,360,636		
15	2023	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 73,000		
16	2024	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 5,000	\$ 1,365,636		
17	2025	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ 20,000	\$ 85,000	\$ 10,000	\$ -	\$ 5,000	\$ 188,000		
18	2026	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,360,636		
19	2027	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 10,000	\$ 5,000	\$ 43,000	\$ 10,000	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 73,000		
20	2028	\$ 1,307,636	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 43,000	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 5,000	\$ 1,360,636		
Eval Period 2009-28		\$ 13,019,336	\$ 463,600	\$ -	\$ 30,000	\$ 80,000	\$ 90,000	\$ 32,100	\$ 192,600	\$ 385,100	\$ 6,418,600	\$ 100,000	\$ 100,000	\$ 860,000	\$ 100,000	\$ 80,000	\$ 340,000	\$ 40,000	\$ 25,000	\$ 100,000	\$ 22,456,336		
Cmpnts as% Total		57.98%	2.06%	0.00%	0.13%	0.36%	0.40%	0.14%	0.86%	1.71%	28.58%	0.45%	0.45%	3.83%	0.45%	0.36%	1.51%	0.18%	0.11%	0.45%	100.00%		

**Table F. Present Worth Of Plan Costs**

Evaluation Period	Calendar Year	Plan Costs In Current Dollars					Base Plan	Present Worth Factor	Plan Costs In Present Worth Dollars				
		Plan 1	Plan 2	Plan 3	Plan 4	Plan 1			Plan 2	Plan 3	Plan 4	Base Plan	
1	2009	\$ 1,850,300	\$ 703,650	\$ 703,650	\$ -	\$ 703,650	0.95352	\$ 1,764,291	\$ 670,942	\$ 670,942	\$ -	\$ 670,942	
2	2010	\$ 3,032,374	\$ 1,977,350	\$ 1,822,024	\$ -	\$ 1,822,024	0.90919	\$ 2,757,013	\$ 1,797,793	\$ 1,656,571	\$ -	\$ 1,656,571	
3	2011	\$ 4,900,450	\$ 1,253,450	\$ 1,253,450	\$ -	\$ 1,253,450	0.86693	\$ 4,248,348	\$ 1,086,654	\$ 1,086,654	\$ -	\$ 1,086,654	
4	2012	\$11,300,724	\$ 3,493,250	\$ 3,337,924	\$ -	\$ 3,337,924	0.82663	\$ 9,341,538	\$ 2,887,632	\$ 2,759,234	\$ -	\$ 2,759,234	
5	2013	\$17,518,000	\$ 3,583,200	\$ 3,583,200	\$ -	\$ 3,583,200	0.78821	\$13,807,805	\$ 2,824,302	\$ 2,824,302	\$ -	\$ 2,824,302	
6	2014	\$ 1,337,124	\$ 1,581,550	\$ 1,365,636	\$ -	\$ 1,365,636	0.75157	\$ 1,004,939	\$ 1,188,642	\$ 1,026,368	\$ -	\$ 1,026,368	
7	2015	\$ 188,000	\$ 188,000	\$ 188,000	\$ -	\$ 188,000	0.71663	\$ 134,727	\$ 134,727	\$ 134,727	\$ -	\$ 134,727	
8	2016	\$ 1,332,124	\$ 1,576,550	\$ 1,360,636	\$ -	\$ 1,360,636	0.68332	\$ 910,267	\$ 1,077,288	\$ 929,750	\$ -	\$ 929,750	
9	2017	\$ 73,000	\$ 73,000	\$ 73,000	\$ -	\$ 73,000	0.65156	\$ 47,564	\$ 47,564	\$ 47,564	\$ -	\$ 47,564	
10	2018	\$ 1,332,124	\$ 1,576,550	\$ 1,360,636	\$ -	\$ 1,360,636	0.62127	\$ 827,608	\$ 979,463	\$ 845,322	\$ -	\$ 845,322	
11	2019	\$ 78,000	\$ 78,000	\$ 78,000	\$ -	\$ 78,000	0.59239	\$ 46,206	\$ 46,206	\$ 46,206	\$ -	\$ 46,206	
12	2020	\$ 1,447,124	\$ 1,691,550	\$ 1,475,636	\$ -	\$ 1,475,636	0.56485	\$ 817,414	\$ 955,479	\$ 833,519	\$ -	\$ 833,519	
13	2021	\$ 73,000	\$ 73,000	\$ 73,000	\$ -	\$ 73,000	0.53860	\$ 39,318	\$ 39,318	\$ 39,318	\$ -	\$ 39,318	
14	2022	\$ 1,332,124	\$ 1,576,550	\$ 1,360,636	\$ -	\$ 1,360,636	0.51356	\$ 684,127	\$ 809,655	\$ 698,770	\$ -	\$ 698,770	
15	2023	\$ 73,000	\$ 73,000	\$ 73,000	\$ -	\$ 73,000	0.48969	\$ 35,747	\$ 35,747	\$ 35,747	\$ -	\$ 35,747	
16	2024	\$ 1,337,124	\$ 1,581,550	\$ 1,365,636	\$ -	\$ 1,365,636	0.46693	\$ 624,338	\$ 738,467	\$ 637,651	\$ -	\$ 637,651	
17	2025	\$ 188,000	\$ 188,000	\$ 188,000	\$ -	\$ 188,000	0.44522	\$ 83,702	\$ 83,702	\$ 83,702	\$ -	\$ 83,702	
18	2026	\$ 1,332,124	\$ 1,576,550	\$ 1,360,636	\$ -	\$ 1,360,636	0.42453	\$ 565,522	\$ 669,287	\$ 577,626	\$ -	\$ 577,626	
19	2027	\$ 93,000	\$ 73,000	\$ 73,000	\$ -	\$ 73,000	0.40479	\$ 37,646	\$ 29,550	\$ 29,550	\$ -	\$ 29,550	
20	2028	\$ 1,332,124	\$ 1,576,550	\$ 1,360,636	\$ -	\$ 1,360,636	0.38598	\$ 514,168	\$ 608,511	\$ 525,173	\$ -	\$ 525,173	
		-----	-----	-----	-----	-----		-----	-----	-----	-----	-----	
		\$50,149,840	\$24,494,300	\$ 22,456,336	\$ -	\$ 22,456,336	12.60	\$38,292,288	\$ 16,710,927	\$ 15,488,696	\$ -	\$ 15,488,696	

**Table G - Plan Average Annual Costs**

Investment Costs	Plan 1	Plan 2	Plan 3	Plan 4	Base Plan
		Brownfields	Brownfields		Brownfields
	New CDF	Restoration	Restoration	No Action	Restoration
	OLP		OLP		OLP
	FMP	FMP	FMP		FMP
Total Implementation Costs	\$ 50,149,840	\$ 24,494,300	\$ 22,456,336	\$ -	\$ 22,456,336
Interest During Construction (1)					
Investment Costs	\$ 50,149,840	\$ 24,494,300	\$ 22,456,336	\$ -	\$ 22,456,336
Present Worth Of Investment Costs	\$ 38,292,300	\$ 16,710,900	\$ 15,488,700	\$ -	\$ 15,488,700
<b>Average Annual Costs</b>					
Present Worth Of Investment Costs	\$ 38,292,300	\$ 16,710,900	\$ 15,488,700	\$ -	\$ 15,488,700
Partial Payment Factor (2)	0.07939	0.07939	0.07939	0.07939	0.07939
Average Annual Costs	\$ 3,040,200	\$ 1,326,800	\$ 1,229,700	\$ -	\$ 1,229,700
Annual Maintenance (3)	159,500	32,100	32,100	-	32,100
Total Average Annual Costs	\$ 3,199,700	\$ 1,358,900	\$ 1,261,800	\$ -	\$ 1,261,800
(1) No computation of Interest During Construction since all project costs are incurred on or AFTER the Base year, and average annual project benefits are being realized.					
(2) Partial Payment Factor based on 20 yr project life and a 4.75% annual interest rate					
(3) Annual Maintenance taken as 0.5% of Contractors Earnings & Contingencies					

**Development of Plan Average Annual Benefits**

Benefits for this evaluation are the transportation cost increases avoided, by continuing to maintain the channels at the harbor. The difference in vessel transportation costs associated with maintaining current harbor depths (with Project Condition[WP]) and vessel transportation costs associated with discontinuing harbor dredging (without Project Condition[WOP]), over a 20 year period, are the benefits associated with continuing to maintain the harbor.

The increase in vessel transportation costs under the WOP condition is a function of the harbors shoaling rate. Shoaling rates in Great Lakes harbors are highly variable over time. The general pattern is 1) for a shoal to develop at the protected side of an unattached breakwater situated in the open waters of a Great Lake that shelters the entrance channel to a riverine harbor and 2) for the shoaling rate to increase as one progresses upstream along a channelized river channel.

Shoaling at Lorain Harbor follows this general pattern. Characteristically a shoal does develop in the Entrance channel. More critical is the fact that shoaling upstream, in the Black River Channel in vicinity of the ICH Steel dock, is more rapid. Review of pre and post dredging soundings indicates that the shoaling rate along the Black River is somewhere between 1.0 and about 2.0 feet per year. The shoaling rate used in the analysis is one foot per year. (The shoaling rate will impact the rate of increase in vessel transportation costs under the Without Project condition, when harbor channels are allowed to shoal up to 21 feet.)

Appendix G contains an economic evaluation entitled “Lorain Harbor Economic Viability Analysis.” Table 5 of this Lorain Harbor viability analysis provides the average annual vessel transportation costs associated with the WP Condition (continued maintenance of the harbors authorized 27 foot channels). These average annual transportation costs are \$13,582,000.

If dredging at Lorain Harbor was to cease, due to lack of a suitable dredged material management plan, the channels would gradually fill in, and additional transportation costs would be incurred. Table 5 of Appendix G’s “Lorain Harbor Economic Viability Analysis” summarizes these transportation costs assuming a one foot annual shoaling rate at the Harbor. The harbor is allowed to shoal to a dept of 21 feet LWD for plan evaluation purposes. WOP condition average annual transportation costs were \$15,802,700. Alternative plan benefits are the difference between WOP and WP condition transportation costs. Benefits associated with any one plan are \$2,220,700. Greater detail on the calculation of WOP and WP condition average annual vessel transportation costs can be found in Appendix G: “Lorain Harbor Economic Viability Analysis”.

(Note: Project benefit calculations for implementation of any Plan do not include land creation benefits since brownfield restoration is not considered land creation. Since Brownfield restoration is not considered land creation, policy is to not include land creation benefits in the benefit evaluation).

Table H provides Benefit Cost Ratios by alternative plan. Net Benefits are the difference in Average Annual Transportation Costs between the WOP and WP condition. Net Alternative Plan costs are the difference in harbor maintenance costs between the WP condition and the WOP condition. Since the WOP condition assumes all harbor maintenance expenditures cease in project year 1, the WOP condition harbor maintenance costs are zero. For each alternative plan, net harbor maintenance costs equal WP condition average annual harbor maintenance costs by alternative Plan.

**Table H - Benefit to Cost Ratios by Plan**

<b>Benefits, Costs, Benefit Cost Ratios, Net Benefits</b>					
	<b>Plan 1</b>	<b>Plan 2</b>	<b>Plan 3</b>	<b>Plan 4</b>	<b>Base Plan</b>
	New CDF	Brownfields Restoration	Brownfields Restoration	No Action	Brownfields Restoration
	OLP	OLP	OLP		OLP
	FMP	FMP	FMP		FMP
<b>Benefits</b>					
Without Project Average Annual Transportation Costs	\$ 15,802,700	\$ 15,802,700	\$ 15,802,700	\$ 15,802,700	\$ 15,802,700
With Project Average Annual Transportation Costs	\$ 13,582,000	\$ 13,582,000	\$ 13,582,000	15,802,700	\$ 13,582,000
Plan Benefits	\$ 2,220,700	\$ 2,220,700	\$ 2,220,700	\$ -	\$ 2,220,700
<b>Costs</b>					
With Project Average Annual Harbor Maintenance Costs	\$ 3,199,700	\$ 1,358,900	\$ 1,261,800	\$ -	\$ 1,261,800
Without Project Average Annual Harbor Maintenance Costs	\$ -	\$ -	\$ -	\$ -	\$ -
Plan Costs	\$ 3,199,700	\$ 1,358,900	\$ 1,261,800	\$ -	\$ 1,261,800
<b>Plan Benefit Cost Ratios</b>					
Plan Average Annual Benefits	\$ 2,220,700	\$ 2,220,700	\$ 2,220,700	\$ -	\$ 2,220,700
Plan Average Annual Costs	\$ 3,199,700	\$ 1,358,900	\$ 1,261,800	\$ -	\$ 1,261,800
Plan Benefit To Cost Ratio	0.69	1.63	1.76		1.76
Plan Net Benefits	\$ (979,000)	\$ 861,800	\$ 958,900	\$ -	\$ 958,900

Table H shows Benefit to Cost Ratios ranging from .69 to 1.76. Plan 1 has a benefit to cost ratio less than 1. Plan 4, the No Action Plan, has no net benefits and no net costs. However, the No Action Plan does not provide any facilities to place sediments. This alternative does not meet the major goal of providing sediment storage facilities for a 20 year evaluation period. Plan 3 is the NED plan since it has the highest net benefits.